Handbook of Regional Growth and Development Theories

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23 Regional policy: rationale, foundations and measurement of its effects

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23.1 Introduction

Since the 1930s generations of policy-makers have developed and implemented regional policies for both economic (efficiency) and social (equity) reasons. As regards efficiency, regional disparities in, for instance, unemployment and per capita income often have negative effects on the efficient operation of the national and regional economy. Armstrong and Taylor (2000) give several arguments. The whole nation is better off when unemployed in regions with high unemployment become employed, if the possible loss of jobs in other regions is smaller. A redistribution of jobs may lower the number of hard to fill vacancies in regions with low levels of unemployment. Other benefits are an increase in gross domestic product (GDP) at the national and regional level, and lower costs of social security. A more equal spread of economic activities may also reduce the negative cost of congestion, such as traffic jams and environmental damage in the more densely populated regions of a country. Finally, smaller regional differences in unemployment may also reduce inflationary pressure. As regards equity, reducing interregional disparities may contribute to the general objective of reducing all kinds of unwanted inequality between individuals. In this respect, two classical dilemmas (Stilwell, 1972) are still relevant.

First, there is the dilemma of 'place prosperity versus people prosperity'. At first instance, a direct targeting of individual inequities by means of, for instance, income support seems the preferred strategy. Such social security programs may also contribute to interregional equity, as their recipients tend to be over-represented in the lagging regions (see Stoffelsma and Oosterhaven, 1991; Huffman and Kelkenny, 2007). However, 'place prosperity' may still be needed as an independent goal alongside 'people prosperity', as pursuing only the latter may have unwanted indirect effects. The most important of these are the negative effects of cumulative outmigration of (re)schooled and entrepreneurial individuals, which thus aggravate the situation of the less-schooled, low-income part of the population staying behind. Policy measures that enhance the place characteristics of the region, for instance by means of building new infrastructure, will be mainly beneficial for the individuals that stay in the region. On the other hand, using regional policy for social purposes assumes that this helps the poor individuals in poor regions and, thus, works in the same direction as non-spatial social security policies. However, Dupont (2007) argues that there is little theoretical and empirical evidence for this assumption, and shows that policies designed to reduce interregional disparities may well increase individual inequality. Duranton and Monastiriotis (2002), in fact, show this has been the case in the United Kingdom for the period 1982–1997. Thus, this first classical dilemma is still unresolved.

The second dilemma regards the issue of 'interregional equity versus national efficiency'. Richardson (1979) reviews the neoclassical foundation of the efficiency–equity

trade-off hypothesis and lists cases of efficiency–equity compatibility, such as generative (now labeled endogenous) growth policies and growth pole policies, which may promote interregional equity in an efficient manner. The Williamson (1965) curve, with interregional equity occurring at low and at high levels of economic development, represents another case of efficiency–equity compatibility. Note that this case should not be interpreted as a predecessor of the Krugman (1991) model with spreading equilibriums at high and at low levels of transport cost, as the agglomeration/spreading of workers and firms is not the same as the divergence/convergence of real wages, per capita incomes or welfare levels (see, for a more detailed explanation, Oosterhaven, 1997).

In order to provide a foundation for the discussion of these and other dilemmas and to understand the logic behind regional policy measures, we will discuss several theories that underpin the choice between different regional policy strategies in section 23.2. The subsequent choice between different types of regional policy instruments and an overview of these instruments will be discussed in section 23.3. Note that there does not exist a one-to-one correspondence between theories and instruments, because theories partly overlap and instruments can sometimes be based on more than one theory. As the choice of policy instruments will be based on estimates of their effects, section 23.4 discusses the measurement of the effects of aggregate regional policy and of individual regional policy instruments.

23.2 Theories of regional development

Regional policy is usually founded on theories of regional development. Armstrong (2002) states that there are at least seven related theories of regional growth that play a role in formulating regional policy. Although Armstrong does not pay attention to some recent developments, like the work of Florida (2002) about the 'creative class' and the emerging literature on evolutionary economic geography (Boschma and Lambooy, 1999), we will use his classification as a framework for a brief overview of the relevant theories of regional economic growth.

Neoclassical growth theory

In the interregional versions of this theory, output growth is determined by the growth and mobility of production factors and technology (see Capello, 2007). It predicts that in the long run regions converge and regional per capita GDP disparities will disappear. Convergence occurs because lead regions accumulate capital faster till they run into a situation of diminishing returns that makes investment in lagging regions more attractive and productive. This process is reinforced by four other convergence mechanisms: interregional trade, labor migration, capital mobility and technology transfer. Typical policy instruments based on this theory are the stimulation of labor mobility, free trade and technology transfers.

Endogenous growth theory

An important shortcoming of neoclassical growth theory is that technological progress is assumed to be exogenous. The main feature of endogenous growth theory, as developed by amongst others Romer (1986, 1990), is that technological progress is explicitly modeled, and is itself determined by the growth process. Depending on the way in which technological change is made endogenous (key aspects are human capital, scale effects, spillovers

from investment in physical capital and R&D, and the provision of public services) the outcome can be convergence, but may also lead to cumulative polarized growth. Recent empirical papers analyze the links between growth, geography, agglomeration and learning spillovers (see, for instance, Autant-Bernard et al., 2007). They show evidence of localized knowledge spillovers. Jaffe et al. (1993), for example, show that new patents generally cite previous patents from the same geographical area. Ciccone and Hall (1996) find a positive link between density and productivity of firms in the USA, whereas Broersma and Van Dijk (2005, 2008) find evidence for the Netherlands that high density can also be a disadvantage when congestion and shortages of local production factors, such as land, hamper productivity growth. Typical policy instruments are increasing the level of education of the labor force and the stimulation of start-ups, spin-offs and knowledge diffusion.

Post-Fordism and 'radical' theories

Post-Fordism views history as a sequence of periods of conflicts and consensus between the working and the capital-owning classes. In the post-Fordism model of production, technological change offers firms the opportunity to trade their products globally and enjoy economies of scale, but also requires flexible production methods in response to changing consumers' fashions. This can be realized within a geographical concentration of small and medium-sized firms ('new industrial districts'). Regions which are able to develop such new industrial districts will be booming, while those which are not will stay behind. How long this lasts is not a priori clear, because neoclassical convergence processes also continue to exist (Dunford and Smith, 2000; Glaeser and Gottlieb, 2006).

Social capital theory

This theory emphasizes the impacts of social, cultural and political influences on economic growth, although the focus is more on networks and social cohesion. It has come to the foreground in regional science since Putnam (1993) used it to explain the large differences in income levels between northern and southern Italy. Social capital as such can be added as an extra production factor in the framework of the neoclassical growth theory. In the regional policy debate, however, social capital theory is mainly used to motivate policy measures that develop social capital in lagging regions as a goal itself, whereas the ultimate goal is of course to stimulate economic growth. Durlauf (2006) argues that although there is a strong interest in social capital in economics, the concept itself has proven to be too vague to permit analysis with clarity and precision that matches the standards of the field. This criticism has been developed in a spatial context by among others Florida (2002) and Westlund (2006).

New economic geography models (NEG)

NEG models are based on the work of Krugman (1991) and are essentially cumulative causation models (see Ottaviano and Puga, 1998; Neary, 2001, for overviews). Once a region has got a head start, it attracts new firms and labor because it is able to exploit economies of scale and variety. The agglomeration process can also be driven by productivity effects from close input–output linkages (Venables, 1996). The cumulative causation process may lead to increasing regional disparities, but when transport costs fall sufficiently, convergence is also a possible long-run outcome. Adding congestion costs produces more cases of long run dispersed equilibriums (Brakman et al., 2001). This

theory is typically pessimistic about the effects of policy and it gives no recommendations for policy measures.

Evolutionary economic geography (EEG)
In EEG, agglomeration advantages are also important, but it focuses much more on the role of entrepreneurship and innovation in the Schumpeterian sense in relation to the cohesion in networks and clusters (Boschma and Kloosterman, 2005). EEG differs from NEG and neoclassical theory in that it assumes bounded rationality. It focuses on the explanation of processes of change in which a region is seen as a 'complex adaptive system' wherein the generation and use of knowledge is a crucial factor. Technology is seen as a combination of knowledge and competences. Knowledge is subdivided into 'information' (data), 'coded knowledge' (books, websites, patents, and so on) and 'tacit knowledge' (embedded in persons). Information and coded knowledge become more easily available and distance becomes much less important due to technological progress. The accumulation and use of tacit knowledge is still, or even more so, influenced by geographical proximity.

Demand-driven export competition models
The essential mechanisms in these models are that some regions are more competitive in export markets than others. Increasing competitiveness is mostly based on Verdoorn's Law, where productivity growth is a function of growth of total output. More recently Porter (1990) has added that competitive strength is likely to occur in regions where four mutually reinforcing elements are present: good factor conditions like skilled labor; a strong set of related supporting industries; a competitive milieu for firms within the region; and a strong and critical local demand. Both models predict a cumulative causation process that leads to divergence of regions, as some regions are more successful in creating clusters of exporting firms than others.

Innovative milieus and 'learning' regions
Several of the previous theories take the emergence of a geographical cluster of high-tech firms ('innovative milieux') as a factor that causes divergence between regions. The innovative milieu theory presents the underlying mechanisms. In such milieux firms develop and retain key competencies necessary for rapid growth and success (Lawson, 1999). Of special importance is a pool of specialized labor that shares and combines knowledge within a complex system, and forms and maintains effective social relations in organizations. This implies that such regions become 'learning regions', which are attractive for dynamic people and firms, and will therefore show higher growth rates than other regions. This argument typically fits with the ideas of Florida (2002) about the importance of the 'creative class' for regional development. Urban regions that are attractive to dynamic people and firms will have dynamic workers ('the creative class') and entrepreneurs and will, therefore, produce higher growth rates than other regions (Audretsch et al., 2006). Saxenian (2006) adds that the globalization of production systems and processes of outsourcing requires an emerging group of entrepreneurial knowledge workers ('new Argonauts') that are internationally mobile. Regions with the appropriate production structure and an open innovation system that are attractive to these 'new Argonauts' tend to show higher growth rates (Atzema and Boelens, 2006)

From the above overview it is clear that regional disparities in income levels and growth rates may be explained by a broad variety of relevant factors. Some theories predict that regional disparities will converge over time, while others predict divergence. Most theories, however, allow for different outcomes under different conditions. Attempts to explain empirically why some regions succeed (and others do not) have by and large identified similar factors, although the terminology may vary from one study to another. In a recent attempt to explain differences in economic performance between European regions, Cuadrado-Roura (2001) identifies seven attributes that correlate positively with superior performance. In our opinion they adequately summarize the current state of the empirical outcomes. The factors are:

1. City system: the presence in a region of a group of medium-sized cities (population: 40 000 to 150 000) in combination with a large city.
2. Human resources: supply of labor with medium to high educational levels, preferably with moderate wages.
3. Accessibility: proximity to major markets and large urban centers in a physical sense, but also in terms of access and receptivity to new ideas.
4. Producer services: a varied set of firms specialized in consulting, advertising, finance, and so on.
5. Institutional infrastructure: a supporting local government with well-developed development strategies and leadership from the region itself.
6. Image: a positive social climate (particularly, few labor conflicts) and a local environment conducive to cooperation among institutions and organizations.
7. Industrial size mix: many small and medium-sized firms easily leading to knowledge spillovers, as opposed to dominance of a region by a few large firms.

Of course, the characteristics of regions that correlate with relative, and eventually absolute, population and employment decline are also important from a policy point of view. Based on a study of Canadian regions Polèse and Shearmur (2006) formulate the following preconditions for regional decline.

National attributes:

1. A geographically large nation with a periphery, that is, inhabited spaces located beyond a one-hour drive from a major urban center.
2. A nation in the last stages of demographic transition: natural population increase is either close to zero or negative.

Regional attributes:

1. Located in the periphery of the national or continental space economy.
2. Not located along a major transport axis or trade route.
3. No urban area of over 100 000 and/or less than three urban areas with over 40 000 within a 100 km range of each other (thresholds can vary with context).
4. An economic base in resource exploitation and/or primary processing.
5. A resource base whose limits of (profitable) exploitation have been reached.

6. Presence of Weberian weight-losing[1] industries, capital-intensive, with high labor productivity and high wages.
7. Climatic and geographical conditions that limit year-round tourism.

All of the conditions need not be present for decline to occur. In poorly located, sparsely populated regions, attribute 6 for instance is not a necessary condition. Moreover, attributes may reinforce each other, but a positive attribute may also compensate negative impacts of others.

What are the implications of both lists? One could argue that policy measures for regions destined to decline are a waste of resources given the very low chances of success. For regions that meet the criteria for success, regional policy measures do not seem necessary because these regions can realize growth without help. However, most regions will have characteristics in–between these two extremes, and regional policy measures could be aimed at removing less favorable characteristics and stimulate the creation of success factors.

23.3 Instruments of regional policy

Let us now turn in more detail to the implications of the above for the design of regional policy measures. From a people's prosperity perspective, it seems most evident to help immobile unemployed in lagging regions to move to more prosperous ones. The rationale is that if individuals were perfectly mobile the unemployment problem would not persist. Apparently there are major obstacles to mobility. In this respect there are interesting differences between Europe and the US. The classic studies by Blanchard and Katz (1992) for the US and by Decressin and Fatás (1995) for Europe show that there are major differences in the adjustment process in the regional labor markets. In the US about two-thirds of the adjustment takes place via migration, whereas in Europe changes in regional participation rates account for more than two-thirds of the adjustment. This result has been confirmed in many studies and is remarkably stable (see Broersma and Van Dijk, 2004). The high mobility of workers may explain why regional policies and regional inequality are not considered public priorities in the US (Dupont, 2007). In the US, regional policy mainly takes the form of stimulating job creation and entrepreneurship at the city level, and of reducing racial and class segregation (Jonas and Ward, 2002).

In Europe, in contrast to the US, migration stimulation policy measures have been used in the 1960s and 1970s. Van Dijk (1986) shows for the Netherlands that the number of workers assisted was very limited. Moreover, Van Dijk et al. (1989) show that the correlation between migration rates and re-employment rates is much weaker in the US than in the Netherlands. The main explanation is that unemployed in the Netherlands migrate after they have found a job (contracted migration), whereas in the US they do so before (speculative migration). In a follow-up study, Van Dijk et al. (2000) show that the benefits of migration in the US are especially high in terms of wage increases for highly skilled workers, whereas such benefits are much lower in most continental European countries due to their centralized national wage-setting. Layard (2006) argues that stimulation of migration does not seem to be an adequate instrument to help people with poor chances on the labor market, as their willingness (and ability) to move to other regions is low. Moreover, he argues that although migration may lead to higher income, the negative effects of loss of family stability and higher crime rates tend to dominate the income gain.

Instead of moving 'workers to work', moving 'work to workers' is a different and much more used regional policy strategy in Europe. In this respect there are two approaches:

1. moving jobs from regions with tight labor markets to regions with high unemployment rates (exogenous or redistributive growth);
2. stimulating the creation of new jobs in regions with high unemployment rates (endogenous or generative growth).

Moving jobs can take several forms. Especially in the UK in the 1960s and 1970s, firm migration was seen as a means to transfer work and prosperity to lagging regions, while at the same time reducing congestion, such as labor shortage and lack of space, in the core regions. In the 1980s and 1990s, however, policy incentives were much more focused on the stimulation of endogenous growth, while policy-makers lost interest in stimulating firm migration (Pellenbarg et al., 2002). Another way of moving jobs from leading to lagging regions is the relocation of public sector jobs. Oosterhaven (1981) has shown that this has been a very effective regional policy measure for the Netherlands, and recently Marshall et al. (2005) point out the positive effects of public sector dispersal for Britain.

By far the most important strand of regional policy measures nowadays aims at stimulating job creation in lagging regions. Over time and space, a host of different types of measures have been taken, such as supporting starting firms, providing export and innovation subsidies for small local firms, creating social networks among firms, stimulating spin-offs of universities and technological institutes, and providing office space with common facilities. Some measures are in operation for only a few years, but others are applied for longer periods. The differences in measures reflect the continuously changing ideas about how regional development can best be achieved. Oosterhaven (1996) presents the following typology of policy measures to stimulate job creation:

1. direct versus indirect measures;
2. restrictive (stick) versus stimulating (carrot) measures;
3. subsidies on capital versus subsidies on labor;
4. single measures versus integrated packages.

Direct versus indirect measures

To stimulate firm establishments a government can opt for indirect measures, such as creating a better infrastructure (roads, railroads, industrial sites, and so on), stimulating research and development (R&D) and innovations, improving educational facilities and providing an attractive environment (housing, facilities for sport and recreation, cultural facilities, and so on). Such improvements may tempt entrepreneurs to locate in an area they used to ignore as a location alternative. Alternatively, government can choose a more direct way by offering financial compensation such as tax deductions (fiscal zones), soft loans, investment premiums, low land prices, favorable energy contracts, and so on. These measures are more direct than investments in infrastructure, and so on, as they provide a direct financial contribution to an individual firm, but they are also indirect because the effect ultimately depends on the entrepreneur who is free to decide. Examples of strictly direct measures are the relocation of government institutions, which is under complete control of the government, and financial assistance of specific firms who are in financial

trouble. Substantial financial participation in firms (over 50 percent) by state-owned regional development companies may also be seen as a rather direct policy measure.

The stick versus the carrot

Relocation of economic activity is influenced by push- and pull-forces. Attempts to influence relocations are mostly aimed at the pull side by making the target regions as attractive as possible. Investment premiums are a good example of a carrot to attract new firms or to stimulate growth of existing firms. But it is also possible to act on the push side by stimulating entrepreneurs to outmigrate from congested areas with tight labor markets. This can be done by direct push-measures, such as permits for investing in new establishments or expanding existing ones, or by more indirect push-measures, such as congestion taxes.

Subsidies on capital or labor

When the carrot is chosen, the next question is: which production factor(s) should be subsidized: labor, capital, energy, intermediate inputs, services, knowledge? The choice will depend on such factors as output, price, substitution possibilities, sector structure, multiplier and long-run effects. This can be illustrated by the choice between capital and labor subsidies (see also Armstrong and Taylor, 2000). Labor subsidies will stimulate the output of labor-intensive industries or the remuneration of labor. Moreover, labor subsidies may lead to substitution of capital by labor. In the case of capital subsidies particularly capital-intensive industries and profits will benefit. Labor may be substituted by capital leading to a decrease in the number of jobs. So, when employment creation is the primary goal, labor subsidies are more effective than capital subsidies. This effect on labor is further strengthened by indirect macro effects, as increased labor demand and higher wages will lead to local expenditure which, *ceteris paribus*, is greater than the effects due to subsidized capital and profits, since the latter impacts are more likely to end up outside the region, especially when it is weak and lagging.

There are two arguments that qualify this conclusion. First, labor-intensive industries may have less long-run growth potential than capital-intensive industries, especially in the case of weak regions in developed countries. Second, it is more effective only to subsidize an idle production factor rather than (also) its stock already in use which is more easily implemented in the case of capital than of labor. Of course, one should avoid subsidizing mobile capital, such as means of transportation, that can easily leave the region after the subsidy is collected. The implementation of a subsidy on new jobs is more complex than that on new capital: what is a new job and for how long should the subsidy last? Comparable, but differently weighted, arguments apply to the choice for technology, R&D, energy and other factor or sales (exports) subsidies.

Single measures versus integrated packages

In its first stages a regional policy program tends to focus on specific policy goals and specific policy measures. Later on (partly due to bureaucratic forces) regional programs usually develop towards complex packages of policy goals and policy measures. The costs of these packages tend to increase strongly while it becomes more and more difficult to evaluate their effects, and especially the effects of single measures included in these packages. Therefore, when funds for regional policy are limited, it is advisable to restrict the

set of measures and make them as selective as possible, aimed at a restricted set of goals or even a single goal (see Oosterhaven, 1996, for a description of this long-term development in regional policy in the Netherlands).

23.4 Measurement of effects

Measurement of policy effects is a crucial step in the development and adaptation of regional policy. In this section we present a brief overview of the main measurement approaches and methods. We start with the conceptual framework which is made up of the following elements:

1. Policy goals and targets: as mentioned above, the most general goal variables of regional policy are equity and efficiency. From these policy goals more concrete and operational policy targets need to be derived, such as the desired level of investment or employment growth.
2. Policy instruments, that is, the variables under the command of the government by which the policy goals and targets are pursued. An instrument consists of a specific set of governmental acts which are internally cohesive and externally distinguishable.
3. Non-policy variables: the policy targets are usually influenced not only by policy instruments but also by non-policy variables that are not under the command of the regulator. The effects of the non-policy variables may be more important than the effects of the policy instruments.
4. Additional impact variables: regional policy may not only affect policy targets but also other variables.
5. Direct and indirect effects: indirect effects on policy targets materialize via intermediate variables.
6. Time lags: some effects may materialize in the short run whereas others materialize over longer time horizons. Moreover, one and the same effect may materialize over several periods.
7. The total effect of a policy instrument consists of all the direct and indirect effects on both the policy and additional impact variables over all time periods.

The measurement approaches can be divided into micro and spatial approaches. In the former the data are of the lowest level of aggregation and refer to such units as firms, households, workers, and so on. In spatial approaches the individual data have been aggregated by regions.

Micro approaches

Controlled experiments This type of micro approach has been used relatively little in impact studies of regional policy so far. There seems to be a growing interest, however, and therefore it is described here. The essence of laboratory experiment lies in observing the effect on a dependent (policy target) variable of the manipulation of an independent variable under controlled conditions. Rather than this extreme form, a more common approach in (regional) economics operates along the following lines. Groups with different histories of the policy instrument are selected, and in these groups differences with respect to the policy target are analyzed. The selection is supplemented by matching as many of

the relevant independent policy and non-policy variables as possible, so as to control the effects of other variables than the policy instrument. In practice, only a limited number of variables can be matched. Therefore, the matching is supplemented by 'control through measurement'. This means that a relevant variable, which cannot be used for matching, is taken into account by gathering information about it from the respondents. Finally, the possible disturbing influences of uncontrolled variables are taken into account by randomly selecting samples from the matched groups (see, among others, List, 2006).

It is clear that the main advantage of controlled experiments lies in the high degree to which the causal relations between policy instrument and policy target are isolated from the disturbing influences of other variables. There are, however, various difficulties inherent in the use of controlled experiments in policy research. First, the problem of matching may be difficult or impossible. In regional impact studies the problem of matching is worsened by the fact that both the experimental and control groups have to be located in the same region or at least in similar regions, which may seriously limit the number of members in both groups. Secondly, the results are limited by the experiences of the groups involved in the experiment. So the specific results may be difficult to generalize to other situations. Finally, the experimental setting may have disturbing effects on the participants, which may lead to unreliable outcomes. In spite of these difficulties, controlled experiments have been applied in various situations. For instance, Smith (1979) studied the provision of public goods while Hall (1975) analyzed the effects of income taxes on the supply of labor.

In general economics controlled experiments have become a standard research tool and are applied in a wide variety of fields including market behavior, decision-making, bargaining, social preferences, learning, free-riding, the provision of public goods and environmental policy. See *inter alia* Kagel and Roth (1995). Since many of the topics mentioned above are also relevant in regional science, it would be worthwhile investigating the applicability of controlled experiments in this field.

Quasi-experimental and non-experimental research Quasi-experimental research consists of surveys among agents who are expected to have been affected by policy. They may provide detailed information on the various factors influencing decision-making and especially on the relative weights of the policy instruments. The information obtained via surveys may relate to direct and indirect effects of policy. As an example of the latter, consider the case that investment subsidies have led to the establishment of an important industrial enterprise in a given region. In order to assess indirect effects for other firms, a survey could be held among these firms with respect to the importance for their operations of the newly located enterprise. From the above it follows that well-designed surveys may give detailed information about the decision processes of the respondents; in particular, of their perceptions of the importance of relevant factors. Furthermore, surveys may provide information to make comparisons between different situations, for example before and after the move of a firm. Finally, information about such matters as time lags between decisions with regard to, and realizations of, for example, investments may be obtained.

The survey approach as a measurement method may suffer from the drawbacks of surveys in general. These can be grouped under the headings: misinterpretation of questions, strategic responses and measurement errors. An example of the first problem

is the *ex post* rationalization of the proper factors underlying the decision made. An example of the second problem is the under-reporting of the effect of investment subsidies to promote higher subsidies in the future. Part of these problems may be mitigated by incorporating questions which only indirectly relate to the policy variables. Another limitation is that the information obtained is affected by the perceptions and expectations of the interviewees. Moreover, it is often difficult to obtain reliable data on the past because of the 'loss of memory' of organizations as a consequence of new management, destruction of information, and so on. The survey method has been applied to a variety of problems. For instance, Baumont (1979) investigated the impacts of migration incentives; Calame (1980) studied effects of wage subsidy programs; Marquand (1980) and Krist (1980) investigated the impacts of investment subsidies on the location decisions of firms; whereas Pellenbarg et al. (2002) and Meester and Pellenbarg (2006) used the approach to analyze firm migration and the spatial preference map of Dutch entrepreneurs, respectively.

The second kind of micro approaches consists of non-experimental research. Whereas the researcher has control over the influences of the causal variables on the policy target in experimental research, and over data collection in quasi-experimental research, no control is exerted by them in non-experimental research. It is restricted to the observation of the policy target in different situations, such as before and after a policy intervention or in different regions. In non-experimental research no attempts are made to separate effects of policy instruments from effects of non-policy variables. Therefore, its use is restricted to situations where the latter types of effects do not exist or can be taken into account in other ways. This is *inter alia* the case in situations where direct effects of instruments of the control type are under study. For instance, the direct employment effects of the construction of an infrastructural project can be derived from the construction expenses in a straightforward way.

Regional approaches

The data used in spatial approaches are usually obtained from micro units in surveys conducted by authorities, such as a central office of statistics. The surveys tend to be relatively simple and relate to key issues such as investments, number of persons employed, and so on. In contrast to the surveys discussed above, the information asked for usually does not directly relate to regional economic policy. Therefore, there is less danger of answers which have been biased to influence future policy. It is obvious that when no information on policy is gathered from the micro units it has to be obtained elsewhere, for instance at the ministry responsible for the policy. An important advantage of many surveys organized by public authorities, such as a ministry or a central bureau of statistics, is that they are repeated periodically. This means that information to estimate effects of policy becomes available for much longer periods than in the case of the micro studies, which are usually organized only incidentally. However, there are two shortcomings: (1) in repeated surveys only successful firms are tracked over time which may result in survival bias; and (2) not all surveys are representative at the regional level. The former type of problem can be handled by means of careful comparison of drop-outs and survivors, whereas the second requires action at the stage of the sample design.

Using the present kind of data, the following types of approaches have been used to measure effects of regional policy.

Approaches with explanatory variables of the policy type only These approaches compare the scores of impact variables in 'policy-on' situations with their scores in 'policy-off' situations, and ascribe the differences solely to policy. Thus it has to be assumed that the possible effects of non-policy variables may be neglected. This approach can only be used in situations with prior knowledge about the absence of the effects of non-policy variables or in situations when non-policy effects on the impact variables can be completely isolated from effects of policy, as in the case of the relocation of government offices. In practice these conditions are seldom fulfilled.

Single-equation models with explanatory variables of the non-policy type only This type of approach is based on comparisons of the actual policy-on situation with the hypothetical policy-off situation, where the latter is extrapolated on the basis of non-policy variables only. The gap between the two situations is defined as the effect of policy.

Several variants of this class of models can be distinguished. The simplest variant is the extrapolation on the basis of a univariate time series of the impact variable for the policy-off situation in a single region. It rests on the assumption that the autonomous development of the impact variable in both the policy-on and the policy-off period is the same. This assumption may be violated, especially when a development from a short policy-off period is extrapolated over a long policy-on period. The extrapolation may also be made by means of such methods as seasonal autoregressive integrated moving average approaches (Box and Jenkins, 1976). It may also be based on more simple methods, such as relating the development of the impact variable in a policy region to the development of the impact variable in non-policy regions, or to the development of related variables in the same region which have not been affected by policy. If there is evidence of adequate extrapolation of the impact variable, the method is a simple and easy device to estimate policy effects. It has been used by Begg et al. (1976) to measure effects on investments.

Single-equation models with both policy and non-policy variables In the present context, two kinds of situations will be considered. In the first, information on important non-policy variables is missing but is taken indirectly into account. In the second, information on all relevant variables is available. The method to be used in the first situation will be called 'two-stage time-series analysis'. In order to apply two-stage time-series analysis, a univariate time series of the impact variable for the pre-intervention period and a multivariate time series of the impact variable and the various policy instruments for the policy-on period must be available. The first step is to model the pre-intervention series. Of considerable applicability is the class of multiplicative seasonal autoregressive integrated moving average models (that is, SARIMA models; see Box and Jenkins, 1976). The second step consists of removing the effects of the non-policy variables, estimated on the basis of the pre-intervention series, from the second series. This removal is successful if the relationships between the impact variable and the non-policy variables in the intervention period are the same as in the pre-intervention period. Under the conditions of independence of policy instruments of non-policy variables and an additive model structure, the effects of policy on the impact variable can be estimated by standard techniques from the transformed multivariate time series. For an application of the present measurement approach see Folmer (1986).

When information on both policy and non-policy variables is available, standard approaches with both types of explanatory variables explicitly included (that is, multivariate time-series analysis to a single region, multi-regional or interregional cross-section analysis or a spatio-temporal analysis) can be used to estimate effects of the policy instruments. Examples can be found in, among others, Ashcroft and Taylor (1977) and Heckman (1997). Observe that with single-equation methods only direct effects of instruments on an impact variable can be estimated. In addition, single-equation methods as such do not allow of the estimation of the effects of an instrument on several impact variables. For both purposes, either several single-equation models are required or simultaneous equation methods have to be used. Of the latter we will discuss input–output models and general simultaneous equation models.

Input–output models Input–output models represent sectoral and regional disaggregations of the well-known macroeconomic income–expenditure model, with $Y = C + I + G + X - M$. They especially record the intermediate transactions between industries and industry sales of final goods and services to households, government and exports. Input–output models therefore are typically suited to calculate the indirect effects – for example on value-added, employment or energy use – of exogenous final demand changes. The core impact equation of a typical (type II) interregional input–output model reads as follows (see Oosterhaven, 1981):

$$\Delta v = \mathbf{c'} (\mathbf{I} - \mathbf{A} - \mathbf{Q})^{-1} \Delta \mathbf{f} \tag{23.1}$$

where:
Δv = change in the impact variable, for R regions and J industries;
$\mathbf{c'}$ = RJ row with impact variable per unit of output;
$\mathbf{A}$ = RJ x RJ matrix of intermediate input coefficients;
$\mathbf{Q}$ = RJ x RJ matrix of households' expenditure per unit of output;
$\Delta \mathbf{f}$ = RJ column with changes in exogenous final demand.

Model (23.1) can be generalized in various ways. Usually it is embedded in either a demo-economic model framework with time lags (see Batey, 1985; Oosterhaven and Folmer, 1985) or it is embedded in a regional econometric framework (see Treyz, 1993). From (23.1) it is clear that only policy interventions that can be specified in terms of changes in exogenous final demand or changes in the model's coefficients can be handled by means of input–output models, and then only when the economy does not suffer from supply bottlenecks. When policy interventions primarily work through prices and the supply–side of the economy is restricted, different models need to be used.

The use of the input–output models is limited by the scarcity of data, especially with respect to interregional linkages. For the same reason, the relations in input–output models usually are not quantified by means of conventional econometric methods. Examples of the input–output measurement approach can be found in Moore and Rhodes (1976), where the impacts of labor subsidies are investigated; in Oosterhaven (1981), where the effects of the relocation of governmental offices and a land reclamation project are analyzed; and in Oosterhaven et al. (2001), where Dutch spatial mainport policy is evaluated.

General simultaneous equations models The structural form of the conventional general simultaneous equations measurement model reads as follows:

$$A_0 y_t = \sum_{i=1}^{p} A_i y_{t-i} + \sum_{j=0}^{q} B_j x_{t-j} + \sum_{k=o}^{m} C_k z_{t-k} + \varepsilon_t \tag{23.2}$$

where:
y_t = g-vector with current endogenous variables at time *t*;
y_{t-i} = g-vector with lagged endogenous variables in period *t-i*, i lags;
x_{t-j} = m-vector with exogenous non-policy variables in period *t-j*, j lags;
z_{t-k} = n-vector with exogenous policy instruments in period *t-k*, k lags;
ε_t = g-vector with random disturbances;
A_i = g x g matrix with unknown coefficients corresponding to y_{t-i};
B_j = g x m matrix with unknown coefficients corresponding to x_{t-j};
C_k = g x n matrix with unknown coefficients corresponding to z_{t-k}.

As mentioned above, single-equation approaches are not appropriate to decompose policy effects which arise along causal chains of length longer than one, and to estimate effects on several impact variables simultaneously. Both aspects, however, can be handled by means of simultaneous equations models. In order to estimate the direct effects of an instrument of policy, all impact variables should be incorporated into the model as current endogenous variables (that is, should be included in the vector y_t). Each impact variable should be specified as a function of the instruments of policy and of the other relevant explanatory variables. In order to decompose indirect effects of an instrument on a given impact variable, both the ultimate impact variable and each of the intermediate variables in the causal chain between the impact variable and the instrument of policy should be specified as current endogenous variables. Thus, a causal chain is represented by a system of equations where each causal variable is among the explanatory variables of the variable it directly affects. For an example of a general simultaneous equation model see Folmer (1986).

Social cost–benefit analysis Finally, social cost–benefit analysis (CBA) may be used to evaluate regional policy (see Heyma and Oosterhaven, 2005). In doing so, it is important to realize that the welfare of a certain population is the goal variable in any well-done CBA, and not the government-declared goals of the regional policy at hand. Any CBA consists of the following more or less standard stages (Hanley and Spash, 1994; Hanley, 2000).

Stage 1: definition of the project or policy. This includes defining: (1) the policy-driven reallocation of resources being proposed; and (2) the population whose welfare is to be considered.

Stage 2: identification of project impacts. In the case of, for instance, a new railway this stage would include a listing of all resources used in constructing the railway (concrete, steel, labor hours) as well as effects on local unemployment, traffic movements, local property prices, time saving and accidents, wildlife populations, and impacts on the quality of landscape in the area not picked up by changes in property values (for example Elhorst et al., 2004).

Stage 3: selection of economically relevant impacts. A CBA assumes that society is interested in maximizing the weighted sum of utilities across its members. These depend,

amongst others, on consumption of marketed and non-marketed goods (for example clean air). Benefits will either be increases in the quantity or quality of the goods that generate positive utility, or a reduction in the price at which they are supplied, whereas costs relate to opposite effects. CBA is primarily interested in the net total of all effects. Important measurement problems relate to additionality and displacement (SACTRA, 1999). Additionality implies that benefits should be measured net of any effects that would have occurred without the policy (for instance employment effects due to national economic recovery), whereas displacement relates to crowding-out elsewhere (for example employment decline due to the stimulation of investments in the region).

Stage 4: physical quantification of relevant impacts. This involves determining the physical size of the impacts, and identifying when in time they will occur.

Stage 5: monetary valuation of relevant impacts. In order for physical measures of impacts to be comparable, they must be valued in common units like relative prices generated by markets. A CBA should therefore: (1) predict prices for value flows extending into the future; (2) correct market prices where necessary, for example at imperfect markets; and (3) estimate prices for non-market goods, such as lost nature and life.

Stage 6: discounting of cost and benefit flows. Due to the existence of a market interest rate, impatience and risk, future cost and benefits need to be converted into 'present values' to make them comparable. The value of a future cost or benefit (X) occurring in time t is made 'present' with a discount rate d as follows: $PV = X_t(1 + d)^{-t}$

Stage 7: net present value and redistribution test. The main purpose of CBA is to help select projects and policies which are efficient in terms of their use of resources. The net present value (NPV) test simply asks whether the sum of the discounted gains exceeds the sum of discounted losses. If so, the project can be said to represent an efficient change in resource allocation. Secondary inventories of who is actually losing and gaining need to be added to the NPV test in order to enable the political weighting of the efficiency and equity effects for different income groups.

Stage 8: sensitivity analysis. The NPV test tells us about the efficiency of a policy or project, given a set of data and assumptions. If these data and/or assumptions change, then clearly the results of the NPV test will also change. An essential final stage of any CBA is therefore to conduct sensitivity analysis, that is, recalculating the NPV when key values are changed, such as the discount rate, the physical quantities, market and especially non-market prices, and the project life-span.

23.5 Conclusion

In this chapter, we have surveyed the theoretical foundations of regional policy by reviewing eight groups of regional growth theories, and we have discussed the strategic and operational dilemmas in selecting regional policy goals and regional policy instruments. In addition we have given an overview of the micro and spatial approaches that can be applied to assess the efficiency and equity impacts of regional policy, and indicated the relative strength and weaknesses of these approaches. From the overview it is clear that regional disparities in income levels and growth rates can be explained by a broad variety of relevant factors. Some theories predict that regional disparities will converge over time, while others predict divergence, but most theories, however, allow for different outcomes under different conditions. Although the theories provide an analytical and behavioral

framework for the choice of policy goals and policy instruments, it is also a political choice that is dependent on the institutional and socio-economic setting and the norms and values with regard to expected spatial and labor market behavior of individuals and firms in a given society. The discussion about differences in migration behavior in the US and in Europe shows that causal mechanisms may show substantial differences over time and space. The differences in characteristics of regions with very good and hardly any potential for a successful regional policy indicate that the choice of policy goals and policy instruments should take into account these variations. The spatial scale may also be important. It is likely that the choice of appropriate policy goals and effective and efficient policy instruments will be different for a local government in a local setting than at the national or state level or at the level of the European Union or the United States. This even holds for measuring the effects of regional policy, as causal mechanisms are different, data are different and the interference of non-policy variables will be different in space and time. Hence, one size definitely does not fit all.

Note

1. The weight of the final product is less than the weight of the raw material that goes into making the product.

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