This paper presents work in progress in the School of Economics at USP. Comments, criticisms and enquiries should be addressed to the corresponding author.

Copyright © 2009 by the authors. All rights reserved.
Innovation, Herd Behaviour and Regional Development

G.C. Geerdink, P.J. Stauvermann and A.E. Steenge

1 Introduction

"Innovation is the key to a region's competitiveness in a globalized economy. It attracts further investment and opens the door to sustainable growth and quality employment. We need to create the right conditions for enterprises to innovate", as noted by Danuta Hübner, EU Regional Policy Commissioner, at recent speeches. At her speech in Lower Saxony she added that € 700 million will be invested through structural funds in the best projects assisting in stimulating innovations in designated EU areas. Those projects will be selected by governments, social and economic partners.

We note that quite a lot is being said here by the Commissioner. The matter, per se, looks rather straightforward. However, as we shall see in this contribution, we are dealing with complicated issues, involving many forces, some of which work in opposite directions. So, let us take a look at the forces that are involved in the issues at stake. Below we shall take a look from an economic point of view employing the contextual frameworks and concepts of modern insights. A first question, evidently, concerns the notion of innovation and innovating enterprises. In which way does innovation contribute to sustainable growth and development? In this context sustainable growth consists of two subcategories: Competitiveness for Growth and Employment, and Cohesion for Growth and Employment. The two subcategories are connected and aim to increase the Union's competitiveness, boost the European economy and create better jobs. Various community programs like research, innovation, education, the internal market and the EU networks are financed under the first subcategory.

1 We like to thank Gert-Jan Hospers for useful remarks.
2 Hubner, Danuta, Regional Policy Commissioner European Union; -Speech, 13 September 2006, Lower Saxony, Germany -Lecture, 12 June 2008, University of Twente, The Netherlands
3 The definition of sustainable growth applied by EU policy makers deviates considerable with the definition often used in environmental economics. Here we use the definition of the EU as found on: www.2007-2013.eu/budgetary_headings_1.php consulted 05-02-09.
The second subcategory finances the regional policy the policy aims are to enhance convergence of the least developed Member States and regions and contribute to a sustainable development.

A further question concerns the notion of competitiveness. We shall interpret this in the same way the Commissioner does, i.e. in terms of a situation where regions are actively involved in increasing competitiveness of firms which could result in competing with each other for innovating firms to settle. We shall see below that a situation of competitiveness between regions can bring advantages, but that also it evokes unintended and harmful effects. Normally, if a region is “competitive”, this is associated with rising production and productivity, and falling (at least in a relative sense) costs. The relevant question then if such a situation can be invoked by a process of competition for new high-tech industries.

Fundamental economic insights point to the fact that competition in general will enhance efficiency. Meant is then usually a situation of business firms competing with each other. However, can we extend the principle to regions? That is, does competition between regions enhance efficiency? First of all, there is the matter of definition: we cannot simply transcribe the standard economic concept to geographically defined “regions”. Above all, we should recall here that regions consist of local authorities and local administrations, being organized along specific institutional, legal and historic principles. Very influential in this respect has been the work of Michael Porter (2000, 1995) on regional development and competitiveness. Porter specifically highlights the relation between location and competition, economic development and the role of clusters. 4

Many policy makers are inspired by the works of Porter, and saw it as providing a foundation for their policies of attracting new technologies such as bio-technology, ICT, or nanotechnology, to boost local development. Public authorities often are convinced that it is possible to actually create and design high-technology clusters like California’s Silicon Valley. Local policy-makers are eager to attract high-technology firms, and are willing to facili-

4 A cluster is a group of interconnected and institutions in a particular location. Companies in a cluster can benefit from important complementarities, spillovers, and relations with public institutions which improve productivity and productivity growth and stimulate new business formation. Important is that a firm’s comparative advantage can include characteristics outside the firm itself; often geography and location have important implication on how firms or industries can compete in the market, see e.g. Sachs and McCord (2008).
tate such firms in many ways. This kind of policy involves often very substantial investments, financed by public funds. An economist then would like to know if this policy, which traditionally aims at increasing the competitiveness of the region, really is welfare increasing.

However, also another effect is present, which is different from Porter’s. Modern insights tell us that, unlike in Porter’s approach, externalities arise mainly from innovation - which need not take place within clusters. Here we meet another modern concept, i.e. externalities arising from innovation. Externalities are the indirect effects of consumption or production activities; that is, the effects on parties other than the originator of such activity. We speak of positive externalities when the influence is welfare increasing, negative when not. Environmental pollution is an example of a negative externality; it creates losses for society as a whole which are not accounted for in the respective commodity prices. Positive externalities are, for example, associated with investments in innovation which translates in a higher productivity and increases region’s competitiveness and income. This can result into additional working places and increased regional production and stimulate the economic development in the long run. Subsidies often are involved, where the justification for giving them is based on the view that attracting high-technology firms will generate these so-called positive externalities, a key concept.

Below we shall focus on two important aspects, the role of externalities and the interaction between regions. The types of externalities we shall focus on invariably are seen as an important element in regional development. On a more general level, the presence of externalities is an important argument in favour of economic integration. The reason is that integration makes it possible to “internalize” the externalities; that is, to create circumstances such that the benefits accrue to the parties which have generated the externalities.

We shall highlight the behaviour of the local government and the possible consequences for regional development. 5 We shall distinguish three elements of the local government behaviour.

• First increasing the regional competitiveness is seen as an important element in enhancing regional development. Therefore the local governments are eager to attract innovative firms who can contribute in this process. As such this is an important incentive for regions to attract firms. However, there are dangers. The externalities of the innovative firms are

5 Because our purpose is to highlight some elements of governance we will do the analyses in a less formal way. A more formal treatment can be found in Geerdink and Stauvermann (2009).
the incentives for regional policy makers to attract these firms. But, because many regions apply the same strategy, this will create or increase –willingly or unwillingly- competition among regions to attract the firms.

- The second important aspect we like to put forward is the notion of a “desirable level of investment” – which also means that this level may not be reached. Firms’ decisions are based on their own cost-benefit calculations which normally do not take into account the beneficial effect of their activities on other firms, and, thus, on the entire region. In this sense, the investments are below the optimal level of investment where this level is defined as the level which generates the highest possible regional production. To achieve this optimal level of investment the government should intervene through, for example, subsidizing investments in innovation by supporting innovative firms. This is one of the important findings of so-called endogenous growth theory (more about that later). The matter is complicated by the presence of information asymmetry between the government and innovative firms. That is, most of the time governments do not possess the required knowledge to monitor such programs. Firms can use subsidies for other purposes than innovation. Or in other words, subsidies for innovative investments for firms are observable but not verifiable by the local government. All this results in firms behaving strategically.

- A third, and related aspect is that local governments do not know on forehand which sectors are most likely candidates for innovation to take place. Even more important is which of these sectors fit best in their strategy to increase local competitiveness and economic development: Do we have to bet on bio-industries or rather on nano-technology? If policy makers are risk-adverse and want to be re-elected than this basically could mean that they will look at other policy makers. To reduce risk they then copy apparently successful policies and strategies. All policy makers want to establish one more Silicon Valley (e.g. Hospers, 2006). This process of copying others strategy in order to reduce risk is frequently called “Herd Behaviour” in financial economics. Herd behaviour and –also- the fact that policy makers do not have to bear the financial consequences of their decision can lead to an increase in competition between regions.

2 Firms, Innovations and Welfare Gains

---

6 We are reminded here of the accepted public finance wisdom that one of the drawbacks of the budget mechanism is the separation of decision making and bearing the consequences of the decision (Stiglitz, 1988).
So, the central piece of local and regional economic policy is about innovation. Why precisely? In this section we will pay attention to the role of innovation and innovative firms in economic development processes. An important aspect of innovation is the appearance of externalities or spill over’s. Externalities associated with innovation can lead to an overall decrease in the average costs of firms and an increase in the labour productivity of the region. This is in the interest of the region as a whole, here personified in the regional policy makers which have the power to initiate programs for improving the competitiveness of a region.

We shall present the main concepts and the functional relationships. Among these concepts, long run profitability is a key concept. Because the trajectory from laboratory to initial stage and later operationalization usually is extremely long, an enterprise’s long run profitability is essential. Basically, the enterprise has to finance its R&D itself; one reason being that government support will often not be available. For our analysis it is sufficient that we distinguish only two types of firms. First we have firms that produce goods (often associated with final goods which can be used for consumption as well for investments) which make no long run profit. Final goods are assumed to be the same, so firms producing them operate under perfect competition. Inputs for the production of these goods are labour and capital goods are used. Secondly, the capital goods are produced by innovative firms which invest in R&D and produce (capital) goods that are unique in themselves. Because of their uniqueness, firms producing them are monopolists. These firms make long run profit which is used to finance their R&D. Clearly firms only will devote resources to R&D if it is profitable. That means that employing the standard line of argument involving perfect competition is not appropriate in modelling the type of processes we shall deal with. In the perfect competition case profits of firms are zero and so there is no incentive for a firm to invest in research and development. However if a firm produces a unique product we speak of a monopolist, but if there are many firms who all supply a unique product, which are partly comparable we speak of monopolistic competition. After the path breaking article of Dixit and Stiglitz this market situations has been widely applied in different branches of economics. For an overview of this “monopolistic revolution” see Heijdra & Brakman (2004). An important difference compared to monopoly is that in the last case firms take into account other firms actions. Still the firm is able to earn long run profits to be used for investments in R&D. A monopolist can charge a price above
the marginal cost or variable cost. This profit then is the incentive to invest in R&D. To become a monopolist a firm has basically to produce and sell a unique product.  

Next to the fact that R&D enables a firm to earn a long run profit it has a side effect for the economy as a whole. Through R&D the available stock of knowledge increases. The stock of knowledge is generally free accessible and so an increase of it leads to an increase of the average productivity of the economy. We noted that capital good producing firms invest in innovation and so one usual effect is that new capital goods are more productive that the old ones. These are the positive externalities of research and development and innovation. In modelling externalities, Romer (1990) was one of the first who described the processes involved. He incorporates externalities generated by innovations as well as the market incentives that stimulate firms to invest in R&D. Because externalities from innovations are endogenous (that is, they are the result of innovations by firms due to market incentives), the resulting technical progress (increase in overall productivity) is also endogenous. The important contribution of endogenous growth theory is that market incentives (profit opportunity) determine investment (innovation) behaviour of firms. At the same time this increases the stock of knowledge, or technological progress\(^8\), in the economy which in turn results in economic growth. Because technological progress is the result of endogenous firm behaviour, economic growth is also determined endogenously. There are three basic premises underlying of the basic Romer model of endogenous growth:

- It focuses on the fact that technological change lies at the core of economic growth.
- Technological change is based on knowledge creation. Knowledge differs from other economic goods because it is a “non-rival” good and can be accumulated without bounds per capita (where non-rival means that using it does not go at the expense of others goods. It also does not depreciate like capital goods and therefore it generates externalities).
- The third premise is that technological change arises of intentional actions taken by firms responding on market incentives, that is long run profit. \(^9\)

---

\(^7\) For a more extensive and general treatment of this topic see Acemoglu (2007) or Church and Ware (1999) for an analysis from an industrial organization point of view.

\(^8\) In neo classical growth theory technological progress is exogenous, there is no economic behavior underlying the development of technical progress

\(^9\) Romer was influenced by the well-known Dixit-Stiglitz (1977) model of monopolistic competition. This model acknowledges that consumers demand a large range of different varieties of similar, but not identical products. This approach is used by for by Romer (1990) to model the production of final goods using different varieties of capital goods.
3 Competition between Regions

If an innovative firm settles in a particular region this, can be expected to lead to an increase in the overall wage rate and wage income and an increase in capital income. Simultaneously, regional output and competitiveness (in the sense we have defined it) will also increase resulting from these positive externalities. This immediately provides an incentive for regions to compete with each other in order to attract an innovative firm. Here we encounter a phenomenon called “best practice”. In many regions it is felt that other regions are performing better with respect to economic development, employment and income. Local policy makers, who are eager to increase their region’s competitiveness, are easily convinced that it is wise to imitate the policy off apparently better performing regions: “Why should a successful policy of those example regions not be successful applied in the own region?”

With respect to this type of competition, we take only the two-regions into account. This case will offer sufficient complexity to discuss the mechanisms at stake. In our context, both regions can be assumed to be comparable regarding the number of inhabitants and capital goods producing firms. And, more importantly, the government of each region has an interest in increasing its (regional) income. What will happen now if an innovative firm settles in a region to produce a new type of capital good? Let us say that the firm settles in region one. If there is no economic integration, i.e. in case of autarky, the results are clear. Only the region where the firm settles will have an increase in income, wages as well as capital income. In case of labour mobility, the wage rates will converge and this will change the wage income of both regions. (A competitive labour market would predict an equalizing between the wage rates of the two regions irrespective what region the firm settles). As noted there will be an increase in income for both regions no matter where the firm will settle, due to the overall increase in wages. Regions, however, can be expected not to take this positive externality into account in their decision making.

Let us take a closer look now at politicians’ behaviour. Whereas the objective of firms is to make profit, the prime objective of policy-makers who are assumed to be self-interested, want to be (re-) elected. The impact of electoral incentives on economics has been recognized for a long time. Several variants are discussed in the literature. In a recent paper, Coconi &

\[10\] Clearly, in this situation the incomes of both regions also are comparable.
\[11\] See for example Nordhaus (1975), Person & Tabellini (1990), or Rogoff (1990).
Sahuguet (2005) focused on co-operation of international organizations and policy makers with renewable mandates and credibility. In the present context, we shall focus on policy makers who wish to increase the probability to be re-elected. They usually will try to enhance their reputation as good and successful policy-makers. One way of doing this is to attract additional firms to settle in their region, because this means additional employment, higher tax revenues and—hopefully—an increase in productivity which will enhance the overall welfare of the region. With that expectation in the background, most regions in Europe and the USA are offering subsidies to attract such kind of firms. The problem however is that no policy-maker knows ex-ante which technology will be successful or not.

It should be noted that policy-makers are risk-averse regarding their own position, but they are at best risk-neutral regarding spending tax money.\(^{12}\) Noticing this best practice is an attractive \(r\). Clearly, if their decision appears not to be successful, policy-makers are not personally liable. In this case one could say that policy makers are always “bailed out” by the taxpayer. Still, policy-makers dislike failing, and a strategy to reduce the risk of failing is to copy the (successful) behaviour of other regional policy-makers as pointed out earlier above. This “herd” behaviour however seems to be rational. So, if all policy makers have made the wrong decision, the whole herd fails. It is less spectacular as if only one policy-maker, who did not follow the herd, would have failed. In so far each policy-maker has an incentive to copy other policy-makers. It is illustrative to quote Machiavelli (1841) here; “Men, nearly always follows the tracks made by others and proceed in their affairs by imitation” (see further Bikhchandani, Hirshleifer & Welch, 2008).

This kind of behaviour is particularly well-known in financial economics.\(^{13}\) It seems to be most rational to follow the choice of previous decision makers. To explain these effects we assume a sequence of decision makers who have to take decisions under uncertainty. All decision makers make use of the available information, which consist of private information and public information. Public information consists of observations of choices of preceding decision makers. From this public information, all the decisions made previously, the current decision maker draws inference. If a decision maker copies the decisions of the predecessor regardless of his own private information an information cascade has arrived. All successive

\(^{12}\) See Stiglitz (1988, p. 209) who notices; “it is generally accepted that an individual should have less discretion—should take greater care—in spending the money of others than he might in spending his own money.”

decision makers will imitate this decision ignoring their private information. Based on the information inferred from decision of the first few decision makers, who are outside the information cascade, all succeeding decision makers will do the same. According to Bikhchandani, Hirshleifer & Welch (2008), an information cascade is a situation in which an individual makes decisions based on observations of others without regards to his own private information and it occurs when individuals having observed the actions and possible pay-offs of those ahead of them, take the same actions regardless of their own information.

4 How do Regions compete, the Competition Game

As we have described in the previous section that there are a number of incentives for regions to attract especially innovative firms. Next to that, the above presented behaviour could even lead to an increased competition between regions. The next thing we want to describe is how regions compete. Regions can not be straightforward compared with firms who compete with each other about market shares and so on. Firms produce but this is not the case with regions. The regional production is depending on its local firms and enterprises and the region only can facilitate this, but not produce themselves.

As point of departure to define competition between regions we use a slightly modified definition of Stigler (1957, 1987)\textsuperscript{14};

“Competition is a rivalry between individuals (or groups, nations or nations or regions), and it arises whenever two or more parties strive for something that all cannot obtain.”

We have include “or regions” between brackets in the definition. The “something that all cannot obtain” for regions is the increase in economic activity through attracting firms.

In policy practice we often can observe that regions facilitate firms in many different ways’s in order to have them settled in the regions. This varies from granting subsidies, supplying infrastructural investments in favour of firms and offering plots at prices far below costs. The big question at the end is how much recourses a region wants to invest in order to have the firm settled in the region. This of course is depending on the expected welfare gains that a region attributes to the settling of the firm. Because there are more regions competing for the same firms this also influences the investment decision. To describe the above process we use a Contest Success Function, one of the key ingredient of “Economic Theory of Con-

The Contest Success Function describes how inputs in conflict (exerting effort) can be translated into wins and losses for the different parties involved in the conflict. Below we highlight the main aspect of this theory applied on regional competition.

In line with our argumentation above there is a contest of two regions to attract the firm. So he two regions compete and so we have a competition game, where the prize consist of the benefits of the firm to be settled. We assume that without competition the firm has a preference for a region. This can be due to the comparative advantage the preferred region has over other regions. This results in lower production cost of the firm and results in higher profits. If a competing region wants to have any change the firm settles, it has to facilitate the firm in a way that profits of the firm exceeds that of the preferred region. The preferred region observing this also increases its investments in attracting the firm. Doing not so, it would mean that the probability of attracting the firm would reduce to zero. Note that the comparative disadvantage can be compensated through facilitating the firm by this region. This is the competition game between regions. From that, using “Economic Theory of Conflict” approach, expected gains can be calculated and optimal investment for the competing regions can be calculated. The introduction of competition result in uncertainty where the firm will settle. The probability of a firm to choose for a region depends on the investments of both regions. The optimal investment level of both the competing regions is the point where the expected gain of the settling of the firm equals the resources invested. The central point however is that although both regions invest, only one region will have the benefits of the firm and the additional income and production. That means the investments of the losing region are wasted and foregone. That also means that there is a welfare loss because without competition both the regions would have been better off. Aside from that externalities resulting from innovation will not stop at the border of the region and therefore leads to an overall increase in income, a fact which is overseen by the policy makers. Most probably there is no interest of policy makers that the positive externalities due to the innovative firm will also increase overall productivity and economic development.

So, because of the emergence of competition between regions resulting from interacting policy makers in their ambition to stimulate economic development and the immediate danger of information cascades, the overall picture is that this kind of competition is not beneficial for the regions concerned. The increase in income without competition exceeds the increase in income for the two competing regions. From this it should be clear that introducing this kind
of competition leads to lower increase in income and therefore causes a welfare loss for both regions. So we have arrived at the following conclusion; from an efficiency point of view regional competition to attract innovative firms with subsidies is generally inefficient; introducing competition between regions does not lead to an increase in efficiency and welfare.

5 Can Competition be avoided?

This results in our conclusion that; competition between regions can not be avoided. There is always an incentive for the regions to start the competition game despite the fact that they are better off without competition.

Can competition be avoided? Clearly, this will be difficult to realize because of the built-in process incentives. As soon as one of the regions offers a small amount of subsidy the probability of the settling of the firm will increase. The other region will note this and will have to offer the firm a subsidy likewise. So, quite soon we will see a competition game developing: as soon one of the regions starts the game, the other one has to follow. That means they are stuck in a prisoners’ dilemma, and “all-out” competition cannot be avoided. In terms of game theory, competition is the dominant strategy. Nonetheless, the best solution is, evidently, avoiding this kind of competition. That means, however, that the two regions should be prepared to find ways to co-operate, knowing that a co-operative strategy may hardly be credible one, as shown earlier.

We thus have seen how competition between regions can emerge resulting from a policy makers’ objective to increasing regional development and competitiveness through innovation. We concluded that competition is not in the interest of regional development. The question to be addressed in this section is if this undesirable outcome could have been avoided. Let us start by assuming that both regions are not pleased with the result. The overall best strategy then is not to compete but in that case only region 1 (where the firm settles) benefits, in the eyes of the relevant policy makers. Could, otherwise, the two regions make a credible agreement in which they refrain from competition? To analyze this possibility we will have to em-

---

15 The way the game will end depends on the characteristics of the players and the over-all context in which the game is played.
16 Whatever the strategy of the other players, the dominant strategy is always the best reaction. This strategy dominates all others.
ploy a different framework, such as offered by a principal-agent (PA) context. Below we shall briefly sketch how one can proceed here. A central point is that coordination can only be achieved when there is an improvement for both regions which (also) must be credible. However, if such an improvement is found, this will be a Pareto type of improvement, where overall welfare increases, while no-one is worse off.

To apply PA-based reasoning, we first have to ask if the ingredients for such an approach are actually present. First, of course, there has to be a surplus resulting from cooperation. This is certainly the case because on aggregate the benefits for the two regions of a no competition solution exceed the benefits of competition. A further important ingredient is that there has to be a conflict of interest. This is also the case because region 1 wants region 2 not to compete but region 2, on the other hand, has an incentive to compete. (If it does not, it knows for sure that the firm will settle in region 1). Last but not least there is the problem of possible a-symmetric information. Here that manifests itself in a situation where one region applies the strategy of no competition but does not know if the other region will stick to the agreement (the problem of so-called hidden action). It then depends on the quality of the enforcement mechanism whether the two regions will stick to the agreement. Here, very clearly, the enforcement mechanism forms a part of the institutional setting (the “rules of the game”) in which the game is played. The basic mechanism works on the principle that if region 1 is the principal and region 2 the agent, than the agent has to be compensated by the principal. (Again, it depends on the precise setting of the situation which outcomes will realize). Next there is a possibility that the principal will not pay after the firm has settled and than the contract has to be enforced before court. The outcome then will be unsure and this has also to be taken into account. It depends, for example, on the jurisdictional structure which is part of the institutional setting under which conditions co-operation will realize. Many regions apply different (jurisdictional) rules for conflict resolution and so also the costs involved with it differ. Presumably a same conflict can therefore be resolved differently by court depending on the region where it takes place. For a more extensive and analytical treatment of this problem we refer to Geerdink and Stauvermann (2007).

6 Asymmetric Information
In the previous section we have seen that there is an incentive for the regions to attract innovative firms by facilitating these firms for example by granting subsidies. In this section we focus on regional policy aimed at stimulating innovation by financial support, by granting subsidies for the innovative firm. Once a firm has settled it invests in innovation which generates externalities. However, there is a problem from a regional point of view: the firm’s investments are below the social optimum, because it does not take the externalities into account by determining the investment level. If innovations generate positive externalities, government intervention is necessary to reach the economically desirable investment level. This is one of the areas where regional policy should be aiming at, i.e. to enhance this type of investment. More formally: the local government has first to attract the firm and then the next thing is to internalize the externalities of the firm by increasing investment in innovations.

In this section we shall further address the issue of a need for government intervention. From standard theory we have that optimal activities’ allocation and efficiency is reached if prices equal marginal cost. We also have that in case of externalities social benefits and cost do not coincide with private benefits and costs, which we interpret in the sense that government intervention is needed. In terms of the above this means that the price of capital goods is in excess of marginal cost. We might remember from the previous section that firms producing capital goods are monopolist who charge a price above marginal costs. Therefore, the level of capital stock is below the social optimum. This optimum is reached if the profits of (often capital goods producing) firms are disappearing (i.e. reduce to zero) which is the case when the price of capital goods equal marginal cost. This is of course the perfect competition outcome. But if there is no profit than firms can make no investments in R&D, which policymakers want to stimulate because they see it as the engine of economic development.

Because there is a demand for capital goods, but the price charged is in excess of marginal costs, the capital stock is below the social optimal capital stock. Using that knowledge (that

---

17 If externalities are taken into account the social level of investments in innovation exceeds that of the firms level of investment. That means that total output and productivity are below the optimum level. This influences income and consumption which of course are also below the optimum level.
social optimal capital stock coincides with a price equal to marginal costs) and having a demand relation for final goods we can obtain the size of the optimal capital stock. So the social optimal capital stock can be derived by equating the price with the marginal costs. The social optimal capital stock can be derived by equating the price with the marginal costs. The perfect competition outcome of setting the price equal to marginal costs lacks incentives for firms to invest in R & D, see our remark above. Because of that the government could give capital good producing firms a subsidy equal to the profit rate of capital goods. Then the price of capital goods could be reduced to its marginal cost and so the social optimal level of capital stock (production of capital goods) would be achieved.

Let us look now in more detail at the consequences of this kind of policy. Especially we shall analyze firm behaviour if it is financially supported by the region, and see whether this kind of policy is effective. So we ask, if this policy will increase innovative investments and therefore generates more externalities. The argument basically goes back to Gertler and Rogoff (1990) who tackled the problem in international lending. Here the problem is the following: is it possible for a region to enhance regional welfare by offering a subsidy to a potential investor who wants to develop a new patent? Point of departure is that innovative firms do not know on forehand if investment in innovation is successful or not, and in so far the investment is risky. What they do know is that the more they invest the higher the probability of success, but at a decreasing rate. Firms invest up to the point where the expected benefits equal costs. These costs equal the cost of capital which in a competitive global capital market equals the world interest rate. Note that in case of externalities this is below the socially desirable level. Therefore the local government can decide to support the firm financially. The region that grants subsidies is, on the other hand, not able to observe the investment behaviour of the firm. This knowledge is private information for the innovative firm. Policy makers, however, can observe the result (expressed e.g. by indicators such as the number of patents obtained by the firm), but they can not verify whether this is due to the investment of the firm.

As soon as the firm receives the grants it has to decides how to invest. Therefore it will compare all investment alternatives. It can invest in innovation but on the other hand it can invest in other alternatives. Finally the firm will decide to invest outside the firm, on the global capital market. The reason is that investment in innovation yields a lower return than investing outside the firm. This is because the probability of successful innovation is decreasing as in-
vestment are increasing. Therefore the return on investment in innovation is below the return on investment on the global capital market which equals the world interest rate.

So we come to the following conclusion: In the case of asymmetric information between the firm and the region, a subsidy will not increase the amount of investment and, therefore will not contribute to an increase in competitiveness of the region. There is no guarantee that financial supporting innovative firms will lead to more innovation and as such will support economic development and increases overall regional welfare.

7 Conclusion; A persistent problem

In this paper we have shown that a policy to give subsidies to attract high-technology firms can be expected to be inefficient from a regional point of view. First we have shown that a competition between two regions to attract firms will be inefficient for the regions and that only the firm will increase its profits. The reason is that both regions experience a prisoner's dilemma. If one region is offering a subsidy, i.e. starts competing, it is rational for the other one to also offer subsidies. No region is better of in the end of, because the probability to attract firms remains the same for them.

Furthermore, we have investigated a situation where a region tries to increase the amount of investment with the help of a subsidy. Because of asymmetric information this is not a realistic option, the amount of investment will remain below the efficient level of investment. Like in the first part, only the investor will enhance his profits with the help of the subsidy.

So, our paper puts forward the message that subsidies are not an efficient means for regions to compete. The existing EU regional development policy should be adapted, because the idea of competition between regions (with the help of subsidies) will not lead to the expected increase in efficiency and welfare.

This result also is important for thinking about the efficiency of the EU structural funds. The general idea behind these funds is to subsidize attracting innovative firms in less developed regions within the EU. The extent of such a possible subsidy is restricted by the EU and depends on the development status of the region in question. That means that less-developed
regions are allowed to offer higher subsidies than developed regions. However, if the offered subsidy of such a region exceeds the subsidy offered by the developed regions, the probable winner of a regional contest will be the low-developed region. In so far the mechanism of the EU works very well, but if we take into account our proposition, we must come to the conclusion that the low-developed region probably will become poorer and the developed region probably become richer. In so far the results of the EU policy are counter-productive, and not consistent with the expressed EU policy goals to equalize the economic differences of regions. Further empirical research based on new growth theory inspired concepts will have to add further insights here.
References;


European Union; Regional Policy Commissioner Hübner,D., 2006. Lower Saxony, Germany, "Innovative regions to benefit most from new Cohesion policy for jobs and growth", 13th September Lower Saxony, Germany.


Church, J.R. & R. Ware, 1999, Industrial Organization; A Strategic Approach, Irwin/McGraw-Hill.


European Union; Regional Policy Commissioner Hübner,D. 2008, at University of Twente, " Innovative regions need innovative policies”, 12th June Enschede


European Union, Evans, L.,2006: Sate aid reform-Modernising the current framework, Seminar organized by the Centre of European Law at King’s College and the European State Aid Law Institute (EstALI), 17th November 2006


Gertler, M. & Rogoff, K. 1990: North-South lending and endogenous capital-market inefficiencies, Journal of Money, Credit and Banking 20, 559-588


Stauvermann, P.J. 1997: Endogenous Growth in OLG-models; Normative and Positive Aspects of the New Growth theory (written in German), Deutscher Universitaetsverlag, Wiesbaden
Stauvermann, P.J. 2007: Economic Theory of Conflicts, mimeo University of Twente
Recent Working Papers

2009/WP:

9  T. K. Jayaraman, Chee-Keong Choong and Ronald Kumar *Nexus between Remittances and Economic Growth in Pacific Island Countries: A Study of Samoa*

8  Azmat Gani and Saia Kami *Food prices and health outcomes in Pacific Island Countries*

7  Biman C. Prasad *Sustaining Development in Pacific Island Countries in a Turbulent Global Economy*

6  T.K Jayaraman *Monetary Policy Response of Pacific Island Countries to Global Economic Downturn*

5  Peter J. Stauvermann and Sunil Kumar *Can the Fijian Economy Gain from Ethanol Production?*

4  T.K.Jayaraman and Chee-Keong Choong *Monetary Policy Transmission Mechanism in Vanuatu*

3  T.K.Jayaraman and Chee-Keong Choong *How does Monetary Policy Work in Solomon Islands?*

2  T.K.Jayaraman and Chee-Keong Choong, *Monetary Policy Transmission Mechanism in Vanuatu*

1  T.K.Jayaraman and Chee-Keong Choong, *Is Money Endogenous In The Pacific Island Countries?*

2008/WP:


15  T.K. Jayaraman, *Do Macroeconomic Fundamentals Influence External Current Account Balances?*
12 Tauisi Taupo, *Estimating the production function for Fiji*.  
10 Filipo Tokalau, *The Road that is; for whom and why: Impacts of tourism Infrastructural development on Korotogo Village, Fiji islands*.  
9 Mahendra Reddy, *Sequential Probit modeling of the determinants of child Labour: Is it a case of luxury, distributional or Substitution Axiom?*.  
8 Neelesh Gounder, Mahendra Reddy and Biman C. Prasad, *Support for Democracy in the Fiji Islands: Does Schooling Matter?*.  
7 Sunil Kumar, *Fiji’s declining formal sector economy: Is the informal sector an answer to the declining economy and social security?*.  
6 T K Jayaraman and Evan Lau, *Does External Debt Lead to Economic Growth in the Pacific Island Countries: An Empirical Study*.  
3 Bill B Rao and Rup Singh, *Contribution of Trade Openness to Growth in East Asia: A Panel Data Approach*.  
2 Bill B Rao, Rup Singh and Saten Kumar, *Do We Need Time Series Econometrics?*.  
1 Rup Singh and Biman C Prasad, *Small States Big Problems Small Solutions from Big Countries*.  

2007/WP:  

24 Biman C Prasad, *Changing Trade Regimes and Fiji’s Sugar Industry: Has the Time Run-out for Reform or is there a Plan and Political Will to Sustain it?*.  
22 T K Jayaraman and Jauhari Dahalan, *How Does Monetary Policy Transmission Mechanism Work in Samoa?*.  

23
20 Biman C Prasad, *Economic Integration and Labour Mobility: Are Australia and New Zealand Short-Changing Pacific Forum Island Countries?*
18 K L Sharma, *High-Value Agricultural Products of The Fiji Islands: Performance, Constraints And Opportunities*
16 Saten Kumar Determinants of Real Private Consumption in Bangladesh
15 K.L Sharma, *Public Sector Downsizing in the Cook Islands: Some Experience and Lessons*
14 Rup Singh and B C Prasad, *Do Small States Require Special Attention or Trade Openness Pays-off.*
11 Rup Singh, *Testing for Multiple Endogenous Breaks in the Long Run Money Demand Relation in India*
10 B.B Rao, Rukimini Gounder and Josef Leoning, *The Level And Growth Effects in the Empirics of Economic Growth: Some Results With Data From Guatemala*
9 B. Bhaskara Rao and K.L Sharma, *Testing the Permanent Income Hypothesis in the Developing and Developed Countries: A Comparison Between Fiji and Australia.*
8 T. K Jayaraman and Chee K Choong, *Do Fiscal Deficits Cause Current Account Deficits In The Pacific Island Countries? A Case Study of Fiji*
7 Neelesh Gounder and Mahendra Reddy, *Determining the Quality of Life of Temporary Migrants using Ordered Probit Model.*
6 T K Jayaraman, *Fiscal Performance and Adjustment in the Pacific Island Countries: A Review.*
4 Sanjesh Kumar and Biman C Prasad, *Contributions of Exports of Services Towards Fiji's Output*
3 Paresh Kumar Narayan, Seema Narayan, Biman Chand Prasad and Arti Prasad, *Tourism and Economic Growth: a Panel Data Analysis for Pacific Island Countries*
1 Arti Prasad Paresh Kumar Narayan and Biman Chand Prasad, *A Proposal for Personal Income Tax Reform For The Fiji Islands*
2006/WP:


33 T.K. Jayaraman and Chee-Keong Choong, *Why is the Fiji Dollar Under Pressure?*

32 T.K. Jayaraman and Baljeet Singh, *Impact of Foreign Direct Investment on Employment in Pacific Island Countries: An Empirical Study of Fiji*

31 B. Bhaskara Rao and Toani B Takirua, *The Effects of Exports, Aid and Remittances on Output: The Case of Kiribati*

30 B. Bhaskara Rao and Saten Kumar, *Cointegration, Structural Breaks and the Demand for Money in Bangladesh*

29 Mahendra Reddy, *Productivity and Efficiency Analysis of Fiji’s Sugar Industry.*


27 Maheshwar Rao, *Challenges and Issues in Pro-Poor Tourism in South Pacific Island Countries: The Case of Fiji Islands*

26 TK Jayaraman and Chee-Keong Choong, *Structural Breaks and the Demand for Money in Fiji*

25 B. Bhaskara Rao and Saten Kumar, *Structural Breaks and the Demand for Money in Fiji*


20 Benedict Y. Imbun, *Review of Labour Laws in Papua New Guinea*

19 Benedict Y. Imbun, *Review of Labour Laws in Solomon Islands*

18 Rup Singh, *Cointegration, Tests on Trade Equation: Is Devaluation an Option for Fiji?*


16 TK Jayaraman and Chee-Keong Choong, *Public Debt and Economic Growth in the South Pacific Islands: A Case Study of Fiji*


14 Rup Singh, *A Macroeconometric Model for Fiji.*

13 Rup Singh and Saten Kumar, *Private Investment in Selected Asian Countries.*
12 Ganesh Chand, *The Labour Market and Labour Market Laws in Fiji*

11 Carmen V-Graf, *Analysis of Skilled Employment Demand and Opportunities in the Pacific Labour Market*

10 Philip Szmedra, Kanhaiya L Sharma and Cathy L Rozmus, *Health Status, Health Perceptions and Health Risks Among Outpatients with Non-communicable Diseases in Three Developing Pacific Island Nations*

9 Heather Booth, Guangyu Zhang, Maheshwar Rao, Fakavae Taomia and Ron Duncan, *Population Pressures in Papua New Guinea, the Pacific Island Economies, and Timor Leste*


7 Paresh K Narayan and Biman C Prasad, *Macroeconomic Impact of the Informal Sector in Fiji*


5 Rup Singh & Saten Kumar, *Demand For Money in Developing Countries: Alternative Estimates and Policy Implications.*

4 B. Bhaskara Rao, Rup Singh & Fozia Nisha, *An Extension to the Neoclassical Growth Model to Estimate Growth and Level effects.*

3 Rup Singh & Saten Kumar, *Cointegration and Demand for Money in the Selected Pacific Island Countries.*


1 Rup Singh, *An Investment Equation for Fiji*

2005/WP:


26 B.Bhaskara Rao, Fozia Nisha & Biman C. Prasad *The Effects of Life Expectancy on Growth*

25 B. Bhaskara Rao, Rup Singh, & Neelesh Gounder, *Investment Ratio in Growth Equations*

24 T.K. Jayaraman, *Regional Economic Integration in the Pacific: An Empirical Study*

23 B. Bhaskara Rao & Maheshwar Rao, *Determinants of Growth Rate: Some Methodological Issues with Time Series Data from Fiji*
22 Sukhdev Shah, Exchange Rate Targeting of Monetary Policy
21 Paresh Narayan and Baljeet Singh, Modeling the Relationship between Defense Spending and Economic Growth for the Fiji Islands
20 TK Jayaraman, Macroeconomics Aspects of Resilience Building in Small States
19 TK Jayaraman, Some “Shocking Aspects” of a Regional Currency for the Pacific Islands.
18 Bimal B. Singh and Biman C. Prasad, Employment-Economic Growth Nexus and Poverty Reduction: An Empirical Study Based on the East Asia and the Pacific Region
17 Biman C. Prasad and Azmat Gani, Savings and Investment Links in Selected Pacific Island Countries
16 T.K. Jayaraman, Regional Integration in the Pacific.
13 Philip Szmedra and KL Sharma, Lifestyle Diseases and Economic Development: The Case of Nauru and Kiribati
12 Neelesh Gounder, Rural Urban Migration in Fiji: Causes and Consequences.
11 B. Bhaskara & Gyaneshwar Rao, Further Evidence on Asymmetric US Gasoline Price Responses
10 B. Bhaskara Rao & Rup Singh, Demand for Money for Fiji with PC GETS
9 B. Bhaskara Rao & Gyaneshwar Rao, Crude Oil and Gasoline Prices in Fiji: Is the Relationship Asymmetric?
8 Azmat Gani & Biman C. Prasad, Fiji’s Export and Comparative Advantage.
7 Biman C. Prasad & Paresh K Narayan, Contribution of the Rice Industry to Fiji’s Economy: Implication of a Plan to Increase Rice Production
6 Azmat Gani, Foreign Direct Investment and Privatization.
5 G. Rao, Fuel Pricing In Fiji.
3 Sukhdev Shah, Kiribati’s Development: Review And Outlook.
1  T.K. Jayaraman, *Dollarisation of The South Pacific Island Countries: Results Of A Preliminary Study*

2004/WP:

15  Vincent D. Nomae, Andrew Manepora’a, Sunil Kumar & Biman C. Prasad, *Pov-erty Amongst Minority Melanesians In Fiji: A Case Study Of Six Settlement*

14  Elena Tapuiga & Umesh Chand, *Trade Liberalization: Prospects and Problems for Small Developing South Pacific Island Economies*


9  B. Bhaskara Rao, *Testing Hall’s Permanent Income Hypothesis for a Developing Country: The Case of Fiji.*


7  B. Bhaskara Rao, *The Relationship Between Growth and Investment.*

6  Wadan Narsey, PICTA, PACER and EPAs: *Where are we going? Tales of FAGS, BOOZE and RUGBY*


4  Michael Luzius, *Fiji’s Furniture and Joinery Industry: A Case Study.*


<table>
<thead>
<tr>
<th>No.</th>
<th>Authors</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>B. Bhaskara Rao</td>
<td>The Nature of The ADAS Model Based on the ISLM Model.</td>
</tr>
<tr>
<td>8</td>
<td>Azmat Gani</td>
<td>High Technology Exports and Growth – Evidence from Technological Leader and Potential Leader Category of Countries.</td>
</tr>
<tr>
<td>7</td>
<td>TK Jayaraman &amp; BD Ward</td>
<td>Efficiency of Investment in Fiji: Results of an Empirical Study.</td>
</tr>
<tr>
<td>6</td>
<td>Ravinder Batta</td>
<td>Measuring Economic Impacts of Nature Tourism.</td>
</tr>
<tr>
<td>5</td>
<td>Ravinder Batta</td>
<td>Ecotourism and Sustainability.</td>
</tr>
<tr>
<td>4</td>
<td>TK Jayaraman &amp; Rajesh Sharma</td>
<td>Determinants of Interest Rate Spread in the Pacific Island Countries: Some Evidence From Fiji.</td>
</tr>
<tr>
<td>1</td>
<td>T.K. Jayaraman</td>
<td>A Single Currency for the South Pacific Island Islands: A Dream or A Distant Possibility?</td>
</tr>
</tbody>
</table>
Economic Theory of Conflict

In traditional economic theory we presume that agent devote resources only to produce and to trade because these transaction increase the welfare of agents. The exchange and the gains from trade results in a win win situation for the involved agents. It is assumed that the underlying institutional structure

In reality this however is seldom the case, and property rights are imperfectly specified and enforced in the current institutional setting. Maintaining the assumption of self interest behaviour of agents, resources can also be engaged in appropriation, grabbing the production of others or defending what they themselves have produced.

Central to the “economics of conflict” are the analysis of the trade off between these two activities, and its consequences.

An important feature of the economics of conflict lies in the modelling of conflict as a contest- that is, a game in which participants expend resources on arming so as to increase their probability of winning the conflict were actually take place. Or put it differently, a contest is a game in which players exert effort in order to win a certain prize. Actual a conflict does not necessarily have to occur but payers exerting effort can also be used as a bargaining tool.

An important element and key element of contest is the Contest Success Function (CSF) or technologies of conflict. These technologies show how probabilities of winning vary with the different levels of exerting effort of the agents potentially engaged in conflicts. These technologies (CSF) are analogue to for example to production functions and utility functions. Unlike in case of economic production (inputs are combined to produce useful output) the inputs of conflict by agents are used in an adversarial way against other agents. The output of it, can be seen in terms of losses and wins (instead of useful production).

The Contest Success Function, or technologies of Conflict describe how inputs in conflict (exerting effort) can be translated into wins and losses for the different parties involved in the conflict.