Innovation Policy and Economic Development in Peripheral Regions in the Context of Electoral Institutions[1]

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Abstract

Although studies show that innovation policy should be adjusted based on the types of specific regions, it seems that governments are not keen to pursue such selective policies. The article advances a view that depending on how the government is elected (proportional vs. majoritarian rules) will have an impact on its approach to regional innovation policy. More specifically, majoritarian electoral systems provide incentives to overinvest in R&D in more peripheral regions, as this may be more beneficial for re-election and that under such systems R&D spending is less proportionally divided among regions than under proportional representation systems. Preliminary analysis of empirical data provides some support for the hypotheses and the model, but due to difficulties in measurement and low availability of data, the results are not robust. The study could be enhanced by empirically estimating the link between the intensity of innovation policy in peripheral regions and their development in a single model.

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1. Introduction

Different rates of growth in countries and regions indicate processes of convergence and divergence. For example, Crespo Cuaresma, Doppelhofer and Feldkircher (2014) find that there is some convergence within countries in Western Europe and between countries in Central and Eastern Europe. At the same time, although according to neoclassical growth theories, the growth rate should ideally arrive at a steady-state, real-world economies do not show such tendencies, as growth rates vary significantly. Indeed, while some regions are developing rapidly, others remain on the periphery. This is evident both at country and regional levels.

One of the main drivers of economic growth has been technological advancement, as manifest in neoclassical (Solow, 1956; Mankiw, Romer and Weil, 1992), endogenous (Romer, 1990, Aghion and Howitt, 1992), semi-endogenous (Jones, 1995) and evolutionary (Nelson and Winter, 1982) growth theories. This should also be applicable at the regional level – the more innovative economic agents are in a region, the faster it develops.

While there is disagreement about the specific effects of innovation policy (cf. Guellec and Bruno de la Potterie, 2001; Falvey, Foster and Greenaway, 2006), most scholars agree that it has positive effects on productivity. Furthermore, it helps solve market failure strongly associated with research innovation activities. However, different regions may require different policies and investments depending on the local level of development (Tödtling and Trippl, 2005). Based on the logic of Selectorate Theory (Bueno de Mesquita, Morrow, Siverson and Smith, 2003) and studies on the effects of electoral systems and public spending (Milesi-Ferretti, Perotti and Rostagno, 2002), it could be claimed that a government's considerations on what innovation policy to implement will depend on the way in which the government is (s)elected.

This provides good reason for the analysis of the process of the incumbent's decision-making and the response of the selectorate under different electoral rules. Based on the interactions between different actors, a sequential game approach is seen as potentially beneficial for the construction of a theoretical model. Research presented in this paper aims at providing a basic model explaining the variation in innovation policy in peripheral regions under different electoral systems. Consequently, the research questions are:

- How do electoral systems affect the innovation policy pursued in peripheral regions?
- What could the implications be for their development?

These questions have not yet been addressed in depth in the literature. Even at the broader level, research into constitutional economics of innovation is still uncommon, while more specific topics, such as regional policy variations in the context of electoral systems, are still lacking. Therefore, given the theoretical basis described in section 2, this paper contributes to a new area in innovation studies.

Although the paper mainly concentrates on theory-building, a preliminary exploration of empirical data is also carried out. This is achieved using cross-country data from the OECD statistics database at the level of large regions (TL2). While there are no direct indicators to measure central-government innovation policy inputs in peripheral regions using the OECD Regional Innovation dataset, a proxy measure of R&D performed by the government is chosen and used in multiple regression models to identify the effect of electoral institutions on regional innovation policy.

The remainder of this paper is divided into four parts: 1) building the theoretical framework, which covers literature on innovation policy and the development of peripheral regions; incentives for government to pursue specific policies; a sequential game model,

which leads to 2) the development of the methodology and 3) results obtained from the preliminary exploration of empirical data in light of the developed model; ending with 4) discussion and conclusions drawn from the paper.

2. Theoretical framework

2.1 Regions and innovation policy

Despite the fact that regions in a country belong to the same political body, they nonetheless often show different development trends. This may be due to many factors, such as location of capital, human capital, or geographical location (Crespo Cuaresma, Doppelhofer and Feldkircher, 2014). Therefore, a variety of causes for differences in regional development could be distinguished. One of the reasons for the variation in growth rates both between countries and regions can be traced to innovation, which is seen as one of the main mechanisms that helps to achieve growth. Ever since Solow (1956), technology was seen as one of the main drivers of growth. This view remained dominant in the new growth theory, which endogenized technology through R&D and innovation (Romer, 1990), and evolutionary growth theory (Nelson and Winter, 1982).

An important aspect of research and innovation activities is that they tend to cluster at specific locations. Therefore, different types of regions require differentiated approaches to innovation (Tödtling and Trippl, 2005). A region with a high density of innovators needs different policies to those needed in a region where innovators are scarce. The distinction includes peripheral regions. According to Suorsa (2007, p. 15), peripheral regions have "fewer resources" and "are located far from core areas and main markets", therefore "not normally recognized in innovation policies and strategies".

Peripherality may be analysed at different levels:

- Global, when specific regions or countries are considered to be peripheral compared to other regions or countries. Such examples could include countries in Latin America or Central and Eastern Europe, which according to Kattel and Primi (2010, p. 9) are marked by "co-existence of islands of technological excellence with a generalized low-tech and low-skilled labour production structure and marginal positioning in global production chains". Which makes these regions peripheral.
- Supranational, when regions of specific supranational organisations, such as the EU, are considered (McAdam, McConvery and Armstrong, 2004).
- National, where specific regions of the country are developed significantly less than others, e.g. Dytiki Ellada in western Greece (Komninaki, 2015).

The peripherality of a region within a country is often conceived as determined by the difficulty in retaining a critical mass of innovation agents to generate innovations and a lack of knowledge transfer (Fitjar, Rodríguez-Pose, 2011). Peripheral regions are also likely to be marked by lower income, higher unemployment, and so on, which in the context of this paper are considered proxies for peripherality.

Research shows that peripheral regions are most likely to benefit from policy encouraging catch-up learning, and attracting research agents into specific regions. In this way, the region would be enabled to catch-up with the more advanced regions of a specific country (Tödtling and Trippl, 2005). The need for regional policy differences was also indicated in the case of

technopoles (Hassnik and Berg, 2014). In the periphery, important improvements may be enabled through university cooperation (Kempton, 2015). However, Fernandez-Esquinas, Pinto, Perez Yruela and Santos Perreira (2016) suggest that policies should be aimed at incentivising interactions between different sectors based on the industrial structure of a region rather than concentrated only on universities. Regional industries may also differ in their knowledge base, which also implies the need for better tailored innovation policy (Martin and Trippl, 2014). This suggests normatively what the policy should be, but does not say much about what the policies targeting peripheral regions actually are. In any case, such assessments do not tell how much governments are likely to invest in peripheral regions, and what determines such decisions. Furthermore, there is evidence that coherence with other policy areas may be more important than regional diversification, due to challenges faced by industry as a whole (Coenen, Moodysson and Martin, 2015).

Suorsa's (2007) empirical study of the Nordic countries, which are advanced innovators, reviewed the actual innovation policies specific to peripheral regions. However, no significant mentions of policies aimed at peripheral regions are identified in documents. Even in practice, Suorsa (2007) finds that the best performing regions actually attract the highest investment, while the less developed ones are 'forgotten'. Meanwhile, a study of the Seinäjoki region of Finland showed that even when there are actions taken to enable knowledge driven growth in peripheral regions, the results are slow to emerge (Pelkonen and Nieminen, 2016). This shows that governments do not give proper attention to the development of the periphery, even if measures and policies that would be beneficial are defined in the literature, and even in countries seen as being at the innovation and innovation policy frontier, as indicated in country assessments in the European Innovation Scoreboard (Hollanders and Es-Sadki, 2017).

Rodríguez-Pose and Crescenzi (2008) studied regional growth in the EU and innovation policy. They find that both R&D investment and local socio-economic factors are important for regional growth. However, and of importance for this paper, they also find that innovation is geographically bound and decays over distance. Peripheral (distant from core regions) regions also require different policies, as a linear R&D policy may not be as effective in them as it is in core regions; for example, policies that aim to affect socio-economic barriers found in those regions (Rodríguez-Pose and Crescenzi, 2008).

Other scholars also discuss the concerns that existing policies do not favour peripheral regions, meaning that there is underinvestment in innovation there, or that the type of policy planned is ineffective. Even such programmes as Smart Specialisation supported by the European Commission in the EU Member States can be seen as non-beneficial to the periphery (Boschma, 2016). This could especially be the case in smaller regions that do not have individual operational programmes, and thus are forced to rely on "higher-level" strategies. They may not be well aligned with the specialisation of this smaller region. Therefore, while scholars openly discuss how governments could help lagging regions develop, there is little evidence that this is what is actually happening. Therefore, what is important to understand here is why governments seem reluctant to pursue the innovation policies that would encourage peripheral regions to catch-up with advanced regions. Little research is being conducted to answer this question.

For the purposes of this paper, periphery refers to those regions of countries that are less developed compared to more advanced regions in the same country. In other words, it is conceptualized as a purely economic phenomenon, not accounting for geographical, social

or cultural differences. Although, peripherality may also be defined in those terms, it would not contribute to analysing the chosen research problem. The approach taken here is somewhat similar to that adopted by McAdam et al. (2004), who consider that a region is peripheral if it has standards of living and economy performing below average. Here, only economic development is considered, while standards of living are not included (the specifics are more broadly discussed in chapters 3 and 4 below).

Generally, considering the need for government intervention in the area of innovation, it is worth remembering that innovation activities usually suffer from several flaws, which policies may amend. Most of the literature distinguished two types of flaws:

- Market failure – a firm may not successfully internalise all benefits from an innovation due to knowledge being a public good (Arrow, 1962) and investment being risky, as it may not bring any revenues. Therefore, governments must get involved in order to overcome this issue, as without intervention investment in innovation will be sub-optimal from the perspective of society. It is in the interests of the government/social planner to invest and overcome market failure.
- Systemic problems – based on the systems of the approach to innovation, it is indicated that governments should correct the innovation system, where it is seen that its functioning is problematic (cf. Chaminade and Edquist, 2010). Governments may attempt to strengthen ties within the system and correct systemic weaknesses. Again, from the point of view of society such policies are necessary.

In addition, although less studied, another failure may arise precisely due to government intervention (rather than being a condition for it). Government failure emerges when a government has imperfect information or due to selfish motivation implements policies that have negative impacts (Keech and Munger, 2015) on entire research and innovation systems. The effects of a selfish failure of government are discussed by Rodríguez-Pose and di Catalda (2015), who find that the quality of government, its ineffectiveness and corruption in particular, limit the impact of instruments aimed at promoting innovation. Comparable results are also found in other areas, (e.g. transport) (Crescenzi, Di Cataldo and Rodríguez-Pose, 2016). As Chaminade and Edquist (2010) indicate, the government being a part of an innovation system may result in system-level problems. Therefore, governments aiming to solve market and system failures related to innovation activities may not only bring benefits but do harm as well, as their motives do not allow maximizing societal welfare. Although selfishness and motivation have received more attention from scholars, the role of political institutions in creating government failures in innovation policy has been little studied. That is, institutional aspects of government failure, when the system incentivises agents to act in specific ways, have so far lacked broader theoretical considerations. This is discussed in the following section.

2.2 The logic behind policy decisions

Decisions on public investment are made by governments, and these decisions are influenced by the willingness of politicians in office to keep their position for as long as possible. This section outlines the motives behind policy making, and how they can be shaped by electoral systems. The approach combines motivational and institutional government failures.

Whether in democracies or in dictatorships, the main aim of incumbent politicians is often to remain in office for long periods of time. While in dictatorships this aim appears to be self-

evident (with regards to the view of a greedy dictator), it might seem less clear in democracies. After all, if it is the rule of the people, should governments not first of all concentrate on increasing societal welfare? The answer is twofold and contradictory – yes and no.

This comes from the fact that irrespective from the type of regime, if a politician wants to implement any policy, whether it is kleptocratic or socially beneficial, in order to achieve this she must remain in office. Not holding a government position makes it impossible to pursue any policy. Therefore, the first step to achieve personal (or societal) goals is to remain in office. After all, politicians who are not thinking about their survival are not remaining in office long enough to implement their policies (Bueno de Mesquita et al., 2003). This is the basic motivation of failure – survival in office comes before implementing socially beneficial policy, even if the politician holds a society-friendly stance.

An explanation of the differences between the behaviour of dictators and democratic leaders can be based on Selectorate Theory by Bueno de Mesquita et al. (2003). The main logic of this argument is that two subsets of a country's population are important for politics:

- The selectorate, i.e. people who have the power to choose a political leader;
- The winning coalition, i.e. a subset of the selectorate that consists of people whose support is essential in selecting the leader and keeping her in office.

The size of the selectorate and the winning coalition, as well as their ratio, define what type of regime exists in a country. In dictatorships, winning coalitions are small (the size of the selectorate may vary), and therefore an authoritarian ruler can distribute private resources and remain in office without implementing policies which would increase societal welfare. An opposite situation exists in democracies. Here, both the selectorate and the winning coalition are large, making it unlikely that the provision of private goods would be enough to keep the winning coalition satisfied (Bueno de Mesquita et al., 2003). Therefore, democratic rulers tend to implement policies that benefit their electorate but not in an obviously corrupt manner.

The distribution of resources in democracies is heavily affected by the way in which the election of political leaders is conducted. Two basic categories[2] of electoral systems are (Reynolds, Reilly and Ellis, 2005):

- Majoritarian, where candidates are voted for in smaller districts of low magnitude. Majoritarian systems vary among single member plurality, alternative vote, second round, single non-transferable and other systems;
- Proportional, where candidates are voted for in larger districts of high magnitude. Plurality systems vary based on specific electoral thresholds, the way party lists are constructed and formulas used to allocate seats, etc.

The different ways in which political leaders are elected also defines their policy behaviour (here the potential for failure caused by the institutional setting can be seen). Since re-election is on their minds, they will try to enact policy to maximize their chances of keeping a group of voters large enough to ensure them an additional term in office. Therefore, it is important to consider what actions are more appropriate in each case, and what the implications are for innovation policy in peripheral regions.

First of all, the most important difference between these electoral systems indicates that in the case of proportional rules politicians must target a large group of people (at least half

[2] There are also mixed electoral systems that combine majoritarian and proportional rules. However, since they do not present ideal types, they are not further considered in this paper, although future studies would benefit from extension.

of the voting population with the right to vote) irrespective of their geographic location. In such a case, the incumbent can appeal to their electorate (specific social groups) across the country. Meanwhile, in the case of majoritarian electoral rules, the situation is different – the country is divided into many smaller districts where a candidate is selected. Oftentimes districts vote consistently for a specific party and are not likely to change their preference. This is due to the specific demographic/social composition of the population in these districts, which suggests that the majority of voters in those districts will retain their party preferences from election to election. Therefore, politicians can be quite sure that these districts are not worth targeting – they will not change their position irrespective of what policy is implemented, unless some radical actions are taken. Therefore, it is mostly swing (non-entrenched) districts without stable party preferences that are worth being the focus of policy, and Persson and Tabellini (2004) note that the incentives to target swing (non-entrenched) districts are strong.

Together, these arguments outline the main difference between policy behaviour under different electoral systems – under proportional representation rules the main target groups of policy will be distributed across the country, while under majoritarian rules they will be concentrated geographically. This should affect public policy decisions made by governments, depending on the way in which elections are conducted. Here, the incumbent's incentives are shaped by institutions, some of which might be better for innovation-based growth in peripheral regions than others.

Following a similar line of thinking, considering investment incentives as shaped by institutions, Milesi-Ferretti, Perotti and Rostagno (2002) provide a formal model explaining variance in spending under different electoral rules. In their model transfer spending affects the whole country, while public goods spending is available for public use, but it is regionally concentrated. They suggest three hypotheses:

- Transfer spending is higher under proportional rules;
- Public goods spending is higher under majoritarian rules;
- Total government spending under majoritarian rules is higher when general spending trends favour public spending, and vice versa in countries with proportional rules.

From this approach, an important question regarding differences in innovation policy could be raised as follows: Do electoral institutions affect government's decisions to invest in innovation? If so, under which type of spending should innovation policy be classified? The answer is not entirely straightforward.

Innovation policy. The nature of innovation policy is ambiguous and arguments can be put forward both arguing that it relies on transfer payments and that it is a regionally-bounded public good. While arguments exist to explain that distributing public resources to specifically selected private firms are equal to transfer payments (Kim, 2011), or that innovations are based on knowledge which is a public good (cf. Arrow, 1962), the most important aspect for this research is the spatial nature of innovation. If innovation is bounded in space, then it could be considered a public good in the sense used by Milesi-Ferretti, Perotti and Rostagno (2002), as public investment in innovation should affect a particular region. If innovation does not tend to concentrate on a specific geographical location, then, following Milesi-Ferretti, Perotti and Rostagno (2002), it could be classified as a transfer payment, meaning that:

- If innovation is geographically concentrated, then under majoritarian rules it should attract more investment;

- If innovation is not geographically concentrated, then under proportional rules it should attract more investment.

Although there has been a tendency to interpret knowledge as a non-rivalrous and non-excludable good (cf. Arrow, 1962), researchers came to notice that it does not spread without boundaries. Indeed, knowledge can come in different forms. If it is pure information, then it is possible that it can spread mostly without boundaries (e.g. thanks to the internet resources such as freely accessible encyclopaedias). However, if on the other hand in order to be utilized successfully knowledge requires specific skills or training (e.g. operating specific machinery), then it cannot be spread in an unlimited manner. Therefore, some knowledge is tacit or sticky (Von Hippel, 1994), meaning that it can be bounded geographically. Consequently, there are good theoretical reasons to believe that innovation activities tend to cluster. Apparently, empirical research also provides evidence that innovation activities mostly happen in geographically bounded locations (Feldman and Kogler, 2010).

Implications for regional innovation policy. As has been shown, for the purposes of the current research, innovation policy should be defined as a public good in the sense of Milesi-Ferretti et al. (2002); that is, regionally-bounded. Therefore, it is important to discuss the implications for regional policy, including innovation policy. Judging by the fact that regions are more important under majoritarian rules but not so much under proportional rules[3], it should not come as a surprise that regional innovation policy should be pursued more actively when a country has a majoritarian electoral system rather than a proportional one. What is most important, however, is that this should be especially relevant in the case of non-entrenched districts. If it is not clear that a district will vote for a particular candidate (or when there is lower probability of there being a clear favourite in the district), then it is worth investing in such a region in order to get support from non-entrenched voters. Although innovation policy may not necessarily be the most important instrument in the toolbox of a political leader, it can still be used to influence voters. Indeed, as research shows (although research in this area is obviously lacking), governments elected through majoritarian rules are spending more on research and development than governments elected under proportional representation rules, although such an interpretation should be taken with a grain of salt, as additional factors are also likely to play a role (Kim, 2011).

Therefore, the following should be expected:

- Under majoritarian electoral systems public spending on innovation will be less proportional and will vary across regions more than under proportional electoral systems;
- Under proportional electoral systems public spending on innovation will be distributed among regions following certain proportions (e.g. depending on the number, size and performance of research agents established in the region), contrary to countries with majoritarian electoral systems.

[3] Of course, this does not mean that regional policy is not pursued in countries with proportional electoral systems. Many factors can drive it; for example, population distribution, economic importance of a particular region, European level policy (e.g. through Smart specialisation platform) and others. However, the argument here considers all other factors as being equal.

2.3 Electoral systems and innovation policy: a sequential game

The logic behind decision-making in proportional representation and majoritarian democracies can be summarised in the form of a sequential game between the political incumbent and the median[4] voter. Furthermore, another game could be developed to explain the incumbent's investment decisions in countries with majoritarian electoral rules for non-entrenched and entrenched districts.

Several assumptions must be made before proceeding. First of all it is assumed that there are two candidates competing – incumbent and challenger. Secondly, the reasons for voting are mixed. That is: a) voting is economic and if the median voter feels the effects of public spending, then she prefers the incumbent over the challenger; b) if the district is entrenched, then the median voter has a clear preference for or against the incumbent irrespective of spending policy. Here now the players' strategies in a proportional vs. majoritarian game and an entrenched districts game are presented.

Proportional vs. majoritarian game. Under any of the rules the government player has two options:

- Support innovation activities proportional to research agents attributes, with largest/best units getting the most funding (e.g. most advanced research institutes, fastest growing high-tech firms or top-level higher education institutions, employing most researchers are getting proportionately more funds);
- Support innovation activities based on their geographic location instead of proportional distribution of resources (or at least provide more resources to smaller research units, which are nonetheless important with respect to their geographical location).

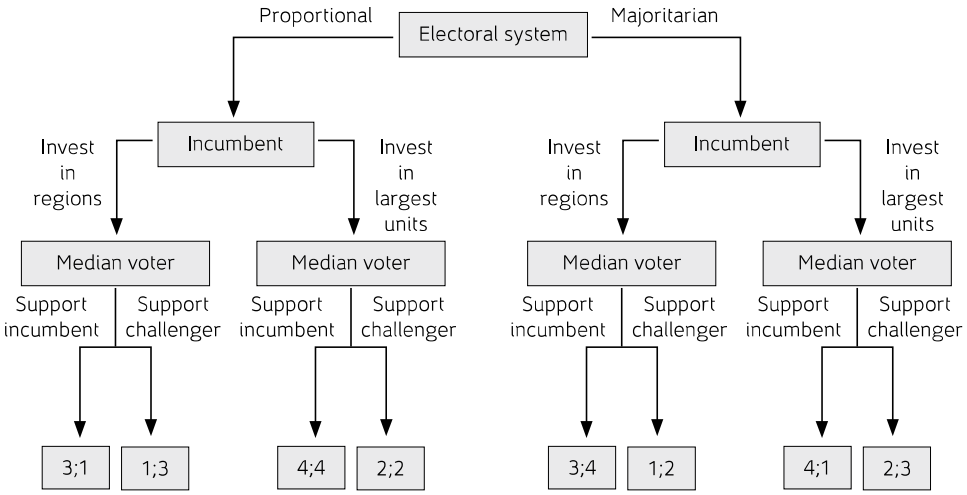
In both of these cases, the median voter then has to decide whether to support the incumbent or not, taking into account the incumbent's behaviour in retrospective. Since the median voter player is not the same under different electoral rules (i.e. size and composition of districts differ), they do not form a uniform group that behaves similarly under different electoral systems. Accordingly, it is assumed that in the case of proportional elections the voting player will be the median voter at the country level, while in the case of majoritarian elections, the behaviour of the median voter at the regional level is considered to represent the majority of the electorate. In both cases, the median voter can:

- Support the incumbent;
- Support the challenger.

Strategic interactions between the players are shown in the following sequential form game in Figure 1 below. Outcome numbers indicate preferential ordering for different players (the first number for the incumbent, the second for the median voter). Classification is ordinal, so outcome values do not indicate how much one option is preferred to another. Instead, the higher the value, the more preferable the outcome is for the player (i.e. options are ranked $4 > 3 > 2 > 1$ with 4 being the most preferable and 1, the least). Therefore, under a proportional electoral system for the median voter, supporting the incumbent when he is investing in largest units is preferable to supporting challengers ($4 > 2$). However, this does not indicate by what margin one outcome is preferred over another.

[4] Median voter is a hypothetical voter who is the median in the set of all voters given the expenditure levels preferred by all individual voters. However, there are problems in assessing actual situations when his position is ultimately influential (Romer and Rosenthal, 1979). Nonetheless, an assumption is made here, that during the election the median voter (or, at least, the "deciding voter") has an impact on the chances of re-election for the incumbent.

Figure 1. Proportional vs. majoritarian game



Source: Author's illustration

It is expected that median voters under proportional representation systems prefer investment in the largest units because the median voter is not regionally bound. Voters around the median may be dispersed geographically, and regional investment would not affect them all. Meanwhile, investment in the largest units would affect all due to R&D spillovers, etc. It is also better to support the incumbent than the challenger due to better information on his policies.

Under majoritarian rules, median voters are regionally bound; therefore, for them region-based spending is more important than investing in largest units. If the incumbent invests regionally, then the support of the median voter goes to him (higher risk when electing a challenger) and vice versa.

Given the logic of Selectorate Theory, the current incumbent in both cases getting more support than the challenger is considered preferable. Secondly, investment in larger units would be preferable to regional spending due to the likely higher public return on investment, but getting support from the median voter still comes first.

As demonstrated, under majoritarian rules, investing in specific regions might be considered a better strategy for the incumbent due to its ability to affect the median voter directly where it matters. Concentrated spending makes changing the outcomes of elections possible at the district level, where it is actually possible. At the same time, geographically targeted spending enables the incumbent to save resources by not investing in regions where the decision of the median voter cannot be influenced.

Meanwhile, under proportional representation rules, it is best for the incumbent to try and influence the median voter's decision by investing in the best/largest units, so that the highest number of citizens would be affected. This also leads to the conclusion that what the incumbent under proportional representation rules does is invest in innovation performers in proportion to their size.

Entrenched district game. In this game, elections take place under majoritarian rules. Each district has probability p that it is entrenched and investment decisions cannot affect voting decisions (i.e. other reasons drive their voters' preferences). Consequently, each region has a 1-p probability that it is a non-entrenched district. What this means is that investment decisions are based on the likelihood that additional resources will push the region to support the incumbent.

Consequently, the incumbent has the following options:

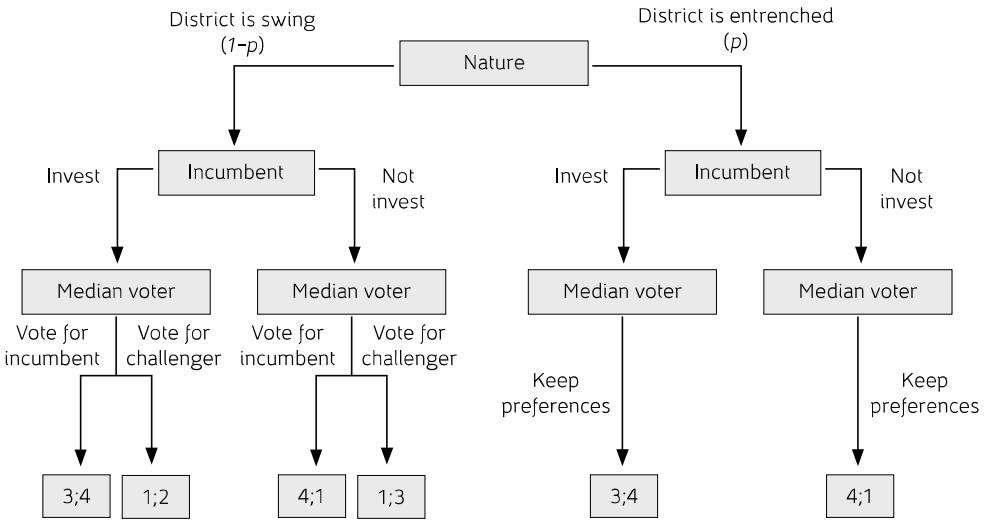
- To invest in the region, hoping that this will change the mind of the median voter to support her in the election;
- To not to invest in the region, believing that the preferences of the median voter in that particular region cannot be changed.

Meanwhile, the median voter has to make a decision to take into account the new investment (and change his or her preferred candidate):

- To make a decision to vote for the incumbent;
- To make a decision to vote in favour of the challenger;
- To keep the same preferences.

The game shows that investing in non-entrenched regions is potentially more beneficial than investing in regions which cannot be affected by investment decisions. Therefore, it is safe to assume that non-entrenched regions should benefit disproportionately more from innovation policy in countries with majoritarian electoral rules. Numbering is ordinal, as in the case of the "proportional vs. majoritarian game".

Figure 2. Entrenched district game



Source: Author's illustration

It is considered that if the district is entrenched the incumbent prefers not to invest in the district, because it will not change the outcome of the election. The median voter will also stick to his or her preference whatever it is (more likely in favour of the challenger), because the assumption is that the district is entrenched. On the other hand, if the district is swing, then it is more beneficial to the incumbent to invest, as investment may impact the median voter's decision. At the same time, for the median voter it is more beneficial to vote for the investing incumbent rather than the less known challenger.

Implications for peripheral regions and their development. Although the above games could be applied to any sort of region-specific public investment, in this paper the effects on innovation-related policy are considered. What this means for peripheral regions and their development is rather straightforward. The model has the following implications:

Implication 1. Under majoritarian rules, the overall distribution of funds should be less proportionate than under proportional representation rules. Consequently, growth among regions should be more varied. If the peripheral region is (becomes) important politically for the re-election of the incumbent, then this region will develop faster and the process of catch-up with more advanced core regions might emerge, while advanced regions may stagnate. At the same time, however, it is equally possible that regional divergence will become even stronger, if peripheral regions are deemed not important politically, and receive less than a proportionate amount of innovation spending with respect to the number of research agents. However, a similar trend should be noticeable under proportional representation systems, as demonstrated by implication 2; therefore, in general majoritarian electoral systems should provide better conditions for the knowledge-based development of peripheral regions.

Implication 2. Under proportional representation systems, most advanced regions should receive a higher share of investment than under majoritarian systems due to the larger number of research agents in advanced regions[5]. This implies that regions that have more research units should develop proportionately faster than those with less. Since more advanced regions are also likely to host more research agents, it is likely that peripheral regions will further lag behind the more advanced parts of a country. Therefore, it is more likely that peripheral regions will benefit more under majoritarian electoral system, which will enable their faster development.

Implication 3. Non-entrenched regions should receive disproportionately high investment compared to entrenched regions under majoritarian electoral rules. Therefore, non-entrenched regions under majoritarian rules should experience faster development than entrenched regions. Here, if the peripheral region is a likely non-entrenched district, it should develop faster, if it is not, then it should lag further behind. Or, in other words, non-entrenched districts should develop faster than entrenched districts if the country has a majoritarian electoral system.

Due to the way the data are constructed, the effects on development are assumed as implied by the conceptual model, and only the relationship between electoral systems and innovation policy is further studied. Namely, implications 1 and 2 are turned into the following hypotheses:

Hypothesis 1. Under majoritarian electoral rules, innovation spending is less proportionate than under proportional electoral rules.

Hypothesis 2. Under majoritarian electoral rules, peripheral regions will receive disproportionately more spending than under proportional electoral rules.

[5] Unless swing districts are located in the most advanced regions. Under such conditions, these regions could also attract more investment. However, mostly, it should be the case that such investment should be lower in more advanced regions if the country has majoritarian electoral rules.

3. Methodology

Given the hypotheses raised above, this section of the paper outlines the methodology used to test them empirically. It describes the challenges to data collection and the proposed research methods. The specific regression equations and results are provided in the following section. The empirical assessment is conducted by employing panel data modelling.

The main problem of studying regional innovation policy at the cross-country level is the lack of available data. It is difficult to obtain precise and exhaustive data on innovation policy in general and it is nearly impossible to get regional-level data for large regions (OECD TL2), and even more so for NUTS2/NUTS3, not to mention district levels. Nonetheless, in this part of the paper, a methodology to test the proposed hypotheses is outlined. The chosen level of region is TL2 – not the most appropriate for the analysis of peripherality; however, given the nature of the existing data other options are unviable.

It should be noted that, due to available indicators, public spending on innovation is measured as R&D investment, which should serve as a good proxy for measuring the overall willingness of a government to invest in a given region.[6] The chosen sample covers OECD countries for two main reasons: a) data availability; b) OECD countries have more different electoral systems. This therefore makes it possible to distinguish better between different types of regimes, as the sample would be less heterogeneous with only the Eurostat dataset. Due to missing values at the beginning of the time series, it is more convenient to left-truncate the data to 2000, which therefore covers 2000–2013 (time series were chosen instead of averages due to possible changes in spending based on who the incumbent is, which is a time-varying factor), but there are significant differences in time series for specific countries ranging from 1 to 14. Furthermore, several additional amendments to the sample were made – countries that have only one or two regions were removed due to a potential lack of variation. This left the sample with 18 countries (however, due to data availability for the required indicators, the final sample consists of 16 countries[7], only three of which[8] have majoritarian electoral systems).

Lamentably, there is no data on government investment in R&D at the regional level, which would be the most suitable dependent variable representing and measuring the intensity of innovation policy. This could be the share of GERD spent in different regions. However, the regional innovation dataset in OECD statistics only covers R&D expenditure by sectors of performance rather than sectors of funds. This makes the direct measurement of regional innovation policy impossible and an alternative approach should be proposed.

Therefore, while it is not possible to directly determine the share of government R&D spending provided to a specific region, it is possible to measure the amount of R&D performed by different sectors in the region (at TL2 level). If the share of funds provided by government to a specific sector does not vary much and is rather constant, this measure could be used as a proxy. Given these limitations, it is worth analysing whether this variable could be used as a proxy for innovation policy. That is, it is necessary to determine if R&D performed by the business sector, the government sector or the higher education sector

[6] Although innovation systems theory would claim that R&D investment is not the most appropriate measure to assess the whole innovation policy, due to available data, this is the only reasonable variable to use in this study, thus making the empirical part rely more on the linear view of innovation.

[7] Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Spain, Finland, France, United Kingdom, Italy, Norway, Poland, Portugal, Slovakia, Sweden.

[8] Canada, France, United Kingdom.

could be used as a proxy to measure the intensity of innovation policy, by assessing if the government-funded share of R&D performed in specific sectors is constant among OECD countries or not.

To do this, it was decided to check whether any type of performers show a constant share of government funds at the country level. Three main types of performers were chosen: a) government sector; b) higher education sector; c) business enterprise sector. The share of R&D performed in these sectors that was funded by the government was calculated in comparison to total performed R&D in that sector. Table 1 provides an overview of the data.

Table 1. Summary statistics on the share of R&D government funds

Sector	Mean	Median	Minimum	Maximum	S.D.	5%	95%
Government funds in business sector R&D	0.103	0.078	0.000	0.642	0.099	0.016	0.299
Government funds in higher education sector R&D	0.778	0.802	0.296	1.000	0.140	0.523	0.963
Government funds in government sector R&D	0.871	0.873	0.480	1.000	0.097	0.699	0.999

Source: Author's calculations based on OECD data.

The data show that all three types of R&D performers show rather low variation with respect to the share of government-funded R&D. Means and medians in all three cases are very close and standard deviations are lower than 0.1, with the exception of R&D performed in the higher education sector. This is important, because if a sector demonstrates that it usually receives a steady amount of funds coming from the government sector, the use of the proxy is better supported. That is, a more stable share of government funds shows that moves in sectoral R&D are more likely to be accompanied by comparable moves in the share of government R&D. While admittedly there is variation and there are outlier cases, it still seems worth pursuing the path of using sector-specific R&D. Therefore, three ways to construct a proxy measure for the intensity of innovation policy could be used as follows:

- Business performed R&D times 0.103 can be interpreted as government R&D funds for the business sector;
- Higher education performed R&D times 0.778 can be interpreted as government R&D funds for the higher education sector;
- Government performed R&D times 0.871 can be interpreted as government R&D funds for the government sector.

The results regarding business sector R&D are interesting; a large majority of the funds come from the industry itself, meaning dependence on government funds is low in OECD countries. This is not surprising, given that business is overall the main driver of innovation there, and government sector agents lack internal resources to finance R&D. Consequently, although business performed R&D shows results quite similar to those of government performed R&D, due to the significantly higher share of government funds the latter is chosen for the empirical investigation (as well as due to closer values of median and mean). Such a choice as a proxy variable is definitely complicated and suffers from several major drawbacks:

- Concentration of R&D performers might differ from region to region, thus requiring different levels of investment;

- Quality of R&D performers might differ from region to region, thus requiring different levels of investment in innovation;
- Size and wealth level of different regions might differ, meaning that larger regions should attract more investment in absolute terms, all other things being equal;
- Total intensity of R&D investment in a particular region may vary due to potentially different amounts of R&D carried out in separate sectors across regions.

These issues are likely to affect the results of the study. However, lacking better proxies, no other comparable choice was identified with the available data. Nonetheless, potential remedies do exist for some of the problems. In the first two cases, the number of R&D personnel in a region could be considered a proxy for concentration, and at least partly for quality, assuming that larger research centres perform better (and small but well-performing research centres should grow fast). That is, the more R&D workers there are, the more R&D performers there should be (or they could be larger and similarly require more expenses). In the case of the third problem, expenditure per capita could be considered or the total population of the region could be taken into account, so that region's level of development would be accounted for. The final issue, however, is more difficult to overcome and it is not addressed in this paper.

Optimally, the dependent variable should measure government expenditure in a particular region. However, this being unavailable, alternative measures were identified. First of all, as per Table 1, it was determined that the share of government performed R&D as funded by the government is rather constant. Therefore, the main indicator is government performed R&D in a particular region. However, to be able to use this in estimations, some transformations are needed. Since it is assumed that electoral systems affect the proportionality of spending, it is expected that under majoritarian rules, governments will either spend a disproportionally high or disproportionally low amount of resources in a specific region. In order to measure this the following steps were taken.

For hypothesis 1:

- Average government performed R&D per one unit of R&D personnel was measured at the regional level.
- Average government performed R&D per one unit of R&D personnel was measured at the country level.
- The difference between the two was measured. The further from zero it is, the less proportionate is spending in that particular region.
- The absolute value of the distance was taken, so that negative and positive values would not cancel out the effects, but would instead show how far a region is from the country average.

For testing hypothesis 2, the dependent variable of non-absolute difference was chosen to see whether there is a tendency to underfund or overfund a region based on its economic indicators (GDP per capita and unemployment), thus accounting for regional peripherality. All data required to measure the dependent variable were taken from the OECD Regional Statistics database.

In order to measure electoral systems, the definitions provided by IDEA were used. In order to make sure that the sample measures the difference between systems as best as possible, no countries with mixed electoral systems were introduced. The dummy coding was done as follows: 0 - majoritarian electoral system, 1 - proportional electoral system. Several control variables were used to determine whether alternative explanations for

variation in the dependent variable are likely. The natural log of GDP per capita to measure wealth, natural log of total population to control for the size of the region, log of the absolute amount of government performed R&D and unemployment level were used with data taken from OECD Regional Statistics.

After constructing the data panel, diagnostic tests were carried out to see what problems exist with the data and what model is the most preferred. Although the p-value for the normality of residuals test indicated non-normal distribution, examining the graph showed that the data are approximately normal, just skewed to the right. However, this indicates that the results might be less reliable. Secondly, White's test was conducted for heteroskedasticity, and this showed the data to be heteroskedastic (p-value < 0.01). Therefore, modelling was conducted using robust standard errors for pooled ordinary least squares estimations (Arellano, due to cross-sectional units being more than the time series length). Finally, panel diagnostics were used to determine the type of model that fits the data the best. The results are indicated below in Table 2.

Table 2. Panel diagnostics

Test	p-value	Preferred model
Joint significance of differing group means	7.8×10^{-32}	Fixed effects over pooled OLS model
Breusch-Pagan test statistic	2.5×10^{-27}	Random effects over pooled OLS model
Hausman test statistic	0.3807	Random effects over fixed effects model

Source: Author's calculations based on OECD data

The results indicate that the random effects model should be preferred when estimating the regression. Nonetheless, two additional models – pooled OLS and weighted least squares – are also estimated to assess the robustness of the results. The fixed effects estimation is not used since it omits electoral systems as it is a time-invariant factor. Therefore, the fixed effects model is not estimated at all.

4. Results

The first hypothesis that *under majoritarian electoral rules, innovation spending is less proportionate than under proportional electoral rules* is tested with the following regression formula:

$$Difference_{ABS} = \beta_0 + \beta_1 Electoral_{it} + \beta_2 Unemployment_{it-1} + \beta_3 Population_{it-1} + \beta_4 GDP_{it-1} + \beta_5 R\&D_{it-1} + \varepsilon_{it}$$

Here i stands for region, and j stands for year. $Difference_{ABS}$ is the absolute difference in expenditure per researcher, *Electoral* stands for the dummy variable representing electoral systems, *Unemployment* measures the number of unemployed persons in a region, *Population* – the total population of a region, *GDP* – GDP per capita and *R&D* general level of R&D performed by the government. The results of the estimations of three different estimations of the model are presented in Table 3 below.

Table 3. Model estimation results: Dependent variable – absolute difference between region and country with respect to government performed R&D per one unit of R&D personnel

Independent variable	Pooled OLS	Random effects	Weighted least squares
Constant	−0.0997*** [0.0484]	0.0873* [0.0484]	−0.061*** [0.0087]
Electoral	−0.0179** [0.0082]	−0.0294*** [0.0046]	−0.0124*** [0.0012]
Unemployment	$1.19x10^{-8}$ [$1.3x10^{-8}$]	$1.27x10^{-8}$ [$1.14x^{10-8}$]	$4.9x10^{-9}$*** [$1.78x10^{-9}$]
Population (log)	0.0015 [0.0024]	0.0032** [0.0013]	0.0015*** [0.0002]
GDP per capita (log)	0.0139*** [0.0053]	0.0131*** [0.0048]	0.0089*** [0.0009]
R&D performed by government (log)	−0.0052** [0.0023]	−0.006*** [0.001]	−0.0035*** [0.0002]
Adjusted R-squared	0.0897	NA	0.3062
Log-likelihood	2262.043	2252.843	−1474.687
Akaike criterion	−4512.086	−4493.686	−2961.375
Durbin-Watson statistic	1.006	NA	NA
N	1084	1084	1084

Note: standard errors in brackets, * – statistically significant at 0.1 level, ** – statistically significant at 0.05 level, *** – statistically significant at 0.01 level

Source: Author's calculations based on OECD and IDEA data

The interpretation of the results is rather straightforward. With respect to the electoral system, a negative coefficient indicates that under a proportional representation system, the dependent variable is closer to zero (random effects model, given the size of the constant). It should be interpreted here that there is less variation under proportional electoral than under majoritarian systems. This supports the hypothesis that under majoritarian systems R&D spending is distributed less proportionally and there is more variation among regions.

This bears implications for peripheral regions. It is more likely that a peripheral region will attract more investment under majoritarian rules than under proportional representation, thus allowing for catch-up processes to emerge. Additionally, it is interesting to see that given the random effects model, the richer the region, the less it is likely to attract R&D investment proportional to the number of R&D personnel. Meanwhile, the poorer the region, the more proportional will be funds attributed to it, which seems to indicate that although some poor regions may benefit from greater investments, others will suffer underinvestment. The absolute amount of R&D performed by the government seems to increase the proportionality of spending. That is, if the total amount provided to a region increases, then the disproportionality decreases, meaning that investment is more volatile when the government performed R&D is low. However, total R&D spending does not provide enough information to determine whether specific instruments are tailored according to a region's level of development or not. This would require further case studies. Population also seems to increase the disproportionality of spending.

Further on, the effects of electoral system on non-absolute difference between spending are estimated under different electoral systems. While we already found that majoritarian electoral systems tend to allocate funds less proportionately than proportional representation systems, what the implications for peripheral regions are still remains to be seen. Here, two models are constructed (both random effects), one with an interaction variable that merges electoral systems and level of economic development, while the other with an interaction

variable that merges electoral systems and unemployment. Two models are used for easier interpretation. The regression equations are as follows. Model 1 (notation similar that that used for the above equation):

$$Difference=\beta_0+\beta_1 Electoral_{it}+\beta_2 Population_{it-1}+\beta_3 GDP_{it-1}+\beta_4 R\&D_{it-1}+\beta_5 GDP_{it-1}{}^{*}Electoral_{it}+\varepsilon_{it}$$

Model 2 (notation similar that that used for the above equation):

$$Difference=\beta_0+\beta^{1}Electoral_{it}+\beta_2 Population_{it-1}+\beta_3 Unemployment_{it-1}+\beta_4 R\&D_{it}+$$
$$+\beta_5 Unemployment_{it-1}{}^{*}Electoral_{it}+\varepsilon_{it}$$

Table 4. Model estimation results: Dependent variable – difference between region and country with respect to government performed R&D per one unit of R&D personnel

Independent variable	Model 1	Model 2
Constant	-0.233 (0.1779)	-0.0254*** (0.0083)
Electoral	0.258 (0.1854)	0.0289*** (0.0075)
Unemployment		$8.76x10^{-8}$** ($3.5x10^{-8}$)
Population (log)	-0.0008 (0.0016)	-0.0019 (0.0016)
GDP per capita (log)	0.0205 (0.017)	
R&D performed by government (log)	0.0003 (0.0012)	$4.56x10^{-5}$ (0.0011)
Electoral*GDP	-0.0232 (0.0179)	
Electoral*Unemployment		$-8.45x10^{-8}$** ($3.69x10^{-8}$)
Log-likelihood	2063.912	2059.582
Akaike criterion	-4115.824	-4107.163
N	1084	1084

Note: standard errors in brackets, * – statistically significant at 0.1 level, ** – statistically significant at 0.05 level, *** – statistically significant at 0.01 level

Source: Author's calculations based on OECD and IDEA data

Model 1 shows that there seems to be no effect on the basis of electoral system neither individually nor in interaction with the log of GDP. None of the other variables are statistically significant either. Model 2 shows that proportional electoral systems lead to higher R&D performed by the government in the region. Unemployment also affects R&D performed by the government positively, which might seem counterintuitive, as it could be expected that government funds there would be channelled to social programmes. For countries with proportional rules, higher unemployment means a negative effect on government performed R&D. However, it does take a significant increase to offset the initial positive effect of the proportional electoral system.

Taking into account the results from models 1 and 2 it can be seen that differences in the type of periphery make it difficult to interpret peripherality as a singular economic trait. Indeed, there might well be different types of peripheral regions that suffer different deficiencies, and therefore are differently perceived by policymakers. Therefore, government policy may also depend on the specific aspects in which a region is peripheral. It can be said that proportional electoral rules are worse for peripheral regions, if the peripherality stems from unemployment.

Nonetheless, it must be stressed that this is just a general and not a very sophisticated attempt to provide initial empirical evidence on the discussed topic. Models 1 and 2 do not take into account inter-country differences and treat all regions as similar. This definitely may affect the results and interpretations of the evidence with respect to the proposed theory. Therefore, a model that identifies specific regions as peripheral is also estimated.

Finally, a model is constructed to account for the peripherality of regions. Due to this analysis being illustrative, regions are assessed with respect to their GDP per capita level only, using dummy coding (0 - region is not peripheral, 1 - region is peripheral). Three levels are selected, with the region being considered peripheral when: a) its GDP per capita is lower than the country's GDP per capita (model 1); b) its GDP per capita is lower than 80%[9] of the country's GDP per capita (model 2); and c) its GDP per capita is lower than 75%[10] of the country's GDP per capita (model 3). It is then tested if: a) the peripherality of a region has an effect on the proportionality of spending in a specific region; and b) the peripherality of a region has a different effect on the proportionality of spending in a specific region under different electoral systems. The regression equation and results are presented below (notation similar to equations discussed before, with an additional variable Peripheral being a dummy variable, representing the peripherality of a region at specific levels, depending on the model).

$$Difference=\beta_0+\beta_1 Electoral_{it}+\beta_2 Peripheral_{it}+\beta_3 Electoral_{it}{}^{*}Peripheral_{it}+\varepsilon_{it}$$

Table 5. Model estimation results: Dependent variable – difference between region and country with respect to government performed R&D per one unit of R&D personnel

Independent variable	Model 1	Model 2	Model 3
Constant	-0.02** [0.0088]	-0.0246*** [0.0053]	-0.0281*** [0.0049]
Electoral	0.0196** [0.0099]	0.0254*** [0.0061]	0.0285*** [0.0058]
Peripheral	-0.0011 [0.0089]	0.0199** [0.0091]	0.1067*** [0.0143]
Electoral*Peripheral	0.0013 [0.0105]	-0.0238** [0.0104]	-0.1101*** [0.0155]
Akaike criterion	-4750.661	-4768.569	-4807.620
Log-likelihood	2379.330	2388.284	2407.81
N	1418	1418	1418

Source: Author's calculations based on OECD and IDEA data

Although additional control variables were initially included in estimations, they did not improve models and were not statistically significant. Therefore, they were excluded from the final model presented here. Estimation results show that a proportional electoral system generally has a positive effect on R&D expenditure. Meanwhile, the peripherality of a region was only significant when it is defined at 75% and 80% levels. Finally, when the 75% and 80% boundaries are considered, it seems that the proportional electoral system negatively affects the share of R&D expenditures given to a peripheral region. Therefore, the second and third models provide support for the second hypothesis. However, model 1 rejects it, and given the role of the assumptions behind considering a region peripheral, support found in models 2

[9] *Ad hoc* choice.

[10] Threshold used following EC approach to cohesion policy which considers regions as needing more investment if their GDP per capita is lower than 75% of GDP per capita of EU28.

and 3 should be taken with more than a grain of salt, and additional research is required to obtain more reliable results.

In addition, the policies of CEE countries (the Czech Republic, Poland and Slovakia) are analysed separately.

$$Difference=\beta_0+\beta_1 CEE_{it}+\beta_2 Peripheral_{it}+\beta_3 CEE_{it}*Peripheral_{it}+\varepsilon_{it}$$

However, the results indicate that there is no significant difference between CEE and other OECD countries with respect to regional R&D performance (see Table 6). Due to a lack of variation in the electoral systems of these countries, it was not possible to assess their effects; although, given the results provided in Table 6, it is not likely that effects would be too different.

Table 6. Model estimation results: Dependent variable – difference between region and country with respect to government performed R&D per one unit of R&D personnel

Independent variable	Model 1	Model 2	Model 3
Constant	-0.0049 [0.0046]	-0.0065** [0.0053]	-0.0091 [0.0031]
CEE	0.0055 [0.0137]	0.0027 [0.0075]	0.0045 [0.0079]
Peripheral	-0.0014 [0.0051]	0.0087 [0.009]	0.0187*** [0.0065]
CEE*Peripheral	-0.0043 [0.0156]	-0.008 [0.0102]	-0.0131 [0.0157]
Akaike criterion	-4771.882	-4775.971	-4771.075
Log-likelihood	2389.941	2391.986	2389.537
N	1418	1418	1418

Source: Author's calculations based on OECD and IDEA data

5. Discussion and conclusions

Previous literature on innovation policy in peripheral regions mainly focused on the differentiation of policy instruments (cf. Tödtling and Trippl, 2005; Martin and Trippl, 2014); therefore, the present paper contributes by developing a different perspective on the same issue – by looking at the incentives for governments to invest in peripheral regions. Indeed, quality of government (effectiveness, corruption) has been discussed as an important factor in determining the success of innovation policy instruments (Rodríguez-Pose and di Catalda, 2015). However, corruption covers only one side of the government failure, leaving institutional failure aside. The paper addresses this gap and provides a fresh look at the issue, which implies that: a) studying corruption in government is not enough to explain all innovation policy decisions; b) government failure should be studied further in light of the constitutional setting of a country in various policy domains (innovation and others), and at different levels (national / regional).

Given the literature on the role of electoral institutions in innovation policy at the national level, it partly reaffirms the findings of Kim (2011), indicating that electoral institutions play a role in determining R&D spending levels, and suggests that analysis of the effects of the constitutional setting on innovation policy might be a promising area. Furthermore, it shows that the framework on public spending as provided by Milesi-Ferretti et al. (2002) can be

extended in its scope and used to raise hypotheses on R&D and innovation policies. Here, Selectorate Theory (Bueno de Mesquita et al., 2003) provides a good starting point for developing theoretical arguments as well. The logic of survival may also be connected to findings on the quality of government by Rodríguez-Pose and di Catalda (2015).

The current paper contributes to further development of a hitherto little examined question on the effect of electoral systems on innovation policy. It shows how electoral institutions could affect innovation policy decisions and provide different policy incentives for the government selected via majoritarian and proportional representation rules. Little research to which the paper can be connected directly exists, but hopefully this will pave the way for further studies to expand upon the currently sparse literature. Therefore, the paper will hopefully contribute to promoting increased attention on the political economy of innovation policy. Noting that knowledge is geographically concentrated (Feldman and Kogler, 2010), research started here could be further pursued. For example, whether public spending on innovation within peripheral regions is also concentrated could also be studied. Electoral district boundaries could play a role there as well. Therefore, the existing literature could be expanded further through embedded analysis of peripheral regions and constitutional settings in the current literature more clearly. Consequently, the paper serves as a starting point for research in this area through providing a theoretical explanation of different attitudes of governments towards innovation policy depending on electoral systems.

The proposed theory stresses institutional failure, which may lead to failure in government incentives to provide societal goods, thereby strengthening incentives to maximize individual benefits. This implies that given the political institutions of a country, it is determined that specific policy aspects will be more or less expressed. The practical implications of the research would then mostly concern the design of policy safeguards. Although the paper does not explore potential remedies for the misallocation of public resources, it shows that investment decisions may be based not on considerations of societal good, but on seeking re-election. Additional research should be conducted on the effectiveness of investment. For example, an increase in R&D spending in peripheral regions may lead to lesser results than either other types of investment or investment in more advanced regions. Once this is done, preferably at a national level, it can be determined what specific legal rules could limit the negative effects of electoral systems. For example, they could include compulsory rules for merit-based R&D spending, developing regional innovation programmes with types of instruments tied to absorptive capacities in the region, etc. Although the government may decide to change such legal acts, it would still be more difficult to act selfishly; at least they would offer some safety against the misappropriation of resources.

All in all, the article proposes that electoral systems impact how innovation policy will be implemented in the regions of a country. This, consequently, has an effect on the development of particular regions. Innovation is one of the main drivers of economic development, both in quantitative and in qualitative terms. This means that investment in innovation to increase growth in peripheral regions is a logical path to pursue. However, as the paper argues, governments are also driven by the motivation to be re-elected. Therefore, the resources distributed to regions should follow a distribution that would increase the chances of the incumbent's survival in office. This should correlate with policies increasing innovation-driven catch-up processes.

The role that electoral institutions play is especially important, as they define rules according to which the government is selected. This determines what policy has highest

potential to increase the chances of re-election. Accordingly, the provided model indicates that under majoritarian rules spending on innovation should be less proportionate, and that peripheral regions should benefit more (especially if they are also non-entrenched districts). While empirical investigation provided some support for the hypotheses, a much more elaborate analysis is clearly needed, as the estimations show mixed levels of support and a more precise measurement is required (especially including not only R&D policy, but other instruments of innovation policy as well). Support for the hypothesis indicates that peripheral regions should have better conditions for economic development under majoritarian electoral systems.

The limitations of this paper are evident, especially in its empirical part. However, due to high data limitations (the panel data is unbalanced, with the time-series length varying between 1 and 14 for different regions, the proxy variable is not very reliable), a more elaborate analysis was not possible to implement at this time. However, the main purpose of the paper was to propose a theory explaining the motives for the government to invest in innovation in regions in general, and peripheral regions in particular, and consider the potential impact on the development of peripheral regions. A better-grained study could, of course, falsify the hypotheses, but that remains for future research to determine. Currently, the main aim of this paper was to present a theory that could connect electoral systems, innovation policy and the development of peripheral regions. The proposed approach was based on existing theories and raises important questions, such as the role of the constitutional setting in implementing innovation policy, and if this can affect the convergence or divergence of regions.

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