



NATIONAL RESEARCH UNIVERSITY
HIGHER SCHOOL OF ECONOMICS

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PROVISION WITH NEGATIVE
EXTERNALITIES: ROLE OF
PARLIAMENTARISM**

BASIC RESEARCH PROGRAM

WORKING PAPERS

SERIES: POLITICAL SCIENCE
WP BRP 06/PS/2012

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INNOVATIONS AS PUBLIC GOODS PROVISION WITH NEGATIVE EXTERNALITIES: ROLE OF PARLIAMENTARISM

Technological innovations are inherently problematic (risky, uncertain, possess public goods properties (enhances free-riding since it is easy to steal), but once they succeed, they create negative externalities for incumbents in the form of economic resources redistribution. Economic resources are convertible into political power. Therefore, economic redistribution might eventually result in *political power redistribution*. Those who fear to lose political power have incentives to defend status quo. Innovators will face collective action problems (who will be willing to innovate and risk to fight with incumbents) and commitment problems (who will compensate losers from innovations and why they should believe such promises). My answer is that market is not enough. It is political institutions that solve collective action and commitment problems. Some political institutions e.g. parliamentary government form will deal with political risks better than others e.g. presidential one.

Key words: innovation, scientific technological progress, political institutions, collective action problems, commitment problems, parliamentarism

JEL Classification: O031.

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Introduction

This puzzle has occupied minds of political scientists and economists for centuries: what can be accounted for such a large variance in economic growth between countries? Per capita income in some African and Latin American countries is $1/30^{\text{th}}$ and $1/5^{\text{th}}$ of that in the US, respectively (Acemoglu and Robinson, 2000b; Przeworski and Curvale, 2005). Despite the existence of numerous explanatory mechanisms, the conventional wisdom in economics emphasizes a pivotal role of technological progress and human capital accumulation in determining economic outcome. “Solow's suggestive calculations indicated that perhaps seven-eighths of U.S. growth from 1909 to 1949 was due to technical change and one-eighth to the growth of capital” (Olson, 1988: 44). There is also mutual understanding that a country's abilities to innovate and generate human capital are merely proxies for deeper reasons. Thus, the existing universal agreement that fundamental technological innovations lead to a better economic outcome leaves a lot of unanswered questions i.e. why some countries succeed at innovating, while other fail.

Despite the popular talks about globalization and increased interdependence, some countries are at the technological frontier while others lag behind. Political and economic scientists have put strong efforts into seeking for the coherent explanation of “why it is so” and created numerous ambitious theories. Notwithstanding the considerable accomplishments that have been achieved within the topic, there is a certain shortage in the approach undertaken by most scientists: they tend to dismiss political institutions. My innovation in this paper is to appreciate the role of political institutions by demonstrating their essentiality in determining a country's innovative capacity. The narrower research question that I attempt to answer is the following: what political institutions allow to successfully introduce innovations and optimally allocate externalities.

Before laying out my main theoretical argument, it is necessary to define *innovation* and to draw a difference between invention and innovation. Invention is simply a discovery of a new product or method, whereas innovation means commercial application of the former. In other words, inventions might or might not make their way into becoming innovations. The crucial distinction between the two is that inventions themselves do not hurt anyone, whereas innovations might be regarded as pernicious by some social groups, which makes them a *political* problem. To block innovations means to prevent inventions from being turned into innovations. In this paper I focus on technological innovations only in democratic countries.

Theory in a nutshell

I argue that due to the specific nature of innovations - being public goods with negative externalities in some sense because once idea is disclosed, it becomes public, and possessing highly risky character (outcomes are never certain) - it is differences in “bigger political institutions” (parliamentary versus presidential systems, centralized versus decentralized states, majoritarian versus plurality electoral rules) that will heavily influence individual decisions whether to invest into innovational projects or not. In this paper I focus on the differences between parliamentary and presidential democracies.

Which properties of innovations give me the right to treat them (at least partially) as public goods producing negative externalities? Innovations are public goods in a sense that they are non-excludable: once an innovative idea is disclosed, it is free for the public. Even if intellectual rights are properly defined and protected and an innovator enjoys monopoly rents, there is no monopoly over knowledge that underpins any innovation. Therefore, it is easy for a company to free-ride on innovations made by another firm: the former might spare resources on research and development (R&D) and spend them on marketing and advertisement and be better off at the end. Non-excludability of end innovative products coupled with high uncertainty over innovative projects results discourages individuals from choosing to innovate and make them wait that someone else will innovate, while they (society as a whole) will still be able to reap benefits.

First, due to the public nature of innovations (see a lengthy discussion below) coupled with inherent high risks, an actor deciding whether to innovate or not will face a severe collective action problem. Second, the redistributive character of innovations (once innovations are at place, they tend to produce economic and *political* winners and losers) creates commitment problem (who will compensate losers?). Where do “*political*” winners and losers come from?

It is well recognized economic phenomenon that introduction of new technologies is by no means innocent: holders of old technologies will suffer because if an innovation is successful, they will be most probably replaced by newcomers. Therefore, it is reasonable to assume that those who expect to lose from new technologies will have incentives to block them. Acemoglu and Robinson (2000b) refer to this idea as an “economic-losers hypothesis” that was elaborated in details in the works by Kuznets (1968), Mokyr (1990), Parente and Prescott (1997). However, the authors notice that there are a lot of situations when economic losers failed at their attempts to block innovations (for example, Luddites). With this in mind, the authors propose what they call a “political-losers

hypothesis” arguing that if economic losers have enough power to block innovations, why not use it to simply tax new products and receive higher rents from that? “A more important reason, however, may be that the introduction of new technology, and economic change more generally, may simultaneously affect the distribution of political power” (Acemoglu and Robinson, 2000b: 126). Both political power (e.g., political office) and economic money (e.g., money) are resources that can be easily (e.g., electoral campaign contributions) converted into each other. It is plausible to assume that innovations through redistribution of economic rents redistribute political rents (power) as well.

In this light, I argue that it is political institutions that can produce either more favorable or more detrimental conditions for solving collective action and commitment problems caused by peculiar nature of innovations. The two main mechanisms how political institutions will play their tune are the following. Innovators face collective action problem due to the nature of innovations and vested interests’ power. Political institutions reduce costs of innovating by making it harder for vested interests to defend status-quo (they will face a stronger and more organized enemy) and therefore easier for innovators to organize to promote their interests.

Second, innovators cannot commit to the current power holders i.e. defenders of status-quo that they will not take over political power after innovation is successful. Political institutions solve commitment problem by compensating losers from innovations i.e. diminishing their overall losses and making a “blocking” option less attractive.

Moreover, the efficiency of the solutions will depend on the political institutions themselves: some of them turn out to be more conducive to innovations, while others less so. It is the primary goal of this paper to determine which exact properties of political institutions allow the latter to promote or block technological innovations.

In the light of the fact that the importance of scientific-technological process has been long recognized by political thinkers (Polany, 1944; Solow, 1957), it is striking that the connection between political institutions and innovations remains largely understudied. To the best of my knowledge, the only political variable that receives desirable attention regarding its influence on innovations is decentralization – both political (in the form of constitutional federalism) and fiscal (Tiebout, 1956; Taylor, 2002). In this paper I intend to demonstrate the influence of political institutions, in particular presidential versus parliamentary systems, on the innovative capacity of a country.

Guided by the logic presented above I argue that parliamentary democracies solve collective action and commitment problems more efficiently than presidential ones, which leads to higher

innovative capacity under parliamentarism. Certain features of parliamentary democracies such as decisiveness (which makes it harder for vested interests to block innovations), coalition government and multipartism that often go hand in hand with parliamentary government (provide for more representation, greater public goods provision including innovations and greater redistribution) make such systems more “innovation-friendly” than presidential ones.

First, I briefly touch on the existing explanations of a country’s innovative activity. Second, I explore the reasons and consequences of conceptualizing innovations as public goods and negative externalities. Third, I elaborate on the existing collective action explanations and vested interests’ hypothesis. Fourth, I present a game-theoretic model to illustrate the importance of political institutions. Fifth, I describe theoretical mechanisms through which political institutions impact countries innovation rate. After that I derive a hypothesis regarding the influence of different forms of government (parliamentary versus presidential) on countries innovative capacity and test it on a cross-section 85-country sample. Finally, I conclude.

What Literature Has to Say

The world history is replete with the examples of technological innovations that were blocked or delayed despite being more advanced and efficient from the economic point of view. The most common example is innovations tied to the industrial revolution that started and developed at a very different pace in European and Asian countries.

Acemoglu and Robinson (2002b) give an example that back in 1850 the US enjoyed 14,518 km of railroad track (one of the main industrialization indicators), Britain 9,797; Germany 5, 856, whereas Hapsburg Empire 1,357, and the Russian Empire only 501 km. Moreover, the history offers another fascinating case for the analysis: China and some Middle Eastern states used to be at least as developed as the European states around 1400, but for some reasons they failed at maintaining their supremacy in such spheres as science, trade, military and other. According to Mokyr (1990), the Chinese government at some point in time simply ceased to develop economic growth through technological progress e.g., the Europeans wanted to develop Chinese mining, but were unable to do that due to the lack of state support from the side of the Chinese authorities. So what prevented some countries from innovating?

The lion share of the existing works on the subject focus on the following explanations of innovations: 1) geographic; 2)economic; 3)democratic; 4) public policy, and 5) decentralization. Despite the existence of profound theories, all of them suffer from certain flaws.

Some view geography as a major pillar of the causal link with economic growth since it defines such characteristics as climate, natural resources, transaction costs, knowledge spillovers (Machiavelli, 1519; Sachs, 2001). According to this group of authors, geographic conditions such as climate and resources should influence economic growth time-invariantly: better geographic conditions should yield better economic outcomes. Acemoglu & Robinson (2005) explored relevant data and came to the contrary conclusion: countries that used to be rich in 1500 are poor nowadays and vice versa. Here comes the question: how exactly should resources influence innovations?

On the one hand, it is common sense that necessity is the mother of invention. A lot of European and some Asian countries provide evidence to this idiom: lacking abundant natural resources or population these countries remain top innovators of the world (Ireland, Netherlands (before they found oil), Sweden, Japan, South Korea, Singapore). Furthermore, a lot of countries being granted favorable geographic initial conditions (for example, Russia, several central Asian countries, most African countries) are not at the innovating frontier, which also lends support to the statement above.

On the other hand, it is hard to invent without any resources: as technology progresses, the process of innovating is becoming increasingly costly (education, equipment, information). In this sense, one might assume that it is easier to innovate for countries that possess a rather big territory, large population, ample natural resources etc. so that they can relocate the extracted money and pour it into the innovative activity (Treisman, 2007). There are countries that are blessed with plenty of natural resources and human capital (US, Canada, Holland, Norway) and have remained pioneers of technological development for a long time.

Another approach for explaining economic outcomes is to look at governmental policies. Parente and Prescott (1999) argue that different levels of economic development result from differences in the knowledge that societies apply towards work practices. On the one hand, in 1811–13 the British Crown “sent out more troops to put down the Luddite riots than were in Wellington’s original peninsular army in 1808” (Mokyr 1990, p. 257 as quoted in Parente and Prescott, 1999: 70). On the other hand, Randall (1991) gives a lot of examples of innovation being blocked by workers in the woolen industry e.g. shearers (who were one of the largest trade groups and enjoyed high profits) opposing the introduction of the gig mill. It is without shadow of a doubt that public policy matters and might even determine innovative output. However, these theories fail to tell the story about how public policies are formed.

As opposed to geography-oriented and macroeconomic models, another approach gives

economic institutions i.e. property rights a central role in determining a country's wealth. According to Douglas North (1990), institutions such as property rights protection will dictate which knowledge is valuable in this society, which activity is profitable, whether it is more beneficial to innovate or to confirm.

My concern is that there are a lot of developed countries that enjoy decent property rights protection and competitive environment, but they produce innovations at strikingly different rates. This fact hints at the political stages when innovations might have been blocked, which is unobservable since at the end no innovation occurred, although property rights might be protected and R&D expenditures are above average.

Market Failure: Innovations as Public Goods

The previous explanations used to treat innovations as private goods. However, some properties of innovation coincide with characteristics of public goods and externalities that are two bright examples of market failure. Thus, treating innovations as public goods might shed light on why market conditions are not enough for optimal innovation provision.

At first sight, technological innovations as final products might be regarded as private goods because they are both rivalrous² (private soft-ware companies compete between each other) and excludable (if one firm patents a product, it will become a sole owner of the right to use this innovation given intellectual property protection). However, two main problems with innovations stand out. First, although innovations are believed to be often beneficial for the society at large, they are not a very attractive option either for business or government. Second, innovations possess redistributive nature, which means that they generate new political winners and losers with the latter trying to oppose them. Both cases are plagued with an acute collective action problem. All else equal, any company is better off stealing innovation than creating its own. All else equal, potential winners from innovations lack necessary resources to overcome collective action problem. In this paper I am intended to show under which political conditions these problems can be solved.

In some sense innovations are distinct from other private goods and closer to public goods: once an innovative idea is disclosed, it becomes public so that anyone can enjoy it without diminishing its utility for others, which discourages innovative activity by rational i.e. self-interested utility-maximizers.

² Aranson and Ordeshook (1985) argue that most public goods are private in production.

It is common sense in economics that rational and self-interested individuals can be better off mutually if they cooperate with the usual example being exchange of private goods, or to simplify, market system. It is not obvious, however, why a rational individual with narrow self-interests would choose to exchange goods rather than steal from each other. The most important point is that both individuals are better off if they refrain from stealing, but each of them is better off if she steals. However, stealing does not come without costs since one has to put effort in order to steal and then put effort in order to protect what has been stolen. Hence, one might argue that stealing remains an attractive option as long as the benefits from this activity exceed costs that are incurred. The typical Prisoner's Dilemma is on the surface. If a social contract exists (property rights are clearly defined), risks and costs associated with stealing automatically exceed possible gains, which is considered to be a necessary precondition for the society to end up with a Pareto-optimal outcome.

Apart from property rights being also a costly and time-consuming institution to design, entrench and maintain in the future, the problem with individual incentives to cheat rather than cooperate is exacerbated when a good in question is public by nature i.e. non-excludable and non-rival. To provide some details, two main characteristics of public goods (sometimes referred to as pure public goods) are non-excludability, or impossibility of exclusion (if a good is provided to any member of a society, other members cannot be excluded from also enjoying it) and jointness in supply, or non-rivalry (costs of goods are fixed regardless of how many people contribute i.e. marginal costs of production are zero). The latter characteristic induces cooperative behavior, while the former encourages defecting. Theoretically, the equilibrium outcome of cooperative strategy may emerge in the following cases: 1) if it is a repeated game and players use tit-for-tat strategy (Axelrod, 1984); 2) if it is a repeated game and each player uses cooperative strategy until the other defects, in which case the former will punish the cheater (Taylor, 1987).

However, in practice collective action problems are ubiquitous (although a game format might be the same, there are always new players) and they become even more serious once the number of group members increases (Coase, 1960; Olson, 1965) and usually result in the underprovision of public goods. How do innovations fit this picture?

First, innovations possess public goods properties; second, they are costly and long-term, and finally, they are risky. Innovation process consists of multiple stages with the important step being an innovative idea. Once the latter is disclosed, innovative idea stops being innovative and becomes free to public. First, usage of knowledge and/or ideas by anyone does not diminish its value for

others (implying non-rivalry); second, one cannot exclude others from using it (non-excludability). Public character of an innovative idea makes it easy for companies to steal from each other and thus, creates enormous incentives for companies to free-ride on other firms' innovations. The same logic can be applied for countries.

Apart from that, costly, long-term and risky nature of innovations reinforces the effect of their public good properties: it is not only easy, but also much cheaper to steal an innovation than invest in one's own. Moreover, innovations induce asymmetric information problem: firm managers might not know where to invest due to the lack of specific knowledge or skills that are necessary to calculate risks tied to this or that project. Furthermore, since consumers for the same reason cannot often tell the difference, innovations are in danger of becoming "lemons" (Akerlof, 1971): why will a company tries to innovate a better product if customers are satisfied with the already existing one?

Innovations as Externalities

Apart from being a public good, technological innovations might generate negative externalities for the "old innovators" or the leaders of traditional industries as well as those employed in those industries. This problem goes at least as far in history as to the "luddites" movement in Britain at the onset of the industrial revolution, and it certainly has not diminished since then. Today such innovations are often referred to as "disruptive technology" or "disruptive innovation".

Public goods represent one of the most notorious examples of market failure with the government participation in the provision of these goods often being a justified solution. Apart from that, there is another category of goods that account for market failures i.e. externalities that can be either positive or negative or both for different players. Public goods and externalities share one common characteristic i.e. non-excludability, which produces the same logic for Pareto-optimal solutions. According to Mueller (1995: 25), "An externality occurs when the consumption or production activity of one individual or firm has an unintended impact on the utility or production function of another individual or firm". The difference between public goods and externalities is that with the former all group members consume the same public good, whereas with the latter producers might enjoy profits (from a plant in the center of the city), whereas citizens would suffer from polluted air and/or the absence of a nice park in the city center. As one can notice, the main problem with externalities is that they will affect decisions of other players by changing their utilities.

Innovations might create both positive and negative externalities. Moreover, consequences

might be simultaneously positive and negative for different social groups. The straightforward example of positive externalities in case of innovations is knowledge spillovers from one scientific sphere into another, from one industry into another. Negative externalities imply two phenomena: first, if a better product (method) is introduced, the society is better off, while the economic owners of the previous one lose. Employing cost-efficient alternative energy sources in Russia might be beneficial for the society at large. Moreover, one can safely assume that it will make environmentalists especially happy, while gas and oil companies extremely sad. Another example includes vested interests. By creating negative externalities for the economic owners of the old production means, innovations lead to the redistribution of economic resources and as a consequence, political power. Due to this redistributive nature of innovations vested interests have incentives to oppose innovations. In this case if special interests succeed in blocking innovations, they can be said to create negative externalities for the society as a whole in the form of underprovision of innovations and as a possible result, retarded economic growth and development. So the question is who is responsible for offsetting or at least mitigating negative externalities and stimulating positive ones.

The most common solution to this problem as also in the case of public goods provision is government intervention through levying taxes, granting subsidies etc associated with Pigou (1920).

The author was, however, opposed by Ronald Coase (1960) who argues that there is no need for government resolution. He gives an example about air breathers and air polluters. If the cost of not polluting is low, there will be no pollution anyway: if a firm possesses rights, air breathers will bribe a firm. If the cost of not polluting is high, pollution will occur anyway: if air breathers possess rights, they will sell them to a firm. Is it safe to assume that the sides will agree to negotiate in the first place?

Vested interests

Despite Hardin's (1982) numerous examples of special interests' influence over politics (different taxation laws that make different industries better off), he seems to abandon discussion of why those who may be harmed by these special provisions do not overcome collective action problems and lobby against them. The problem might be that those most heavily hurt are large and therefore disorganized groups (Olson, 1965). Another problem that will be elaborated later in more details is that those most hurt by the underprovision of innovations are not able to perceive that they are actually hurt: 1) negative externalities from not innovating are unobservable; 2) some categories

of the society simply cannot afford the latest innovations. This problem gains its momentum in the modern world where a lot of technological innovations cannot be afforded by the poor. If one does not know about what could have been innovated but in fact was not, and if one will not be able to purchase it once invented, would he/she lobby for it? It appears that there is a subgroup in the society – specifically, the poor – who cannot soberly judge whether they need innovations. As in the case with public goods, the median voter whose income is by definition skewed to the left will definitely prefer to free-ride.

Depending on the size and organization of the old-innovators' groups, their ability to constrain change will vary. Olson (1965) distinguishes between the formation process of small and large social groups. As the number of group members increases, the share of public goods (characterized by non-rival and non-excludable) per member decreases, which means that each member contributes too little and therefore, will have incentives to free-ride since she will be able to calculate that if one member does not contribute, public good will still be provided except that she does not incur any costs of her own. Therefore, social groups will never reach the optimal level of output unless there is a coercion mechanism in the face of enforcer e.g. government or selective incentives being mostly private goods.

Small groups are usually associated with business interested in private gains, which implies it is much easier to overcome collective action problems within a small group when each member's gain is proportionate to his/her effort, whereas large groups are concerned with the provision of public goods that exacerbates the problem of collective action and free-riding. The most important implication for power relations is that those small groups will not only have more incentives to overcome collective action problems and pursue their own interests, but also once they win, they will be able to accumulate even more resources and pour them into the next round of pushing their interests and so on. The point is that although interest groups are costly to organize, once established, they tend to sustain over time.

Olson (1982) argues that such vested interests will have an overall negative impact on the economic growth by impeding innovation. He advances a hypothesis that external shocks such as defeat in war as it happened with Germany and Japan in World War II might create conditions that favor the adoption of new technologies in a sense that they destroy the existing vested interests that oppose innovation for a clear reason: their rents depend on the use of the old technologies. Apart from defeat in war, other mechanisms for dissolving notorious vested interests suggested by the author are revolutions and jurisdictional integration (e.g. EU). What about some societies that

manage to innovate at an impressive rate while remaining quite stable? And which institutions deal with these interests?

My answer to this question lies within “bigger” political institutions such as parliamentary versus presidential systems, majoritarian versus proportional electoral systems, federalism versus unitary state structure: due to specificity of mechanisms at work, these institutions will be more or less capable of solving the problem of vested interests and other hardships that innovative activities suffer from. Some of these were recognized by the earlier authors.

Rosser (2007), for example, draws the reader’s attention to Olson’s conception of the emergence of encompassing groups that was previously overlooked. The logic behind it is that these groups are so large that it is unprofitable for them to seek rents for narrow interests since the optimal strategy would be to redistribute resources efficiently. These groups can emerge only within liberal democracies that as defined by Olson should possess two distinguishing features i.e. rule of law and freedom of organization. Rosser (2007: 4) suggests that “the power of special interest groups could be broken, and a stagnant economy could regain growth and dynamism through peaceful democratic means”, which seems to be a missing link in Olson’s (1982). I think that the mechanisms offered by Olson can be classified by two criteria (external/internal and violent/non-violent) and summarized in the following two-by-two table:

Table 1. Mechanisms of Destroying Vested Interests

	Peaceful	Forceful
Internal	?	Revolution
External	International jurisdiction	War

Although Olson (1982) hints at the potential attractiveness of encompassing versus special interest groups, he warns that the former are by no means a panacea against the collective action problems nor are they universally applicable: if society consists of encompassing groups, it might lead to less information, less checks and therefore, again inefficient outcomes. In this light, I believe that the question of which political systems are more capable or less so in finding the optimal ratio of stability versus change (mechanisms that maintain stability and those that break up vested interests that are no longer efficient) is crucial for explaining innovation.

When Institutions Constrain Change

The question on why some societies fail to adopt the most efficient economic tools that will lead to faster economic development e.g. the best available innovations was addressed by numerous scholars (Gerschenkron, 1943; Kuznets (1968); Olson (1982); Mokyr (1990); Krusell and Rios Rull; Hellman, 1998; Parente and Prescott (1999); Grossman and Helpman, 1994; Acemoglu and Robinson (2000, 2006, 2010). The main claim of these authors is that the powerful and entrenched vested interests will always possess incentives to protect their status-quo because they fear that any political or economic change including technological innovation might lead to redistribution to their disadvantage and diminish their leverage within decision-making process.

Acemoglu and Robinson (2000) notice that attempts to block major innovations (i.e. mechanization of work by those deprived of their jobs known as Luddites in Europe; peasants in the Soviet Russia who destroyed their own machines as a means of protests) often fail. The authors offer a refined argument claiming that from the economic point of view it is questionable that the elite that is in a position to block innovations will not instead allow new technologies to enter and tax them at a necessary rate to compensate themselves from granting access to and therefore sharing profit with more stakeholders. Since it is not always the case, there must be another explanation why elites block innovations. Acemoglu and Robinson state that innovations might result in the redistribution of political resources (power) along with the economic ones. Therefore, they argue that innovations will be blocked only in those cases when economic redistribution caused by innovations also leads to reallocation of political power. Different industrialization patterns in England, Germany, Russia and Austro-Hungary lend support to the hypothesis: while in the former two examples the political elite being landlord vested interests felt safe and therefore allowed – at least did not harshly resist- for economic industrialization to happen, the landowning elite within the latter two feared political redistribution and therefore opposed innovations.

Acemoglu and Robinson (2006) used a more subtle intuition to explain the nonmonotonic effect of political competition on the rapid versus delayed adoption of more effective technologies: when competition is both the largest and the smallest, members of political elite will be disintegrated to block innovations because in the first case they will understand that if they do, they will probably fail and be toppled, and in the second case, the political elite feels so safe that it does not fear losing its political standing and hence there is no reason for them to block economic change. It is the intermediate degree of competition that will encourage attempts to block changes. Apart from competition, such factors as political institutions that themselves might reward or discourage

innovations by diminishing or raising stakes in monopoly rents (e.g. parliamentary constraints on the British leader and absolutist power of landlord elite in tsarist Russia, respectively) and the presence or absence of international threat (Russian after the notorious defeat in the Crimean War in 1905) might impact the elite decision to adopt or block innovations.

Another reason why the elite might block changes instead of taxing *ex post* might be borrowed from economists arguing that it is probably cheaper for the powerful to bribe some groups in the middle class so that to prevent much dissatisfaction. Breyer and Ursprung (1997) ask a question of why the poor do not expropriate the rich under direct democracies. Their answer is that the rich are able to bribe “the poor” –those with incomes below the median - so that the latter do not support confiscatory taxation. The authors say that they are not even interested in representative democracies because they are sure that since the decision-making process is in the hands of several people, it will be easy for the economically powerful to bribe the politically powerful to venue their interests. This might be very true for why the rich usually win, however the theory fails to capture why the poor rarely stand up against the rich. It might be that the very opportunity to vote on confiscating the rich is blocked from them, and opening up this window of opportunity requires collective action that the poor lack resources for. The logic prompts that the answer for representative democracies is the same as in direct ones: it is often cheaper for elite to bribe some groups in the society to keep the necessary level of loyalty. For the theory of innovation it means again bias towards status quo.

The most pernicious implication is that due to the special interests lobbying for particular policies, efficient innovations will be blocked, and as a result, the society at large will lose. Equally telling, there seems to be no conditions under which Coasian world will prevail.

Theory: Political Institutions

The problems that actors face when deciding whether to invest into innovative activity or not i.e. collective action and commitment problem have to be resolved in order for a country to be competitive in innovations. I argue that these problems are subject to political-institutional solution.

North (1990) stresses the importance of property rights protection, the author emphasizes the primacy of political institutions over economic ones, although he admits two-way causality. “The efficiency of the political market is the key to this issue. If political transaction costs are low and the political actors have accurate models to guide them, then efficient property rights will result” (North, 1990: 52).

It has become conventional wisdom to think of political institutions as certain constraints on human behavior that will impact actors' choices, strategies, and moves, and together with preferences will determine an outcome (Plott, 1967; 1991; North, 1990). Moreover, it appears that most institutions would have status-quo bias. However, political institutional designs vary to a significant extent, which makes an enormous difference for to what extent a state is capable of creating the context necessary for optimal and successful innovation.

I have already shown that due to the public nature of innovations coupled with inherent high risks, an actor deciding whether to innovate or not will face a severe collective action problem. Moreover, innovations lead to redistribution of economic resources. The latter are easily convertible into political resources both directly and indirectly. The example of direct conversion is correlation between resources spent on electoral campaign and office seats. The example of indirect connection is economic growth of social groups who support different political parties and will vote out the previous ones. Therefore, innovations redistribute political power as well. The above described redistributive character of innovations (once innovations are at place, they tend to produce economic winners and losers) creates commitment problem: who will compensate losers?

Assuming current power holders are 1) rational (i.e. they should believe that by their actions they maximize their utility even if it is not so from the economic point of view (altruism) and 2) they are interested in the status-quo, they will defend it. Moreover, given that entrenched vested interests possess plenty of resources, the probability that they succeed in organizing against innovators and eventually impeding them is high. Therefore, innovators face a severe collective action problem: not only is innovative process costly and uncertain, the enemy seems too powerful. Is innovation worth fighting? On the contrary, vested interests face commitment problem: innovators cannot commit to them that they will not take over political power if innovation is successful. Isn't it political power that is worth fighting for in this case? What seems paradoxical then is that some countries are able to maintain status of world innovation leaders for quite a long time.

My answer lies in the variety of political institutions with some of them being able to substantially reduce costs of innovating and others failing to do so. Political Institutions reduce costs of innovating by making it harder for vested interests to defend status-quo and therefore easier for innovators to organize to promote their interests. It is also political institutions that compensate losers from innovations (for example, through redistributive policies) i.e. diminishing their overall losses and making a "blocking" option less attractive.

A director of a high-tech company deciding whether its firm should innovate or not will

weigh a lot of factors in order to assess risks associated with this decision. For example, if one finds herself in a country with poor property rights protection, she will probably think twice before making such a decision. On the other hand, one might find herself in a country with highly protected property rights and uncorrupt bureaucracy, but due to the political institutional design these features might work only to the advantage of certain groups that were earlier referred to as vested interests. In order to solve collective action problems caused by innovations being 1) a public good and 2) an extremely risky enterprise, political institutions should be able to reduce risks for a potential innovator so that to encourage innovative activity. What are these institutions?

This leads me to hypothesize that the more permissive and multifaceted political institutions are the more innovations they will produce. By this token, all else equal, federal structure, parliamentary political system, proportional electoral formula will lead to more innovations at a country level than unitary structure, presidential political system, plurality electoral formula, respectively. Each political institution will be given a separate discussion on how it reduces or increases costs of innovating.

Formal Model

I will present a simple game played by two companies that decide whether to innovate or to steal innovations in order to illustrate that *ceteris paribus* “good” institutions will provide for more risk tolerance than “bad” institutions. By “good” institutions I mean protection from illegal activities e.g. stealing, whereas “bad” institutions imply that such activity will be left intact. There are two players i.e. two companies on the market. Their actions include either to innovate or to steal innovation³, and players move simultaneously.

The risky nature of innovation is captured by the probability of success, which is .5 for each company regardless of the other’s actions. Payoff structure is the following: p - profit, c - costs incurred, α - spillovers, d – costs (punishment for stealing, or a proxy for “good” or “bad” institutions protecting property rights), r - political costs (how easy it is to block innovation by winners).

The game proceeds as follows. Player 1 chooses to innovate (I) or steal (S). If I, then Nature (N) flips a coin to decide whether the innovation is successful or not. Player 2 is not aware of the choices made by Player 1 since Player 2 simultaneously chooses whether to innovate or to steal,

³

Innovation is based on the knowledge (ideas) production function and therefore, I view innovations as public good.

after which N again tosses the coin to decide whether this innovation succeeds or fails. The payoff structure depends crucially on the economic and political environment that are parameterized.

If both companies innovate and succeed, they share the market, which means that they equally divide the profit ($.5p$), enjoy spillovers (α), incur costs of innovating ($-c$) and political costs ($-r$). So each obtains $.5p + \alpha - c - r$.

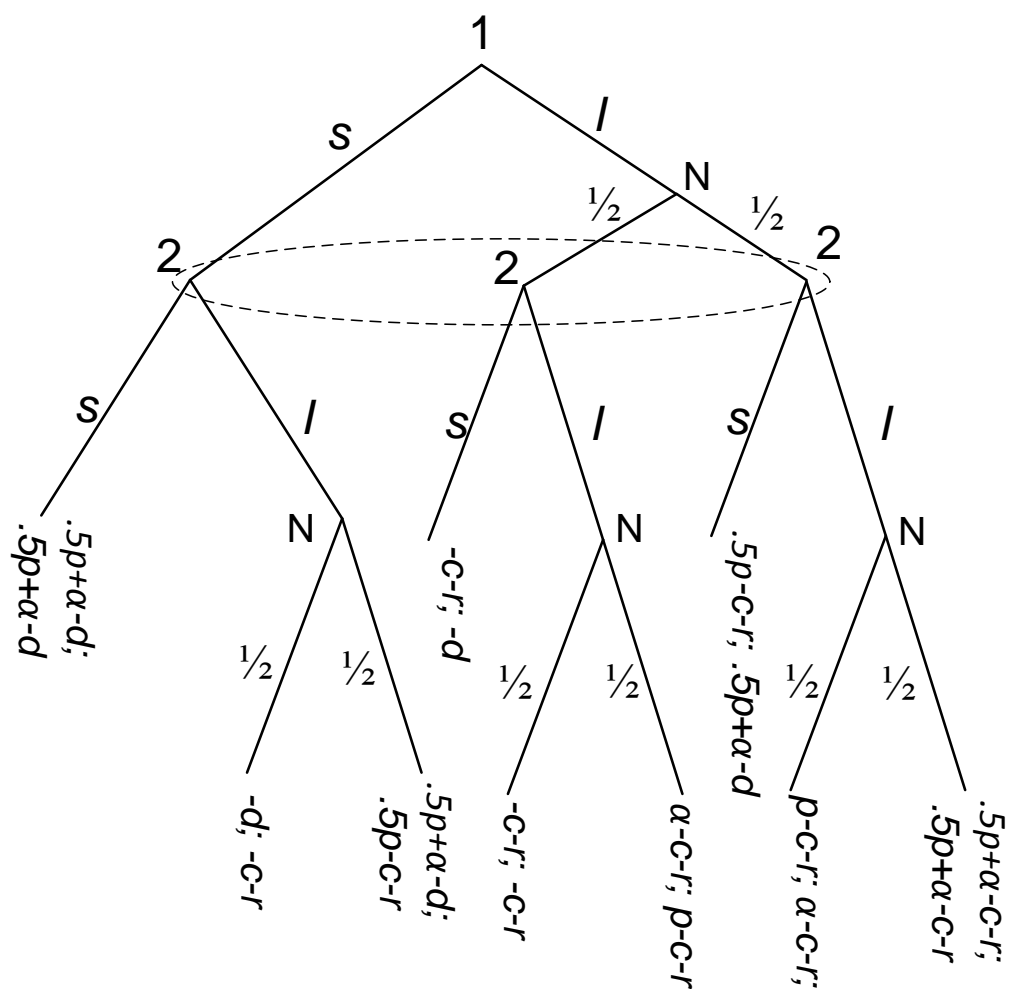
If one company successfully innovates, while the other innovates, but fails, the first will end up with $p - c$ and the second with $\alpha - c - r$.

If one company successfully innovates and the other steals, they will again share the market: the first one will have $.5p - c - r$, whereas the other one $.5p + \alpha - d$.

If both companies innovate and fail, both of them will get $-c - r$.

If neither company innovates i.e. they steal from some other company, they will obtain $.5p + \alpha - d$.

Picture 1. Extensive Form of The Game



After calculating expected utilities payoffs based on payoffs, the strategic form will be the following:

Table 2. Strategic Form of The Game

		Player 2	
		Innovate	Steal
Player 1	Innovate	.375p+.5α-c-r; .375p+.5α-c-r	.25p-c-r; .25p+.5α-d
	Steal	.25p-c-r; .25p+.5α-d	.5p+α-d; .5p+α-d

In order for both companies to be willing to innovate, $.375p+.5\alpha-c-r \geq .25p+.5\alpha-d$, or $p \geq .8c+.8r-.8d$. This means that the net profit from innovative activity ($.375p+.5\alpha-c-r$) goes up when the cost of stealing (d) goes up and political costs of innovating (how easy it is for winners to block innovations) go down. In other words, the willingness to innovate increases as both economic and political institutions improve.

In order for both to steal, $p \leq .8c+.8r-.8d$

Under bad economic institutions, there is no punishment for stealing, or $d=0$, and therefore, in order for both to innovate, $p \geq .8c+.8r$, which means that under bad economic institutions risks from innovations will be tolerated less than under good economic institutions with threshold (expected payoff) for starting to innovate being higher under bad economic institutions.

Moreover, under bad political institutions, political costs of innovating are extremely high, or $r \gg 0$, and therefore, in order for both to innovate, $p \geq .8c+.8r$, which means that under bad political institutions risks from innovations will be tolerated less than under good political institutions with threshold (expected payoff) for starting to innovate being raised even higher than under good political institutions.

In the next section I will attempt to answer how different political institutions manage to reduce political costs associated with innovative process them? I will describe three major political institutions – federalism versus decentralization, presidential versus parliamentary regime, proportional versus majoritarian electoral system - that I consider highly relevant for the theory elaborated above. I will briefly touch on the existing theoretical venues regarding the influence of these political institutions on various outcomes in the economic as well as political sphere such as representation, efficiency, accountability, corruption, public goods provision, redistribution, budget

deficit etc. By stimulating different strategic responses from political and economic agents, political institutions exert heavy impact on outcomes. Since innovation is a subtle construction in that it redistributes resources and at the same time is capable of generating huge social gains at the national and even worldwide scale, I assume that it is political institutions in the first place that should provide innovators with the right system of incentives.

Parliamentarism versus Presidentialism

There is a developed venue of political science research asking whether presidential or parliamentary systems are better and more efficient, which immediately begs a subsequent question: better for what? In order to evaluate parliamentary and presidential government forms, one has to set forth certain criteria. The most common among them are survival, accountability, representativeness, efficiency, level of corruption, transparency of decisions, state capacity, economic policy outcomes, provision of public goods. It is easy to notice that almost all criteria listed above contradict each other i.e. if accountability goes up, efficiency will probably decrease and so on. Another question is whether there is an optimal level of combination of all criteria, which might be a too far-fetched answer to seek for.

Keeping in mind that I am interested in the influence of institutions - in this case presidential versus parliamentary rules - on individuals and groups' incentives to produce, steal, or block innovations, I should first address a question of the criteria: which features of political design are essential in order to build and maintain efficient innovative system? In other words, which system – a more accountable or a more efficient one – will provide more incentives to innovate rather than to block novel products and successfully defend status quo? According to my theory, such system should be able to reduce risks from innovations to make them acceptable for entrepreneurs and a state. In other words, the system should be efficient (so new ideas might penetrate the system without being blocked by multiple vested interests) and redistributive (targeted at broad public programs and public goods provision). By this line of reasoning, parliamentary system is expected to be more prone to innovations due to its high efficiency and interrelated features such as coalition government and multipartism.

Having discussed which qualities a government form should possess in order to seem more innovative, it is necessary to explain how I classify “presidential versus parliamentary systems” and why I choose the dichotomy and do not turn to the more detailed classification e.g. semi-presidential regimes, super-presidential etc. In my classification I follow Shugart and Carey (1992) who are the

classics on the subject. I focus on two fundamental and closely interconnected features of government form: separation of power and confidence requirement. Parliamentary systems are those where the legislative and executive powers are fused and vote of confidence is required. The concentration of power in the hands of cabinet known as “efficient secret” (Cox, 1987) is believed to generate greater efficiency that increases at the cost of weaker accountability before voters. The necessity of continuous support for a cabinet from the majority in the legislature provides for more disciplined parties and frequent coalition governments. Since the main power is vested in the cabinet, the lure of ministerial positions increases, which leads to more frequent coalitional governments under parliamentary regimes. Presidential systems are those that have a stronger separation of powers (between the legislative and executive branch) and do not have a vote of confidence requirement. Separation of powers in the form of checks and balances allows for greater accountability of politicians before voters, but less efficient decisions. Various interests are pit against each other, which often results in stalemate. Absence of vote of confidence requirement leads to rare coalitions and less disciplined parties.

The above offered dichotomic classification – presidential versus parliamentary systems – does suffice for the purpose of this study (to look at the impact of bigger political institutions on innovative rate) since it emphasizes the essential differences between the government forms that influence politicians and voters’ incentives to act this or the other way. Adding other government forms such as semi-presidential or super-presidential regimes might overshadow the effect of more important features. More detailed distinctions certainly deserve attention, but this is well beyond the scope and purpose of this paper.

I believe that certain features of parliamentary systems allow them to create more favorable conditions for innovations. Fusion of executive and legislative renders parliamentary systems more decisive, which makes it harder for vested interests to block innovations. Parliamentary systems often coincide with multipartism, and more parties provide more venues to promote innovative projects. High permissiveness makes government care more about public goods (including innovations) provision. Finally, frequent coalitional governments allow for more redistribution (losers from innovations might hope for better compensation).

To lend support for the abovementioned characteristics of parliamentary systems, I will refer to the theoretical and empirical considerations regarding presidential and parliamentary systems within the existing literature.

The definitional distinction between presidential and parliamentary regimes lies in the

relations between the executive and legislative branches. Under presidential regimes, the executive and legislative branches possess different origins (nationally elected president for a fixed term and nationally elected legislature also for a fixed term) and do not depend on each other for survival i.e. there are no mutual direct constraints such as vote of no confidence or threat of parliaments dissolution (Shugart and Carey, 1992; Stepan and Skach, 1993; Tsebelis, 2002; Persson and Tabellini, 2003). Linz (1996) states that presidential systems are more susceptible to the situation of stalemate between the executive and legislative, which increases the probability of the political system collapse. More recent empirical analyses have corroborated Linz's expectations. However, empirically some authors found the opposite results i.e. democracies tend to survive much longer under presidentialism than under parliamentary system (Stepan and Skach, 1993; Cheibub and Limongi, 2001). Tsebelis (2002) argues that since a president represents an additional veto point, such a system will lead to greater policy stability. However, the dark side of stability is absence of change that sometimes might be necessary. On the other hand, some argue that it is coalition governments that are more common under parliamentary governments and have more veto players and therefore, will lead to a more serious status-quo bias in the face of adverse shocks (Roubini and Sachs, 1989, and Alesina and Drazen, 1991).

Stepan and Skach (1993) present empirical evidence that there are no successful democratic systems with more than three parties that are presidential, which hints at the probability that presidential systems bode badly for multipartism. It is appropriate to mention here that the role of parties might be another watershed line between presidential and parliamentary systems. It has become common wisdom that parties are stronger, more cohesive and disciplined under parliamentary regimes since parties participate in the government formation and therefore, party leaders obtain more control over party rank and file, whereas the latter face more incentives to hue to the party line, show his/her loyalty and hope for a ministerial portfolio.

Persson and Tabellini (2003) hypothesize that presidential regimes will have smaller governments than parliamentary ones since under the former members of legislature tend to succumb to narrow-based special interests, whereas under the latter ones mutual dependence of the legislative and executive provides politicians with incentives to appeal to a broader electorate. Moreover, the authors argue that parliamentary regimes will lead to a higher level of rent extraction by politicians due to the absence of checks and balances and lower direct accountability to voters. Rose-Ackerman (2001) and Kunicova (2005) come to the opposite conclusion about the superiority of parliamentary regimes over presidential in terms of corruption because most presidential systems

lack such checks and balances as in the US, which makes presidents with their enormous powers almost “elected autocrats” and moreover, legislatures have less oversight over executives. Moreover, there are a lot of arguments on how presidential regimes influence policy outcomes in combination with other institutions i.e. electoral rules, federalism, bicameralism etc. Some authors even argue that there are smaller institutions that matter more than mere difference between presidential and parliamentary systems.

Despite the theories being contradictory and empirical support mixed, I would argue that one can derive several features of parliamentary and presidential regimes that are more commonly accepted and might be employed in order to elaborate further predictions. Strong parties and coalitions tend to be distinctive characteristics of parliamentary regimes as opposed to presidential, which by definition lead to greater representation that might come at the expense of efficiency and accountability.

I would argue that greater representation matter for innovations more than accountability because *ceteris paribus*, greater representation means that more groups have access towards politics. Potential innovators will have more incentives to overcome collective action problems since one’s voice is more likely to be heard and there is a better chance that innovations will not be blocked by special interests. Moreover, due to the mutual dependence of the executive and legislative branches, party members have to come to compromises and parliamentary systems tend to appeal to broader electorate, which often leads to bigger governments, greater public goods provision, more redistribution. Innovative activities would supposedly benefit from the willingness of the government to provide public goods, which means that politicians care about the overall quality of their policy, and more redistribution means that the median voter might feel more safe in terms of the credibility of governmental fiscal promises and therefore, even on the individual level innovative risks might become more tolerable under parliamentary regimes. Furthermore, parliamentary systems will be less stable and more conducive towards change i.e. towards innovation because stalemate seems to pose a greater peril under parliamentary regimes for politicians in a sense that it is easy to deal away either with inefficient government or stubborn legislature, whereas under presidentialism stalemates happen every time because mutually independent executive and legislative bodies have no incentives to concede.

All the features listed above – more representation, bigger coalitions, greater proneness towards redistribution, less stability – will together reduce risks associated with innovations. So my main hypothesis that I intend to test comes down to the following one:

H₁: All else equal, parliamentary states will be more conducive towards innovative activity than presidential.

H₀: Political regime does not make any difference.

Research Design and Data

In this paper I hypothesized only about different democracies. Therefore, I will primarily rely on the cross-section data gathered by Perrson and Tabellini (2003). This is the data set for the cross section of 85 countries with observations being averaged over the period 1990-98.

My dependent variable is technological innovations per state. Innovative activity is a thorny variable to measure. A lot of independent variables seem to directly and indirectly influence innovations. Innovations themselves are a vague notion. Moreover, innovative process includes a lot of unobservable processes e.g. knowledge spillovers, management skills etc. These unobservables might be also a part of larger notion of innovative systems: knowledge spillovers depend on how well this system is organized institutionally.

Apart from unobservability problem, it is hard to understand what to count as innovations. There is no clear measure of innovations, especially at the aggregate (country) level. One of the most popular innovation measures is a number of patents

(Griliches, 1990; Jaffe and Trajtenberg, 1998; Acemoglu and Ventura, 2002). There is scientific consensus that patents do not constitute an ideal measure of innovations, but the debate revolves around whether this rough quantitative measure is still better than no measure at all. On the one hand, patents do not allow to distinguish between fundamental innovations and mere improvements. Different patenting laws and regulations might lead to a significant bias in the number of patents, their importance and overall scientific novelty of innovations. One way to assess innovation value is to weight patents by citations it receives. This method dates back to Griliches (1992), Jaffe et al. (2002). However, overcoming this issue by accounting for citations creates another problem in the form of localization or language bias (Aldieri, 2008). Since English is the world oral and written communications language, it is clear that many more people will be able to read in English and cite literature written in English, which might result in the inflated importance of patents from English-speaking countries.

Other measures of patents such as broad indexes and surveys suffer from their own shortages. If it is an index, it is impossible to disentangle the influence of different variables that constitute this index: for example, does a country fail to innovate because of inefficient education

system or because of corrupt government policies or both? As regards surveys, matters are even worse: asking a director of a firm about the most important sources of innovations means relying on her knowledge about innovation process, on her opinion, on her willingness to disclose the truth on whether R&D expenditures are of importance etc.

After carefully weighting all pros and cons, I have made a decision to stick to patents as proxies for innovations at state level. Although patents are considered to be an outdated measure in comparison to indexing and surveys, I believe that for the purpose of this project this measure is a better fit because it captures the overall ability of a nation to create novel products and patent them.

My dependent variable – Innovations - is measured as a total number of patents granted to a country for the time period from 1995 to 2009. The data come from the USPTO (United States Patent and Trademark Office).

My main independent variable is presidential versus parliamentary systems. It is a dummy variable for forms of government, equal to 1 in presidential regimes, 0 otherwise. Persson and Tabellini (2003) code all regimes where the confidence of the assembly is not necessary for the executive as presidential. Most semi-presidential and premier-presidential systems are classified as parliamentary. They use classification made by Shugart and Carey (1992) and national sources. I expect the parliamentary regimes will innovate more than presidential ones.

All the control variables are also taken from Persson and Tabellini (2003). First, I will control for a country's past using a dummy variable for being a former British colony (equal to 1 if the country is a former UK colony, 0 otherwise). The original data come from Wacziarg (1996). Second, I will control for federal versus unitary administrative structure. This is also a dummy variable, equal to 1 if the country has is federal and 0 otherwise. The original source is Adserà, Boix and Paine (2001). Third, I will control for economic development using natural log of per capita real GDP defined as real GDP per capita in constant dollars (chain index) expressed in international prices with base year being 1985. Data through 1992 are taken from the Penn World Table 5.6, while data on the period 1993-98 are computed from data taken from the World Development Indicators, the World Bank. These later observations are computed on the basis of the latest observation available from the Penn Word Tables and the growth rates of GDP per capita in the subsequent years computed from the series of GDP at market prices (in constant 1995 U.S. dollars) and population, from the World Development Indicators. Fourth, since I will control for the population (World Bank). Fifth, since the world is becoming more interdependent and national borders are sometimes believed to blur, I will control for trade openness using index for openness to

international trade compiled by Sachs and Werner (1995). It measures the fraction of years during the period 1950-1994 that the economy has been open and ranging between 0 and 1 (Hall and Jones (1999)).

The expectations from the control variables are the following. The richer the country (higher GDP per capita), the greater its population, the more it will innovate. Expectation from political institutions variables are less straightforward. I expect former British colonies to innovate more following Acemoglu and Robinson (2000) who argue that the imperial Britain mostly set up "good" institutions as opposed to "extractive" ones. These good institutions include intellectual property rights protection that should lead to less risk from innovations and hence more innovations. Advocates of federalism argue that it will lead to more experimentation and spillovers, which makes innovations more valuable. So, all else being equal, I expect a positive relationship between federalism and innovations. As regards trade openness, I expect it to induce competition with foreign companies and encourage domestic ones to innovate more.

Since the dependent variable is a number of patents, I employed a count events model to run the statistical analysis. Due to the fact that the results from the Poisson regression clearly indicated the presence of overdispersion, I turned to the negative binomial regression that efficiently deals with the problem.

Results

The results from the negative binomial regression are summarized in the table below:

Table 3. Negative Binomial Regression Results

Independent variable	Coefficient	(Standard Error)
Presidentialism	-1.69**	(0.40)
Former British colony	-3.97*	(0.38)
Trade Openness	-.52*	(0.47)
Federalism	.70*	(0.56)
GDP per capita	2.41**	(0.21)
Population	.07**	(0.01)
Constant	-13.6**	(1.78)
Dispersion parameter alpha	1.60	(0.22)

Note: Dependent variable is the number of patents granted to a country for the time period from 1995 to 2009;

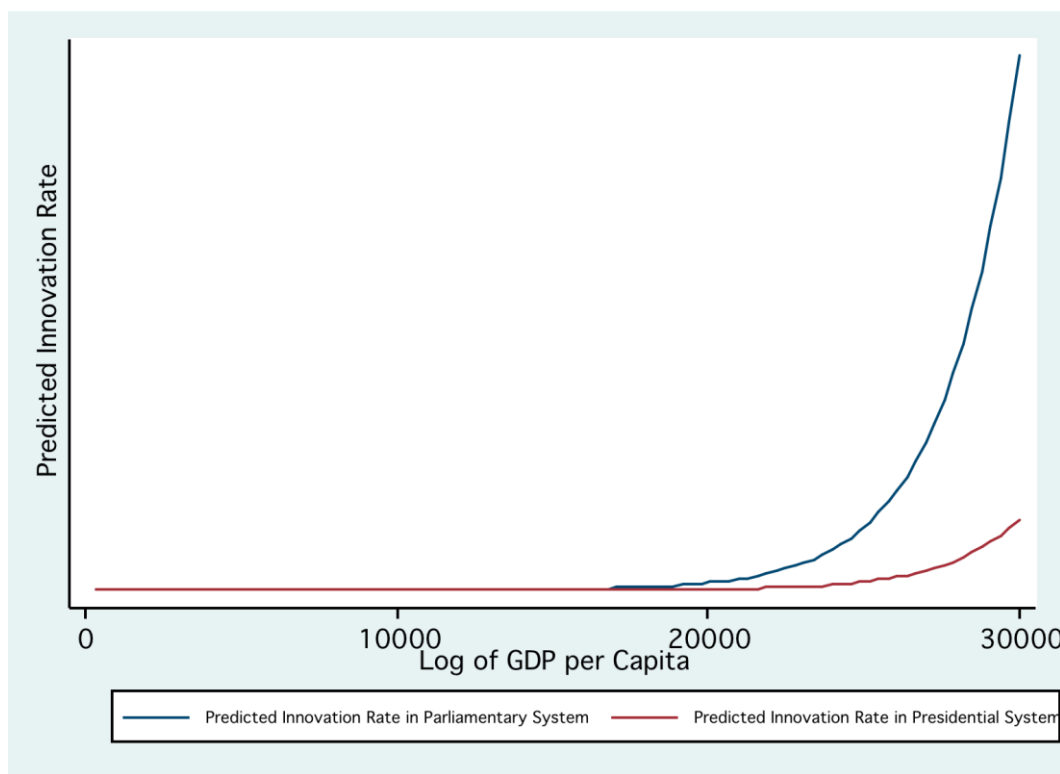
*p<.05, **p<.001

All in all, only two variables did not live up to expectations. Former British colonization as well as trade openness seems to have a negative impact on innovations. My explanation for an

unexpected sign is a small sample size and exclusion of authoritarian regimes. More interesting, however, is that presidential versus parliamentary systems confirmed hypothesized expectation: transforming from parliamentary to presidential system among democracies predicts smaller rate of innovative activity.

In order to illustrate the point more clearly, I ran out-of-sample predictions for innovation rates under presidential and parliamentary systems conditioned on economic development (see the graph below). It seems that after a certain threshold of economic development measured as GDP per capita, parliamentary systems are predicted to have a more positive and steeper effect on innovations.

Picture 2. Out-of-sample Predictions of Innovation Rate for Parliamentary versus Presidential Systems



This graph illustrates an important point, which is not within the scope of this paper, but might be an interesting research direction to delve into in the future: the intensity of the influence of political institutions, particularly form of government, on innovative capacity of a nation increases with the level of economic development. The potential line of reasoning might be that certain political institutions are more capable of creating favorable conditions for entrepreneurs so that the latter will be able to take advantage of country economic success.

Conclusion

In this paper I developed and formalized a broad theory on venues through which political institutions influence innovative capacity of a country. The conventional wisdom holds that scientific-technological progress with innovations being its largest driving force is responsible for the lion's share of the economic development. The literature also acknowledges that economic growth is often hampered by numerous barriers to economic efficiency on the side of vested interests that oppose new players' entrance and defend status-quo. This problem is exacerbated by the very nature of innovative activity: not only is it risky, long-term and costly, but knowledge behind it (especially once disclosed) is tantamount to public goods and provides entrepreneurs with strong incentives to free-ride. The puzzle is that some countries manage to systematically innovate at a better rate than others.

Traditional explanations lie within the geographic, economic (property rights protection), political or public policy realms. It is important to comprehend that the existing political institutional approach focuses mostly on the democratic versus authoritarian government impact on innovations. However, important political institutional distinctions within democracies themselves invite a closer look at them and pose another question: why some democratic countries innovate more than other democracies?

In this paper I demonstrated both theoretically and empirically that democratic parliamentary systems outperform presidential ones in terms of innovations. The main reason for that is 1) the ability of parliamentary systems to efficiently overcome collective action problems on the side of net winners from innovations by making it easier for them to push through their preferred policies and making it harder for vested interests to defend status-quo and their and 2) the ability of parliamentary systems to credibly commit to the net losers from innovations that they will be compensated by broad redistribution schemes.

I tested my hypothesis on the cross-section data set with 85 observations (restricted to democratic countries as dictated by the theory) taken from Perrson and Tabellini (2003). The results obtained confirmed the theoretical prediction: all else equal, parliamentary systems are expected to innovate at higher rates than presidential ones.

At this point the case of the USA – that at the same time remains the most classic example of the presidential systems and the global leader in the technological innovations by a significant margin - stands out of the theoretical and empirical predictions. There is no doubt this is a topic for a separate paper, however, three most possible explanations might be offered. First, the US might

simply represent an outlier, which happens quite often in the literature (running regressions excluding the US has become common practice). Second, there might be an omitted variable bias e.g. cultural factors (protestant ethic), business traditions (entrepreneur's spirit) etc. Third, the effect of government form might appear to be conditional on other political institutions e.g. federalism. Political and economic autonomy of states might partly offset the negative influence of presidential systems on the country innovative activity. Federalism might play its positive tune by mitigating vested interests' influence and increasing collective action incentives on the side of innovators through local- and state-level channels. So the effect of government form might be conditional on the effect of federalism/unitary administrative form. Nevertheless, this is a challenging question that invites daunting empirical investigation and might be a fruitful path for future research.

Within a broader framework, this paper opens an important insight into the political mechanisms of solving economic problems in cases where markets fail e.g. public goods and externalities. Moreover, it turns attention to the fact that technological innovations might possess essential properties of public goods that renders market inefficient in reaching optimal level of innovative activity. Such notion requires further scrutiny of political institutions and their ability to either block or promote innovations.

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