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Abstract

Over the past two decades, cluster policies have become a standard instrument of public authorities and economic development practitioners in many parts of the world. This paper takes a critical stance on this phenomenon and provides theoretical arguments that challenge the widespread application of cluster initiatives to promote long-term regional development. We distinguish between and compare two main bodies of thought: the neoclassical view and the agglomeration view. We show that there are no rationales for cluster policy from the perspective of neoclassical theory. The agglomeration view, in contrast, provides a convincing conceptual basis for justifying economic policies implemented in form of cluster initiatives. At the same time, however, it points to major problems related with the cluster policy approach. We identify and elaborate on three essential difficulties, i.e. the proper (1) targeting, (2) dosing, and (3) timing of cluster policy actions. We highlight that the problems related with these fundamental issues of each public initiative constitute powerful pitfalls and booby traps of cluster policies.

1 Introduction

By publishing the book “The Competitive Advantage of Nations” in 1990 and subsequent writings (Porter 1998, 2000, 2003), Michael Porter triggered a massive wave of publications about the spatial clustering of industries and related policy actions (recent contributions include amongst others Diez-Vial 2011, Drucker 2011, Engel and del-Palacio 2011, Arian and Schilling 2011, Guillaume and Doloreux 2011, Heebels and Boschma 2011). On the one hand, Porter’s arguments generated a substantial amount of academic work dealing with the conceptual foundation of clusters and their empirical evidence (Swann et al. 1998, Gordon and McCann 2000, Malmberg and Maskell 2002, Martin and Sunley 2003). On the other hand, Porter’s work also inspired policymakers to utilize clusters as a lever to strengthen the economies of their respective countries or regions.

It is this latter aspect, that of “cluster policy”, which is at the heart of this paper. We will deal with the following questions: To what extent is cluster policy a reliable form of policy for stimulating regional economic prosperity? What are the obstacles for policymakers to adequately identify the target of their policy, design their policy, and time its implementation? How certain or uncertain is it that cluster policy actions will turn out to be successful? How high is the risk of wasting scarce economic resources?

We will approach these questions from a purely theoretical point of view. In the context of this paper we define cluster policy as “a policy that invests resources into the formation, support, and development of one or more industry clusters with the goal to strengthen the economic position of their policy’s target area in the long run”. This definition differs from most others (e.g., Andersson et al. 2004, Borrás and Tsagdis 2008) by the explicit inclusion of the long term goal. In most practical approaches to cluster policy this aspect is left implicit: Many economically successful regions contain clusters and successful clusters can stimulate the economic performance of regions. So, develop your clusters and economic success will follow, many policy makers are led to conclude. As we will show in this paper, this conclusion is based on very weak grounds. It is the theoretical basis of the cluster concept and particularly its foundation in the theory of agglomeration economies that triggers these concerns. On the one hand, agglomeration economies explain the very existence of industry clusters and their crucial role in economic development, but on the other hand they challenge

the conclusion that policy can generate economic prosperity in the long run by creating, supporting or nurturing industry clusters.

In the core part of the paper we distinguish two bodies of thought: the neoclassical view and the agglomeration view. We show that only the agglomeration view provides a convincing conceptual basis for justifying cluster initiatives. At the same time, however, it implies a fundamental dilemma for the cluster policy approach. As we will show in the following sections, the agglomeration view basis of cluster policy makes it particularly difficult and risky for policy makers to implement such a policy. We identify and elaborate on three essential difficulties, i.e. the proper (1) targeting, (2) dosing, and (3) timing of cluster policy actions.

The rest of the paper is structured as follows: in the next section (Section 2) we will take a quick look at cluster policy as it is currently applied. Section 3 will turn to the theoretical foundations of cluster policy. We will look at two alternative views on how the economy works. In this section we will also discuss some of the implications these views have for the structure and behavior of the economic system. In Section 4 we will apply these insights to cluster policy. We will investigate to what extent the theoretical basis of the policy can assist policy makers in the most fundamental choices they have to make when designing their cluster policy. How many resources should be devoted to the policy? What should be the target of the policy? At what time should the stimulus of the cluster policy be injected into the economy? The paper closes with a concluding section.

2 Current cluster policy practice

Since the beginning of the 1990s, the cluster notion enjoys increasing popularity with policy actors and economic development practitioners (Martin and Sunley 2003, Borrás and Tsagdis 2008). Over the past two decades, public promotion of clusters has become a “standard” tool of policy actors at the regional, national and international level. Cluster initiatives are now an accepted part of regional development policy, not only in developed countries but increasingly also in post-socialist transition countries and developing countries (Sölvell et al. 2003, Ketels et al. 2006).

Cluster policies come in many shapes. Some are directed towards promoting existing clusters whilst others intend to create new ones. Many countries and regions have set up initiatives to (1) seed new high-technology clusters (in particular in the fields of biotechnology and ICT), (2) stimulate the growth of those already located in the region and (3) prevent established ones from decline. Indeed, global cluster initiative surveys (Anderson et al. 2004, Sölvell 2009) provide evidence for the ongoing cluster euphoria in policy in many parts of the world and they suggest that cluster policies take a variety of forms. Anderson et al. (2004) distinguish between five approaches of cluster policy, which are sometimes combined in one concrete cluster initiative. These approaches comprise

- broker policies (measures directed towards stimulation of dialogue, communication and cooperation among cluster actors),
- demand side policies (public procurement, fostering the development of observatories and expanding the range of information and data about markets),
- training policies (vocational training programs),
- measures for the promotion of international linkages (attraction of inward FDI, support of the formation of export networks, public sponsoring of marketing campaigns, etc.), and
- framework policies (policies targeting infrastructure and institutional conditions)

Also earlier work done by Boekholt and Thuriaux (1999) confirms the view that a large variety of measures are employed within the context of cluster policy. These include mapping exercises to identify clusters, networking programs to encourage firms to take up opportunities for collaboration with other firms, setting up of cluster specific technology and research centers, attraction of FDI to deal with the problem of missing elements and support for start-up firms in order to promote cluster growth. There is, however, little systematic evidence on the success of many cluster policy actions (see, for instance, Martin and Sunley 2003).

3 The theoretical background of cluster policy

Many definitions of clusters include a reference to the agglomeration of related economic activities. For example, Porter (1998) provides the following definition: “A cluster is a

geographically proximate group of interconnected companies and related institutions in a specific market, linked by interdependences in providing a related set of products and/or services” (p. 197). In this sense clusters can be seen as a conceptual step in the tradition of Marshall (1920) who underlined the importance of positive agglomeration economies. Another predecessor of clusters is the concept of network externalities (Rohlfis 1974, Economides 1996), which highlights the positive role of interconnectedness and of the corresponding communication standards.

The fact that the cluster concept is seen to be based on agglomeration economies, network externalities and other forms of economic externalities also relates it to other important theoretical developments of recent decades. The most important ones are evolutionary economics and its application to economic geography (Martin and Sunley 2006, 2011, Wolfe and Gertler 2006, Frenken et al. 2007, Ter Val and Boschma 2011) and that of new growth theory and new economic geography (Aghion and Howitt 1998, Krugman 1991, Fujita et al. 1999, Fujita and Thisse 2002). All these theories share the conviction that the mentioned externalities are an essential feature of modern economies rather than an isolated deficit – a market failure – that needs to be corrected by policy.

When we want to analyze the opportunities that cluster policy defined in the above mentioned way has for influencing the long term economic prosperity of a region, we need some understanding of how a regional economy works. At a general level we can distinguish between two main views:

1. The “neoclassical view”, and
2. The “agglomeration view”.

Both views that we will discuss in more detail below take a comprehensive look at the economy and its various elements and interactions. In a general equilibrium perspective they take into account commodity, labor, capital, and additional markets as well as the transfers between these markets and between the spatial units considered.

The two views differ by their treatment of agglomeration forces and transportation costs. The neoclassical view excludes both agglomeration economies and transportation costs by

assumption. This simplifies the formal structure of the model and allows us to derive some very clear and specific results. The agglomeration view, on the other hand, allows for positive agglomeration forces that are counteracted by transportation costs. Depending on the relationship between these forces, the models of the agglomeration view lead to different results. Since the other assumptions of the neoclassical view usually remain unchanged in the agglomeration view models, one can view the neoclassical view as a special case of the agglomeration view. The former results from the latter when we assume neither agglomeration economies nor transport costs do exist in the economy.

Neoclassical view

In regional economics the neoclassical view results from the application of the principles and assumptions of neoclassical economics to a regional economy. The neoclassical view is “what is taught to students, what is mainstream economics today” (Weintraub 1993). Neoclassical economics is based on a set of assumptions and its theoretical conclusions are deduced there from. The most important tool of neoclassical economists is mathematics, in particular calculus. The application of these assumptions and of the economic toolbox has led to a consistent set of arguments and to principles that are widely shared by economists. In the context of our paper, a brief discussion of the neoclassical view is justified by the influence it still tends to have on policy considerations. Most of the market principles that guide the design and implementation of some of our policies are derived from the – fairly limited – perspective of the neoclassical view.

The most important assumptions of the neoclassical view are utility/profit maximization, perfect information, perfect mobility, and perfect competition. The neoclassical assumptions guarantee that economic actors always pursue their self-interest and in doing so are not restricted by limited information, transaction and mobility costs or power of rival actors. Market prices always represent the scarcity in the respective market and signal opportunities to increase their utility or profit. Because of the assumptions actors will always pursue these opportunities. In the context of our paper the assumption of “perfect competition” and the assumption of “perfect mobility” are of particular relevance.

The assumption of “perfect competition” implies that production takes place according to a linear homogeneous production function. This implies that changing all the inputs to a certain production process by a certain factor changes the output by the same factor. So, irrespective of the scale of production, the costs per unit remain the same, larger or smaller units do not have an economic advantage over others, and agglomeration economies are excluded by assumption. We use the term “agglomeration economies” here in a broad sense. They include all effects of concentration of production irrespective of them being within a plant, firm or sector (economies of scale) or between those units (“external economies”, “localization economies”, “urbanization economies”). In summarizing, it can be said that in the neoclassical view there is no economic incentive toward the concentration of production. If such an incentive existed in one sector, for example, it would work toward the concentration of all the global production in this sector in one location. Because of the assumption of perfect mobility, there is no force counteracting this concentration tendency. This would generate one monopolist in this sector, contradicting the requirements of perfect competition.

The assumption of perfect mobility eliminates one of the most important elements of spatial economics: transport costs. The assumption implies that all goods, services, and individuals can be transferred across space without any costs in terms of money, time, and effort. This assumption guarantees that there is “one” market with many suppliers and customers instead of various spatial markets which conflict with perfect competition because of their limited numbers of actors.

Because of the assumption of perfect mobility it is difficult for neoclassical economics to deal with regions and space. When we relax this assumption and allow for physical distance and transportation costs, we either get in conflict with other neoclassical assumptions, like perfect competition, or end up in the perverse structure of “backyard capitalism” (Mills 1972, Starrett 1978). With transportation costs it is profitable for producers to breakup production facilities and locate them as closely as possible to the location of the customers. Because of the assumption of perfect competition, which implies the absence of agglomeration economies, this can be pursued until all products are produced in the backyard of their respective customer. In this “backyard capitalism” there are only subsistence industrialists and no large scale production facilities that require external labor. No products are shipped from one

location to another, no workers commute from home to work. Although transportation costs are the ultimate reason for this structure, in equilibrium no resources are used for transport.

This example shows clearly how the assumption of perfect competition and the assumption of perfect mobility are related. If we want to avoid outcomes of complete concentration and of “backyard capitalism”, whenever we relax one of the assumptions, we also have to adjust the other. They relate to counteracting forces in a spatial economy. Agglomeration economies pull production together while transportation costs pull it apart.

An immediate consequence of its assumptions is that the neoclassical model is a linear model. This has a number of implications which are important for its policy recommendations:

- Marginal changes lead to marginal reactions: In all markets, a small increase in demand yields a small increase in the respective price which in turn stimulates a small increase in supply which brings supply and demand back to equilibrium. There are no threshold levels that need to be crossed before markets react. Consequently, there are no beaten paths that the economy will follow nor can it be locked into a specific equilibrium by the structure it generates.
- There exists only one equilibrium outcome: This equilibrium is Pareto-efficient and socially optimal. The assumptions ensure continuously increasing supply and continuously decreasing demand curves which intersect in one point which defines the market equilibrium. Since actors will trade or produce only when they can increase their utility or profit, everyone reaches the highest level of the objective function that can be achieved under the existing constraints. The resulting equilibrium is therefore optimal for every individual actor as well as for society as a whole.
- Disturbances are washed away over time: They lead to deviations from equilibrium which triggers market forces that bring the economy back toward equilibrium. Therefore, disturbances can only have a temporary effect that disappears over time. The long run outcome of the economy cannot be changed by external disturbances.

These implications lead to the famous policy recommendation of neoclassical economics that policy should leave the economy alone. The market mechanism generates the optimal

outcome through its “invisible hand” and does not need any help from policy makers. Policy interventions may actually just generate disturbances that temporarily prevent the system from reaching the equilibrium. Moreover, according to the neoclassical view policy interventions only have temporary effects and cannot alter the long run outcome. At best they are useless, but probably even damaging and a waste of resources.

It is quite obvious that cluster policy does not fit into the framework of the neoclassical view of the economy. In a neoclassical economy, any attempt to concentrate production in one region will immediately generate counteracting forces that will disperse production again. The concentration of production generated by, say, cluster policy will drive up wages and drive down capital rents in the respective region relative to others (Borts and Stein 1964) which will stimulate workers to move toward the region and capital to move away from it. Through this effect the perfect mobility of resources will dissolve the production cluster again. Consequently, cluster policy of the type that we have defined it above, will not work in a neoclassical economy and the funds allocated to this policy will simply be wasted.

Agglomeration view

In the late 1980s the neoclassical view was more and more criticized. The main source of criticism was its inability to explain economic growth in the long run. In the neoclassical model, because of diminishing marginal returns to capital, growth in the long run depends on the rate of innovation. Moreover, the rate of innovation cannot be explained within the model, because innovation appears as a public good and will therefore not be produced by profit maximizing entrepreneurs.

Attempts to resolve this problem led to models that relaxed the assumption of perfect competition and allowed for agglomeration economies. Work by Romer (1986, 1987, 1990), Rebelo (1991), Barro and Sala-i-Martin (1995) and others popularized “endogenous growth models” which turned out to be major elements in the development of the agglomeration view. Another important contribution was the idea of “monopolistic competition” developed by Dixit and Stiglitz (1977). Their model combined product specific monopolies with competition between the products and became a cornerstone in many formal agglomeration view models.

Krugman (1991) and others extended these ideas to two identical regions and investigated the economic relations between them. This approach became known as “new economic geography”. In order to avoid uninteresting corner solutions, they introduced transportation costs as a force counteracting the concentrating tendencies caused by agglomeration economies. The relation between the centripetal force of agglomeration economies and the centrifugal force of transport costs turns out to be a key parameter for the performance of the new economic geography (NEG) models.

The new economic geography version of the agglomeration view has developed out of the neoclassical view and therefore shares many of its basic assumptions. As has been mentioned above, the agglomeration view can be seen as a generalization of the neoclassical view as it introduces agglomeration forces and transportation costs into its basic structures. The implications of this seemingly minor adjustment are quite dramatic. Because of these changes the agglomeration view models become non-linear and specific results depend to a large extent on specific functional forms of equations and on parameter values. The vast majority of the respective literature discusses model specifications, assumptions and their implications for the properties of the model. The literature dealing with policy consequences is much more limited. An important exception is the book by Baldwin et al. (2003) that deals with the relation between economic geography and public policy. Although it lays out the properties of economic geography models from a policy perspective, it does not take the step that our paper does of looking at the implications these properties have for a specific form of policy.

< Figure 1 about here >

The most important properties of the agglomeration view model can be explained easily by use of Krugman’s famous “tomahawk bifurcation” (Figure 1). It shows the relationship between transportation costs on the horizontal axis and the share of production of region 1 in a two region model. The model that produces this graph is a general equilibrium model that allows capital and labor in the industry sector to move freely between the regions. To keep production from concentrating completely in one of the regions, the NEG-models typically assume that in addition to the industry sector there is another sector (e.g., agriculture) which is not mobile between the regions.

When transportation costs are high, the firms try to stay close to the consumers of the immobile sector. Since agglomeration forces are weak relative to transport costs, it does not pay for them to cluster production in one of the regions. Since production distributes equally between the regions according to the workers/customers in the immobile sector, industrial workers also split equally between the regions. The result is a stable equilibrium with 50 per cent of production, workers, and customers being located in region 1.

When transport costs are low relative to agglomeration economies, the latter dominate the distribution of production. It pays for producers in the industry sector to concentrate all their production in one of the regions and to serve both regions from there. The benefits of concentrated production outweigh the costs of transporting the products to the customers in the other region. Since industrial jobs are concentrated in the one region, industrial workers will migrate to this region as well, thus strengthening the concentration of demand as well as that of labor. This stabilizes the concentrated production equilibrium, where all industrial production will be located in just one region. Only the immobile sector is left in the other region.

Since the two regions are assumed to be identical, the model cannot predict in which one of the two regions industrial production will concentrate. When transport costs are low enough, a small random disturbance may decide between the two options. It is important to note, that both are stable equilibria. Once reached, none of the economic actors can gain by deviating from the respective equilibrium.

Contrary to the neoclassical model, the NEG model yields multiple equilibria. This is the first important property to note. In the range of medium transport costs, there are even three of them. As indicated by the dashed vertical line in Figure 1, production may be concentrated in region 1 (intersection with the top line), or in region 2 (intersection with the bottom line), or it may be split evenly between the two regions (intersection with the middle line). In the latter case, industry finds enough demand in each of the regions to keep production located there. Concentrating it one of the regions would be uneconomical because of the costs of transporting the products to the other region.

The second property to see from the tomahawk bifurcation is “path dependence”. Which one of the three equilibria in a medium transport costs case will be realized depends on the path the economy has taken before. When the economy reached this situation through declining transport costs, it will reach this area with production equally split between the regions (the only stable equilibrium at high transport costs). Since equal distribution is also a stable equilibrium at medium transport costs, this distribution will remain.

When the medium transport costs case is reached through increasing transport costs, production will already be concentrated in one of the regions. Since this is also a stable equilibrium in the medium transport costs case, this distribution will persist as well. Contrary to the neoclassical model, where the effects of disturbances fade away over time and the model always returns to the one equilibrium, in the agglomeration view model the long term result may depend crucially upon the development in the past. Because of this dependence of the long run outcome on the development path, policy interventions may lead the regional economy to one long term outcome vis-à-vis another.

A third important property is “catastrophic changes” (indicated by the arrows in Figure 1). Suppose that the medium transport costs equilibrium has been reached through declining transport costs. Because of the arguments made above, production will remain equally split between the regions. However, when transport costs decline even further, at one point this equal distribution equilibrium becomes unstable. At this point all the production and all the industrial workers will be attracted to one of the two regions. Since this change is not gradual, as it is typical for neoclassical models, it is called “catastrophic”. At this point, usually called a “bifurcation point”, the economy can “choose” between – in this case – two future development paths. One implies the concentration of industrial production and of industrial workers in region 1; the other implies their concentration in region 2.

< Figure 2 about here >

When viewed over time, these mechanisms imply a development path like the one sketched in Figure 2. This is known as the “pitchfork bifurcation”. On the vertical axis it shows again the share of production in region 1 in a system of two identical regions. Instead of a parameter

value as in Figure 1, on the horizontal axis we now show time. So, the economy always moves from left to right through this graph.

The bifurcation point is located at time t_0 . At this point in time, the equal distribution equilibrium that characterized the system up to this point cannot be sustained any longer and the system will either move to the upper branch (all industry concentrated in region 1) or to the lower branch (all industry concentrated in region 2) of the pitchfork. This pitchfork bifurcation diagram will play a central role in the next section of the paper.

When the economy in its development over time approaches such a bifurcation point, the existing equilibrium loses stability and the system can switch to another development path. From an a-priori point of view various possible paths of development exist for the region. At bifurcation points it may move onto one or the other. Once the path is chosen, path dependence sets in and stabilizes the development path until – maybe – another bifurcation point is reached. When the economy is approaching a bifurcation point, relatively small random events or policy interventions may suffice to guide it toward one of the available development paths. At stable periods, away from any bifurcation points, even after substantial policy interventions may the economy return to the stable equilibrium path just like in a neoclassical economy.

Since the entry of a new producer into a regional economy through the agglomeration forces has positive implications for all the already existing firms in the region, the agglomeration forces imply an externality. Therefore, the neoclassical result that the equilibrium is Pareto efficient and socially optimal does not hold any longer in the case of the agglomeration view. The equilibrium that is reached through the market mechanism may be both inefficient and socially undesirable. Under the assumptions of the agglomeration view a Pareto efficient and socially optimal equilibrium is actually a rather unlikely coincidence.

In the neoclassical view, the standard treatment for externalities that threaten the optimality of the market equilibrium is the internalization of the externalities. In the agglomeration view, however, the externalities (i.e. the agglomeration forces) are not just a nuisance, but an essential part of the economy. Removing them through internalization would lead to the

above mentioned structure of “backyard capitalism” and reintroduce all the conceptual problems that have eventually led to the development of the agglomeration view.

4 The pitfalls and booby traps of cluster policy

A need for policy

What does all this mean for cluster policy when defined as in section 1 of the paper? First of all, it should be clear from our previous discussion that cluster policy cannot be justified by the neoclassical view. In an economy where the agglomeration of activities does not generate any benefits, a policy that attempts to generate such agglomerations does not make any sense. Conceptually, cluster policy can only be based on an agglomeration view. A major difference between the neoclassical view and the agglomeration view, however, is that only in the agglomeration view it is possible for policy to influence the long term performance of a regional economy. While in the neoclassical view the economy always returns to its inherent development path after some policy intervention, in the agglomeration view that policy intervention may move the regional economy toward another equilibrium and thus onto another long term development path.

Moreover, the agglomeration view also implies a need for policy; again contrary to the neoclassical view. Since the outcome generated by market forces is not necessarily optimal or socially desirable in an agglomeration view economy, policy may be needed to move the economy to a more desirable equilibrium. So, economic policy in general and cluster policy in particular is not only not a useless effort as in the neoclassical view, but may even be a necessary intervention for the region to reach a desirable development path. The agglomeration view, we can conclude, implies strong support for economic policy, which may be implemented in form of cluster policy.

However, cluster policy may be viewed at and implemented quite differently at different spatial levels. The support the policy provides for agglomeration of economic activities in one region always implies a (relative) loss of economic activities in other regions. Cluster policy successfully implemented in region A will always be at the expense of region B. Since it strengthens agglomeration economies, such a policy will always redistribute activities and

social welfare between regions. While the regional policy maker in the successful region will not be bothered by the effect his/her policy has on neighbors, a cluster policy implemented at the national level will have to take the resulting disparities between its regions into account. Therefore, the optimal cluster policy at the regional level may be quite different from that on the national level.

The problems of cluster policy

The agglomeration view points to a fundamental dilemma: The same mechanisms that provide a conceptual basis for cluster policy also make it extremely difficult to design such a policy adequately. The term “design” encompasses various aspects:

- The targeting of the policy: What sector should be targeted by the cluster policy?
- The dosing of the policy: How strong should the cluster policy incentive be? How much intervention is needed for a long term effect?
- The timing of the policy: When is the right time for the cluster policy intervention?

Targeting of the policy

For cluster policy to be effective, it needs to be targeted to a sector that fulfills at least two requirements: (1) it needs to show strong positive agglomeration tendencies, and (2) it needs to be available for clustering in the target region. These two requirements are somewhat contradictory. The problem is that strong positive agglomeration tendencies cannot be observed directly, but only through their clustering of firms of the respective sector. Because of this, cluster policy guidelines typically identify potential target sectors for cluster policy through the concentration of such sectors in other regions. But sectors that already cluster in other – competing – regions may not be available any more for clustering in our region. The concentration process that allows us to identify target sectors may already imply such strong path dependence that it will be difficult for our cluster policy to attract that sector to our region.

Because of this, cluster policy consultants often start by looking for sectors that already agglomerate in the respective region, and propose to make them the target of cluster policy.

The question that arises then, however, is to what extent cluster policy is necessary to agglomerate this sector in the region. The sector has already revealed a tendency to agglomerate in our region and the growing concentration of production in this sector in the region may automatically lead to a self-sustaining cumulative growth process. Cluster policy applied in this situation may generate a windfall gain for the respective companies, but not lead to another long term outcome of the development path. The resources allocated to the cluster policy will largely be wasted in this case.

Dosing of the policy

The path dependent development paths and the bifurcation points of the agglomeration view imply that threshold levels exist for economic policy. They mark the watershed between the different possible equilibria. When the system deviates from the equilibrium without crossing the threshold level, it will return to that equilibrium. When the deviation is so strong that the economy crosses the threshold, it will converge to another equilibrium.

While threshold levels tend to be very low near bifurcation points, stronger path dependence (and lock-in) implies higher and increasing threshold levels. Policy makers have to take this into account when dosing their cluster policy. When the system is at a bifurcation point, only a minimal policy intervention may be sufficient to permanently move the system in a certain direction. When path dependence is strong, even a substantial policy incentive may not be sufficient to permanently move the system away from the current development path. Consequently, the policy maker will have to adjust the strength of the policy depending on where the economy is with respect to a bifurcation point. However, it is quite difficult for the policy maker to determine where the economy is with respect to a bifurcation point. In order to predict a future bifurcation point, the policy maker would need to know the exact structure of the economic system and all the relevant parameters. Empirically, bifurcation points can only be identified in retrospect. When we look at the economic trajectory in Figure 2, the economy behaves quite normally right up to time period t_0 . It maintains an equal distribution of economic activity between the two regions just like the neoclassical model would predict. Only when we move past t_0 and see that production begins to concentrate in one of the regions we can see that at time period t_0 a bifurcation point was passed.

The fact that the threshold levels vary over time and in particular with respect to the distance from a bifurcation point, makes dosing of cluster policy extremely difficult for the policy maker. A dose that may have been too low at an earlier period may turn out to be excessive now (or the other way around depending on whether the threshold level is decreasing or increasing). Experience from another region will be transferable only when both regions are identical in all parameters and are at the same point in time relative to the same bifurcation point. It is quite obvious that this will never be the case.

A trial and error approach will not work for the policy maker. Because of the thresholds implied in the agglomeration view models, small changes in the dose of the cluster policy may lead to completely different outcomes. Up to the threshold level the system's reaction may be quite minimal or only temporary. When the policy trial moves the system past the threshold level, the change may be catastrophic, i.e., set the system off toward a different equilibrium. Since the policy will have moved the economy past the threshold, a reversal of the policy will not return the system to the original situation. In that case, the policy maker will not be able to correct an error.

Moreover, one has to keep in mind that every policy trial itself changes the constellation of the economic system. Even when a certain policy was not successful, it may have lowered or raised the threshold for some other policy, making its subsequent success more or less likely. This is particularly important in the context of best-practice examples in policy. When a policy has been applied successfully in one region, it has altered the economic system and its parameters thus changing the chance for other regions to successfully apply the same policy. A policy, for example, that successfully established a regional ICT cluster automatically made it more difficult for other regions to copy this success, because the other regions will have to compete against that established and successful ICT cluster.

Timing of the policy

One important aspect in terms of timing of the cluster policy has already been mentioned above: the fact that near a bifurcation point the system will be much more receptive to policy interventions than at other points. This implies that at times near a bifurcation point a certain policy instrument may be quite cost effective, while at other times the same policy may be a

complete failure and waste of resources. But, since it is quite difficult for policy makers to identify these ideal times for policy interventions, chances are high that their policy interventions are wasteful.

Because of difficulties to identify problems that need policy action, most likely their policies will come too late. In the development path displayed in Figure 2, up to the bifurcation point (at t_0) there is no obvious problem for the policy maker to detect. Production shares may fluctuate around the equal distribution but will automatically return to that equilibrium. In this period of time the system actually behaves according to the neoclassical model. Past the bifurcation point, a small deviation from an equal distribution may send the system on a development trajectory toward one or the other concentrated equilibrium. The policy maker, however, may have developed faith in the neoclassical view and the equalizing effect of the market forces based on past experience. By the time the policy maker realizes that the neoclassical view is inappropriate, that the system agglomerates and does not automatically return to an equal distribution, path dependence may be so strong that small policy intervention will be in vain. The policy maker not only faces the challenge to detect a new problem for which there is no empirical evidence in the immediate past, he/she also has to push for a new type of policy at a level that is sufficiently large to overcome path dependence.

To summarize, the three basic problems of cluster policy outlined above – targeting, timing and dosing of public action – provoke serious doubts about the effectiveness of initiatives and interventions aiming at creating or further developing spatially concentrated sectors in a particular region. The agglomeration view, thus, has to be acknowledged for sharpening one's understanding of the potential pitfalls and booby traps of cluster policy actions launched with the goal to advance a region's economic position in the long run.

5 Conclusions

Promoting clusters has become an important economic development policy tool in many parts of the world. As increasing attention is focused by policymakers on developing clusters, the question of whether cluster policies are a sound approach for stimulating regional economic prosperity assumes greater importance. This paper challenges the “cluster hype” in policy from a purely theoretical perspective. We defined cluster policy as a policy that invests

resources into the formation, support, and development of one or more industry clusters with the goal to strengthen the economic position of their policy's target area in the long run. We considered two alternative bodies of thought, the neoclassical view and the agglomeration view, to guide our discussion about rationales for and potential pitfalls of a cluster policy approach. It has been shown that within the neoclassical framework cluster policies cannot be justified. Adopting an agglomeration view yielded more stimulating insights. We highlighted that the agglomeration view implies a fundamental dilemma for cluster policy. On the one hand it provides a sound conceptual basis for a proactive cluster policy approach, pointing to essential rationales for policy actions. On the other hand, it provides a set of critical arguments that suggest a "hands-off" policy approach. We analyzed in more detail three main problems, i.e. the targeting, dosing and timing of cluster policy actions. It was demonstrated that difficulties related with these issues lead to a rather pessimistic view on the usefulness of and prospects for policy interventions in cluster development.

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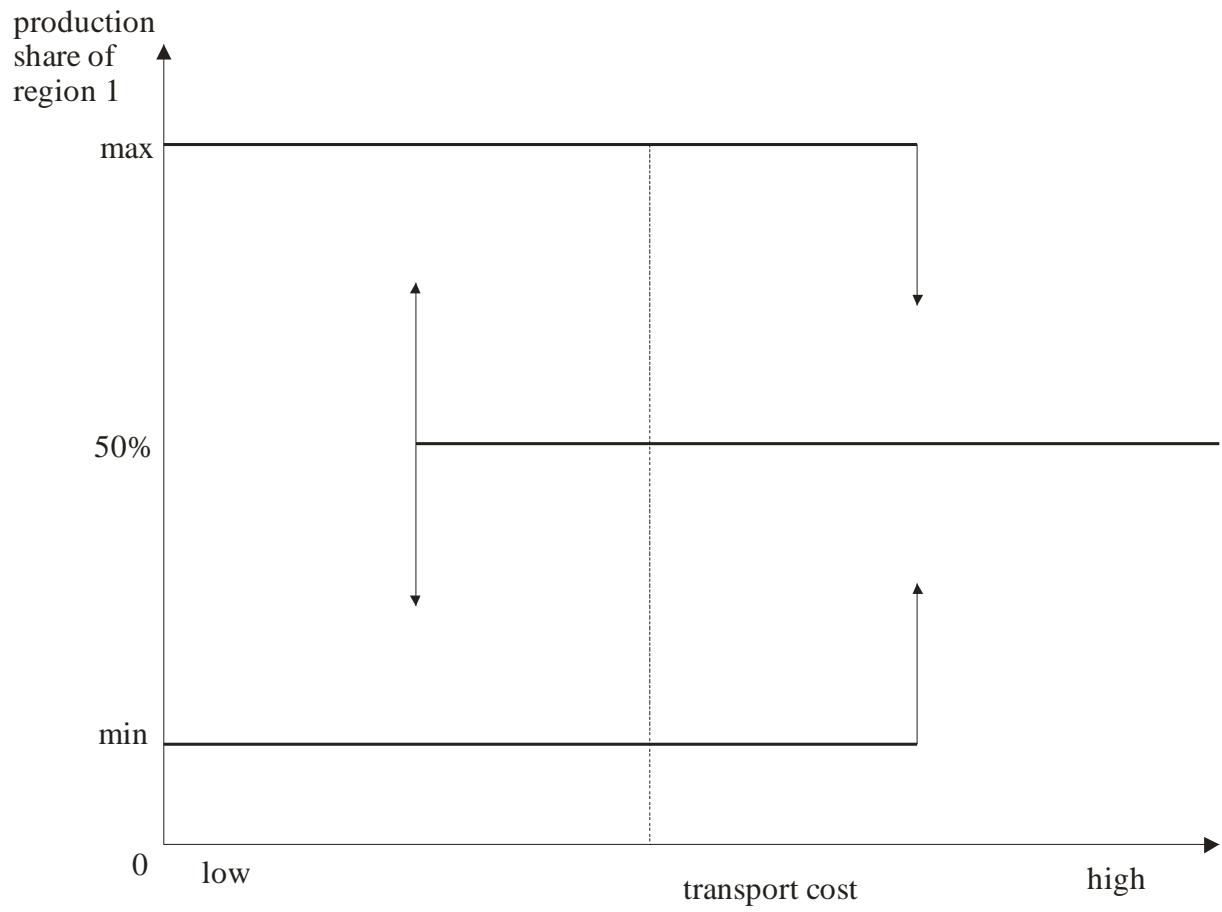


Figure 1: The tomahawk bifurcation

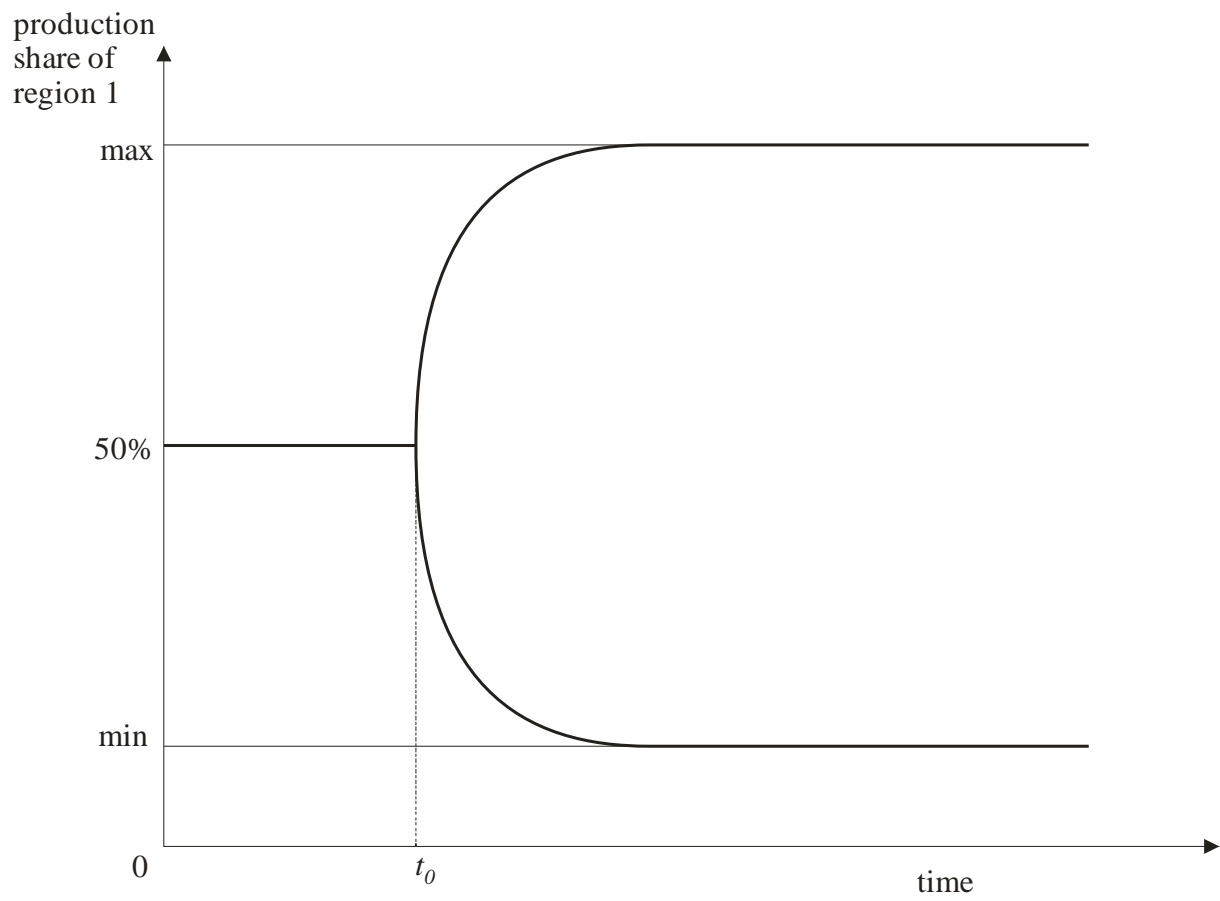


Figure 2: The pitchfork bifurcation



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