Public Policy for Regional Development

Edited by
Jorge Martinez-Vazquez and
François Vaillancourt

Routledge Studies in Global Competition

Public Policy for Regional Development

This book draws on the expertise of both North American and European specialists of regional economics, evaluating the impact of economic policy in certain regions and considering alternative policies to foster regional economic development and improve the employment and income of the residents of these regions.

Martinez-Vazquez and Vaillancourt have gathered chapters from a renowned international pool of experts, arguing for the importance of human capital in the regional economics process. The first section of the book examines the policy tools and process relevant to regional development, presenting evidence on both the American and Irish experience. The second focuses on the empirical evidence on the impact of taxes and public spending in Canada and the USA. The third examines methodological issues, looking particularly at Spain and Poland.

This work will be of interest to students and researchers interested in human capital and public finance, as well as regional policy makers engaged with economic development.

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1 Regional development

Challenge for public policy

Jorge Martinez-Vazquez and
François Vaillancourt

Introduction

The desire to develop one's region is strongly shared by voters, politicians and even some investors across the world. Various reasons explain this desire. In the case of voters, it can be explained by factors that bring about both psychic and financial rewards. Psychic rewards are associated with civic pride and personal identity, living in one's birthplace, admiring its natural beauties, and so on. Financial rewards result from employment opportunities and the continued use of an existing stock of capital. Politicians may genuinely desire greater levels of development for their regions and they also need to respond to their constituencies' desires and how they vote. Politicians will often attempt to implement development policies, for example, by spending in their districts money raised by taxes, preferably paid by other individuals than their own voters, to attract investment. This may be done through a variety of means such as offering tax breaks and direct subsidies to investors, offering new or improved public infrastructure such as road access or serviced lots and offering a better trained labor force through both investor-specific training programs and more generally investments in the human capital of residents of their region.

Economists usually frown upon regional development spending, considering that it attempts to counter the market forces at work in a larger setting – several regions together or the country as a whole – and that the natural adjustment mechanism of labor mobility should be allowed to play itself out. However, as Luger and Maynard (this volume) argue, among many others, market failures, of which they list several examples, can justify government intervention. Another way to justify government development policies is to argue that full reliance on natural adjustment mechanisms and labor mobility neglects the existence of social capital with various externalities (linguistic, ethnic, religious) that may make labor mobility less efficient than capital mobility. But, of course, this interpretation begs the questions of who should subsidize such mobility of capital and how it should be done. For example, spending the same amount on building a site-specific physical facility such as a port or railroad or on improving the human capital of a labor force by offering more post-secondary training to the inhabitants of a region does not have the same consequences in terms of regional labor market flexibility

or, if needed, labor mobility. And yet, the total absence of physical infrastructure will significantly impact regional development. These are some of the compelling questions asked and addressed in this volume.

Independently of what economists say the optimal policies are, it is quite likely that politicians will continue devising different approaches to the development of their regions. Given that regional development policies have been, are, and will continue to be implemented in many countries of the world, the main purpose of this book is to present new research on these activities. The studies resulting from this research, written by a selected group of scholars, address one fundamental question. What are the best possible uses of public funds and the most effective strategies for regional development? The answers and perspectives, though written with the rigor of academic research, are at the same time accessible and relevant to policy makers.[1]

The chapters in this book fall into three categories, preceded by a discussion of the importance of regional disparities and the potential for economic convergence, a main reason for the interest of policy makers in the subject of regional development. The first set of chapters examines the tools generally available to policy makers for pursuing regional development objectives, and how they have been applied in the United States and Ireland, two countries with very vibrant regional economies. The second set of chapters reviews specific empirical findings of considerable relevance to regional economic policy makers in terms of developing human capital and attracting investment flows from outside the region. The third set of chapters examines several methodological issues which must be recognized in the process of regional policy formulation and which, in some ways, will need to be approached in future research in this area. Let us now turn to a more detailed discussion of the contents of the book.

The first chapter by José Manuel González-Páramo starts off by stating that 'the issue of how to deal with heterogeneity in a diverse single currency area has been an issue at the heart of the debate in Europe all along the road to deeper economic integration'. This issue is important for many countries, whether they are federal or unitary, geographically large or small. The issue is probably exacerbated in the European context by the fact that the EU is a young association of economic regions, each with a tradition of full sovereignty. But in the United States, the issue of how to deal with differences in the economic development of states is also important, with states deciding on their own policies to attract investment and thus employment. Even within small countries such as Belgium, regional development is an issue. In developing and transitional countries, such as China and India, the problem of regional economic and other forms of heterogeneity poses significant policy dilemmas for the governments of those countries. Having described the differences in inflation and growth rates between countries in the euro area, González-Páramo looks for explanations. He finds that a growth accounting exercise indicates that differences in the evolution of total factor productivity plays an important role in explaining differences in regional growth. This role for differences in factor productivity is not unique to the euro area; examinations of differences in

growth between the richest members of NAFTA, the United States and Canada shows that factor productivity differences also matter in that economic area. In closing González-Páramo argues that greater flexibility in the labor market is the most important structural reform that euro area members must implement to allow them to adapt to economic shocks in the absence of their own monetary policy. This emphasis on labor which embodies human capital is a theme taken up in chapters in the following two sections of this book.

Policy tools

Four chapters are grouped under this theme. The first one by Michael Luger and Nicolas Maynard presents policy tools broadly while those by Ann Markusen and Roy Green and Johanna Fahy focus respectively on the proper scope of regional development policy (industrial or occupational) with specific examples for California and on the role of innovations in regional development with a focus on Ireland. The fourth by Santiago Lago-Peñas addresses the potential tradeoffs and complementarities between fiscal equalization and regional development. The relevance of equalization policies for regional development lies in the fact that poor regions which are perhaps in greatest need of regional development policies are also those that can least afford to pay for them out of their own resources.

Luger and Maynard begin their chapter by providing a simple yet appropriate definition of regional development as 'efforts to enhance employment, income, wealth, and/or opportunity within a defined geographic area'; these authors note that government action to achieve this has four components: planning, financing, regulating, and managing. An important point made in this chapter is the reminder that the process of regional development will see regions going through different phases of development along a continuum with each phase or level requiring different inputs from governments. Hence regions at an earlier stage of development may require more physical capital than more advanced regions to allow them to access markets and knowledge/ideas. This explains in part the past focus in countries such as the United States on physical investments for regional development; such a need may have changed but institutional inertia makes the focus on these investments still important. For Luger and Maynard, regional development should not only be about attracting new businesses (business recruitment) in a score sheet type approach but also about a more balanced approach with the success of existing businesses mattering as much, if not more. This is often a forgotten point.[2] Luger and Maynard then examine three current policy tools used for regional development. The first one is tax incentives. They show that the evidence on the impact of these incentives is mixed; some authors conclude they have little impact while others argue they do. The main point from a policy maker perspective is that one should at least be aware of the cost of such incentives and thus make informed choices as to their use, given the competitive environment a region finds itself in.[3] The second policy tool is cluster based planning; here the authors endorse its use but sagely note that:

> Of course, if the cluster planning process is not likely to pick the right winners and losers, and the policy process fails to identify the proper amenities and services to provide … A place then may be better off not changing much.

Finally they examine the use of innovation systems, which link universities and more generally research generating bodies (laboratories, …) as idea generators to regional development. In their view, the resistance of traditional regional development authorities to such an approach is interesting when linked to the next two chapters in this volume. This theme is picked up in the following chapter by Ann Markusen.

The chapter by Ann Markusen also addresses the issue of the proper tools of regional development but from a different perspective. After recalling the links between growth theory and regional development policies, Markusen argues that past regional development policies have focused too much on physical capital, noting issues such as import penetration and boom and bust cycles associated with building transport infrastructures, for example. She raises the issue of not only the efficiency and cost but also of the regulation of tax incentives. Markusen then argues that the use of an industry-based approach for regional development is not as desirable as an occupation-based approach:

> Accepting the industry/firm/establishment framework as the skeleton of a regional economy means shaping economic development practice around firm priorities. Implicit in this approach is a vision of economic growth that favors physical capital as the key input, rather than technology or human ingenuity and labor.[4]

Thus, Markusen argues that looking at regions as groupings of workers as opposed to industries provides a more useful and generally better perspective. In particular, this perspective focuses efforts on redeploying resources rather than saving plants when an industrial downturn threatens a region. Hence one can use a cluster-based approach with occupational clusters.[5] Markusen then puts forward specific policy recommendations. Of particular interest in a context where many regions are facing an aging shrinking work force is the recommendation that regions market themselves to individuals and not to employers since firms will follow the workers. A practical step to do this can be found in her recommendation that incentives to employers, if one uses them, be based on their use of target occupations.

In their chapter, Green and Fahy devote considerable attention to two of the tools enumerated by Luger (clusters and innovations systems) and also to the role played by foreign direct investment; how public policy can best attract it is the topic examined in a later chapter in this book by Goodspeed, Martinez-Vazquez and Zhang. In their chapter, Green and Fahy begin by reviewing what clusters and innovation systems are and by showing the links between the two concepts. In that context, they raise the issue of the 'embeddedness' of foreign investment, that is, the nature of its relationship with the local economy. Green and Fahy then turn

to the discussion of the causes of why the medical technology sectors in Galway have emerged as a world class player in the field. They then raise a fascinating question: what next? They argue that:

> explanations for Ireland's success are multi-faceted, but include strategically targeted FDI attraction, an effective social partnership framework, low corporate tax, development of the skills base and policy-relevant use of EU Structural Funds … However … Ireland finds itself in a serious dilemma … (that) … lies in the fact that Ireland has become a world leader in the export of high-tech products … without being a significant innovation generator … the current structure inherited from the 'Celtic Tiger' period is weighted largely towards externally generated R&D, leaving control of the key technology drivers outside domestic influence.

This raises, in the context of a specific region, the issue of the success of existing businesses already flagged by Luger and Maynard. More importantly, Green and Fahy conclude that there is a need to build innovation capacity in Ireland; innovation systems that take innovations from elsewhere are incomplete.

The chapter by Santiago Lago-Peñas raises several important issues in the practice of interregional fiscal equalization and regional development strategies. Equalization is a national policy that can affect the development opportunities of even very similar regions. For example, two poor regions with the same financial needs (revenue potential and expenditure needs) may not receive the same support from their central government. If region A ,adjacent to B, offers the same location advantages as B but cannot offer the same public infrastructure or quality of labor, then it will be hard put to develop at the same pace. Conversely, two rich regions, C and D, may face different demands by the central government on their tax base for equalization programs. In this case, the issue is the maintenance of a comparative advantage. These issues are relevant in both countries with explicit or implicit equalization programs; their salience will depend on the importance of equalization in economic terms which will in turn depend on political forces, as analyzed by Lago-Peñas. There is a also a converse side to the issue of equalization and regional development. As he puts it:

> … regional policy may be seen as a subtle way of equalization. If it succeeds in promoting economic growth in poorer regions, it reduces disparities in future tax capacities and then will make easier the equalization issue. Moreover, political communities from poorer regions will probably be more pleased about a solution that improves their economic performance and make them less dependent in the future.

An important message of this chapter is the importance of being aware of the relevance of regional development to equalization and vice versa. However, these two sets of policies (regional equalization and regional development) are typically designed separately from one another and also by quite different political actors

(for example, the national Ministry of Finance versus the national Ministry of Economy or the regional authorities themselves).

Empirical studies

The next three chapters in the volume address new empirical evidence on the effectiveness of different development policies. The first by Varvara Rakova and François Vaillancourt examines the impact of human capital on productivity; the second by Timothy Goodspeed, Jorge Martinez-Vazquez and Li Zhang compares the roles of public sector governance and spending versus taxes in attracting foreign direct investment; and the third by Luiz de Mello examines the availability and use of foreign sources of borrowing as tool for economic development.

Rakova and Vaillancourt examine the impact of an increase in the amount of human capital in a region on the productivity of both high and low education workers in that region. In fact, this study can be seen as providing an empirical measure of the existence of human capital clusters emphasized as playing a key role for regional development in the previous chapter by Markusen. In this chapter, Rakova and Vaillancourt review the existing empirical evidence for the United States and present new evidence for Canada's metropolitan areas for the year 2000, calculated using micro data from the Census with four different measures of education. Leaving aside the technical details of their estimation, we see that these authors arrive at three key findings of relevance to policymakers. First, the existence and importance of human capital externalities show a positive and significant impact on wages and productivity at the metropolitan area level but they are not as clearly present for large areas; therefore, human capital externalities may dissipate in the case of larger geographical areas, such as provinces or regions. Second, the choice of the measure of human capital matters. Results obtained using the share of holders of graduate degrees show a greater impact than those obtained using all holders of university degrees. Hence Rakova and Vaillancourt note

> the importance of the effect associated with the share of graduate degree holders both for other workers and for themselves. It no longer suffices for a region to have a university educated labor force; one needs a well-educated university labor force with advanced degrees and thus specialized training to compete.

Third, the impact of the clustering of human capital is larger in the private than in the public sector. Overall, the findings by Rakova and Vaillancourt support the view put forward in the preceding section that investing in human capital is an appropriate and effective policy to further regional development.

The chapter by Goodspeed, Martinez-Vazquez and Zhang focuses on the role of fiscal policies in attracting external private investment into an area. While, traditionally, the literature on the determinants of 'foreign direct investment' has focused on the potential role played by tax incentives, Goodspeed, Martinez-

Vazquez and Zhang emphasize the potential role played by good governance and public services in attracting and retaining 'foreign direct investment.' These authors use cross-country and within-country regional data for several countries to test the relative impact of the roles played by taxation levels and a variety of public service and governance measures in attracting foreign direct investment. The main conclusion Goodspeed, Martinez-Vazquez and Zhang draw from their empirical work is that:

> … the adequate provision of public services in a broad sense, and not just low taxes, would seem to be an important policy principle for regional and central governments that want to attract FDI. These governments need to offer a package of public services that generate benefits that are commensurate with the taxes that the beneficiaries will pay.

The chapter by de Mello examines the impact of greater economic integration and globalization on the financing constraints of regional governments. De Mello, indeed finds that greater integration of neighboring countries, with increases in trade and financial flows, leads to a higher reliance on foreign rather than domestic sources of budget financing; however, the lack of regional data prevents the author from carrying out estimations at that level. Nevertheless, his results remain quite relevant for the focus on regional development of this volume for two reasons. First, one can think of European countries as regions of Europe, particularly in the case of the members of the euro area and thus these results apply to them, particularly in the case of new members that are progressively integrating the European economic space. Second, regional development usually leads to greater economic integration as measured by de Mello between parts of a country. This implies that sub-national governments of these regions will have access to outside financing to a greater extent than before, probably replacing internal savings by borrowing and thus modifying the inter-temporal consumption-investment paths for any particular region. But, as de Mello concludes:

> … sub-national financial management autonomy creates risks and challenges. On the one hand, financial autonomy provides regional governments with a richer array of instruments to pursue their policy objectives. But, if budget/fiscal institutions are weak, greater financial autonomy at the regional government level may be inconsistent with national fiscal sustainability goals. This is because policy spillovers among same-level jurisdictions, and between them and the central government, may weaken the incentives for financial prudence. For openness to play a disciplinary role in decentralized financial management, the need for institutional development, including credible fiscal rules and transparent financial reporting systems, should not be underestimated.

Methodological issues

The last three chapters in the volume could be said to address methodological issues. The first by Teresa Garcia-Milà and José G. Montalvo examines how to correctly measure the impact of public infrastructures and in particular road infrastructures on economic activity; the second by Georgio Brosio discusses the interaction between regional development policies and environmental policies; and the third by Grzegorz Gorzelak raises a series of methodological issues of much relevance to regional policy makers inclined to get involved in regional development policies.

The chapter by Garcia-Milà and Montalvo is a contribution to the search for, in their words, 'credible and sensitive methods to evaluate the effect of public infrastructures on economic development'. Garcia-Milà and Montalvo first review the difficulties associated with estimating the impact of public infrastructures using traditional production function estimations and the empirical results obtained using this methodology. This review clearly shows the need for introducing more appropriate estimation techniques, in particular those associated with a reduced impact of public infrastructure on aggregate output. Garcia-Milà and Montalvo then put forward their own methodology, which, after appropriately correcting for endogeneity, compares 'the number of new establishment in the catchment's area of the roads upgraded to highways with respect to the ones not upgraded.' Thus, counting on appropriate control groups may be a way to advance our knowledge on the true economic impact of public investment. As Garcia-Milà and Montalvo conclude, 'the evaluation of the impact of public infrastructures is a very important exercise, given that the size of the budget for public works is quite large in all the levels of government.'

The chapter by Giorgio Brosio is concerned with the potential relationship between environmental regulation and regional economic growth. As Brosio reminds us, the conventional Kuznets' Environmental Curve (KEC) shows that at the national level, the level of pollution and the use of the environment appear to worsen first with the level of economic development, and then it improves as the economy grows, eventually showing an inverted U relationship between the level of development and the level of pollution. The question of much interest to the main theme of this volume is whether this relationship also holds at the regional level, especially when regions within a country may be competing among themselves in attracting scarce investment resources. Brosio notes that there is little evidence to justify the fear that in a decentralized system of government, competition among sub-national governments will lead to a race to the bottom in terms of environmental standards. Hence one should expect that regional growth strategies should produce, besides higher levels of development, better environmental outcomes. To illustrate these dynamics Brosio uses a standard two region – one richer than the other – economy in the presence of environmental spillovers and identified preferences by residents. From this modeling two main findings emerge:

> First, regional environmental policies seem to have a limited (negative) impact on growth, even after considering that in a regional setting the presumed

> or effective mobility by firms could discourage regional governments from introducing higher environmental standards. In some circumstances regulation could even be beneficial to growth, if the regulation is not too intense. The second finding is that regulation at the regional level may amplify disparities between different regions, because of differences among regions in preferences, in the efficiency in regulation, and in the availability of regulatory instruments.

The important message at the end is that it would appear that regional growth and environmental protection are quite compatible policies.

The last chapter under this heading and of this book by Grzegorz Gorzelak is of interest both in itself and as a fitting conclusion to the whole volume. Gorzelak makes an important distinction between exogenous and endogenous factors for regional growth and notes that 'the exogenous factors of local development cannot replace the endogenous ones, but can only assist them. If the local potential is lacking or if it is very weak, then even significant external intervention cannot substitute …'. Gorzelak identifies a number of practical choices that policy makers must make in mapping out a regional development strategy and he provides explicit suggestions as to what may be the right answers in each case. For example, in relation to the proper scope of a development strategy he reasons:

> On the one hand we have the possibility that only these processes which directly depend on the activities of the regional authorities should be embraced by the strategic goals – on the other hand one may propose that all processes and phenomena that occur within a given region should be reflected in the strategy … (Actually), the scope of the strategy should be narrow, limited to the activities for which the regional authorities can take responsibility.

Gorzelak offers an integrated approach to the composition of a development strategy and illustrates its application to the Lubuskie county (or 'voivodship') in Poland. One may disagree with one or the other Gorzelak's suggestions for the right approach but there will be little disagreement on the list of choices that must be made.

In closing this introduction to the volume, let us summarize the main points brought up by the chapters just reviewed:

- There are various approaches to regional development that can be used; their relevance varies with the level of development already reached and with the specific situation of each region.
- There is an overall tendency for human capital to become more relevant and for physical capital to become less relevant with the level of economic development of regions.
- Good governance and efficient public expenditure on infrastructure and services can be as important as, or more important than low levels of taxation in attracting and retaining investment.

- Ecological capital may well be the neglected factor, yet a relevant complementary factor for regional development.
- Proper measurement of the impact of various factors such as human capital or public infrastructure is important for sound policies.
- Attention should be given to the funding of regional governments which need to fund regional development.
- An explicit and carefully designed strategic vision must underpin regional development policies.

Notes

1 Most of the chapters in this volume were presented at a conference in Baiona, Spain organized by 'REDE' at the University of Vigo in September 2005. We are very grateful to Xavier Labandeira and Alberto Gago of the University of Vigo for their support in making that conference and this volume possible.

2 An example of this was the policies of the Québec government in the 1990s towards the aluminum sector; for a while the emphasis was on attracting new smelters (Alcoa, Pechiney) while the success of the well established Alcan smelters was neglected. This was subsequently changed.

3 The authors provide interesting examples for the United State at the state level. In Canada, the federal government replaced direct subsidies used mainly in the 1960s and 1970s by tax expenditures in the 1980s; the use of tax preferences varies greatly by province with Québec, with a more immobile labor force for linguistic reasons, using them more to attract complementary capital.

4 On a more methodological matter, Markusen wisely reminds us of the distinction between firm and establishment and on the difficulty of properly coding the activities of establishments.

5 This of course requires that occupations be properly coded; one should note here that employers and employees might have different perceptions of how to classify a given job in a given occupation. See *The Information Technology (IT) Labour Market in Canada: Results from the National Survey of IT Occupations* (M.Gunderson, L. Jacobs and F. Vaillancourt) Ottawa: Software Human Resource Council, 2005, 156 pages. This represents a telling example of this issue for Canadian IT workers.

2 Regional divergence in the euro area

José Manuel González-Páramo

Introduction[1]

The issue of how to deal with heterogeneity in a diverse single currency area has been an issue at the heart of the debate in Europe all along the road to deeper economic integration, and indeed well before the single currency was introduced. This matter has attracted renewed interest in recent public discussion, in particular after media reports sounded the alarm about increased divergence of growth rates in the euro area in the last quarter of 2004. In this context, the years elapsed since the introduction of the euro provide us with some perspective, albeit surely still an incomplete one, to deal with this topic.

The terms of the debate are very familiar. While inflation and growth differentials are a normal phenomenon in any monetary union, their occurrence in the euro area context is combined with institutional and economic characteristics that are, to a large extent, unique, such as a lack of significant centralized fiscal transfer mechanisms and decentralized responsibility for fiscal and other economic policies, together with limited labor mobility and rigidities in labor and product markets. In addition, monetary policy in EMU is conducted by the ECB with the primary objective of maintaining price stability in the euro area as a whole; it does not, therefore, directly address differences in national economic developments that may emerge across the euro area.

Against this background, three fundamental questions are tackled in this chapter. Are inflation and growth dynamics systematically different across euro area countries? What is behind the observed differences in performance? What are the policy challenges related to these divergences? To deal with these issues, the main facts related to economic differentials in the euro area are first addressed in the next section. Then an analysis of the factors that may explain those differentials is presented in section 3, while a discussion on the implications of regional divergence for the design of economic policies can be found in section 4. Section 5 concludes.

The facts: regional divergence in the euro area

What are the main facts related to inflation and growth dispersion among euro area countries? A first look at the data shows that the dispersion of inflation across the euro area countries has broadly stabilized since the inception of the euro (see Figure 2.1). Looking back to the beginning of the 1990s, the degree of inflation dispersion, measured as the unweighted standard deviation among the euro area countries, was characterized by a strong downward trend. The high degree of dispersion in the early 1990s – around 6 percentage points – was mainly the result of very high levels of inflation in a few countries. Between 1994 and 1998, inflation dispersion declined, and in the second half of 1999 reached its lowest level since the start of the Stage Three of EMU, namely less than 1 percentage point. Since then, with the exception of a modest increase over the period from 2000 to 2002, it has changed very little. By way of comparison, it is worth noting that since 1999 inflation dispersion across the euro area has been fluctuating around the level observed for the 14 metropolitan statistical areas in the United States.

At the same time, inflation differentials in the euro area appear to be very persistent, in the sense that many countries have systematically maintained either a positive or a negative inflation gap with the euro area average since the introduction of the euro. This persistence seems to be a feature specific to the euro area, where seven economies have recorded annual inflation rates either consistently above or consistently below the euro area average since 1999 (see Table 2.1).

A first insight into the possible causes of inflation differentials can be gained by referring to their accounting components. For this purpose, it is useful to distinguish between internal factors – such as unit labor costs, profit margins and net indirect taxes – and external factors – such as import prices. In nine countries, internal factors have been the most important contributors to the inflation differentials in relation to the euro area average. Import costs have also played a major role in a few cases (Belgium, France and Luxembourg). As regards the internal sources of inflation differentials, the main contributions have come from unit labor costs

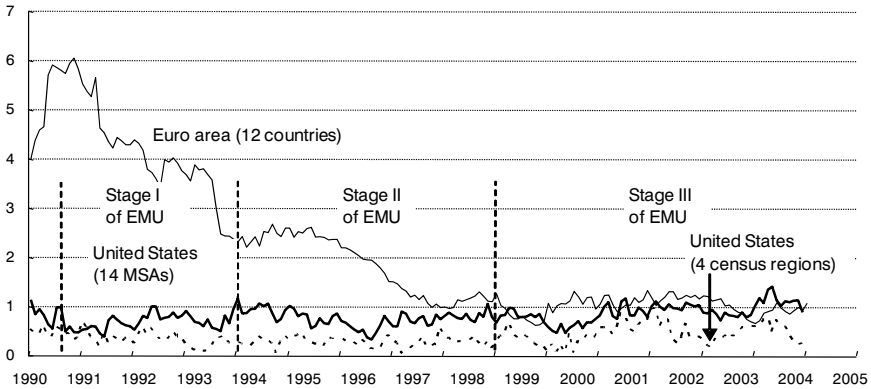

Figure 2.1 Dispersion of inflation in the euro area and the US (Source: Eurostat and US Bureau of Labor Statistics)

Table 2.1 HICP inflation differentials in relation to the euro area average (percentage points)

	1999–2004 (average)	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Belgium	–0.1	0.0	0.6	0.1	–0.7	–0.6	–0.3
Germany	–0.7	–0.5	–0.7	–0.4	–0.9	–1.0	–0.4
Greece	1.2	1.0	0.8	1.3	1.7	1.4	0.9
Spain	1.0	1.1	1.4	0.5	1.3	1.0	0.9
France	–0.2	–0.6	–0.3	–0.6	–0.3	0.1	0.2
Ireland	1.8	1.3	3.2	1.6	2.5	1.9	0.2
Italy	0.4	0.5	0.5	0.0	0.3	0.7	0.1
Luxemburg	0.5	–0.1	1.7	0.1	–0.2	0.5	1.1
The Netherlands	0.8	0.9	0.2	2.8	1.6	0.2	–0.8
Austria	–0.4	–0.6	–0.1	0.0	–0.6	–0.8	–0.2
Portugal	1.1	1.0	0.7	2.1	1.4	1.2	0.4
Finland	–0.3	0.2	0.8	0.3	–0.2	–0.8	–2.0

Source: Eurostat and ECB calculations

and the gross operating surplus. In Germany, France and Finland, in particular, below-average dynamics in both these variables have contributed significantly to the negative inflation differentials in relation to the euro area average. The positive gaps for Greece, Ireland, Italy and Spain were the result of dynamics above the euro area average in both unit labor costs and profits.

The diversity of inflation rates among euro area countries also has an important sectoral dimension. Overall, the degree of dispersion in the upward movement of services prices across the euro area countries has been higher than that observed for the Harmonized Index of Consumer Prices (HICP) as a whole. At the other extreme, the rates of increase in non-energy industrial goods prices converged significantly throughout the 1990s, leveling off at a low degree of dispersion from 1999 onwards (see Table 2.2).

As regards *economic growth*, a first look at growth dispersion within the euro area, measured by the unweighted standard deviation, suggests that it is not particularly abnormal, as compared with recent and past history. In fact, this growth dispersion has been fluctuating around the low level of 2 percentage points since the 1970s; since 1999 it has even experienced a slight downward trend (see Figure 2.2).

As in the case of inflation differentials, euro area growth dispersion is not unusually large compared with that in other currency areas, although it shows a certain degree of persistence. Some euro area countries (Greece, Spain and Ireland) have been, since the mid-1990s, persistently growing above the euro area average, while others (Germany and Italy) have been systematically performing below the euro area average (see Figure 2.3).

Table 2.2 Dispersion of sectoral inflation in the euro area countries

	Overall HICP	*Services*	*Non-energy industrial goods*	*Energy*	*Processed food*	*Unprocessed food*
1994–1998	1.95	2.43	2.12	2.78	2.67	3.25
1999–2004	1.12	1.54	1.06	3.35	1.77	2.44
Memo items						
HICP euro area weights 1998		0.343	0.336	0.093	0.134	0.094
HICP euro area weights 1998		0.413	0.310	0.081	0.118	0.077

Source: Eurostat and ECB calculations

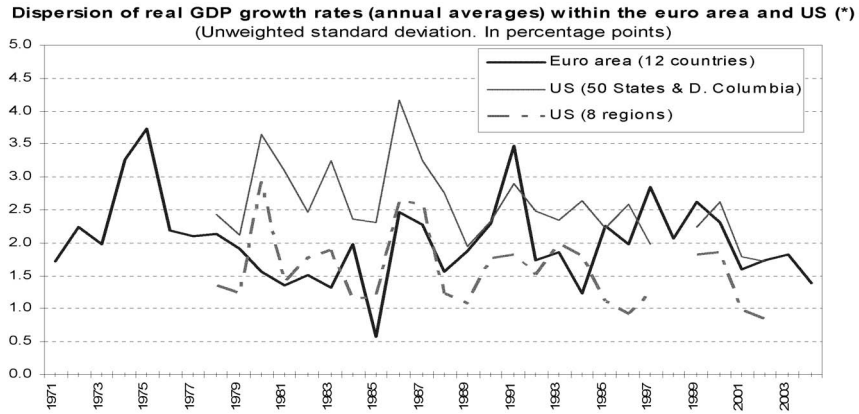

Figure 2.2 Dispersion of growth rates in the euro area and the US (Sources: European Commission and US Bureau of Economic Analysis)

From a supply-side perspective, a growth accounting exercise, where overall GDP growth is decomposed into its different components following a standard production function approach (capital, labor and total factor productivity), suggests that total factor productivity has played a prominent role in explaining dispersion among euro area countries over the last 30 years, although its contribution seems to have decreased since the 1990s. In parallel, the contribution from capital has displayed an increasing trend while that of labor has shown a decreasing contribution (see Figure 2.4).

Focusing upon demand components, total investment, exports and imports have shown a downward dispersion trend since the mid-1990s (see Figures 2.5 and 2.6). If we look at the sectoral breakdown, agriculture and construction feature the

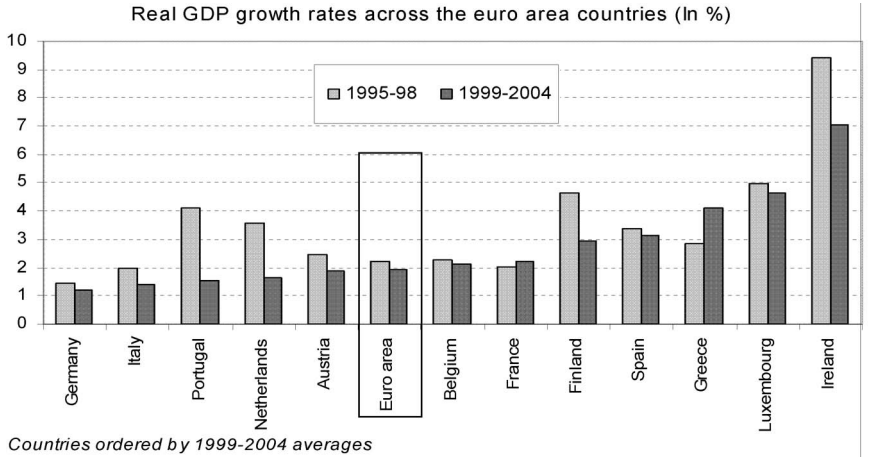

Figure 2.3 Average growth rates (Source: Eurostat)

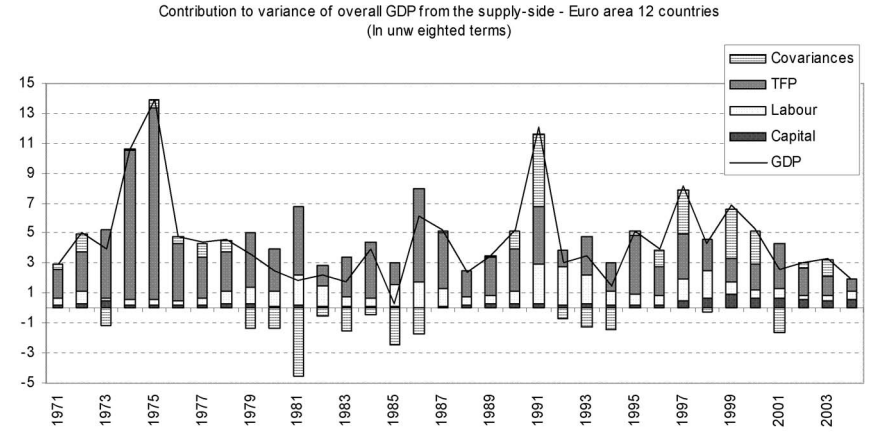

Figure 2.4 Contributions to dispersion of TFP, labor and capital (Sources: Eurostat, ECB Calculations)

highest dispersion, with no defined trends in any sector other than manufacturing, where a clear decline can be seen since the late 1990s (see Figure 2.7).

This account of the facts related to economic divergences in the euro area can be further completed with a reference to the basic characteristics of European business cycles. A first insight into this issue can be obtained from the decomposition of real GDP into its cyclical and trend components, which shows that the current degree of dispersion in overall real GDP growth largely reflects lasting trend growth differences and not cyclical differences (see Figure 2.8). In addition, a close look at simple correlation coefficients of year-on-year GDP growth rates indicates that correlations across countries have increased in the last 30 years (see Figure 2.9). Moreover, on the basis of the analysis of monthly and quarterly

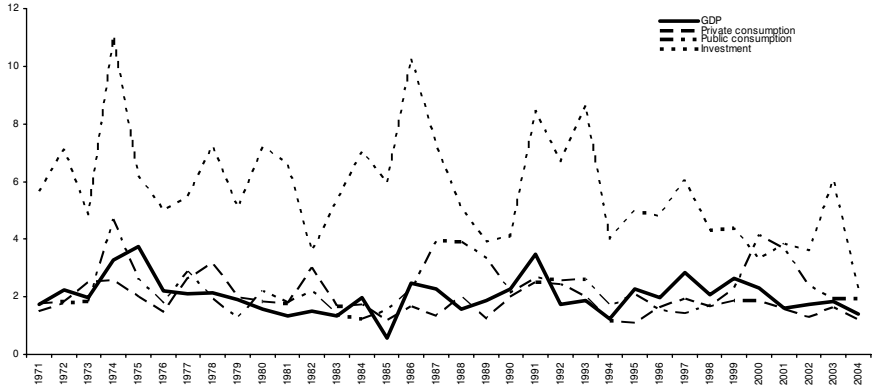

Figure 2.5 Dispersion of domestic demand (Sources: Eurostat, ECB Calculations)

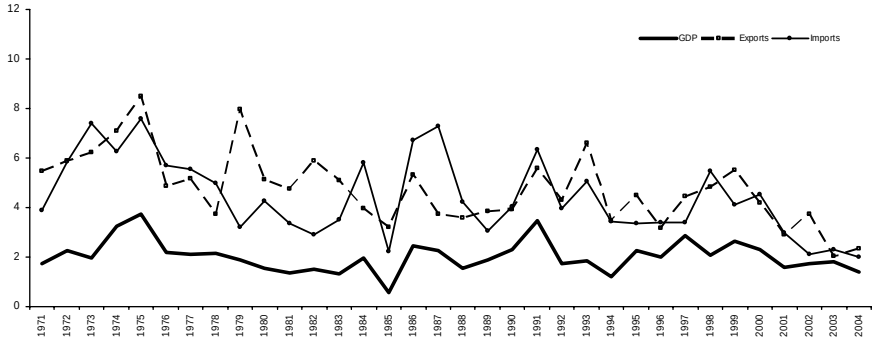

Figure 2.6 Dispersion of external demand components (Sources: Eurostat, ECB Calculations)

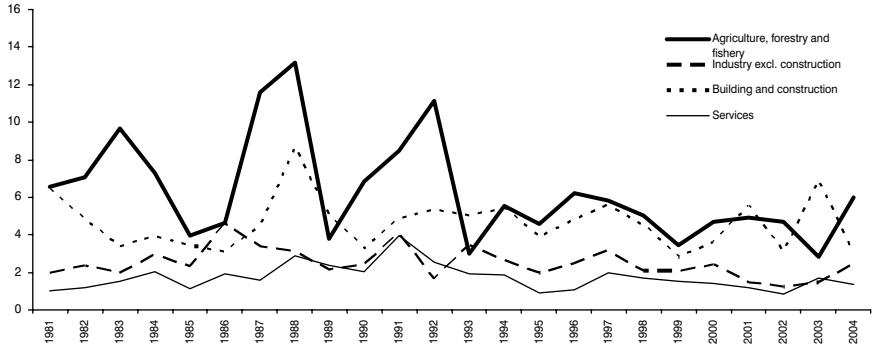

Figure 2.7 Dispersion by sector (Sources: Eurostat, ECB Calculations)

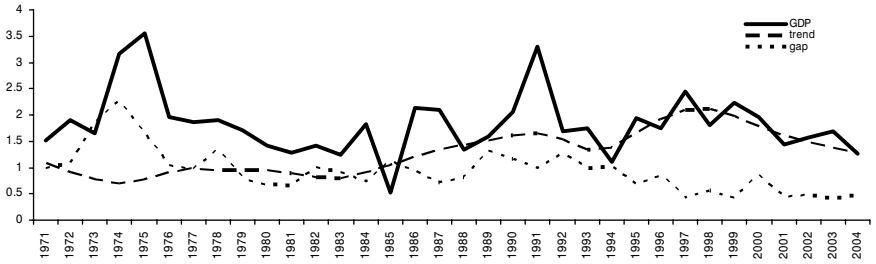

Figure 2.8 Dispersion in trend growth and output gap (Sources: Eurostat, ECB Calculations)

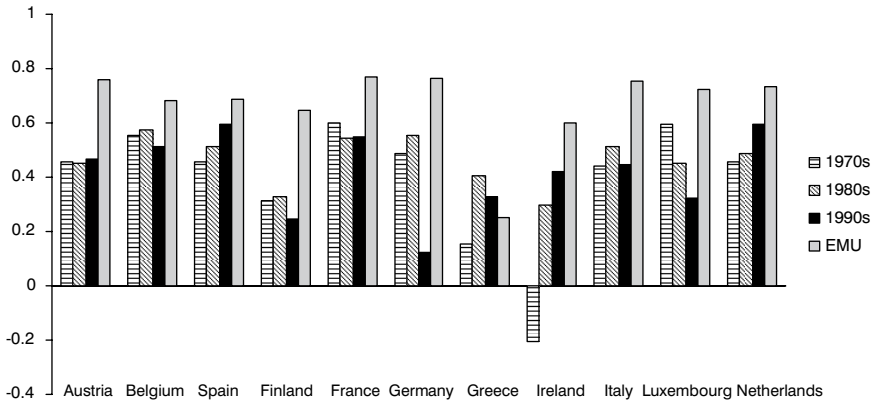

Figure 2.9 Correlation coefficients by country (Sources: Eurostat, ECB Calculations)

industrial production data, recent research work concludes that synchronization of European cycles is high and this strong co-movement dates from before the establishment of Monetary Union (Camacho *et al.*, 2004). From a different perspective, the quarterly chronology of peaks and troughs, according to the Harding and Pagan (2002) algorithm, in GDP across European countries confirms that the euro area countries share relatively similar duration and amplitude of the business cycle. Similarities seem to be the norm rather than the exception, with a complete cycle lasting on average about six to seven years.

All in all, the main facts can be summarized in two conclusions. Current inflation and growth differentials among euro area countries are not large when compared with historical trends or observed differences in other currency unions. However, they tend to be persistent.

The causes of regional divergence in the euro area

In order to better discuss the origins of inflation and growth differentials, it is useful to make a distinction between three groups of driving factors: (i) transitory

factors related to the convergence process; (ii) factors related to long-lasting or permanent differences in national economic structures; and (iii) policy-induced factors related to the conduct and operation of national fiscal and structural policies or to the various regional responses to euro area-wide policies.

The convergence process

Starting with differentials that were caused by the process of convergence prior to Stage Three of EMU, the one-off convergence of nominal interest rates towards the low rates prevailing in the best-performing countries in terms of credibility was an important temporary factor shaping economic differentials in the first years of the euro area's existence (ECB, 2002). The adoption of the euro led to a significant reduction in both nominal and real interest rates and in financial costs in countries that had experienced higher inflation rates in the past, as well as a higher degree of integration with the financial markets of the rest of the euro area. This contributed to a surge in domestic demand in those countries, exerting sustained upward pressure on prices, particularly in the non-tradable goods and services sectors.

A second important factor was the implementation of the Single Market program in the first half of the 1990s and the subsequent introduction of the euro in 1999. Both added to a marked decline in price level dispersion, mainly for tradable goods, which has also contributed to generating some of the inflation differentials observed in the first years of the euro. Looking ahead, the importance of this type of price level convergence for euro area inflation differentials should diminish over time.

While market integration and increased cross-border price transparency has led to convergence in the price of traded goods, a large proportion of consumer price inflation is accounted for by prices of goods and services that are not traded between countries. In this respect, the Balassa-Samuelson effect has often been discussed in relation to persistent inflation differentials in the euro area. At the centre of the Balassa-Samuelson hypothesis are differences in productivity growth between countries' tradable and non-tradable goods sectors. In essence, this theory states that countries with large differences between their labor productivity growth rates in these two sectors – due, for instance, to a process of catching-up in income levels – will also tend to experience higher overall inflation rates. The Balassa-Samuelson effect reflects an equilibrium phenomenon: since international competition puts downward pressure on prices in the tradable goods sector, upward price pressures arise only in the non-tradable sector and the resulting inflation differentials across countries do not need to be reabsorbed. Opinions differ as to the extent to which the Balassa-Samuelson hypothesis is relevant to the euro area, partly because it is difficult to quantify the effect with any precision (ECB, 2003). Overall, there is a growing consensus that this theory constitutes only a partial explanation for the persistent inflation differentials observed in the euro area. Moreover, the size of the Balassa-Samuelson effect for countries currently

in the euro area is likely to diminish over time, provided that convergence in terms of GDP per capita among those countries proceeds.

Finally, as regards the role of a catching-up effect in explaining observed growth differentials in the euro area, it is equally worth noting that gaps between euro area countries in terms of real per capita GDP seem very persistent in the last 30 years (Giannone and Reichlin, 2006). There are no clear indications of a long-term tendency for countries to converge toward a common level of income, with the notable exception of Ireland and to a lesser extent Spain.

To sum up, current and past differential developments in the euro area economies can be only partly explained in terms of a process of transitory convergence. The role played by other factors, more structural or more institutional in nature, should then be analyzed.

Structural differences

The facts presented thus far indeed appear to lend support to the argument that differences in economic developments between euro area countries stem to a significant extent from structural factors. I will concentrate on two of them.

One first element that may have contributed to lasting inflation and output differentials in the single currency area relates to member countries' differing exposure to changes in the determinants of the external trade and in prices of raw materials. Fluctuations in these factors coupled with differences between economies in the degree of openness, in the composition of international trade and in trade links with non-euro area partner countries might be relevant factors behind inflation and growth differentials.

A second important structural factor relates to rigidities in wage and price-setting. The process of adaptation to changing economic conditions typically requires the continuous adjustment of relative prices across regions and sectors. Such a mechanism, which is a normal and desirable feature of a market-based economy, may give rise to short-lived inflation differentials across the regions and sectors of a monetary union in the face of demand and supply shocks. However, the presence of rigidities affecting the price and wage formation mechanism delays the necessary adjustment and gives rise to distortions in relative prices after such shocks, thereby contributing to lasting inflation and growth differentials. Recent provisional evidence gathered by the Eurosystem Inflation Persistence Network – a research network studying the patterns, determinants and implications of inflation persistence in the euro area and its member countries – helps to shed some light on the importance of rigidities in the price-setting behavior of firms in the euro area (Angeloni *et al.*, 2004). For instance, the Network calculates that average consumer price duration – the time elapsing between two successive price changes – in the euro area is between four and five quarters, compared with an estimate of around two quarters for the United States. This seems to indicate that, on average, there is greater rigidity in price-setting in the euro area than in the United States. Looking at the sectoral pattern, energy and unprocessed food prices seem to change most frequently, while services prices appear to be modified less

frequently. If prices for services are indeed characterized by a systematically longer adjustment process, this could, given the large weight of this sector in the euro area economy, generate significant and persistent inflation divergence.

This conclusion would seem to fit well with the evidence cited earlier that the services sector (which accounts for most of the price dynamics of the non-tradable sector) contributes significantly to overall inflation dispersion. It is also supported by the evidence on the importance of unit labor costs in explaining differentials in changes in GDP deflators across the euro area, given that a large share of the total output of the services sector is accounted for by employment compensation. Overall, this suggests that a substantial part of the persistent divergence of price developments may stem from differences in wage developments and in wage-setting mechanisms across euro area countries, including – in some cases – the automatic indexation of nominal wages to prices. In this respect, recent evidence points to the fact that although estimated wage rigidity is similar in the euro area to that found in a number of countries, including the US, wage rigidity in the euro area show some heterogeneity across countries (Sanz de Galdeano and Turunen, 2005).

The role of policies

Finally, both euro area-wide and regional policies may have played a role in shaping the degree of heterogeneity in the currency union. Fiscal policies in particular could be one of the sources of output differentials in the euro area insofar the use of fiscal instruments had been inappropriate. In this respect, there is some evidence that the pro-cyclical effects of the fiscal policies of euro area countries may have helped to increase cyclical differences in the recent past. Furthermore, recent evidence exists that large fiscal deficits tend to reduce business cycle synchronization by creating idiosyncratic fiscal shocks (Darvas *et al.*, 2005).

One such shock, which is the recourse to increases in indirect taxes and administrative prices, also has a particular bearing on the issue of inflation differentials. In effect, changes in administered prices, which account for around 6 percent of the HICP, and indirect taxes can generate inflation dispersion, at least in the short to medium term.

In principle, monetary policy could also add to growth and inflation dispersion in a currency union via its differentiated transmission across countries, particularly in the presence of differing degrees of nominal rigidities. In this respect, however, there is no conclusive evidence of systematic differences in the transmission of monetary policy impulses across regions in the euro area. The effects of monetary policy depend critically on the monetary policy regime in place, and the change in policy regime due to the introduction of the euro may have modified the transmission mechanism of monetary policy in the euro area, making it more difficult to properly and reliably extrapolate from historical experience.

Furthermore, in the public and political domains it has often been argued that the combination of uniform interest rates and inflation differentials imply different 'real' interest rates across countries. It is maintained that such a difference might

have a destabilizing impact on national economies because, for example, countries with above-average inflation would experience lower real interest rates, which would in turn fuel domestic demand and inflation. And countries with below-average inflation would suffer from higher real interest rates, resulting in further downward pressure on domestic demand and inflation and thereby adding to the original inflation and growth differentials. However, these views are to a large extent misleading since they neglect relevant economic considerations.

First of all, the aforementioned argument is generally made with reference to ex post measures of the real interest rate, calculated by subtracting the currently observed level of inflation from nominal interest rates. However, what matters for investment and consumption decisions are ex ante measures of real interest rates, namely the difference between market interest rates and economic agents' expectations with regard to inflation developments over the relevant horizon. The dispersion across countries of ex ante measures of real interest rates is significantly lower than that of ex post measures (see Table 2.3). In the case of long-term interest rates, it has been approximately half that of real interest rates measured using realized inflation since 1999. Furthermore, again since 1999, the dispersion of ex ante measures of real interest rates has been about one-third of that prevailing before the introduction of the euro.

Second, and perhaps even more fundamentally, our assessment of the consequences of different real interest rates should obviously depend on the underlying causes, which could be manifold. For example, if a country's lower-than-average inflation rate is due to higher-than-average productivity growth, this would be an indication that the country in question has strong investment prospects, even if its real interest rate is higher than that of other countries.

Table 2.3 Dispersion of real interest rates within the euro area

		Short-term real interest rates		*Long-term real interest rates*	
		Ex ante	***Ex post***	***Ex post***	***Ex post***
Nominal interest rates deflated by:		*Inflation forecasts for the following year*	*Current HICP annual inflation rate*	*Long-term (6 to 10 years ahead) inflation forecasts*	*Current HICP annual inflation rate*
Standard deviation					
1990–1998	unweighted	1.69	0.82	1.29	0.68
	weighted	1.26	0.75	1.23	0.64
1999–July 2004	unweighted	0.53	0.80	0.26	0.62
	weighted	0.45	0.70	0.23	0.57

Source: BIS, ECB, ECB calculations, Eurostat, Consensus Economics.

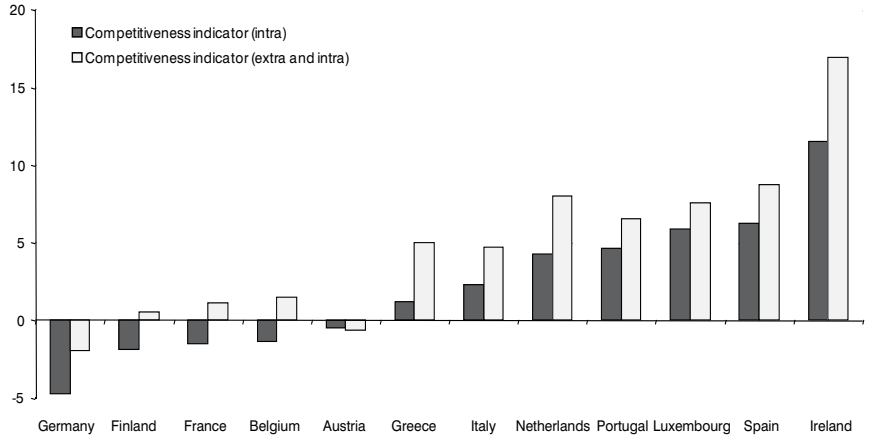

Figure 2.10 Competitiveness indicators: cumulated change 1999–2004

Finally, in a monetary union, where exchange rates among countries are by definition fixed, there are strong market-based forces that work in a stabilizing manner. In particular, if a country has below-average inflation on account of weak demand, it will gain a competitive edge in relation to other countries. Over time this tends to increase demand in that country (and reduce it in others). As shown in a number of recent studies, the competitiveness (or 'real exchange rate') channel, although slow to develop, eventually becomes the dominant adjustment factor (see, for instance, Deroose *et al.*, 2004, and Angeloni and Ehrmann, 2004).

It must be noted that, as a consequence of the prolonged inflation differentials observed over recent years, the euro area countries have experienced marked differences in the evolution of the indicator of national competitiveness (see Figure 2.10). At the same time, this re-equilibrating mechanism could be effective only after an extended period in the euro area, and some of the persistent divergences observed may indeed be harmful if not timely addressed.

The implications of regional divergence for the design of economic policies

What can policy-makers do to tackle regional divergences? Should we worry about regional heterogeneity in the first place?

Shocks, smoothing and policies

A proper answer to the first question, in terms of the potential role for structural and fiscal policies and for monetary policy, requires that prior consideration be given to the size and nature of regional differences and to their effect on consumption and welfare.

Several arguments could be put forward in support of taking a sanguine view on this matter. Inflation differentials are not unusually large at present and may be partly attributed to transitory phenomena. Growth rate dispersion and output gap differentials are not higher than historically, nor are they abnormally different from those in the United States or other federal countries. Further, although output per capita differentials have been very persistent over the last 30 years, the amount of risk sharing (i.e. the variance of consumption smoothed out through capital and credit markets or other mechanisms) has increased dramatically since the early 1990s. This implies that EMU is probably working and asymmetries in output should be less of a concern.

A more balanced view, however, would be that these arguments are true but do not tell the whole story. Dispersion in the euro area is larger than that observed across regions of certain individual countries. In addition, as illustrated by the decline in competitiveness in recent years, the exchange rate channel seems to be operating in a very sluggish fashion.

An additional, related consideration centers on the nature of the shocks. The economic asymmetries observed among countries in a monetary union can be the result of either common shocks that propagate differently across countries or idiosyncratic shocks. This distinction is not only theoretically appealing but also crucial in terms of its policy implications. If variations in economic activity between countries with different institutions, economic structures or economic policies are driven by a common cause, national or regional policies designed to counteract the variations may be ineffective. If, on the other hand, asymmetries are the result of idiosyncratic shocks, then national policies aimed at influencing economic activity would have a role to play. This question is of particular interest in the euro area, where the use of a common monetary policy in response to idiosyncratic shocks is not feasible.

Different attempts can be found in the literature to provide a solution to this issue. The results of recent studies that apply a VAR methodology (Giannone and Reichlin, 2005) allow us to conclude that country-specific shocks, more than euro area-wide or global shocks, are responsible for the output gaps in the euro area countries and may have a long-lasting effect, thus helping to generate persistent differences across countries.

Structural and fiscal policies

Thus national policies would appear to enhance the ability of countries to address shocks and divergences. Starting with *structural policies*, it is widely recognized that two factors are crucial to the smooth adjustment to changing economic conditions and the efficient functioning of the labor and product markets in a single currency area: first, the mobility of factors of production and, second, the flexibility of wage and price-setting behavior.

On the mobility of factors of production, a clear dichotomy can be observed in the euro area. On the one hand, the process of integrating capital and financial markets has already come a long way. A continuous increase in cross-border

financial and capital flows is being observed, as well as increasing competition in the provision of financial services. For example, intra-euro area Foreign Direct Investments (FDIs) stocks have grown from 14 percent of euro area GDP to around 24 percent between 1994 and 2004, and the euro-denominated corporate bond market grew from less than €400 billion of outstanding bonds in 1998 to well over €1 trillion in 2004. Further action is needed, though, to remove the remaining market segmentation and regulatory impediments to free competition. If we take the deep, liquid and unified US financial markets as a benchmark, it is patent that the euro area still has some way to go, especially as regards the integration of equity markets, the establishment of common legal and regulatory frameworks, and the consolidation of the banking sector. Further integration of the European financial markets would help to reduce the volatility of consumption by increasing opportunities for risk sharing and consumption smoothing, and would also promote a more homogeneous transmission mechanism of monetary policy.

On the other hand, labor appears either to be too slow to react to wage and demand conditions or is prevented from doing so by persistently distorted price signals, leading to relatively low labor mobility between countries and regions, as well as between sectors and professions. This points to a need for more flexible labor markets in the euro area, particularly at the national and regional levels. While some discernible progress with regard to labor market reform has been seen in almost all countries of the euro area over the past decade, labor markets still appear to be too rigid and unresponsive to economic conditions – as indicated by the persistently high level of structural unemployment and the low labor force participation rates observed in most countries.

As regards the need to promote flexibility in wage and price-setting, it is crucial to continue the process of strengthening effective competition, for instance through liberalization and deregulation, in order to improve the efficiency of price signals in the goods and services markets, and thereby enhance the efficiency of resource allocation in the economy.

Turning to *fiscal policies*, it is clear that proper fiscal reforms can also help to enhance the ability of individual countries to respond to economic shocks. In particular, sound government finances are crucial to allowing a country to let automatic stabilizers work fully without running the risk of excessively high deficits. This represents an important mechanism in the process of macroeconomic adjustment in response to regional divergence. Historical experience shows that discretionary fiscal policies are – especially in view of the implementation and impact lags involved – a blunt and imprecise instrument when it comes to responding to cyclical fluctuations. It is thus particularly important that governments prevent discretionary policy measures from acting pro-cyclically over the business cycle, thereby exacerbating divergences across countries in the wake of asymmetric shocks.

All in all, structural and fiscal policies that are aimed at fostering greater mobility of production factors, in particular labor, and more flexibility in price and wage-setting can increase the effectiveness of those re-equilibrating mechanisms that sometimes appear too slow to operate in the euro area.

Monetary policy

Moving to the side of monetary policy, I must recall that the establishment of the euro area spurred a far-ranging academic, but also political, debate on the proper design and conduct of monetary policy in a monetary union. More recently, these discussions have also tended to focus upon the implications of inflation differentials for the formulation of monetary policy in a single currency area, particularly where such differentials are coupled with, or are the product of, nominal and real structural rigidities. From this ongoing debate some important general conclusions can be drawn (ECB, 2005).

First, there is a broad consensus among academics, observers and policy-makers that monetary policy should focus on maintaining price stability in the single currency area as a whole. It should thus anchor inflation expectations and contribute to increasing market transparency, thereby facilitating the necessary adjustment of relative prices across different countries or sectors in the presence of economic shocks.

By contrast, it is widely recognized that assigning to monetary policy the additional role of directly addressing the balance between the sectors or regions of the single currency area in the process of adjustment to shocks would overburden monetary policy to the detriment of its primary role. This is particularly the case when, as discussed previously, asymmetries are mainly caused by idiosyncratic shocks. In that case, national economic policies are better instruments to enhance the ability of individual countries to respond to economic shocks and regional divergences.

Second, the very design of monetary policy can cater for regional or national diversity. In fact, the presence of long-term equilibrium inflation differentials across countries constitutes one of the central justifications for a central bank aiming to maintain the inflation rate in the currency area as a whole at a very low level, although not too close to zero.

Third, it is important for the central bank to take into account regional and sectoral information on the source and nature of economic shocks, which includes monitoring and understanding the underlying reasons for inflation differentials, even if policy is formulated with a view to maintaining price stability for the currency area as a whole.

Finally, by maintaining a medium-term orientation in the conduct of its monetary policy, a central bank can facilitate the necessary adjustment of relative prices across regions and sectors in the presence of asymmetric shocks.

All those principles are present in the ECB's monetary policy strategy. First, as laid down in the treaty establishing the European Community, the primary objective of the Eurosystem is to maintain price stability for the euro area as a whole. By keeping price levels stable, monetary policy contributes to the adjustment of relative prices and facilitates their role in guiding the allocation of resources across the sectors and countries of the euro area. This is the best contribution that monetary policy can make to economic welfare and the attainment of high levels of economic activity and employment. In May 2003 – as part of its review of the

ECB's monetary policy strategy – the Governing Council of the ECB clarified its price stability objective, explaining that, in pursuing price stability, it aims to maintain inflation rates 'below but close to 2 percent' over the medium term. By specifying that it aims to keep the inflation rate close to the upper bound of its definition of price stability, the Governing Council made it clear that this also takes into account the implications of inflation differentials across the countries of the euro area. In particular, it provides an adequate safety margin to prevent some regions from structurally operating at negative inflation rates. It was thus recognized that inflation differentials could pose a risk for regions with structurally lower inflation rates in terms of the potential costs of adjustment associated with the possible presence of downward nominal rigidities.

Second, while the ECB's internal work, analysis and assessment of economic information, its policy deliberations and its decisions are fully aligned with the goal of maintaining price stability for the euro area as a whole, this does not mean that the ECB looks exclusively at euro area-wide information. In order to achieve its objective and, in particular, to conduct its broad-based analysis of the risks to price stability over the medium term, the ECB regularly reviews and analyses all relevant information relating to the various sectors and countries of the euro area. Thus, the ECB closely monitors sectoral and national developments in order to better formulate our assessment of the economic situation and its likely evolution for the euro area as a whole. Indeed, it is essential that the monetary policy-maker is able to understand the source and nature of economic shocks – whether demand or supply-related, whether permanent or temporary – and to assess their effects on the economy as a whole in order to formulate the best possible monetary policy response. In this respect, the analysis of disaggregated information is crucial, as many shocks of euro area-wide relevance originate in specific countries or sectors.

Finally, a key element of the ECB's monetary policy strategy is its medium-term orientation, which implies that it does not attempt to maintain or restore price stability in the very short term in the wake of economic changes. This allows the ECB to formulate the best possible monetary policy taking due account of the nature of economic shocks and, at the same time, to provide flexibility for individual economies or sectors to adjust gradually after localized or asymmetric shocks.

Conclusions

After seven years of history of the European monetary union, the growth and inflation differentials among member countries are far from being large, whether from a historical perspective or compared with other monetary unions. However, they appear to be relatively persistent.

While differences across countries can be seen as a normal feature in any monetary union, lasting economic differentials that are the product of misaligned national policies and/or deep-seated structural inefficiencies may be damaging for the national economies and need to be addressed by national policies. In the case of

EMU, in particular, it is therefore crucial that countries pursue suitable structural policies aimed at enhancing their flexibility and adaptability to continuously changing conditions in the monetary union.

On the monetary policy front, by anchoring inflation expectations and increasing transparency, the ECB's monetary policy is contributing to the adjustment of relative prices, thereby facilitating their role in guiding the allocation of resources across countries and sectors. As an indication of the success of this strategy, inflation expectations at the level of the individual countries are more closely aligned than observed inflation rates. Given the importance of expectations for future developments in wage and price-setting behavior, this implies that a powerful mechanism has been put in place to help keep economic developments across the individual countries of the euro area closely bound together.

Note

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3 On the government's role in regional economic development

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Introduction

There is little debate in the literature about whether there *is* a role for government in regional economic development. Some level of government has been at the table since the very founding of the United States (and from the early days of other countries, as well). Today, the local economic development apparatus is so entrenched in the U.S. that it is hard to imagine regions without government involvement. To the extent there is discussion in the literature about government and regional economic development it tends to revolve around the appropriate unit of government, the extent and timing of involvement, and the type of interventions to use.

We develop that theme in three further sections of the chapter. First, we define some terms and concepts. By elaborating what we consider to be 'government roles' and 'regional economic development,' it becomes clear that the two cannot be easily separated in the United States and other countries. We provide an overview of the types of interventions and stylized textbook rationales. Then, we focus on the particular roles of state, regional, and local governments. As we move into the twenty-first century, most regional economic development activity is at those sub-national levels. Finally, in the third section that follows, we discuss three current issues in regional economic development policy that call into question the appropriate role of government. Each of these issues has historical roots.

Definitions and concepts

The textbook definition for the 'government role' in regional development includes the following activities and range of sub-activities:

- Planning – objective setting, *ex ante* assessment (usually cost–benefit analysis), and rule making.
- Financing – development of capital for long-term projects from both taxes and fees, paying as-you-go and through bonds, and the provision of inducements, incentives, and subsidies.

- Regulating – establishment and enforcement of property rights, taxation, and any other rules governing behavior.
- Managing – coordination, contracting out, and *ex post* evaluation, *inter alia.*

Viewed in this broad way, it is hard to conceive of regional development sans government. Often, the absence of government is itself an act of governance, as would pertain to privatization and deregulation.

By 'regional economic development' we mean efforts to enhance employment, income, wealth, and/or opportunity within a defined geographic area. Regional economic development subsumes industrial, workforce, infrastructure, and other types of development efforts. Figure 3.1 presents a schematic of regional economic development.

Economic development can be interpreted as both a noun and a verb. As a noun it is an outcome, equated to a better quality-of-life for citizens. Ultimately that means a more vibrant social and cultural milieu, financial security, physical health and well-being, and a sustainable environment. Those outcomes are commonly measured in terms of jobs and income created, safety, and retention and attraction of population (brain-draw and brain-drain). Indeed, those are the very outcome measures used in popular commercial software, such as by Regional Economic Models, Inc. (REMI).

Much of the literature and many professional reports focus on what are really intermediate outcomes, at least in terms of economic development (it may be legitimate to consider them as ends in themselves in more limited studies). They are

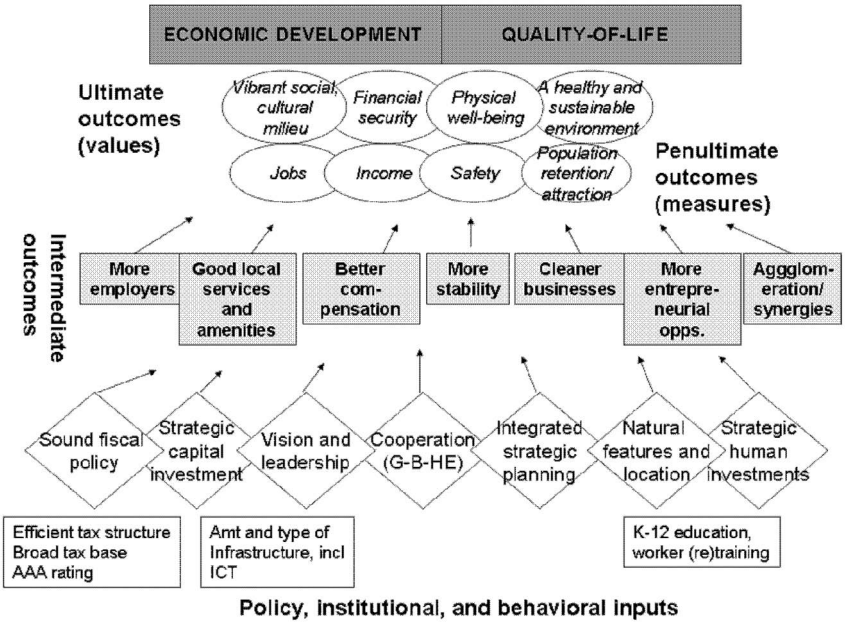

Figure 3.1 Regional economic development

shown as the tan boxes in Figure 3.1: more employers, strategic capital investment, better compensation, more stability, more entrepreneurial opportunities, and agglomeration and synergies.

The role of government (and other inputs) in this schematic is shown at the bottom of Figure 3.1. Among the important policy, institutional, and behavioral inputs are the provision of a sound fiscal environment and strategic investments in capital and labor (Tabellini, 2005). This shows economic development as a verb – the things we do to develop economically.

The definition of 'region' may not have changed over time, but the focus of attention in both policy and the literature has. The government's role in regional development predated the Revolution when the colonies invested in port and waterway improvement and began to build roads (Schultz, 2004). By the early nineteenth century, the new nation was building canals and then railroads. This role was at the center of both constitutional and other legislative acts in the early years of the United States. The interstate commerce clause and federal funding for postal roads recognized the importance of facilitating the flow of goods, people, and information to all parts of the developing nation, including the frontier.[2] That continued after the Civil War into what is now called the 'Era of Bridge Building' (Ibid.). Federal involvement expanded into the twentieth century with further development of roads (including the construction of interstate highways starting in the 1950s), water systems, electrification projects, and the development of airports and seaports. Today, government has added investments in information and advanced communications technology to its list of responsibilities (Luger and Stewart, 2003; Luger, 2001; Luger and Bae, 2005). These activities may not have been explicitly for regional development, but are recognized to have had profound regional effects.

More explicit attention to regional development by the federal government was intended to alleviate pockets of poverty. Many New Deal programs were directed where unemployment was highest or where infrastructure needs were greatest, for example the Works Projects Administration (WPA), Tennessee Valley Authority (TVA), the Appalachian Regional Commission (ARC), and Rural Electrification Administration (REA) were targeted to laggard regions. Some of these regional development efforts survive today, notably the TVA and ARC. The longevity of these programs is not proof of their success in promoting economic development within their regions, but rather the staying power of the political institutions. Both the TVA and ARC cover multiple states within the region; the ARC includes 13 state governors within its commission and converts that participation into the political support necessary for continued funding (Bradshaw, 1992). ARC has expanded into new areas, including the metropolitan area of Pittsburgh, as Congressmen and Senators look to expand the benefits of the commission across their districts. The TVA, at its heart a rural electrification program, has also been shown to have limited economic impact on its region, despite decades of regional investments (Chandler, 1984).

Large federal projects like the construction of the Hoover and Grand Coulee dams in Nevada and Washington (and many other large hydro projects), flood

control on the Mississippi and other rivers, and more, have had profound effects on regional development. The federal government also has used the location of large federal facilities, including military bases and national laboratories, to enhance regional development (see Markusen *et al.*, 1991). Today, there are ongoing regional development programs sponsored by the U.S. Department of Agriculture in rural areas, the U.S. Economic Development Administration, and to lesser degrees other federal agencies. Of course there is also a history of programs targeted to sub-regions or neighborhoods, including for example Model Cities, Community Development Block Grants, and other programs with income and/or unemployment criteria in their allocation formula.

Luger (2004a, 2004b) has described the role of government in regional economic development in terms of appropriate interventions along a continuum, as represented in Figure 3.2.

Whether we refer to a cross-section of countries or regions across the development spectrum, or track a single country or region over time, the economy passes through stages, in terms of its organization of production and types of infrastructure and workers. (Other trajectories can be shown, for example for capital, ranging from micro-finance in developing countries to venture capital and other sophisticated equity arrangements in advanced economies.) As economic policies shift focus from importing, to import substitution, to export promotion, to knowledge creation, and from an employment-based to a knowledge-based economy, they have different needs which must be met by both the market and government.[3] That is illustrated in Table 3.1.

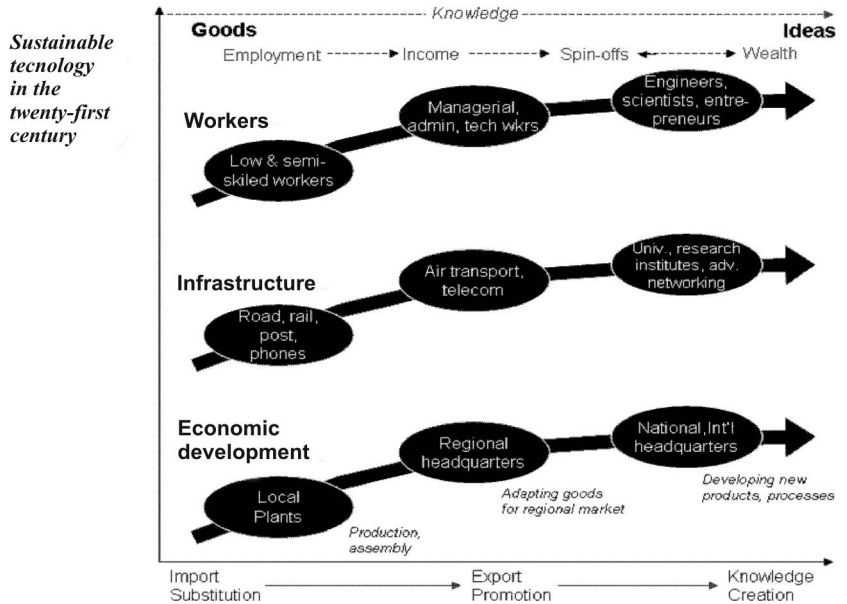

Figure 3.2 The economic development continuum

Table 3.1 Sample government interventions to help economic development

Appropriate Policy: Services along the economic development Continuum	*Improving production techniques and inputs* →	*Conducting applied research* →	*Commercializing outputs of basic and applied research*	*Conducting basic and applied research* ←
	Provide worker training	Provide technical training	Provide licensing and patenting assistance	Provide/operate specialized equipment and facilities
	Provide managerial training	Build/operate testing/calibration equipment	Build/operate incubator	Provide a good work environment
	Provide technical assistance to solve problems	Help organizations link to local universities/ institutes	Provide marketing assistance	Help organizations connect to appropriate global resources
	Build/operate a pilot plant	Provide crunch space	Provide entrepreneurial training	
	Help establish networks			
	Lower levels of economic development →			Higher levels of economic development

In economies (less-developed) seeking to improve production techniques and inputs, government helps by providing worker and managerial training, technical assistance, pilot plants, and networking assistance. When the economy moves to the next level (or to help it move to the next level) the government helps connect businesses to local knowledge resources, and provides crunch space for companies producing for export. For economies (more advanced) focusing more on R&D, the government provides specialized equipment and facilities, connection to global resources, and a good work environment attractive to footloose knowledge workers. And for economies seeking to be successful in commercializing new products and processes, licensing and patenting assistance, incubators, startup financing, and entrepreneurial training.

These government activities just summarized have a mix of what the literature calls intended and unintended or derivative regional consequences. Many authors have pointed out that there are really no geographically neutral federal policies. Luger (1984), among others, has shown that the federal tax code has distinct spatial biases. There was a period during the presidency of Jimmy Carter when the federal government sought to use the federal tax system explicitly to help laggard regions. But that attempted federal targeting of the tax system was short-lived.

Also in the 1970s there was discussion in the U.S. about national industrial policy. Robert Reich, Ira Magaziner, and other progressive writers at the time

advocated for an open debate about what industries should be supported by policy (Reich and Magaziner, 1982). In short, that would make the selection of winners and losers among America's businesses more explicit. But that also had a relatively short half-life.

Today the literature is relatively quiet on these macro questions about the federal government's responsibility and effect on economic development. Central government in the U.S. continues to fund (although at increasingly lower levels) the Appalachian Regional Commission (ARC), Economic Development Administration (EDA), and other federal agencies that help distressed regions more than others. And questions of regional economic impact are part of discussions about military base closings and realignments (BRAC), for example. Some new federal programs require a regional (or distressed community) economic impact assessment – for example, New Market Tax Credits are now available to taxpayers who invest in designated Community Development Entities that can demonstrate the use of the funds for job creation and income enhancement.[4]

Rather than directing multi-state or regional development efforts, the federal government has become a source of funding and other support to state and local efforts. One clear advantage of devolution in the economic development system is the creation of national competition and innovation across states and regions, which can quickly develop best practices for regional development. Unencumbered by the federal government, state and regional leaders can free to pursue innovative policies and programs to address economic shortfalls, as suggested by David Osborne in his 'Laboratories of Democracy' (Osborne, 1988). However, without a coordinated public-private dissemination effort, these best practices fail to spread across areas (McDowell, 1995), concentrating program benefits and potentially widening regional disparities. Those regions without the infrastructure, expertise, and technology to replace declining industries may also experience destructive competition which can lead to a race to the bottom for financial incentives, limited cross-state cooperation, and a duplication of development efforts within a single geographic area (Cooke *et al.*, 1997). Whether the outcome of this devolution is net positive or negative, there are significant consequences for regional economic developers who must work within this new system.

The entrenchment of state and local government in economic development

It is now common for states to have an economic development program whose purpose is to grow industry, mostly by tax incentives and recruiting. The strategic development of those programs in many cases is overseen by an economic development board at the gubernatorial or legislative level. In many states, multi-county economic development organizations also provide services. In addition, there are over 2,500 cities, towns and counties across the U.S. with full-time economic development professionals, often reporting to an economic development commission. Those state, regional, and local economic developers; Chambers of Commerce and issue groups with names like 'the

Committee of 100'; economic development 'allies,' including law firms, banks, and utilities; elected officials; NGOs; foundations; consultants; the education sector; state legislative 'standing committees'; and several federal agencies all constitute a broad and deep professional community of interest around economic development. These stakeholders have no shortage of state-wide and national meetings to attend, sponsored by such organizations as International Economic Development Council (IEDC), State Science and Technology Institute (SSTI), U.S. Economic Development Administration (USEDA), and state economic development associations. And several professional publications are outlets for information about economic development at the state, regional, and local levels, including: *Applied Research in Economic Development* (ACCRA), *Economic Development Journal* (IEDC), *Economic Development Now* (IEDC), and *Economic Development America* (IEDC and the National Association of Regional Councils – NARC), to name a few. There is also a community of scholarship around economic development, in many universities and colleges. That has another set of organizations and journals to create legitimacy (see Luger and Stewart, 2003).

Within this wide range of state-level efforts, the typical goal and most common metric of success is the number of new business announcements. Figure 3.3 shows the typical process to achieve that end. State and local developers not only are involved in prospect handling, but increasingly provide financial incentives to lure the prospect. Some of the incentives that are offered are based on federal (mostly EDA) grant and loan programs, others use state and local taxpayers' money.

Economic development scholars and some enlightened practitioners long have argued that too much attention is focused on business recruitment, as opposed to business retention and entrepreneurship (see Luger and Stewart, 2003). The commitment to this more balanced approach varies among jurisdictions. In any case, they require another (overlapping) set of stakeholders, including Small Business Development Centers, community colleges, manufacturing (industrial) extension partnership programs, entrepreneurship support networks, loan and equity funds, and more. Many of these resources are provided and/or subsidized by government.

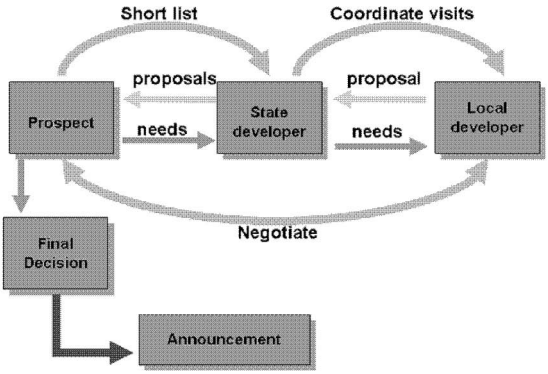

Figure 3.3 The economic development process

The bottom line should be very clear: the government's role in regional economic development is broad and deep. In general, it is not disputed. It is firmly entrenched with many stakeholders who derive financial benefit from the system. Over the past 50 years we have moved farther away from the laissez-faire notion of businesses seeking location based on their assessment of resource and transportation costs, and business performance driven solely by the company's inherent efficiency.

In the third section of the chapter, we discuss three particular issues concerning the role of government at the state level: the expanding use of business tax incentives, cluster-based planning, and the development of innovation systems. The former is meaningful, in part, because virtually every state with a business income tax provides tax incentives for employment, investment, R&D, and other desired activities, some of which are geographically targeted. The second is interesting because cluster-based planning is just another version of the industrial policy mentioned above, from the 1970s. The third is of interest because innovation is the currency of the much-ballyhooed 'new economy' of the twenty-first century. Increasingly, states are competing to create environments attractive to footloose, high-tech businesses, and knowledge workers and what Florida calls 'the creative class' (Florida, 2003).

Examples of possible government intervention abound. We mention some in the section that follows. But Table 3.1 and the examples beg the question: are these government roles justified?

The textbook case for a government role in economic development

Implicit in the foregoing discussion were rationales for government involvement in regional economic development. The justifications are a combination of market failure, equity, and efficiency – all related to the inability of the unfettered market to deliver the outcomes shown at the top of Figure 3.1. In practice, the case for government action includes the following (which are not necessarily mutually exclusive), which go beyond simple textbook rationales. (Each can be contested, and often are by libertarian groups.)

- Capital barriers can preclude a critical level of infrastructure. This is true in most places, but certainly in poor regions. The physical infrastructure needed to support growth and development is lumpy. There are economies of scale in its provision, and because it is long-lived, equity considerations require its costs to be spread over time. The number of future users and/or their median incomes may dwindle, requiring a subsidy. Or the initial cost to provide a level of service adequate for health and safety may be beyond the means of the users.
- The market may not value economic 'transformation' adequately. Economists who have studied the rapid development of the Asian dragons and tigers note the massive investments made by central government, building entire science cities, universities, and other research facilities; investing in transportation

and communications infrastructure, including high speed rail and large airports; and luring expatriates back from the West (see World Bank, 1993). That has enabled economies like Taiwan, Singapore, and Korea to leapfrog ahead, moving up the economic development trajectory in Figure 3.2 quite rapidly. There is no market mechanism for that type of progress.

- Economic development is a merit good and is associated with cross-border flows. Some of the inputs used to achieve economic development (the noun) can be mobile. Trained workers and educated students can move to jurisdictions different from where they were trained and educated, and students from elsewhere can attend local colleges. This type of externality warrants government action.
- As trade barriers are lifted, unfettered global competition may overwhelm indigenous industries. In the short-term, the government can play a central role in supporting industries that are newly opened to competition while retraining workers that are forced out of the sector. Over the long-term, the government's role shifts to become more promotional, identifying local sectors with global competitive advantage and bolstering their growth, and more managerial, monitoring trade partners and foreign corporations to ensure a fair playing field for the local private sector.
- Economic development is defined by the courts as a 'public purpose,' so that government involvement to achieve social benefit is justified, for example, through eminent domain.
- Strategic investment can be efficient, by returning more than itself in benefits. There is such a focus on 'multipliers' in economic development because, in principle, a value greater than one passes the benefit–cost test of efficiency.

Three current issues with implications for government involvement: tax incentives, cluster-based planning, and the development of innovation systems

Tax incentives

During the past several decades, state governments have created and expanded business tax incentive programs to help recruit businesses from other states, assist existing businesses, and induce new start-ups (Luger and Bae, 2005). For example, while 24 states offered tax incentives for job creation in 1984, 43 states offered those incentives in 1998. R&D tax incentives were offered to businesses by 9 states in 1977 and 39 states in 1998 (Chi, 1989; Chi and Hofmann, 2000).[5]

There is considerable debate in the literature and among policy makers about the effectiveness of these state tax incentive programs and whether they are justified as public policy.[6] A review of legislative intent indicates that state tax incentive programs usually are enacted and implemented for political rather than cost–benefit or cost-effectiveness reasons. Brunori (2001) argues that most business tax incentives are the product of inter-state competition to attract businesses from other states, or what he calls an 'arms-race mentality.' State policy makers

appear to be obliged to offer tax incentives to businesses when other states are implementing tax incentive programs. They fear that they will lose businesses already located in their states to other states with tax incentive programs.[7] On the other hand, Greenstone and Moretti (2004) estimated that jurisdictions that won the competition for 'million-dollar plants' gained welfare relative to the runners-up, in terms of wage and property tax premia and, consequently, more spending on services, in their and neighboring jurisdictions.

Given the growth of tax incentive programs at the state level over the past 25 years, the stakes involved with their use also have grown. The tax expenditure nationally from state business tax incentives is substantial. For example, in California, the estimated loss of revenue from business tax incentives was approximately $15 billion in 2001–2002.[8] New York forewent approximately $2 billion in 2002.[9] And North Carolina spent some $74 million on business tax incentive programs in 1997–1999.[10] In addition, Thomas (2000, p. 159) estimated that state and local corporate subsidies in the United States reached approximately $48.8 billion in 1995–1996. This large tax expenditure justifies a careful look at whether business tax incentive programs are justified as public policy. Indeed, several states have sunset provisions or required reviews written into the legislature (e.g. North Carolina, Oregon, and Texas). The need for careful reviews has been amplified in the past fiscal year by serious budget crises in many states,[11] often accompanied by renewed cries from legislators to curtail incentive programs (an action also referred to as 'close tax loopholes').[12]

If the use of tax incentives is based on rationales for government intervention, the last two of the six listed above would particularly apply:

- Economic development is a 'public purpose,' so that government involvement to achieve social benefit is justified.

The public purpose had been challenged in several law suits. For example, in *Maready* vs. *Town of Winston-Salem, NC* (342 NC at 723, 467 SE2d at 624) William F. Maready, a trial lawyer, successfully argued in state Superior Court that his city and the surrounding county violated the state's constitution by giving taxpayer money to private companies for such incentives as helping to rent an office building and providing subsidized parking. The judge, ruling in August 1995, also found that the statute authorizing local government expenditures for economic development was impermissibly vague. Local governments throughout North Carolina began to question their own use of incentives. State officials worried that if the ruling were upheld on appeal, other statutes governing state-level expenditures for economic development might also be cast into doubt. In this case, the ruling was reversed in the state Supreme Court. The Democratic majority accepted the argument that incentives 'are directly aimed at furthering the general economic welfare', while one dissenting judge castigated the state for justifying its use of incentives on the rationale that 'all the states are doing it.'

That provided a reprieve for the state to continue offering incentives, and between 1996 and 2004, the state expanded its repertoire, using several new

incentive programs to lure corporate giants Merck and Dell (among other companies) to the state. The opposition to incentives intensified in response, led by former Supreme Court justice Robert Orr, who formed the North Carolina Institute for Constitutional Law to oppose business incentives.[13] An odd coalition of progressive and libertarian groups has joined Orr in opposing the state's use of incentives, including the Corporation for Enterprise Development on the left, and the John Locke Foundation on the right.[14]

To date, the political center that supports the use of incentives has prevailed in North Carolina (as elsewhere), but pressure for reform is mounting. The recent *Cuno* vs. *Daimler-Chrysler* decision in the U.S. Court of Appeals (2004 FED App. 0293P (6th Cir.)) created a specter for economic developers throughout the U.S. The Court upheld the plaintiff's claim that a Toledo, Ohio, investment tax credit violated the Commerce Clause of the constitution. It remains to be seen how broadly that decision will apply.

The impact of the Cuno case was muted somewhat by *Kelo* vs. *New London*, CT (268 Conn. 1, 54 n.49 (2004)), decided by the U.S. Supreme Court in June, 2005. In Kelo, the court affirmed the use of eminent domain when the result would be jobs for the community. 'The City's proposed disposition of petitioner's property qualifies as "public use" within the meaning of the Takings Clause' (pp. 6–20 of Opinion). In a highly publicized dissent, Justice Sandra Day O'Connor said: 'Under the banner of economic development, all private property is now vulnerable to being taken and transferred to another private owner, so long as it might be upgraded …'

- Strategic investment can be efficient, by returning more than itself in benefits.

Whereas the rationale used above relies on legal/ideological interpretation of constitutional intent, this rationale is empirically based. Incentive supporters argue that incentives pay for themselves by inducing new jobs and investment that otherwise would not have occurred, and that net new activity has direct and indirect economic benefits.

Very little empirical work exists to validate that claim. The Greenstone and Moretti article was noted above, which found positive welfare effects of recruiting. In a recent study, Luger and Bae (2005) provide a two-edged conclusion. Using a simulation model of how tax incentives change the real cost of inputs, the authors conclude North Carolina's business tax incentive program has relatively little net inducement effect: less than 10 percent of new jobs and investment can be linked to receipt of incentive money. As a consequence, the program is not cost-effective, with the cost of each new job about $147,500 on average. In a recent opinion piece, Paul Krugman highlighted an example of tax incentives where a U.S. state lost out to a Canadian province for a new auto manufacturing plant, despite offering significantly higher incentives (Krugman, 2005). The company cited the U.S. state's higher healthcare costs and lower education rates as its reasons for locating in Canada. This example illustrates the larger set of economic development issues,

beyond tax incentives, involved in business recruitment that are already being assessed by private enterprise in their cost–benefit analysis – but that still need to be holistically addressed by state leaders.

Luger and Bae do not rule out efficiency, however. They point out that the tax incentive program is helping many very poor counties that have failed in previous attempts to create jobs. In distressed places, the legislature's willingness-to-pay for induced jobs may be higher than elsewhere. Luger and Bae also point out that tax incentive money not used directly to hire more people and machines is likely to be used in ways that have positive multipliers, for example, by increasing the stock value of the firm. (Many of those benefits may be exported to other parts of the U.S. or world, however, where the companies have other facilities.)

The debate about the efficiency of business tax incentive has also been referred to as a race to the bottom, as states are forced to compete with one another to attract investment and jobs from national and international firms. This has led some critics of tax incentives to call for federally mandated prohibitions in the use of tax incentives (Schweke, 2000). Some critics have looked to the incentive policies of the European Union, such as disclosure laws and cross-national coordination, as a model for U.S. states (Bartik, 2005).

In a 2001 assessment of North Carolina's business tax incentive program, Luger (2001) estimated the direct, indirect and induced effects of the incentives to be sizable. Assuming that 10 percent of all reported activity was actually induced by the incentive program, the incentives accounted for a total of some 3,500 jobs, $2 billion in gross state product, and $6.5 million in new income and franchise taxes per year, in the years studied. Since approximately $30 million in tax revenue was being foregone on average each year, the incentives did not pay for themselves, but the cost per job and dollar of GSP is quite favorable compared to other economic development programs.

Cluster-based planning

During the past dozen or so years the regional science and economics literature has exploded with articles about industry clusters – what they are, how they can be measured, and how policy can and should support their development (see Bergman and Feser, 1999, for an extensive bibliography). A parallel explosion of cluster-based planning activity has occurred in the professional economic development community. Seemingly, all states, many regions, and hundreds of cities in the U.S. and many other countries around the world have commissioned cluster studies. The practice was promoted by the U.S. government, when then-director of the Economic Development Administration, David Sampson, stumped around the U.S. telling applicants for EDA funding that they needed to do cluster-based planning to get priority.[15] And the practice was promoted by high-profile academics or consultants, notably Michael Porter and his Monitor Group, who completed many of these cluster studies. His 2001 study (with the prestigious Council on Competitiveness), *Clusters of Innovation*, attracted attention in the academic, policy, and professional worlds.

There is a general consensus in the literature that cluster-based planning is a worthwhile activity. Feser and Luger (2003) sum up that sentiment as follows:

> … industry clusters are popular because they provide a useful framework for policy makers, business and community leaders, and everyday citizens to understand the dynamic nature of their region's economy. That framework is aided by cluster analysis, defined here as the systematic identification and documentation of key groups of interdependent businesses in the local economy. In certain fundamental ways, cluster analysis is similar to benefit–cost analysis which became popular in the 1970s and 1980s as a way to understand the complex trade-offs between up-front investments and long-term benefits. We now teach benefit–cost analysis as a mode of inquiry more than as a technically sophisticated model that can generate benefit–cost ratios to guide policy, accurate to three decimal places. Similarly, cluster analysis is important not because it leads to a precise way to define the industrial landscape, but rather, because it too is a highly useful and flexible mode of inquiry.

The question remains, however, whether cluster-based planning is a legitimate governmental activity. Feser and Luger (ibid.) liken it to the industrial policy that was in vogue in the 1970s; it amounts essentially to government (or its contractors) picking winners and losers within the industrial economy, to guide its policy interventions.

All of the rationales for government intervention listed above can be used to justify a public sector role in cluster-based planning. Here, we focus on two in particular:

- The market may not value economic 'transformation' adequately.

Many of the places that muster resources to pay for cluster-based planning services are motivated by a desire to move from a traditional to a knowledge-based industrial base. Cluster-based planning allows those places to identify emerging and potential new sectors, and the amenities and services that must be developed to attract and support businesses in those sectors.

If a standard benefit–cost analysis were done to justify the kinds of investments needed to transform that economy, it would likely not justify the expenditure because the benefits side of the equation would be vague. Cluster-based planning allows business and government leaders to envision what their economy could look like, and therefore, makes it easier to commit scarce resources to new uses.

- Economic development is a merit good and is associated with cross-border flows.

Recognizing that the human and financial capital that are critical for success in the twenty-first century economy are mobile, places may not invest in the

education and training necessary to attract knowledge-based clusters, without some help from the government.

Of course, if the cluster planning process is not likely to pick the right winners and losers, and the policy process fails to identify the proper amenities and services to provide, these rationales for a government role are moot. A place then may be better off not changing much.

Development of innovation systems

An innovation system is the interconnected relationships among government, universities, and private sector companies focused on science and technology (S&T) research, development, and commercialization. Innovation system policies direct public funds to develop new businesses that are capable of competing in the global market. These technology innovations affect both products and services within the economy, making the private sector more productive, which in turn bolsters both competitiveness and long-term economic development (Feinson, 2003). Innovation policy is different from traditional economic development policy which focuses on the use of tax incentives to affect the location of branch plants of existing companies.

In Europe and Asia the development of national innovation systems has been a major concern of central governments. In the U.S. that mantle has been assumed by states for the most part.[16] Much like the industrial policy debate of the 1970s, the level of appropriate state involvement in developing the innovation capacity has been a matter of debate in the literature. Moreover, that approach has been resisted by traditional economic developers and elected officials who equate economic development with 'smokestack chasing.'

The case against branch plant recruitment, and for innovation system development, is built by a growing number of authors. Nunez (2004), for example, argues that the benefits from successful branch plant recruitment do not spill over to the surrounding (often poorer) region. With an increasingly global supply chain, corporations are able to use suppliers outside the region, limiting the multiplier effect. Feldman and Link (2001) add that branch facilities also fail to enhance the local knowledge-base or create opportunities for new business startups. The alternative is for the government to help create indigenous innovative capacity and foster entrepreneurship by directing resources toward innovation systems (Bozeman and Dietz, 2001). Maillat (1998) points out that the United States' economic success in the post-WWII era has been due largely to strong linkages across universities, government, and the private sector, which has led not only to advances in science, but as important, to an unprecedented growth in the commercialization of technology. These commercial opportunities have tapped into a deep entrepreneurial culture within the U.S., which has been supporting new startups and technologies for decades.[17]

Several rationales for government intervention in economic development that are listed above are applicable to the public sector's role in developing innovation systems. Here, we focus on three in particular:

- Capital barriers can preclude a critical level of infrastructure.
- Innovation infrastructure, including R&D facilities and communications access, require long-term investments with risky pay-offs. For low-income areas, the private sector may not be sufficiently developed to support an innovation system on its own. In advanced countries, innovation systems are so large and complex that it requires extensive funding and coordination across government, academic, and private sector entities to successfully sustain the system. This high level of risk can only be mitigated by the full or partial guarantees of government involvement.
- The market may not value economic 'transformation' adequately.

No matter the current level of development within a given region or state, a well-functioning innovation system can play a key role in transforming the economy. Innovation systems can help lead the rest of the economy towards transformation, creating new opportunities for the private sector, increasing productivity, and enhancing local competitiveness. For regions to be truly capable of competing globally they must be able to finance, support, and commercialize the outputs of an indigenous innovation system. To achieve this goal, the government must be involved at many of the stages for planning, funding, and maintaining the system.

Conclusion

This chapter summarizes the sense of the literature about the role of government in regional economic development, focusing mostly on the U.S., using examples from our own state, North Carolina. But the lessons are more broadly applicable. The three main take-aways are: (1) regional economic development is so entrenched as an activity of government there is little debate about its legitimacy; (2) several 'stylized' rationales for government intervention can be applied to the activities we observe; and (3) to the extent there are controversies they are at the state level, surrounding the three most widespread, and fast-growing activities of government: the use of business tax incentives, cluster-based planning, and the development of what is referred to as 'innovation systems.'

The debate about tax incentives is whether they really make a difference, or simply shift activity from one place to another and reward the companies' owners, who are relatively more wealthy than the average citizen. The opposition typically comes from a coalition of progressive and libertarians. The majority in the middle argues that there is a prisoner's dilemma: because everyone else is using incentives, they would hurt themselves by unilaterally disarming. That same group would gladly disarm if others did too. That suggests a place for federal legislation outlawing the practice.

The debate about cluster-based planning is much milder than for tax incentives. If simply used as 'a mode of inquiry,' cluster-based planning is widely accepted as a helpful way for regions to understand their strengths, weaknesses, opportunities, and threats, and create priorities for action. But to the extent that the practice is

used to pick winners and losers it runs into the same criticism as industrial policy had in the 1970s – the government cannot do better than the unfettered market. But market failure may exist in the difficulty places have in assessing the value of economic transformation, and in investing in resources that are mobile.

The focus on innovation systems has been controversial more among practitioners than among scholars. Many economic developers are steeped in the tradition of smokestack chasing and are rewarded for their success in luring branch plants that create jobs. Because of that incentive structure, the parochialism that characterizes a decentralized and devolved political system like the U.S., and a conservative streak that militates against spending money to build long-term capacity, there is less innovation systems development in the U.S. than many critics would like to see.

Notes

1 An earlier version of this chapter was presented by Luger at REDE's International Conference on the Role of Government in Regional Economic Government, in Baiona (Galicia), Spain, September 19–20, 2005.
2 The Interstate Commerce Clause of the U.S. Constitution grants the U.S. Congress the power to regulate international and interstate trade. This clause was used in the 19th and 20th centuries to expand federal regulatory power at the expense of the states. The clause became the basis for federal environmental, safety, and labor standards, among others.
3 Figure 3.2 collapses a broad literature on economic development theory. (See Malizia and Feser, 1999, inter alia.)
4 http://cdfifund.gov/programs/programs.asp?programID=5.
5 Coenen and Gekkersteubm broadly define tax incentives as the 'entire class of direct and indirect government subsidies to business that are not inherently part of a generally accepted tax structure, including but not limited to property tax abatements, tax exemptions, low interest loans, free real estate, firm-specific infrastructure, and firm-specific job training' (1996; as cited in Buss, 2001). According to Chi and Hofmann (2000), tax incentives refer to 'any credits or abatements of corporate income, personal income, sales-and-use, property or other taxes to create, retain, or lure business.' This definition is much narrower than Coenen and Gekkersteubm's, because tax incentives exclude grants, loans, loan guarantees, loan subsidies, job training programs, and infrastructure subsidies. Fisher and Peters (1998) distinguish tax incentives and non-tax incentives. Tax benefits are provided to any businesses if certain conditions or criteria are satisfied, while non-tax incentives are 'discretionary' in that a firm must compete with other firms to get any benefits from state governments. Programs such as grants, loans, infrastructure subsidies, and job-training programs are classified as non-tax incentives. Since they define tax incentives from the aspect of competition among states, some tax incentive programs such as tax exemptions for R&D are excluded.
6 For pros and cons on state tax incentives, see Lynch (1996), Fisher and Peters (1996), and Chi and Hofmann (2000).
7 This can be verified with any state Department of Commerce secretary. Quotes are available from authors.
8 This amount does not cover all tax credits expenses. It covers only four types of tax credits: Manufacturers' Investment Credit, Research and Development Tax Credit, Carryover of Net Operating Losses, and Enterprise Zone Hiring and Sales Tax Credits. See California Department of Finance, *Tax Expenditure Report 2001–2002*.

9 This amount covers only five types of tax credits in New York: New Capital Investment Tax Credits, Research and Development Credit, Emerging Industries Jobs Act, Credit for Hiring Persons With Disabilities, and Alternative Fuel Vehicle Credit. See New York Division of Budget and Department of Taxation and Finance, *Annual Report on New York State Tax Expenditures 2002–2003*.

10 n addition, Massachusetts spent about $220 million in 1997–1998 for Investment Tax Credit, Research and Development Tax Credit, and Economic Opportunity Area Credit. Iowa spent about $61 million for New Jobs Credit, Research and Development Credit, and Investment Credit in 2000. See Luger (2001); Massachusetts Fiscal Affairs Division, *The Governor's Budget Recommendation Fiscal Year 1999*; and Iowa Department of Revenue and Finance, *Iowa Tax Expenditures 2000*.

11 For example, North Carolina and California faced budget shortfalls in 2002–2003 of upwards of $2 billion and $23 billion, respectively. 2004–2005 saw some improvement, but still tight budget times.

12 The North Carolina House decided to close $60 million in corporate tax loopholes in 2002–2003, and will close additional tax loopholes in 2003–2004. The Missouri House will close or cut corporate tax breaks and loopholes to cover expenses for elementary and secondary schools in 2003–2004. Bill Ratliff, Texas Lieutenant Governor, proposed to close some corporate tax loopholes to address school financing problems in 2002–2003. See *The Charlotte Observer* (July 12, 2001); *The News and Observer* (February 13, 2002); *The St. Louis Post-Dispatch* (April 8, 2002); and *Houston Chronicle* (October 20, 2001).

13 Web address: www.ncicl.org.

14 Web addresses: www.cfed.org and www.johnlocke.org.

15 See material on http://www.eda.gov/NewsEvents/WebCastsVideos.xml.

16 See publications of the European Trend Chart programme: http://trendchart.cordis.lu/.

17 In addition to the startup culture, the U.S. also has the strongest network of funding sources to start and maintain innovation efforts. There are a wide-range of financial mechanisms supported through federal and state governments, including R&D tax incentives and small business set-asides, which spur private sector innovation (Russo, 2004). There is no single administrative agency or national policy on innovation tying the various components of the system together. Instead, there is an *ad hoc* approach that allows states, universities and research facilities to flexibly develop their innovative capacity while competing with each other for funding and other support.

Despite the strong position of the U.S. innovation system, there are several important critiques concerning the U.S. retaining its global position. These critiques include an education system that is not producing enough science and math students, with foreign students representing a growing share of that number (Clovis, 2003). With stricter immigration requirements and increased global competition, the U.S. is also having a more difficult time attracting scientists and entrepreneurs. Competitor countries are also increasing their R&D spending, catching up with the U.S., while the U.S. also lags behind in infrastructure deployment in vital areas such as broadband communications. The final critique refutes the U.S.'s ad hoc system and suggests that the U.S. government needs to increase its role in planning and coordinating a strategic vision for the U.S.'s innovation system.

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4 Human versus physical capital

Government's role in regional development

Ann Markusen

Introduction

Concern with unbalanced regional development remains robust in a time of rapidly integrating world markets and production systems. In some countries, the United States for instance, responsibility for economic development has been pushed down to the state and local level, where competition with other jurisdictions is fierce, fiscal constraints are binding, and labor, goods and capital flow freely across political borders. A growing movement challenges the incentive give-aways that have been used to lure and retain firms. Although regional policy is still practiced on the national level in many other countries, the funds available to finance it are likewise restricted. Research scrutiny of past regional development investments and programs has produced a complex record of mixed success and sometimes, badly wasted resources. For all these reasons, the pressure on governments at all levels to shepherd regional development in ways that are effective and cost-efficient has never been greater.

In this chapter, I explore the difference between government programs that focus on physical capital (both for public infrastructure and private sector plants and equipment) versus those that target human capital, through education, training, entrepreneurial and related interventions. I argue that regional development has been seen almost entirely as the product of physical capital investments, so that the bulk of public spending has been sunk into these while very small amounts are spent, in contrast, on human capital, despite sound economic analyses that underscore the significance of the latter. A hallmark of this bias is the prominence of industry analysis and targeting in regional development. I argue for a co-equal emphasis on occupational analysis and targeting, bringing 'stereo vision' to regional economic development.

In the first section of the chapter, I reflect on the physical versus human capital debate in regional economic development and conclude that the latter is woefully underdeveloped, given its demonstrated importance. In the second section, I contrast the physical capital approach to regional development, using an industrial lens, with a human capital approach, using an occupational lens. I show, for several regions in California including one rural region, how each depicts the regional economy and the major actors with whom government policymakers conceive of themselves as

working. In the third section of the chapter, I explore existing and new elements of a human capital/occupationally targeted policymaking approach.

Physical and human capital in regional development

Regional economists working in the second half of the twentieth century largely adopted traditional economic growth theories to the regional terrain. These models posit that output (or income) growth is a function of physical capital and labor, the former consisting of land, plants, and equipment that were used over longer periods of time and could be augmented by investment, and the latter consisting of the labor hours harnessed to physical capital. In general, since there were constraints on the size of the labor force, nations and regions could only increase output by making investments in physical capital, either in the public sector or by firms. A series of challenges to this view has led to greater appreciation for the role of labor, especially skilled labor. In the 1950s, Wassily Leontieff (1953) demonstrated in his famous paradox that the American economy as a whole relied upon skilled labor, not physical capital, for its success (Leamer, 1980). Robert Solow (1956) articulated the role of technology as a third, exogenous force, and in the debate that followed, economists began to analyze technological change as partly embedded in physical capital and partly in labor. A decade later, Harvey Leibenstein (1968) developed the notion of 'x-efficiency,' attributing additional output to the role of entrepreneurs, a decidedly human capital/labor phenomenon. More recently, Romer (1986) argued that social externalities may account for aggregate growth even when there are diminishing returns to capital and no technological change, and Lucas (1988) made a similar argument about the external effects of human capital (Malizia and Feser, 1999, Chapter 6). These developments in the theory of growth, along with disenchantment with physical capital growth measures, have prompted regional economists, political scientists and planners to call for a more explicit human capital approach to regional development (Reich, 1991; Clarke and Gaile, 1997; Mathur, 1999; Markusen, 2004).

Regional policies have been heavily skewed towards physical capital investments with only very modest investments in the fostering of human capital and skill. In the making of the American continent, huge investments in land (much of it taken from Native Americans), canals, railroads, ports and highways helped to drive and integrate the American and Canadian economies in the nineteenth and twentieth centuries. These investments enabled a boom in internal trade, tying agriculture and industry together across the regions, and, since labor was relatively scarce given the land to exploit, prompted large investments in private capital (Markusen, 1987, Chapter 4). Similarly, public and private investments in power and electricity generation and transmission, water and sewer systems and recently, internet connectivity have been heralded as powerful growth engines. Many developing countries have mimicked the capital intensive strategies of the U.S., Europe and Japan, making large transportation investments to facilitate exports and reach internal markets and building huge dams and power plants to fuel industrialization.

What are the downsides of government investments in physical capital, whether directly publicly-built or induced through subsidies and tax holidays? First, many physical infrastructure investments simply favor one place over another, often undermining existing production complexes and causing under-utilization of capacity. Isserman *et al.* (1989) show that towns situated on the American interstate freeway system have done better in the longer term than similar towns that are not. Furthermore, in calculating the return on investment, the negative consequences for other regions and cities is not taken into account. A factor in the South's losing the Civil War was its squandering of infrastructure dollars in extending canals a few miles more up each of the tidal rivers to reach additional plantations; in contrast, the North used its infrastructure dollars to knit together its eastern manufacturing cities with its rich agricultural hinterland (Markusen, 1987: Chapter 4).

Second, while transportation infrastructure may facilitate exports, it also enables import penetration, as every American city and small town now ringed with Wal-Marts has come to understand. The interstate freeway system in the U.S. along with container port facilities on east and west coasts has enabled manufactured goods made in China, often by U.S. companies, to reach dispersed small settlements cheaply, undercutting domestic production.

A third problem with public and private physical infrastructure projects, often celebrated as job creators, is that many of them employ as many as ten times the number of workers to construct them as to operate them. This creates a boom and bust cycle that can be debilitating to smaller towns on both the up- and down-swing (Markusen, 1978). Capital-intensive projects also nourish a large construction sector that can become a powerful political actor, a fourth problem. In many countries and regions, many more roads and buildings are built than is justified by their future returns, simply because the combined lobby of the construction, real estate, auto and other sectors is so powerful in legislatures and parliaments. Japan has tried for more than a decade to deal with its stagnation by spending lavishly on public infrastructure without clear returns. In one extremely expensive project, the central government in conjunction with the local prefecture has recently built a multi-billion dollar new container and transfer point in Fukuoka for trans-Pacific mega-ships carrying Chinese goods to the U.S. The project, using capital-intensive construction techniques, employs limited numbers of workers to build it and many fewer to operate it when done. It is unclear whether the port will successfully compete with Pusan, in South Korea, its rival.

In contrast, only small portions of regional development moneys go towards human capital investments. In many of the $100 million plus packages offered by states to woo large plants, up to 5 percent may be used for training new workers, but this is still a tiny fraction. Some governments have created entrepreneurship training programs and built business incubators to foster new firm formation, but the amounts devoted to them are small. Workforce development programs exist at subnational levels in the U.S., but are funded at only a fraction of physical capital-related outlays, especially when tax expenditures are included. To the extent that states or localities own and fund elementary, secondary, technical and university

educational systems, human capital is fostered; though generally not under the rubric of regional development, these are large public investments. The presence of universities is closely correlated with favorable regional growth, although empirical studies show that universities' impact is more important in educating labor than in underwriting R&D and prompting regional innovation (Markusen *et al.*, 1986).

In the past decade, academic critiques and organized protests on the part of regional governments, planners, workers and citizens have grown in volume against the excesses of state and local government subsidies for private sector physical capital projects in the U.S. (Thomas, 2002; Leroy, 2005). Often given without performance requirements and not enforced in cases of failure to perform, companies increasingly bargain their way out of years of future tax payments while receiving huge grants of infrastructure and land on the promise of job creation. A market has grown up in which international consulting firms pit one mayor against another and one state or province against those on another continent, controlling information about actual prospects and extracting enormous concessionary packages. The European Union has a much better regulatory process that restrains such competition, but countries outside the EU face formidable problems in implementing such a system (Sinnaeve, 2004). In this environment, interest in labor-oriented regional development strategies and in using occupational analysis in addition to industrial analysis has grown stronger, for reasons I explore in the following section.

The brain drain constitutes a serious concern about human capital strategies at the regional level. In Gunnar Myrdal's (1957) famous 'cumulative causation' model of inter-regional development, he posited that higher wage-seeking skilled labor moves from rural places and smaller towns to larger agglomerations more quickly than lower-cost seeking firms move to the former. In recent years, analysts have hypothesized that it is not simply wages and work opportunities but also amenities that draw mobile workers from the countryside. However, not all educated individuals will choose to leave their communities, and education will particularly quicken the level of local entrepreneurship. Even those who leave may choose to return later in their work lives. Even If they don't, it is increasingly understood that skilled migrants to richer regions may act as bridges back to their communities, transferring know-how and sometimes mobilizing resources there for export-based activities (Saxenian, 1999).

Envisioning regions by industry and occupation

Industries dominate the regional economic mental map of geographers, regional scientists, planners and policymakers. But industrial categories are not the only way to describe and disaggregate regional economic structure. Occupations offer an alternative. Employment, for instance, can be analyzed either on the basis of industries or occupations. In most countries of the world, data are collected on each. In this initial section, I compare the two lenses and the regional economic traits and actors emphasized in each.

The industry lens

No economist, citizen or policymaker ever 'sees' a regional economy. Instead, we develop mental maps for it, based on conceptual categories that frame its spatial, structural and organizational dimensions. Such mental maps showcase certain decision-makers, or actors, as key to economic development. Most Californians, for instance, including daily newspaper readers, think of California's economy as big and diverse and as producing goods and services such as lumber, fruit and nuts, wines, electronics, software, aircraft, biotech substances, shipping services and so on. Generically, we can organize these productive outcomes as sectors or 'industries.' Industries are conceptual groupings of organizations (firms, trade associations), establishments, and decision-makers (owners, managers) who are bundled together by what they make and produce – by the resulting goods and services. Since the mid-eighteenth century, American federal and state governments have delineated these groupings in industrial codes and collected data on a few metrics such as output and employment on the basis of individual, single-site establishments (Rhode, 2001). These codes are quite similar to those used by most countries world-wide.

Scholars of regional science, economic geography and economic development work with industry groupings to map regional economic activity and analyze past and projected change. In doing so, they model the behavior of key decision-makers within each industry, introducing the notions of 'firm' and 'establishment' into the framework. A firm is a legally-constituted business organization with a decision-making structure – a Board of Directors, CEOs and other key managers – that decides what and how much to produce, how to market it, whom to hire and fire and train and where to locate its operations. It may operate in several industries and in multiple locations. An establishment is a spatial unit of production that may comprise an entire firm or form only one unit in a far-flung empire. Managers of establishments make decisions within the hierarchy of the larger firm to which they belong.

In rural northern California, for instance, a regional analysis might highlight the lumber industry and probe the behavior and economic viability of firms (for example, Georgia Pacific) and establishments (a particular Georgia Pacific mill, small family-run sawmills, small firms in the woodworking business). In Silicon Valley, it would focus on the electronics, computing, aerospace and software sectors, including large firms such as Sun, Lockheed Martin, and IBM, and the many small and oft-mutating entrepreneurial firms (Gray *et al*., 1999; Saxenian, 1994). In the Los Angeles area, it might center on a set of disparate industries – filmmaking, apparel, electronics and aerospace among them – with their mixes of large and small, locally and externally owned firms (Storper and Christopherson, 1987; Scott, 1984; Scott and Angel, 1987). Such intelligence has informed economic development interventions, such as incentives and regulatory changes to attract new establishments (for example, design firms to Los Angeles), engender new firm start-ups (for example, biotech in Silicon Valley), or forestall closings or relocations away from a region (for example, lumber in northern counties).

Such a depiction of a regional economy, its components and its key actors, however, constrains the vision of possible economic development initiatives. Industries are not real entities but are conceptualizations made operational through the coding and data collection efforts of the U.S. Department of Commerce and its state-level equivalents. To be sure, industries are useful groupings. Firms within industries often share information and exercise political power in the guise of trade associations. But industry definitions do not map neatly onto firms, and not all firms join relevant trade associations or actively shape their priorities. Furthermore, firms routinely migrate into new product offerings that may shift the assignment of their plants and labs into unrelated industries.

Economic development practice is also muddied by the tendency to conflate firms, which are the key decision-making unit in place-indifferent economic theory, with establishments, which are the key location target for economic developers. Firms are non-spatial legal entities, while establishments are site-based operations of individual firms. Entire bodies of theory have emerged to explain the location calculus that firms use to site their facilities in various regions (Losch, 1954; Isard, 1956). Excellent studies have been done of the relative strength and significance of causal factors such as resources, labor quality, wages, infrastructure, taxes, and so on in explaining the distribution of employment, often disaggregated by industry (see, for instance, the studies in Herzog and Schlottmann, 1991, and Hekman, 1978).

But as firm headquarters increasingly locate separately from other firm functions, state and local economic developers relying solely on industry categories are left with weaker tools to increase good jobs and expand the tax base. Establishments within the same industry and especially within the same firm often perform starkly different functions. Some conduct only R&D, while others engage in management, production or distribution. A large California coastal city, for instance, might host a firm's food scientists, market researchers and managers, while its agricultural product is grown, processed and packaged in smaller Central Valley towns. The industry to which an establishment belongs may thus be a weak indicator of the functional strengths of its host community.

Accepting the industry/firm/establishment framework as the skeleton of a regional economy means shaping economic development practice around firm priorities. Implicit in this approach is a vision of economic growth that favors physical capital as the key input, rather than technology or human ingenuity and labor. A great deal of state and local economic development effort, as a consequence, has gone into facilitating the acquisition, building, maintenance and refurbishing of physical capital, including land and infrastructure. Very modest amounts, in contrast, have gone to train workers or encourage entrepreneurs. Underwriting physical capital is an expensive proposition. Increasingly, local governments find themselves indentured to paying off bonds and foregoing tax base with funds that might better be used elsewhere. Many communities have a tough time holding recipients of economic development incentives to performance criteria.

The occupational lens

Think now of a regional economy as consisting in the first instance of people as decision-makers and workers. They are starting up and closing down firms, buying and using resources, building plants and equipment, hiring others and configuring work to generate marketable goods and services. In this conception, we visualize and characterize economies by 'what workers do, not what they make' (Thompson and Thompson, 1985; Feser, 2003). These activities are captured in the notion of 'occupation.' Some workers manage entire chains of conceptualization, production and marketing processes (managers). Some create, implement and monitor technologies (scientists and engineers). Some develop, write, adapt and trouble-shoot information systems (systems analysts and software programmers). Some educate (teachers, trainers, parents, coaches). Some adjudicate, advocate and make law (judges, lawyers, legislators). Some run, interact with and maintain machines (assembly line workers). Others build structures and repair them (craft workers). Others move commodities and services across space and out to consumers and other users (longshoremen, truckers, retail and wholesale and warehousing clerks). Yet others care for the sick, elderly, and children (nurses, home care and child care workers). Yet others entertain us (musicians, athletes). And so on.

Imagine a mental map of a regional economy based primarily on occupation. Each occupation – like industry, a conceptual category – is distinguished by its skill, educational content and work tasks. Individual workers are key decision-makers in an occupational framework, because they decide whether to acquire skills and how to deploy them, given their options in labor markets (another conceptualization). But other decision-makers are also important – those who supply skills and training, including schools and colleges and private sector firms. As an analogue to firm location theory, we might imagine a whole body of occupational location theory that explores why certain occupational groups migrate more frequently than others and why members of each choose to enter, leave or remain in specific regions.

With the occupational lens, we might picture northern California as a region of foresters, sawyers, truckers, farmers, and B&B operators, among others. Silicon Valley would emerge as a region of technology managers, venture capitalists, aeronautical and electrical engineers, inspectors and testers, and commercial artists. Los Angeles would be a showcase of aircraft assemblers and engineers, sewing machine operators, broadcast technicians, camera operators, and musical instrument repairers. The occupational lens helps us to see the relatively unique pools of talent possessed by a region.

Until the 1940s, the Census Bureau, which belonged to the Department of Commerce, did not classify occupations on the basis of what workers did but rather on the basis of industry, as in 'forestry workers,' 'bank workers,' and so on. Up to that time, the conception of regional economy was dominated, then, by industries. In the 1940s, the Bureau began to use occupational categories, long used by the Bureau of Labor Statistics in the Department of Labor, to characterize

employment on the basis of what workers did rather than what they produced. Meanwhile, State Departments of Employment Security using the occupational categories and Departments of Economic Development using the industrial categories began to work together on some specific projects and data series. Both approaches are now operational, although the industry data is somewhat more friendly to regional economic researchers, largely as a result of long term demands and petitions from the research community.

Approaching economic development as an occupational rather than an industrial phenomenon opens up alternatives paths for economic developers. For instance, when an industry is in structural decline because it is just simply cheaper to produce elsewhere or because substitutes are destroying its market or because defense spending plummets, working with occupational groups offers an alternative to simply trying to prevent plant closings or convincing firms to convert. Rather than approach the problem of huge layoffs among aerospace workers as synonymous with an imploding aerospace industry, as southern Californians did in the 1990s, an occupational approach might have enabled a more creative and less expensive economic development approach. Engineers exiting aerospace, for instance, brought exotic substances developed with military research dollars into sports and sportswear lines like golfing and athletic clothing.

Given their evolved industry orientation, economic development practitioners in the past few decades have worked extensively with firms, industries and business associations, seeing them as their customers. In contrast, a practice re-oriented around occupations would seek occupational and occupation-shaping partners. Prominent among these would be membership associations based on occupational lines, from trade and craft unions (electricians, machinists, writers, musicians, operating engineers, nurses, actors, janitors) to professional associations (mechanical engineers, economists, doctors, accountants). Strong ties would also be forged with institutions and organizations that recruit, educate, train, and retrain workers.

Why an occupational lens?

The occupational lens gives priority to human rather than physical capital as the key to regional development. The generic unitary actor in an occupational analysis is the worker, meaning the individual who exchanges his or her time and skills for a wage or salary, whether he or she is a manager, scientist, blue collar or home care worker. We aggregate these workers on the basis of occupations.

Our central theoretical contention is that the education, training, placement, location and migration of individuals with particular skills, proxied by occupation, may be as important in explaining economic development as the location and migration of establishments, firms and industries (Mathur, 1999). The two are related, but the 'chicken-egg' problem here is conceptualized as one in which skilled workers' location choices are independent of firms' choices to some extent and in which workers' preferences are different from those of firms. Certainly workers follow jobs, but our argument is that jobs also follow workers, perhaps

increasingly so. Workers choose locations based on amenities and personal preferences and firms then follow workers (see also Florida, 2002).

Markusen (2004) has made several theoretical arguments for an occupational, or worker-centered, approach to economic development, invoking the following points. First, decreasing commitment of both firms and workers to each other and to regions, due to global integration and the ability to work from remote sites via the Internet, makes the decisions of where workers want to live and work increasingly more important. Second, occupations that might otherwise be considered purely local-serving – artists, for example – enhance productivity and livability for other, export-based activity and thus should be investigated in their own right. Third, job creation may be more successfully nurtured by searching for patterns of entrepreneurial success by occupation rather than by industry. Fourth, an occupational focus may be tailored to particular neighborhoods and under-employed socio-economic groups, thus facilitating equity goals, in ways that an industrial focus, for operational reasons, cannot.

I hypothesize that regions are distinguished by relatively unique occupational mixes. Over the long term, a significant number of occupations are 'footloose,' meaning that they are inter-regionally moveable or capable of being engendered locally through education and training. Their presence in a regional economy will be less well predicted by their presence in the past. Industries, in contrast, are less mobile, since they consist of establishments with physical plant and equipment that are more difficult to move.

How different are the results from using one lens or the other? Two recent studies offer some insight into this question. A recent article by Renski *et al.* (2007) shows that industrial clusters chosen by traditional value chain or input-output relationships differ quite substantially from clusters built up from a skill-based occupational matrix. Another by Barbour and Markusen (2007), using data on eleven California metropolitan areas, finds that although occupational structure can be fairly well proxied in the aggregate by using national industry-by-occupational matrices applied to regional industrial structure, employment totals for key occupations such as high tech professionals, business service professionals and blue collar workers deviate substantially from the norm across metro areas. These studies suggest that important regional economic intelligence can be gained by probing occupational structure in its own right and not as an exercise subsidiary to industrial analysis.

Human capital-centered regional development

An occupational approach offers new options for practitioners in developing their regions' economic base. It is built on the growing recognition that human skill is an essential ingredient in regional economies and may be more tractable and less expensive to attract, nurture and retain than physical capital. For national government regional policymakers, an occupational approach can help inform what types of human capital expenditures and training programs might work best in distinctive regions. At the provincial and local levels, targeting occupations

enables planners and policymakers to combat the proliferation of 'poor jobs' or the filling of new jobs by outsiders associated with some types of development incentives and to fashion a strategy more closely tied to the skills and character of current regional populations.

Support for education and training is the single most important thing a government at any level can do for its stock of human skills. Angel de la Fuentes' work on Andalusia, elsewhere in this volume, finds that investments in elementary and secondary education can make a huge difference to a region's development and that these returns are greatest in the poorest regions. In federalist countries like the U.S., local control offers considerable choice and community involvement in the schools, while state level standards and fiscal equalization programs eliminate large differences in local capacity. Currently, a movement is growing to extend public funding into universal early childhood education, also to be managed locally.

Although the United States no longer pursues explicit regional policy, its federalist experience with decentralized higher education systems could be considered a de facto regional human capital strategy. Competitive state-run public university systems, originally funded federally by land grants and today benefiting from a federal student loan system, are quite spread out in the U.S. For more than a century, they have been producing considerable human capital at the regional level that is available to businesses and policymakers and helps to broaden the ranks of regional entrepreneurs. Brazil, too, has a federal governance structure that enables states to raise revenue to support their own public universities, which in turn become human capital generators for regional development. Campinas, in the state of São Paulo, is an excellent example, a high tech pole outside the major metropolis (Diniz and Razavi, 1999). Highly centralized governments have tried to build and support university campuses outside the major primate cities as ways of decentralizing skill and talent. South Korea has done so most recently with its Korea Institute of Technology in Taejon (Jeong and Park, 1999).

Similarly, good training programs for entry level and displaced workers, funded by central government but administered locally in tandem with industrial policies, constitute a human capital approach of major significance. In a world market that is rapidly integrating, skilled workers thrown out of work need specialized training or further education to match them with new occupations and industries. A system that sets standards centrally and shares revenue but enables regions to adopt training programs to their unique circumstances can operate as a powerful regional development strategy at a more modest cost than physical infrastructure programs.

At the state and local levels, where almost all economic development policy is currently funded and implemented in the U.S., regional policymakers can tailor economic development programs to target occupations as well as industries and human skill as well as physical capital. The policy inferences addressed in what follows are based on research that I and others have done on the micro-workings of specific occupations at the regional level (e.g. Markusen and King, 2003). Here, we explore approaches and tools that can be used to sharpen the occupational

focus and build to a region's strengths in its economic base. A discussion of how to choose occupations to target and how data can be used to operationalize this exercise is found in Markusen, 2004.

Build on occupational networks, organizations and institutions

Regional development officials can tap into existing occupationally-oriented institutions – including professional associations, trade unions, education and training institutions, and informal networks – to identify policies that could improve the viability of those occupations within the region. This utilization of existing associational infrastructure is a fairly common organizing tool among economic developers targeting specific industries, especially those using an 'industry cluster' approach (Waits, 2000).

Many occupations, especially in professional and scientific fields, have counterpart professional associations and/or are linked to national or international bodies – for instance, the American Society of Mechanical Engineers, or the National Writer's Union. On the national level these organizations establish standards for education and certification, provide forums for networking and technical debate, do research on pay and benefits, offer support on issues of contracts and property rights, and monitor relevant public policy issues. On the regional level, they are more commonly a vehicle for networking and professional development, but rarely an active participant in efforts to promote economic development related to their field.

For example, efforts to promote biosciences should include not only trade associations comprised of bioscience firms, but also educational institutions that directly impact the future supply of workers in these fields (in this specific example the 'supply' side is generally the province of universities and their personnel responsible for research efforts, e.g. the Minnesota Bioscience Initiative). These efforts should not overlook the interests and motivations of bioscience workers, whose individual decisions to move into or out of a particular region or to pursue an entrepreneurial venture have enormous impact on a region's economic trajectory. Traditional, firm-oriented economic development approaches largely miss this important piece of the puzzle. Working with occupationally-oriented institutions would facilitate the kinds of interventions discussed below and enhance industry-oriented development efforts as well.

In practice, the involvement of occupationally-based organizations in economic development initiatives works better under certain circumstances. One is when a real or perceived shortage of workers in a given field is either current or projected. This was clearly the case in the 1990s with information technology occupations, when rising demand for workers in these fields mobilized a number of educational institutions and training organizations to develop programs (Benner, 2002; Chapple *et al*., 2000). This was also the case with the need for telecommunications installers as new technologies came on line in the 1990s. Unions such as the Communications Workers of America and the IBEW became important partners to smaller firms in their effort to train workers for this job (Wolf-Powers, 2003).

Second, working with occupational groups is particularly important when an occupation is not closely co-terminant with a single industry and where there are high levels of self-employment and entrepreneurship. The arts are a good example here. Artists (including visual and performing artists, musicians and writers) exhibit high rates of self-employment, between 30 percent and 65 percent depending on the genre (Markusen *et al*., 2004). Many of them work across industry sectors, doing contractual work for non-arts firms and selling their work and services through the internet, publishers, at art fairs and by traveling to perform, none of which is captured in regional employment figures based on employers' records. Some regions are beginning to understand the economic development significance of artistic spaces, facilitating artists' live/work buildings and studio space, supporting artists' centers (hothouses where artists congregate to compare notes on craft and livelihoods, share equipment, find mentoring, exhibit and present), and commissioning public art as part of redevelopment projects (Markusen and Johnson, 2006). Agglomerations of artists also have salutary benefits in stabilizing and upgrading neighborhoods, although spirals of unsettling gentrification have sometimes ensued (Markusen, 2006).

Of course, a well-disciplined system will ensure that organizations involved in these activities are monitored to prevent opportunistic behavior (e.g. to ensure that unions don't use training funds to run their general operations or to discriminate against certain groups of workers). The use of intermediaries, described below, is one form of structural monitoring – in this model, employers who seek workers and community groups who represent aspiring workers work collaboratively via third-party groups to build intermediaries that identify and teach desirable skill sets in sites resembling workplaces with employer instructors. They rely on community organizations to provide non-firm specific recruiting, counseling and training. Providers offering training should be held to performance standards and should be expected to compete periodically for contracts.

Promote entrepreneurship in key occupations

A human-capital strategy pays particular attention to entrepreneurship, a phenomenon that we believe is easier to identify by thinking occupationally rather than industrially. It relies on the cross-fertilization of occupational knowledge across sectors to generate new entrepreneurial opportunities for economic development and to deepen the process of regional specialization. Occupation-led economic development can facilitate this by working through organizations and institutions to help individuals identify entrepreneurial and self-employment opportunities and to learn the business skills to pursue them.

While career development is a common focus in unions and professional associations, such efforts are generally directed toward improving, upgrading, and codifying skills. This occurs through certification processes, training seminars and short courses that allow individuals to remain current on new technology, issues, etc., related to the occupation. Benner (2002) discusses the importance of continuing education through professional associations (as labor market

intermediaries) in assisting information technology workers in Silicon Valley to keep pace with rapidly-changing technologies for applications such as Web design.

However, most traditional occupational organizations stop short of active assistance in helping their members to identify new business opportunities, develop business plans, navigate capital access and intellectual property concerns, and learn management skills. At the same time, the resources that do exist for individuals to pursue entrepreneurial ventures – such as the U.S. federally-funded Small Business Development Centers – tend to be occupationally- and industrially-generic and thus less directly attuned to the particular circumstances or knowledge base of a given occupation. Many engineers, for instance, aspire to start their own businesses but lack the managerial acumen. Economic developers could help to supply entrepreneurship training to occupational groups that show interest and promise.

In occupations such as the arts, where the rate of self-employment is quite high, this blurring of boundaries between professional development and entrepreneurship is more common. Across the U.S., help for artists in designing their careers and dealing with the business side of it has been forthcoming from enterprising arts organizations, not from economic development agencies. In Minnesota, Springboard for the Arts offers inexpensive counseling for artists on these issues, and in Los Angeles, the Center for Cultural Initiatives does the same. Both have helped thousands of regional artists to create viable strategies for pursuing art as their major livelihood, figuring out how to connect to new markets and beginning to build businesses that employ others.

Secure and enhance the pool of regional talent

A regional human capital strategy develops the region's ability to supply and retain top-notch talent – both 'home grown' and imported – around its occupational specializations. The goal is to build a regional identity around key occupations that allows it to be known as a 'place to be' for that occupation. Examples are IT professionals in the Bay Area, media artists in the Los Angeles region, automobile engineers in Detroit, outdoor gear designers in Boulder, software engineers in Seattle, writers in Boston and so on.

How should policymakers approach this? To begin with, having well-funded education and training institutions is essential. But just as importantly, those institutions need to be connected systematically to the demand side of the labor market, allowing them to ably recruit regional graduates before they leave for greener pastures elsewhere and to ensure that graduates remain current. This is common practice at universities and community colleges through industry advisory groups and customized training programs. In addition, planners and policymakers need intelligence on what kinds of environmental amenities and networks members of target occupations prefer and attempt to enhance the presence of these in their regional economies.

Efforts to recruit and retain individuals within targeted occupations can also work through occupational intermediaries. States and localities should market themselves directly to individuals within key occupations by advertising in occupationally-specific trade publications, marketing within education and training institutions, etc. For example, Michigan recently established the Michigan Recruitment Alliance to connect job seekers, businesses and educational institutions around its targeted areas of life sciences, information technology, and advanced manufacturing occupations. Recruiters can also work with lists of alumni of regional universities and colleges, encouraging them to come home to work and/or run their businesses. Such efforts appear to be oriented primarily toward retention of regional college graduates. It is less clear whether they are successful in tapping into existing occupational labor pools in other places.

Link initiatives with community-based organizations

A region pursuing a human capital strategy will seek to ground its occupational specializations in unique 'place' characteristics that endow them with local character, and generate benefits for the broader community. This can be done by linking occupationally-oriented economic development efforts to community-oriented goals of community-based organizations. Community-based organizations (CBOs) often take a direct stake in the vitality of industry sectors and occupations with a substantial presence in those communities. In the 1980s the City of Chicago institutionalized the use of CBOs for this purpose through its Local Industrial Retential Initiative (LIRI) that funded CBOs to provide technical assistance and outreach to local manufacturing businesses (Fitzgerald and Leigh, 2002). Over time, many of these organizations have worked actively to link the prosperity of regional businesses to that of regional residents through training and placement services targeted at good-paying, skilled and semi-skilled occupations critical to those businesses. A widely cited example of this is the Jane Addams Resource Corporation, whose metalworking training program feeds skilled workers to manufacturing businesses throughout the city and surrounding region (Fitzgerald and Leigh, 2002; Glasmeier *et al*., 2000).

Efforts to create districts that harbor particular occupations and related work and shop or performance spaces are another route that is becoming increasingly more important. For instance, in the arts, economic developers are beginning to understand that funding large destination arts facilities surrounded by parking lots is an expensive way of remaking an area and often fails to create synergies in the immediate neighborhood. Shaping revitalization around artist live/work buildings, instead, has required modest funds with large payoffs for areas such as St. Paul's Lowertown neighborhood. Artists residing in concentrated numbers has prompted commercial and retail growth, the revival of the farmer's market, and spring and fall art crawls where thousands come to visit artists showing their work in their studios. Smaller towns are investing in artists' centers and artists' live/work buildings as the keystone to revitalization of aging downtowns (Markusen and Johnson, 2006).

Use occupational screens in allocating employer incentives

Occupational analysis has often been used as a subsidiary exercise when targeting industries in economic development. Once industries are chosen, their occupational structure is examined for ways to harness the workforce development system to the effort (Balfe and McDonald, 1994; Theodore and Carlson, 1998). Our research suggests that occupational analysis could play a lead role in economic development efforts. Turning the tables, economic development planners and policymakers could choose a set of target occupations and then use these as a screen for deciding how employer-based incentives might be allocated across industries.

If occupations are targeted on the basis of their current presence (even if modest), capturability, good pay and benefits levels, longer term promise, cross-industry fertilization and fit with the regional populations' skills and aptitudes, the resulting occupational set can be matched to the occupational composition of a prospective employers' workforce or that of a current employer asking for retention incentives. Those employers where there is a good fit would be more readily funded, while those with a poor fit could be asked whether they are willing to upgrade their technologies and skill profiles as a counterpart for public support. They could also be asked to work with key occupational groups and CBOs as recruitment and training partners. Similarly, if the region has strength in post-secondary colleges and universities in particular fields where local demand is under-represented, it could target its recruiting on employers who need these skills to stem the outflow of graduates from the region.

Conclusion

These planning and policy prescriptions are the product of a mixed-method research agenda that has endeavored to understand the broader trends regarding regional occupational specialization as well as the micro processes that give rise to those trends. This is very much a work in progress, as the recognition of the role of human capital and skill in economic development is only now taking hold. The effort to make labor pool formation and retention co-equal with physical capital investments and firm retention is a promising economic development challenge for the coming decade.

One very positive sign that labor is being taken more seriously in development planning is the structural reorganization of state and local agencies in some U.S. cities and states to force greater integration between workforce and economic development. In Minnesota, the state Departments of Economic Development and Employment Security have been merged into a single Department of Employment and Economic Development. At the city level, Minneapolis has abolished its powerful Metropolitan Community Development Agency and merged its operations with the workforce development agency, directing that all economic development efforts should take the needs and skills of the city's workforce into account.

Complicating the creation of an occupationally-focused and/or 'stereo vision' (both occupational and industrial lenses) strategy for metropolitan economic development is the fact that responsibility for job creation and retention is currently split between states and local governments, each with different tools at their disposal and political constituencies to answer to. Although metropolitan planning around land use, transportation, and environmental issues has made great gains over the past twenty years, metropolitan economic development planning remains vestigial. It will take at least a decade for regional planners to realize that rational land use, transportation, and environmental planning must take into account the powerful economic development competition among jurisdictions if it is to succeed. Experiments at the regional level are more apt to drive this fusion, we believe, than is reform of state level economic development.

Two final caveats should be made. First, the human capital strategy described here does not contain a neat formula for optimizing the deployment of educational and skill investments among individuals or places. Just as infrastructure can be over-invested in, human capital may be as well. The chronic problem of over-production of college graduates in Africa compared with under-investment in elementary and secondary education is well known. Systems should be monitored for over-production in certain fields or skills training that poorly match the market. Not every community should have a community college, and states, regions and national governments must make tough decisions about how many research universities to support and where. Towns hosting colleges will undoubtedly do better than those that do not, so it is difficult to avoid competition and conflict over such policy. Nor is concentrating on 'people prosperity' rather than place prosperity clearly preferable. Also, deciding whether or not to concentrate resources on lower levels of literacy as opposed to higher education is an important political choice, one that good research on the societal returns can help inform. For each of these dimensions, the proper locus of responsibility – at local, regional and national levels – is a major enveloping policy issue.

Finally, a human-capital focused and occupationally-targeted regional development strategy is not costless. The kinds of organizational interactions, the hands-on work with individuals, the cultivating of educational and training institutions and the monitoring systems to ensure that they work well all come with a price tag. Apart from the formal educational system, which has many non-economic benefits for the society, it is hard to imagine that human capital strategies would come close to the price tag for physical-capital investments that have formed the bulk of regional policy for a half-century. In addition, human capital investments are quite labor-intensive and likely to increase the regional multiplier associated with them as well as honing skill sets of providers that generate ongoing productivity for the region. Nevertheless, human capital strategies require ongoing monitoring and research to determine their effectiveness and to compare them with other development strategies and with alternative spending priorities.

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5 Regional innovation systems and public policy

Ireland's medical technology cluster

Johanna Fahy, Majella Giblin and Roy Green

Introduction

The regional dimension of innovation in a global competitive environment is attracting increased interest among both researchers and policy-makers as regional economies are recognised as 'sites of the most advanced forms of economic development and innovation' (Storper, 2003: 580). This chapter examines the recent emergence of the highly successful medical technology cluster in Galway, Ireland – now the biggest concentration of medical technology employment in Europe – in the context of the growing literature on industrial clusters, its further evolution as systems of innovation and the related emphasis on the role and 'embeddedness' of FDI in these systems at a regional level. The literature would suggest that regions are 'synergy-laden' systems whose innovative activity and capacity are determined largely by 'the set of organisations and linkages present for the generation, diffusion and application of scientific and technological knowledge' (Galli and Teubel, 1997: 345), which can position, or reposition, regions on specific technological trajectories.

Michael Porter has taken the paradigms of industrial clustering and innovation systems further with the concept of a 'National Innovative Capacity Framework', which embodies the factors enabling a national or regional economy to innovate at the global frontier, identifies metrics for evaluation of the vitality of innovation processes and, ultimately, provides the foundation for public policy directed to promotion of these processes in a specific locality. Indeed, the role of government and public agencies is critical to the development of a coherent and effective regional innovative capacity framework, as rule-maker, producer and consumer of goods and services and as underwriter of innovation, 'with consequences for the distribution and anchoring of employment within and across regions' (Markusen *et al*., 1991). A key element in the effectiveness of this framework is the degree to which it can engineer the 'embeddedness' of FDI subsidiaries in the host economy through networks and institutional linkages, which may in turn lead to knowledge spillovers and local spin-off industries with the capability to access global markets (Young *et al*., 1994a; Phelps, 2000). The importance of embeddedness or what Markusen calls the 'stickiness' of FDI companies in their locality is well understood by policy-makers: 'The full benefit of the presence of

foreign production firms depends on the extent to which they can be integrated into their environment' (OECD, 1998).

In this context, the present chapter provides a starting-point for a research programme on the newly emerging medical technology sector in Ireland, focusing on Galway and Ireland's west region. Over the last decade, Ireland has become a global site for medical technology, with the sector employing a workforce of about 26,000 in over 140 companies, representing 11.5 per cent of Ireland's total manufacturing employment. The sector is dominated by the leading multinational companies – 10 of the world's top 12 medical technology companies (as ranked by medical devices revenues, 2004) have substantial operations in Ireland – with a growth rate of approximately 16 per cent per year. The medical technology sector is concentrated primarily in the west and mid-west regions of Ireland, with 30 companies in Galway employing approximately 7000 people. The formation of this regional cluster, the largest in Europe and significant on a global scale, is a result of conscious policy planning, which has focused on the development of a skilled labour force, relatively low unit labour costs and IDA Ireland grant aids encouraging FDI companies to locate outside the Dublin area. In the case of Galway, special support for medical technology and ICT companies was made available from 1994, as part of a local cluster development strategy, following the closure of the manufacturing operations of Digital Equipment Company (DEC), employing over 1800 people, and the takeover of DEC's software division by Compaq (Green *et al*., 2001).

In addition to FDI attraction in the medical technology sector, IDA Ireland, Enterprise Ireland and a range of research funding and policy agencies, have introduced programmes to encourage the 'stickiness' and sustainability of the sector through the establishment of R&D facilities in local FDI subsidiaries and linkages both with regional development agencies and with universities and institutes of technology. Nor is Ireland's successful transition to a knowledge-based economy seen to depend simply on the long overdue expansion of research capabilities, but there is increasing emphasis as well on the challenges of intellectual property protection, technology transfer and the commercialisation of research outputs. The final section of the chapter discusses these challenges with a specific focus on the policy-making implications of the transition in the context of the EU Lisbon strategy to become the 'most competitive and dynamic knowledge-based economy in the world', a strategy requiring appropriate policy interventions at the regional as well as national level.

Concept of the regional innovation system

The role of the regional economy as a site for innovation has generated interest from a number of disciplines, including economic geography (Krugman, 1991; Camagni, 1995, 1991; Harrison et al 1996), evolutionary economics (Nelson, 1993; Nelson and Winter, 1974, 1975) and strategic management (Porter, 1990, 1998, 2000a, 2000b, 2001; Porter and Stern 2001). Some authors claim that globalisation has undermined the significance of national and regional economies,

while others, by contrast, suggest that regional economic organisation has become a source of competitive advantage and innovative capacity (eg. Amin and Thrift, 1994; Lundvall, 1992; Henry and Pinch, 2000). Storper defines a region as any area of substantial extent that is functionally organised around some internal central pole, and argues that, 'regional economies are synergy-laden systems of physical and relational assets … [T]he role of selected regions are as springboards of the development process, and as sites of the most advanced forms of economic development and innovation' (2003: 580).

Industrial clusters

Recent analysis of regional economic development has largely drawn from two theoretical constructs: 'industrial clusters' and 'systems of innovation'. We will examine these two constructs in turn. The literature on industry clusters may be traced back to Alfred Marshall's identification of external economies in 'localised' industries:

> When an industry has thus chosen a locality for itself, it is likely to stay there long: so great are the advantages which people following the same skilled trade get from near neighbourhood to one another…good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organisation of the business have their merits promptly discussed: if one man starts a new idea it is taken up by others and combined with suggestions of their own; and thus becomes the source of further ideas …
>
> (Marshall, 1920: 225)

Since then, Porter's work on business clusters, defined as a group of interconnected companies in geographical proximity, has become an important influence on the direction of the literature. At the core of the Porterian 'diamond' model is the role of the home-base in fostering competitiveness in particular industries according to four main attributes – factor (input) conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry. Clusters occur because proximity reinforces interaction between the actors of the system and consequentially the benefits of this interaction are intensified. The focus of clusters is on dynamic external economies, such as the transfer of knowledge, ideas and technology between firms and institutions within particular sectors (Porter 1998, 2001). A cluster is also perceived as an important stimulus for new businesses, as the existence of external economies attracts firms to an area where resources are easily accessed and better information is readily available.

Two important characteristics of clusters were identified by Porter (1990), which shaped much of the research that followed. The first of these was that clusters do not take the same form across nations and, second, that they tend to develop at a regional level. These observations, as well as the apparent success of specific high technology regions such as Silicon Valley, led to the development of a considerable body of research and empirical data on regional clusters (e.g. Krugman, 1991;

Malmberg and Maskell, 1997). However, Porter's (1990) prescriptions for cluster development and associated competitive advantage have come under increased scrutiny, with criticisms that they lack theoretical specification (Martin and Sunley, 2003) and that therefore they are inadequate, elusive concepts (Malmberg and Maskell, 2001; Steiner, 1998). In addition, the cluster concept more generally has been criticised for not having clear geographical boundaries (O'Donnell, 1998); the rationale and mechanisms of inter-firm interaction remain unclear (Martin and Sunley, 2003); and the concept does not work very well for smaller, open economies, in which domestic demand is not a major determinant of competitive success (Clancy *et al*., 2001).

In response, Porter and Stern (2001) have redefined the cluster concept in a less rigid, more inclusive fashion, conceding that 'Defining clusters and drawing cluster boundaries is a creative process … [which] should encompass all firms, industries and institutions with strong linkages'. Furthermore, 'clusters vary in their state of development and cluster boundaries evolve' (Porter and Stern, 2001: 35). Porter also integrates the research on innovation systems, which we examine next, to develop the idea of innovative capacity, encompassing the role of clusters in national and regional economies.

Embeddedness

Closely related to cluster development – and a primary determinant of its success – is the role played by the subsidiaries of FDI companies and the extent to which they are 'embedded' in the host economy. This is of particular importance in the Irish case, with its substantial FDI presence both in global growth sectors and local supply chain activity. More widely, the importance of knowledge management in multinational companies (MNCs) has attracted interest in recent years (e.g. Ghoshal and Bartlett, 1998; Schulz, 2003), the main driver being the incessant search by MNCs for sustainable competitive advantage as they seek to globalise operations (Levitt, 1983; Yip, 1992; Porter, 1990). In this context, it is increasingly apparent that the embedded nature of knowledge within the organisational and environmental contexts is what influences subsidiaries' mechanisms for leveraging knowledge as a source of power. Subsidiaries can exploit their knowledge to create resource-dependency relations. If subsidiaries cannot do this, their value as a strategic resource diminishes (Tregaskis, 2003: 434). It is recognised that networks established outside the subsidiary are also important in shaping knowledge production. This includes relations with policy-makers, the scientific community and the local business community – customers and competitors (Murray, 2001). This spiral model of innovation and collaboration is depicted later as a 'triple helix' model.

The positive impacts of globalisation are founded on the belief that MNCs provide well-paid jobs, superior skills and technology and opportunities for local linkages and exports (Dunning, 1993; Young *et al*., 1994a, 1994b; Dicken, 1998; Hood and Young, 2000). While FDI-led development policies are not new, they are perceived as taking on a greater significance as more recent waves of investment

are seen as being of higher quality in terms of affiliate autonomy and local sourcing (Amin *et al*., 1994). As a result, the extent to which inward investors have become 'embedded' within host economies has achieved greater relevance (Young et al., 1994a; Phelps, 2000). In this context, 'embeddedness' refers to the nature and extent of connections between inward investors and host economies. Markusen had already coined the term 'stickiness' (1996: 293) to connote both the ability to attract as well as to retain firms in a region. She emphasised the 'continued power of the state and/or MNC to shape and anchor industrial districts, providing the glue that makes it difficult for firms to leave, encouraging them to stay and expand, and attracting newcomers into the region' (1996: 294). Subsequently, economic geographers have studied how firms are embedded in networks and institutional settings, particularly at the local and regional scale. For example, Phelps et al. (2003) seek to operationalise embeddedness by examining factors such as affiliate status, R&D activity, local purchases, skills and training demands and repeat investment. These indicators encompass both traditional concerns about the character of local linkages (Phelps, 1993; Turok, 1993) and the more recent interest in affiliate evolution and the skills requirements of inward investment (Amin *et al*., 1994; Phelps and Fuller, 2000).

Henderson *et al*. (2002) offer another conceptualisation of embeddedness as part of their larger attempt to understand global production networks. Specifically, these authors identify two distinct forms of firm embeddedness – territorial and network. Territorial embeddedness relates to the manner in which firms become anchored in particular places. Supplier linkages are the most common indicators of territorial embeddedness. Through linkages, firms create indirect employment and support the development of local supplier base, which in turn leads to further investment (Kennedy, 1991; Phelps, 1993; Turok, 1993). Inter-firm relationships potentially benefit both local firms and MNCs. For instance, more collaborative linkages allow local firms access to the technological knowledge and extensive resources of MNCs. Similarly, by linking downwards into local networks, MNCs often gain access to sources of unique, tacit knowledge and thereby enhance their innovative capacity (Lyons, 2000; Zanfei, 2000). Nonetheless, the quality of the linkages ultimately determines the extent to which they contribute to regional economic development (Turok, 1993).

Whereas territorial embeddedness emphasises local inter-firm relations, network embeddedness examines the roles played by intra-and extra-firm relations. In regard to the former, this element of firm embeddedness considers the growing interest in intra-corporate competition and affiliate evolution in both the business studies literature (Birkinshaw and Fry, 1997; Molloy and Delany, 1998; Hood and Taggart, 1999) and the geographic literature (Amin et al., 1994; Phelps and Fuller, 2000). While performance and affiliate capacity are necessary conditions for the survival of locally based affiliates, local factors alone do not determine firm embeddedness. As a result, intra-corporate relations within an affiliate's wider corporate network, such as those between local managers and key decision-makers in headquarters, represent an important part of the equation determining firm embeddedness. Local institutions such as regional development

agencies or universities are geared to deepen firm embeddedness by supporting locally based affiliates in their drive to upgrade and develop their internal capacity (Peck and Burdis, 1996; Phelps *et al*., 1998). Network embeddedness therefore accounts for the stability and importance of firm relations in the wider corporate and institutional networks in which firms are situated, and not just locally based, inter-firm relations (Henderson *et al*., 2002).

Systems of innovation

Since innovation – characterised as a process transforming new discoveries, inventions and technologies into commercial value – is a key ingredient in productivity and competitiveness in a knowledge-based economy, the quality of innovation support policies is widely understood to be a critical lever of economic development. Successful innovation is dependent on understanding the needs of international markets, an open competitive environment and the ability to anticipate and adapt to changes in demand and market conditions, as well as a commitment to invest in R&D (National Competitiveness Council, 2004).

The concept of a national system of innovation was developed in the mid-1980's as a means for describing how the economic structure and institutional set-up of a nation affects innovation and technological development within an economy (Nelson, 1993; Lundvall, 1992). The systems approach rests on the premise that 'innovation by firms cannot be understood purely in terms of independent decision-making at the level of the firm. Rather, innovation involves complex interactions between a firm and its environment' (Smith, 2000: 73). This literature places a strong emphasis on environmental conditions for the generation, diffusion and application of knowledge within a nation (Kaiser and Prange, 2004).

The innovation systems model derives from the evolutionary economics of Joseph Schumpeter, who viewed innovation as a social phenomenon shaping economic evolution. Early writers (Nelson and Winter, 1974, 1975; Nelson, 1986) were critical of the prevailing neoclassical tradition that treated innovation and technical progress as a 'residual' with no explanation of its sources and effects in the economy. Evolutionary economics sought to explain the dynamics of technical progress by identifying important characteristics of knowledge as an endogenous factor in growth and accumulation. In particular, Nelson (1981) proposed not only that many different external forces influence the level of innovation within a company, but that it involves a network of interconnected economic agents, with knowledge spillover effects on investment in innovative activities, such as R&D spending by firms.

Moreover, the external environment of the firm consists of the social, cultural, political and institutional aspects that impact on their behaviour (Smith, 2000). It is proposed that interactions between a firm and its environment in these aspects will affect the extent of and means for undertaking innovative activity in an economy. Hence, a national innovation system is defined here as 'a set of institutions whose interactions determine the innovative performance of … national firms' (Nelson, 1993: 4), or, more specifically, 'the set of organisations and linkages for the

generation, diffusion and application of scientific and technological knowledge operating in a specific country' (Galli and Teubal, 1997: 345). Institutions can be formal, consisting of regulations, directives, property rights and the constitution, or informal, which is said to include codes of conduct, norms of cooperation and traditions that are embedded in cultures and societies (Edquist and Johnson, 1997).

More recently, there has been a shift in the spatial dimension of the innovative systems approach from the national to a regional level (Braczyk *et al*., 1998; De la Mothe and Paquet, 1998). A number of arguments have been provided by Todtling and Kaufmann (1999) in support of this shift in approach. First, the availability of a skilled labour force, educational institutions and research centres may be specific to particular regions that give them an innovative advantage over others. Second, drawing from the cluster literature, it is suggested that networks between the actors of the system may be highly localised. Third, since knowledge transfer within the system often occurs as a result of the mobility of labour and face-to-face contact, this is also a localised process. Fourth, innovation policy has itself assumed a more regional focus in recent times. Finally, the authors point to the unique 'technical and organisational culture' (1999: 701) that develops where interactions are highly localised and impacts on the overall innovative performance of that region.

It may be argued that the industrial cluster model has been superseded by the more recent regional innovation systems approach theory. Both approaches share the vision of innovation as a product of interactions between different economic agents, occurring in a geographically confined space. However, the innovation systems approach provides a more general understanding of the forces at work, and departs from the cluster model on a number of different levels while validating its analysis in a specific context. First, in contrast with the cluster model, this approach does not concentrate on any particular industrial sector (Niosi and Bas, 2003; Asheim and Coenen, 2004), since it may cut across a number of different sectors: 'as long as there are firms and knowledge organisations that interact systematically, a regional innovation system can be identified' (Asheim and Coenen, 2004: 7). Furthermore, while cluster theory and innovation systems do overlap in terms of the transfer of knowledge and technology, institutional factors play a more significant role in an innovation system than in the traditional 'Porterian' cluster framework (Andreosso-O'Callaghan, 2000). Finally, the main focus of the innovation system is the interactions of organisations and institutions to bring about technological change and steer a region onto a particular technological trajectory, while the cluster framework centres on the creation and maintenance of regional competitive advantage in a defined sector of activity.

From this discussion, it is clear that innovation is not solely technological, but is a social process within a spatially defined economy, and it is recognised as one of the most critical factors in long-term economic growth and prosperity. In this context, there is scope for analysis and policy formation at the regional level, through development of the concept of a regional innovation system. The region is now seen as a key site for innovation to a large extent because of the social and

often tacit nature of innovation. The locus of economic policy has consequently also begun to shift in many cases to the regional level, and a new policy approach is emerging, whose focus is enabling the creation and commercialisation of knowledge through the encouragement of R&D linkages and an 'open systems' architecture.

Combining the concepts of cluster development, embeddedness and innovation in the regional innovation systems approach requires an overall capacity-building framework to drive this approach from the viewpoint of public policy. This framework may be found in a recent contribution by Porter, who has proposed a 'National Innovative Capacity Framework', which establishes the conditions for successful innovation at the level of the individual firm and organisation.

National innovative capacity

The 'national innovative capacity' framework was developed more recently by Porter, building on the essential elements of previous approaches. The main objective was to identify factors enabling nations and regions to innovate at the global frontier and shape the vitality of the innovation process in a specific geographical location. Although the framework was initially devised for application at the national level, it also has relevance for the development and evaluation of innovative capacity at the regional or local level. Porter depicts the framework in the following way:

> Why does the intensity of innovation vary across countries? How does innovation depend on location? On the one hand, firms and the private sector are the ultimate engines of innovation. On the other hand, the innovative activities of firms within a country are strongly influenced by national policy and the presence and vitality of public institutions. Competitiveness advances when the public and private sectors together promote a favourable environment for innovation.
>
> (Porter and Stern, 2001: 2)

The national innovative capacity concept is constructed around three distinct strands. The first is the theory of endogenous knowledge and ideas-driven growth, associated with the work of Paul Romer. The second is microeconomic models of national competitive advantage based on an understanding of industry clusters, a research agenda largely identified with Porter himself. Finally, the authors draw upon the rich national innovation systems literature, especially the contributions of Richard Nelson. As a result, Porter and Stern argue that building innovative capacity has a strong relationship to a country's overall competitiveness and level of prosperity, as 'innovation has become perhaps the most important source of competitive advantage in advanced economies' (2001: 15).

More specifically, the framework highlights three determinants of national innovative capacity that are seen to drive a nation's ability to innovate at the world's technological frontier:

1 *The common innovation infrastructure* – this is the set of cross-cutting investments and policies supporting innovation throughout an entire economy. It includes the overall human and financial resources a country devotes to scientific and technological advances, the public policies bearing on innovative activity and the economy's level of technological sophistication, including excellence in basic research. Cross-cutting innovation policy areas include the protection of intellectual property, the extent of tax-based incentives for innovation, the degree to which antitrust enforcement encourages innovation-based competition, and the openness of the economy to trade and investment (Porter and Stern, 2001: 5).
2 *The cluster-specific environment for innovation* – this determinant is captured in the 'diamond' model referred to earlier, whose basic premise is that the global competitiveness of a cluster depends importantly on its innovation orientation. Although the diamond model was subject to criticism in isolation, its presence is justified here as one of three components in the national innovative capacity framework.
3 *The quality of linkages* – the relationship between the common innovation infrastructure and a nation or region's industrial clusters is reciprocal. Strong clusters feed the common infrastructure and also benefit from it (Porter and Stern, 2001: 6). What are described as 'institutions for collaboration', a variety of formal and informal organisations and networks such as a nation's university system, provide a strong and open bridge between technology and companies.

Earlier, Etzkowitz and Leydesdorff had anticipated this last important aspect of national and regional innovative capacity in their suggestion that a 'spiral model of innovation is required to capture multiple reciprocal linkages at different stages of the capitalisation of knowledge' (1995: 15). The involvement of universities, industry and governments in the innovative capacity framework results in a triple helix model of innovation. Etzkowitz and Leydesdorff demonstrate that this triple helix is a key component of regional innovation strategies, based on the combined involvement of these agents in research cooperation and knowledge-based economic development. It represents a major challenge for such development in Ireland.

Ireland's medical technology sector

Over the past 20 years, Ireland has transformed from a predominantly agrarian society to an emerging knowledge-based economy, performing exceptionally well by historical standards and international comparisons. Between 1993 and 2003, employment in Ireland experienced the fastest growth in the OECD at 40 per cent and unemployment fell from 15 per cent to less than 5 per cent, exports more than tripled to over €100 billion, GNP per capita increased from 75 per cent of the EU average to well over the average and national debt fell from 93 per cent to around a third of GNP (Enterprise Strategy Group, 2004a). Ireland's remarkable economic

success has been traced to a number of strategic factors, including the targeting of FDI, the associated growth in global markets and favourable framework conditions such as the corporate tax regime, social partnership policy, the development of the skills base and demographic profile and the effective deployment of EU Structural Funds (DETE, 2003).

High-technology and knowledge-intensive sectors have, and continue to be, the primary source of this economic success. Employment in such sectors grew by 45 per cent during the 'Celtic Tiger' period, contrasting with negative growth in low-technology industries. By 1999, high-and medium-to-high-technology manufacturing in Ireland accounted for almost one fifth of total value added in the economy, the highest of any developed country (OECD 2003). The growth of these industries was driven by a strong export orientation, led by a high level of inward FDI and the dominant role of MNCs in the key knowledge-intensive industries of ICT, pharmaceuticals and medical technology. Flows of FDI into Ireland increased from an annual average of around $140 million in the 1980's to $2700 million per annum in the second half of the 1990's (Enterprise Strategy Group, 2004a). As may be seen from Figure 5.1, Ireland's trade in R&D-intensive industries doubled to 40 per cent in the decade to 2000, five times the OECD average. The total stock of FDI in Ireland in 2002 reached a staggering $157 billion, the highest in the world in per capita terms after Hong Kong (UNCTAD, 2003). Throughout this period, the FDI sector was a major contributor to growth in output, exports and employment. FDI companies also produced a significant multiplier effect, with positive effects on the indigenous sector.

A significant proportion of foreign investment in Ireland during this period has been directed to the establishment of a world competitive medical technology sector, with a number of clusters formed throughout the country, especially in Galway in the west of Ireland. This is a direct result of the regional focus of FDI attraction as part of a national spatial strategy in more recent years, whereby FDI firms can obtain more favourable grant packages for locating outside the capital city of Dublin. With Ireland now a leading global site for medical technology investment, the sector as a whole employs 26,000 people in over 140 companies, representing 11.5 per cent of total manufacturing employment (IMDA, 2007).

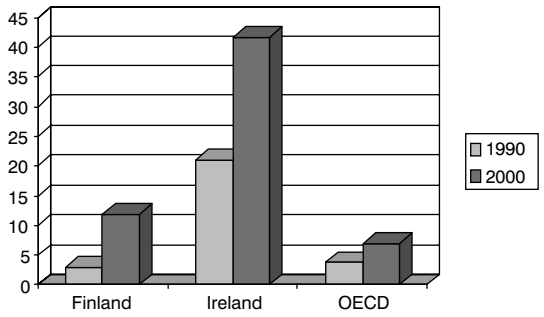

Figure 5.1 World trade in highly R&D-intensive industries, 1990 and 2000 (percentage of GDP) (*Source:* OECD)

Again these enterprises have a strong export orientation, with exports at €6 billion per annum, an increase of 225.4 per cent since 2000 (IMDA, 2007). The key areas of activity in the sector are the manufacture of medical devices and diagnostic equipment, as well as their components, with the majority of companies involved in the sub-areas of cardiovascular and cardio-rhythm management, orthopaedic, ophthalmic and hospital products (Enterprise Strategy Group, 2004b). The medical technology industry is dominated worldwide by MNCs, and 10 of the top 12 companies are located in Ireland. This has contributed to Ireland's newfound status as a leading location in Europe for medical technology production. Indeed, the growth rate of the sector is now approaching 16 per cent a year, which makes the Irish medical technology sector similar in scale to the world's largest clusters in Minnesota and Massachusetts (IMB, 2004). The presence of these FDI companies, primarily from the US, has also stimulated the growth of an indigenous base of small companies providing low-tech support services. These companies, producing medical devices or diagnostics, are mainly spin-offs from MNC's or universities (Enterprise Strategy Group, 2004b).

The medical technology sector is concentrated primarily in the west of Ireland, with only around 13 per cent of companies located in Dublin. Initially, MNCs locating in this region established low-tech manufacturing sites and were attracted to the region mainly by a low corporate tax rate and special grant aid incentives. However, once established, they were encouraged by the policy agencies, particularly IDA Ireland and Enterprise Ireland, to 'move up the value chain' to encompass more knowledge-intensive activities (Green *et al*., 2001). By 2001, 600 people were employed in R&D in the sector, an increase of one fifth from the previous year, and by 2003 MNCs were spending €51 million on R&D (IMDA 2002, Enterprise Strategy Group, 2004b). This investment in R&D was further stimulated by the availability of a large pool of highly skilled workers, supplemented by growing research activity in the higher education institutions, with more than 40 per cent of employees in the sector possessing third level qualifications. The significance of human capital in regional economic development has been noted by Markusen (2005). In addition to broadening the base of the medical technology sector, IDA Ireland has developed a policy of promoting the establishment of R&D facilities and other supporting functions, such as marketing, sales, finance and IT to ensure the sustainability of the sector in Ireland. Over 80 per cent of the sector's companies are now 'innovation active' (IMDA, 2007).

Emerging Galway cluster

Galway, the west of Ireland's largest city and one of the fastest growing population centres in Europe, is now also described by the *Financial Times* as 'one of Europe's leading industrial clusters' (Murray Brown, 2005) as it is home to three of the top four companies in the field of stent-making with support from rapidly evolving SME supply chains. Together with local companies, there are now 30 medical devices companies in Galway, employing approximately 7000 people, around 500 of whom are engaged in leading-edge research and development.

The medical technology companies within this cluster are relatively committed to investment in R&D, with 4 per cent of company revenues generated by the companies reinvested in R&D, compared with an average 1 per cent across Irish industry. For example, Boston Scientific's Galway facility, initially lacking its own R&D facility, was responsible in March 2004 for the launch of the company's latest product, reflecting the broader trend for incremental devolution of R&D functions to the local subsidiaries of MNCs and their newly emerging role as sites for innovation (Best, 2005). A recent questionnaire survey of medical technology companies in Galway (Giblin, 2005) found that many firms in the region are involved in a high level of innovative activity, including R&D. Of the 87 per cent of companies surveyed engaging in R&D, 46 per cent were found to spend one fifth or more of their turnover on R&D, while a further 31 per cent spend up to one tenth (see Figure 5.2).

In addition, while most firms engage in experimental development research, which draws on existing knowledge research for a particular application, 39 per cent of companies are involved in basic research (OECD, 2002), defined as original research undertaken to acquire new knowledge without an application in mind (see Figure 5.3). However, a significant proportion of the firms surveyed also identified particular barriers to conducting R&D in the region as 'very important', namely, a lack of funding (60 per cent), high research costs (40 per cent), high financial risk (20 per cent) and convincing headquarters to locate an R&D department in the region (20per cent).

Knowledge investment

Significantly, the reliance on FDI for the development of a knowledge-based economy over recent years has meant that while Irish exports embody a relatively high technological and R&D-intensity, the origins of these technologies are largely generated at the home base of the FDI companies. Ireland has been promoted

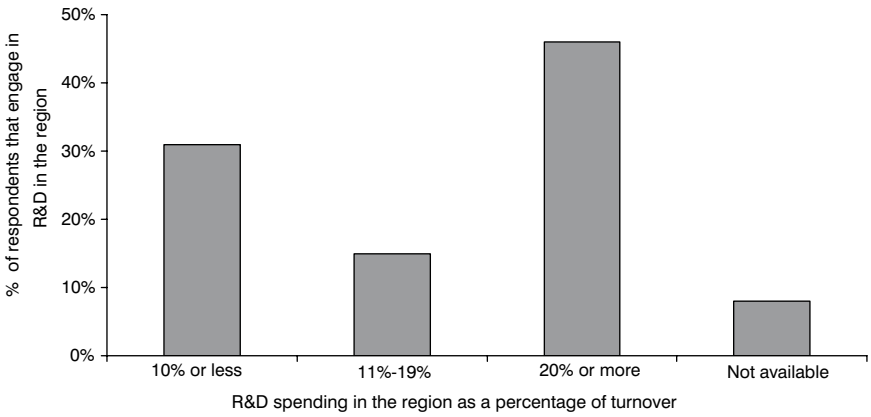

Figure 5.2 Corporate R&D in the Galway medical technology cluster (percentage of turnover), 2005 (Source: Giblin, 2005)

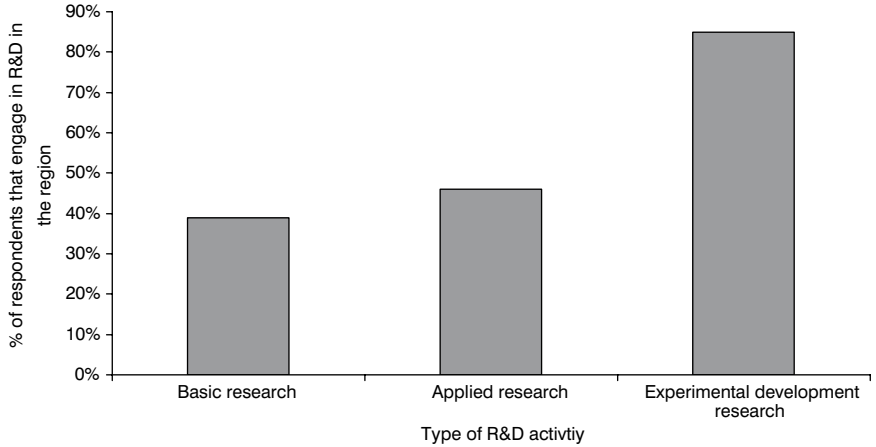

Figure 5.3 Type of R&D activity conducted in the Galway medical technology cluster, 2005 (Source: Giblin, 2005)

consistently over many years as a platform for low-cost manufacturing, especially for the European market, and only recently has begun to place importance on R&D activity and content. Likewise, in the services sector, Ireland has been used by FDI companies as a site for duplication and localisation of software for global markets, with the paradoxical outcome that in the 1990s it found itself to be the biggest 'exporter' of software in the world. The degree to which Ireland has become a 'technology taker' through net imports of R&D as opposed to a 'technology maker', with an emphasis on products and services embodying local R&D, is illustrated by the OECD's technology balance of payments (see Figure 5.4).

This characteristic of Ireland's recent economic development reflects low levels of investment in knowledge, as measured by expenditure on R&D, software usage and higher education, compared with other aspiring knowledge-based economies such as Finland (see Figure 5.5). Indeed, as against the EU's 'Lisbon target', which

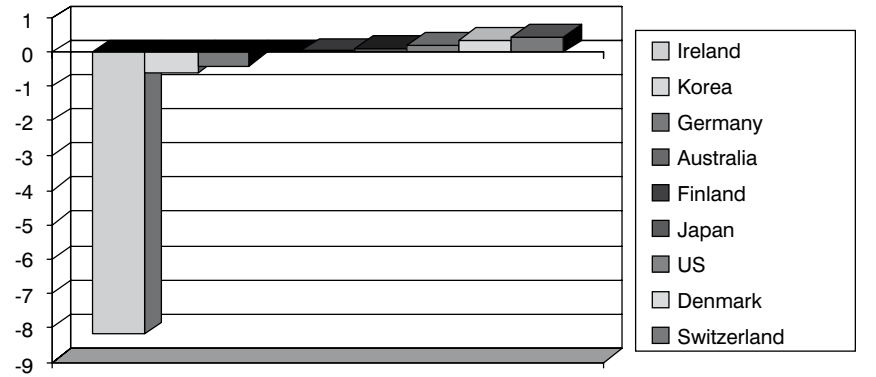

Figure 5.4 Technology balance of payments (percentage of GDP, 2000) (Source: OECD TBP Database, 2003)

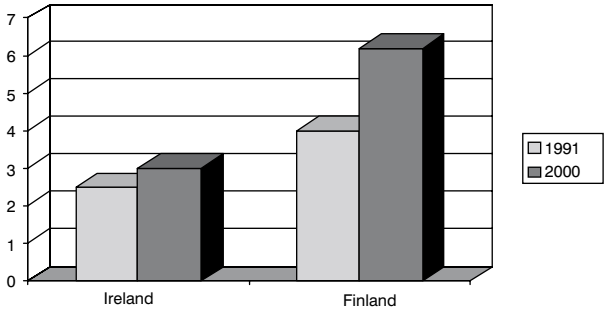

Figure 5.5 Investment in knowledge (R&D, software, higher education) (percentage of GDP, 1991–2000) (Source: OECD)

identified an R&D expenditure target of 3 per cent of GDP by 2010, Ireland could achieve only 1.56 per cent by 2006, with the OECD average at 2.25 per cent, the US 2.68 per cent and Finland 3.51 per cent (see Figure 5.6). Finally, it is an issue of particular concern that the sectors of key strategic importance to the Irish economy have significantly lower R&D intensities (R&D as a per cent of industry output) than these sectors internationally. For example, the Irish pharmaceuticals sector recorded 1.3 per cent R&D intensity rate in 2001 compared with the OECD average of 5.6 per cent (Forfás 2003).

Irish research funding agencies such as Science Foundation Ireland (SFI) have begun to address the problem of under-funding of research. In the case of the medical technology sector, SFI recently awarded €15 million to the National University of Ireland, Galway, to establish a Regenerative Medicine Institute (REMEDI) in partnership with Medtronic, among others, to develop a new generation of devices that can deliver stem cells to rebuild damaged organs inside the body (Brady, 2006). This comes on top of earlier large grants to the university's National Centre for Biomedical Engineering Sciences and funding support through Enterprise Ireland for intellectual property protection and the commercialisation of research findings. We may here be observing the building blocks of a 'triple helix' model for the cluster in the context also of an emerging regional innovation system, but a more definitive interpretation will follow further, more detailed research on the internal composition, behaviour and trajectory of the cluster.

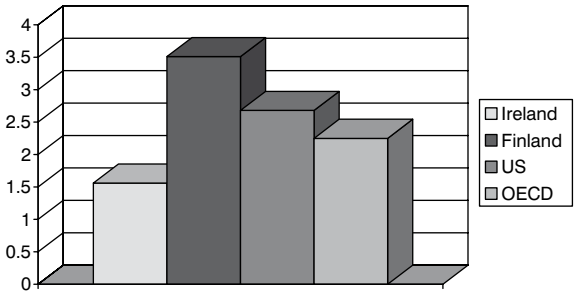

Figure 5.6 R&D expenditure (percentage of GDP, 2006) (Source: Forfás)

It may in conclusion be noted that the cluster was joined in 2004 by three new medical technology companies: Respironics Inc, Ulbrich Stainless Steels and Special Metals Inc and Labcoat Ltd. Together they created more than 200 highly skilled jobs in R&D, manufacturing, logistics and engineering in the region and cumulatively invested €5 million in their new plants. Later that year, Merit Medical Systems, supported by IDA Ireland, invested €9.3 million expanding its R&D and manufacturing activities at its Galway plant, creating over 230 new jobs over five years, with at least 20 per cent of the jobs intended for third level graduates. In early 2006, USCI (Universal Sciences Catheter and Instruments) Japan Ltd., a highly specialised sales and marketing organisation in the medical technology industry established a research, manufacturing and distribution centre for high-value interventional vascular products in Galway, again with the support of IDA Ireland. This €10 million investment is expected to create over 125 jobs within four years, with approximately 20 per cent being employed in R&D related activities. These companies are global leaders in their respective fields, and their presence is a tangible endorsement both of Galway's newly established reputation as a premier location for medical technology production and research, and of the efforts of IDA Ireland and other public agencies to attract and develop strategic R&D activity in knowledge-based, global industries.

Implications for policy

Can Ireland sustain the momentum of its remarkable and much admired economic transformation into the next decade of the twenty-first century? Or are the foundations of this success too narrow and precarious to respond effectively to changing patterns of global competition? These are the questions asked by researchers and policy-makers as Ireland embarks on its next transition – from a low cost magnet for foreign investment in Europe's evolving single market to a more self-confident and diversified knowledge-based economy, where competitive advantage has its source in research and innovation.

As we have seen, explanations for Ireland's success are multi-faceted, but include strategically targeted FDI attraction, an effective social partnership framework, low corporate tax, development of the skills base and policy-relevant use of EU Structural Funds (Green and Hilliard, 2004). However, despite this success, Ireland finds itself in a serious dilemma, amounting to a policy turning-point, which threatens if unresolved to undermine its achievements. This dilemma lies in the fact that Ireland has become a world leader in the export of high-tech products and services – especially in ICT, pharmaceuticals and medical devices – without being a significant innovation generator (Green *et al*., 2001). This leaves the economy vulnerable, as the current structure inherited from the 'Celtic Tiger' period is weighted largely towards externally generated R&D, leaving control of the key technology drivers outside domestic influence. Policy reviews, such as that conducted recently by the Enterprise Strategy Group, have also recognised that being a 'technology taker' rather than a 'technology maker', in other words relying predominantly on being the export base for technologies invented elsewhere,

leaves the Irish economy overly dependent on external factors with limited room to manoeuvre domestically. Evidence of this vulnerability is provided by Ireland's poor overall R&D performance, which seriously impedes Ireland's ambition to create a competitive knowledge-based economy. Indeed, we calculate that the government's R&D spend must increase by a net additional €1 billion per year to reach the EU15 average, let alone the Lisbon target (Green, 2005).

Framework conditions in Ireland have traditionally focussed on encouragement of employment growth and the reduction of unemployment (Green and Hilliard, 2004). However, in line with a changing policy emphasis, embodied in the Enterprise Strategy Group Report, *Ahead of the Curve* (2004a), these conditions are being reoriented towards an innovation focus, with a range of initiatives to make Ireland an attractive environment for world class research; provide a strong intellectual property management framework; realign enterprise support budgets and services towards R&D; introduce tax credits for R&D investment; and develop a pro-innovation culture (Green and Hilliard, 2004). In addition, one of the most significant recent statements of the key policy challenges for the Irish economy places innovation firmly at the heart of the government's policy focus:

> Ireland is vulnerable in the growth sectors of the knowledge economy as the R&D capability to underpin success in these sectors is not well developed in the public and private sectors … A failure to address the structural differences in R&D performance in the enterprise base will mean we are not replacing low skill industries with new technology companies, 'high-tech' manufacturing operations will be more vulnerable and we will not attract and create new waves of firms in the technology areas of the future.
>
> (Government of Ireland, 2004: 19)

Capacity-building in research and innovation

The government has commenced the process of building Ireland's research and innovation capacity with the introduction of a host of strategic funding initiatives. These include the Programme for Research in Third-Level Institutions, Science Foundation Ireland, Irish Research Council for the Humanities & Social Sciences, Irish Research Council for Science, Engineering & Technology, Health Research Board, Enterprise Ireland funding schemes and, as a potential focus for these initiatives, the appointment of a Chief Science Adviser. Progress has also been made towards the development of a 'Knowledge Society Foresight' project, driven by the Taoiseach's Department and building on the successful 'Technology Foresight' of the late 1990s which contributed to the subsequent policy shift towards national innovation capacity-building. The problem, however, remains that, 'Ireland has lost the basis for one economic development model (low cost, pool of young educated workers, hidden reserves for labour) without yet having completed the construction of another (R&D infrastructure, childcare, adult learning, etc.)' (Information Society Commission, 2004: 2). Most recently, the Government's new *Strategy for Science, Technology and Innovation, 2006–2013*

has set out clear and ambitious goals for Ireland's evolution from impressive latecomer to acknowledged leader in the STI arena. Establishing an international profile of Ireland as a premier location for carrying out world class R&D will require greater coherence and exploitation of synergies in the development of STI policy. In doing so, steps are being taken to benchmark Ireland with countries such as Sweden and Finland, whose R&D already exceeds the Lisbon target and whose research systems have roots extending back over a century or more. Encouraging education and skill development in science, engineering and technology and building a 'fourth level' of postgraduate and postdoctoral research are critical paths towards achieving these goals. Essentially, the strategy aims to deliver world class research, world class skills and world class enterprises with the drive to succeed, as well as the resources to do it. The intention is that Ireland by 2013 will be internationally renowned for the excellence of its research and will be at the forefront of generating and using new knowledge for economic and social progress, within an 'innovation driven culture' (Government of Ireland, 2006: 8).

In conclusion, we may identify the three major challenges for Irish policy-makers as follows. First, as recommended in the OECD's review of Ireland's higher education system, greater policy coherence is required across the myriad government departments and agencies concerned with research funding and performance. The Government's latest strategy document recognizes that this is more than a tidying-up exercise as it implies setting clear, consistent objectives and related delivery mechanisms in close cooperation with both the universities and other public institutions. The challenge has been described in a separate OECD project as one of achieving coordination through 'horizontal innovation policy' (Green and Hilliard, 2004). These recommendations are consistent with Porter and Stern's 'Common Innovation Infrastructure' (2001) – the set of crosscutting investments and policies supporting innovation throughout an entire economy and contributing to a national innovative capacity framework.

Second, again following the OECD recommendations, immediate action must be taken to address the serious infrastructure deficit in Ireland's higher education institutions, which have not performed credibly in recent world rankings. While it makes strategic sense for Irish universities to specialise and collaborate in key areas to achieve critical mass, there is still a resources gap which must be bridged. A recent report by the Royal Irish Academy estimated the required additional investment at €450 million a year (RIA, 2005). Third, even with substantially increased funding for research and infrastructure, there is a further challenge – effective intellectual property protection and the development of world best practice in technology transfer and commercialisation, to link research to the market. Again there is scope for collaboration among Irish universities and the establishment of 'shared services' facilities, consistently with Porter and Stern's proposition that 'institutes for collaboration' (2001: 6) provide an essential open bridge between technology and companies.

The argument presented here – evidenced by the development of an outward-looking medical technology sector – is that Ireland's future competitiveness and prosperity will depend on building national and regional innovative capacity.

Porter and Stern's framework is highly pertinent to this objective and its associated policy requirements. Innovation and sustainable growth are strongly influenced by national policy and the presence and vitality of public institutions. As Porter and Stern put it, 'competitiveness advances when the public and private sectors together promote a favourable environment for innovation' (2001: 2). This combination of the political, economic and knowledge sectors in research cooperation and knowledge-based economic development also suggests that Etzgowitz and Leydesdorff's 'triple helix' model (1995: 15) will provide an additional, complementary tool for analysis, which may in turn be pursued at the regional level in line with the shift in the spatial dimension of the innovation systems approach. However, further work will be needed to understand and draw lessons in a global context from the dynamics of regional innovation in Ireland, the development of an innovative capacity-building policy framework and its effectiveness in embedding locally the R&D activity of FDI companies in collaboration with SME supply chains and networks and an enhanced research and educational infrastructure.

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6 Unbalanced development and regional governments

How much to equalize and how to equalize?

Santiago Lago-Peñas

Introduction[1]

> The point, of course, is that the equalization process is always and inevitably political in all federal countries. Formulae, no matter how elaborate, remain acceptable only so long as their results are acceptable. With little exaggeration, in most federal countries it may be said that it is not so much that the distribution of transfers reflects the outcome of a principled formula as that the formula used is the one that produces the desired distribution of transfers.
>
> (Bird, 1994, p. 302)

Most of modern public finance instruments involve redistribution between individuals. With an uneven inter-regional distribution of average fiscal capacities, that means that from a regional viewpoint economic agents from poorer regions will enjoy a surplus between overall paid taxes and the cost of enjoyed public services and grants, and vice versa.

From an analytical standpoint, inter-regional redistribution may be decomposed into financial flows: first, directly affecting individuals, second, involving regional economies, and third, those affecting sub-central governments[2]. For the first category, a centralized social security system implies some level of redistribution between individuals, which in turn may imply (substantial or not) regional imbalances – both surpluses and deficits – between overall payroll taxes paid and payment benefits received. Second, regional policies also involve some sorts of inter-regional redistribution. Both direct investment from the central government and capital grants to subcentral governments aim at boosting public capital accumulation by poorer regional economies and thus reducing future fiscal imbalances. Third, redistribution affecting regional governments is in the realm of fiscal equalization. Differences in spending needs or tax capacities involve different abilities to provide analogous levels of public services with similar levels of tax effort. Fiscal equalization grants (from the central government –the most usual procedure – or directly from richer to poorer regions) are used to fill the gap.

The aim of this chapter is to shed light on two key questions: how to equalize and how much equalize. In order to do it, a number of issues both political and economic must be previously examined. Moreover, while my interest concentrates into the third type of inter-territorial redistribution, discussion on fiscal equalization often mixes the effects involved by the other two. Hence the need for also dealing with them in what follows. The organization of the chapter is as follows. Section 2 analyzes the relationships between equalization and inter-territorial redistribution with politics. Section 3 focuses on the effects of equalization on efficiency and economic growth. Section 4 discusses a number of key issues for equalization formulas. Section 5 concludes.

Redistribution and equalization in federal countries

Equalization: narrow view versus broad view

As introduced by Buchanan (1950), an individual's net fiscal benefit (NFB) is the difference between the taxes he pays and the public expenditure he enjoys.[3] Let there be two identical individuals living in different regions. According to the narrow view of equalization, inter-regional differences in their NFBs to be corrected should be those involved by federal expenditure and taxes (Boadway and Flatters, 1982). This narrow view is generally accepted in all countries because it is the fiscal translation of the concept of citizenship (Boadway, 2000a). The alternative broad view of equalization claims for correcting differences in NFBs due to subcentral taxes and expenditures. In this case, consensus is not so easy to attain. Cross-country differences in political debates and consequent equalization efforts may be more significant because of several factors, both economic and political.

Regarding the economic factors, the extent of inter-regional disparities is crucial. If they are small, equalization will tend to be a second order political issue. Provided that inequalities are significant, as in most countries, other elements must be considered. In particular, equalization negatively affects the competitiveness and attractiveness of richer regions, insofar as the taxes they pay exceed the public services enjoyed. While this might be a minor problem in the case of closed economies,[4] it may be a real one in the case of open economies, as in the case of European regions. Because equalization is mostly a country issue, two border regions belonging to two different countries and enjoying a similar per capita GDP may be subject to very different ratios taxes/expenditure. Let there be two border regions (i and j) belonging to two fully centralized countries and economically integrated, as in the case of two European countries. Assume also that per capita GDP is the same in both regions, but it reaches 90 percent of the country average in the case of region i and 110 percent in the case of region j. Taxes in both countries are fixed at 40 percent on GDP in each region as in the rest of the whole countries. Public expenditure is evenly distributed with no relationship with per capita GDP. While in region i, the ratio between taxes (cost) and public expenditure (enjoyed services) is:

$$\frac{T}{E} = \frac{40\% \times 90\%}{40\% \times 100\%} = 0.9$$

in region *j* this figure raises until:

$$\frac{T}{E} = \frac{40\% \times 110\%}{40\% \times 100\%} = 1.1$$

If some of those services were productivity enhancing, as usual, region *j* should make additional efforts to be as competitive as region *i*. Things are much the same if both countries are decentralized but strong equalization schemes are implemented. On the contrary, the competitiveness problem disappears if all services are decentralized to regions and equalization is dropped: regions *i* and *j* would enjoy the same unit ratio. Of course, fiscal equalization at European level would be another solution. Intermediate results would be found if decentralization and/or equalization were different in both countries.

Two real examples of this situation are provided by Ontario in Canada and Catalonia in Spain. Both regions are rich in their own countries, and they support the cost of fiscal equalization. And both have started in recent years to claim that its contribution to equalization hurts its competitiveness. In the first case, the highly competitive northeast US supports significantly lower levels of equalization than Ontario (Courchene, 1999). In the second one, southern French departments with low per capita GDP for French standards (largely determined by Île-de-France) are net receptors of fiscal flows while they have similar per capita GDP than Catalonia and are direct competitors in some sectors (Castells, 1999; Prud'homme, 1999). In any case, international competitiveness of firms not only depends on differences in terms of equalization. There are many other differentials in other aspects as relevant as equalization: business taxes, regulation, labor markets, R&D system, and so on. Let us consider the case of EU members. While a European-level centralization of fiscal equalization processes would solve the problem (of course, the same would apply for business taxation or regulation), as it has been already explained, for the time being, the European Union does not offer a political basis for fiscal equalization efforts as strong as those in the member countries.

Societies greatly committed to equality will be more prone to social expenditure and presumably to equalize regional disparities in public spending needs and tax capacities. In particular, a constitution greatly committed to equality will involve a federal government prone to play a maximum strategy in terms of inter-regional redistribution (and fiscal equalization, in particular).[5] However, this factor is qualified by the strength of local or regional political cleavages and their translation into the degree of nationalization of party systems.[6] In countries with poorly nationalized party systems, fiscal equalization becomes a multiplayer game with multiple potential equilibriums. In particular, in a political situation where seats from regional parties in rich regions become key for attaining majorities in national parliament, equilibriums with a lower degree of equalization will be more probable: even rich regional political communities seriously concerned with

equality might be more prone to concentrate efforts inside their own territory. Support for inter-regional equalization might be tempered by citizens' willingness to tolerate a certain degree of inter-regional inequality (Leslie, 1988; Watts, 1999).

Table 6.1 synthesizes four basic scenarios according to both political dimensions. Setting aside economic factors, the strongest fiscal equalization would correspond to countries placed in cell 1. In contrast, cell 4 would involve the weakest fiscal equalization. In order to fill up the table with some real examples corresponding to federal countries, commitment with equality is proxied by data on social expenditure over GDP. Data is from OCDE (Social Expenditure Database), except in the case of Brazil (IMF, 2001). It covers the period 1990–1998, except again in the case of Brazil (1995–1996). Values are the following: Austria (26.8 percent), Germany (25.8 percent), Switzerland (25.1 percent), Canada (19.5 percent), Australia (16.7 percent), United States (14.9 percent), and Brazil (14.5 percent). Concerning the degree of nationalization of party systems, available data show that Germany and Austria have extremely highly nationalized party systems, and Brazil is very poorly nationalized. Between both extremes, Canada and Switzerland are nearer to Brazil, and Australia and USA to Austria and Germany (Cox, 1999; Jones and Mainwaring, 2003; Moenius and Kasuya, 2004).

According to those data, Austria, Germany and Australia could be placed in cell 1; Canada and Switzerland in cell 2; the US in cell 3, and Brazil in cell 4. It fits considerably well with relative equalization efforts observed in those countries. Equalization is very strong in Austria, Australia, Germany, and Canada and weak in Brazil and the US. Switzerland would be between both groups (Bird, 1986; Ter-Minassian, 1997).

In sum, four factors may fuel critics on full equalization: significant inter-regional disparities in tax capacities and spending needs, border competition, lack of social commitment with equality of results, and poorly nationalized party systems. Some examples follow. Low equalization in the US case may be explained by a weak commitment to the principle of equality than in European countries, or in Canada. Current critics from richer regions in Germany – a country with a highly nationalized party system and greatly committed to equality – would be related to the size of regional disparities, significantly increased since reunification. Claims from Ontario in Canada would be mostly related to the fact that equalization means a lower competitiveness with respect to developed Northeast US.

Spain is another interesting case. While decentralization just started in the early 1980s, expenditure made by regional governments attained 36 percent of total public expenditure in 2005. Equality of access to public services was proclaimed

Table 6.1 Several political scenarios for fiscal equalization

	Highly nationalized party systems	*Poorly nationalized party systems*
Society strongly concerned about equality	1	2
Society weakly concerned about equality	3	4

by the Spanish Constitution adopted in 1978. Moreover, equalization of both tax capacity and spending needs has been a serious concern during the devolution process and it is still very strong. Figure 6.1 shows both equalization grants and taxes in per capita terms for 2005, while Figure 6.2 shows the relationship between per capita taxes and per capita total revenues.[7] Regressing total revenues on taxes

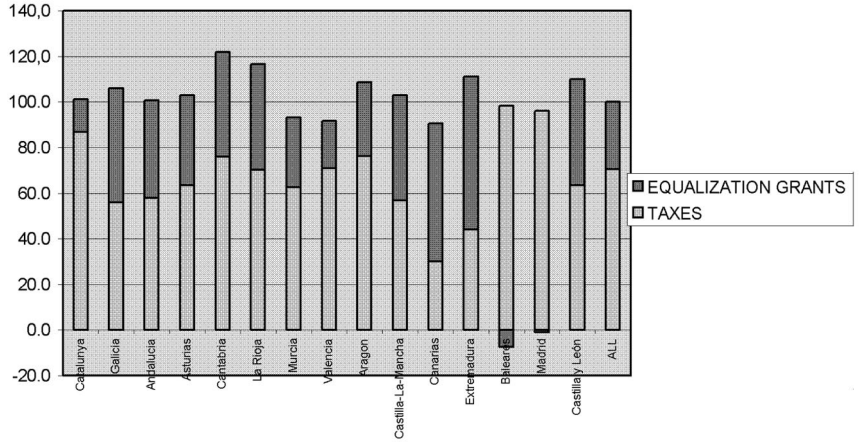

Figure 6.1 Per capita taxes and equalization payments in Spanish autonomous communities for 2005

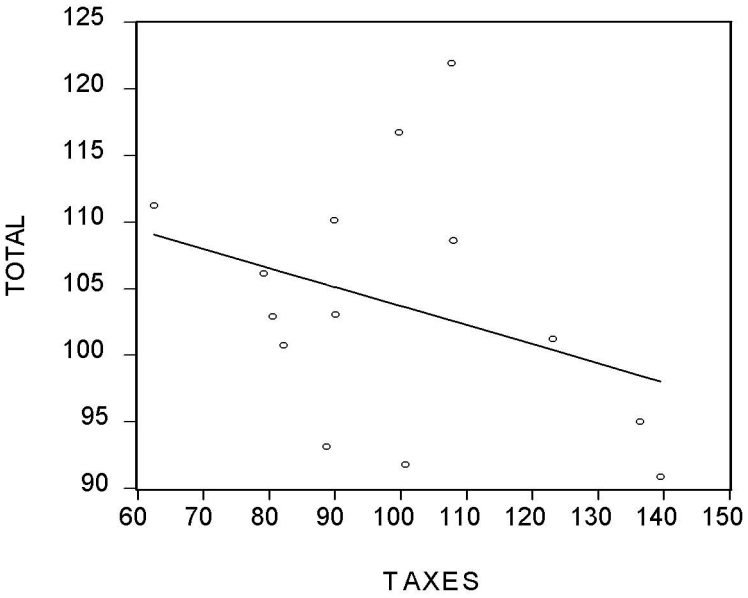

Figure 6.2 Relationship between per capita taxes and total revenues in Spanish autonomous communities for 2005

yields a negative but statistically not significant coefficient.[8] In sum, higher per capita taxes do not seem to be associated with higher total revenues.

However, success in the decentralization process itself has reduced the degree of 'nationalization' of the Spanish party system,[9] pushing Spain from cell 1 to cell 2 in Table 6.1. In this sense, current reforms in regional statutes of autonomy point out the possibility of future cuts in equalization efforts (López-Laborda, 2007). The reformed statutes of some regions like Catalunya, and the Balearics claim a partial equalization (only spending needs in health care, education and social services should be equalized). Probably, the expected renegotiation of fiscal arrangements in 2008 will put full equalization at stake.

To end with political considerations, another argument often put forward in favor of equalization is that it can strengthen political union, because it redistributes the social dividends generated by a common market that would otherwise favor the spatial concentration of production and fiscal resources; perhaps with the aid of federal policies.[10] Indeed, equalization grants (and regional policy aimed at boosting poorer regional economies) would take the wind out of calls for satisfaction of regions that claim to have been discriminated against. Equalization would be a kind of 'social glue' preventing secession by poorer regions.

However, this is a quite optimistic view of the political consequences of equalization. Equalization may also be source of discontent in richer regions, which may argue for its reduction (like Ontario in Canada, or richer West *Länder* in Germany). Indeed, some political parties may use the cost of equalization for richer regions as an economic argument for political secession.[11]

In any case, the (negative or positive) net effect of equalization on political stability of federations should not be exaggerated.[12] As mentioned above, reality shows that other factors have to be also taken into account, such as cultural and social inter-regional differences,[13] and the fragmentation of the party system motivated by strong regional cleavages in combination with a permissive electoral system.[14] Why, if this is not the case, are secessionists in Quebec much more numerous than in Ontario?

Equalization, efficiency, and economic growth

The literature on fiscal federalism provides a number of economic reasons supporting equalization:

1 Equalization makes possible the provision of public services at nation-wide standard levels. And some of them, as education, infrastructure, and public health are crucial for national long-run economic growth. Therefore, equalization would promote the economic development of the whole country.
2 Standard economic theory contemplates migration as an instrument of assuring that labor is efficiently allocated across regions. However, inter-regional differences in fiscal residuals may distort this adjustment mechanism. Assuming perfect mobility, where individuals and firms locate depends not only

on marginal productivities, and hence on the wages and the return on capital in each region, but also on relative NFBs. Since total output is maximized by a spatial distribution in which the marginal contributions of the inputs are equal, efficiency requires the elimination of NFB differences.[15] If perfect mobility does not hold the argument requires greater finesse in its details but is essentially the same. While seminal results by Watson (1986) from Canada showed that inefficient allocation of labor in the face of differences in net fiscal benefits was of little real world importance, more recent estimates by Wilson (2003) demonstrate that gains may be much more relevant. Moreover, from a holistic communitarian point of view, the elimination of NFB differentials is desirable if migration threatens the maintenance of established communities (Bramley 1990; Telford 1998).

3 Equalization of NFBs may reduce excess tax burden for the whole national economy. From the perspective of optimal taxation, equalization involves efficiency gains because of lower tax rates on average (Gordon, 1983; Dahlby, 1996), but also avoiding tax competition (Esteller and Solé, 2002).

4 Last but not least, equalization might soften regional asymmetric shocks. While the main aim of equalization is correcting structural disparities, it relates revenues from subcentral governments to the dynamics of the national economy, potentially reducing the short-run effects of negative asymmetric shocks on regional budgets. This reasoning is most often applied to households, analyzing differences between per capita GDP and household income, as in Bayoumi and Masson (1995) and Melitz and Zumer (1998), or in relation to private consumption, as in Asdrubali et al (1996). However, empirical results show that, in general, risk-sharing based on fiscal variables is of secondary importance in comparison to market mechanisms. Moreover, potential smoothing effects of equalization grants will crucially depend on their design. If the calculations do not adopt an annual basis, delays could prevent any kind of short-run stabilization to occur. For instance, equalization grants in Canada are yearly updated, but they have not been updated in Spain since 2002.

On the other hand, there are also a number of criticisms addressed to equalization also on the basis on efficiency arguments:

1 Equalization might remove the incentive to efficiency-increasing migration because of the disincentives provided by subsidies to firms located in regions in crisis or generous federal unemployment benefits, for instance. However, second-best theory tells us that a problem caused by one policy – such as subsidization of firms in depressed areas, or the provision of unemployment benefits favoring developed regions – is generally best tackled by correcting the root cause, not by modifying other policies (Boadway, 1998).

2 Second, it has been suggested that differences in NFBs would be capitalized, affecting the prices of the assets located in each region in such a way as to make external equalization mechanisms unnecessary. However, the difficulty

of capitalizing NFB differences would probably lead to very imperfect compensation; and in any case, as Boadway (2000b) points out: 'It should do no harm to correct for NFB differentials since to the extent that the capitalization hypothesis does apply, the correction will simply be absorbed into further capitalization'.

3 Third, it can be argued that equalization removes the pressure on a regional government to seek efficiency in its taxes and spending decisions insofar as revenues scarcely depend on regional economic growth (Smart, 1998; Dahlby and Wilson, 2003; Fenge and Von Weizsäker, 2001).

4 Boadway (2000a) also relates equalization with literature on economic geography. In particular, if spatial concentration of economic activity is more efficient than a more homogeneous distribution, equalization may slow national economic growth down. In a similar vein, Qiao *et al*. (2007) theoretically show the existence of a trade-off between overall national economic growth and regional equity concerning the distribution of fiscal resources among subnational governments. They also confirm the empirical relevance of this theoretical result using data from China.

In sum, while there is a number of reasons to expect that fiscal equalization may favor national economic growth (namely, provision of public services at nation-wide standard levels, reduction of excess tax burden for the whole national economy, and softening of regional asymmetric shocks), negative effects may also be relevant. First, granted regional governments would make less efficient economic choices. This argument claims for a clever design of equalization schemes, putting pressure on regional governments to boost regional economic growth. Second, it would hamper an efficient spatial concentration of economic activity. The first question is addressed in next section. With respect to the optimal concentration of economic activity, the argument is probably more related to regional policy than to fiscal equalization itself. I will come back to this question in Section 5.

Technical solutions: equalization formulas

Individuals or governments?

If fiscal equalization is regarded as desirable but inter-regional grants are unlikely to be made without the intervention of central government,[16] then formulas governing obligatory grants must be established and applied. The first decision to be made in this respect is whether to implement grants between administrations or direct subsidies or tax reductions for individuals resident in disadvantaged regions, as in Buchanan's original proposal in 1950.[17] The former approach is preferable. Direct subsidies do not make for inter-regional uniformity in the prices of public goods and services when these are expressed in terms of tax rates. It simply increases personal income, with the result that in order for regional government to obtain proportionally the same revenue as in richer regions it has to make its citizens

pay their taxes at higher marginal rates. This means that it is necessary to take into account either the welfare losses due to the extra tax burdens (if higher taxes are indeed imposed), or the underlying provision, due to the higher fiscal price, of public goods and services that are relevant to economic growth. Moreover, political support for equalization in net contributor regions might be lower for the direct subsidy approach than for inter-administration transfers, not only because it is less intuitive, but also because the goal pursued – equal access to public goods and services for all – is achieved only indirectly. As noted above, its direct effect is to increase the available income of individuals in subsidized regions.

Federal grants versus inter-regional grants

Equalization grants may be implemented in two ways: vertical grants, from the federal government to regional governments, or horizontal grants among regional governments. The most usual procedure is the first one, with Germany being the most quoted example of the second (but in reality Germany combines both methods). In my opinion, the first solution is better from a political standpoint. If fiscal equalization is a federal power, as it is commonly defined in most constitutions, it should be financed by means of federal taxes and implemented as a federal grants program. With equalization financed by means of regional taxes, governments – and individuals – from richer regions may be tempted to interpret the equalization grants as another regional expenditure program. In a situation of fiscal pressure, claims for cutting the equalization grant program would be unbearable. Probably this could even happen in countries placed in cell 1 of Table 6.1.

Representative tax systems versus macro-formulas

In order to measure tax capacities there are two methodological options. On the one hand, using a Representative Tax System (RTS) based on the observation of tax bases and rates; on the other, using Macro-formulas as Gross Regional Product or Gross Regional Income corrected in order to take into account aspects as tax externalities (tax exportation).[18] Macro-formulas enjoy several advantages. First, moral hazard is less problematic than using observed tax bases. Regional governments could be tempted to relax supervision of tax evasion. Or, depending on the way equalization grants system is defined, they may play around with tax rates to increase equalization grants, as detected in Canada (Boadway and Hobson, 1993). Second, it is simpler to calculate one macro-indicator than comparing all regional tax bases and rates, especially when taxes are not homogeneous across regions. Third, when using macro-formulas it is not necessary to assume the same efficiency of tax administrations across regions.

However, the use of macro-formulas has also some problems. First, tax externalities may be difficult to quantify: border consumption, tourism, and so on. While macro-formulas may be modified to capture better those externalities, it involves complexity and therefore losing one of the positive features of macro-

formulas. Second, statistical correlation between macro-formulas and regional tax capacity may be imperfect when the number (and diversity) of regional taxes is small.

Equalization and incentives

Regarding the perverse incentive that equalization may exert on the efficiency of regional governments fiscal choices, and setting aside differences in spending needs, equalization grants should look for dynamic equilibria between equity and efficiency. A possible solution would be the following (Lago-Peñas, 2002):

1 Defining the degree of equalization in the base year (t).
2 Defining the duration of the period p until the next revision of the equalization grants system.
3 Defining an exogenous growth rate for equalization grants to be applied from t+1 to t+p. For instance, the growth rate of federal taxes. Then equalization payments will be independent from regional fiscal choices until the next revision of the equalization grants system.
4 Recalculate equalization grants as if one wanted to get again the degree of equalization set in point 1. However, instead of using a tax capacity index in year t+p, a simple average from t+1 until t+p is taken. As a consequence, regions with growth rates below (above) the average from t+1 to t+p will enjoy lower (higher) total resources than the average in the new base year. In this case, partial equalization is not an end, but a mean to encourage the growth of tax capacities.

A key issue in this procedure is the parameter p. A trade-off appears. While higher values provide incentive to efficiency in fiscal choices, lower values are better to guarantee equity.

The equalization of spending needs

Per capita public spending on a given service in a given region can be decomposed as follows (Castells and Solé, 2000):

$$\frac{S}{P} = u \times o \times i \times c; \quad u = \frac{U}{P}, o = \frac{O}{U}, i = \frac{I}{O}, c = \frac{S}{I} \tag{5.1}$$

where S is public spending, P the population, U the number of users, I the total input and O the total amount of the service that is provided (output); u is the proportion of the population that uses the service, o the service provision per user, i the input required for each unit of service provided, and c the average unit cost of the components of the input.

Equalization of inter-regional differences in per capita spending is only legitimate if higher spending is due to the percentage of the population who are

users (u) being larger, to input costs (c) being higher, or to productivity ($1/i$) being lower because of factors outside the control of the regional government, such as scale costs due to the population being smaller or more dispersed.[19]

While grants devoted to correct differentials in tax capacities should be unconditional, grants devoted to compensate for above-average spending needs should be conditional and compensatory, because they must be used to cover above-average costs. If they are not devoted to the provision of the most costly services, then equality of resources is sacrificed without the guarantee of getting equality of welfare. Therefore, the most reasonable approach, and the most transparent, would be to adopt different formulas for the two kinds of grants.

The compensatory transfer G_{jr} for region r in service j, expressed as a percentage of national per capita spending on j, may be modeled as

$$G_{jr} = \sum_{K} \beta_{jk} (X_{kr} - 100) \tag{5.2}$$

where the X_k are factors affecting spending on service j (expressed as percentages of their national averages) and the β_{jk} are the weights of these factors. Before this or any similar formula can be applied, a number of steps must be taken:

1 Establishment of the set J of services eligible for compensatory transfers. If total spending is concentrated in a small number of categories, it may well be convenient to limit equalization to these services so as to simplify the problem (Rye and Searle, 1997).
2 Establishment of factors X_k.
3 Estimation of the coefficients β_{jk}.

The most problematic stages of this process are steps 2 and 3, the latter especially. The main ways of tackling them are as follows:

1 Acceptance of total population as a measure of spending needs, which implies limiting equalization to fiscal capacity defined in per capita terms.
2 Pursuit of political agreement on the list of factors xk and the values of the coefficients β_{jk}.
3 To rely on econometric estimates of equations in which the dependent variable is spending on service j and the set of explanatory variables contains both proxies standing in for factors determining spending needs and also control variables.[20]
4 Resort to independent bodies to determine the X_k and β_{jk} by means of a variety of mutually complementary methods, including statistical analyses, interviews, and in situ inspections.

Of these four approaches, the first two are pleasantly simple but involve subjective evaluations and other processes that might well result in significant deviation from reality. The last two are in principle more objective and precise,

but also harder to put into practice. The initial obstacle to approach 4 is the difficulty in setting up an independent body whose evaluation is to be, as in Australia, generally accepted by the governments concerned (Brown, 1996).[21] Finally, approach 3 does not avoid the problems faced by econometric methods in general and in particular, the omission of relevant explanatory variables and multicollinearity. It must be recalled that accuracy in estimating the coefficients of the model is essential, because it is ultimately these coefficients that will determine the distribution of equalization funds. But probably the main problem with 3 is the difficulty of controlling for disparities in variables difficult to measure such as preferences or efficiency.

Concluding remarks: how much to equalize and how to equalize

As Bird (1994) states, the equalization process is always and inevitably political. In section 2, two key factors have been pointed out in this respect: the understanding of the concept of equality in each country and the degree of nationalization of party systems. However, economic considerations should be also very relevant. Social choices may change if reliable information on benefits and costs of equalization is available. Because they may be different in each country, a cost-benefit analysis should be carried up in each case. For instance, the effect of equalization on migration may be different across countries depending on the relevance of cultural differences across regions; reductions on excess tax burden for the whole national economy may depend on tax structure; the size of regional asymmetric shocks may differ; and so on.

In any case, economics is the most important factor when defining how to equalize. First, regional policy may be seen as a subtle way of equalization. If it succeeds in promoting economic growth in poorer regions, it reduces disparities in future tax capacities and then will make the equalization issue easier. Moreover, political communities from poorer regions will probably be happier about a solution that improves their economic performance and makes them less dependent in the future.[22]

However, regional policy may be also troublesome. How much of federal resources may be spent in poorer regions to change economic geography? What is the cost-effectiveness of regional policy? Moreover, if regional policy means lower public investment in richer regions, what is the cost of the former for the economic growth of the whole country? The answer to those questions may also differ across countries. Careful economic analysis is then necessary in order to decide how much inter-regional redistribution should be channeled by regional development policy. De la Fuente (2004) is a good example of this approach and it is complementary to the above quoted by Qiao *et al*. (2007). While the latter study shows a non-linear trade-off between national overall growth and equality in the geographical distribution of fiscal resources, the former shows that the trade-off may be different for different instruments of inter-regional redistribution. From this perspective, the optimal solution would be to mix the different types of

inter-regional redistribution (personal, equalization, and regional policy) to meet equity goals.

Second, there are several questions with respect to the design of the equalization grants system. According to above considerations, I would like to stress three of them:

1 Dynamic aspects are crucial when discussing the incentive effects of equalization grants. In section 4, a possible solution is suggested, based on three key ideas. First, the amount of equalization grants should not be revised every year: an exogenous annual growth rate should be applied between consecutive revisions of the equalization system. Second, periodical revision of equalization grants should look at average data corresponding to several years. Third, different period duration yields different solutions for the trade-off between equity and efficiency.
2 With respect to the choice between RTS or macro-formulas, two factors are determinant: the decentralization of tax administration and tax system homogeneity. The change to macro-formulas should be especially studied in countries where cross-regional heterogeneity in both tax administration and tax legislation are significant.
3 The last suggestion concerns spending needs equalization. While it may be extremely difficult to implement this type of equalization if one wants to consider all expenditure categories and all cost factors, the problem may be simplified if just the most important categories and factors are taken into account.

Notes

1 This chapter has benefited from very helpful comments by Alex Esteller, Ignacio Lago-Peñas, Jorge Martinez-Vazquez, Joan Rosselló, and François Vaillancourt.
2 Terms ‘federal government’ and ‘central governments’ are indistinctly used in what follows; the same for regional and subcentral government. The local level is set aside.
3 A somewhat subtler concept of NFB may be defined in terms of the *per capita* benefits from expenditure, rather than the expenditure itself.
4 In fact, in closed economies fiscal flows may boost purchasing power in the common market integrated by all regions. Firms from richer regions would find customers in subsidized territories and, therefore, redistribution would mean increasing market size and then growth in richer regions. However, things clearly change when the economy is open and foreign customers are available (Vaillancourt, 1998).
5 A confederation would be the opposite case insofar as the concept of inter-regional fiscal inequity is scarcely relevant (Leslie 1988). The European Union may be illustrative. While inter-regional redistribution inside EU members is strong, cross-country redistribution is comparatively weak. The Spanish case may be a good example, being one of the EU countries most benefiting from redistribution at the European level during the 1990s. Estimates by Sanchez Maldonado (2000) for 1996 and the three regions (Autonomous Communities) with lowest per capita GDP in 1996 (Extremadura, Andalucía and Galicia) are used. Fiscal flows with the European Union account for 28.2 percent, 20.6 percent, and 23.5 percent of total regional fiscal

imbalances, respectively. Taxpayers from the richest Spanish regions finance the remainder.

6 In nationalized party systems the highly localized and territorialized politics is replaced by national electoral alignments: programs and policies become national in scope and cancel out or at least reduce the scope of local problems, with the most relevant issues being transferred from the local to the national level (Caramani, 2004). Cox (1999) calls this process *linkage,* and Chhibber and Kollman (2004) 'party aggregation': it can be defined as the extent to which parties are uniformly successful in winning votes across districts (Moenius and Kasuya, 2004).

7 Excluding indebtedness, capital grants mostly related to regional policy, and other minor revenues.

8 This equation is estimated by Ordinary Least Squares; t-statistics are shown in parentheses; the null hypothesis of homokedasticity is not rejected using a White test. The Canaries are excluded due to the particularities of its fiscal arrangements.

9 See Gunther *et al*. (2004, Chapter 6) for a discussion of the decentralization of politics in Spain since the late 1970s.

10 Trade policy or industrial policy may have benefited certain regions more than others in the past. Then 'path dependence' would explain current disparities in economic development. See Krugman (1991).

11 Theoretical results by Le Breton and Weber (2003) support this interpretation:

> In order to prevent a threat of secession by disadvantageous regions, they must be subsidized by advantageous regions, and in order to deter a threat of secession by advantageous regions, their required contributions should not be excessive. We specifically determine a degree of partial equalization generated by secession-proofness and incentive compatibility. In particular, we show that in the case of uniform distribution of citizens' preferences, the equalization rate is exactly 50 percent.

12 Berkowitz (1998) theoretically shows that, setting aside the equalization issue, separatism can destabilize an economically viable fiscal federalism. Moreover, Bolton and Roland (1997) show that differences in income distribution across regions are enough to explain secession. Indeed, their model shows that a poorer region may prefer independence 'even if this involves both efficiency costs and possibly loses of fiscal transfers from richer regions' (Bolton and Roland, 1997, p. 1059).

13 'In a perfectly congruent federal system, the component units are *miniature reflections of the important aspects of the whole federal system*. Conversely, incongruent federations have units with social and cultural compositions that differ from one another and from the country as a whole' (Lijphart, 1999, p. 195).

14 'The effective number of parties appears to depend on the product of social heterogeneity and electoral permissiveness, rather than being an additive function of these two factors. The intuitive formulation of this finding is that a polity can tend toward bipartism either because it has a strong electoral system or because it has few cleavages. Multipartism arises as the joint product of many exploitable cleavages and a permissive electoral system' (Cox, 1997, p. 221).

15 For detailed analysis of equalization to discourage migration see, among others, the papers by Boadway and Flatters (1982), Usher (1995), Courchene (1998), Boadway (1998), and Wilson (2003).

16 Although voluntary transfers are theoretically optimal according to Myers (1990) and Burbidge and Myers (1994), these authors make very strong assumptions, which throws doubt on whether their results are applicable in practice in most federal states. Germany appears to be an exception, possibly because it complies better with the requirement of a homogeneous population.

17 Ladd and Yinger (1994) present theoretical and formal analyses of equalization by subsidy.
18 Debates on this question have been especially interesting in Canada and the US. See, among others, Usher (1995), Courchene (1998), and Boadway (1998), for the former, and Reeves (1986), Compson and Navratil (1997), and Tannenwald (1999) for the latter.
19 A problem with this position is that it may create incentives for undesirable actions by regional government. For example, to what extent is the dispersion of the population due to the planning policy of regional government?
20 Among others, this approach has been used in Spain by Bosch and Escribano (1988) and Castells and Solé (2000), in the United Kingdom by Bramley (1990), in the United States by Ladd (1994), and in Canada by Shah (1996).
21 And indeed the Australian equalization program also suffers from a number of shortcomings. See Shah (2005).
22 From the perspective of a rich region, the model by Desmet and Ortuño (2004) is able to give a rational answer to inter-regional redistribution by means of public employment, lump-sum grants or unemployment benefits, but it cannot explain its support to regional policy. In the first case, 'the leading region pays transfers to make sure it remains in the lead'. On the contrary, in the second case, 'it is unclear what the richer regions gain from such an arrangement' (Desmet and Ortuño, 2004, p. 21).

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7 Human capital externalities and regional development

Evidence for Canada – 2000

Varvara Rakova and
François Vaillancourt[1]

Introduction

The purpose of this chapter is to present evidence on the wage externality created by highly qualified workers for Canadian regions for 2000. This is of interest in the context of this book since human capital is argued to be a key factor in promoting regional development (Markusen, this volume). The presence of a wage externality allows one to measure how important to the productivity of others is the presence of such capital. The chapter is divided in three parts: the first briefly reviews existing empirical work and presents the analytical framework; the second presents the model and Canadian data and the third the econometric results.

Policy makers will find evidence in this chapter that the sum of the parts when connected through regional proximity can be higher than simply adding them up. An increase in the share of the labor force with higher educational qualifications increases the labor income of both the members of that group and of less qualified workers in the region. While evidence on this is provided for metropolitan cities in Canada for 2000, it is quite likely in our view that this will hold in other countries; we know from the literature review that this is the case for the USA. It may also hold for other types of networks such as virtual networks that can connect together semi–urban and rural labor pools; this is a research question that is probably becoming more salient as high speed Internet becomes more and more accessible.

Analytical framework and literature review

We begin with the literature review then turn to the analytical framework.

Literature review

We identified four studies that examine human capital externalities at the sub–national level, two at the US state level and two at the US city level. They are summarized in Table 7.1. Their main points are:

- All four studies use individual data with labor income as the independent variable, various individual characteristics such as sex, age or experience and individual levels of education as independent variables. They all use econometric methods more sophisticated than OLS.
- Results depend on the size of the area used for the study. The two studies (Acemoglu and Angrist, 2000 and Rudd, 2000) who use state level data find no or very little impact of an increase in human capital on labor income while the two (Moretti, 2004 and Rauch, 1993) who use metropolitan (CMA) data find a positive impact. For example, Moretti finds that a 1 percent increase in the share of college graduates produces a 1.08 percent to 1.31 percent increase in the labor productivity of all workers. This points to a role for externalities since the large size of American states makes it unlikely that externalities would be observed at that level.
- The measure of education is either average year of schooling or the share of higher educated workers. This does not distinguish between types of human capital. Yet one expects that human capital directly linked to the productivity of workers would have a larger impact on wages; hence an increase in the share of engineers is more likely to affect productivity than an increase in the share of anthropologists (or economists!). Similarly more specialized knowledge associated for example with graduate degrees should have a greater impact.

Analytical framework

A simple model that illustrates the connection between aggregate human capital level and wages for different education groups of workers is presented in Figure 7.1. There are two types of workers, with high (indexed by $_H$) and low education (indexed by $_L$), and these two types of workers are complements. Perfectly competitive job markets insure that workers' wages correspond to their marginal productivity value (MPV).

The initial equilibrium ($w_H^0\ L_H^0$ and $w_L^0\ L_L^0$) in a given region is given by the intersection of MPV curves (demand curve) with a supply curve of each type of labor (S). When the population becomes more educated in a city, the supply of educated workers shifts from S_H^0 to S_H^1 so that their number increases to L_H^1. By the complementarity assumption, the demand for low education workers increases then so that MPV_L^0 shifts to MPV_L^1 and the number of less educated workers rises to L_L^1. To reach a new equilibrium B in the absence of human capital externalities, high education workers wages should fall to w_H^1 and low education workers wages should rise to w_L^1. While the absolute number of both types of workers increases in such a scenario, the proportion of educated workers in the total number of workers in the region rises if the increase in the absolute number is stronger for the high education group than for the low education one.

However, if there are human capital externalities, the higher proportion of educated workers will raise the productivity of both kinds of workers (these increases are not necessarily of the same magnitude). This translates into the

Table 7.1 Summary review of the literature on human capital externalities at the microeconomic level

E. Moretti (2004)

Subject

Social returns to education and, in particular, spillover effects from a college education on different education groups.

Variables

Dependant variable: Log(hourly wage)

Individual control variables: Sex, race, experience, square experience, years of schooling

Metropolitan statistical area (MSA) level control variables: Unemployment rate, log(monthly rent), Katz and Murphy index.

MSA human capital measure: Share of workers with college degree

Data

1) Longitudinal individual data from 1979 to 1994 (panel structure) from United States

2) Cross–sectional data from the US 1980 and 1990 Censuses of Population also used for construction of a first–differentiated data.

The college share effect on wages was estimated for different education groups: less than high school, high school graduates, workers with some college, and workers with education superior to college.

Estimation method

1) Estimation with city interacted or not with individuals fixed effects with correction for a cluster structure of MSA level variables

2) Instrumental variables method (age structure used as instrument for first differentiated model and a presence of a land grant college used as an instrument for cross–sectional estimations)

Results

1% increase in a college share produces 1.08% to 1.31% increase in the labor productivity of all workers; from 0.58% to 2.22% increase in the labor productivity of less than high–school educational group; from 0.74% to 2.08% increase in the labor productivity of high–school educational group; from 0.63% to 1.66% increase in the labor productivity of educational group with some college; and from 0.45% to 0.86% increase in the labor productivity of educational group with college education or more.

The positive effect of a college share even on the most educated group provides evidence for human capital externalities at MSA level.

D.Acemoglu and J. Angrist (2000)

Subject

Estimation of human capital externalities

Variables

Dependent variable: Log(hourly wage)

Individual control variables: Age, individual years of education

State level human capital measure: Average education

Data

Individual panel data from 1960 to 1980 United States Censuses of Population (adding 1950 and 1990 Censuses data in some regressions)

Sample of white males aged between 40 and 49 years old with an additional estimation for white males aged from 30 to 39 years.

Estimation method

Estimation with fixed state effects and with instrumental variables method at the same time (quarter of birth is an instrument for a potential heterogeneous individual education variable and constructed dummies from Compulsory Attendance and Child Labour Laws are instruments for the state human capital)

continued …

Table 7.1 continued

Results
Human capital externality effect is found not always significant and when significant, ranging from 1 % to 3% increases in wages following one year increase in average state education.
OLS estimates provide much higher estimates of around 7% increase in wages.

J. Rudd (2000)
Subject
Human capital spillovers at state level
Variables
Independent variable: Log(hourly wage)
Individual control variables: Sex, race, marital status, experience, square experience, education (measured alternatively by years of schooling and by a set of dummies for different levels of education completed), industries dummies
State level control variables: Non–labor income per capita, unemployment rate, agglomeration index, education quality
State level human capital measure: Average education and educated workers share (with 16 years or more of education)
Data
Individual data for a period from 1978 to 1991, United States (panel type data)
Estimation method
Two–stage estimation:
1) Individual wage estimation with individual control variables and state dummies for each year.
2) Construction of panel data with a state–year panels where a dependent variable is a vector of coefficients of state dummies from first stage regression. Independent variables are state level control variables and state level human capital measure.
Results
Most of the results are insignificant, especially when individual returns to education from a first stage regression are allowed to vary by region and be non linear. In some cases, a year increase in average education produces an increase from 1.8% to 2.9% in wages of all workers; 1% increase in the share of workers with 16 years of education or more produces an increase in wages of workers with 12 years or less of education from 0.5% to 0.7%.

J. E. Rauch (1993)
Subject
Productivity gains from geographic concentration of human capital
Variables
Dependent variable: Log (hourly wage)
Individual control variables: Sex, race, marital status, their interaction terms, experience, square experience, profession dummies, years of education.
Standard Metropolitan Statistical Area (SMSA) level control variables: Population, climate, culture per capita.
SMSA level human capital measures: Average education and average experience.
Data
Cross–sectional individual data from 1980 United States Census of Population
Estimation method
GLS estimations with correction of standard errors for a cluster data structure of the SMSA level variables
Results
Significant external effects found: one year increase in average education produces from 2.8% to 5.1% increase in wages; one year increase in average experience produces from 0.2% to 0.7% increase in wages.

positive shifts of MPV curves from MPV_H^0 to MPV_H^1 and from MPV_L^1 to MPV_L^2. So wages of both groups of workers rise compared to the equilibrium without human capital externalities to attain a new equilibrium *C*. The final effect of the increase of the proportion of more educated labor on wages of the low education workers is an increase combining two separate positive effects: the demand effect implying a shift of MPV_L^0 to MPV_L^1, due to the complementarity between low and high education workers, implying an increase of wages from w_L^0 to w_L^1; and the externality effect working through the additional shift of the demand curve to MPV_L^2 because of their higher productivity when the proportion of high education workers rises, so that wages increase from w_L^1 to w_L^2. The final effect of the increase of the proportion of more educated labor on their own wages is ambiguous depending on the relative strength of two opposite sign effects: the supply effect implying a drop in wages from w_H^0 to w_H^1; and the externality effect implying a shift in the MVP curve and an increase in wages from w_H^1 to w_H^2. If the externality effect were strong enough, as it is shown in the Figure 7.1, then the overall effect of the increase in the proportion of educated workers in a given city on their own wages is positive, everything else equal.

From a policy perspective, the key issue to take away from this theoretical framework is that externalities or spillovers arising from an increase in the importance (share) of more qualified workers in a given region will not only increase their own productivity but can also increase the productivity of the less qualified workers. For example, an increase in the share of university graduates means that lower qualified workers can be better supervised, trained or coached and that this will increase their productivity. This in turn will lead to an increase in wages since this is how higher productivity is rewarded in the labor market.

This simple model[2] illustrates the basic problem associated with empirical attempts to assess human capital externalities. It shows that an observed effect can be a combination of two separate effects, one being a simple supply–demand

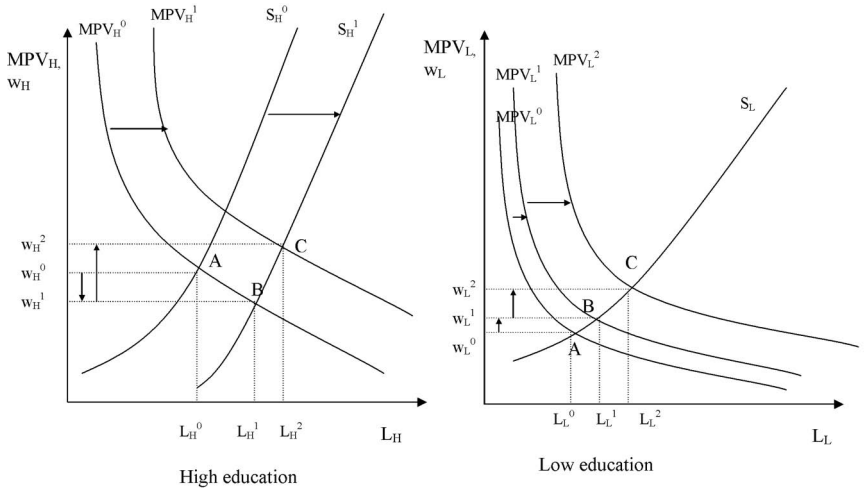

Figure 7.1 Demand and supply of two types of labor (high and low education)

effect and the other representing a human capital externality effect working through an increased labor productivity of workers.

Model and data

The model used in this chapter is a standard Mincerian earnings equation with a regional (Census Metropolitan Area[3]) human capital measure and a CMA R&D measure added. The equation below represents a general form of a model estimated in this study:

$$\text{Log}(\text{Earnings}_{ij}) = \beta_0 + \beta X_{ij} + \alpha \text{R\&D}_{jj} + \gamma Hj$$

where

i = individuals and j = CMA.

Earnings_{ij} is a sum of the wage income and of the self–employment income for an individual i in a CMA j.

X_{ij} is the vector of the following individual characteristics: number of weeks worked during the year, part time work, sex, marital status (and their interaction), visible minority or native status indicator, a combination of mother tongue and knowledge of official languages, experience and its square, schooling, occupation and industry.

$\text{R\&D}_j$ is the total amount of university R&D expenditures in a given CMA (× $1000) for 2000. It is introduced since a higher level of human capital in a given CMA might be associated with more university R&D that has a positive effect on labour productivity. Thus we want to guard against biasing our educational variables coefficients as a result of an omitted variable problem.

H_j is a measure of the availability at the CMA level of human capital. We use four alternative measures:

- average schooling and average experience, measured as the average number of years for all individuals of a given CMA;
- share of workers with university degree(s)/all workers; workers with university degree(s) are defined as workers with at least one of the following degrees: bachelor degree, other university degree, degree in medicine, master degree or doctorate;
- share of workers with a graduate degree(s)/all workers; workers with a graduate degree(s) are defined as workers with at least one of the following degrees: degree in medicine, masters degree or doctorate;
- share of scientists and engineers/all workers; scientists and engineers are defined as workers with university degree(s) – as defined above – in the following fields of study from the classification of the 2001 Census of Population (variable DGMFSP): agricultural, biological, nutritional and food sciences; engineering and applied sciences; data processing and computer technologies; electronic and electrical technologies; other engineering technologies; mathematics, computer and physical sciences.

All data used except for R&D spending are taken from the 2001 Canadian Census of Population micro data sample (2.7 percent of all respondents) providing data for earnings in 2000. The full sample consists of workers aged 15 years or more with non-zero earnings that were not full time students and that resided in 22 Canadian CMAs, six of which are regrouped in three pairs, yielding 19 areas that can be identified in the micro data used in the chapter.[4] The details on the construction of the variables are provided in Appendix Table 7A.1.

The equation is estimated for four sets of workers: first, workers from all industries, (1) without the educational characteristics used to calculate the aggregate human capital measure and (2) with the educational characteristics used to calculate the aggregate human capital measure; second, private sector workers[5] (1) without the educational characteristics used to calculate the aggregate human capital measure and (2) with the educational characteristics used to calculate the aggregate human capital measure. We distinguish between all workers and private sector workers for two reasons. First, the relationship between productivity and earnings may not be as strong in the public sector as in the private sector since the profit motive is absent in the former. Second, the public sector tends to have a higher ratio of workers with university diplomas than other economic sectors; hence, the major part of the variance in the metropolitan human capital measure might be explained by the concentration of public administration employment in some CMAs. We distinguish between workers with and without the educational characteristics used to calculate the aggregate human capital measure to estimate effects for respectively the L and H groups of workers of Figure 7.1. Only the regressions of aggregate human capital on these workers' own labor income allows us to assess the presence of the human capital externalities beyond the supply effect if the total observed effect is positive. This is not done for the regressions with the average education and the average experience that are estimated over the whole sample of workers in 19 CMAs.

Table 7.2 and Figure 7.2 allow the reader to become familiar with our sample. One notes:

- that CMAs vary substantially in size, with three above 1 million in population;
- that mean annual earnings of CMAs range roughly from $30,000 to $40,000 [6] in 2000;
- that the CMAs' share of university graduates in the population ranges from 18 percent to 32 percent, being the highest in Canada's capital;
- that there is a positive relationship between the three measures of CMA human capital and average earnings in CMAs shown in Figure 7.2.[7] The strongest correlation is observed when the aggregate CMA human capital is measured by the share of scientists and engineers ($R^2 = 0.26$), followed by the correlation with the share of workers with a university degree(s) with a R^2 of 0.11 and with a R^2 of 0.08 for the correlation when the human capital is measured by the share of workers with graduate degree(s).

Table 7.2 Selected characteristics, 19 Canadian CMAs 2001

CMA	*2001 population*	*Average labour income (2000 $)*	*University R&D expenditures (× $1000 of 2000)*	*Share of workers with university degree(s), all industries*	*Share of workers with university degree(s), private sector*	*Share of workers with graduate degree(s), all industries*	*Share of workers with graduate degree(s), private sector*	*Share of scientists and engineers, all industries*	*Share of scientists and engineers, private sector*
Halifax	359,183	32,003	81,165	26.0	20.2	7.0	3.3	7.5	6.1
Québec	682,757	32,929	197,019	22.7	15.1	5.8	2.5	6.6	4.7
Montréal	3,426,350	33,637	493,101	22.9	18.2	5.9	3.7	6.8	5.9
Sherbrooke – Trois–Rivières	291,318	30,355	53,655	18.0	10.0	4.8	1.8	4.8	3.0
Ottawa–Hull	1,063,664	40,728	144,289	31.6	23.9	9.8	6.0	10.4	9.9
Oshawa	296,298	38,579	0	14.9	9.8	2.7	1.3	4.0	3.6
Toronto	4,682,897	39,062	409,509	28.4	24.9	7.0	5.2	9.6	9.1
Hamilton	662,401	37,147	106,766	18.8	13.6	4.5	2.4	6.1	4.8
St–Catharine's – Niagara	377,009	32,388	4,342	14.0	8.5	3.2	1.2	3.5	2.5
Kitchener	414,284	35,570	0	18.6	13.6	4.9	2.5	6.1	5.5
London	432,451	34,868	108,795	19.5	12.6	5.3	2.1	5.5	3.7
Windsor	307,877	40,592	10,866	20.2	14.5	5.1	3.2	6.4	5.9

Sudbury – Thunder Bay	277,587	34,109	12,469	16.0	8.3	3.8	1.6	3.5	2.3
Winnipeg	671,274	31,451	78,906	19.8	13.0	4.2	1.8	5.6	4.2
Regina – Saskatoon	418,727	31,626	81,012	20.0	12.7	4.5	1.8	5.2	3.8
Calgary	951,395	37,924	124,442	24.3	20.5	5.6	3.7	8.8	8.3
Edmonton	937,845	33,817	186,580	18.3	11.9	4.4	1.9	5.9	4.5
Vancouver	1,986,965	35,034	191,465	25.0	20.4	6.1	3.9	8.0	7.3
Victoria	311,902	32,485	30,647	23.7	15.8	7.2	3.5	6.1	4.7
All 19 CMAs	18,552,184	35,964	2,315,028	23.9	18,9	6.0	3.8		6.8

Source: authors using the 2001 Canadian Census micro data and the CAUBO 2000–2001 Financial information of universities and colleges (URL: http://www.caubo.ca/pubs/pub_colleges_e.cfm (restricted access to the database)

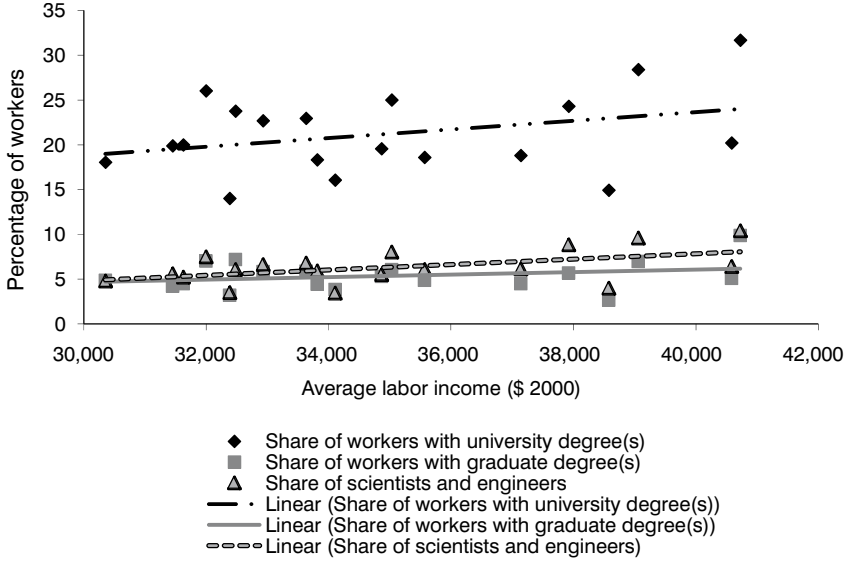

Figure 7.2 Relationship between human capital in 19 Canadian CMAs and average labor income (2000)

Econometric analysis

We report results for all workers in Table 7.3 and for the private sector in Table 7.4. Equations are estimated using OLS with a correction for the bias in the standard errors caused by the clustered nature of the CMA aggregate human capital variable and for heteroscedasticity.[8]

We first discuss the impact of R&D and the measures of aggregate human capital then turn to the control variables.

University R&D expenditures: as noted by Rauch (1993), the higher level of human capital in a given CMA might be associated with a higher concentration of university R&D that potentially has a positive effect on labor productivity. In our case, for CMAs with universities, a choice that increases the correlation coefficients, the maximum correlation is less than 0.6. While this variable is not statistically significant except once, it has a positive sign in almost all specifications. Rauch (1993) also found a positive, but statistically insignificant effect of this variable. Since it could be correlated with our aggregate human capital variables and since both results of columns 0 and 1 of Table 7.3 and unreported results show that its inclusion reduces the t–statistics and coefficients of the aggregate human capital variables, we include it in all estimations. Note here that the potential impact of the CMAs' size measured by their population was also explored. However, there is a strong correlation (0.9) between R&D and population so that both cannot be included in the same estimation. Rauch (1993) did not find a significant impact for population, even when correcting for its potential endogeneity (the population of CMAs may not be an exogenous variable here since higher earnings (potential) may attract individuals to a CMA increasing its population).

Table 7.3 Regressions with alternative measures of aggregate human capital for the labour income of workers that are not included and that are included in the human capital measures. All industries, individuals in 19 Canadian CMAs (2000)

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*0*	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
INDIVIDUAL INDEPENDENT VARIABLES								
Intercept	4.13	4.56	6.29	6.16	6.27	7.08	6.18	6.64
	(3.60)	(5.00)	(49.60)	(33.37)	(56.99)	(40.64)	(49.62)	(46.38)
PERSONAL CARACTERISTICS:								
Number of weeks worked	0.027	0.027	0.026	0.030	0.027	0.027	0.026	0.030
	(57.83)	(58.32)	(59.59)	(28.44)	(62.16)	(15.50)	(62.95)	(19.80)
Part time work (= 1 if worked mostly at part time)	–0.73	–0.723	–0.71	–0.76	–0.72	–0.83	–0.72	–0.71
	(–48.60)	(–50.79)	(–49.53)	(–36.04)	(–50.15)	(–28.62)	(–51.86)	(–46.77)
Sex (= 1 if Female)	–0.13	–0.13	–0.16	–0.06	–0.13	–0.08	–0.13	–0.09
	(–11.89)	(–11.94)	(–11.82)	(–6.59)	(–11.72)	(–3.10)	(–10.87)	(–2.86)
Visible Minority (= 1 if has visible minority status or native)	–0.20	–0.20	–0.20	–0.14	–0.20	–0.12	–0.21	–0.100954
	(–10.84)	(–10.59)	(–9.98)	(–9.52)	(–9.94)	(–5.09)	(–10.67)	(–5.37)
Marital Status (= 1 if married)	0.19	0.19	0.20	0.182	0.20	0.16	0.20	0.12
	(16.07)	(16.45)	(15.82)	(14.29)	(15.89)	(8.17)	(19.70)	(5.11)
Sex * Married	–0.17	–0.17	–0.17	–0.16	–0.17	–0.14	–0.18	–0.12
	(–12.20)	(–12.20)	(–10.81)	(–8.71)	(–11.63)	(–5.10)	(–14.63)	(–2.74)
English bilinguala (= 1 if English is the mother tongue and is bilingual)	–0.01 *	–0.02 *	–0.03 *	–0.01 *	–0.03*	–0.003 *	–0.02 *	–0.001*
	(–0.44)	(–0.76)	(–1.37)	(–1.03)	(–0.96)	(–0.17)	(–0.85)	(–0.04)

continued …

Table 7.3 continued

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*0*	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
French unilingual (= 1 if French is the mother tongue and speaks only French)	–0.18	–0.20	–0.19	–0.20	–0.21	–0.30	–0.18	–0.16
	(–4.29)	(–5.44)	(–6.19)	(–8.67)	(–6.98)	(–7.88)	(–5.63)	(–2.76)
French bilingual (= 1 if French is the mother tongue and is bilingual)	–0.05	–0.07	–0.09	–0.04	–0.09	–0.03 *	–0.07	0.01 *
	(–2.39)	(–3.85)	(–6.81)	(–1.80)	(–4.79)	(–0.87)	(–3.95)	(0.29)
Allophone English (= 1 if mother tongue other than English and French and speaks English)	–0.07	–0.07	–0.04	–0.15	–0.06	–0.21	–0.05	–0.23
	(–5.50)	(–5.75)	(–5.16)	(–6.88)	(–4.91)	(–7.52)	(–5.06)	(–8.07)
Allophone French (= 1 if mother tongue other than English and French and speaks French)	–0.36	–0.38	–0.38	–0.51	–0.40	–0.88	–0.36	–0.59
	(–14.99)	(–16.12)	(–12.76)	(–11.02)	(–19.68)	(–18.03)	(–10.16)	(–4.68)
Allophone bilingual (= 1 if mother tongue other than English and French and speaks both)	–0.11	–0.12	–0.18	–0.07	–0.16	–0.04 *	–0.14	–0.07
	(–4.43)	(–5.33)	(–13.92)	(–2.58)	(–6.06)	(–1.31)	(–7.36)	(–2.09)
Allophone (= 1 if mother tongue other than English and French and doesn't speak any of these languages)	–0.20	–0.20	–0.20	–0.39	–0.19	–0.44	–0.18	–0.81
	(–6.73)	(–6.73)	(–7.59)	(–3.55)	(–6.28)	(–2.25)	(–6.35)	(–4.14)
English–French (= 1 if English and French are both mother tongues)	–0.13	–0.15	–0.14	–0.20	–0.15	–0.16	–0.13	–0.28 *
	(–3.90)	(–4.64)	(–3.62)	(–3.03)	(–4.67)	(–1.78)	(–4.25)	(–1.33)
Immigration Status (= 1 if has a status of permanent resident or non permanent resident)	–0.05	–0.05	–0.03	–0.11	–0.04	–0.09	–0.05	–0.10
	(–4.62)	(–5.64)	(–2.76)	(–7.93)	(–5.10)	(–4.07)	(–4.74)	(–5.06)
Experience	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05
	(19.28)	(19.39)	(18.35)	(29.80)	(19.38)	(11.57)	(20.46)	(7.73)
Experience squared	–0.0007	–0.0007	–0.0007	–0.0009	–0.0007	–0.0009	–0.0007	–0.0008
	(–15.78)	(–15.88)	(–15.13)	(–23.85)	(–15.84)	(–11.48)	(–16.94)	(–6.82)
INDUSTRY DUMMIES b:								

Primary Industries Other Than Farming	2.40	2.41	2.29	2.81	2.41	2.36	2.40	2.17
	(20.88)	(20.59)	(20.73)	(18.18)	(20.44)	(13.79)	(20.81)	(11.19)
Manufacturing	2.12	2.11	2.01	2.54	2.11	2.10	2.12	1.93
	(18.35)	(18.44)	(18.77)	(19.65)	(18.10)	(15.61)	(18.62)	(11.32)
Construction	2.09	2.09	1.99	2.33	2.09	1.88	2.10	1.74
	(16.17)	(16.19)	(16.30)	(18.69)	(16.06)	(10.32)	(16.47)	(8.77)
Transportation/Storage	2.12	2.11	2.01	2.45	2.11	2.09	2.13	1.77
	(17.55)	(17.55)	(17.53)	(18.59)	(17.29)	(14.26)	(17.83)	(8.25)
Communications	2.22	2.22	2.10	2.61	2.21	2.22	2.22	2.02
	(18.19)	(18.21)	(18.38)	(19.49)	(18.00)	(14.73)	(18.43)	(11.41)
Wholesale and Retail Trade	1.96	1.96	1.86	2.33	1.96	1.87	1.97	1.76
	(15.99)	(16.02)	(16.61)	(15.78)	(15.96)	(10.89)	(16.36)	(9.33)
Finance/Insurance/Real estate	2.19	2.18	2.08	2.56	2.18	2.15	2.20	1.90
	(17.69)	(17.74)	(19.04)	(17.48)	(17.76)	(13.28)	(18.38)	(9.31)
Business Management Services	2.06	2.06	1.93	2.47	2.05	1.99	2.06	1.85
	(16.37)	(16.41)	(16.23)	(18.62)	(16.21)	(13.95)	(16.61)	(10.05)
Federal Administration Services	2.17	2.18	2.14	2.46	2.21	1.97	2.21	1.78
	(20.45)	(20.08)	(20.53)	(20.72)	(19.96)	(14.83)	(20.46)	(10.58)
Other Government Services	2.19	2.19	2.11	2.48	2.19	2.01	2.21	1.80
	(17.71)	(17.68)	(18.04)	(18.74)	(17.42)	(13.93)	(18.02)	(9.67)
Education & Related Services	2.003	2.002	1.86	2.38	1.99	1.95	2.02	1.70
	(17.80)	(17.84)	(17.31)	(19.39)	(17.25)	(14.23)	(18.20)	(9.90)
Accommodation/ Food Services	1.78	1.78	1.70	2.02	1.78	1.56	1.80	1.33
	(14.86)	(14.87)	(15.16)	(15.42)	(14.82)	(8.45)	(15.10)	(8.18)
Health and Welfare Services	2.02	2.02	1.90	2.40	2.01	2.01	2.02	1.82
	(17.28)	(17.29)	(17.48)	(18.76)	(17.17)	(14.16)	(17.61)	(9.98)
Other Services	1.81	1.80	1.72	2.12	1.81	1.59	1.82	1.50
	(14.14)	(14.18)	(14.65)	(14.59)	(14.14)	(10.16)	(14.58)	(8.53)

continued …

Table 7.3 continued

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*0*	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
OCCUPATIONAL CATEGORY DUMMIES								
Professional or technical staff	0.01 *	0.01 *	0.05	–0.08	0.02 *	–0.09	0.002 *	–0.01 *
	(0.51)	(0.55)	(2.25)	(–6.42)	(1.05)	(–8.47)	(0.11)	(–0.49)
Supervisor	0.07	0.07	0.13	–0.09	0.09	–0.15*	0.08	0.02*
	(1.66)	(1.68)	(3.17)	(–1.71)	(1.99)	(–1.38)	(1.75)	(0.41)
Administration and Office staff	–0.17	–0.17	–0.09	–0.38	–0.16	–0.46	–0.17	–0.36
	(–6.38)	(–6.40)	(–3.82)	(–16.96)	(–5.83)	(–13.55)	(–6.05)	(–9.52)
Sale and Services staff	–0.26	–0.25	–0.20	–0.36	–0.24	–0.62	–0.25	–0.42
	(–9.53)	(–9.69)	(–8.40)	(–11.44)	(–9.49)	(–11.19)	(–9.88)	(–9.69)
Manual or Artisan workers	–0.20	–0.20	–0.14	–0.55	–0.19	–0.68	–0.19	–0.54
	(–5.88)	(–5.92)	(–4.52)	(–15.59)	(–5.63)	(–10.95)	(–5.54)	(–9.77)
INDIVIDUAL SCHOOLING DUMMIES								
Less then high–school	–0.11	–0.11	–0.13	———	–0.12	———	–0.12	———
	(–17.89)	(–18.11)	(–20.29)		(–19.82)		(–19.94)	
Trades certificate/diploma	0.05	0.05	0.05	———	0.05	———	0.05	———
	(7.01)	(7.86)	(7.27)		(7.79)		(8.21)	
College (cegep) certificate/diploma	0.12	0.12	0.14	———	0.13	———	0.13	———
	(11.92)	(12.11)	(13.55)		(12.48)		(13.15)	
University < bachelor level	0.15	0.14	0.16	———	0.15	———	0.15	———
	(6.88)	(6.83)	(6.84)		(6.85)		(7.02)	

Bachelor degree(s)	0.30	0.30	———	–0.17	0.30	———	0.28	0.06
	(14.54)	(14.37)		(–5.26)	(14.74)		(17.17)	(1.80)
University > Bachelor level	0.32	0.32	———	–0.15	0.33	———	0.34	Omitted
	(22.68)	(22.49)		(–3.38)	(25.53)		(34.81)	Category
Medicine/Dentist/Vet/Optometry	0.84	0.83	———	0.40	———	Omitted	0.26	0.54
	(14.40)	(14.21)		(13.80)		Category	(2.58)	(8.63)
Master degree(s)	0.36	0.36	———	–0.10	———	–0.45	0.36	0.12
	(13.41)	(13.41)		(–3.45)		(–10.92)	(19.17)	(3.50)
Earned Doctorate	0.43	0.43	———	Omitted	———	–0.38	0.43	0.18
	(8.53)	(8.82)		Category		(–13.71)	(11.47)	(2.91)
CMA HUMAN CAPITAL MEASURE:								
Average Education	0.14	0.12	———	———	———	———	———	———
	(2.60)	(2.83)						
Average Experience	0.008 *	0.009 *	———	———	———	———		
	(0.34)	(0.04)						
Share of workers with university degree	———	———	0.005 *	0.009	———	———	———	———
			(1.51)	(3.09)				
Share of workers with graduate degree	———	———	———	———	0.01 *	0.02	———	———
					(1.24)	(3.85)		
Share of scientists and engineers	———	———	———	———	———	———	0.02	0.02
							(2.36)	(4.61)
CMA LEVEL CONTROL VARIABLE								
University R&D expenditures per worker	———	1.18×10^{-7}	7.64×10^{-8}*	6.27×10^{-8}*	1.37×10^{-7}*	1.28×10^{-9}*	5.59×10^{-8}*	-8.22×10^{-8}*
		(1.67)	(0.72)	(0.76)	(1.35)	(0.02)	(0.59)	(–1.40)
N	249,207	249,207	189,551	59,656	234,226	14,981	230,340	18,867
R^2	0.40	0.40	0.37	0.42	0.39	0.38	0.39	0.40

Source: authors' estimations using the 2001 Census of Population micro data and CAUBO 2000–2001 Financial information of universities and colleges (URL :http://www.caubo.ca/pubs/pub_colleges_f.cfm (restricted access to the database)))and STATA program

Note: T–statistics in the brackets. An * indicates coefficients that are Not significant at the 5% level (bilateral i.e. less than 1.65). English unilingual (= 1 if English is mother tongue and speaks only English) is the omitted category. Farning is the omitted category for industries. Senior, middle and other managers is the omitted category for occupation. High school diploma is the omitted category in equations 0,1,2,3,and 4

Table 7.4 Regressions with alternative measures of aggregate human capital for the labour income of workers that are not included are included in the human capital measures, private sector, individuals in 19 Canadian CMAs (2000)

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
INDIVIDUAL INDEPENDENT VARIABLES :							
Intercept	4.98	7.96	8.13	7.98	8.64	7.97	8.30
	(4.91)	(201.93)	(75.40)	(209.38)	(66.70)	(228.00)	(84.77)
PERSONAL CHARACTERISTICS:							
Number of weeks worked	0.03	0.03	0.03	0.03	0.03	0.03	0.04
	(101.21)	(67.30)	(56.80)	(90.12)	(18.81)	(78.21)	(32.85)
Part time work (= 1 if worked mostly at part time)	–0.73	–0.71	–0.78	–0.72	–0.84	–0.72	–0.81
	(–48.65)	(–48.58)	(–32.38)	(–49.81)	(–15.70)	(–51.58)	(–15.23)
Sex (= 1 if Female)	–0.14	–0.16	–0.07	–0.14	–0.06 *	–0.14	–0.10
	(–11.32)	(–12.17)	(–7.31)	(–11.78)	(–1.04)	(–10.57)	(–3.20)
Visible Minority (= 1 if has visible minority status or native)	–0.19	–0.19	–0.14	–0.19	–0.12	–0.20	–0.09
	(–11.89)	(–10.34)	(–10.39)	(–10.44)	(–4.36)	(–10.78)	(–6.10)
Marital Status (= 1 if married)	0.18	0.18	0.20	0.18	0.20	0.19	0.11
	(17.33)	(15.64)	(11.25)	(16.28)	(7.95)	(19.75)	(4.29)
Sex * Married	–0.14	–0.14	–0.17	–0.15	–0.15	–0.15	–0.07 *
	(–13.19)	(–12.86)	(–7.22)	(–12.33)	(–2.22)	(–15.81)	(–1.41)
English bilingual (= 1 if English is the mother tongue and is bilingual)	–0.01*	–0.02 *	–0.02*	–0.021*	–0.02 *	–0.01*	–0.03
	(–0.26)	(–1.05)	(–0.80)	(–0.77)	(–1.01)	(–0.45)	(–2.24)

French unilingual (= 1 if French is the mother tongue and speaks only French)	–0.19 (–4.65)	–0.18 (–5.16)	–0.28 (–10.00)	–0.20 (–6.34)	–0.32 (–4.84)	–0.18 (–5.54)	–0.27 (–2.72)
French bilingual (= 1 if French is the mother tongue and is bilingual)	–0.06 (–2.42)	–0.07 (–4.55)	–0.04 * (–1.40)	–0.08 (–4.57)	–0.06* (–1.23)	–0.07 (–3.30)	0.01 * (0.21)
Allophone English (= 1 if mother tongue other than English and French and speaks English)	–0.07 (–5.26)	–0.05 (–5.28)	–0.16 (–5.60)	–0.06 (–5.08)	–0.21 (–6.04)	–0.06 (–4.90)	–0.22 (–5.97)
Allophone French (= 1 if mother tongue other than English and French and speaks French)	–0.35 (–13.67)	–0.36 (–10.63)	–0.48 (–7.52)	–0.38 (–13.90)	–0.66 (–6.79)	–0.35 (–9.63)	–0.57 (–4.06)
Allophone bilingual (= 1 if mother tongue other than English and French and speaks both)	–0.13 (–6.31)	–0.17 (–11.87)	–0.09 (–4.10)	–0.16 (–9.33)	–0.06 (–1.75)	–0.16 (–9.76)	–0.07 (–2.84)
Allophone (= 1 if mother tongue other than English and French and doesn't speaks any of these languages)	–0.23 (–12.34)	–0.23 (–12.46)	–0.35 (–3.08)	–0.23 (–11.70)	–0.39 (–1.73)	–0.22 (–11.67)	–0.61 (–3.58)
English–French (= 1 if English and French are both mother tongues)	–0.14 (–4.15)	–0.15 (–4.04)	–0.13 (–3.14)	–0.16 (–4.38)	–0.02* (–0.15)	–0.14 (–3.95)	–0.25 * (–1.17)
Immigration Status (= 1 if has a status of permanent resident or non permanent resident)	–0.06 (–8.37)	–0.04 (–3.99)	–0.13 (–14.00)	–0.05 (–6.86)	–0.14 (–5.83)	–0.05 (–6.79)	–0.11 (–3.18)
Experience	0.04 (22.47)	0.04 (19.89)	0.05 (24.13)	0.04 (22.82)	0.04 (12.24)	0.04 (22.45)	0.04 (6.41)
Experience squared	–0.001 (–17.99)	–0.001 (–15.96)	–0.001 (–25.41)	–0.001 (–18.13)	–0.001 (–13.12)	–0.001 (–18.21)	–0.001 (–5.80)
INDUSTRY DUMMIES							
Primary Industries Other Than Agriculture	0.65 (15.11)	0.64 (12.19)	0.67 (7.27)	0.67 (14.40)	0.42 (3.53)	0.64 (12.43)	0.73 (8.78)
Manufacturing	0.35 (11.98)	0.34 (11.03)	0.42 (7.79)	0.36 (10.44)	0.17 * (1.24)	0.34 (10.98)	0.50 (8.02)
Construction	0.34 (10.06)	0.34 (10.07)	0.22 (2.93)	0.36 (9.02)	–0.03 * (–0.19)	0.34 (10.01)	0.30 (3.88)
Transportation/Storage	0.34 (17.19)	0.35 (15.86)	0.33 (4.45)	0.36 (15.90)	0.17 * (1.05)	0.35 (18.17)	0.35 (3.24)
Communications	0.43 (19.85)	0.42 (18.82)	0.47 (7.83)	0.45 (16.65)	0.27 (1.80)	0.43 (19.43)	0.58 (8.93)

continued …

Table 7.4 continued

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
Wholesale and Retail Trade	0.17	0.17	0.20	0.19	–0.08 *	0.17	0.32
	(6.87)	(7.17)	(3.71)	(6.23)	(–0.68)	(6.74)	(5.85)
Finance/Insurance/Real Estate	0.38	0.38	0.42	0.40	0.18	0.39	0.46
	(12.94)	(13.83)	(7.49)	(11.74)	(1.34)	(13.11)	(6.52)
Business Management Services	0.28	0.25	0.34	0.29	0.06*	0.27	0.41
	(9.10)	(7.39)	(6.30)	(7.98)	(0.50)	(8.11)	(6.54)
Accommodation/ Food Services	–0.01 *	0.01 *	–0.09	0.02 *	–0.36	0.004 *	–0.11 *
	(–0.32)	(0.67)	(–1.87)	(0.72)	(–2.81)	(0.19)	(–1.25)
Other Services	0.03 *	0.04 *	0.01 *	0.05 *	–0.31	0.03 *	0.08 *
	(0.99)	(1.56)	(0.15)	(1.55)	(–2.65)	(1.22)	(1.09)
OCCUPATIONAL CATEGORY DUMMIES:							
Professional or technical staff	–0.08	–0.07	–0.11	–0.07	–0.19	–0.09	–0.10
	(–9.00)	(–10.52)	(–8.23)	(–7.97)	(–9.05)	(–11.89)	(–6.50)
Supervisor	–0.20	–0.17	–0.30	–0.19	–0.38	–0.20	–0.25
	(–14.03)	(–12.50)	(–12.57)	(–14.27)	(–4.90)	(–13.99)	(–4.93)
Administration and Office staff	–0.28	–0.23	–0.42	–0.27	–0.52	–0.27	–0.48
	(–19.42)	(–28.81)	(–19.89)	(–20.44)	(–15.74)	(–19.92)	(–10.39)
Sale and Services staff	–0.36	–0.33	–0.40	–0.35	–0.61	–0.35	–0.45
	(–21.89)	(–24.48)	(–17.36)	(–22.15)	(–13.51)	(–23.49)	(–11.86)

Manual or Artisan Workers	–0.34	–0.30	–0.61	–0.32	–0.76	–0.32	–0.62
	(–18.42)	(–19.98)	(–20.11)	(–18.49)	(–9.59)	(–18.88)	(–10.17)
INDIVIDUAL SCHOOLING DUMMIES:							
Less then high–school	–0.11	–0.1	———	–0.1	———	–0.1	———
	(–17.73)	(–20.25)		(–19.71)		(–20.28)	
Trades certificate/diploma	0.05	0.05	———	0.05	———	0.05	———
	(8.63)	(8.03)		(8.72)		(9.10)	
College (cegep) certificate/diploma	0.09	0.10	———	0.10	———	0.10	———
	(8.17)	(8.59)		(8.30)		(8.41)	
University < bachelor level	0.11	0.12	———	0.11	———	0.11	———
	(4.20)	(4.12)		(4.20)		(4.21)	
Bachelor degree(s)	0.267	———	–0.06	0.28	———	0.26	–0.16
	(12.21)		(–1.67)	(12.40)		(14.54)	(–2.65)
University > bachelor level	0.27	———	–0.04 *	0.27	———	0.31	–0.22
	(12.31)		(–0.98)	(12.35)		(25.17)	(–2.72)
Medicine/Dentist/Vet/Optometry	0.31	———	0.03*	———	Omitted	0.073*	Omitted
	(6.95)		(0.69)		category	(0.54)	Category
Master degree(s)	0.33	———	0.003 *	———	0.01 *	0.32	–0.11
	(8.12)		(0.11)		(0.11)	(9.49)	(–1.74)
Earned Doctorate	0.28	———	Omitted	———	0.01 *	0.21	–0.14
	(5.47)		Category		(0.12)	(3.83)	(–1.97)
CMA HUMAN CAPITAL MEASURE:							
Average Education	0.17	———	———	———	———	———	———
	(4.00)						
Average Experience	0.03 *	———	———	———	———	———	———
	(1.39)						
Share of workers with university degree	———	0.01	0.01	———	———	———	———
		(1.94)	(4.26)				

continued …

Table 7.4 continued

Dependent variable	*Log (annual labour income) of all workers*	*Log (annual labour income) of workers with less than university degree*	*Log (annual labour income) of workers with university degrees*	*Log (annual labour income) of workers with less than graduate degrees*	*Log (annual labour income) of workers with graduate degrees*	*Log (annual labour income) of workers other than scientists and engineers*	*Log (annual labour income) of scientists and engineers*
Specification	*1*	*2*	*2a*	*3*	*3a*	*4*	*4a*
Share of workers with graduate degree	———	———	———	0.03 (1.99)	0.07 (6.26)	———	———
Share of scientists and engineers	———	———	———	———	———	0.02 (2.43)	0.03 (5.78)
CMA LEVEL CONTROL VARIABLE:							
University R&D expenditures	5.88×10^{-8}* (0.86)	3.36×10^{-8}* (0.28)	1.48×10^{-8}* (0.15)	5.78×10^{-8}* (0.48)	-1.28×10^{-7}* (–1.63)	7.35×10^{-8}* (0.70)	-7.14×10^{-8}* (–0.90)
N	188,153	152,487	35,666	181,104	7,049	175,444	12,709
R^2	0.43	0.41	0.44	0.43	0.41	0.42	0.44

Source: authors' estimations using the 2001 Census of Population micro data and CAUBO 2000-2001 financial information of universities and colleges (URL :http://www.caubo.ca/pubs/pub_colleges_f.cfm (restricted access to the database)) and STATA program

Note: T-statistics in the brackets. An * indicates coefficients that are not significant at the 5% level (bilateral ie less than 1.65). English unilingual (= 1 if English is mother tongue and speaks only English) is an omitted category. Farming is an omitted category. Senior, middle and other managers is an omitted category. High school diploma is an omitted category.

Aggregate human capital variables: the results depend on the definition of the aggregate human capital and the sample considered.

The *average education* (significant) and *average experience* (insignificant) indicate that an increase of average education by a year would increase individual labor productivity by 12 percent (all sectors) to 19 percent (private sector) for all workers. However, it is important to keep in mind that this increase does not necessarily represent a human capital externality, but could result from its combination with a supply effect that is negative for educated workers but positive for uneducated ones.

The *share of workers with university degree(s)* is significant in all specifications at 10 percent or more for 'non university degree workers' and at more than 1 percent for 'workers with university degree(s)'. The values of this variable coefficients indicate that an increase of 1 percent of this share increases the labor productivity of non university degree workers by approximately 0.6 percent and their own earnings by 1 percent. The fact that the effect of the share of workers with university degree(s*)* on their own earnings is positive indicates that the externality effect is positive and higher in absolute value than the negative supply effect.

The share of workers with *graduate degrees* has no impact on the earnings of 'workers without graduate degrees' in all sectors but a positive impact in the private sector. The effect of this aggregate human capital variable is stronger and more significant for workers with graduate degrees with earnings increasing for all workers by 2 percent and for private sector workers by 7 percent. Thus there is a strong externality effect in the private sector.

An increase of 1 percent in the share of the *scientists and engineers* in a CMA increases the earnings of 'non scientist and engineer workers' and their own earnings by approximately 2 percent to 3 percent.

One interesting finding from comparing the results for the three share measures is that the absolute value of the impact of an increase in the share of highly qualified workers on the wages of other workers is substantially larger when one limits oneself to either holders of graduate degrees or scientist and engineers. Yet these groups occupy a much smaller share of the labor force[9] than all university degrees holders; thus the displacement impact on the earnings of non qualified workers should be smaller and the regression coefficients smaller. This supports the hypothesis that it is an increase in the ratio of more qualified workers with less qualified ones that explains the increase in the productivity of the less qualified workers; this highlights the presence of human capital externalities.

Turning to the control variables, we find that:

- Weeks worked: an additional week of work in a year increases earnings, with a stronger impact for the private sector.
- Part time work (hours): it reduces earnings.
- Sex (female): women have earnings lower than men by about 6 percent to 15 percent.
- Visible minority (including native people): members of that group have lower earnings than similar workers not belonging to visible minority.

- Marital status: married workers have higher earnings than unmarried ones by about 10 percent to 20 percent. However, when the marital status variable is interacted with the sex variable, the coefficient becomes negative, showing that for women the fact of being married affects negatively their earnings.
- Mother tongue and knowledge of official languages: the possibilities are: mother tongue English–unilingual; mother tongue English–bilingual; mother tongue French–unilingual; mother tongue French–bilingual; mother tongue other than English or French–allophone–English; allophone–French; allophone–bilingual; allophone–no official languages spoken and English and French mother tongues. The omitted category is English–unilingual. The main result is that earnings of unilingual Anglophones are higher than or at least equal to those of individuals with any other combination of language skills. One also finds that knowledge of English is overall a valuable skill. This is not surprising insofar as English is the dominant language of Canada's labor market, used by about 80 percent of its workers.
- Immigration status: non Canadians by birth have lower earnings than Canadians by birth.
- Experience: (measured as worker's age minus her/his years of education minus six) and its square are both strongly significant, the first being positive and the second being negative, showing the classic inverted U pattern.
- Industry: (omitted category: farming), workers in industries other than farming have higher earnings.
- Occupation: (omitted category: Senior, middle and other managers). For all workers, the omitted group has the highest earning while for private workers, one finds less hierarchical results.
- Education (omitted category varies by equation). Earnings increase with the level of education in all equations. For example, a bachelor degree increases earnings by around 35 percent compared to high–school graduates for all workers and high earnings are associated with degrees in medicine.

One issue addressed by previous studies is the potential endogeneity of the aggregate human capital variable. Higher human capital level would not cause higher productivity, earnings and thus income; instead, higher income individuals would acquire more education (a normal good). This in our opinion is unlikely since education is acquired mainly for investment purpose and not for consumption. Furthermore, two of our measures of human capital, the share of workers with graduate degrees and the share of scientists and engineers, are less likely to suffer from such endogeneity given their more demanding and specialized requirements; they show a greater externality than the share of workers with university degree(s).

In summary, individual variables are largely statistically significant with the expected signs, the R^2 are reasonable for cross–sectional data, ranging from 0.37 to 0.42 and the coefficients of the aggregate human capital variables support the hypothesis that there are labor market externalities.

Conclusion

This chapter innovates by both calculating results for Canada and using four alternative measures of human capital: average education and average experience combined, share of workers with university degrees, share of workers with graduate degree and share of scientists and engineers. The estimation of the impact of aggregate human capital on individual labor productivity at the level of CMAs for all sectors and the private sector produces consistent results that point to the existence of human capital externalities at the CMA level in Canada in 2000. Results not reported here show similar results for 1990 (Rakova, 2005). These results, in conjunction with those already existant for the USA, should lead regional policy makers to put forward policies that take into account these externalities. Thus, when improving the quality of the labor force of a region, one should aim for an across the board improvement rather than just one in selected groups since spillovers will be present. That said, one must note the importance of the effect associated with the share of graduate degree holders both for other workers and for themselves. It no longer suffices for a region to have a university educated labor force; one needs a well–educated university labor force with advanced degrees and thus specialized training to compete. Put differently, regional governments should invest in generating, attracting and preserving high levels of human capital in the same way that they invest in generating, attracting and preserving physical infrastructure and private investment.

Notes

1 Paper prepared for this volume, drawing on the MSc essay of the first author supervised by the second author. This paper does not represent the views of Finance Canada.
2 For a richer general equilibrium model that explains the locational choice of individuals and the reasons behind the different levels of human capital level in two different metropolitan areas, but reaches the same conclusions as in Figure 7.1, see Moretti (2004), pp. 180–4.
3 A Statistics Canada CMA is defined as follows: census metropolitan area (CMA) is formed by one or more adjacent municipalities centred on a large urban area (known as the urban core). The census population count of the urban core is at least 100,000 to form a census metropolitan area. To be included in the CMA, other adjacent municipalities must have a high degree of integration with the central urban area, as measured by commuting flows derived from census place of work data (see http://www12.statcan.ca/english/census01/products/reference/dict/geo009.htm).
4 There are in 2001 27 CMAs in Canada; those not included are St John's, St John, Chicoutimi-Jonquière, Kingston, and Abotsford. We chose to include pairs of similar CMAs (same province, similar size and economic activity) since estimations made without them yielded results similar to those with them and their presence increases the number of observations.
5 Workers in federal administration services, other government services, education & related services and health and welfare services are excluded.
6 Canadian dollar: the exchange rate in mid-2000 was 0.68, thus US$20,400 and US$27,200 respectively.
7 Estimated as follows: Earnings= B_0(Constant)+B_1(Human capital measure) so the R^2 is the regression R^2.
8 Rauch (1993) points out this issue. We use the *cluster* command of Stata 8.

9 The shares for all 19 CMAs reported in Table 7.2 are: 23.9% (18.9%) for all (private) workers with university degree(s), 6.0% (3.8%) for those with graduate degree(s) and 7.6% (6.8%) for scientists and engineers.

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Appendix

Table 7.A1 Variables definitions and construction

Variables	*Codes from census*
Labour income	= WAGESP (wages) + SELFIP (self employment income)
Number of weeks worked	= WKSWKP variable of the Census microdata
Part time work (= 1 if worked mostly at part time)	= 1 if FPTWKP (Full time or part time weeks worked) = 2
Sex (= 1 if Female)	= 1 if SEXP = = 1
Visible Minority (= 1 if has visible minority status or native)	1 if VISMINP (Visible minority indicator)= 1 or 2 or 3 or 4 & if ABSRP (aboriginal identity) = 2 or 3 or 4 or 5 or
Marital Status (= 1 if married)	= 1 if MARSTLP (legal marital status) = 2
English unilingual (= 1 if English is the mother tongue and speaks only English)	= 1 if MTNP (mother tongue) = 1 & if OLNP (official languages spoken) = 1
English bilingual (= 1 if English is the mother tongue and is bilingual)	= 1 if MTNP (mother tongue) = 1 & if OLNP (official languages spoken) = 3
French unilingual (= 1 if French is the mother tongue and speaks only French)	= 1 if MTNP (mother tongue) = 2 & if OLNP (official languages spoken) = 2
French bilingual (= 1 if French is the mother tongue and is bilingual)	= 1 if MTNP (mother tongue) = 2 & if OLNP (official languages spoken) = 3
Allophone English (= 1 if mother tongue other than English and French and speaks English)	= 1 if MTNP (mother tongue) = 4 or 5 & if OLNP (official languages spoken) = 1
Allophone French (= 1 if mother tongue other than English and French and speaks French)	= 1 if MTNP (mother tongue) = 4 or 5 & if OLNP (official languages spoken) = 2
Allophone bilingual (= 1 if mother tongue other then English and French and speaks both)	= 1 if MTNP (mother tongue) = 4 or 5 & if OLNP (official languages spoken) = 3
Allophone (= 1 if mother tongue other than English and French and doesn't speak any of these languages)	= 1 if MTNP (mother tongue) = 4 or 5 & if OLNP (official languages spoken) = 4
English-French (= 1 if English and French are both mother tongues)	= 1 if MTNP (mother tongue) = 3 & if OLNP (official languages spoken) = 3

continued …

Table 7.A1 continued

Variables	*Codes from census*
Immigration Status (= 1 if has a status of permanent resident or non permanent resident)	= 1 if IMMPOPP (indicator of the immigration status) = 2 or 3
Experience	= years of education – age – 6 where years of education = 0 if TOTSCHP (total years of schooling) = 1 years of education = 7 if TOTSCHP (total years of schooling) = 2 years of education = 9 iif TOTSCHP (total years of schooling) = 3 … years of education = 13 if TOTSCHP (total years of schooling) = 7 years of education = 15 if TOTSCHP (total years of schooling) = 8 years of education = 18 if TOTSCHP (total years of schooling) = 9 age= AGEP
INDUSTRY DUMMIES	
Farming Industry	= 1 if IND80P (Industry from 1980 Classification of industries) = 1
Primary Industries Other Than Agriculture	= 1 if IND80P (Industry from 1980 Classification of industries) = 2
Manufacturing	= 1 if IND80P (Industry from 1980 Classification of industries) = 3
Construction	= 1 if IND80P (Industry from 1980 Classification of industries) = 4
Transportation/Storage	= 1 if IND80P (Industry from 1980 Classification of industries) = 5
Communications	= 1 if IND80P (Industry from 1980 Classification of industries) = 6
Wholesale and Retail Trade	= 1 if IND80P (Industry from 1980 Classification of industries) = 7 or 8
Finance/Insurance/Real Estate	= 1 if IND80P (Industry from 1980 Classification of industries) = 9
Business Management Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 10
Federal Administration Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 11
Other Government Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 12
Education & Related Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 13

Variables	*Codes from census*
Health and Welfare Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 14
Accommodation/ Food Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 15
Other Services	= 1 if IND80P (Industry from 1980 Classification of industries) = 16
OCCUPATION DUMMIES	
Managers	= 1 if NOCHRDP (Occupation from national classification of occupations)= 1 or 2
Professional or technical staff	= 1 if NOCHRDP (Occupation from national classification of occupations)= 3 or 4
Supervisor	= 1 if NOCHRDP (Occupation from national classification of occupations)= 5 or 6
Administration and Office staff	= 1 if NOCHRDP (Occupation from national classification of occupations)= 7 or 10
Sale and Services staff	= 1 if NOCHRDP (Occupation from national classification of occupations)= 8 or 11 or 13
Manual or Artisan workers	= 1 if NOCHRDP (Occupation from national classification of occupations)= 9 or 12 or 14
INDIVIDUAL EDUCATION LEVEL DUMMIES:	
Less than high school	= 1 if DGREEP (the highest grade, certificate or diploma) = 1
High-school certificate	= 1 if DGREEP (the highest grade, certificate or diploma) = 2
Trades certificate/diploma	= 1 if DGREEP (the highest grade, certificate or diploma) = 3
College (cegep) certificate/ diploma	= 1 if DGREEP (the highest grade, certificate or diploma) = 4
University < bachelor level	= 1 if DGREEP (the highest grade, certificate or diploma) = 5
Bachelor degree(s)	= 1 if DGREEP (the highest grade, certificate or diploma) = 6
University > bachelor level	= 1 if DGREEP (the highest grade, certificate or diploma) = 7
Medicine/Dentist/Vet/ Optometry	= 1 if DGREEP (the highest grade, certificate or diploma) = 8
Master degree(s)	= 1 if DGREEP (the highest grade, certificate or diploma) = 9
Earned Doctorate	= 1 if DGREEP (the highest grade, certificate or diploma) = 10

continued …

Table 7.A1 continued

Variables	*Codes from census*
CMA HUMAN CAPITAL MEASURE:	
Average Education	= mean (years of education)
Average Experience	= mean (experience)
Share of workers with university degree	= % of workers if DGREEP (the highest grade, certificate or diploma) = 6 or 7 or 8 or 9 or 10
Share of workers with graduate degree	= % of workers if DGREEP (the highest grade, certificate or diploma) = 8 or 9 or 10
Share of scientists and engineers	= % of workers if DGREEP (the highest grade, certificate or diploma) = 6 or 7 or 8 or 9 or 10 & if DGMFSP (the main field of studies) = 10 or11 or 13 or 14 or 15 or 17 or 18
University R&D expenditures	= Sum of university R&D expenditures for all universities in a given CMA (source: CAUBO 2000–2001), 1,000 $ de 2000

Table 7.A2 Correlation between R&D expenditures and human capital, 19 CMAs with universities

Human capital measure	*All workers*	*Private sector*
Share of workers with university degree	0.4742	0.5819
Share of workers with graduate degrees	0.3504	0.5684
Share of scientists and engineers	0.4297	0.4434
Average education	0.1558	0.3042

8 The role of public services and taxes in attracting 'foreign' direct investment

Timothy Goodspeed, Jorge Martinez-Vazquez and Li Zhang[1]

Introduction

Foreign direct investment (FDI) can provide a number of benefits to regions and countries that need capital including higher growth, greater exports, higher wages, and greater productivity through technology spillovers to local firms. While the evidence of the impact of FDI is somewhat mixed,[2] a big question for public officials at the regional and central government levels in developing and developed countries alike is how to set tax and public expenditure policies to attract foreign investors. To a large extent, the globalization process and the high mobility of capital across international borders has placed countries in a role similar to that played by regional and local governments vis-à-vis capital investors within the borders of a national economy. From the viewpoint of regions and local governments, globalization and the higher mobility of capital across international borders has increased the level of competition they always have faced within their national borders. Now regions may be as likely to compete for investment with other regions outside their own country as with regions inside.

The main thesis of this chapter is that in setting budget and regional development policies, public officials at the regional and central government levels must internalize that businesses are quite unlikely to be willing to pay taxes that are not matched by their desired level and quality of public services. Thus the adequate provision of public services, and not just low taxes, would seem to be an important characteristic of regions or countries that want to attract FDI. In particular, relatively higher regional or national taxes may be acceptable or even competitive if investors see them compensated or offset by higher levels and quality of public services and infrastructure.

Indeed, the local public finance and regional economics literature has traditionally emphasized the impact that local taxation and spending has on the location decisions of mobile households and businesses. That potential investors are likely to compare services they need and use with the taxes they will have to pay is known as the Tiebout hypothesis in the local public finance and regional economics literature; this hypothesis has a great deal of empirical support and is widely accepted. It seems quite natural to extend this proposition to the FDI decisions of multinational companies as they decide in what country and region

to invest. From this perspective, it would appear that the right approach to 'tax and public expenditure packages' by national and regional governments is to adopt a benefit tax principle: offer a package of public services that generate benefits that are commensurate with the taxes that the beneficiaries will pay.[3] Attempting to tax a business more than the benefits received from public services, or even impose low taxes and a package of services that is lower than that desired by the business, may be ineffective in attracting foreign direct investment (FDI).

However, at the international level, the interest in the public finance literature on the determinants of FDI has to date mostly focused on the role of taxes. Of course, benefit taxation is perfectly compatible with the view that global competition and capital mobility impose significant restraint on the ability of national and regional governments to impose progressive and redistributive taxes on capital.[4]

The main goal of this chapter is to document the relevance of the benefit principle of taxation to the international experience with flows of FDI across countries and regions. The rest of the chapter is organized as follows. In section two we review the relevant previous literature on this issue at country and regional levels. Section three takes a look at some stylized facts across countries and regions within countries on the provision of certain public services and general trends in FDI flows. Section four presents a more formal statistical analysis using panel data set for developed and developing countries for FDI and regional data within several countries. Our focus is on the role played by public service provision in attracting FDI flows controlling for taxation levels and other control variables. In section five we conclude with policy implications for regional development policies at the national and regional levels.

Literature review

The study of the determinants of FDI is quite broad.[5] For our purposes, it is useful to focus on three general areas: taxes, public sector spending, and other determinants. An excellent recent summary of factors that impact FDI is found in Blonigen (2005). He breaks the factors that influence FDI into two groups: firm characteristics that impact multinational decisions and factors that are external to the firm. He further emphasizes that the empirical literature to date has generally been of a partial equilibrium nature, and much of his review is concerned with the general equilibrium endogeneity of certain factors. We draw on his survey below to summarize factors other than taxation and spending variables without, however, delving into the general equilibrium endogeneity issue.

A fundamental question concerning FDI is why a firm would choose to produce abroad rather than export or use a licensing agreement with a local producer. The traditional answer, emanating from the transactions cost approach of Williamson (1975) and the ownership-location-internalization (OLI) paradigm of Rugman and Dunning (1985), focuses on internal firm characteristics. It revolves around the idea that the multinational firm possesses certain intangible assets that do not diminish as the firm expands, in combination with several manifestations of

market failure (such as the existence of asymmetric information) that makes it difficult to extract full rents from a third party licensing agreement.

The two major external factors that we wish to emphasize in this review are taxes and public spending, since these can be closely shaped by government policy. We interpret public spending broadly to include capital spending (such as infrastructure), non-tax investment incentives, the (in) efficiency of the government sector (as reflected for instance in the level of corruption), and the regulatory and legal aspects of a country. The public finance literature on multinationals has concentrated on taxes as a motivating factor for FDI. In contrast to the finding in some of the literature in development economics,[6] public finance economists have found evidence that taxes matter.

The point of departure for the public finance literature is a set of papers from the 1980s, including Hartman (1984), Boskin and Gale (1987), and Young (1988). These papers use a time series of aggregate Bureau of Economic Analysis (BEA) data and find significant effects of taxation on FDI with an elasticity of about –0.6. Others, such as Swenson (1994) find significant effects when disaggregating the data by industry. A second set of studies, such as Hines and Rice (1994) and Grubert and Mutti (1991), use the cross-sectional depth of the BEA data to examine FDI across countries for a given year. These studies also find significant effects, though with more variation in the point estimate of the effect of taxes. A third set of studies uses firm-level data, usually in a panel form, from a variety of sources. Studies such as Auerbach and Hassett (1993) and Cummins and Hubbard (1995) use Compustat data; Ondrich and Wayslenko (1993) use a Commerce Department survey; and Altshuler, Grubert, Newlon (2001) use U.S. Treasury data. Of particular interest from the regional perspective, Hines (1996) also uses a panel, but exploits state-level tax differences using BEA data. All these studies find significant effects of taxation levels on FDI flows, though the estimated elasticity varies significantly between them.

Transfer pricing issues are also important in understanding the impact of taxes. To the extent that transfer prices are used strategically by firms operating in different jurisdictions to reduce tax burdens, there may be serious revenue consequences for both home and host countries.[7] Indeed, there has been a growing attention to the costs associated with tax incentives. These issues have become increasingly important in the toolkit of regional governments pursuing economic development policies as well as in developing and emerging market economies; in the latter places budgetary demands and corruption levels pose more serious constraints than in industrial countries.

Tax rate changes are only one of a series of things to which regional and central governments sometimes turn to attract investment. Certain high-profile regional incentive policies to attract Toyota in Northern France or Mercedes-Benz AG in the U.S. State of Alabama have generated considerable debate about whether governments have offered unreasonably large incentives to persuade those firms to invest in their area. The use of investment incentives is common among developing and developed countries, but these types of countries tend to use different types of incentives. For instance, tax holidays – the temporary reduction

of taxes for a number of years for investment – is common in developing but not developed countries. Developing countries tend to rely on tax holidays and import duty exemptions, while developed countries tend to use accelerated depreciation and sometimes subsidized loans.[8]

The literature on regional and local government competition, and in particular the Tiebout model mentioned previously, suggests that the spending side of the budget is also important for firm decisions and FDI location. For instance, it seems clear that infrastructure such as good roads, the human capital that comes from a good school system, other publicly provided goods and services, the impact of government regulations including laws regarding private property and the general state of business conditions, will influence the attractiveness of different locations and hence should influence FDI. Yet, the study of the spending side of the budget and the efficacy of governments and government regulation has received limited attention in the public finance literature; for instance, recent studies such as Deveraux and Griffith (1998) and Head et al. (1999) looking at taxes include wage and capital subsidies rather than general infrastructure spending.

One of the more studied aspects of government output and FDI is the impact of roads. Road systems are an important component of transportation infrastructure, but the evidence concerning their effect on FDI is mixed. Billington (1999) finds that road infrastructure does not affect FDI, using the data for seven industrialized countries: the U.S., Japan, France, Germany, Australia, Canada and the U.K. These results may have been affected by the little level of variation in road infrastructure for the seven industrialized countries. However, at the regional level, the existing evidence is that road systems can make a significant difference. For example, Hill and Munday (1991), using data for the U.K. regions, and Broadman and Recanatini (2003), using data for Russia, find that roads positively affect FDI. Broadman and Recanatini (2003) also find that level of education positively affect FDI flows in Russian regions. Makabenta (2002), who analyzed the data for FDI location in the Philippines in 1987–1998, obtains expected signs and significant coefficients for the number of highways and ports located in the area, as well as for real income, wages, and special economic zones.

A different way to measure infrastructure has been explored by Kumar (2001) who constructs a composite index of infrastructure availability that captures availability of transport, telecommunications, and information infrastructures as well as energy availability for 66 countries over 1982–1994 period and analyzes whether this index explains variation in multinational enterprises presence across the countries. His estimates suggest that infrastructure availability contributes to the relative attractiveness of a country towards FDI by multinational enterprises, holding other factors constant. According to the results that he received, Kumar suggests that governments of developing countries should focus on development of physical infrastructure in their countries, rather than competing with developed countries on the ground of investment incentives.

Loree and Guisinger (1995) examine the impact of infrastructure and other policy and non-policy variables on the location of new U.S. direct investment abroad, using 1977 and 1982 Benchmark data, gathered by the Department of

Commerce. They find statistically significant effects for telecommunication and transportation infrastructure as well as for investment incentives, performance requirements, host country effective tax rates, political stability, cultural distance, and GDP per capita. Dollar *et al*. (2004) estimate the effect of some 'investment climate' indicators (days to clear goods through customs, days to get a telephone line and sales lost to power outage) on FDI. They find that FDI is larger in those countries where these indicators are better.

Another way to estimate the effect of public services on FDI is by using government expenditures for certain functions as proxies that reflect the level of appropriate public service. Büttner (2002) looks at how taxes and government expenditure affect FDI within the European Union in the period 1991 to 1998 using data from Eurostat. He finds that an increase in 'public consumption' is associated with a significant decline of FDI outflows from the country. When government expenditures are separated by functions, some of them show the expected effect on FDI, while some do not. Ranking of spending for science and technology shows positive effects on FDI, but spending on education does not seem to affect them at all. The most unexpected result is that an increase in spending on transport and communication seems to reduce FDI. The use of expenditure data as a proxy for the level and quality of public services, as done by Buettner (2002), raises several problems.

One problem with using expenditure figures is that they may not reflect the impact on the desired outcome. School expenditures, for instance, may not be a very good measure of the human capital being produced.

A second problem with using expenditures figures is that they are a crude measure of the services provided. Perhaps more important is how effectively resources are used. For instance, a corrupt government is likely to waste a substantial amount of resources as well as impose 'hidden taxes' on businesses. The problem of corruption appears to be of importance for FDI flows. Wheeler and Mody (1992), Hines (1995), and Wei (2000) have found a negative relationship between corruption and FDI. In another study, Smarzynska and Wei (2000) analyze the impact of corruption in a host country on foreign investor's preference for a joint venture versus a wholly-owned subsidiary.[9] Empirical tests of the hypothesis on a firm-level data set show that corruption reduces inward FDI and shifts the ownership structure towards joint ventures.[10]

Beyond outright corruption, Drabek and Payne (2001) indicate that the 'non-transparency factor,' a term given to a set of government policies involving processes and procedures, increase the risk and uncertainty faced by foreign investors. This increase in risk and uncertainty stems from the possible presence of bribery and corruption, unstable economic policies, weak and poorly enforced property rights, and inefficient government institutions. Their empirical analysis indicates that on average a country could expect a 40 percent increase in FDI from a one point increase in their transparency ranking.

Apart from taxes, the spending side of the public budget, and the regulatory and legal environment of a country, other factors that influence FDI and are external to the firm are many. They include market size, cost differences, economic growth,

per capita income, exchange rates, openness to trade, riskiness of investment, distance, and macroeconomic stability.[11]

Other things being equal, firms that aim at production for host country consumption will want to invest in countries with a large market. Firms that aim to produce abroad for export to a third country will be more concerned with low relative costs of production, such as low wages in particular regions or as is the case in many developing countries. Of course, productivity could also be lower, which brings us back to the importance of a good educational system.

From the viewpoint of regional development policies it is important to note that agglomeration has been found to have an impact on FDI. For instance, Dunning (1981, 1986) and Root and Ahmed (1979) find that the extent of urbanization impacts FDI as multinationals prefer to establish subsidiaries in urban centers. This may reflect the desire to be near a large market with significant labor pools, or it could reflect benefits of the infrastructure of cities. Chen (1997) finds that FDI inflows into China are concentrated in the more developed, more urbanized Eastern region provinces of China, while the less developed and urbanized Western zone has a low concentration of FDI inflows.

The impact of the exchange rate on FDI is somewhat tricky, as there is some reason to think that exchange rates will not affect FDI since it affects the both the cost of assets abroad and the expected return in the home currency. However, Froot and Stein (1991) argue that a home-currency appreciation can increase outward foreign investment (or equivalently, depreciation in a country's currency can increase inward FDI). As summarized in Blonigen (2005), a number of papers have found this effect.

Stylized facts about FDI and public service provision

A striking observation in the study of FDI flows is that the vast majority of this activity takes place among high-income developed countries, with considerably less going to middle-income countries, and a very small share by comparison going to low-income countries. These comparisons are a bit less dramatic if we instead use the average FDI inflow for countries in each income category, but still apparent (Figure 8.1).

Over time, during our sample period from 1984 to 2002, the average FDI inflow rose steadily for all three-country income categories peaking in 2000 and declining thereafter, with the exception of low-income countries, which appeared to have recovered immediately after.

The main proposition we explore in this chapter is whether benefits from government services matter in explaining the variation of FDI flows across regions and countries. Unfortunately, there are too many different types of public services to capture them in a single index, plus each of those public services can be measured along many different dimensions (expenditure, intermediate outputs, performance outcomes, and so on). Nevertheless, other things being equal, we would expect better public services to be a significant magnet in attracting FDI.

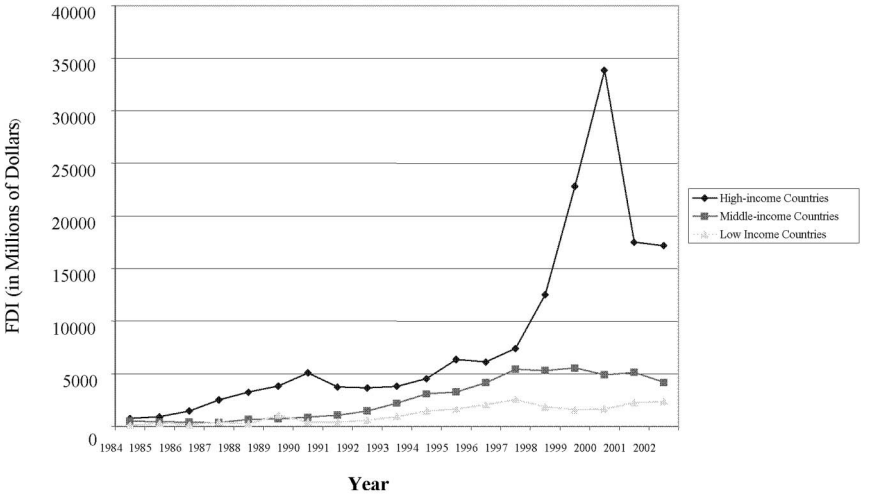

Figure 8.1 Average FDI inflows in countries by income categories

Clearly, this relationship needs to be explored using multivariate regression techniques, which we do in the next section.

Nevertheless, it is instructive to look at the aggregate relationship between FDI flows and government services. At the international level, Figure 8.2 shows graphically how developing countries rank when we compare average FDI inflows side by side with the average 'ranking for infrastructure'.[12] By grouping developing countries into two categories by the level of FDI, it is clear from Figure 8.2 that the group of developing countries with higher average FDI inflows is also the group of countries with average 'ranking for infrastructure.' We would anticipate

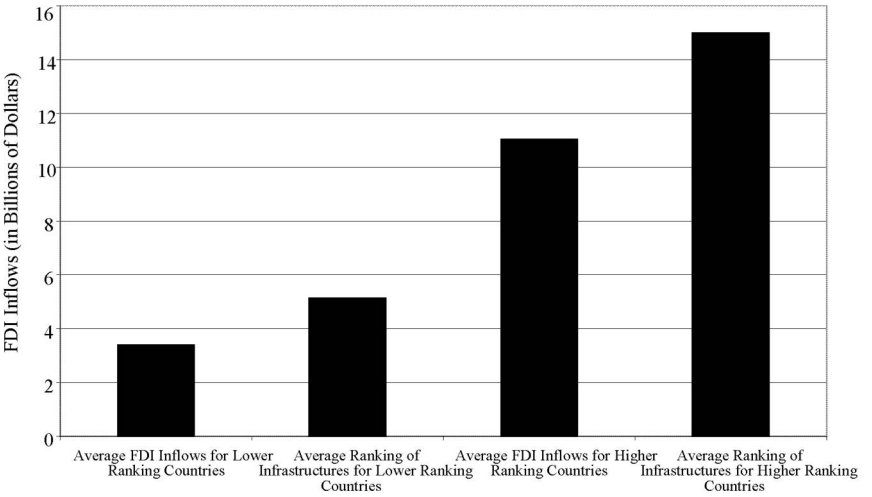

Figure 8.2 Average FDI and average ranking of infrastructure in developing countries

that similar correlations exist between average FDI inflows and other measures of public expenditure performance.

Similar correlations can be found at the regional level for a number of countries. Figure 8.3 shows the data of Indian states for accumulated FDI over the years 1991–2002, where the states are divided into two groups according to their infrastructure ranking developed by Mohanty (2004).[13] Although several other things are likely to be at play, it is quite clear from Figure 8.3 that states with higher infrastructure ranking on average have received considerably more FDI.

A similar story is told for Russia's regions using FDI flows for 2001 (GKS, 2001) and several measures of 'Attractiveness to Investment' developed by the organization GatewaytoRussia; the two most important regional indexes are 'Investment Risk' and 'Investment Potential,' which in turn are built on the basis of seven risk factors and eight potential factors, respectively.[14] Largely, these indexes reflect the quality of governance and the availability of public services and infrastructure. As shown in Figure 8.4 and 8.5, Russia's regions with lower risks

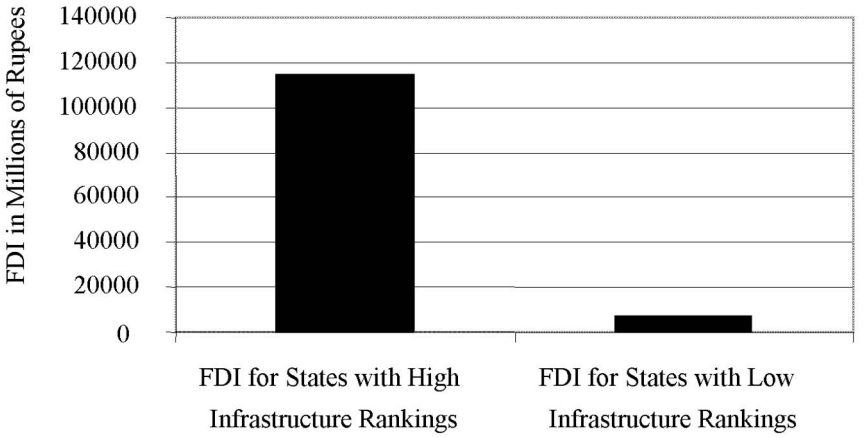

Figure 8.3 India: average FDI for states with high or low infrastructure

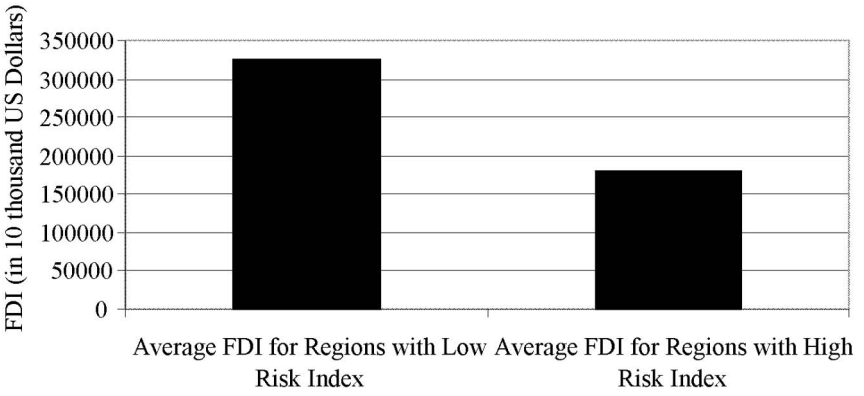

Figure 8.4 Comparisons of FDI and risk index for Russian regions

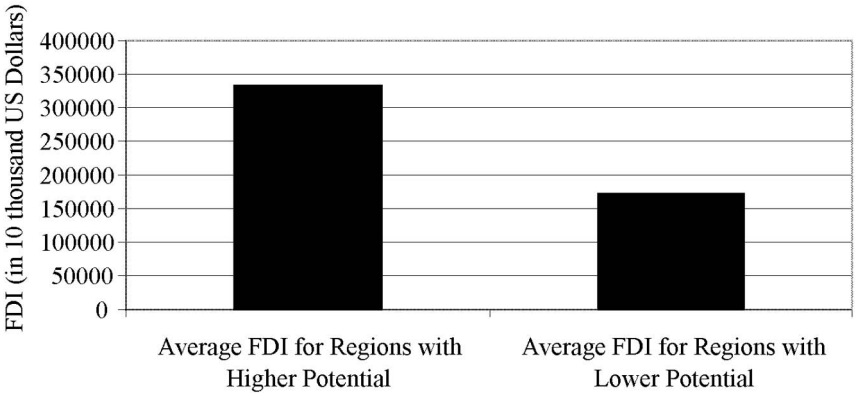

Figure 8.5 FDI and potential for Russian regions

and high investment potential, attract significantly larger flows of FDI. Similar patterns hold if we group Russia's regions using more direct indicators for public service provision, such as power consumption or availability of telephone lines. Broadman and Recanatini (2001) provide further support for our basic hypothesis in the case of Russia. These authors study the determinants of the geographical distribution of FDI across Russia's regions from 1992 to 1999 and find beyond market size, the two most important determinants of the level of FDI across regions are infrastructure development and the investment climate or policy framework offered by the regional governments.

Empirical approach and results

In this section, we look at some statistical evidence on the role played by government services in FDI flows. First, we consider panel data cross countries at the international level. In the second part of the section we look at some data for regional within country analysis.

Cross-country analysis

Empirical methodology and data

The baseline model for our empirical testing takes the following form:

$$\text{FDI}_{it} = a_0 + a_1 X_{it} + a_2 T_{it} + a_1 G_{it} + u_{it}$$

where FDIit is the log of FDI divided by GDP, X_{it} represents a vector of non-fiscal control variables, T_{it} is a tax measure, G_{it} is a vector of measures of government quality, and u_{it} is the error term. A number of econometric issues arise in estimation of this equation. A common criticism of empirical work using cross-country data is that it is difficult to control for unobserved country differences that are

correlated with the variables of interest – and so one might attribute significance to a variable that is really due to some unobserved country factors. For this reason we use a panel data set and employ fixed effects estimation.[15] Second, we test for serial correlation by employing the Durbin Watson test for serial correlation, but find none. Finally, we run sub-samples of industrialized countries and developing countries because there are reasons to expect that FDI flows into these two sets of countries may respond differently to our set of explanatory variables.

Our data set is a panel of 53 countries, covering developing and developed countries in different regions of the world, with per capita GDP ranging from $200 to almost $60,000 (in 1995 constant dollars), spanning the period 1984–2002 for most variables. This panel data set was constructed with the objective of allowing us to capture variations on the effects of different factors, especially public services, on FDI. Most of our data are from the World Development Indicator (WDI) 2005, although information on taxes and labor cost are from the Bureau of Economic Analysis (BEA) and education data are from the United Nations Educational, Scientific and Cultural Organizational (UNESCO). The definition of the variables, data sources, and summary statistics are presented in Tables 8A.1 and 8A.2 in the appendix.

As the dependent variable we use the logarithm of FDI inflows divided by GDP. The set of explanatory variables can be divided in three main categories.

First, we include a vector of non-fiscal control variables that are theoretically important determinants of FDI flows and that have been found to be significant in the previous literature. These include population, per-capita GDP, exports multiplied by the exchange rate, and a measure of labor costs in the host country. Second, on the fiscal revenue side we control for the taxes that foreign investors face in their host countries. This is measured by the average effective tax rate (AETR) faced by U.S. subsidiaries, as this is the group for which we have data.

The third group of variables is our primary focus. This is a set of variables that influence FDI through the quantity and quality of public sector expenditures. A common expenditure component in all our specifications is government consumption expenditures. These are primarily redistributive expenditures rather than investment.[16] We also include in all specifications two indexes that may be but are not always related to the public sector, especially in more developed countries, electric power consumption and telephone landline use. We then focus on regression variations that try to get at both the quantity and quality of expenditures by using a number of variables from the International Country Risk Guide (ICRG) that are available for 1984–1997 to act as proxy for the quality of the public sector and the 'rule of law' in the private sector. Government quality is measured by bureaucratic quality and repudiation of government contracts.[17] The 'rule of law' is measured by the tradition of law and order and expropriation risk.

Regression results

The regression results in Table 8.1 generally indicate that government quality and the 'rule of law' positively influence inflows of FDI, although the results are

Table 8.1 Fixed effects with ICRG data, balanced panel, 1984–1997

	(1) Full Sample	*(2) Developing*	*(3) Developed*	*(4) Full Sample*	*(5) Developing*	*(6) Developed*
Dependent variable: logarithm of FDI inflows per GDP						
Population	1.427	1.176	–12.468	1.209	1.103	–12.750
	(6.32)***	(4.69)***	(1.99)**	(5.49)***	(4.52)***	(1.97)**
Per capita GDP	0.020	0.070	0.034	0.054	–0.078	0.041
	(1.30)	(0.79)	(2.20)**	(3.56)***	(0.88)	(2.57)**
Government consumption expenditure	–0.397	–0.350	–0.636	–0.241	–0.083	–0.568
	(2.29)**	(1.54)	(2.00)**	(1.44)	(0.37)	(1.70)*
Electric power	1.121	–5.360	2.648	0.594	–5.446	2.380
	(0.92)	(1.72)*	(2.30)**	(0.51)	(1.84)*	(2.02)**
Telephone landline	0.028	0.134	0.018	0.007	0.101	0.009
	(2.05)**	(3.94)***	(1.24)	(0.48)	(3.03)***	(0.57)
Export* exchange rate	–0.662	–5.369	–71.014	–0.254	–3.687	–15.151
	(0.32)	(2.18)**	(0.39)	(0.13)	(1.56)	(0.08)
Labor cost	–0.013	–0.030	–0.012	–0.025	–0.043	–0.015
	(1.71)*	(1.97)**	(1.64)	(3.44)***	(2.94)***	(1.92)*
Average effective tax tate	–0.084	–0.066	–0.042	–0.026	–0.001	–0.040
	(2.92)***	(1.75)*	(0.94)	(0.91)	(0.01)	(0.88)
Rule of law	1.227	2.642	–0.863	–0.176	0.844	–0.909
	(2.45)**	(3.74)***	(1.25)	(0.31)	(0.96)	(1.21)
Bureaucratic quality				–2.238	–3.407	–0.763
				(2.72)***	(3.06)***	(0.59)
Repudiation of government contracts				0.722	1.056	0.323
				(1.84)*	(2.09)**	(0.44)
Expropriation risk				1.736	1.593	0.831
				(4.37)***	(2.95)***	(1.02)
Constant	–62	–60	–26	–63	–61	–28
	(13.38)***	(12.57)***	(1.76)*	(12.06)***	(11.02)***	(1.62)
Observations	674	341	333	674	341	333
Number of countries	51	26	25	51	26	25
R^2	0.22	0.32	0.20	0.30	0.39	0.21

Notes: Absolute value of t–statistics in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%

In this table, we rescale FDI by ln(FDI/GDP)*10, population by pop*10^{-3}, per capita GDP by PGDP*10^{-2}, electric power by epower*10^{-3}, interaction between export and exchange rate by export*10–6, labor cost by labor*10^{-2}, average effective tax rate by AETR*10^{2}.

somewhat different for developing than developed countries. The results indicate that FDI going into developed countries is negatively impacted by government consumption expenditures, while FDI going into developed countries is negatively impacted by repudiation of government contracts. An unexpected result is that bureaucratic quality seems to negatively impact FDI in developing countries and has no effect on FDI going to developed countries. This could be because FDI is going into developing countries that lack expertise in the private sector; if this is positively correlated with expertise in the public sector, then bureaucratic quality could be inversely related to FDI.

The results also indicate that the 'rule of law' is important, particularly for developing countries. Expropriation risk is positive and highly significant for developing countries, though it loses significance for developed countries. A tradition of law and order is also significant and positive for developing countries, but not for developed countries.[18]

On the revenue side of public budgets, our tax rate measure is significantly negative for the sample as a whole in column 1, and for developing countries in column 2. We do not find it to be a significant determinant of FDI for developed countries, however.

Among the control variables, wage costs are significantly negatively related to FDI across our specifications. The size of the population appears to affect FDI flows differently in developing countries (positively) and developed countries (negatively). Per capita GDP is a positive significant factor in attracting FDI but only in developed countries. The existence of telephone landlines is always a significant positive factor in attracting FDI but only in developing countries. In the case of electric power, greater consumption per capita is a positive significant factor on FDI in the case of developed countries; however, in the case of developing countries is unexpectedly a negative factor. The interaction between the level of exports and the exchange rate is in most cases not statistically significant.

Regional within country analysis

Most of the empirical literature studying the relationship between taxes and public services with FDI uses national level data. A main reason for this is data availability. In general, it is much harder to find the necessary data at the regional level. In particular, we are not able to replicate for the regional analysis several of the control variables we used above in the cross-country analysis. The measurements for governance quality that we used there, including law and order tradition, bureaucratic quality, repudiation of government contracts, and expropriation risk, are based on data from surveys conducted by International Country Risk Guide (ICRG), which are only available at the national level. Data on the quantity and quality of public services and infrastructure at the regional level are somewhat available but not with the depth and width we find at the country level. In addition, the taxes that foreign investors pay in different regions within a county might not be the same, because of tax autonomy at the national levels. However, data on the effective tax burdens at the regional level are not always possible to find. In some

other country cases, because regional governments lack tax autonomy, there is no need to control for differences in tax burdens.

In this section, we examine regional data for a few selected countries, with the main objective of identifying what role public service provision plays in the distribution of FDI flows to the different regions of a country.

China: FDI at the provincial level

To examine the role of public service provision on FDI regional inflows in China, we compiled a data set covering 30 provinces over the period 1987–2002. To capture differences in public service provision across provinces we use a group of variables measuring public service provision directly, which include the density of highway and railway networks, number of telephone lines, number of doctors per 1,000 people, primary education enrollment rates, and percentage of children with primary education that continue on to secondary schooling.

In addition to the public service variables, we examine the regressions control for per capita GDP, population size, and share of export over GDP in each province over the years. We use fixed effects estimation to control for other non-observable provincial characteristics.

The results from the different regression specifications in Table 8.2 show that differences in public service provision tend to matter where FDI goes. The estimated coefficients for road density and telephone lines are positive and statistically significant in all regressions, indicating that provinces with better infrastructures draw more FDI. The regression results also show that the quality of social services also seem to matter. Better quality of health services, represented by more doctors per 1,000 people, takes a positive and statistically significant coefficient, as does the percentage of children graduating entering into secondary schools. However, this latter variable loses significance when the variables road density and telephone lines are also included in the regression.

In addition, Table 8.2 shows that higher levels of FDI go to richer provinces and those that are more export oriented, as the coefficients for per capita GDP and export are both positive and significant.[19]

United States: FDI at the state level

To examine the role of public service provision on FDI regional inflows in the United States, we compiled a data set covering 50 states over the period 1998–2002. To capture differences in public service provision across provinces we use highway mileage and educational attainment. In addition, the regressions control for per capita GDP, wage level measured by the average annual pay for workers in each state, population size, and the share of exports in GDP, government consumption expenditure, and top corporate tax rate. In addition, in order to control for the influence of industry concentration on the educational attainment in each state, we calculated an index grouping industries that require higher education level and industries that do not require it. In the regressions results, we show the estimates

Table 8.2 Fixed effects regressions for China's provinces, 1987–2002

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	fdi	fdi	fdi	fdi	fdi
Per capita GDP	1.65	24.04	24.68	4.47	4.03
	(0.74)	(13.71)***	(13.76)***	(1.82)*	(1.85)*
Population	0.16	26.91	22.16	–4.03	–1.38
	(0.03)	(4.29)***	(3.47)***	(0.79)	(0.27)
Net export	2,095.3	2,379.9	1,534.4	2,241.9	1,878.9
	(4.13)***	(4.39)***	(2.77)***	(4.50)***	(3.70)***
Transportation	494.81			251.38	298.20
	(4.53)***			(1.97)**	(2.75)***
Telephone subscribers	0.073			0.090	0.082
	(16.58)***			(17.78)***	(17.48)***
Share of capital construction		–452179.108			
		(2.96)***			
Share of social service		–1006494.8			
		(4.41)***			
Share of administration		78,398.5			
		(0.29)			
No. of doctors per 1000 people			4,548.5	6,725.2	3,015.7
			(2.00)**	(3.78)***	(2.05)**
Enrollment rate					1,278.3
					(0.91)
Percent of primary to secondary			2,619.5	–742.8	
			(3.39)***	(1.18)	
Constant	–182,895	138,145	–437,647	–182,198	–308,805
	(6.02)***	(1.93)*	(6.39)***	(3.07)***	(2.24)**
Observations	541	563	504	484	514
Number of ID	29	30	29	28	29
R^2	0.69	0.52	0.52	0.72	0.71

Note: Absolute value of t–statistics in parentheses. *Significant at 10%; ** significant at 5%; *** significant at 1%

for the index without special requirement for education, denoted by nonedu. The respective definitions and data sources are listed in Table 8.3.

In contrast to the findings in previous studies for the 50 U.S. states, we find that random effects estimation is more appropriate than fixed effects estimation according to the Hausman test.

In addition to panel estimation we also run a cross-section regression for 2002 alone, since it is the most recent year with data available. The summary statistics are listed in Table 8.4 and 8.5.

Next we group the results for the panel regressions and the cross section 2002 regressions in Table 8.6.

Table 8.3 Variable definitions for the U.S. regressions

Variable	*Definitions*	*Source*
fdi	Gross book value of property, plant, and equipment (million dollars)	U.S. Census Bureau
nexport	Share of U.S. exports by state of origin over GSP	U.S. Census Bureau
pgsp	Per capita gross state products	U.S. Bureau of Economic Analysis
pop	Population	Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce
highway	State highway agency-administered public roads (interstate), in miles	U.S. Federal Highway Administration, Highway Statistics, annual
tax	Corporate tax rate: top tax rate	Office of Tax Policy Research
labor	Average annual pay by state	U.S. Bureau of Labor Statistics. *Employment and Wages, Annual Averages*
consum[a]	Government expenditure for current operation (in thousand dollars)	U.S. Census Bureau
college	Percent of population over 25 years old with bachelor's degree or higher education	U.S. Census Bureau
highschool	Percent of population over 25 years old who are high school graduates or more education	U.S. Census Bureau
nonedu	Shares of industry products that do not need high level educated labor in gsp	Bureau of Economic Analysis, U.S. Department of Commerce

Note: a Includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security but excludes military expenditures that potentially have wider public use and are part of government capital formation.

Table 8.4 Summary statistics for panel regressions for the U.S. (1997–2002)

Variable	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
fdi	304	18802.1	21253.48	684	121040
nexport	306	6.05	3.720	0.67	25.12
pgsp	306	33516.32	11511.17	20869.25	118974.8
pop	306	5499436	6095006	489451	3.50E+07
highway	306	891. 6	584.2	11	3234
tax	300	6.53	2.861	0	12
labor	305	31547.58	6283.56	265.5	57914
consum	300	10246.36	11020.73	836.64	77760.95
college	255	25.13	4.75	15.3	42
highschool	255	85.15	3.91	76.4	92
nonedu	306	40.57	8.73	5.55	56.93

Table 8.5 Summary statistics for cross-section regressions for the U.S. (2002)

Variable	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
fdi	51	17891.22	19276.26	684	91936
nexport	51	5.48	3.04	1.17	14.79
pgsp	51	36564.71	13361.18	23915.44	118974.8
pop	51	5646761	6347912	499045	3.50E+07
highway	51	862.21	572.11	13	3234
tax	51	6.56	2.90	0	12
labor	51	33833.19	7770	265.5	57914
consum	50	12449.79	13465.08	1270.076	77760.95
college	51	26.18	4.94	15.3	42
highschool	51	85.95	3.66	78.75	91.55
nonedu	51	38.60	8.41	5.55	55.09

Regressions 1 and 2 in Table 8.6 correspond to the random effects panel estimations, while regression 3 and 4 correspond to the cross-section estimations for 2002 only. Note that we use two different measures of educational attainment: percentage of population over 25 years old with high school education (denoted by 'highschool') and with college or higher education (denoted by 'college'). For the two panel results, whether we use 'highschool' or 'college', the results are basically the same. Highway mileage is positively related to FDI, even though the results are insignificant. Educational attainments are negatively and insignificantly

Table 8.6 Panel and cross–section regression results for the U.S.

	1	*2*	*3*	*4*
	fdi	fdi	fdi	fdi
nexport	523.42	534.72	911.22	800.75
	(3.05)***	(3.12)***	(3.11)***	(2.93)***
pgsp	0.471	0.447	0.646	0.678
	(3.42)***	(3.28)***	(4.04)***	(4.58)***
pop	0.003	0.003	0	0
	(9.95)***	(9.48)***	(–0.15)	(–0.57)
highway	3.46	3.74	9.72	10.25
	(1.49)	(1.61)	(2.97)***	(3.31)***
tax	–254.2	–310.3	–139.2	–269.3
	(0.84)	(1.06)	(0.44)	(0.93)
consum	–0.34	–0.34	1.03	1.09
	(2.93)***	(2.84)***	(3.01)***	(3.37)***
college	–246.35		–480.88	
	(1.28)		(1.89)*	
highschool		–135.425		–714.189
		(0.79)		(3.00)***
nonedu	311.029	340.317	113.618	236.799
	(2.37)**	(2.70)***	(0.63)	(1.55)
labor	0.255	0.239		
	(2.20)**	(2.07)**		
Constant	–30,822	–25,002	–21,220	23,932
	(3.34)***	(1.51)	(1.83)*	(1.13)
Observations	241	241	50	50
Number of id	50	50		
R^2			0.93	0.94

Notes: Absolute value of z–statistics in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1

related to FDI. This is an unexpected and puzzling result. However, when we take into account the positive and significant coefficient for the industry concentration index nonedu, the story seems to be that industrial concentration in a state does not generally require workers with high education levels. The positive and significant coefficient for labor costs can also be interpreted in the same manner. For other control variables, we can see that per capita GDP, population and export are all positively related to FDI. Government consumption is negatively related to FDI, and the results are statistically significant. Tax rate is also negative, though insignificant.

In the cross-section results for 2002, highway mileage appears to be a significantly positive factor in attracting FDI. However, the educational attainment variables now become significantly negative, while the industry concentration index is insignificant, though still positive. Similar to the panel results, per capita GDP and export are still positively related to FDI, while the tax rates are negative.

Overall, the estimation results at the state level for the U.S. also provide support for the hypothesis that public services play a significant role in attracting FDI inflows.

Conclusion

The main goal of this chapter has been establishing the relevance of the benefit principle in explaining the variation of FDI flows across countries and across regions within a country. Our logical premise is that businesses are quite unlikely to be willing to pay taxes that are not matched by their desired level and quality of public services and that, other things being equal, lower taxes per se are unlikely to attract FDI unless certain level and quality of public services are in place. Although these ideas have been long understood and practiced at the local level, at the international level, the interest in the public finance literature on the determinants of FDI has to date mostly focused on the role of taxes.

At the international level, we empirically test our proposition by using a panel data set of 53 developing and developed countries in different regions of the world, spanning the period 1984–2002. The regression results generally indicate that government quality and private sector quality positively influence inflows of FDI, although the results are somewhat different for developing than developed countries. At the regional level within a country, we also find supporting evidence that the provision of public services level also matter for the direction and level of FDI flows. This tends to confirm many similar findings in the regional-local empirical public finance that has tested the Tiebout hypothesis.

In conclusion, the adequate provision of public services in a broad sense, and not just low taxes, would seem to be an important policy principle for regional and central government that want to attract FDI. These governments need to offer a package of public services that generate benefits that are commensurate with the taxes that the beneficiaries will pay.

Appendix

Table 8.A1 Source and definitions

Variable	*Definition*	*Source*	*Years available*
FD[a]	FDI inflows, in millions of current dollars	United Nations Conference for Trade and Development (UNCTAD)	1984–2002
Population	Population, in 10,000 people in a year	World Development Indicator (WDI) 2005, World Bank	1984–2002
Per capita GDP	Per capita GDP, measured in current dollars, calculated by GDP/pop	World Development Indicator (WDI) 2005, World Bank	1984–2002
Government consumption expenditure[b]	General government final consumption expenditure (% of GDP)	World Development Indicator (WDI) 2005, World Bank	1984–2002
Electric power	Electric power consumption (kwh per capita)	World Development Indicator (WDI) 2005, World Bank	1984–2002
Telephone mainline	Telephone mainlines (per 1,000 people)	World Development Indicator (WDI) 2005, World Bank	1984–2002
Export* exchange rate	Interaction of % of export/GDP and exchange rate, which is measured by LCUs/dollar	Share of export is from World Bank; the exchange rate is from International Financial Statistics, IMF	1984–2002
Labor cost	Wages of employees working in U.S. companies' foreign affiliates, in dollars per year	Calculated with data from Bureau of Economic Analysis (BEA)	1984–2002
Average effective tax rate	Average Effective Tax Rate = foreign income taxes/(foreign income tax + net income) of all affiliates for U.S. firms operating abroad in each country and year	Calculated with data from Bureau of Economic Analysis (BEA)	1984–2002
Rule of law	Rule of law (law and order tradition)[c]	International Country Risk Guide (ICRG)	1984–1997
Bureaucratic quality	Bureaucratic quality[d]	International Country Risk Guide (ICRG)	1984–1997
Repudiation of government contracts	Risk of repudiation of contracts by government[e]	International Country Risk Guide (ICRG)	1984–1997
Expropriation risk	Risk of expropriation of private investment[f]	International Country Risk Guide (ICRG)	1984–1997

Notes:

a According to the UNCTAD definition, for associates and subsidiaries, FDI flows consist of the net sales of shares and loans (including non-cash acquisitions made against equipment, manufacturing rights, etc.) to the parent company plus the parent firm´s share of the affiliate's reinvested earnings plus total net intra-company loans (short- and long-term) provided by the parent company. For branches, FDI flows consist of the increase in reinvested earnings plus the net increase in funds received from the foreign direct investor.FDI flows with a negative sign (reverse flows) indicate that at least one of the components in the above definition is negative and not offset by positive amounts of the remaining components.

b General government final consumption expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security but excludes government military expenditures that potentially have wider public use and are part of government capital formation.

c This variable 'reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes'. Higher scores indicate: 'sound political institutions, a strong court system, and provisions for an orderly

Table notes continue overleaf

Notes to Table 8.A1 continued

succession of power'. Lower scores indicate: 'a tradition of depending on physical force or illegal means to settle claims'. Upon changes in government new leaders 'may be less likely to accept the obligations of the previous regime'.

d High scores indicate 'an established mechanism for recruitment and training', 'autonomy from political pressure', and 'strength and expertise to govern without drastic changes in policy or interruptions in government services' when governments change.

e 'This indicator addresses the possibility that foreign businesses, contractors, and consultants face the risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down' due to 'an income drop, budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities'. Lower scores signify 'a greater likelihood that a country will modify or repudiate a contract with a foreign business'.

f This variables evaluates the risk 'outright confiscation and forced nationalization' of property. Lower ratings 'are given to countries where expropriation of private foreign investment is a likely event'.

Table 8.A2 Summary statistics

Variable	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
FDI	1007	5332.8	13185.2	–4550	198276.5
Population	1007	6985.8	19774.6	25.3	128040
Per capita GDP	1007	13154.82	12686.01	216.4417	59053.04
Government consumption expenditure	1007	15.92	6.01	3.08	39.23
Electric power	988	4221.13	4514.68	57.84	24858.41
Telephone mainline	1007	273.53	215.69	2.38	796.82
Export* exchange rate	984	134309.3	2020635	9.10E-09	4.41E+07
Labor cost	1007	24298.02	16754.57	2591.548	89733.34
Average effective tax rate	1007	0.34	0.197	0.002	0.924
Rule of law	728	4.20	1.56	1	6
Bureaucratic quality	728	4.13	1.53	1	6
Repudiation of government contracts	728	7.74	2.10	2	10
Expropriation risk	728	8.27	1.92	2.8	10

Notes

1 We are very grateful to René Rendon-Garza, Dmitry Shiskin, and Vid Adrison for very helpful research assistance

2 Lipsey (2002) surveys this literature and finds that the evidence indicates that FDI increases exports, sometimes increases growth (especially in developing countries

with export promotion policies), has a somewhat ambiguous impact on local wages, and also has an unclear impact on technology spillovers to local firms.

3 Of course, to the extent that a particular location may offer special rents to businesses governments should be able to tax away these rents without necessarily offering a quid-pro-quo in terms of public services.

4 See e.g. Goodspeed (1998) for a commentary on the role of benefit taxes in an internationally competitive environment.

5 According to the IMF, Foreign Direct Investment, FDI, is defined as foreign investments in which the investor owns more than 10 percent of the stock. This definition generally refers to investments by multinationals in foreign controlled corporations such as affiliates or subsidiaries. FDI flows consist of two broad categories: (i) direct net transfers from the parent company to a foreign affiliate, either through equity or debt, and (ii) reinvested earnings by a foreign affiliate. Other ways to finance the investments of subsidiaries, such as local borrowing or local issuance of shares, are not registered as FDI. UNCTAD (2001) defines foreign direct investment as an investment involving management control of a resident entity in one economy by an enterprise resident in another economy.

6 See for instance Root and Ahmed (1978), Agodo (1978), Shah and Toye (1978), and Lim (1983). In 1978, Root and Ahmed performed an econometric study with data for 41 developing countries for the period 1966–1970. They classified countries in three categories of unattractive, moderately attractive, and highly attractive according to their average annual per capita inflow of FDI. Forty-four variables were chosen as potentially significant discriminators of the three country groups. Among the six policies related discriminators were three relating to tax levels. Of these, corporate tax rates proved to be an effective discriminator of the three defined country groups; however tax incentives laws and liberality were not found to be effective discriminators. Agodo analyzed a sample of 33 U.S. firms having 46 manufacturing investment in 20 African countries. Tax concessions were found to be insignificant as a determinant of FDI in simple and multiple regressions.

7 See Grubert *et al*. (1993) for some evidence on transfer pricing for the U.S.

8 For more details on investment incentives influencing the location decision of FDI see Guisinger (1985).

9 They employ a unique firm-level data set based on a survey conducted by the European Bank for Reconstruction and Development. In January 1995, a brief questionnaire was sent out to all companies (about 9,500) listed in the Worldscope database. Responses were obtained from 1,405 firms that answered questions regarding their existing or planned FDI in Eastern Europe and the former Soviet Union. In the survey, 7,381 respondents had actually invested and further 70 firms planned to invest in the region.

10 U.S. firms are found to be more averse to joint ventures in corrupt countries than investors of other nationalities. This may be due to the U.S. Foreign Corrupt Practices Act.

11 For a comprehensive survey of the studies of the location factors in determining FDI inflows into developing countries, see Dunning (1993).

12 This index measures the extent to which resources and systems are adequate to serve the basic needs of business and is calculated with rankings from various issues of World Competitiveness Yearbooks. See Table 8A.1 in the Appendix.

13 Mohanty (2004) calculates the infrastructure rankings on the basis of communication and transportation infrastructures and the availability of electric power.

14 Investment risk represents the likelihood of the loss of investments or income from investments. The integral risk evaluation consists of seven different risk types covering legislative, political, social, economic, financial, criminal, ecological components. Investment potential takes macroeconomic characteristics into account, such as the geographical concentration of industrial facilities, consumer demand, and other factors.

The aggregate investment potential of a region consists of eight individual potential factors including labor, consumption, production, financial, institutional, innovational, infrastructural,and natural resources. In general, these indexes incorporate indicators such as bureaucrats, investment climates and strategies, as well as administrative efficiencies, and so on.

15 Hausman tests indicate that fixed effects are preferred to random effects in all the specifications presented. From an econometric point of view the fixed effects model is costly in degrees of freedom, while the random effects can be criticized by assuming the country's specific effects are uncorrelated with the other regressors, but the Hausman tests reject the random effects estimation in all our specifications.

16 According to the WDI, 'general government final consumption expenditure' includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security but excludes government military expenditures that potentially have wider public use and are part of government capital formation.

17 We have attempted to introduce other government quality measures such as performance in education, health and other basic services. While intermediate output data, such as enrollment rates, were available for most countries in our sample, these variables expectedly showed very little variation among developed countries. More outcome oriented data, such as test scores, were not available for many countries, especially developing countries.

18 These results are likely due to the lack of variation of the rule of law variables for the sub-sample of developed countries.

19 We leave out of the regressions the variable wage levels because it is highly correlated with per capita GDP.

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9 Regional economic integration and budget financing

Looking towards international markets?

Luiz de Mello[1]

Introduction

Regional economic development is conventionally thought of as the process by which the poorer regions within a country catch up with their more prosperous counterparts. But in a globalised world – where globalisation refers to the economic forces, such as trade and financial integration, that bind together countries that share a common border or those that belong to the same 'economic area' – regional development policies within countries have international cross-border implications. Because regional economic integration has pros and cons, there is a role for policy. The government may be called upon to provide the infrastructure needed to facilitate integration, especially in transport, but also to deal with the impact on the economy of terms-of-trade volatility and income shifts between the tradable and non-tradable sectors. The effect of regional integration on public finances is therefore far from clear-cut, especially because international tax competition may undermine the government's ability to raise revenue to meet the demands for higher spending.[2]

Against this background, this chapter will empirically test the hypothesis that trade and financial openness creates new sources of budget financing as well as cross-border regional spillover effects, such that policymakers in one country respond to changes in policy in neighbouring countries or regional peers. While the focus of the analysis will be on cross-border interregional integration, the chapter's main findings do have implications for regional development policies within countries. It will be argued that, because financial openness allows the government to borrow from non-residents, external sources of budget financing may substitute, at least in part, for domestic ones. The argument is related to the empirical evidence reported in de Mello (2005) that the association between openness and fiscal outcomes is shaped by two opposing forces: on the one hand, financial openness facilitates access to external financing, which may be associated with larger budget deficits, and, on the other, it brings about greater market scrutiny over public finances, creating a disciplinary effect that constrains budget imbalances.

The main findings of the chapter are as follows. First, as hypothesised, openness is associated with greater reliance on external, rather than domestic,

sources of budget financing, but in a non-linear fashion. The more open the economy, the lower the sensitivity of domestic financing to changes in the budget balance. Second, consistent with the existence of regional policy spillovers, the composition of budget financing is affected by policy in neighbouring countries, which may compete for foreign funds. Countries that are more open to trade than their regional peers also seem to rely more on non-residents for budget financing than their more closed counterparts. The relevance of these findings from the vantage point of regional development within countries is that, where regions enjoy policymaking autonomy in the fiscal area, especially in tax policy and financial management, they may face the incentive to use tax policy as an industrial policy tool, granting tax exemptions to attract investment and residents, and to borrow abroad as a means of financing investment.

The chapter is organised as follows. The next section surveys the literature on how trade/financial openness affects public finances. The hypotheses to be tested and the empirical findings are reported in Section 3. Section 4 discusses the implications of the empirical findings from the point of view of regional economic development within countries. Section 5 concludes.

The links between trade/openness and public finances

There is a large and growing literature on the effects of trade/financial integration, also referred to as globalisation, on the size and scope of government. The focus of empirical analysis has been on testing two hypotheses: 'efficiency' and 'compensation'. The efficiency hypothesis is associated with the constraints openness imposes on the ability of the government to raise revenue in the presence of increasingly mobile tax bases and against the need to enhance the country's competitiveness in world markets. The compensation hypothesis is more closely related to welfare considerations: the government is posited to compensate individuals for the greater risk arising from openness-induced job losses and to act as a shock absorber to provide social insurance against terms-of-trade volatility, which is hypothesised to rise with globalisation, and its effect on domestic income and consumption.

The efficiency hypothesis stresses the fact that the government cannot meet the demands for higher spending, especially on welfare programmes, while keeping the tax take low in search for economic efficiency in an increasingly competitive environment. Tanzi (2001, 2002) refers to this line of argument as the 'fiscal termites hypothesis'. Empirical evidence suggests that openness has indeed induced a shift in the composition of government revenue in OECD countries away from mobile bases, such as capital, towards labour (Bretschger and Hettich, 2002).[3] By the same token, due to international tax competition, countries also seem to respond to tax policy elsewhere, reacting more strongly to changes in other countries' tax rates when their own level of taxation is above their peers' average (Devereux *et al*., 2002).

A related, earlier literature focuses on developing countries and argues that openness provides a 'tax handle' for governments that would otherwise be unable

to increase the revenue of taxes other than those associated with foreign trade (Tanzi, 1967, 1973; Musgrave, 1969; Cameron, 1978; Katzenstein, 1985). Where revenue-to-GDP ratios are low, the tax handle allows the government to mobilise the necessary resources to finance the provision of basic goods and services to the population, such as education and health care – demands which would otherwise not be satisfied – thus increasing, rather than undermining, efficiency and competitiveness. The tax handle hypothesis is therefore at odds with the idea that globalisation leads to leaner government as a means of boosting efficiency through lower taxes. Because of this tax handle, the correlation between globalisation and the size of government may be strong but unrelated to welfare considerations.

The compensation hypothesis, on the other hand, essentially argues that social spending must be maintained or even increased to compensate workers for the individual risks associated with economic integration. Spending pressures may also arise to improve the quality of 'human capital', therefore boosting competitiveness in a more integrated global economy. In this respect, the evidence reported by Avelino *et al*. (2005) for Latin America suggests that economic integration has been associated with an increase in government spending on education, but only in countries with democratic governments. In this regard, social spending acquires some of the characteristics of public goods, in addition to possibly galvanising political support for the pro-market policies that are needed to foster competition. The expenditure pressures associated with the compensation hypothesis can also be felt at the sub-national level of government, because the central government may try to offload commitments onto state and local governments through the decentralisation of expenditure assignments without a commensurate increase in revenue (Sáez, 2001).

Related to the compensation hypothesis is the 'shock absorber hypothesis' put forward and tested by Rodrik (1997, 1998). The argument is that increasing trade openness makes countries more vulnerable to terms-of-trade volatility, which calls for government-sponsored risk-pooling and hence higher aggregate spending, especially on social programmes. This hypothesis has nevertheless been contested on both analytical and empirical grounds. For example, Tanzi and Schuknecht (2000) argue that the intellectual winds that produced the welfare state were long in coming and became strong exactly in those years following the Great Depression, when the economies became less open not only commercially but also financially (Obstfeld and Taylor, 2002).

A related strand of literature argues that openness has a bearing on political integration and the forces that bind countries together. Openness affects political integration, because stronger international economic linkages tend to reduce the advantages for smaller independent states to be formally integrated into larger jurisdictions. Trade between nations can substitute for trade within nations, and the size of the internal market becomes a progressively less important determinant of national wealth. Therefore, not only the size, but also the number of political jurisdictions or independent nation-states becomes endogenous to social preferences about the provision of public goods (Wei, 1991; Alesina and Spolaore, 1997; Bolton and Roland, 1997; Panizza, 1999). By the same token,

outright secession is postulated to take place when the benefits of economies of scale in public administration and policy coordination are outweighed by the costs of a mismatch in regional preferences over policies, which are affected by globalisation (Alesina *et al.*, 1997). In any case, it is difficult to disentangle the effects of globalisation per se, through greater trade/financial integration, from those related to the political economy of decentralisation of economic decision-making powers to regional or local governments, which is taking place concomitantly in many countries.

As suggested in relation to the compensation hypothesis, openness has a bearing on the vertical structure of government and the extent to which fiscal powers are shared among the different layers of government (Persson and Tabellini, 1996a, 1996b). While decentralisation may be a means of forestalling secession, it also undermines risk-pooling, especially in countries where regional business cycles are not well synchronised and with strong regional specialisation of economic activity. Garret and Rodden (2002) show that international market integration has been associated with fiscal centralisation, rather than with the decentralisation of fiscal powers within states. The central government might enhance the political autonomy and discretion of subnational officials by loosening its regulation and oversight of subnational governments, transforming conditional grants into block grants, and allowing local jurisdictions greater freedom over local schools and cultural institutions, for example, while at the same time centralising public expenditure and taxation. The question of whether the decentralisation of fiscal powers across levels of government is conducive or not to regional development is open to debate and empirical evidence in this area remains by and large inconclusive.

The compensation/shock absorber hypothesis rests on the premise that openness exacerbates volatility and therefore increases risk. This is nevertheless not always borne out by the data. The evidence reported by Iversen and Cusack (2000) on the link between globalisation and labour market risk (measured in terms of unemployment and earnings) is weak, although deindustrialisation (i.e. the shift in the composition of value added over time away from agriculture and industry towards services) in the advanced economies is argued to have heightened demand for social protection. The authors contend that demand for compensation and risk pooling stem from structural changes in domestic labour markets due to technological progress and the falling demand for output from traditional sectors, rather than increased cross-border financial and trade integration per se. These structural changes are hypothesised to have created pressure for redistributive spending, especially where trade unions are strong and centrally organised and governments are left-leaning (Garrett, 1998; Garrett and Mitchell, 2001). Nevertheless, the empirical evidence reported by Kittel and Winner (2005) casts doubt over whether the partisan composition of government is in fact a strong predictor of cross-country variations in the size of government.

The literature on how economic integration affects fiscal outcomes and budget financing, rather than the size and scope of government, has been less prolific. This is surprising, because the efficiency and the compensation/shock absorber

hypotheses make the implicit assumption that openness is, or should be, deficit-neutral: the government's ability to meet the demands for higher spending on risk-pooling and individual compensation is constrained by its ability to raise revenue in a world of increasingly mobile tax bases. At the same time, the efficiency hypothesis overlooks the fact that international competitiveness also depends on the government's ability to maintain a stable macroeconomy, which implies sound public finances. Trade and financial openness may therefore place a higher premium on fiscal discipline at all levels of government. As suggested by de Mello (2005), openness facilitates access to alternative sources of budget financing but also increases market scrutiny over public finances. As a result, budgetary imbalances may worsen as a result of greater access to external borrowing at first, while greater exposure to market scrutiny may play a disciplinary role in public finances.

Empirical evidence: how is budget financing affected by regional economic integration?

The estimation strategy and the data

The baseline model

The hypothesis to be tested is that trade/financial openness affects the composition of budget financing between domestic and foreign sources (i.e. public debt held by residents and non-residents). Openness is hypothesised to be associated with a shift away from domestic financing, because it creates opportunities for the government to borrow from non-residents, which is not possible under autarky. The empirical analysis will be carried out from the point of view of cross-border interregional integration, but the main findings have implications for the design of regional development policies within countries.

The baseline estimating equation is as follows:

$$D_{it}=a_0+a_1B_{it}+a_2C_{it}+e_{it}, \tag{9.1}$$

where D_{it} and B_{it} denote, respectively, domestic budget financing and the budget balance (both in per cent of GDP) in country i at time t, C_{it} is a set of control variables, and e_{it} is an error term.

The hypothesis to be tested is that a_1 in Equation (9.1) is statistically significant, negative and less than minus one in magnitude. This implies that an increase in the budget deficit would require the mobilisation of funds not only from residents but also from non-residents. A one-to-one relationship between changes in the budget balance and in domestic financing would be consistent with financial autarky as far as budget financing is concerned. It can nevertheless be argued that budget financing may be limited to domestic sources even in economies that are financially open because of restrictions on foreign borrowing for budget financing purposes, as well as portfolio preferences, including a possible 'home bias' in

investment decisions. While institutional impediments are more likely at the sub-national government level, where a variety of restrictions remain in place even in OECD countries (OECD, 2002, Chapter IV; OECD, 2003, Chapter V), this is becoming less widespread at the central government level.

In financial autarky, the repayment of accumulated public debt requires a budget surplus, because the debt is held entirely by residents. However, in an open economy, the debt is held by both residents and non-residents, and its repayment requires surpluses in both the budget and the external (balance of payments) current account. In this case, the ratio to exports of the share of public debt held by non-residents becomes important. This is because, if the economy is relatively closed, so that exports account for a low share of GDP, the government is constrained by how much it can borrow from non-residents: it needs to finance the accumulation of external liabilities through foreign exchange. Thus, by increasing the share of exports in GDP, trade/financial openness also increases the government's ability to service its public debt held abroad.

These considerations are related to the recent literature on the association between trade and financial integration. It suggests that trade openness Granger-causes financial openness, controlling for a variety of political economy factors (Aizenman and Noy, 2004), and that, under relatively mild conditions, a reversal in the sequencing of trade and financial liberalisation makes the economy vulnerable to 'sudden stops' in capital inflows (Martin and Rey, 2005). The experience of Latin America is illustrative, because financial openness combined with relative closedness to foreign trade makes these economies prone to balance-of-payments crises, particularly when the fiscal stance is perceived as unsustainable. See also Obstfeld (2004) for more information.

Testing for threshold effects

Openness may affect the composition of budget financing between domestic and foreign sources in a discontinuous manner, a hypothesis that can be tested as follows:

$$D_{it}=a_0+a_1B_{it}+a_2B_{it}*G_{it}+a_3C_{it}+u_{it}\,, \tag{9.2}$$

where D_{it} and B_{it} are defined as in Equation (9.1) for country i and time t; G_{it} is an indicator of the extent of openness, taking the value of '1' when the share in GDP of the sum of imports and exports is above a certain threshold, and '0' otherwise; and $u_{it,}$ is an error term.[4]

By Equation (9.2), the hypothesis to be tested is that is statistically significant, negative and less than one, as before, and that is positive. In this case, domestic financing should become less sensitive to changes in the budget balance, because access to foreign financing is facilitated by cross-border economic integration.

Preferred estimator and data

Equations (9.1) and (9.2) are estimated using the Arellano/Bond (AB) difference-GMM estimator. Robustness checks are carried out by estimating the models in first differences, given that some of the relevant series may exhibit unit roots for some countries, and by the fixed- and random-effects estimators, where deemed appropriate on the basis of the conventional test statistics. Preference for the AB/GMM estimator is due to the fact that the time dimension of the data set is large relative to its cross-sectional dimension, and to deal with the likely joint endogeneity of the regressors and serial correlation in the residuals. When the AB/GMM estimator is used, the results of the step-one estimations are reported with standard errors calculated using the robust estimator of the variance-covariance matrix. The conventional tests for second-order autocorrelation and the Sargan test of over-identifying restrictions are also reported.

Country selection was based on data availability and income level. Data are available from the World Bank's World Development Indicators database. Only countries with GDP per capita above US$ 4,000 (1995 US$) in 2000 were included in the data set. This cut-off point corresponds to the average income level of the sample of upper middle-income countries (WDI definition) during 1970–2000. Lower-income countries would typically not have access to international capital markets on a commercial (non-concessionary) basis. For example, the countries included in the sample accounted for nearly 85 per cent of world net FDI inflows on average during 1970–2000. Elimination of missing observations for the main variables of interest in the baseline regressions reduces the data set to at most 47 countries in the period 1984–2002 (Annex Table 9.A1).[5]

The main variable of interest is the domestic component of budget financing, the dependent variable in equations (1) and (2). The WDI database defines budget financing obtained from residents as the

> means by which a government provides financial resources to cover a budget deficit or allocates financial resources arising from a budget surplus. It includes all government liabilities – other than those for currency issues or demand, time, or savings deposits with government – or claims on others held by government and changes in government holdings of cash and deposits.

Foreign financing is obtained from non-residents and includes all government liabilities or claims on others held by government and changes in government holdings of cash and deposits. Debt guarantees are excluded from both domestic and foreign budget financing and the data refer to the central government only. Although the distinction between resident and non-resident transactions is not always easy, a preliminary look at the data shows that the raw correlation between the budget balance and domestic financing is –0.83 (significantly different from zero at the 1 per cent level, 618 observations).

Several indicators can be selected to control for other determinants of domestic budget financing. In the baseline regressions, two control variables are used: the

ratio of M2 to GDP, proxying for financial market depth, and the ICRG corruption index, proxying for the quality of institutions and hence foreign investors' perception of risk. Financial market shallowness constrains the government's ability to tap domestic capital markets, whereas the perception of risk affects investors' willingness to finance a foreign government. It would have been desirable to control for restrictions on foreign investors' holding of government securities (discussed above), but the information is not readily available for a longer time span. Controlling for the level of public indebtedness would also be desirable, but it is impossible in view of data constraints for most countries in the sample.

The baseline results

The hypothesis that the association between changes in the budget balance and in domestic financing is less than one-to-one is confirmed by the data, controlling for financial depth and the quality of institutions (Table 9.1, Model 1). The hypothesis of financial autarky is clearly rejected in all models. In particular, an increase in the budget deficit by one standard deviation is associated with an increase in domestic financing by about two-thirds of a standard deviation, regardless of whether the model is estimated by random effects (Model 3) or the AB GMM estimator (Model 1). The estimated coefficients are somewhat lower when the budget balance and domestic financing enter the equation in first differences to account for the presence of unit roots in the data, which is likely in some of the countries included in the sample (Models 2 and 4). Including the trade-to-GDP ratio in the estimating equation does not change the results (Models 5 and 6). Trade openness does appear to be associated with lower domestic financing, controlling for the level of the budget balance, financial deepening and risk perception.

The baseline results are reasonably robust to a variety of model specifications (not reported). In particular, replacing M2 by M3 in the calculation of the financial depth indicator, as well as substituting the average import duty for the trade-to-GDP ratio, does not alter the results qualitatively. Both variables enter the equation with a negative sign but are not statistically significant. Neither does the use of domestic credit to the private sector (in per cent of GDP) or the ratio of liquid reserves to bank assets as alternative proxies of financial depth change the results in any significant manners. Both indicators are negatively signed but statistically insignificant. Inclusion of the interest rate spread (i.e. lending rate minus deposit rate) as an additional control variable does not change the results qualitatively; the interest rate spread was found to be positively signed but statistically insignificant.

Substituting the S&P/IFS investment index (annual per cent changes) and the sovereign risk premium for the ICRG index to test the sensitivity of parameter estimates to different proxies of investment risk does not change the results qualitatively. The sovereign risk premium was found to be positively signed and statistically significant in most model specifications, but the data are only available for a sub-set of country-years. The variable was therefore excluded from the baseline specification to maximise the number of observations.

Table 9.1 Openness and the composition of government financing
Dependent variable: domestic budget financing in per cent of GDP

	1	2	3	4	5	6
Lagged dependent variable	0.16*	–0.27***			0.12	
	(0.088)	(0.096)			(0.072)	
Budget balance	–0.55***	–0.46***	–0.64***	–0.50***	–0.48***	–0.50***
	(0.131)	(0.150)	(0.032)	(0.038)	(0.104)	(0.037)
Openness (log)					–2.97***	–3.35***
					(0.797)	(0.708)
Ratio of M2 to GDP (log)	–0.34	0.21	–0.10	–0.06	0.24	0.06
	(0.765)	(0.595)	(0.351)	(0.235)	(0.579)	(0.608)
ICRG Index (log)	1.16	0.26	–0.34	0.09	0.58	0.70
	(1.366)	(1.179)	(0.911)	(0.810)	(1.338)	(0.982)
Estimator	AB	AB	RE	RE	AB	FE
No. of observations	334	330	367	364	304	336
No. of cross-sectional units	29	28	29	29	27	27
Level (L) or first difference (FD)	L	FD	L	FD	L	L
Prob > χ^2 (p value)	…	…	0.00	0.00	…	0.00
Hausman: Prob > F(p value)	…	…	0.13	0.94	…	0.00
Over–identification test (p value)	0.96	0.99	…	…	0.99	…
2nd-order autocorrelation (p value)	0.57	0.49	…	…	0.54	…

Notes
FE, RE and AB refer to, respectively, the fixed effects, the random effects and the Arellano-Bond GMM estimators. Standard errors are reported in parentheses. All models include an intercept (not reported). Statistical significance at the 1, 5, and 10 percent levels is denoted by respectively (***), (**), and (*).

The results are robust to the inclusion of per capita income (in constant PPP terms) among the regressors to control for the level of development of the countries in the panel. The variable was found to be negatively signed but statistically insignificant, possibly because the sample already excludes lower-income countries, thus reducing the scope for cross-country differentiation on the basis of income. Adding changes in the real effective exchange rate and in the terms of trade to the set of control variables does not change the results qualitatively. Changes in the real effective exchange rate were found to be negatively signed, whereas changes in the terms of trade attracted a positive sign, although neither coefficient was found to be statistically significant. Inflation was experimented with as a measure of macroeconomic stability and its inclusion in the regressions did not alter the results qualitatively.

Inflation was found to be positively signed but its statistical significance was not robust across model specifications. Finally, the results are robust to the inclusion of the ratio of government consumption to GDP in the regressions to control for the size of government. The government consumption ratio was found to be positively signed but not a statistically significant level. Likewise, the results are robust to the inclusion of the public debt ratio among the regressors, which was found to be positively signed but not at a classical level of statistical significance. The sample size is nevertheless much smaller in this case.

To test for whether or not the sensitivity of domestic financing to changes in the budget balance is stable over time, rolling equations were estimated and the results are reported in Figure 9.1. The equations were estimated for 10-year windows starting in 1984. The results suggest that since the late-1980s, a period associated with financial liberalisation and increasing cross-border integration, the estimates have become more precise (lower standard errors) and domestic financing has become somewhat less sensitive to changes in the budget balance. This finding is consistent with the hypothesis that openness is associated with greater access by the government to international markets for budget financing, although caution needs to be exercised when interpreting these results due to the short time span for which the data are available. Other factors are also expected to have played a role, including the introduction of the common currency in Europe: for example, non-resident holdings of French government bonds rose from about 15 per cent at the end of 1997 to about 35 per cent by 2002. As of 2002, foreigners held three-quarters of Belgian government long-term bonds and 63 per cent of Irish government debt (Galati and Tsatsaronis, 2003). The liberalisation of trade and investment regimes in many countries over the 1990s, including the emerging-market economies in the sample, is a case in point.

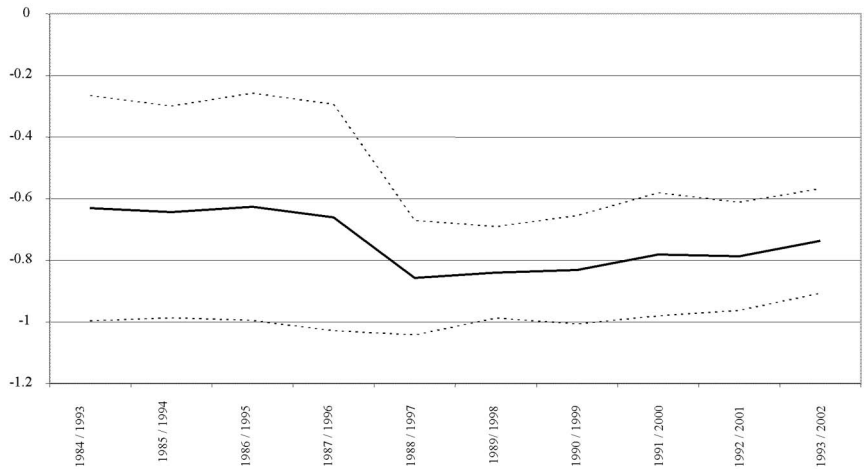

Figure 9.1 Rolling equations, 1984–2002 (based on the coefficient of the budget balance in Equation (9.1) reported in Table 9.1 (Model 1), 10-year windows, and 2 standard-error confidence bands)

Threshold and regional policy spillover effects

Threshold effects

The possibility that the sensitivity of domestic financing to changes in the budget balance is affected by openness in a non-linear fashion was examined by using the trade-to-GDP ratio to identify the country-years with 'low', 'intermediate' and 'high' levels of openness. The cut-off levels were selected based on the sample distribution of the trade-to-GDP ratio: those country-years where the trade-to-GDP ratio lies between the sample median and the seventy-fifth percentile are characterised as having an 'intermediate' level of openness, whereas those in the top quartile of the sample distribution are considered to have a 'high' degree of openness. Based on this strategy, two indicator variables were constructed taking the value of '1' for the country-years in the intermediate range, and '0' otherwise. The same procedure was used to identify the country-years in the high range.

The indicators of the degree of openness were interacted with the budget balance, and the regressions were estimated using the AB/GMM and the random- or fixed-effects estimators, where appropriate on the basis of the conventional test statistics. The results are reported in Table 9.2. The presence of non-linear effects is confirmed when the models are estimated in levels (Models 1 and 3) and first differences (Models 2 and 4), with the exception of the regression estimated by AB/GMM in levels. The results, which are reasonably robust to different cut-off points (not reported), including the splitting of the sample in three equally spaced ranges, suggest that raising openness from low to high levels reduces the sensitivity of domestic financing to changes in the budget balance.

The possibility that trade openness precedes financial openness was investigated. It is possible that economies that are very open to trade may still impose restrictions on capital flows, including for budget financing. This could explain the absence of threshold effects when the model is estimated by AB/GMM. When the lagged, rather than contemporaneous, indicator of openness is interacted with the budget balance, the regression estimated by AB/GMM confirms the existence of threshold effects (Model 5). The findings for the regressions estimated by random effects are robust to the inclusion of the lagged indicator of openness (Model 6).

Fiscal contractions and expansions

The hypothesis that the composition of budget financing differs between fiscal expansions and contractions was tested. This asymmetry would arise if foreign investors were more willing to finance the budget, and borrowing costs were lower in periods of fiscal retrenchment, when governments are perceived as implementing sound policies. This is consistent with the idea that portfolio investors respond to policy signals in the recipient country, and fiscal adjustment may indicate market-friendliness in other policy areas, including foreign direct investment and trade. An obvious caveat is that an increase in the budget deficit may not necessarily imply fiscal irresponsibility. The budget deficit is likely to rise in a recession depending

Table 9.2 Openness and the composition of government financing: threshold effects
Dependent variable: domestic budget financing in per cent of GDP

	1	*2*	*3*	*4*	*5*	*6*
Lagged dependent variable	0.16 ** (0.081)	–0.30 *** (0.079)			0.01 (0.093)	
Budget balance	–0.54 *** (0.080)	–0.79 *** (0.078)	–0.64 *** (0.060)	–0.82 *** (0.088)	–0.74 *** (0.087)	–0.67 *** (0.074)
Budget balance* intermediate openness	0.18 (0.129)	0.34 ** (0.137)	0.14 * (0.075)	0.22 ** (0.105)	0.15 (0.106)	0.16 * (0.084)
Budget balance* high openness	0.09 (0.255)	0.28 (0.237)	0.16 * (0.094)	0.45 *** (0.094)	0.59 ** (0.295)	0.35 ** (0.155)
Openness (log)	–2.26 *** (0.868)	–1.74 *** (0.660)	–2.66 *** (0.736)	–0.03 (0.189)	–3.07 * (1.714)	–0.38 (0.541)
Ratio of M2 to GDP (log)	–0.36 (0.500)	–0.02 (0.438)	–0.16 (0.606)	–0.01 (0.254)	–0.07 (1.300)	0.31 (0.521)
ICRG Index (log)	0.44 (1.339)	0.71 (0.812)	0.75 (0.988)	0.38 (0.794)	–4.30 *** (1.468)	–1.18 (1.193)
Estimator	AB	AB	FE	RE	AB	RE
No. of observations	302	298	335	335	161	184
No. of cross-sectional units	27	26	27	27	21	23
Level (L) or first difference (FD)	L	FD	L	FD	L	L
Lagged openness indicator	No	No	No	No	Yes	Yes
Prob > χ^2 (p value)	…	…	0.00	0.00	…	0.00
Hausman: Prob > F(p value)	…	…	0.00	0.85	…	0.03
Over-identification test (p value)	0.99	0.99	…	…	0.99	…
2nd-order autocorrelation (p value)	0.69	0.44	…	…	0.75	…

Notes
FE, RE and AB refer to, respectively, the fixed effects, the random effects and the Arellano–Bond GMM estimators. Standard errors are reported in parentheses. All models include an intercept (not reported). Statistical significance at the 1, 5, and 10 percent levels is denoted by respectively (***), (**), and (*).

on the size of automatic stabilisers, for example. However, the data on budget balances are not readily available for most of the countries in the sample on a cyclically-adjusted basis, making the analysis somewhat cruder than desirable.

Taking this caveat into account, the results reported in Table 9.3 (Models 1 and 2) provide some evidence that the sensitivity of domestic financing to the budget balance is indeed lower in periods of fiscal retrenchment than during expansions, at least in the case where the equation is estimated by AB/GMM, while controlling for trade openness, financial deepening and the quality of institutions. The results were obtained by constructing a binary indicator variable taking the value of '1' for the country-years where the change in the budget balance is positive, and '0' otherwise, and interacting this indicator with the budget balance.[6] The results are robust to estimating the regressions in first differences.

Regional policy spillover effects

Another aspect of openness and its effect on the composition of budget financing is how governments react to policy in neighbouring countries. This is consistent with the idea of a policy reaction function, which has been estimated in the tax policy literature to take into account the constraint imposed by tax competition (discussed below) on the government's ability to raise revenue. Horizontal tax competition within countries may be predatory, especially when the regions use tax competition as an industrial policy tool to attract investment to their jurisdiction, as discussed above. The risk of cross-border financial contagion would also motivate the estimation of policy reaction functions to gauge the extent of openness-induced changes in budget financing, especially in emerging market economies. The argument is that market scrutiny over domestic policies may rely on regional 'benchmarks', even when the trade linkages among neighbouring countries are weak. For example, sovereign risk premia are highly correlated between Brazil and Peru, although trade between these two countries is relatively small.

Regional benchmarking is related to the fact that investors may optimally choose to mimic arbitrary market portfolios. This behaviour exacerbates contagion and herd instinct in investment decisions when securities markets grow as a result of greater international financial integration, because the cost of extracting country-specific information rises (Calvo and Mendoza, 2000). Information asymmetries are expected to play a more important role in investment decisions in global markets than in domestic markets not only because of political and economic developments but also due to differences in regulations and reporting standards. Changes in sovereign credit ratings and their effect on bond yield spreads (Kaminsky and Schmukler, 2001), as well as gravity considerations (Portes and Rey, 2000), also create regional spillovers, underscoring the need for assessing the effect of globalisation-induced changes in budget financing in terms of international policy reaction functions. This literature focuses on international spillovers but has implications for regional development policies within countries.

To assess these regional policy spillover effects, an indicator variable was constructed for each country in the sample as the average value of the relevant

Table 9.3 Openness and the composition of government financing: fiscal tightening and regional externalities
Dependent variable: domestic budget financing in per cent of GDP

	1	*2*	*3*	*4*	*5*	*6*
Lagged dependent variable	0.15 *		0.08		0.05	
	(0.083)		(0.070)		(0.054)	
Budget balance	–0.50 ***	–0.51 ***	–0.75 ***	–0.80 ***	–0.72 ***	–0.74 ***
	(0.101)	(0.042)	(0.069)	(0.058)	(0.061)	(0.044)
Budget balance* fiscal tightening	0.09 *	0.01				
	(0.047)	(0.050)				
Budget balance* more open than neighbours			0.37 ***	0.42 ***		
			(0.098)	(0.068)		
Budget balance* more foreign financing than neighbours					0.39 ***	0.43 ***
					(0.061)	(0.052)
Openness (log)	–2.34 ***	–3.27	–3.32 ***	–3.56 ***	–2.66 ***	–2.88 ***
	(0.869)	(0.743)	(0.706)	(0.670)	(0.650)	(0.645)
Ratio of M2 to GDP (log)	0.29	0.14	0.00	0.09	0.23	0.16
	(0.472)	(0.685)	(0.418)	(0.574)	(0.519)	(0.552)
ICRG Index (log)	0.97	0.67	0.59	0.99	1.16	1.27
	(1.729)	(1.033)	(1.218)	(0.929)	(1.170)	(0.894)
Estimator	AB	FE	AB	FE	AB	FE
No. of observations	278	320	304	336	304	336
No. of cross–sectional units	27	27	27	27	27	27
Prob > F. (p value)	…	0.00	…	0.00	…	0.00
Hausman: Prob > χ^2 (p value)	…	0.00	…	0.00	…	0.00
Over-identification test (p value)	0.99	…	0.99	…	0.99	…
2nd-order autocorrelation (p value)	0.49	…	0.55	…	0.56	…

Notes
FE, RE and AB refer to, respectively, the fixed–effects, the random–effects and the Arellano–Bond GMM estimators. Standard errors are reported in parentheses. All models include an intercept (not reported). Statistical significance at the 1, 5, and 10 percent levels is denoted by respectively (***), (**), and (*).

indicators in neighbouring jurisdictions.[7] In doing so, the empirical analysis, which has so far focused on regional integration from a cross-border perspective, can be extended to the assessment of policy spillovers within economic areas, and ultimately within countries. The results, reported in Table 9.3, suggest that a country that is more open to trade than its neighbours or regional peers seems to have a lower sensitivity of domestic financing to changes in the budget balance (Models 3 and 4). This is also the case in countries that rely on foreign financing more than their neighbours or regional peers (Models 4 and 5). The results are robust to estimating the regressions in first differences.

From cross-border integration to regional development within countries

The main findings reported above, obtained on the basis of cross-border inter-regional policy spillovers, have implications for the design of regional development policy within countries. While regional governments typically enjoy limited financial autonomy relative to the central government, given the widespread adoption of fiscal rules limiting sub-national borrowing from domestic, and especially foreign, sources in several countries, there is much scope for inter-jurisdictional spillovers in the area of tax policy. Horizontal tax competition, for example, may be used as an industrial policy tool towards regional development. Inter-governmental fiscal relations, including the design of transfers and revenue-sharing schemes, also affect regional government budgets, influencing the choice of development policy instruments by regional governments.

Regional financial autonomy

The financial autonomy of regional governments is often constrained by fiscal rules and/or market forces. Quantity restrictions and securitisation ceilings are common at the regional government level in many countries. Prudential regulations in the form of portfolio composition requirements often cap investors' exposure to regional government debt. Some countries impose a golden rule on regional government budgets, allowing borrowing to finance investment only, rather than current outlays. These constraints tend to limit regional government access to credit markets, domestic or foreign, for budget financing purposes. But, even where they do have financial autonomy to borrow, regional governments may not tap credit markets because they often face an interest premium relative to higher levels of government. The experience of the United States, on which the bulk of the existing empirical evidence is based, suggests that this borrowing cost differential is due essentially to bond market characteristics, reflecting the fact that the central government debt market is deeper and more liquid than that for regional government securities, as well as to political economy and institutional factors.[8]

The main implication for the design of regional development policy is that, where greater subnational financial autonomy is not deemed inconsistent with overall

longer-term fiscal sustainability, ancillary measures can be taken to strengthen public finances at the regional level (i.e. middle-tier and local governments). Stronger budget reporting systems are essential for fostering transparency, accuracy and timeliness in the availability of information on regional government finances, which is a prerequisite for effective market scrutiny over decentralised public finances. In this regard, these measures could facilitate the development of regional government debt market by reducing borrowing costs, at least for the regional governments that will have built a solid track record in responsible financial management. As suggested by the experience of the United States, the existence of fiscal rules at the sub-national level of government, whether self-imposed or not, can do much to boost credibility in the fiscal regime. But, in general, policymakers should guard against the risks posed by decentralised financial management to overall fiscal sustainability, at least until market scrutiny over regional government finances can be strengthened, creating a disciplinary effect on decentralised financial management.

Regional spillovers in tax policy

When faced with limited borrowing autonomy, regional governments may engage in tax competition to boost revenue. Neighbouring jurisdictions – across or within countries – often compete among themselves to attract cross-border shoppers, where the cost of travel is not prohibitive and cross-border differentials in tax rates are sizeable. Empirical evidence, surveyed by Brueckner (2003), among others, suggests that horizontal tax competition does have an impact on tax rates, at least as far as price-inelastic tax bases are concerned, such as excises. Vertical tax competition is also possible when different levels of government co-occupy the same tax base. In this case, taxes in a given sub-national jurisdiction respond to changes in central government taxation in addition to tax policy in same-level, neighbouring jurisdictions. Co-occupancy is fairly common in the case of the income tax, as illustrated by the experience of the United States and Canada, for example. Hayashi and Boadway (2001) estimate a reaction function for the corporate income tax using Canadian provincial data, whereas Esteller-More and Solé-Olle (2001) focus on the personal income tax and use US state data. Brulhart and Jametti (2004) provide evidence for a sample of Swiss municipalities in support of vertical tax competition.

Regional governments may also use tax competition as an industrial policy tool to attract businesses and, sometimes, wealthy residents. This may be predatory to the extent that it erodes tax bases and, consequently, reduces the ability of regional governments to meet the demands for the provision of local goods and services. The experience of Brazil, where the states have considerable autonomy in the value added tax (VAT), is illustrative. Empirical evidence suggests that the states react strongly to changes in their neighbours' tax policy (de Mello, 2007). Effort to curb predatory tax competition among the states has been by and large unsuccessful. Although tax benefits can only be granted in a collegial manner involving all states, there are no formal institutional mechanisms for penalising

non-compliance. At the same time, it has been particularly difficult for the federal government to secure congressional approval for legislation to harmonise the state-level VAT rates and bases, and hence to reduce the scope for predatory tax competition.

The design of inter-governmental transfers affects the extent of horizontal interdependencies in tax setting through fiscal illusion. The regional governments may be willing to forego their own tax revenue through competition because they can rely on revenue mobilised elsewhere to maintain the level of spending. The fiscal illusions associated with these 'common pool' financing problems are well documented and are at the root of chronic budget imbalances at the regional government level in countries where inter-governmental financial management is weak.[9] The implications for the design of regional development policies is that sub-national tax bases should be uniform and regional government autonomy to set tax bases should be limited. Where regional governments enjoy greater autonomy in tax policy, transparency is needed in the concession of tax benefits to businesses, calling for strengthening fiscal reporting systems. A sound institutional framework for decentralised fiscal policymaking is therefore essential.

Conclusions

This chapter's main finding is that trade/financial openness, which is an important pre-requisite for economic integration among neighbouring countries, affects the composition of budget financing between domestic and foreign sources. Increased openness is associated with greater reliance on foreign sources of budget financing. Also, openness appears to create policy spillovers at the regional level. This is related not only to competition for foreign funds, which depends on foreign investors' preferences and portfolio composition considerations, and tend to have a strong regional component, but also to regional 'benchmarking', because sovereign credit risk tends to be highly correlated within regions.

An obvious direction for future research is to further explore the interactions between trade integration and financial liberalisation when assessing the impact of globalisation on fiscal outcomes and the composition of budget financing. The finding that domestic financing responds to changes in the budget balance, albeit not on a one-to-one basis, suggests that cross-border budget financing is not frictionless. This may be due to portfolio preferences, for example, although institutional restrictions also apply. Fiscal rules have played, and continue to play, an important role in anchoring fiscal sustainability. But, to the extent that trade and financial liberalisation go hand in hand, it may become increasingly difficult for governments to impose restrictions on foreign budget financing as economies become more commercially integrated. Policymakers also need to be mindful of the risks associated with mismatches in the timing of trade and financial liberalisation, which may expose the economy to capital flow reversals and balance-of-payments crises.

The main implication of the empirical findings reported above (using cross-border data) for the design of regional integration policy within countries is that

sub-national financial management autonomy creates risks and challenges. On the one hand, financial autonomy provides regional governments with a richer array of instruments to pursue their policy objectives. Nevertheless, if budget/fiscal institutions are weak, greater financial autonomy at the regional government level may be inconsistent with national fiscal sustainability goals. This is because policy spillovers among same-level jurisdictions, and between them and the central government, may weaken the incentives for financial prudence. For openness to play a disciplinary role in decentralised financial management, the need for institutional development, including credible fiscal rules and transparent financial reporting systems, should not be underestimated.

Annex

Table 9.A1 Descriptive statistics (in per cent of GDP, unless otherwise indicated)

	Mean	*Standard Deviation*	*Maximum*	*Minimum*	*No.*
Observations					
Domestic financing	1.7	4.0	30.5	-16.1	620
Budget balance	-2.6	4.8	32.5	-31.3	728
Trade openness (sum of imports and exports)	91.9	53.3	296.0	12.4	987
M2	63.6	35.2	238.2	6.2	689
ICRG score (0–100 range: higher score, less corruption)	76.7	10.1	96.0	25.5	837

Source: World Bank, *World Development Indicators*.
Note: The sample is 1984–2002.

Notes

1 The views expressed here are the author's own and do not necessarily reflect those of the OECD. I am indebted to Vito Tanzi, Jorge Martinez, François Vaillant, Axel Dreher, Peter Jarret, Nanno Mulder, Rolando Avendano, and the participants of the Conference on 'The Role of Government in Regional Economic Development', Vigo, Spain, 18–20 September, 2005, for comments and useful discussions. Mailing address: OECD Economics Department, 2, rue André Pascal, 75775 Paris Cedex 16, France. Tel: (33-1) 4524-8752, Fax: (33-1) 4430-6384, E-mail: luiz.demello@oecd.org.

2 See Agenor (2003) and Prasad et al. (2004) for a review of the literature.

3 See Wilson (1999) for a survey of the literature on international tax competition.

4 The trade-to-GDP ratio is by no means a perfect metric for trade openness. Other variables have been used in the literature, including measures of trade protection, such as tariff and non-tariff barriers, and export intensity. The sensitivity of trade flows to short-term variations in the terms of trade is a disadvantage that needs to be acknowledged.

5 The countries are: Argentina, Australia, Austria, Bahamas, Bahrain, Belgium, Brazil, Canada, Chile, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Gabon, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Kuwait, Luxembourg, Malaysia, Malta, the Netherlands, New Zealand,

Norway, Oman, Portugal, Saudi Arabia, Singapore, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, the United Kingdom, the United States and Uruguay.

6 The hypothesis that the composition of budget financing is affected by the country's external balance was assessed by interacting the budget balance with a variable indicating the periods in which the external current account balance had improved in the previous year relative to the year before. The results (not reported) are not robust across estimators but provide some evidence that the sensitivity of domestic financing is reduced following periods of external adjustment.

7 In the case of islands, the countries in the same economic area were treated as neighbours whenever possible. For example, for the Caribbean countries, the averages were constructed for the other Caribbean countries in the sample. For the Asia-Pacific area, the Middle East, Eastern Europe and the Nordic countries that are not members of the euro-zone, the averages were constructed for the whole of the respective regions. But Gabon, Israel and Malta were treated as individual countries. Greece was considered as Cyprus's neighbour. For the member countries of the European Union, as well as Switzerland, the averages were constructed including the euro-zone countries in addition each country's neighbours. For South America, the broader 'economic' area concept was used: Brazil is included in the average for Chile and vice versa, although these countries do not share a border.

8 See de Mello (2001) for empirical evidence and a review of the literature.

9 See de Mello (2000) for a survey of the empirical literature.

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10 Do new highways attract businesses?

A new microeconometric methodology

Teresa Garcia-Milà and José G. Montalvo

Introduction

Credible and sensitive methods to evaluate the effect of public infrastructures on economic development are critical to understand the economic relevance of these programs. This is especially important since very often governments use the construction of public infrastructures as a generic device to spur growth. The recent emphasis on public infrastructures by international development agencies like the World Bank and the continuing efforts of the EU to finance these kinds of projects makes the search for credible analysis of the impact of public infrastructure even more relevant.

The results of the economic literature on this issue are contradictory and quite controversial. The emergence of the literature on the effects of public infrastructure on productivity and growth took place around the end of the 1980s and the beginning of the 1990s. Most of the initial papers, focused on estimating aggregate production functions, found (incredibly) large elasticities of production to public capital. However, the model specifications and econometric techniques used by these initial papers had many pitfalls. Varying the level of aggregation of the data (national, regional, metropolitan), and using more sophisticated techniques to estimate production functions, the effect of public infrastructure on growth reduces drastically or even tends to disappear. Even if one could rely on the results obtained in the estimation of aggregate production functions, it is under question whether that is the appropriate way to evaluate the long term growth impact of a new or improved infrastructure on the area that has received the investment.

In this chapter we propose a new methodology to measure the impact of new highways on regional economies, diverging from the mainstream studies in two dimensions. On the one hand, we focus on location of new firms instead of aggregate measures of output; on the other we use matching techniques to control for the possibility of endogeneity in the decision of the investment and the location of highways.

The outline of the chapter is the following. Section 1 discusses the basic results obtained using production functions and the drawback of this specification and associated estimation procedures. In section 2 we consider alternative procedures

to evaluate the impact of public infrastructures and, in particular, highways. The review of the literature includes quasi-experimental and matching methods. Section 3 presents our propose methodology. Section 4 describes the characteristics of our methodological proposal and an application to the Spanish case. Section 5 contains a brief summary of conclusions.

The limits to the estimation of production functions

Most of the research dealing with the economic effect of public infrastructures has relied on the estimation of aggregated Cobb-Douglas production functions. The novelty of including public capital as an input, along with labor and private capital, put aside many of the econometric problems that had been identified in the estimation of production functions, both at the firm level or on the aggregate. Therefore, in the first generation of studies on the effect of public infrastructure, the specification commonly used was a Cobb-Douglas production function estimated by OLS, despite the well-known econometric problems posed by this type of production function estimation.[1]

First of all, the estimation of the typical production function, in general, suffers of several important endogeneity problems. There is an omitted variable bias since a critical variable (individual specific productivity shocks) is not observable but is correlated with the observable inputs. Therefore, labor and capital are endogenous. If public capital is included as a factor of production the problem is even more severe since it can be contemporaneously correlated with output because more productive regions can spend more in public capital. Lagged values of public capital do not solve the problem if productivity shocks are serially correlated.

Second, various additional problems may be present linked to the characteristics of the specification chosen. A Cobb-Douglas production function imposes strong restrictions on the substitution among factors. In addition the aggregation of all types of public capital in a single variable implies a strong assumption of homogeneity. Moreover, aggregate functions neglect the effect of infrastructures on individual firms.

All these problems have been well-known in the econometric literature for a long time and, various solutions have been proposed. The omitted variables bias has been tackled using several procedures. Initially the specification was allowed to include a time constant individual effect, which afterwards received the generic name of fixed (correlated) effects specification (Mundla,k 1961, Chamberlain, 1982). As we will detail in the next section, the second generation of studies on the effect of public infrastructure rely on this type of estimator. It should be taken into account, though, that Grilliches and Hausman (1986) have shown that, in the presence of measurement error – likely when capital measures are central to the analysis – the constancy of the individual effect can generate worse results than the simple OLS regressor.

Another solution to the endogeneity in the specification of production functions is to estimate a system of inputs demand using three stages least squares to deal with the endogeneity problem (Jorgenson and Laffont, 1979). Obviously, another

possible solution is to find instrumental variables (IV) correlated with the inputs (labour and private and public capital). The problem in this case is to find suitable instruments since the assumptions needed to argue about the exogeneity of those variables (competitive markets in the case of input prices) may not be adequate.

In addition, when the estimation is carried on with time series, spurious causality due to common trends may also be present. Differentiation or cointegration are then to be called for.

More recently new techniques have appeared to deal with the estimation of production functions, mostly in the context of data from firms. Two of the most successful techniques are the structural approach and the dynamic panel data specification. Olley and Pakes (1994) and Levinsohn and Petrin (2005) have used the structural approach to identify the effect of the inputs in the presence of individual specific productivity shocks.

$$y_{it} = \beta_1 k_t + \beta_2 l_t + \omega_{it} + \varepsilon_{it} \tag{10.1}$$

where k is capital, l is labor and ω is a productivity shock.

The idea relies in the construction of some orthogonality conditions derived from the timing of investment. Capital in period t depends on capital in t–1 and investment in t–1.

$$i_{it} = g_t(\omega_{it}, k_{it}) \tag{10.2}$$

Therefore, capital in period t is, by construction, uncorrelated with the productivity shock (if we assume that productivity follows, for instance, a Markov process). The inversion of productivity as function of investment and capital and the monotonicity condition of the function allows the identification of both parameters in a two stages procedure. Unfortunately, this process cannot be easily applied to the case of aggregated production function with public capital inputs.

The limitations imposed by the Cobb-Douglas specification have been overcome using more complex specification like generalized Leontieff functions or the translog, although most of the endogeneity problems remain.

Besides the econometric problems, mainly related to endogeneity, that can be recognized in relation to the estimation of aggregate production functions, this type of approach to evaluate the impact of infrastructures on economic activity has other limitations. The estimation of aggregated production functions at the national or regional level cannot account for the possibility that some areas displace activity from some others within the same geographical area as a consequence of the building of new public infrastructure. Theoretical basis for this type of results can be found in the economic geography literature that studies the location of economic activity. Work by Martin and Ottaviano (1999) and Martin (1999), study how the reduction of transaction cost due to the construction or improvement of an infrastructure, may affect the location of firms, and overall growth. Outcomes depend on the type of spillovers (local, global), and in whether the infrastructure facilitates intra-regional trade or inter-regional trade. This framework is especially

useful to analyze the impact of a new infrastructure in a less developed area that improves the communication within the area, and that at the same time may improve the connection with a city or area with a high concentration of economic activity. In the presence of local spillover effects, one possible outcome is that the new infrastructure favors higher concentration of firms in the already developed area without any visible impact on the region where the infrastructure is built. Puga (1999) adds an interesting perspective to the analysis by considering how migration influences the results under different degrees of trade costs.

The empirical methodology that we propose in this chapter will be able to discern between these potential different outcomes, and evaluate if new infrastructure in relatively low industrialized areas can attract firms nearby, or if the pattern of firm location reinforces the already developed areas.

Public infrastructure as a factor of production

Most of the studies of the effect of public infrastructure on economic activity rely on the estimation of aggregate production functions with public capital as an input. Although we can find early estimates in Eberts (1986), it was not until Ashauer (1989) obtained a very large output elasticity of public capital (larger even than the one for private capital), that studies on this topic suddenly spurred. The initial studies estimated Cobb-Douglas production functions using aggregate post-war time series data for the United States. The results obtained by Ashauer, supported by Munnell (1990a) and Lynde and Richmond (1993), were questioned by Aaron (1990) and Tatom (1991) arguing that the strong result was due to the spurious correlation that arises from the common trend of output and public capital. When these authors corrected for nonstationarity of the national time series, the estimates were not significant, and therefore the relationship washed out.

To partly overcome the time series problems, state level data was incorporated into the analysis. Munnell (1990b) and Garcia-Milà and McGuire (1992) obtain much lower values for the output elasticity of public capital when estimating state level production functions. Their analysis, though, has a potential endogeneity problem related to an omitted variable bias, state specific productivity shocks, not observable but correlated to the observable inputs. In Holtz-Eakin (1994), Evans and Karras (1994), Holtz-Eakin and Schwartz (1995) and Garcia-Milà *et al.* (1996), state specific productivity differences are taken into account through a panel data estimation that includes state-specific effects. The estimates for the output elasticity of public capital turn out to be very low or even zero. Furthermore, Garcia-Milà *et al*. find evidence that private capital could be measured with error, which in turn would put under question the panel data estimates. More recent work by Fernald (1996) differentiates between industries that are vehicle intensive or not, overcoming some of the endogeneity problems of previous analysis.

The literature on the impact of public capital on the economic activity is very prolific for the case of Spain. This is probably in part the outcome of availability of high quality regional data on capital, both private and public, that has been

elaborated by the IVIE-Fundación BBVA, which distinguishes Spain from other European countries.

The Spanish studies also started using aggregate time series, as is the case in Argimón *et al.* (1993), and Bajo y Sosvilla (1994). Later work moves to regional production function estimates that use panel data techniques and in some cases control for spatial productivity spillovers (Mas *et al.*, 1996). Further work has been done estimating cost functions (Avilés *et al.*, 2001; Boscá *et al.*, 2002; Moreno *et al.*, 2002), or evaluating the effect of public capital on TFP.

When human capital is included, together with public capital, in the estimation of a production function (as in de la Fuente and Vives, 1995), the impact of public capital is reduced and part of the productivity effect is shared with human capital.

Although there is also a large spread of results for the Spanish case, all available estimates, to our knowledge, find a positive (even if it is small) output elasticity of public capital. Nevertheless, the drawbacks pointed out in the previous section on the estimations of production functions as a way to identify the impact of public capital on the economy, apply in general to all these studies.

Randomized experiments versus natural experiments

Since the middle of the 1990s there is a general statistical procedure that has won an increasingly important role in the econometric evaluation of public policies. These methods provide a credible approach to deal with sample selection and endogeneity problems. The number of applications of these methods to economic problems is increasing exponentially.

By analogy with natural and medical sciences, the experimental approach is based on generating a treated and a control group selected randomly and tightly controlled. Several well known experiments like Mexico's PROGESA program, the Proempleo program of Argentina or the vouchers program of Colombia have attracted a lot of attention among economists.

However, the purely randomized experimental approach cannot work easily in the context of the evaluation of the economic impact of public infrastructures. To perform it properly we would need two similar areas in terms of their geography and economic situation. In one a new highway is constructed while in the other no highway is constructed.

Since this approach is not feasible in the context of large public infrastructures, the literature has turned into natural or quasi-experiments. Dehejia and Wahba (1999) show that matching on the propensity score produces very similar results to a randomized experiment. They use as a benchmark the well-known data of Lalonde (1986).

In the context of the impact of public infrastructure on economic performance there are still very few examples in the literature. Hooks *et al*. (2004) consider the impact of the construction of prisons on total employment growth of the counties. They analyze data on new prisons from 1960 until 1994 and evaluate the impact of these infrastructures on the pace of counties' employment growth. They compare

metropolitan and nonmetropolitan counties using a simple differences estimator. The methodology is not quasi-experimental in strict sense, since they do not deal with the endogeneity in the location of the prisons. Nevertheless, Hooks *et al*. (2004) use instruments (unemployment rate in 1970 and total housing units in 1950) to deal with that problem, although it is not clear how exogeneous is the variation of those instruments.

Rephann and Isserman (1994) consider a quasi-experiment to examine the impact of highways construction on counties which obtained a link or are close to those. Their approach does not use matching on the propensity score but a different technique, which implies three steps. First, they apply a sequential calliper, then they calculate a similarity measure (based on the Mahalanobis distance) and, finally, they use the so-called 'optimal matching' to set the twins (treated observation-control). Rephann and Isserman (1994) conclude that the benefits of the interstate system are concentrated on the areas close to large cities or with a high degree of urbanization in the pre-treatment period. Isolated rural areas and areas close to the system do not receive any benefit.

The approach of Chandra and Thompson (2000) is different. They analyze the relationship between interstate highway construction and the level of economic activity. They argue that the construction of a new highway is endogenous in the case of metropolitan areas but it is unrelated with past economic performance in the case of non-metropolitan areas. The U.S. Interstate Highway System was designed to connect major metropolitan areas in the U.S. and serve to the national defense.[2] In principle the fact that a highway goes through a particular non-metropolitan area is a consequence of the need to link two metropolitan areas at the lowest cost. Therefore, for non-metropolitan areas the highway is an exogeneous event.

Chandra and Thompson (2000) use this exogeneity assumption[3] to justify a quasi-experiment in which the treatment group is the non-metropolitan counties in the U.S. that received an interstate highway and the control group is the set of counties that never had an interstate. Chandra and Thompson (2000) also study the effect of a new highway on areas that are close to the counties that received the highway but the infrastructure do not cross their territory. For this exercise they use as a control group the set of non-metropolitan counties that are adjacent to counties that received a highway. Their findings show that non-metropolitan counties that received a highway experience an increase in earnings compare with countries where the highway did not cross through. However, counties that were adjacent to highways counties suffer a reduction in retail trade and government earning. Chandra and Thompson (2000) claim that this finding explains why some authors find no statewide impact of public infrastructure on output.

There are other recent studies that consider the U.S. Interstate Highway System as a viable source of a policy experiment. Michaels (2005) uses the construction of highways to analyze the effect of reducing trade barriers on the demand for skills. Michaels (2005) considers the possibility that political or economic conditions may have affected the specific placement of the highways in contrast with the original design. He proposes to use two instruments to deal with this problem: an

indicator of having the highway planned in 1944 and the orientation of the nearest large city with respect to each county's geographic centroid.

Highways construction and business location in Spain

Most of the microeconometric exercises considered in the previous section deal with the analysis of earning at the county level in the U.S. Since we are interested in the Spanish case it is not possible to use information on earnings at the level of municipalities/counties. Recently Holl (2004) has used GIS techniques to estimate the impact of road transport infrastructure on manufacturing location. He uses a fixed effect Poisson specification to analyze if the municipalities that are closer to a highway attract more new business than the ones further away. Holl (2004) argues that highway construction can be assumed to be exogenous to changes at the municipality level because the decision about the route of the highway is taken at a higher governmental level. Using this exogeneity assumption he regresses the number of new manufacturing establishments on proxies for intra and inter-regional demand accessibility, supplier accessibility and distance to the closest highway. Holl (2004) finds that highways affect the spatial distribution of new manufacturing establishments increasing the number of them in municipalities close to highways. He also finds sectoral differences in the attractiveness of municipalities close to highways.

One important point in Holl's argument is the exogeneity of highways construction. Holl (2004) argues that the prime objective of the highways constructed after 1984 was to improve the link between the major cities, but was not targeted to deal with changes in local demand. This is basically the argument in Chandra and Thompson (2004) and Michaels (2005). However, knowing the political decision process in the Spanish context it is difficult to argue that highways are exogenous from the point of view of municipalities.[4]

A quasi-experimental approach to the impact of highways

We propose an approach that takes seriously the possibility of endogeneity in the placement of highways. The basic idea is to compare the number of new establishments in the catchment area of the roads upgraded to highways with respect to the ones not upgraded. For this purpose some methods have been recently developed to estimate average treatment effect under different forms of exogeneity.[5] The most popular versions of this assumption in the literature are unconfoundeness (Rosembaum and Rubin 1983) and selection on observables. In both cases the assumption is that receiving the treatment (in our case a highway) is independent of the potential outcomes if certain observable covariates are constant. Following the standard notation of the Rubin model for potential outputs let's consider the existence of N units, i=1,…N, which in our case are segments of roads. Each unit has two potential outputs, $Y_i(0)$ for the outcome under the control treatment and $Y_i(1)$ for the outcome under the treatment. Additionally there may be a set of pre-treatment variables, X. Each unit is either exposed to the treatment

(W_i=1) or not exposed (W_i=0). Each observation is completely characterized by a triple (W_i, Y_i, X_i), where Y is the realized outcome.

$$Y_i = \begin{matrix} Y_i(0) & \text{if } W_i = 0 \\ Y_i(1) & \text{if } W_i = 1 \end{matrix}$$

Therefore, the problem is transformed in a missing variables situation in which one of the outcomes is always missing for each observation. We are interested in the (population) average treatment effect (ATE) of the transformation of a road in a highway[6] and, therefore, we want to evaluate the expression:

$$\text{ATE} = E(Y(1) - Y(0))$$

Using the traditional method of moments we can calculate the sample average treatment effect as the sample analog of the ATE:

$$\text{SATE} = \frac{1}{N}\sum (Y_i(1) - Y_i(0))$$

However, this expression provides no information about the (population) average treatment effect without further assumptions. In the context of this framework there are usually two basic assumptions.

Unconfoundness

This assumption implies that the treatment and the potential outcomes are independent conditional on a set of X variables.

$$(Y(1) - Y(0)) \perp W \,/\, X$$

This assumption is the analogous to exogeneity in the context of linear regression. To clarify this point imagine a regression where the outcome depends on some explanatory variables X and the indicator W (receive/not received the treatment). If the outcome is independent of W conditional on X then W and the random perturbation are independent conditional on X.[7]

Overlap condition

The overlapping condition implies that the probability of receiving the treatment must be positive.

$$1 > \Pr(W = 1 \,|\, X) > 0$$

This assumption implies that when, for instance, we match observations in the treated and the control group we can always find observations in both groups with similar probabilities of having received the treatment:

To deal with the likely selection bias in location of highways one can use the propensity score to summarize the influence of the observables on the treatment. The propensity score is the conditional likelihood of receiving treatment

$$e(X) = \Pr(W = 1 \mid X = x) = E(W \mid X = x)$$

This method balances the observed covariates between treatment group and the control group. Therefore, after matching on the propensity score the control and the treatment group are identical in terms of the observed characteristics.[8] Obviously, if the set of X variables would not contain the most important non random determinants of the placement of the highways then it would not be possible to reproduce the results of a randomized experiment. Rosenbaum and Rubin (1983) show that under unconfoundeness, sometimes also called strong ignorability, the matched of control and treatment groups generate an observational analog to a randomized experiment. In fact Dehejia and Wahba (1999) show, using the data of Lalonde from the U.S. National Supported Work Demonstration (NSWD) program, that matching on the propensity score provides very similar answers to the original randomized experiment.[9]

Once the matching has been conducted the evaluation uses differences-in-differences (or double differences) or panel data techniques to estimate the average treatment effect.

The use of matching techniques has increased at a fast rate during the last years. Most of the applications are centered around the evaluation of active labor market programs (training, search help, subsidized employment, etc.). However, in the context of development economics there are several evaluations of the impact of the construction of roads in underdeveloped countries. For example social funds target ask for proposals from communities with preference for poor areas. Some areas apply, some areas don't and some other are rejected. Therefore, some areas receive a road while some other in the same targeted area with poor infrastructure will receive nothing. The ex-post evaluation of such programs is, in our days, mostly conducted using experiments or pseudo-experiments.[10]

Van de Walle (2002) reports the evaluation of a rural road in which using simplistic regressions of incomes of villages that get the program and those that do not seems to indicate a large income gain when, in fact, there was none. Van de Walle and Cratty (2005) compare the kilometers of road rehabilitated in communities that participated in an aid-financed project with a control group of communities that did not participate finding no sign of any impact.

Why quasi-experiments instead of randomized experiments?

Randomized experiments are able to control for observable and unobservable variables in the composition of control and treatment groups. However, as we argued before, randomized experiments are difficult to conduct in the case of the evaluation of the impact of roads and highways. In particular, and opposite to the case of the evaluation of training programs or other educational projects, randomization is not feasible since two important conditions are not met: it would be very difficult to program a large scale project (sufficiently large number of treated and control areas) and it cannot avoid issues of political and ethical constrains imposed by the exclusion of some areas from the program.

Since the randomized approach is not feasible, in general, for the analysis of infrastructures the best available technique is the quasi-experimental approach.[11] There are two basic elements in the matching estimation: the definition of 'distance' of a neighbor and the number of neighbors included in the imputation of the missing outcomes. The adjustment based on the distance can take into account all the covariates directly or use the propensity score. If we consider all the covariates then the imputation is performed in the following way. Let's consider the sample (Y_i,X_i,Z_i) for i=1 to N. Define dm as the distance from the covariates of unit i, X_i, to the mth nearest match with the opposite treatment. Assuming that there are no ties then we include the observations such that m units of the opposite treatment are the nearest to unit i. Define $l_m(i)$ as the index l that satisfies that

$$\sum_{j:W_j \neq W_i} 1\left\{\left\|X_j - X_i\right\| < \left\|X_l - X_i\right\|\right\} = m$$

where 1(.) is an indicator function. The $1_l(i)$ would be the nearest match to i.

Another important issue is the distinction between the analysis of construction of new roads and improvement of already built roads. In the case of the impact of new roads the problem of finding suitable matches for treated units is quite difficult. Much easier is the issue of the improvement of old roads since it is eventually possible to find a match with a non-improved road that can be used as a control. The estimator depends on the definition of the distance used to characterize the 'closeness' of the covariates. Three are the basic alternatives:

1 the generalized Euclidean metric:
$$\left\|x_i - y_j\right\| = (x_i - x_j)' \, diag\left(\sum^{-1}\right)(x_i - x_j)$$

2 the Mahalanobis metric:
$$\left\|x_i - x_j\right\| = (x_i - x_j)' \sum^{-1} (x_i - x_j)$$

3 the propensity score, which is the conditional probability of receiving a treatment
$$e(x) = \Pr(W_i = 1 \mid X = x) = \frac{\exp(X\beta)}{1 + \exp(X\beta)}$$

where x_i is a vector of characteristics of segment i, and Σ is the covariance matrix of the covariates. The matrix of x's should include two types of conditioning variables: physical conditions (surface type, width, etc.) and the socio-economic conditions of the areas covered by the improved road (population density, mix of agricultural/non-agricultural production, education level, sectoral composition of employment, etc.).

How likely is the presence of unobservable characteristics that generate sample selection? Differently from the non-infrastructure programs (which usually are targeted to individuals or households) in the case of roads the selection, if it is

present, is based on the characteristics of communities and other geographically defined conditions. Non-observables like the integrity of community leaders or social cohesion could play a role in projects in underdeveloped countries. In developed countries some of these effects (like the coincidence of the political party in the central/regional government and the majority in the municipality) can eventually be controlled.

Proposed methodology with an application to the Spanish case

The new methodology proposed in this chapter consists of an evaluation scheme to measure the impact of the transformation of national roads in highways during the period 1980–2000. Figure 10.1 presents the situation of the Spanish national/highways system in 2004. Since we want to analyze the upgrade of a road to the category of highway we are dealing with a simple situation in terms of constructing a match for the treated areas. The basic idea is to analyze the number of new establishments around the new highways in comparison with the non-transformed roads. We consider segments of 10 km long as the basic unit of analysis. Among the X variables used to measure the distance between treated and untreated units we propose to include the following:

Figure 10.1 Spanish main roads and highway system (2004)

- population density;
- total population;
- sectoral composition of employment (in particular proportion of industrial and tertiary employment);
- average level of education;
- participation and unemployment rates.

All these variables are calculated using the initial municipality of each segment and the data of the closest census before the beginning of the period.

The previous methodological approach requires of a database of establishments where the exact location is present, to be able to calculate the exact location and determine how many firms are in the catchment area of the different segments of roads and highways analyzed. Probably the only database that contains such detailed information about location are the data of Duns and Brandstreet for Spain.[12] This dataset contains the id of more than 1 million establishments, the exact address, the sector of activity (SIC, four digits), the year of birth of the firm, an indicator for headquarter, the number of employees, the region, province and municipality as well as the zip code. The total number of establishments reaches 1 million. The addresses were transformed into Universal Transverse Mercator (UTM) ED50 zone 30 coordinates by Geomarketing, Arvato Services using GSI software. In some cases (around 10–15 percent) the exact address was not present in the dataset or the GIS system could not find it. In those cases, and since the postal code was present in 99.9 percent of the establishments, the UTM coordinates where calculated for the center of the centroid corresponding to the postal code.

Figure 10.2 shows one possible use of these data in line with the estimations in Duranton and Overman (2005). It presents the non-parametric estimation of the distance among firms in one particular sector (recorded music).[13] It shows that most of the recording studios are concentrated in very short distances, with very low frequencies over 40 km.

In line with our methodological proposal Figure 10.3 shows the location of the establishments in the one small four-digits sector in the north-center quadrant of Spain. The catchment area is 10 km wide, or 200 square kilometers (10 km wide by 20 km long) except for some segments that cannot be 20 kilometers long because they finish, for instance, in the sea. Catchment areas are classified in two groups: the ones that have been transformed into a highway and the ones that have not yet been transformed. In total we have 510 segments: 52 percent of them were transformed into a highway. Each of the transformed areas is associated with a year of transformation. The next objective is to assign the sample of firms to the different catchment areas. At that stage it is critical to have the foundation dates of the firms to know if they started before or after the transformation of the area. In a second stage, catchment areas, transformed and not transformed, but are compared with similar socio-economic characteristics. In particular, the pre-intervention variables are the proportion of workers with secondary education, proportion of university graduates among the working population, participation

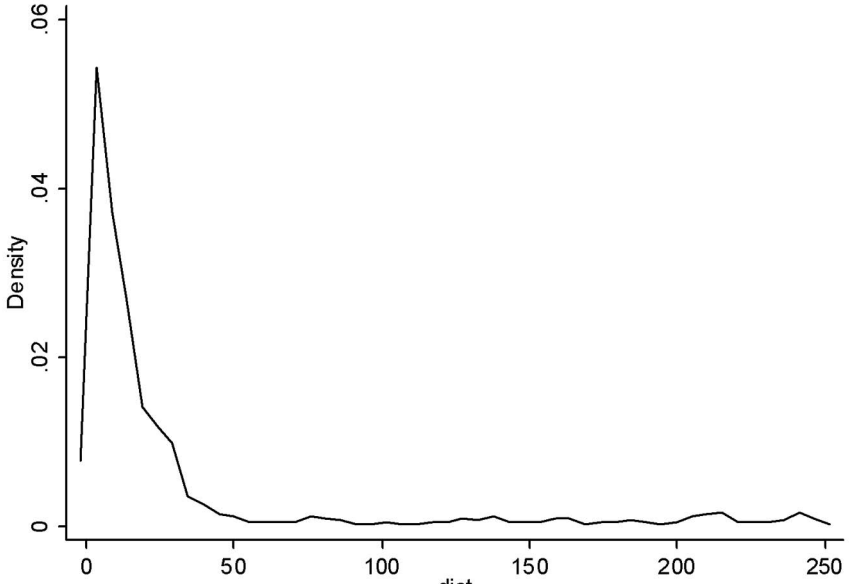

Figure 10.2 Non-parametric estimation of distance across firms: SIC 3562 (musical records)

Figure 10.3 Firms' locations and road catchment areas

Table 10.1 Average treatment effect

Wideness	*Intervention*	*N*	*M=4, GEU*	*M=4, MAH*	*Propensity Score Match*
10 km	Transformation into highway	493	40.62 (1.23)	43.51 (1.26)	30.76 (1.20)

Note
t-ratio between squared brackets; *m* represents the number of matches, GEU: generalized Euclidean distance for matching, MAH: Mahalanobis distance.

rate, unemployment rate, proportion of working population in the agricultural sector, proportion of construction workers in the working population, proportion of workers in the service sector over total working population, proportion of entrepreneurs with workers in the total working population, proportion of entrepreneurs without workers and population density.

Since, as we argue before, not all the catchment areas can have a length of 20 kilometers, the endogenous variable is the number of new firms during the period divided by the number of linear km of the segment (or by 10 square kilometers). Table 10.1 presents the results of the estimation[14] using the three concepts of distance discussed previously (Generalized Euclidean, Mahalanobis and propensity score). The results in Table 10.1 show that, the impact of the transformation of national road into highways is always positive and around 40 firms by 10 square kilometers. However, no matter what measure of distance we use, it is not statistically significant. Therefore, we find that the effect of the transformation is always positive, but it is not statistically significant in terms of the number of firms locating around transformed roads versus untransformed roads. One possible explanation is that many transformations of roads into highways were made for the purpose of improving access to areas of second homes or to facilitate the access to areas where production takes place. It is also important to notice that we are not dealing with the construction of a highway in an area where there was no road previously. Therefore, the reduction in transportation time is not as large as it would be in the case of constructing a high capacity road instead of transforming an already existing national road.

In any case, we have to keep in mind that these are preliminary results. It is quite likely that if we run the same exercise using industries, in some of them (such as road transportation) we find an important positive effect. Finally, note also that we have included all the sectors (including services) and most of the previous studies have worked only with the manufacturing sector.

Conclusions

The evaluation of the impact of public infrastructures is a very important exercise, given that the size of the budget for public works is quite large in all levels of government. During a long period of time, even today, the estimation of production and cost functions has dominated the evaluation of the productive effect of infrastructures, despite the problematic nature of such estimations.

Recently, economists have moved into the application of more credible methods of evaluation than aggregated production, cost, or function. Experiments and pseudo-experiments are quickly becoming the new econometric standard for credible evaluation.

Obviously, running a randomized experiment involving public infrastructures is unfeasible. However, it is possible to search for a set-up that allows a pseudo-experimental evaluation of many public infrastructures. The objective of this chapter is to propose a new methodological approach, based on a pseudo-experimental situation, to evaluate the economic impact of the conversion of national roads in highways. The methodology matches pieces of highways and national roads using a propensity score based on the pre-conversion characteristics of the areas, and a very detailed dataset on the location and characteristics of firms in Spain. The preliminary results published in this chapter indicate that the transformation of national roads into highways increase the number of firms in the transformed segment in 40 by 10 square kilometers with respect to the counterfactual of no transformation. However, this effect is not statistically significant. Future research should test the robustness of this result to other estimators and analyze the reasons that could explain this result.

Notes

1 See for instance the summary in Grilliches and Mairesse (1998).
2 Federal Aid Highway Act of 1944.
3 Chandra and Thompson (2000) present some evidence that support this assumption (page 482).
4 The recent debates and political pressure to determine the route of large infrastructures like the high speed train from Barcelona to Madrid indicate that the exogeneity assumption may be more a desire than a real possibility.
5 In the context of this model exogeneity has a meaning somewhat different from, for instance, the usual definition in time series analysis.
6 There may be other objects of interest like the average treatment effect on the treated, the population average treatment effect, marginal treatment effects, etc.
7 It is possible to use weaker versions of the unconfoundeness assumption.
9 The advantage of truly randomized experiments is that both groups are also identical in the distribution of the unobserved characteristics. However, in the case of the placement of highways the unobservable characteristics are less important since we observe most of the characteristics (location, population, economic structure, etc.) of the areas that could receive it.
9 Lalonde (1986) had already shown that observational methods (like regression) provide the wrong answer due to a large selectivity effect. The non parametric nature of the matching method avoids the strong parametric assumptions implied by other methods of correction for selectivity like Heckman's two stages. In addition it is well known that the parametric methods are very sensitive to specification changes.
10 Except in the European Union where the effectiveness of the funds invested by, for instance, the European Social Fund, is a priori certainly believed very high and evaluations (ex-ante and ex-post) are simply a formality.
11 If a baseline survey is available it would be possible to improve, or check the results, using differences-in differences.

12 We are aware that this dataset has some problems. However, this dataset, referred to the U.K., has been successfully used by Duranton and Overman (2005) in their analysis of the distance between firms in the same sector.
13 Montalvo (2005), Agglomeration and distance across firms: a non-parametric approach, mimeo.
14 Notice that the sample size is not 510 but 493. The reason is the absence of information on some of the variables needed for the distance used for the matching.

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11 Regional growth and environmental regulation

Friends or enemies?

Giorgio Brosio

Introduction

The relationship between environmental regulation and regional growth is rapidly evolving both in the practice and in the literature. The traditional view among policy makers and industrialists is that strict environmental policies will hamper growth, by reducing the competitiveness of firms, particularly of those producing 'pollution-intensive' goods. (See, for example, van der Ploeg and Withagen (1991), and Ligthart and van der Ploeg (1994.)[1]

However, there are recent contributions to the literature referred to in Section 3 of this chapter, which show that, under certain conditions, environmental policy can stimulate economic growth. Also regional officials have assumed a more optimistic view about the impact of regulation on growth, particularly with reference to newer industrial areas. Obviously, positive or negative impacts derive from the intensity and the quality of regulation and on the economic characteristics of the regions. For example, regulatory policies that allow flexibility in compliance will impose on firms lower costs than strict control and command policies. This is because firms will be able to choose innovative and cheaper ways to meet the standards. Moreover, since firms and economies compete on a worldwide market, the impact of environmental regulation on growth depends on the intensity of regulation in each region. On the other hand, stricter environmental policies are harder to introduce and implement in old industrial regions, where firms operating in traditional sectors are subject to intense competition. Here, stricter regulation could endanger their competitiveness.

There is a large agreement in the literature on the relationship that goes from growth to environmental regulation and thus to environmental quality. According to the literature on the EKC, the Environmental Kuznets curve,[2] growth produces a better environment. More specifically, pollution and use of the environment appear to worsen first and then to improve as economies grow, showing an inverted U relationship. Most of this literature has been referred to national economies, but there are no arguments against holding that the assumed relationship should also work at the regional level.[3] In general, the EKC literature does not support per se stricter environmental regulation, but it predicts that it will become stricter, because of higher demand for environmental quality and because of the improvement in

technologies. If demand is the main determinant of environmental quality, then an inverted U relationship should even be more evident at the regional level, because decentralization allows stricter adaptation to preferences, which in turn depend on income levels.

Another, almost unrelated, stream of the literature focuses on regulation of the environment in a decentralized/regional setting. The traditional literature holds that in a decentralized system of government environmental policies are conducive to a typical competition at the bottom. This is because regional governments will reduce environmental standards and/or taxes to keep on their territory the existing firms and/or induce the relocation of other firms on their territory. The consequence of this competition is that, either environmental policy is centralized, or it will be kept at an insufficient level. This would deny regional regulation and render this chapter useless.

However, according to the evidence surveyed in the main review of the literature (Oates *et al*., 2001) the real world provides very scarce evidence on the race to the bottom. There is a lot of decentralized environmental regulation and there is no sentiment that it is kept at an insufficient level.[4] Moreover, in general richer regions have higher levels of environmental standards than poorer regions. This is a statement that is difficult to test, since measuring differences in regulation is hard. However, some indirect, but rather convincing evidence can be provided. For example, California is an outstanding case of the relationship between stringency of regulation and high growth. Another indication is provided by the fact that rich Italian regions introduced environmental regulation and instruments for control long before the poorer regions (Capozza and Garrone, 2007). As Diego Martinez shows in his comments on this chapter, in Spain there is a clear, positive correlation between regional GDP and regional expenditure for environmental protection. Again, per se, stricter environmental regulation does not seem to be an absolute hamper to growth.

In a regional perspective the analysis of differential impacts and interactions among regions of environmental regulation is crucial. For example, richer regions may manifest higher preferences for environmental quality than poorer regions. The former will reduce their level of pollution and shift some of their more pollution-intensive productions to other, poorer, regions. However, reduced environmental quality could induce movements of skilled labour force towards the richer regions, offsetting the previous advantages. But is it to be taken for granted that poor regions will stay inactive and will not increase their environmental standards at their turn?

Answering these questions requires the consideration of a host of factors, such as individual preferences for environmental quality and other goods, the characteristics of the political system, the evolution of technologies, especially of the link between production, consumption and environmental damage, the structure of the regional economy and its relations with the external world. In addition, environmental regulation can be pursued by the central or the regional governments with, plausibly, highly different results.

Given these difficulties, the chapter presents a simple analytical framework that basically helps to explore the links between the environmental regulation supplied by regional governments and regional growth. It makes use of the existing literature trying to adapt its mainly national focus to the regional context. Two main findings emerge. First, regional environmental policies seem to have a limited (negative) impact on growth, even after considering that in a regional setting the presumed or effective mobility by firms could discourage regional governments from introducing higher environmental standards. In some circumstances regulation could even be beneficial to growth, if not too intense. The second finding is that regulation at the regional level may amplify disparities between different regions, because of differences among regions in preferences, in the efficiency in regulation, and in the availability of regulatory instruments.

The chapter has three sections plus concluding remarks. The first section presents the analytical framework used. The second section deals with preferences for environmental quality. The third section considers the choice of regulatory instruments concerning environmental policies. The impact of increased environmental standards on the level of economic activity is explored in the third section with a focus on the effects of decisions about relocation by firms and individuals. The conclusions are presented in last section.

The analytical framework: looking for an optimal regulatory policy

To be as neutral as possible in a field where values and interests have such a huge weight, I use a purely definitional notion of an optimal regulatory policy. Individuals derive utility from environmental policies and are subject to their costs. In principle, one has to assume that economic activity can be imperiled by stricter environmental standards, at least in the short term. Individuals appreciate a cleaner environment, but also the advantages of the current level of economic activity, since it produces jobs, salaries, and profits.

In its simplest form, the utility function for individual *i* can be written as:

$$U_i = m_i\, a_i\, Q_j + b_i\, E_i$$

where:

m_i are his/her preferences for a cleaner environment, which can be more or less closely approximated by the government;

a_i is a simple parameter that transforms the reduction of pollution into utility;

Q_j is the reduction of pollution brought up by the policy of region *j* (A or B);

In turn, Q_j can be expressed as a function of the instruments chosen with an efficiency transformation *g*; that is, $Q_j = g\, R_j$, where *g* is an efficiency factor applied to the instruments chosen by region *j*;

b_i is a parameter that transforms the current level of economic activity into utility;

E_i is current level of economic activity.

An increase in regulation increases the utility of individuals, through higher environmental quality: That is:

$$\delta Q/\delta R \geq 0$$

At the same time, an increase in regulation decreases utility through a reduction in economic activity:

$$\delta E/\delta R \leq 0$$

Thus, there is for each individual an optimal level of the policy that maximizes his/her total utility and that is determined by equating marginal benefits from environmental regulation policy with its marginal costs.

A classical utilitarian regional government, with no preferences for itself, would maximize the aggregate utility of its citizens. The optimum solution depends on a number of factors, such as the preferences of citizens for both environmental quality and the level of economic activity, the impact of stricter regulation on the level of activity, the efficiency of the regulatory policy and so far. The optimal policy is also affected by economic and political interactions between the two regions. I will observe these factors in turn, reviewing the relevant literature.

To highlight the main issues and to keep the length of the chapter to manageable proportions, I introduce a number of simplifications.

a There are two regions: A more developed and B, less developed. The impact on the environment originated by their industrial structure is broadly similar. A has more industry than B. Potentially, this could mean more pollution. At the same time, industry in A has more modern sectors and firms, which pollute relatively less per unit of output (or, possibly, per worker).

b There is only an environmental policy, for example the control of air pollution.

c This policy is assigned to the government of the regions. These governments have, in addition to environmental air control, other policy responsibilities, such as building and operation of infrastructure, education, industry promotion.

d There is no overspill of pollutants between regions. In other words, pollution in A cannot reduce the environmental quality of B via the diffusion of pollutants in the latter, and *vice versa*. This is a rather strong assumption, considering that overspilling of air pollution between regions and even countries (e.g. acid rains) is a case of environmental conflicts and of environmental analysis.[5] However, in the context of the present chapter assuming that there is no overspill amounts to assume that regional regulation policy is dictated only by its impact within regional boundaries, which is the content of the next assumption.

e Citizens in each region are interested only in what happens within their region. In other words, there is no interregional interdependence in utility

functions. This is another strongly simplifying assumption, considering that in the real world there is growing evidence that environmental quality in an area – for example, the Amazonian forest – enters, as an argument, into the utility function of residents of other areas, either a because they assign a value per se to it, or because they actually use (or intend to use) the forest for recreational purposes. In fact, concerned citizens around the world are showing a growing willingness to pay for conservation of the Amazonian forest. There is also a rising demand for centralization in a supranational authority of regulation of forest conservation.

f Preferences concerning the environment and other goods are homogenous within each region and non homogenous between regions. This is the typical fiscal federalism hypothesis, that is increasingly questioned by empirical evidence. However, in the framework of the present chapter it does not lead to a substantial loss of hindsight.

g There are economic interactions between the regions. Goods are traded, residents, workers and capital move between the regions. However, the system is not closed. Regions have economic interactions also with other areas.

h Finally, I consider that there are political interactions between the two regions. In particular, citizens of less developed and/or the more polluted region may observe choices made in the other region and ask, if its outcome looks positive, their government to follow the example. However, I will not model explicitly benchmark competition in environmental policy.

In the sections that follow the ingredients of the optimal regulation policies are analyzed and empirical evidence on them is presented. We start from preferences for environmental quality and thus from demand for regulation. The choice of instruments for regulation is then presented. The relative efficiency with which they are used is also briefly considered. Then, we come to the core of this chapter: how increased environmental regulation is likely to impact on growth.

Preferences for the environment (m_A and m_B)

Most of the literature on the impact of growth on the environment considers that a cleaner environment is a superior good, its demand increasing when people become richer. In other words, the emergence of environmental awareness is correlated with affluence.[6] Social scientists have provided a number of explanations (see Duroy, 2005, Martinez-Alier, 1995 and Magnani, 2000, for short reviews). Sociologists (see Inglehart, 1990, 1997) have suggested that, when income grows individuals shift their preferences from material to immaterial goods, such as a cleaner environment and focus on increased quality of life, rather than on material gains alone. Maslow's (1954) hierarchy of needs provided an explanation on similar lines. In essence, environmental quality satisfies high order needs that are felt once lower order needs, such as food and shelter, are satisfied.

There is resistance to this explanation and a number of researchers (including Duroy, 2005 and Martinez-Alier, 1995) have objected that environmental

awareness has also other determinants, such as the level of education (that is, however, closely correlated with education). Marsiliani and Renstrom (2000) suggest that equality of income and wealth is also an important determinant of the level of environmental preferences in a society. According to my reading, they still maintain that poor people have lower preferences for the environment because: 'Individuals with a higher marginal utility of consumption (the poorer ones) have a lower marginal rate of substitution between environment and private consumption if environment is not an inferior good' and are concerned with the loss of jobs that sustain their consumption. In a more equal society, however, there will be a smaller number of these persons, making the median voter richer and more sensitive to environmental issues.

There is no necessary contradiction between those who assign importance to income considerations and those who deny it. As pointed out by Duroy,

> the type of environmental concern expressed in wealthier countries is focused more on global issues, such as climate change and ozone depletion, while in poorer countries it tends to be more local (industrial development threatening traditional activities in certain communities). In the latter case, protection of the local environment is a lower-order need because it directly affects subsistence needs.
>
> (2005: 5)

In general, however, one can observe that environmental standards tend to become more stringent as countries grow and that large scale environmental programs are correlated with a nation's GDP level, while individual awareness and involvement in environmental protection may manifest themselves somewhat independently of the level of economic growth. The disparity between the actual policy standards of distinct regions and the individual awareness and preferences for the environment, that according to some authors are not influenced by income conditions, may be explained by the budget constraint of poorer regions. More specifically, since poorer regions have more difficulties to compensate firms affected by regulation, they may feel constrained to attenuate the level of their regulation.

Summing up the arguments, it would appear that m_A *is* likely to greater than m_B and that region A would set higher environmental standards than region B, unless there is substantial interaction of preferences between the two regions that induces region B to set its standards according to those of A.[7]

A short digression on the interpretation of preferences

As explained in the first section, the chapter does not enter into the realm of the political economy of environmental regulation. It assumes homogeneity of preferences within each region and allows some difference of preferences between them (which is, however, not essential for the argument). It also assumes that governments maximize a utilitarian social welfare function. Thus, environmental

regulation is assigned to regions and is not constrained by the pressures coming from the concerned firms. To maximize the utility of their citizens regional governments have to interpret with complete accuracy the preferences of their citizens, the m_i.

Since the policy is assigned to regions, it is likely, according to the literature on decentralized government, that regional governments will be able to ascertain quite precisely the preferences of their citizens; at least, they will interpret them more accurately than the central government. If preferences diverge by regions and if regional governments formulate their policies as to satisfy them, then environmental regulations will be diversified accordingly, setting up more interactions than in centralized setting.

The choice of the instruments (R_j)

The same level of pollution abatement can be obtained with very different instruments. There is a wide availability of them. Textbooks rank them in three categories: first, bargaining/institutional solutions, such as the codification of liability, or the releasing of public domain information on polluters; second, command and control instruments, such as controls on inputs, controls on outputs, imposition of a specific technology, output quotas, ceilings on emissions, planning and location controls and third, market based instruments, such as taxes on products or on emissions, subsidies, marketable trading permits, etc. Each instrument has a set of attributes. It can be more cost efficient or less cost efficient; it impacts in various ways on the distribution of income and wealth and has a different incentive structure. For example, the imposition of a specific production technology – an instrument widely used in the US for air pollution abatement – is considered by a majority of experts as having non favorable long term effects, since firms stick to the imposed technology and disregard the options that could enhance their long term competitiveness.

Cost effectiveness has clearly an immediate impact on growth, since it involves the use of smallest amount of resources to reach a specified target of abatement, saving resources for investment. It is an important, but not dominant criterion. Monitoring and enforcement are also important factors that impinge on the choice of instruments. Command and control instruments, while less efficient – since they impose the same solution to everybody – are generally less costly to implement and easier to monitor. This explains their widespread use. Finally, there are interactions between the impact of an instrument on the distribution of income and its impact on long-term growth. For example, region A could choose to impose a specified technology to reduce air pollution and pay a subsidy to firms go cover the costs. The degree of competitiveness of firms will not be affected, at least according to a partial equilibrium analysis, since partial analysis does not consider the opportunity cost, in terms of growth promoting policies, of the subsidy. It could have more long term undesirable effects, since firms are not induced by the existence of the subsidy to look for innovations, as mentioned before.

Clearly, distinct instruments have different appeals to regions, when the choice is devolved to the regional level. Region A, being richer than B, has a wider choice, given also its lesser budget constraints. Different time preferences would also impact. Region A could have a longer term perspective than region B, and could be induced to introduce instruments that would enhance the long term competitiveness of its firms. Unless the central government intervenes with transfers that give to each region an equal opportunity of choice among instruments, it is likely that region A would, *ceteris paribus,* that is, with similar level of abatement, choose instruments that increase in the long term its competitiveness relative to region B.

The choice could be, and in the reality is, determined also by the concerned firms, as is widely discussed in the literature (see Oates and Portnoy, 2001 and Jaffe *et al*., 1995). Firms will exert pressure to bend the choice of the instruments with a view to their interests. However, there is a variety of interests and conflicting claims between firms. Old firms could ask for the 'Grandfather Clause' that would subject only the new firms to the new regulation. This clause would have possibly adverse effects on the growth of the regional economy. Firms can also pressure for the choice of an instrument that is expected to produce adverse effects on their competitors, thus increasing their market power. A tentative conclusion from all this is that, not only differences in the level of growth can impact on the choice of instruments, but also the structure of the economy, more specifically the share of old versus new industries.

A digression on the efficiency of regulation ($Q_j = g\, R_j$)

The cleaner environment, Q_j, is the result of the introduction of an instrument, R_j, and of the efficiency, g, with which it is used. Let us consider here the efficiency parameter, and postpone for a while the analysis of the impact of the instrument on growth. The efficiency with which the instrument is used may diverge between regions. This is, in general, a result of differential of productivity between regions. The fact that a region is poorer than another region implies that the productivity of the inhabitants of the latter is lower, whatever the reason. Otherwise, there would be no differential in income. Differences in productivity are evident in the public sector and thus, presumably, in the efficiency with which environmental policy is enforced. This means that, with the same intensity of regulation, its administration costs will be lower, and/or that the costs of compliance by firms will be lower in the richer region. It has also to be remarked that this differential in efficiency is not necessarily due to the existence of a regional administration; that is, to decentralization. In other words, this differential could persist even with central administration.

The main conclusion suggested by the arguments advanced in this section is that decentralization of environmental regulation will end up in a wide variety of policies. Richer regions would have a larger freedom of choice than poorer regions and would likely to be able to use more efficiently their chosen instruments.

Higher environmental standards and the level of economic activity ($\delta E/\delta R$)

Let's now suppose that one or both regions increase the level of their standards and that the increase is higher in A than B and try to enucleate the impact.

Without mobility of firms and individuals

With constant technologies, higher levels of environmental stringency have a negative impact on the level of economic activity. This is the reverse of the argument that growth generates more pollutants. More specifically, if when an economy grows all its activities expand proportionally at the same rate, increasing total output requires more inputs, including natural resources. Furthermore, a by-product of increased economic activity is increased production of waste and emissions. If now the government reduces the permitted emissions of pollutants in the region this will, *ceteris paribus*, impose an immediate cost on firms by reducing their free access to a natural resource; namely, the use of the environment. If firms do not immediately adjust to the new requirements by investing in pollutant reducing equipment and/or reducing operating costs, they will be forced to reduce their level of activity. The reductions will be concentrated in the 'dirty' sectors. Thus, the impact will depend on the relative importance of these sectors. However, in regions with a huge presence of old and 'dirty' sectors, it is likely that the impact will be mitigated by exempting older plants from new requirements, and by requiring compliance with the new standards only from new plants (the 'grandfather clause'). But then, environmental policy would lose its stringency and we would no longer proceed in our analysis.

We are left with uncertainty about the likely impact and the conflicting results of the literature do not provide conclusive evidence, neither to policy-makers, nor to analysts. This is exemplified by the US about-face on the ratification of the Kyoto protocol between the Clinton and the G. W. Bush administrations. It witnesses not only political gaming, but also uncertainty about the impact on growth of a more stringent environmental policy. A report issued in 1998 by the Council of Economic Advisors estimated that the reduction of CO_2 emissions would imply an annual decrease of GDP of less than 0.5 percent, no negative effect on trade deficit, a negligible impact of the price of gasoline, lower electricity rates and no significant impact on aggregate employment.

Other studies, especially those sponsored by industry groups, showed a different picture: costs would be substantial and include an expansion of the trade deficit, cuts in the number of jobs by the million and substantial increases of gasoline prices and electricity rates. The loss of jobs has been a critical factor for shaping the attitude of legislators. Already in 1997, during the negotiations, the U.S. Senate passed by a vote of 95 to 0 a non binding resolution that stated that the U.S. should not accept climate agreements that did non ask similar sacrifices to all participants. As Shogren (2004) explains, Democrat and Republican senators had very little incentive to pass legislation that would impose perceived costs in

terms of jobs in their states, with uncertain benefits that were not mobilizing the large public around the issue.

Coming back to our argument, there is an initial and immediate scale effect on output *via* costs and thus on competitiveness, if technology is not changed or, alternatively, if the rest of the world does not follow region A. This effect can be corrected by the composition effect. This is a major argument advanced by supporters of environmental regulation. First, some sectors that provide environmental services, such as producers of gas, or water purification equipment, may immediately benefit from regulations imposed on their customers. (The literature, see Jaffe and others, 2005, provides factual examples.)

A similar beneficial effect could accrue to producers of more environmental compliant goods. For example, producers of small, fuel efficient cars can receive a net benefit from stricter emission standards, if they can cut a share from the market of less efficient cars that will compensate them for their direct costs of compliance. Third, comes the more discussed impact on technological innovation. The idea, here, is that stricter regulation forces firms to reconsider their production processes and to find out new technologies that, not only will comply with the new standards, but will also allow overall cost reductions or increases in output. The idea has been forcefully forwarded by Porter (1991), but found considerable skepticism in the economic profession. This skepticism originates in the question of why firms should wait for environmental regulation before engaging in productivity enhancing investments. In other words, the impact on technological innovation is subject to a non profit maximizing behavior by firms. However, there is some limited literature on this effect (for example, Barbera and McConnell, 1990). It is also plausible that stricter standards should accelerate closure of highly inefficient plants, and their substitution with newer and more efficient ones.

To be true, if there is a pronounced decline in general economic activity, the composition effect should work in the same direction of the scale effect, since neither individuals nor firms will have the resources to purchase more fuel efficient cars or better water purification equipment. However, it is unlikely that the regional government would introduce a new regulation with a devastating impact on its economy.

Introducing mobility of firms

Higher standards in region A can induce firms to relocate to B, if the cost of relocation is lower than the cost that firms have to sustain to change the production technology to comply with higher environmental standards. The fear of relocation is the factor that originates the race to the bottom of environmental policy, when it is decentralized to the regions. This is one of the most debated issues in the theory of environmental federalism (see Oates and Schwab, 1988; Oates and Portnoy, 2001). To our present purposes it is not essential to check if this race to the bottom does effectively takes place. Rather, it is crucial to verify if firms actually respond to environmental stringency by reallocating their plants to other regions, such as B.

Relocation of firms is dictated by a number of considerations, such as the market to serve (this consideration impacts mostly on relocation across national borders), the quality of the work force, the availability of social, political and physical infrastructure, the tax pressure and now, increasingly, the quality of life. Environmental regulation is thus one of these factors and likely not to be the most important one. One has also to distinguish between relocation of existing plants, which is a more remote occurrence given the importance of relocation costs and the location of new plants. Studies on relocation (see the classical review of Jaffe *et al.*, 1995; Woods, 2005, for a contemporary survey) show that firms do relocate when they face important production cost differentials, but environmental regulation costs do not seem to play a big role in total cost differentials and thus in the relocation decision of firms (see also Duffy-Deno 1988; Bartik, 1985; Plaut and Pluta, 1983). Other studies (Bartik, 1988, 1989; Levinson, 1992) find that stringency of regulation has some limited impact on the start-up of small firms, or on the location decisions of plants of highly intensive polluting goods producing firms, but the overall impact should be small. In general, thus region A would lose little and region B would gain even less.

Brief considerations on interregional trade

Stricter environmental regulation in region A induces specialization in less pollution-intensive productions in the same region and larger imports of pollution-intensive products from region B. This can represent an advantage for B from keeping lower environmental standards. However, this advantage could be balanced by imports by B residents of environmental friendly goods and inputs from region A, if B increases somewhat its own levels of environmental standards. The final balance is thus an empirical issue.

Trade-off between environmental stringency and other policies toward firms

Regional governments are caught in a hard dilemma. On the one hand, they have to respond to the aspirations of the large proportion of their voters. Evidence and the literature (see Farber, 1992; Vogel, 1993) show that preferences for a cleaner environment have become much stronger in the recent decades and that politicians want (or have) to satisfy them for fear of losing next election. The public wants actual outcomes and not only symbolic legislation, or policies. This means that not only laws have to be approved, but also that they have to be enforced.[8] On the other hand, governments feel direct pressure from firms, and indirectly the pressure of voters who are closely concerned with the fate of firms that have to bear the burden of regulation.

To solve this dilemma, regions can attenuate the impact of regulation on firms, by increasing their own investment for pollution abatement – that is, they can substitute public for private expenditure – or they can reduce taxes and/or other burdens on firms. As a consequence, one can in reality observe stringent

environmental standards and no relocations and, at the same time, not be allowed to imply that stringency would never impact on relocation. At the same time, this would imply that stringent environmental regulations have a real cost, although it is dissimulated.

This would imply also that, if the regional governments are really intent on maximizing their citizens' welfare, these combinations of environmental standards with other instruments may not be welfare enhancing, contrary to what is presented by the literature on the argument (see Oates and Schwab, 1988, 1996).

As always, opportunities are not equally distributed among the regions. Richer regions, with larger per capita budgets, have more possibilities than poorer regions with stricter budget constraints. The latter may thus be forced to introduce softer environmental regulations than the former, being less able to compensate the firms that could lose.

Coming to our regions, all the preceding arguments show that the impact of differentials in environmental stringency is expected to be small. In other words, region B will have only marginal gains from keeping a differential between its standards and those of region A. This stems not only from the previous arguments about the weak propensity of firms to relocate, but also from the consideration that in an open world firms have plenty of locations to consider and B is only one among them.

Finally, the relative size of the regions may be relevant and it could lead to attenuate some of the previous considerations. If B is small compared to A, it could receive a substantial (compared to its size) number of relocations. If it lowered its environmental standards, then the quality of its environment would immediately suffer.

Introducing mobility of individuals

The improvement in the quality of the environment makes a region more attractive to its residents. This has some economic relevance. A tenet of the theory, supported by frequent empirical observation, is that to accept working with high levels of recorded pollution individuals ask for higher salaries. If there is symmetry in the relationship between wages and environmental quality, wage requests by workers should decrease with less pollution, since their money income is supplemented by (in kind) environmental income, allowing firms to pay (part of) the cost of pollution reducing investments.

The trade-off salary/pollution should be larger with highly paid and skilled workers. If the relation between environmental awareness and salary levels holds, highly paid workers should accept larger reductions in their salaries. Employment in these sectors should increase through new start ups and relocations from other regions.

Residents may also migrate among regions according to differences in environmental quality. This can exacerbate disparities, if those who leave have higher income and higher preferences for environmental quality.

The previous considerations are part of 'Growth follows amenities' doctrine. The theory maintains that, increasingly, firms include environmental quality in their location decisions, taking into consideration the preferences of their workers, particularly of their managers. There is surely a grain of truth in this argument, but one has to avoid overstating its importance, considering the host of factors that impact on relocation decisions of firms, as previously illustrated.

Conclusions

On a balanced view, and excluding trade and other spatial interactions, moderately stricter environmental policies have a limited negative impact on growth. They impact negatively on highly polluting sectors, but stimulate environmentally friendly techniques and products.

Introducing trade and relocations of firms does not fundamentally alter the previous conclusions, unless there are huge differentials in standards; that is, unless distinct regions introduce very stringent standards that are not followed by the other regions. While this could be a likely occurrence on a worldwide scale, it appears most unlikely when we consider regions that are part of the same country.

The smallness of the impact of environmental stringency is explained by the fact that the burden (and the advantages) of environmental policies is only a component of the whole costs that impinge on production and relocation of firms (with the exception of highly polluting sectors).

Individual and politicians, who represent them, may have different perceptions. In fact, most of the literature shows that decision-makers frequently behave as they were certain that environmental policies have a strong and real impact. Thus, poorer regions might be induced to distance their environmental standards from those of the richer regions. But, if the economic impact is minimal, then their inhabitants will receive a net disadvantage. These prospects can change slightly if a poor region is located close to a big sized and rich region.

Exaggerated perceptions of a strong impact of environmental regulations are frequently nourished by the actions of lobby groups. They may be a reason for the centralization of standards. However, this reason is not compelling, since provision of correct information is possibly another alternative, especially if we believe that citizens have the capacity to determine the policies of their government.

The analysis also shows that decentralization of environmental regulation may increase disparities in environmental quality between regions, the more so the less environmental regulation impacts on growth. Richer regions are likely to introduce stricter standards. They are also able to choose better instruments and to use them more efficiently, while poorer regions may be induced to choose less efficient instruments that can impact on their long-term perspectives.

At the same time, centralization, that is the choice of the instruments by the central government, is not necessarily a good alternative. Decentralization may work as a laboratory for new techniques and policies, which can be transferred from the leading region to the other. At the same time, equalization transfers may

compensate poorer regions for the costs of choosing instruments with higher long-term efficiency.

The last message of the chapter is that strategic use of environmental policies to promote growth depends on the industrial characteristics of the regions concerned. The presence of old industrial sectors acts as a restraint, while regions freed from this kind of legacy can clearly engage more easily in environmental friendly growth-promoting policies.

Notes

1 This is the so-called Porter hypothesis (1991). See, also, Bovenberg and de Mooij (1997); Bovenberg and Smulders (1995); and (1996) Nielsen *et al.* (1995).
2 See, for reviews, Borghesi (1999); Brock and Taylor (2005); Grossman and Krueger (1991) and (1994); Seldon and Song (1994); Shafik, (1994); Shafik and Bandyopadhyay (1992).
3 De Groot *et al.* ((2004) provide one of the few analysis of the Kuznets curve at the regional level. They focus on China. It has to be stressed, however, that the size of Chinese regions is larger than most European states. Evidence is quite mixed. The shape of the relation between growth and the quality of the environment depends on the pollutant that is considered and on the specification of the variable used for it. For example, only for waste gas in levels there is a clear Kuznets pattern, but when gas emissions are modeled in per capita terms, emissions increase with income. However, when measured per unit of output they decrease with income. Waste water shows a continuous increase in quality associated with growth. For solid waste measured in levels a N shaped curve is found: the quality increase after a sharp decrease. But again when solid waste is measured per capita no significant relation is found with income. Clearly, China still faces problems with the environment and does not provide a strong case in favor of the Kuznets curve, although its per capita can be still considered to be too low to be able to ignite a virtuous circle between growth and environmental quality.
4 For example, List and Gerking (2000) analyze the devolution of responsibilities to the American states during the Reagan years and look at levels of environmental quality and abatement expenditures. They conclude that '… the race to the bottom did not appear to materialize' (quoted from Oates and Portnoy, 2001).
5 It is important to remark that the analysis applies not only to traditional pollution control policies, but potentially to a broader range of environmental policies, such as conservation of natural resources.
6 Awareness is also determined by the occurrence of environmental problems and, most likely, of disasters. Vogel (1993) explains how in Britain the origins of first law on air pollution, control that was passed in 1956, have to be traced back to the 'unusually nasty fog' settled over London in the winter of 1952. Other important pieces of legislation were passed in the 1970s after the *Torrey Canyon* spill of a huge quantity of oil off the coast of Cornwall in 1966 prompted the membership of local and national environmental groups and induced political parties to become active defenders of the environment.
7 There is an increasing literature on spatial interactions between sub national levels of governments. Revelli (2006) provides a survey of the literature. Konitsky (2005) analyses specifically the interactions between US states concerning environmental protection.
8 There is a popular view especially in public choice literature that argues that stringent regulation will be rendered ineffective through capture of the enforcement process by concentrated interests. As McCubbins *et al.* (1987) explain in their paper on

administrative procedures, most of (American) environmental legislation contains procedural mechanisms that protect against the watering down of their content in the implementation stage. One can observe, as mentioned above, disparities in the degree of enforcement. In general enforcement is higher and more efficient in richer states and regions, a fact that than can be explained more easily with reference to citizens' preferences than to power of the lobbies.

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12 Methodological dilemmas in regional strategy building

Grzegorz Gorzelak

Introduction

Success cannot be achieved without good *organization of future activities* (see, for example Blakely, 1989). By facilitating a better understanding of conditions and goals regarding regional/local development, strategic planning allows authorities to prepare more effectively to realize their objectives. This message is commonly accepted. In addition, even if the strategy is not conceived as a tool of efficient management of regional affairs in the future, it can be used as the necessary document for applying for external assistance. The European Union's Structural Funds are the usual addressee of such applications.

Even though the usefulness of a strategy for regional/local development is clear, there exist several issues that are unsettled among those who prepare the strategies. An examination of several Polish strategies of regional development leads to a conclusion that there is a wide array of theoretical and methodological approaches in strategy building, relating to all aspects of the strategy itself and the process of its preparation (Gorzelak and Jalowiecki, 2001). This variation in strategy development can be also observed in regions of different countries.

This chapter presents an analysis of some of these issues by characterizing current dilemmas that are being solved – in most cases unconsciously rather than after deep consideration – by the authors of the regional development strategies. Next, it will be argued that some methodological approaches are more appropriate than others. An approach is favored when it leads to more useful and functional strategies that are better adapted to the challenges which regional development faces in a contemporary, globalized, competitive and innovation-driven economy.

Exogenous and endogenous factors of regional/local development

Due to the growing role of internal (endogenous) factors in regional and local development the importance of regional and local development strategies has been increasing.

It is no coincidence that the well-known book by Stöhr and Taylor (1981) appeared just when innovations in technology were becoming the main factor in

economic growth, and when many countries, at least the European ones, had begun to decentralize their territorial administrations (see Putnam *et al.*, 1993). The Stöhr and Taylor book represented a declaration of the shift from an economy steered from above to a new model of development in which local and regional factors were to play a fundamental role. These processes, simultaneous and mutually interdependent, meant that the role of endogenous factors grew significantly. Regional and local development became less dependent on decisions taken exclusively beyond the local level, such as the national government administration or economic units. This change was especially visible after 1990 in the post-socialist countries in which these two spheres were unified during the period of 'real socialism'.

As would be expected, on the other hand, changes in the development model did not mean that the influence of exogenous factors ceased altogether. As had been the case in the past, the development of a given region, city or locality could be aided significantly by the appearance of an important investor who would provide capital and employment, augment local demand, generate local tax revenues and increase the chances additional investors arriving to the area. Improvement of infrastructure, which is of national importance, can be beneficial for regions too; a grant or subvention can accelerate the region's development.

Foreign aid, the last from of external intervention, occurs on a wide scale thanks to various state and international programs. These programs widen the pool of available funds in countries that have just recently begun to receive foreign aid. However, there are several opinions (Boldrin and Canova, 2000) which propose that regional subsidies delivered to the poorer member states of the European Union do not enhance the regions' potential for growth, but are, in fact, a simple redistribution of income which does not lead to sustainable growth.[1] As a result, the regional convergence in the European Union has not increased contrary to the goals and expectations of the structural policies executed by the European Commission (see, for example, Rodriguez-Pose and Fratesi, 2004; Martin, 2003). There are also those who counter this critical viewpoint by arguing that the differences would have been larger had no cohesion policy been implemented. Sometimes the external assistance may also reduce the awareness of the need for own efforts and can create a subsidy-dependence attitude (for extensive discussion of this issue see Bauer, 2000).

Increasing polarization of regional development may be explained in several ways. One plausible interpretation suggests the growing importance of endogenous factors over the exogenous ones. As was seen in several regions and localities all over the world, external assistance has not been able to induce sustainable growth in such regions as Southern Italy or Central Appalachia. East Germany is one of the saddest examples of how external assistance may not induce development in a region whose endogenous development potential – mostly of a social nature – cannot induce stable growth in spite of tremendous subsidies directed there from the German federal budget amounting to over one trillion US$ over 15 years.[2]

Research proves that the exogenous factors of local development cannot replace the endogenous ones, but can only assist them. If the local potential is lacking or

if it is very weak, then even significant external intervention cannot be a practical substitute. A wide panorama of the interplay of exogenous and endogenous factors in development is given by D. S. Landes (1999) and Gorzelak (2004).

The 'new economic geography' (Krugman, 1991) stresses the impact of the reduction of transaction costs on concentration tendencies. He claims that economies of scale increase the attractiveness of the already well developed regions that offer rich opportunities for cooperation and innovation at the expense of the more backward ones where lower production costs cannot outweigh their disadvantages of peripherality and poor business environment.

Another proof for the importance of exogenous factors is given by the institutional economy (De Soto, 2000), and – in a wider perspective – by the analysis of cultural underpinnings of development (Harrison and Huntington, 2001).

In sum, these theoretical proposals clearly indicate that the potential for growth lies within a given territorial socio-economic system. It is up to the internal socio-economic features of a country or a region to determine how it capitalizes on the exogenous opportunities such as potential investors, trade opportunities and/or public assistance. As a result, regional development strategies are becoming more important since they help in preparing the regions well in advance for such chances. Their role is to mobilize local/regional potential around the goals of development in such a way that endogenous and exogenous opportunities are used in the most efficient and effective way (see Gorzelak, 2004).

The methodological dilemmas

The six methodological and theoretical issues discussed below can be considered as the most important dilemmas which have to be solved during the process of strategy building. As would be expected, the solutions to these tough decisions are often interrelated; in several cases a particular solution to one issue may be followed by several adjustments to the decisions made regarding other issues.

Dilemma 1: whose strategy?

Being 'an owner' of a strategy entitles one to privileges as well as responsibilities. The owner is responsible for the results of his/her decisions and bears all consequences of them. At the same time, one may dispose of his/her property and take more or less independent decisions on its use.

The 'ownership' of the strategy may be conceived in two ways:

1 it can be 'owned' by *the authorities* which will be implementing it – in most cases the regional government; and
2 it can be 'owned' by *all major 'actors'* located in the region – enterprises, institutions and organizations, political bodies, etc.

In the first case the entity which 'owns' the strategy can be clearly identified. Usually this is the regional authority which is equipped with some degree of autonomy in a decentralized system. The authority which prepares the strategy has full freedom for choosing its methodological base and procedures of its preparation. Most importantly, it is responsible for the strategy's implementation. In this understanding of the strategy ownership, owning the strategy is a *commitment* of the regional authority to implement it. The authority thus bears political *responsibility*, and in due time[3] will be evaluated by the voters according to the level of success in implementing the strategy.

In the second case the ownership of the strategy is 'fuzzy' – the strategy is owned by everybody (which may mean nobody). There is no one single subject who can be made responsible for the strategy implementation. In fact, nobody in particular can be blamed if the strategy is not fulfilled in practice since the responsibility was shared.

> *Suggestion*: the strategy should have a well specified owner. A strategy is a commitment, and its owner bears responsibility for the shape and implementation of the strategy. The *regional authorities* are a natural body which should prepare the strategy and later implement it.

Dilemma 2: how broad a strategy?

The process of regional development is really a multidimensional and multifaceted process. It is a result of not only the actions undertaken by the regional authorities themselves, but also of activities of a wide array of independent actors equipped with different powers, located both inside the region and outside it. These actors include (1) the inhabitants of the region, (2) small firms and big companies already operating in the region or planning to locate in it, (3) the many organizations and public service companies like the railroads, the postal service, the telecommunications system and (4) the national government 'above' the region and the local governments within it. All these agents have their own interests that do not necessarily follow the interests of the regional authorities. All of them impact on the process of regional development, albeit some of them stronger than others.

So what should be covered by the strategy? On one hand we have the possibility that only the processes which directly depend on the activities of the regional authorities should be embraced by the strategic goals, while on the other hand one may propose that all processes and phenomena that occur within a given region should be reflected in the strategy.

These two opposite standpoints are related to the issue of strategy ownership. If we decide that the strategy is 'owned' by the regional authorities who commit themselves to put it in practice and take responsibility for the final results then we have to conclude that the strategy should be *limited to the field of competence* of these authorities. The scope of the strategy should therefore be narrow enough so that it is limited to the activities which the regional authorities can undertake by

themselves. Its scope may be a bit broadened to encompass some activities which are independent from the regional authorities like contracting some services from a private or public provider or even lobbying on the national and international level for some public investment. Even in these cases where the scope is wide enough to cover the activities of several important actors who could affect the development of the region in the time horizon of the strategy, the regional government must still be the axis of the strategy.

> *Suggestion*: the scope of the strategy should be narrow, limited to the activities for which the regional authorities can take responsibility. Only the goals that can be directly reached or indirectly influenced by the authorities should be included in the strategy, and the goals and tasks that would be performed by the subjects independent from the regional authorities (like private or state enterprises, self-governmental cities and municipalities, state governmental administration, etc.) should not be included among the strategy goals.

Dilemma 3: what comes first: vision or SWOT [4] analysis?

The strategic goals have to be rooted in some background. There are two ways of constructing this background:

1 formulating a *vision* – a description of the regions' features by the end of the time horizon of the strategy; or
2 running a *SWOT analysis* which leads to an evaluation of regional potential conducted from both internal and external perspectives.

A commonly applied approach is to start by performing SWOT analysis. Then, one of the four 'fields' (or cells) of the SWOT analysis which will play the major role in formulating goals is selected, and finally goals to achieve improvements are constructed. In this approach the goals will have to be rooted in the current and future potential of the region, meaning that they will be stemming from the objective reality. No development goals that transgress the currently noticed regional potentials and opportunities can be formulated in this way. Not too much imagination can be applied, since the 'cold' factual analysis is the basis for goal formulation.

Alternatively, a vision of the region in the more distant future can be made the foundation for goal formulation. In this approach the strategy is built around the desires and aspirations of those who are involved in the preparation of this document. To begin, they sketch a 'region of dreams' and then they try to conceive actions that would lead to its practical realization.

The vision has a very important meaning for strategy building. First, it states the preferences of the public which are formulated by the authorities. Second, it provides the *criteria for evaluation* of the influences of the external environment of the region and of the region's features. Without a vision such an evaluation of the region's features would not be possible, and the diagnostic analysis would have

to remain on the descriptive and explanatory levels. This implies that it wouldn't be possible to assign value judgments to the strategic goals. Accordingly, it would not be possible to claim what is 'good' and what is 'bad' for the regions. By having the vision, we can determine that those processes which bring us closer to the desirable state are 'good', and those which prevent us from materializing the vision are 'bad'. Thus, the vision provides the overall value orientation in strategy building.

It is obvious that the vision cannot be *unrealistic*. It has to be verified by the SWOT analysis, and dreams have to be cut down to the objective possibilities. From the two questions 'what we want' (vision) and 'what we can do' (SWOT) one joint answer is driven, and this answer composes the strategic goals.

> *Suggestion*: the vision should precede the SWOT analysis, so that these desired processes are included into the set of goals generated from the SWOT analysis.

Dilemma 4: how many strategic goals?

The formulation of strategic goals is the result of integrating the generated vision of the region's development (within the strategy's time horizon) with the objective analysis of the region's potential.

Formulation of strategic goals is the result of a deliberate and usually difficult *choice*. This choice relates to the progress of development of the region, to the needs of particular socio-economic groups and their interests, inter-regional differences, political pressures, etc. Not all dreams or wishes can be fulfilled realistically. In fact, the opportunities are limited and progress will be long, slow, difficult and variant among particular groups of actors and territorial parts of the region.

There is an obvious temptation to put many goals into the strategy so that the wants and needs of all those who are interested, and strong enough to exert visible pressure, are represented. Also, such a strategy would be 'comprehensive' (i.e. embracing all issues that are important for a given region).

However, such a goal-rich strategy will have at least two fundamental deficiencies. To begin, it will be impossible to implement, because too many 'right' goals inevitably cannot be reached at the same time. Second, it will not perform its informational function as no one has the capacity to remember and correctly interpret too many goals.[5]

Among the strategic goals, those which refer to the routine activities of the regional administration are notable. For example, 'improving the efficiency of the regional government', 'improvement of health care provision', 'broader access of the inhabitants to sport facilities', 'better provision of social assistance', etc… These should be absent from the set of strategic goals unless they are really considered as major directions of regional development. The strategy, as already indicated, is a result of deliberate choices, and should not cover obvious activities that have to be performed in every region and in all circumstances.

Suggestion: the strategy should not have more than five to six goals, the smaller the number the better. In many cases four goals appear sufficient. The goals should reflect the strategic choices and should not cover routine, obvious activities of the regional administration.

Dilemma 5: social needs or growth?

This decision is a fundamental dilemma. It directly relates to understanding the process of development, and has clear ideological and political underpinnings. That said the following remarks may still be made. First, the general principle holds true: before one can distribute, one has to create. Thus, orienting the strategy more towards the satisfaction of social need and neglecting the economic development should be considered as incorrect. This is especially important in countries and regions which have to achieve rapid growth in order to improve their relative position vis-à-vis much better developed ones. The regions of the post-socialist countries are typical of this type of scenario, though the worse-off regions of Western Europe should also strive to move up the development ladder by focusing more on growth than social needs.

Presenting a socially-oriented strategy is usually more tempting than providing one which states that some social and economic costs have to paid if the region is to achieve a sustained ability to compete internationally and thus to secure stable growth. These sacrifices will stem from the necessity of restructuring, which is not a one-event action, but has to be conducted on a permanent basis. Restructuring means that some parts of the socio-economic fabric have to be scrapped which will create opportunities for the emergence of the new ones (let us remember Schumpeter's famous concept of 'creative destruction'). There are always some losers in the process of economic development, and therefore there can be winners too.

Obviously, the problem of distribution of social gains and losses should not be neglected. Very high social costs and/or a particularly uneven distribution between socio-economic groups should be considered as a warning and should prevent substantial restructuring attempts. However, since the strategic goals are formulated by the regional authorities who would be seeking public support in general elections, this danger seems to be of lesser importance than the temptation of presenting a strategy promising everything to everybody which would highlight the (unachievable) social gains and hide the (necessary) social costs.

Suggestion: the strategy should be development-oriented. The emphasis given to economic growth versus satisfaction of social needs should depend on the regional situation.

Dilemma 6: politicians and experts or wide social participation?

The strategy may be prepared in two different ways:

1 by a narrow group of experts who agree with the region's key politicians on assumptions of the strategy who propose a draft and final version which will then have to be accepted by the political authorities of the region (i.e. the regional assembly or council); or
2 by a wide committee, composed of all regional actors and agencies (specialists, firms, organizations, media, etc.) which – under the leadership of regional authorities – work out the assumptions of the strategy, its goals and approve the final version (such a committee can be composed of several hundreds of participants).

Both approaches have their virtues and deficiencies. The first one has a smaller mobilizing power leading the strategy to perhaps be regarded as 'authoritarian' which could discourage several actors important for regional development from being involved in its implementation. However, a strategy prepared in this way can achieve greater internal consistency and can be more development oriented since the experienced experts can contribute their knowledge and independent evaluation of the region's potential.

The 'collective' approach may result in a vast number of goals.[6] This approach may also lead to a strategy with poor internal coherence. However, greater internal knowledge of the region's problems including internal/hidden conflicts may be collected in this way which in turn enriches the scope of information used for strategy building.

> *Suggestion*: the strategy building should be based on an expert approach. However, the participation of the general public in the final stage of getting the strategy approved by the political authorities is wanted in addition to the involvement of key regional stakeholders. This can be achieved through publicizing the strategy in the media, organizing public discussions about it, etc.

The strategy – proposed procedures and features

Overall, the strategy building process should have the following structure (see Figure 12.1):

1 The analysis of the region should be conducted in a broad, whole-regional perspective. It may relate to all processes and phenomena that occur in the region's territory, no matter who or what is responsible for their appearance and features (square A).
2 The *vision* should specify the desired changes of the region in the time horizon of the strategy. It should be a result of a broad discussion involving several institutions, organizations and actors (circle B).

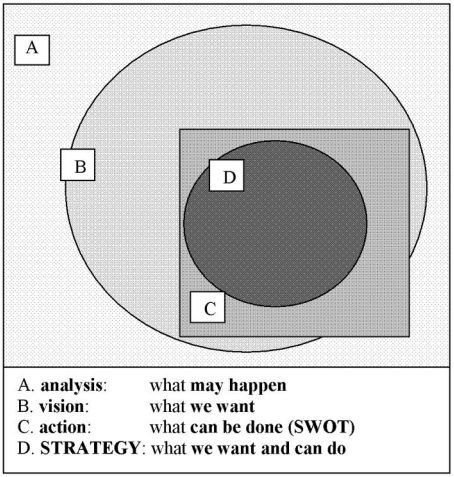

Figure 12.1 Regional strategy and its context

3 The vision should be confronted with the objectively evaluated *diagnosis* of the present and future state of the region. The cross-product of the vision and the diagnosis (square C) defines the range of possible actions that should be undertaken in order to achieve the vision. Some hopes have to be abandoned during this element of the strategy building process because the diagnostic analysis will show that they are unrealistic.
4 Only some actions can be undertaken by the regional authorities, while some others lie within the competences of other subjects. The final strategy (circle D) should contain only goals which can be reached by the activities of the regional government.
5 The *vision* should be prepared by the political authorities responsible for the region. The preparation of the vision should be done in parallel to the analytical process of preparing the diagnosis. Several actors can be consulted in the process of vision elaboration. This phase may involve a great deal of PR. For example, there can be announcements in the press that the strategy is being built for the region and the readers can be asked to contribute their 'dreams and wishes' about their region, city or municipality, for example, their ideas for their area for the year 2010. Similarly, children in schools may be asked to prepare written or artistic works on the same topic. Meetings, panels and open discussions may be organized. In total, these actions would create an occasion for the following two parallel processes:
   a 'socializing' the regional authority by making it open to the public and sensitive to the public opinion; and
   b mobilizing the public opinion to have an intellectual reflection on regional problems and opening channels of communication between the society and the authorities.
6 The *diagnosis* preparation should be undertaken at the same time as the creation of the vision. It should be conducted by a professional, narrow group

of experts who have intellectual and professional support from a wider set of specialists. The members of the core group should assume an interdisciplinary perspective. However, at the same time, they should assume responsibility of coordinating the work of broad spheres of analysis. The following *spheres* might be considered in the historical and prospective dimensions:

a international environment of the region/city;
b the systemic environment of the region/city;
c economy: manufacturing, services, R&D, etc.;
d society and politics, culture;
e business and civil society institutions; and
f spatial structures, physical infrastructure.

7 If possible, a bench-marking exercise should be undertaken to compare the community with local or international competitors and/or its neighbors for the following key factors:

- location advantage
- national incentives for investors
- local incentives for investors
- population and labor force growth
- unemployment
- industrial structure and dynamism
- labor rates
- labor skills
- training capabilities
- property availability in main categories
- property costs

8 Most of the analyses should be performed in a four-stage pattern:

a *description* of past and current situation;
b *explanation* of the observed processes;
c *predicted* development of a given item or process; and
d *evaluation* of how these developments will relate to the vision.

The fourth part of the analysis is especially important since it leads toward the goal formulation.

9 The diagnostic phase should be ended with a typical *SWOT analysis*. However, a relatively broad understanding of the SWOT analysis is advisable (i.e. all four types of the region's characteristics: strengths, weaknesses, threats and opportunities should be related to both internal and external perspectives).[7]

10 Upon the joint examination of the three elements: the vision, the SWOT results and the range of the regional authorities potential for directly and indirectly influencing the region's development, the *strategic goals* can be formulated. These goals should then be disaggregated into operational goals which are further broken down into programs of action.

11 The strategy should be *realistic*. One should remember that it is a commitment of local authorities and that voting citizens will evaluate the performance of the regional government by comparing the objective achievements with the

government's promises; the strategy is in fact the most important promise made by the authorities.

12 The strategy should be *concrete* including measures for preparing operational programs. Specifically the strategy should indicate those tasks that are to be achieved, the institutions and persons responsible for their implementation, time-tables, sources of funding and ways of measuring the level of task achievement.

13 The strategy should be *open and flexible* since nobody is able to foresee precisely the future. Openness of the strategy should not imply, however, that it is weak and subject to permanent changes.

The trade-offs

In situations where choices have to be made within a complex process of socio-economic development, conflicts and tensions cannot be avoided. The strategy has to take into account these potential conflicts and trade-offs.

A concept of 'four capitals' can be applied to assess these trade-offs (see Ekins, 1992). The four capitals are:

- manufactured (or human-made) capital consisting of material assets created by man: infrastructure, buildings, machinery, goods and commodities;
- natural/environmental capital, which embraces traditional natural resources (water, energy, mineral reserves) and also natural assets that are not easily valued monetarily, such as biodiversity, endangered species, and the ecosystems which perform ecological services;
- human capital which refers to individuals and their features, like health, education, and skills which improve the productive potential of a given socio-economic system; and
- social capital which is composed of the potential for cooperation and joint actions. For such relationships to develop, the existence of trust between individual people and socio-economic groups is a necessary precondition (see Fukuyama, 1995).

A proper strategy will allow for increasing the total volume of capital in a given region. However, a question arises if the aggregate value of the four capitals grows while some of them deteriorate considerably (e.g. social capital deteriorates because of dramatic changes in social structure due to unfair privatization, or natural environment degradation due to rapid development of transport infrastructure. Specifically, the following question is posed: what are the thresholds for compromising some spheres of development beyond which one should not go even if the gains elsewhere can be high?

The concept of four capitals allows for controlling the trade-off situations. Each of the Capitals may be described by a set of indicators, and these indicators can then be used for examining the forecasted effects of implementation of the strategy goals.

Strategy building and evaluation – example of Lubuskie region

The principles of strategy building which were described above were used as the foundation of the preparation, evaluation and amendment of the regional strategy in one Polish region, the Lubuskie voivodship.

The region is located in the middle of the Polish-German border region. This territory became a part of Poland in 1945 after several centuries of belonging to German states. Its German population was replaced by migrants from the eastern territories of Poland lost to the Soviet Union, and by people who came from other parts of country seeking new opportunities after the disasters of World War II. It is one of the economically weakest regions in Poland being deprived of big cities[8] and important industry. About 40 per cent of its surface is forested, which creates good potential for tourism. The border location is its main asset, and the high unemployment stemming from the collapse of the former state farms is the main social and economic burden. However, the real situation of the labor market is better than is demonstrated by the official statistics because a large portion of registered unemployed workers operate in the grey economy (for which the border location is an incentive) or work in Germany.

As empirical research has revealed, the local authorities in this region, as in other areas in the western and northern parts of Poland, displayed greater efficiency and effectiveness than the ones from the central and eastern regions (Gorzelak *et al.*, 1999). This might be the result of the fact that the inhabitants of these regions are the descendants of migrants, who when settling in the new territories had to develop the spirit of cooperation and trust. Moreover, the mix of population may present higher innovativeness and activity as compared to the often stagnant, mostly rural societies of central and eastern Poland.

For the last 10 years, the region has been enjoying a steady inflow of funds (€50 million yearly) from the EU under the heading of cross-border cooperation. Lubuskie voivodship also hosts many relatively smaller firms with foreign (mostly German) capital. For several years it benefited from cross-border trade due to differences in consumer prices (up to DM 5 billion – US$ 2.5 billion – yearly in mid-1990s).

The region has a stable political leadership. It is the only regional government in Poland where the ruling party, the social democrats, has retained a majority in the regional assembly after the second election (2002). This has allowed for the continuation of policies formulated at the beginning of full regional government in Poland in 1999.

In 2000 the regional authorities, with the assistance of external experts, prepared the strategy for the region. The strategy was later approved by the regional assembly (without 'no' votes). The strategy for the Lubuskie voivodship was constructed around four goals:

1 securing social, economic and spatial cohesion of the region though modernization of its major transport infrastructure and accelerated economic development;
2 increasing the level of education of the region's inhabitants and promoting research, innovation and technology;
3 supporting entrepreneurship through improving conditions for local businesses and attracting external investors; and
4 efficient use of the region's natural environment and cultural heritage for economic development.

These four strategic goals were formulated for a 15-year time horizon. The goals are functionally interrelated, with each of them supporting the other three. They are further disaggregated into 19 operational goals that are composed of sets of clearly defined actions such as 'establishing a regional university' which happened a few years ago.

According to the regional authorities, the strategy is incorporated into their everyday activities. In particular, projects that are being financed by the EU (pre-accession funds and currently the Structural Funds and the Cohesion Fund) are rooted in this document. The authorities consider the strategy as a tool that helps them in organizing their own activities.

After Poland's accession to the European Union, a need for updating the regional strategies has emerged. This has presented authorities with a good opportunity for evaluating the achievements of the regions in strategy implementation. A concept of four capitals was used for this exercise (see Table 12.1 on p. 229). Participants included the representatives of regional authorities and their administrations, entrepreneurs, representatives of social organizations and NGOs, as well as external experts who moderated the discussions.

In 2005, five years after the strategy was formulated and adopted, a brainstorming session was performed by major stakeholders from the region. Each of the 19 operational goals was evaluated from two points of view: to what extent it could have potentially contributed to growth of a given capital (first columns for each of the four capitals), and to what extent this growth was really achieved due to strategy implementation (second columns). Three levels of this impact were distinguished: very strong (++), weak (+) and no impact (–). An additional category – non applicable – was also used (blank cell).

The crux of the matter in the evaluation procedure lies in the relation of potential and real impacts. If the strategy implementation was satisfactory, no big difference between these two impacts will be observed. However, if the achievements in strategy implementation were unsatisfactory, this difference will be clearly observable. Unsatisfactory achievements are marked — in the third column for each capital as a warning for the next strategic period.

The results of this exercise allowed for reformulating the goals of the updated regional strategy. In particular, the goals which were least developed were considerably strengthened such as enhancing links between business and science,

intensifying efforts for information society development and improving the public transport with a wider use of public–private partnerships.

The example of the regional strategy from the Lubuskie region demonstrates several principles of strategy building, implementation, evaluation and adaptation to changing conditions. This could be regarded as a set of possible and advisable solutions. Openness of the regional authorities to external (sometimes critical) advice, ability to draw the key regional stakeholders into the process of strategy building and evaluating, readiness for reconciling realism with visions and resistance to often populist pressures are the main features of local politicians which create the promising basis for preparing modern strategies and implementing them with integrity.

Conclusions

'There is nothing more practical than a good theory'. This well-known saying has a direct applicability for regional strategy building. A good strategy has to refer to modern theories of regional development that take into account the current processes and relations between factors of socio-economic development. At the same time, the strategy has to be prepared in accordance with the principles of theory of organization and management, which relates to the roles of authorities and social participation in undertaking joint actions. In addition, strategy building requires a bit of art, a touch of emotions and a flavor of imagination. A proper combination of theory and creativity may produce a brace but also an implementable strategy which can change the development path of a region.

Notes

1 One may argue that although there is a need for regionalized social policy, a socialized regional policy should not be conducted since it is a part of development policy.
2 See for example the *New York Times* article of 21 July 2004 with a to-the point title 'East Germany Swallows Billions, and Still Stagnates'.
3 This time is usually when the next election for the regional assembly is held.
4 SWOT stands for strengths – weaknesses – opportunities – threats. It is a widely used analytical tool balancing the present and future potentials of a given entity (a person; a company; an organization; a region; a country, etc.) in order to summarize the diagnosis of this entity and in this way formulate the goals of future activities. See for example http://www.mindtools.com/pages/article/newTMC_05.htm and many other references on the Internet.
5 The leaders of the region/locality should be able to memorize the strategic goals and interpret them at any time.
6 This happens, for example, through subdividing the big committee into subgroups, each of which proposes and defends their own strategic goal.
7 In a 'classical' SWOT analysis strengths and weaknesses relate only to the internal features of the region, while threats and opportunities are related only to the external conditions of its development.
8 Its two major cities – Zielona Góra and Gorzów have 119,000 and 126,000 inhabitants, respectively.

Table 12.1 Strategic and operational goals of Lubuskie region in relation to the four capitals

Goals	*Manufactured captital*			*Human Capital*			*Social Capital*			*Natural Capital*		
	Potential impact	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*
Achieving economic, social and territorial cohesion of the region												
Improvement of the transportation system	++	–	—	+	–		–	–		–	–	
Establishment of an efficient air transport	++	–		–	–		–	–		–	–	
Improvement and development of technical, municipal and social infrastructure	++	+		++	+		+	–		++	++	
Development of active cross-border and inter-regional co-operation	++	+		+	+		+	+		+	+	
Achieving high effectiveness of the use of funds coming from the European Union	+	+		++	++		–	–		–	–	
Improvement of the educational level of population and enhancement of the innovative potential												
Increase of educational opportunities on secondary and higher levels	++	+		++	++		++	+		–	–	
Adaptation of the educational system to the requirements of the regional labour market and consequences of the European integration	++	–	—	++	+		+	–		–	–	
Equalization of the educational chances for all social groups	–	–		++	–	—	++	–	—	–	–	
Growth of research and academic employment and development of academic institutions	++	+		+	+		+	+		–	–	
Creation of the Lubuski University	+	+		++	++		+	+		–	–	

continued…

Table 12.1 continued

Goals	*Manufactured captital*			*Human Capital*			*Social Capital*			*Natural Capital*		
	Potential impact	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*	*Potential impact*	*Real impact*	*Warning*
Entrepreneurship development												
Development of active support for enterprises, regional promotion and attracting investors	++	+	—	+	–		+	–		–	–	
Creation of the regional innovation system	++	–	—	++	–	—	+	–		–	–	
Development of an institutional and financial support system for businesses	++	++		++	+		++	+		–	–	
Development of non-agricultural sector in the rural areas	+	–	—	+	–	—	+	–		+	–	
Restructuring and reorientation of farms and food-processing firms	+	+		+	–		–	–		+	–	—
Efficient use of natural and cultural resources for regional development												
Enhancement of ecological awareness	–	–		+	+		+	+		++	+	
Use of natural and cultural resources for tourist development	+	–		–	–		+	–		+	–	
Efficient promotion of tourist attractions of the regions, improvement of the tourist information system	+	+		–	–		–	–		+	–	
Development of services for inhabitants and tourists	+	+		+	+		+	–		–	–	

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13 Conclusion

What advice for policy makers?

Jorge Martinez-Vazquez and
François Vaillancourt

There is an important question this volume should answer. What are the practical lessons and advice that the contributions in the volume inspire? Instead of writing a conventional concluding chapter with those lessons, we have decided it would be more expedient to simply write a draft speech that a candidate for the head executive office of the region could deliver in her electoral campaign in addressing the issue of the region's development. Perhaps, in this day and age this approach will have a more direct impact on policy makers! This is the draft speech:

My fellow citizens,
As you know I am asking you to elect me as head of our regional government. Today I will present to you my economic development program in seven points. I have been inspired in preparing it by reading and reflecting upon a series of papers on regional development found in a recent book on this issue.

I am one who was born amongst you and who after seeking out education outside our region decided to return to it to marry and settle my family here, to gain my livelihood here and to die, hopefully old, here. Some will say that this was foolish as there are currently limited opportunities here for employment. But look back at the history of our region over the last 300 years or so. Were we not an important source of food for the rest of our country 250 years or so ago? Yes, this came to pass as other regions and countries with more fertile soil made our production uneconomic. But did we not emerge from the doldrums this caused as a manufacturing center producing metal instruments of various kinds that we sold not only within our borders but all over the world. But we once more became uncompetitive, this time as a result of the lower costs competition on foreign markets and of the reduction of trade barriers to our markets. Yes, it was fashionable to rail against the dastardly decision of the far away central government to open our markets to other countries. But recall that I left this region to train as an economist. That and the common daily observations of lower prices for the consumer and of some of our firms selling abroad convinced me that it was proper to have lowered these trade barriers. But drawing on the manufacturing tradition of our region, we converted part of our industrial base into the manufacturing of instruments and equipment made of plastic composites. But this is not satisfactory as it has only slowed down the loss of jobs and of our children.

Thus we need a new regional economic development strategy – REDS (but not the communist kind!). I believe that this strategy must be guided by the following seven principles that emphasize the importance of the overall context –macro and financing policies, the process-interaction with the community and foresight, the importance of the context-temporal, geographical and environmental, the role of human capital-knowledge acquired both in school and by work experience and the role of government – both through its spending and taxation activities. Let me present these seven principles that I shall refer to as the MVV principles after the editors of the book aforementioned.

Labor market flexibility must be high to ensure the success of REDS

We must take into account that we are part of a larger monetary zone and that we thus have no control on the rate of inflation or that the exchange rate between our region and that of both other regions of our country and between our region and the rest of the world is not set by us and we have little influence on it. This means that we cannot use it to adjust the relative cost of our labor and thus its productivity. We must aim at flexibility in our labor markets to allow for the required adjustments in real wages that will help ensure employment in our region. This will be facilitated if our labor force is well trained and thus adapts more easily to change as discussed below.

REDS must be implemented in the context of revenues available to regional governments

Regional governments have access to both their own revenues, generated by various taxes, fees and so on and transfer revenues, with both specific transfers and general purpose transfers and in many cases equalization transfers adding to their revenues. We will discuss the role of taxes further below. We must ensure that we receive a fair share of such transfers and more importantly that they are not counter-productive to our economic growth. These transfers will help us finance improvements in the quantity and quality of human and physical capital available in our region. But while clamoring for our just share of help from central government, we must show some long term vision and ensure that these transfers do not unduly weaken better off regions in our country, particularly in the light of international comparisons for one day we hope to be a rich region. We must also remember that responsible borrowing while not a source of net revenues as such (since it must be repaid) is a source of liquidity in the short and medium terms, but we must spend this money wisely and productively so repayment is not a burden to future generations. In summary, used wisely, these funds can help us finance key aspects of our REDS. We must make full use of our access to various financial markets to minimize borrowing costs but realize that this will require us to submit to the implicit discipline they impose on borrowers. The positive side is that this discipline can be seen as one more guideline for our REDS.

REDS must be the responsibility of regional decision makers, be well focused and be open to evaluation

We will encourage as wide as possible input into the design of REDS but we will be ultimately responsible for its design using expert advice and for its success or lack thereof. We are, or at least hope to become, an elected officials, we spend public money and surely we cannot blame others for our failures while basking in our successes. This means that while interacting with other agents such as national utilities, large firms and so on, we will focus on what is under our control. This is a sensible choice in the context of the powers that regions have in our country since we can affect both the quantity and quality of human, physical and social capital in significant ways. I would not be putting forward this REDS if I could not affect key factors for its success. While we keep our attention on near term impact of growth, we must, and this may seem laughable coming from the mouth of a politician facing election shortly, think not only of our children but of our grandchildren. Thus the needs of the next policy should already be taken in to account in this REDS. Finally, one must design policies that reflect the best advice from experts and also that allows them to monitor and evaluate its impact. In that way I shall be accountable to you but we will also learn from our mistakes and successes.

Specific REDS policies must be adapted to the region and the period of implementation

I need not remind you, my fellow citizens that, just like any other region, our region is unique; unique in its geography, unique in its history, unique in its demography, unique in its traditions. Why do I insist on this? Because each and every REDS is also unique and must be so to yield the best possible outcome. In particular, one must be very careful to design the proper policies for the times. But could it be that the best REDS is a dead REDS? No, as an examination of regional economic policies in the richest regionally diversified nation, the United States of America clearly shows. Even in that bastion of capitalism, regional development policies have been used consistently by regional governments since its founding. The key point is that they evolved over time, from canals and railroad to post secondary education and airports. They are particularly responsible for providing both a sound fiscal environment and human and public capital. Let us turn to each in more detail.

REDS must be first and foremost about human capital

At this start of the twenty-first century, most REDS will focus on enabling individuals to offer employers the most valuable set of skills to attract them to a region. Of course high quality public services discussed below are a prerequisite to attract workers and capitalists to a region. And such services require the presence of physical capital such as sewers, roads, and so on. Individuals live in the real world, not in Second Life! But if the skills of workers are, if not obsolete, at least

not competitive, then fewer employers will settle in a region, however nice its roads and other infrastructure. We will thus focus on workers not as employees of a given sector but as holders of specific occupational skills that can be transferred from one sector to another as demand shifts over time. It is important to state this as part of our REDS since it will inform our policy choices and how we look at our economic environment. For example, we will encourage the emergence of clusters that benefit from interactions or externalities as we economists say between various kinds of workers such that the productivity of the whole is greater than that of each of the parts separately.

REDS requires a match between public services and the relevant taxes

The role of reduced taxes or direct subsidies in attracting private capital is a controversial one. Some will say; let's lower their taxes and give them subsidies. Many will say; why should we subsidize big capital; if they come, make the rich pay! Unfortunately they may not come when faced with such an attitude and thus will never pay. What we must realize is that business needs a combination of various inputs to succeed and that this includes human, private and public structures and social capital. The issue is then from a business perspective; is this REDS offering me the appropriate mix of capital at the appropriate tax price we will have to pay? Thus higher taxes that provide a publicly trained better qualified labor force and, in this aging world, that attracts new entrants to a region because of the associated quality of life may actually be seen as attractive by firms needing such a continuous supply of qualified labor. Our REDS will strike a balance between spending and taxes, insuring long term renewal of infrastructure needed by businesses and using as much as possible fair pricing shared by all users to provide it.

REDS need not involve a trade-off between the environment and growth

Before closing this speech, let me reassure you that economic growth and a sound environmental policy are not incompatible. Why? No one would like to live and invest in a region with a deteriorated and unhealthy environment. Besides, in most cases, the cost of environmental norms is a small share of the cost of doing business. Of course this is not true of heavily polluting industries but these are not what our human capital centered REDS will attract to our region. Indeed, we will make use of the power of regions to set environmental norms, and will fight central government attempts to impose a one size fits all policy environmental policy to attract forward looking industries.

My dear friends, in closing, let me restate that a key part of my electoral program is this REDS. It is important since without productive economic activity, there is no wealth and without wealth there is little future for our children in this region.

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