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TAX INCENTIVES TO ENCOURAGE INVESTMENTS IN INNOVATION

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ABSTRACT

Much has been said about the importance of innovation, especially after the rise of globalization and implementation of more open markets. In this paper, we will show how innovation is linked to schools of thoughts that sought to explain and understand what would lead nations to reach a certain degree of long-term development, since the model of Joseph Schumpeter in the mid-1930s until Romer's model in the mid-1980s. We seek to bring a definition for innovation, aiding in the standardization adopted by OECD manuals that mentioned the four species of innovation contained in the Oslo Manual. In doing so, we try to answer the question why would we need the presence of government functioning as an inducer of an innovation policy? In order to answer this question we will bring six arguments to justify this presence of government, emphasizing that improving productivity will be a key factor for developing economies like Brazil, and the benefits of closing the income gap with advanced countries. Furthermore we will show that there is a strong positive correlation between total factor of productivity and income per capita, and on the other hand a considerable positive correlation between total factor of productivity and investments in R&D. This suggests that investment in R&D has high social return. Thus we mention the main tools used by the government to resolve the market failures that hinder firms from investing in innovation and adopting new technologies, two of which are Direct Subsidies and Tax Incentives. We will present two charts making a comparison between Brazil and a sample of countries: In one graphic, we show the absolute amount invested in R&D, and the other graphic the relationship between investment in R&D and GDP is displayed, demonstrating that Brazil faces with the reality of underinvestment in R&D and needs to urgently leverage investments in the area. In light of this, and after giving an overview of the main direct subsidies and tax incentives used in Brazil to foster investments in innovation, we conclude that a national effort with the presence of the states must be given in order make such a leverage. At the end of the paper we will make the transition from theory-based discussion to a more practical approach to the matter. This will bring about some sort of contribution that can positively change a part of the reality of Brazil, and with that, enforce all the knowledge learned in Minerva Program classes and research. So, we present a draft of tax incentive legislation, a draft of an agreement of tax benefit related to a state jurisdiction tax called ICMS, in order to show how Brazilians States could help in a effort to reduce the underinvestment in R&D in Brazil.

KEY WORDS: Innovation; R&D; Tax Incentive; Direct Subsidy.

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1 INTRODUCTION

In the beginning of this paper we will demonstrate that technological innovation is only one species of the genus innovation. We will mention some definitions contained in the Manual of Oslo and Frascatti Manual, both of which were developed by the Organization for Economic Co-Operation And Development **(**OECD). Furthermore we will discuss a series of economic currents that sought to explain and understand what would lead nations to reach a certain degree of long-term development, and we will explain how innovation is presented in all of these models as a key issue to sustainable growth in the long-term.

At the end of second chapter we will discuss some reasons that would drive an entrepreneur to invest in innovation and we ask the first question: *Because there are so many important reasons that have led the entrepreneur to invest in innovation by itself, why would we need the presence of government functioning as an inducer of an innovation policy?*

In order to answer this question we will discuss in Chapter 3, six arguments to justify government involvement as a promoter of innovation policy. We will explain the theoretical argument relative to information asymmetry and moral hazards, as well as arguments contended that knowledge is considered as a public good and the need for institutional coordination.

Moreover, in another argument, we will show that what Ludwig Von Misses said in the mid-1950s seems to hold true today. We will present a study from the Institute of Applied Economy Research (IPEA) of Brazil to corroborate with some teachings of Von Mises, since this study indicates that is a positive correlation between innovation and wage improvement.

Thereafter, we will highlight a report by the OECD showing the relevance of innovation. This report indicates that the relative increase of this type of investment is crucial and may be the solution for countries like Brazil to reach the income level of some developed countries.

Furthermore, we will emphasize an excellent study conducted by the Inter-American Development Bank (IDB) that shows that there is a strong positive correlation between total factor of productivity and income per capita, and on other hand a considerable positive correlation between total factor of productivity and investments in R&D. In the end, this suggests that investment in R&D has high social return.

At the end of third chapter, we raise one more question: *What would be the main tools used by the government to resolve the market failures that hinder firms from investing in innovation and adopting new technologies?*

In the fourth chapter we will discuss the main tools to conduct this policy, which are Direct Subsidies and Tax Incentives. So we will discuss some positive points and drawbacks of these mechanisms, and the differences between direct subsidies and tax incentives, basing this discussion in two surveys, Gustavo Crespi's survey from IDB and Elizabeth Bustom's survey.

Soon we will develop two charts from the data obtained by the OECD database, collected in the web site of Ministry of Science Technology and Innovation of Brazil. These charts will be made in order to make a comparison between Brazil and a sample of countries showing in one graphic the absolute amount invested in R&D, and in the other graphic, the relationship between investment in R&D and GDP.

Thus we will demonstrate that Brazil is faced with the reality of underinvestment in R&D and suggests an urgent need to leverage investments in R&D, so a national effort with the presence of the states must be given in order make this leverage, and tax incentives should be use to help boost these kind of investment.

In the fifth chapter we will give an overview of the main direct subsidies and tax incentives used in Brazil to foster investments in Innovation. We will emphasize that Brazil still had only 1.24% of GDP invested in R&D in 2012, in order highlight that a national effort with the presence of the states must be given in order to leverage these indicators.

At the end of fifth chapter we will ask one more question: *"Would it be possible for a state to contribute to the innovation policy drafting with regard to tax incentives? If yes, how to avoid an unfair dispute between the State to attract these kind of investments?"*

Next in Chapter 6 we will mention the major taxes that the Constitution of Brazil allows states to charge, demonstrate that one of them, the ICMS, is responsible to 80 to 90% of all state collect taxes, in order to show that anything related to ICMS tax benefit arouse a lot of interest from the private sector. In this way, if the states want to participate as inducers of a policy to encourage innovation using tax incentives, the tax incentives related to ICMS could have greater chances of penetration in society.

Furthermore we will emphasize that the Constitution of Brazil requires the observation of a Supplementary Law (LC 24/75) to curb unfair competition among states when they are imposing tax incentives related to ICMS.

Finally in Chapter 7 we will try to make a transition from all theory presented to a practical approach, in order to bring about a contribution that can somehow positively change a part of the reality of our country, and with that, enforce all the knowledge learned in Minerva Program classes and research.

This leads us to our presentation of a draft of tax incentive legislation, one related to ICMS that could allow Brazilians States to help reduce the underinvestment in R & D in Brazil. We will finish by discussing and analyzing the major conclusions of this paper.

2 WHAT IS INNOVATION? THE IMPORTANCE OF INNOVATION IN LONG-TERM ECONOMIC GROWTH

Much has been said about the importance of innovation, especially after the rise of globalization and implementing more open markets. Some scholars mention that innovation has been one of the key factors for the success or failure of a company—for many CEOs of large companies, innovation is inseparable from a sound business strategy.

So much so, that in mid-2003, The Council on Competitiveness, a group of corporate CEOs, university presidents and labor leaders, created the National Innovation Initiative (NII) in an effort to engage 500 public and private leaders to enhance their ability to innovate the set of American society, sustain gains productivity, improve living standards, and ensure its leadership in the world.

> "At the end of 2003, the Council on Competitiveness launched the National Innovation Initiative (NII) – a multi-year effort engaging hundreds of leaders across the country and from all walks of life to optimize our entire society for a future in which innovation **will be the single most important factor in shaping prosperity**.[1]

In Brazil there is a similar movement called the Mobilization for Innovation Business, organized by the National Confederation of Industry, which has the challenge of making innovation a permanent topic of senior management in Brazilian companies. This movement recognizes that this agenda is vital to the competitiveness of the industrial sector.[2]

As we will see in this paper, innovation is not only an important aspect of the business, microeconomic view but it also induces improvements in a number of several macroeconomic indicators.

Along these lines, in general, it is accepted that innovation is central to the growth of gross domestic product (GDP) and productivity (total factor productivity). Next to these indicators innovation can be correlated with an improvement of development indicators, such as income per capita. In the next chapter we show an empirical study that would confirm this preconceived notion of innovation. Even countries that adopt economic policies more averse to government intervention in the economy have still incorporated government support to R&D activities.

With regard to knowledge, this is increasingly seen as a key driver of economic growth and innovation. Thus knowledge in all its forms plays a key role in the economic

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[1] Available in: <http://www.compete.org/about-us/initiatives/nii> (Accessed in: 09/20/2014)

[2] CONFEDERAÇAO NACIONAL DA INDÚSTRIA (CNI). ***Mobilização Empresarial pela Inovação: Estratégia e Objetivos***. Available in: <http://www.cni.org.br/portal/lumis/portal/file/fileDownload.jsp?fileId=FF80808129F81234012A1AEF6F7D19F8>. (Accessedin: 09/23/2014)

progress and innovation, but this interaction between these quantities is a complex and systemic phenomenon, so this work will not discuss knowledge management in depth.

What are innovation, and which kinds of innovation exist? Where would one find a definition of innovation?

2.1 The link between innovation and models of long-term economic growth

The concept of innovation has been known since Adam Smith in the eighteenth century, who studied concepts related to capital accumulation, technological change, division of labor, and competition. Smith sought to demonstrate that the wealth of nations resulted from the actions of individuals, including those powered by their own interest (but not exclusively), promoting economic growth and technological innovations. For Smith the private sector should act freely, with little or no government intervention. The free competition between different providers would lead not only to falling commodity prices, but also to the consistency of technological innovations, as well as the desire to lower the cost of production and beat competitors.

But only from the work of Joseph Schumpeter that established a relationship between innovation and economic development (Theory of Economic Development, 1934), the study of innovation began to arouse greater interest. According to this author, for an economy to emerge from a steady state and begin a process of expansion, the emergence of some innovation would be required from an economic point of view, which considerably alters the preconditions of equilibrium.

These innovations that change the state of equilibrium could be the introduction of a new good in the market; the discovery of a new method of production or supply of goods; the conquest of new sources of raw materials; or even a change in the structure of the current market, as in the breaking of a monopoly.

Schumpeter became famous for his theory of "creative destruction" which holds that the capitalist system progresses by constantly revolutionizing its economic structure through new firms, new technologies, and new products replacing the old ones.

> *"The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of* ***Creative Destruction*** *is the essential fact about capitalism."*[3]

[3] Schumpeter, Joseph A. ***Capitalism, Socialism, and Democracy***. 3rd ed. 1942. New York: Harper and Brothers, 1950. p. 83.

In a simplified form, the term innovation to Schumpeter would be used to define innovations that destroy the previous way an activity was done.

After the subject innovation began to appear in economic studies, several researchers started to look into the issue, forming three theoretical currents. The first current that arose was the traditional neoclassical (exogenous) initially developed in the 1950s by Solow-Swan (1957). In the early 1980s, the evolutionary theory of Nelson and Winter (1982) gained strength, followed by the endogenous growth model of Romer (1986).

The traditional neoclassical Solow-Swan (1957) treated the process of technological change as an exogenous phenomenon to the production function of a nation. A basic point of his theory is to treat technological change as neutral, implying that it increases the productivity of both labor and capital.[4]

Solow, who developed an economic model of growth in the long-term, sought to answer this simple question, among others: *"Why are some countries are richer than others?"* He answered this question by treating the process of technological change as an exogenous phenomenon to the production function of a nation and treating technological change as neutral, implying that technological change increases the productivity of both labor and capital.

This author was first to demonstrate that advances in the pace of technological progress contributed more to economic growth than the increase of capital or labor, published in a 1957 article entitled, *"Technological Change and the Aggregate Production Function."*[5] The article noted that half of economic growth cannot be explained by increases in capital and labor, which shows that nations should pay attention to quantity, but also quality of investments. This difference was called ***"Solow Residual"*** technological innovation. Before the publication of that article, economists had believed that the main causes of economic growth were only increases in capital and labor.

Solow concludes that the growth rate of per capita output of an economy, once reached the long-run equilibrium (steady state), will only increase output per capita (Y/L) if technical progress occurs in the economy. However, labeled as a model of exogenous growth, the

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[4] VARELLA, S. R. D.; MEDEIROS, J. B. S; SILVA, M. T. J.. ***O Desenvolvimento da Teoria da Inovação Schumpeteriana***. In: XXII Encontro Nacional de Engenharia de Produção. Bento Gonçalves, RS, Brasil, 15 until 18/october-2012. p.5. Available in: <http://200.132.139.11/aulas/Agronegocio/A5%20-%20Quinto%20Semestre/Inova%C3%A7%C3%A3o%20Tecnol%C3%B3gica/ENEGEP2012_TN_STO_164_954_21021.pdf>. (Accessed in: 09/20/2014).

[5] SOLOW, Robert M.. ***Technical Change and the Aggregate Production Function***. Review of Economics and Statistics. Vol. 39. N. 3. August 1957. p. 312-20.

Solow model is open to criticism for not explaining the intrinsic nature of technological transformation processes.[6]

In short, according to the Solow model, productivity growth is the only source of long-term growth of output per capita, thus a full explanation of long-run economic growth requires a explanation of productivity growth. However, the model is too simple in that it takes the rate of productivity growth as given, rather than trying to explain how the rate is to be determined.[7]

In the mid-1980s, a group of growth theorists became increasingly dissatisfied with common accounts of exogenous factors determining long-run growth. They favored a model that replaced the exogenous growth variable (unexplained technical progress) with a model in which the key determinants of growth were explicit. This line of research began with the work of Kenneth Arrow (1962), Hirofumi Uzawa (1965), and Miguel Sidrauski (1967), which formed for the thesis of Paul Romer (1986), Robert Lucas (1988), and Sergio Rebelo (1991) .

Romer, one of the most renowned figureheads exogenous theory wrote in 1983 his Ph.D. thesis, which led to two articles being published in 1986 and 1990 at *Journal of Political Economics*, amounted to constructing mathematical representations of economies in which technological change is the result of the intentional actions of people, such as research and development. This started endogenous growth theory.

A basic difference between exogenous and endogenous theory stems from the treatment of knowledge. In exogenous theory, knowledge is considered as exclusive and in endogenous theory, knowledge is considered partially exclusive. This endogenous theory incorporates the concept that knowledge is not rival, but now partially exclusive, in other words, firms benefit from knowledge generated, but there is also a greater improvement to society knowledge developed by private firms, or spillover effects. In short, endogenous model considers the learning-by-doing and knowledge spillover.

Another school of thought derived from the thoughts of Schumpeter, began with the work developed by Nelson and Winter (1982), which are considered the founders of evolutionary theory. Using the concepts of Darwin as the central element of the theory that govern changes in business, evolutionary theory is defined by the main characteristic of considering routines as organizational units of selection in the economic context. A good

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[6] MORA, Rubens Guimaraes Togeiro; CORREIO, Helio Nogueira da Cruz. ***Teoria do crescimento endógeno e a inovação tecnológica no Brasil***. Revista de Administração e Inovação – RAI. Universidade de São Paulo. São Paulo – Brazil. Vol. 10. N. 3. July-September/2013: p. 231

[7] ABEL, Andrew B.; BERNANKE, Ben s.; CROUSHORE, Dean. ***Macroeconomics***. 8th Ed. 2014. Pearson. p. 233.

comparison is made when imaginary business routines are regarded as the genotypes of biology, while specific decisions resulting from each routine are applied as phenotypes in biological theory. The procedures of the companies that obtains satisfactory results will longer being used, rather those that generate growth and profits will be.

It emerges from a concern to establish an alternative to the neoclassical theoretical framework, which is able to deal more broadly with the issue of technological change economy. In essence, it seeks to explain the structural changes in the economy, from a logic centered on technological dynamics, seeks to establish the elements of the aggregate change process characterized by a series of concepts, such as opportunity, appropriability, cumulativeness, dimension tacit, uncertainty, variety in the knowledge base, search procedures, irreversibility, and so forth. Firms would be the agents of technological change, as they seek to build asymmetries in relation to their competitors.[8]

As we saw previously, the first definition of innovation introduced by Schumpeter triggered a series of economic currents that sought to explain and understand what would lead nations to reach a certain degree of long-term development.

2.2 The treatment of Innovation in the Guidelines of OECD

However, in this work we will not use the definitions of innovation contained in these economic models, but we will use the definitions contained in manuals prepared by the OECD. These manuals were developed in order to introduce a uniform research methodology that would enable the measurement and comparison of data on science and technology in different countries.

The Oslo Manual, developed jointly by Eurostat and the OECD, is part of a family of guides dedicated to the measurement and interpretation of related science, technology and innovation data.

Besides the Oslo Manual, there are other documents of the OECD that establish guidelines for the measurement of Research and Development (Frascati Manual); indicators of globalization; patents; information society; human resources; Science and Technology (Canberra Manual) and biotechnology statistics.

Innovation can occur in any sector of the economy, including government services like health and education. However, it is worth keeping in mind that the scope of the Oslo Manual

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[8] CUNHA, André Moreira. ***O Enfoque Evolucionário da Firma***. Available in: <http://www.ufrgs.br/decon/publionline/textosdidaticos/Textodid13.pdf>. (Accessed in: 09/23/2014).

only deals with innovation in business enterprises.[9] However, this paper will focus on the innovations of the commercial, more specifically in the manufacturing industry, primary industries and the service sector. When we refer here to innovation, we will be referring to innovation occurring in these sectors.

Despite its importance, little is done to measure the process of innovation in sectors that are not market-oriented. Within the public sector, the OECD is likely to create a manual to study and develop a framework for collecting data on innovation in the coming years.

Let us now turn to the definitions of innovation contained in the Oslo Manual. First, a company can undertake all types of change in its working methods, their use of production factors, and the types of results that increase your productivity and / or business performance.

> *"*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.*"* [10]

The minimum requirement for an innovation is that the product, process, marketing methods or organizational methods must be new (or significantly improved) to the firm.

Thus the Oslo Manual defines four types[11] of innovation that contain a wide range of changes in business activities:

1) product innovations;
2) process innovations;
3) organizational innovations, and;
4) marketing innovations.

A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness and other functional characteristics. Product innovations can utilize new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies.

A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment

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[9] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. ***Oslo Manual*** *- Guidelines For Collecting And Interpreting Innovation Data,* 3rd Edition. Paris. 2005. p. 14

[10] Ibidem, p. 46.

[11] Ibidem, p. 47.

and/or software. Process innovation can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.

A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.

An organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization, or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labor productivity), gaining access to non-tradable assets (such as non-codified external knowledge), or reducing costs of supplies.

It is important to mention that while the legislation will be discussed in chapter six, we will only cover two kinds of innovations—the product and process innovations—since these are more strongly connected to technological innovation and are more likely to be increased from incentives provided by tax policy innovation. Furthermore, the largest share of research and development (R&D) is related to product innovation and process innovation.

In defining the concept of innovation, it is also important to talk about R&D, since this magnitude will be discussed in the following chapter, including some graphics.

In accordance with the approach advocated by the Frascati Manual, this study defines R&D as:

> "(…)creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications".[12]

The term "research and experimental development" is used interchangeably with the term "research and development," and both are abbreviated by the expression "R&D." The term R&D covers three activities: basic research, applied research and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. Applied research is also original

[12] Idem. ***Frascati Manual****: Proposed Standard Practice for Surveys on Research and Experimental Development*., 6th Edition. Paris. 2002. p. 31

investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed toward producing new materials, products or devices, installing new processes, systems and services, or improving substantially those already produced or installed. R&D covers both formal and informal or occasional R&D units.

There are two inputs to R & D, for statistical purposes: the expenses incurred by R & D and the staff employed in these works. These inputs are measured annually and this is how the amount is spent on R & D during the year, and the number of people dedicated to this work during the same period is calculated.[13]

It is important to mention that innovation policies seek to stimulate not only R & D, but also other activities of science and technology, such as education and scientific and technological training, as well as scientific and technical services. The latter include, for example, S & T services provided by libraries and museums, the translation and publication of works on S & T, surveying and prospecting, collecting information on socio-economic phenomena, testing, standardization and quality control, consulting activities for clients, as well as activities on patents and licenses from the government and public administrations. Thus in the proposed legislation in Chapter 6, we seek to increase the tax incentive of companies that are linked to universities.

2.3 Brief conclusion of this chapter and a question to be answered in chapter 3.

Briefly we mentioned in this chapter that we use the definition of innovation contained in the Oslo Manual, and inform that this paper will focus on innovations in product and process by being more connected to the idea of technological innovation and the reason they are derived largely from investments in R & D.

And yet, we have seen that models that seek to explain economic growth in the long-term since the economic model of Schumpeter, through exogenous economic growth theory of Solow, the endogenous economic growth theory of Romer, and, finally, the evolutionary economic theory of Nelson and Winter, all have in common the fact that they highlight the technology development as a key to sustainable growth in the long-term.

[13] Ibidem. p. 20.

In providing contextualization and before entering the next chapter, let us preliminarily analyze some reasons that would drive an entrepreneur to invest in innovation. What was behind a given impulse to innovate?

Four reasons can be related:

a) With expectations of higher earnings, the entrepreneurs seek better (i.e., more efficient) productive and management processes that reduce costs and/or improve the quality of production.[14]

b) The identification of an unsatisfied consumer need, which they could design and launch new products that improve on the quality of existing products.[15]

c) Sustain or expand the positions of the company, in terms of market share, in terms of margins, as innovation is to create value for the company and its stakeholders.[16]

d) The need to be competitive with products coming from other countries.

The reasons listed above for the entrepreneur to invest in innovation seem to be inseparable from a good business strategy to survive in the market or magnify participation. We can assume that the above reasons are already strong enough to take the entrepreneur to invest in innovation, so we ask: *Since there are so many important reasons that have led the entrepreneur to invest in innovation by itself, why would we need the presence of government functioning as an active role of an innovation policy?*

[14] CRESPI, Gustavo. ***Fiscal Incentives for Business Innovation***. In: Corbacho, Ana (Coord). Fiscal Institutions For Tomorrow. Washington-DC. 2012. Inter-American Development Bank.. p. 133

[15] Ibdem.

[16] PACHECO, Carlos Américo; ALMEIDA, Julio Gomes de. ***A Política de Inovação****: Texto para Discussão*. n. 219. May-2013. Economy Institute of Unicamp. p. 2

3 ANALYZING WHY GOVERNMENT SHOULD FUNCTION AS AN INDUCER OF INNOVATION POLICY

To answer the question left at the end of the previous chapter, we would argue the fact that the currents of thought, described above, have presented economic models that attempt to explain economic growth in the long run and have as a common feature the importance of technological development to serve as an argument to justify the participation of the government as a vector for innovation policy. However, we decided to go a little further and bring into this chapter other arguments that corroborate the need for state participation in such policies, which can divided in:

1) A theoretical argument concerning to information asymmetry, moral hazard;
2) An argument relating to the fact that knowledge is considered as a public good;
3) An argument linked to the need of institutionally coordination;
4) An argument linked to wage improvement;
5) An argument based on the OECD report showed that improved the productivity will be the key factor for developing economies such as Brazil, to close income gap with advanced countries;
6) An argument based on the study of Inter-American Development Bank (IDB) showing that increased investments in R&D may be correlated with increased productivity, and suggests a high social return on investment linked to innovation when looking at the possible impact on per capita income.

3.1 Theoretical argument concerning information asymmetry, moral hazard;

In this part we will talk about the innovation linked to small units, such as firms. We decide to take this approach because:

> "(…) the fact that many "big" issues can be best understood by recognizing that they are composed of numerous small parts. Just as much of our knowledge of chemistry and physics is built on the study of molecules, atoms, and subatomic particles, much of our knowledge of economics is based on the study of individual behavior."[17]

With regard to this quote, suppose a certain firm wants to finance investments in innovation with research and development activities. This firm can be financed with own capital and/or capital owned by third parties.

If the firm decides to finance with capital owned by third parties they could:

[17] BROWNING, Edgard K.; ZUPAN, Mark. ***Microeconomics****: Theory and Applications*. 17th Ed. 2012. John Wiley & Sons. p. 02.

i) Issue shares of stocks;

ii) Seek external loans.

We must keep in mind that those who invest in innovation seek to protect the information content of their projects in order to avoid revealing any confidential knowledge. If the firm chose to capitalize with third parties, these external funders, whether bank or new shareholders, could not have access to the entire information content of such projects.

Due to this limitation, there would be an inequality of knowledge about the nature of the innovation project, its potential return, and your chances of success. This uncertainty and lack of information ends up increasing the risk perception of lenders, which ultimately end up raising the cost of raising external capital to the firm.

If the firm decides to finance with own capital they could:

i) Use the profit from the previous year;

ii) Do a reversal of reserves;

As a general rule, the innovation projects are riskier than are physical projects. When a company considers a particular project has a high risk, and it is unable to change this risk, the company has generally a lower propensity to afford this investment relative to other types of less risky investments. Also in cases of innovation projects the company will not appropriate all the knowledge generated by their own efforts of Research and Development (R & D). One solution would be to split the risk with different capital providers.

The two cases illustrated above are linked to the problem of asymmetric information, through the prism of adverse selection, which in the end results in the inhibition of the propensity to invest in innovation—and certainly some of these could be quite profitable. These innovation projects end up being left out and one way to avoid this would be the presence of tax incentives as a mitigating factor of the elements described above, which inhibit investments in innovation. Soon these tax incentives serve as a balancing factor in the face of asymmetric information and therefore could increase the speed and volume of investments in innovation.

Another facet arising from asymmetric information is moral hazard, which may occur due to the existence of the principal-agent problem, thereby increasing the agency costs. In other words these costs come from the incompatibility of interests between owners and managers or employees of R & D that could end up emphasizing the other stakeholders the knowledge obtained from R & D, requiring an increase in cost control. It is noteworthy that,

as a rule, more than 50% of R & D expenditures are allocated to salaries of scientists and engineers.

In addition, there is an attitude on the part of administrators, averse to risk unconventional business practices, that tend to reduce the propensity to invest in R & D projects of long maturation. Furthermore, considering that today we observe greater volatility of senior executives, this can decrease a commitment to long-term projects maturing even more with the ability to receive high bonuses when profits are expected, which would influence the effect of inhibiting the tendency for long-term investments as some related innovation.

It can be argued that there are administrative and legal remedies to mitigate these moral hazards, but surely a government incentive could also serve to reduce these moral hazards, and thereby encourage higher investment in R & D.

3.2 Argument relating to the fact that knowledge is considered as a public good;

Knowledge has been considered a non-excludable and non-rival good.[18] When innovators cannot take advantage of all the benefits associated with knowledge creation, a gap arises between social and private returns from related investments and, therefore, the investment in knowledge generation is less than desired.

According to Gustavo Crespi, it is possible to protect technological knowledge by using intellectual property rights. However, this does not imply that an enterprise's investment in generating technological knowledge will necessarily be optimal from a social point of view. There are also cases of incomplete appropriability regarding this kind of knowledge given that the coverage offered by intellectual property rights is always limited, especially with regard to scientific knowledge that underpins technological innovations. An example is article 10 of Law 9279/1996 (Patent Law of Brazil).

> "Art. 8 It is be patentable an invention must meet the requirements of novelty, inventive activity and industrial application.
>
> Art. 9 It is patentable as a utility model the object of practical use, or part thereof, is susceptible of industrial application, which presents a new shape or arrangement and involves an inventive act, resulting in functional improvement in use or manufacture.
>
> Art. 10. It is not considered inventions or utility model;
>
> I - discoveries, **scientific theories** and mathematical methods;

[18] CRESPI, Gustavo. ***Op. Cit,*** p. 136.

> II - purely abstract concepts;
>
> III - schemes, plans, principles or business, accounting, financial, educational, publishing, lottery and monitoring methods;
>
> IV - literary, architectural, artistic and **scientific works** or any aesthetic creation". [19]

Thus, innovation policy could offset these disincentives and make the company invest in innovation that could lead to the discovery of new scientific knowledge, which ultimately could result in a high social return.

3.3 Argument linked to the need of institutional coordination;

Cristian Koler[20] mentions an argument called the cooperation paradigm, which corresponds to firms not finding all inputs that are needed for developing innovations within their own boundaries. Collaboration with suppliers and knowledge providers thus become essential, and are increasingly embedded in the institutional landscape.

Fiscal policies can support and strengthen the links between industry and public research in numerous ways, such as extra-deductions on expenses for contract research with public research, pushing universities to appropriate and transfer their knowledge (via technology transfer organizations), and to develop a favorable environment for spin-offs and start-up firms (through incubators, science parks and the like).

In this way, as mentioned by Gustavo Crespi,[21] the literature favors the innovation of institutional designs that promote public–private interactions and that connect the different actors participating in the innovation process (e.g., universities, public research agencies, producers and users of new technologies, and consumers).

Policies are then mobilized to support a structural change in the national innovation system, and the innovation costs are not wasted on duplicate efforts that lead to identical results, diverse externalities become internalized, and the coordinated joint investments may turn out to be complementary.

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[19] Loose Translate

[20] KOHLER, Cristian; LAREDO, Philippe; RAMMER, Christian. ***The Impact and Effectiveness of Fiscal Incentives for R&D***, Available in: <http://www.nesta.org.uk/sites/default/files/the_impact_and_effectiveness_of_fiscal_incentives.pdf >. (Accessed in: 10/08/2014).

[21] CRESPI, Gustavo. ***Op. Cit,*** p. 137.

3.4 Argument linked to wage improvement;

After turning to some theoretical arguments that lead us to conclude that the participation of the state in encouraging innovation policy would be positive, this next section will analyze how this policy can be reflected in wage improvements.

Before we point out some conclusions of experts, we would like to mention a few notes of Ludwig Von Mises, who in spite of his ideas existing over half a century ago, are perfectly applicable to our current situation.

Economy Policy is the book where Mises analyzes why the population of some countries show a pattern of life more advanced than others, and refutes the idea that the advanced development of some countries is due to the existence of a superior ability of their workers compared to other "developing countries. Furthermore, Mises also refutes the argument that there would be an inferiority of entrepreneurs of "Developing Countries" in relation to entrepreneurs in developed countries, like the USA.

According to Von Mises, one explanation for the discrepancy in degrees of development of those economies would come from the fact that the average of earnings for the same type of labor is lower in "Developing Countries," than it is in some developed countries. According to the economist, what explains this difference is not the personal qualities of the workers of developed countries, but the conditions in countries that make this possible for their workers to produce more.

Keeping in mind that, ″wages are determined by the marginal productivity of labor,″ a worker who had more efficient tools could complete more tasks in less time than another employee who did not possess the same tool. So a worker who is equipped with the best tools and desktop machines produce more in a given period of time than another worked located in a country without the same access. The worker is more productive, and can earn more in real terms, thus the standard of living in a country as a whole would improve.

Given the relevance of the theme, we chose to place some extracts from the observations of Von Mises below:

> "The standard of living is lower in the so-called developing countries because the average earnings for the same type of labor is lower in those countries than it is in some countries of Western Europe, Canada, Japan, and especially in the United States. If we try to find the reasons for this difference, we must realize that it is not due to an inferiority of the workers or other employees. There prevails among some groups of North American workers a tendency to believe that they themselves are better than other people—that it is through their own merit that they are getting higher wages than other people.(…)
>
> The economists describe this state of affairs by saying "wages are determined by the marginal productivity of labor." This is only another expression for what I have just said before. It is a fact that the scale of wages is determined by the amount a man's work

> increases the value of the product. If a man works with better and more efficient tools, then he can perform in one hour much more than a man who works one hour with less efficient instruments. It is obvious that 100 men working in an American shoe factory, equipped with the most modern tools and machines, produce much more in the same length of time than 100 shoemakers in India, who have to work with old-fashioned tools in a less sophisticated way."[22]

We will discuss a study[23] conducted by Mario Sergio Salerno and Luis Claudio Kubota published in 2008, to corroborate the above teachings punctuated by Von Mises. This research examined whether or not there would be a correlation between innovation and wages. It is noteworthy that a existence of such correlation would be absolutely relevant, since it would indicate that a policy to support innovation would also be consistent with an improvement of Brazilian wages.

Salerno and Kubota analyzed the data published by the IBGE survey called PINTEC (which collects data on innovation, in particular, investments in R&D). This is not to make the mistake of comparing wages paid to firms with very different characteristics, as more efficient, more educated workers, as a rule, pay higher wages, larger companies have tried using one statistical tools to isolate this effect.

Thus, the variables that were not directly related to innovation were "discounted" (or "controlled" in the jargon of economists). Examples of such variables are: revenues, number of employees, industry sector, type of product, education and length of service of employees, coefficients of export and import, county (controlling for differences in union agreements), among others.

So they found the following: If two companies are alike, and one of them innovates and differentiates their product, while the other does not differentiate products and have lower productivity, the first will tend to pay salaries 23% higher than second.

If two companies are alike and the first company innovates and differentiates their products, and the second has only standardized products, wages paid for the first company will be 11% above the second company. We can also conclude that companies that innovate have a 16% higher chance of being exporters.

It is evidente that there is a very strong correlation between technological innovation and product differentiation (ie, technological innovation is a key source of differentiation for

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[22] MISES, Ludwig Von. ***Economic Policy***. 3rd edition. Alabama. 2006. Ludwig Von Mises Institute. p. 76-78.

[23] SALERNO, Mario Sergio; KUBOTA, Luis Claudio. ***Estado e Inovação***. In: NEGRI, João Alberto De; KUBOTA, Luis Claudio (Coord). *Políticas de Incentivo à Inovação Tecnológica*, Brasília. 2008. IPEA-Instituto de Pesquisa Econômica Aplicada. p. 18-23.

income differential by companies). We already said this empirical study corroborate the theoretical teachings of Von Mises. mentioned above.

Furthermore, we can also mention that this study brings other relevant data concerning education and the retention of workers in innovative firms. Jobs created in companies that innovate and differentiated products require 20.9% more schooling of the worker, and the average stay of these workers in these firms is 30.4% higher than the average.

3.5 Argument based on the OECD report;

Another argument that justifies the participation of the state in innovation policies is that the OECD (July 2014) showed that improved productivity will be the key factor for developing economies, such as Brazil, to close the income gap between advanced countries.

In the press conference of the report *"2014 Perspectives on Global Development,"* Angel Gurria, the OECD Secretary-General, spoke to the concern about the productivity in Brazil:

> "Boosting productivity will be the key to boosting growth – and in turn sustaining improvements in living standards – in middle-income countries. This is the focus of the report we are launching today.
>
> Over the past decade, productivity growth in a number of middle-income countries **was insufficient** to close the gap in productivity with advanced countries. **In Brazil**, Mexico and Turkey, the gap even widened. In contrast, China's record is impressive, with labour productivity in manufacturing and services rising by 10 per cent, year on year."[24]

In this report the OECD argues that for sustained convergence, developing countries need to boost productivity and narrow their significant productivity gap with advanced economies. It was mentioned that while China, Kazakhstan and Panama are on track to reach OECD levels of average income by 2050, a number of middle-income countries - including Brazil, Colombia, Hungary, Mexico and South Africa - will take much longer at current growth rates.

> Notwithstanding the recent boost from China's rise, within the traditional view a number of middle-income countries are still not growing fast enough for their per capita incomes to converge with those of advanced countries by 2050. It is natural for growth to slow as economies mature, as predicted by growth convergence theories and seen in lower average annual growth rates (over 2000-12) in upper-middle-income compared to lower-middle-income and low-income countries However, this slowdown has become important enough to prevent convergence of many upper-middle-income countries with average OECD incomes by 2050 at their average growth rates over 2000-12. These

[24] Remarks by Angel Gurría, OECD Secretary-General, delivered at the press conference in 2 of July of 2014 at OECD in Paris.

countries include **Brazil**, Colombia, Hungary, Mexico and South Africa among others.

In some middle-income countries, the average growth rate over 2000-12 was sufficient or actually above that needed for convergence with average OECD incomes by 2050 China, Kazakhstan and Panama are among those upper middle-income economies that will be at average OECD levels in the next decades, if they can sustain their growth performance. Also the Russian Federation, which is classified as high income since 2013, is growing fast enough to increase incomes to the OECD average level. Impressively, some lower-middle-income countries – Armenia, Bhutan, Georgia and Mongolia, for example – will also move to the high-income bracket before 2050.

These results are of course just indicative and countries' growth trajectories are not set in stone. For example, India surprised everyone when it started to grow at around 8% after 2003, having grown at an average of closer to 5% for the previous decade. Also, trends in "shifting wealth" will change with lower average growth in China, which will affect growth prospects in other developing economies too.[25]

From this report it is possible to verify that the increase in productivity not only could directly translate into economic growth, but also correspond with income growth. In short, without an investment in productivity we do not have an economic growth that would enable a low unemployment rate, as well as have difficulty achieving the standards of life observed in developed countries.

There is a gap in productivity levels of many middle-income countries relative to the United States, and this gap is still very high. As we see in the graphic below, the labor productivity of the Total Economy in Brazil is smaller than that in USA. Even with a strong agriculture which helps Brazil, Mexico and the Russian Federation have a the total aggregate labor productivity higher than their levels in manufacturing.

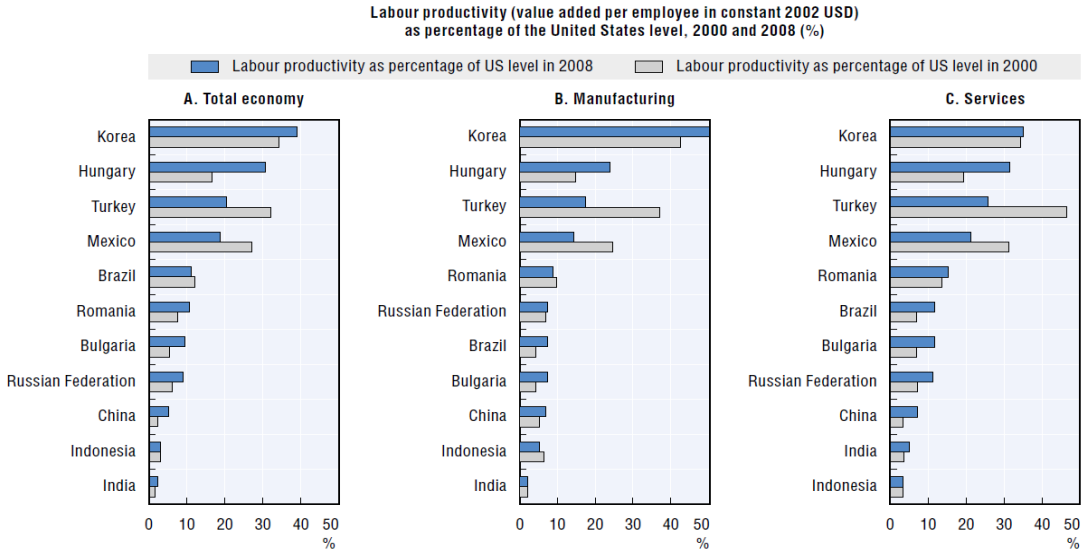


FIGURE 1 - LABOUR PRODUCTIVITY AS PERCENTAGE OF US LEVEL

[25] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. ***2014 Perspectives on Global Development***. Pocket Edition. 2014. p. 14

3.6 Argument based on the study of Inter-American Development Bank showing that there is a huge a positive correlation between of total factor of productivity and a considerable positive correlation between total factor of productivity and investments in R&D

Before entering in the numbers of the study conducted by the Inter-American Development Bank, we suggest that it would be important to further clarify some concepts from that reserach.The first concept to review is the total factor of productivity. It is a standard indicator used to measure the efficiency with which the economy transforms its accumulated factors of production into output.

$$Y = A \times K^{\alpha} \times L^{\beta}$$

In the equation above, (Y) is a production function, and represents total output or GDP. Y is a function of total-factor productivity (A), capital input (K), labor input (L). In other words Total Factor Productivity (A) is the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production.

If two economies using the same amount of capital input (K) and labor input (L), and if one of them had a 1 percent increase in TFP, it is implied that 1 percent more of the product is being created with the same inputs by this economy compared with the other. In short it indicates that capital and labor, including human capital, are 1 percent more efficient.

The figure below[26] shows that the failure to catch up on productivity is evident in Brazil. Compared to 1987, Brazil decreased their relative position in TFP with respect to the United States. In 2007, the aggregate productivity of Brazil is about 60 percent of aggregate productivity in the United States.

[26] INTER-AMERICAN DEVELOPMENT BANK. ***Science, Technology, and Innovation in Latin America and the Caribbean*** - *A Statistical Compendium of Indicators*. Washington-DC, 2010, pag 29

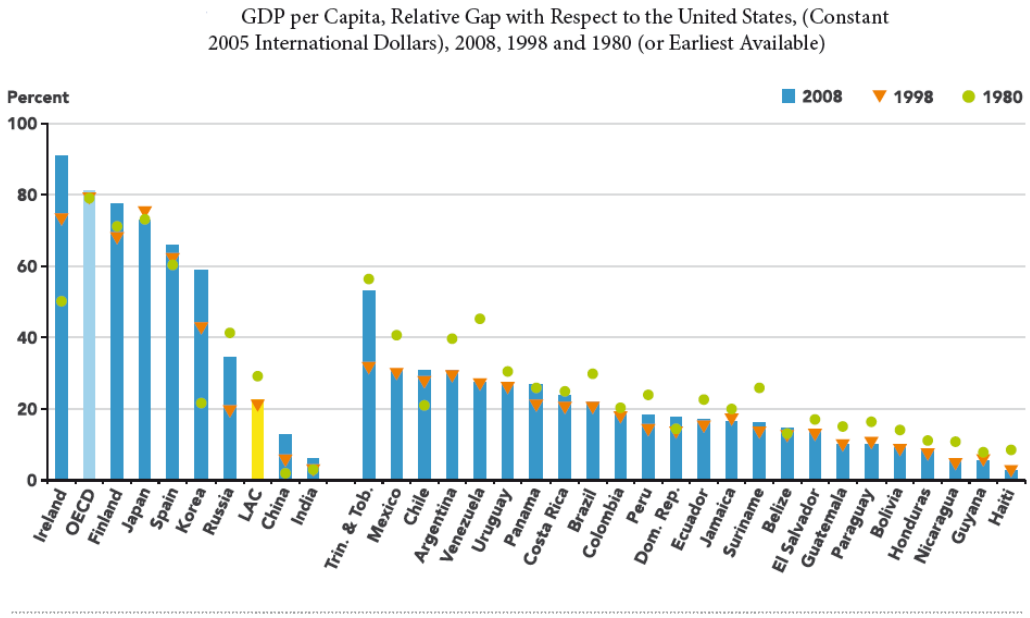
FIGURE 2 - TOTAL FACTOR OF PRODUCTIVITY RELATIVE TO US LEVEL

Another concept that is important to review is GDP per capita. The per capita GDP is a measure that takes the gross domestic product (GDP) and divides it by the number of people in the country. The per capita GDP is especially useful when comparing one country to another because it shows the relative performance of the countries. A rise in per capita GDP signals growth in the economy and tends to translate as an increase in productivity.

According to IDB[27] per capita income reflects the level of economic development of a country. It is a measure of economic wealth per inhabitant and, in a broad sense, the quality of life of the population. In Latin American countries, per capita income gaps (measured as GDP per capita relative to that of the United States) continue to open up.

In this line, the IDB writes that between 1998 and 2008, with some exceptions, the income levels of most of the countries in the region have worsened compared to the United States. This is not a new trend; the region has been experiencing chronically slow economic growth since the 1970s. The per capita incomes of Paraguay, Bolivia, Honduras, Nicaragua, Guyana, and Haiti, the least developed economies in the region, are less than a tenth of that of the United States.

[27] Ibidem. p. 27-28.



Source: World Development Indicators.
Notes: For Russia, 1989 data are used for 1980. Data for LAC and high-income OECD countries (referred to as OECD in the figure) are provided in the WDI database.

FIGURE 3 - GAP OF GDP PER CAPITA RELATIVE TO US LEVEL

In Brazil the per capita income in 2008 was about 20% of that of the United States, and is almost the same level in 1998 but lower than in 1987. This date contrast sharply with dates of emerging economies in other regions. If we ignore the most recent years due to the global economic crisis. the GDP per capita in China, Russia, and India grew at an annual average rate of above 5 percent. China's growth rate was the highest, averaging percent annually.

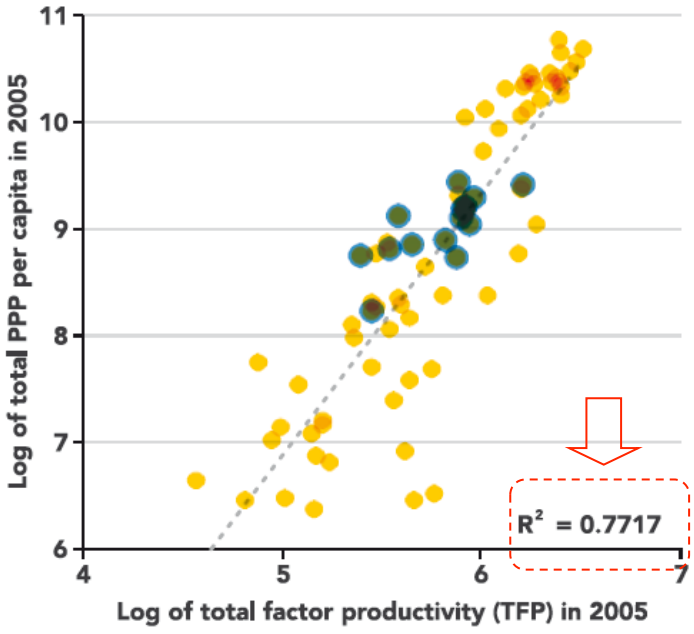
After we see all these dates related to TFP and income, it is important to emphasize some conclusions brought about by IBD, pointing that the lack of sustainable economic growth is strongly linked to the problem of efficiency and productivity growth deficit, not due merely to a lack of education and physical investment. The option of Brazil to be only a strong agricultural country contributes to the maintenance of this situation, because the country does no incentivize concentrating on higher value-added activities.

> Recent studies show that income gaps in LAC are widening not due to a lack of physical investment or education or to the slow growth of the labor force, but rather to a chronic productivity growth deficit. In other words, the growth gap is essentially a problem of efficiency rather than a problem of lack of investment in productive resources (Daude and Fernandez Arias, 2010). Accordingly, if TFP increased to its potential and if factor inputs are kept constant, the per capita income of the typical Latin American country would actually double (to about a third of that of the United States). Further, the evidence shows that productivity increases leverage private returns to physical and human capital, which in turn reinforces incentives to invest in productive resources. (…)

> With very few exceptions, LAC's attempts to become industrialized have been only partially successful. For countries for which data are available, the share of the manufacturing sector in the total economy, which is assumed to lead the economy to higher value-added activities, remains almost unchanged between 1975 and 2005.[28]

After referring to the TFP and per capita income, there remains a correlation between both variables. As the dollar does not accurately describe the differences in material prosperity, to compare the income per capita of two countries, is to use the technique of purchasing power of parity (PPP). Soon the PPP is an alternative method to the exchange rate to calculate the purchasing power of the two countries. The PPP measures how much a particular currency can buy in international terms (usually U.S. dollars), since goods and services have different prices from one country to another, (ie, relates the purchasing power of that person to the local cost of living, if he can buy everything you need with your salary). A market basket of goods and services are use as parameter.

Relationship between Income (PPP per Capita) and Total Factor Productivity (TFP), 2005



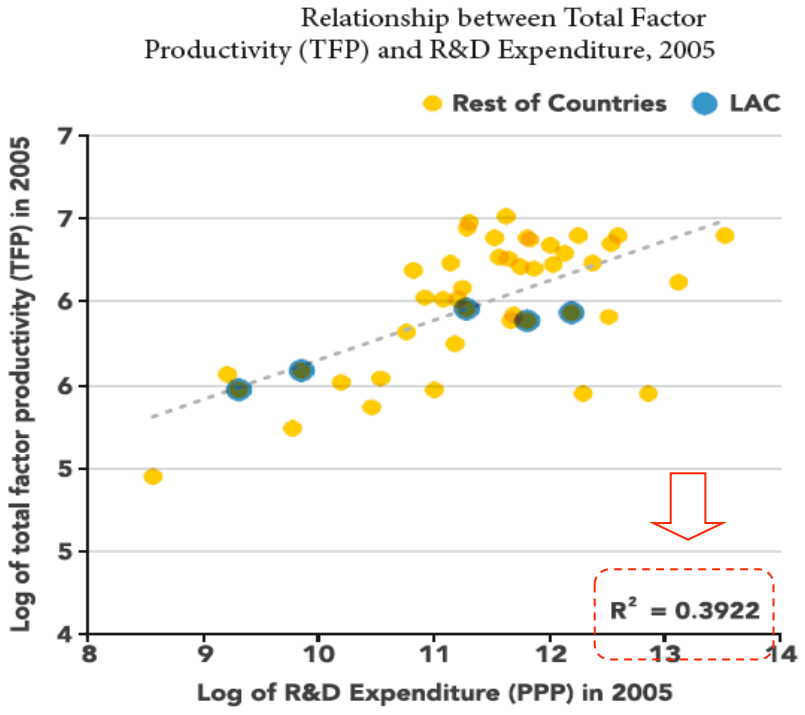
Sources: IDB, 2010. Calculations are based on data from Daude and Fernandez Arias (2010) and World Development Indicators.

FIGURE 4 - RELATIONSHIP BETWEEN INCOME PER CAPITA AND TFP

[28] Ibidem. p. 29 and 31.

The IDB using the concept of PPP and the statistical technique of ordinary least squares (OLS), shows that there is a close relationship between income per capita and total factor of productivity. The coefficient of determination R^2 is a measure of quality of the model with respect to its ability to correctly estimate the values of the response variable "y." It is defined as a ratio of "explained" variance to the "total" variance of the dependent variable "y." In simple words, R^2 indicates that almost 80% of variation in income per capita among sample countries can be explained by variation in levels of total factor of productivity, as we can see in the graphic above.

IDB also examined whether or not there was a correlation between total factor of productivity (TFP) and R&D investment. It came to the conclusion[29] that there is a positive and statistically significant correlation between investment in intangible assets (e.g., research and development, or R&D) and productivity in a wide-ranging sample of countries. The strength of this correlation suggests such investment has high social returns. In effect, nearly 40 percent of the variations in productivity among the sample countries can be explained by variations in levels of investment in R & D.



Sources: IDB, 2010. Calculations are based on data from Daude and Fernandez Arias (2010), Lederman and Saenz (2005) and RICYT.

FIGURE 5 - RELATIONSHIP BETWEEN TFP AND R&D EXPENDITURES

[29] CRESPI, Gustavo. ***Op. Cit.***. p. 133-134.

As we see above, there is, on one hand, a strong correlation between TFP and per capita income, and, on the other hand, a correlation between TFP and investment in R&D, so we appropriately assume that that there is also a positive correlation between R&D in investment and per capita income—this is why the study suggests that investment in R&D has high social returns.

3.7 Brief conclusion of this chapter and a question to be answered in chapter 4.

In summary, this chapter answered the question posed in the final section of chapter 2, *why would we need the presence of government functioning as a vector of an innovation policy?*

We try to use 6 arguments to justify the presence of government functioning as a vector of an innovation policy. The first argument connects with the theory of microeconomics, which is related to asymmetric information and inequality of knowledge about the nature of the innovation project. Moreover it focuses on potential returns and chances of success that generate an uncertainty and lack of information, which ends up increasing the risk perception of lenders. This ultimately ends up increasing the cost of raising external capital to the firm. Further, when a company deems a particular project to have a high level of risk, and it is unable to change this risk, the company has generally a lower propensity to afford this investment, mainly for having difficulty in appropriating all the return of their own efforts to Research and Development (R & D). One solution would be to split the risk with different capital providers.

Another fact related to moral hazard, which consequently increases agency costs, could occur due to the existence of the principal-agent problem. The second argument, then, is that knowledge, considered a non-excludable and non-rival good, creates the situation where innovators cannot take advantage of all the benefits associated with knowledge creation. A gap then arises between social and private returns from related investments and, therefore, the investment in knowledge generation is less than desired.

The third argument is linked to the need of institutional coordination and corresponds to the fact that firms cannot find all inputs that are needed for developing innovations within their own boundaries. Collaborations with suppliers and knowledge providers thus become essential, and are increasingly embedded in the institutional landscape. Also, fiscal policies support and strengthen the links between industry and public research through numerous ways, like extra-deductions on expenses for contract research with public research, pushing universities to appropriate and transfer their knowledge (via technology transfer

organizations) and developing a favorable environment for spin-offs and start-up firms (through incubators, science parks and the like).

The fourth argument is linked to wage improvement. A study by Mario Sergio Salerno and Luis Claudio Kubota indicates that are a positive correlation between innovation/wages, in turn corroboratating with the teachings punctuated by Von Mises.

The fifth argument is based on the OECD report and states that improving the productivity will be a key factor for developing economies like Brazil, closing the income gap with advanced countries, and productivity growth in a number of middle-income countries like Brazil which are otherwise insufficient to close the gap.

Finally, the sixth arguments comes from a study from IDB that indicates, in one way, a strong correlation between TFP and per capita income, and, in another way, a correlation between TFP and investment in R&D, which suggests that investment in R&D has high social returns.

After justify the presence of government functioning as a vector of an innovation policy we need to know: *What should be the main tools used by the government to resolve the market failures that hinder firms from investing in innovation and adopting new technologies?*

4 FISCAL INCENTIVES: DIRECT SUBSIDIES AND TAX INCENTIVES

To answer the question asked in the final section of chapter 3 we try to expose the main tools used by the government to resolve the market failures that hinder firms from investing in innovation and adopting new technologies. These two tools are Direct Subsidies and Tax Incentives, and in the next sections we will mention some positive points and drawbacks of these mechanisms.

4.1 Direct Subsidies.

First, direct subsidies are a form of financial assistance from the Government toward an economic sector. They come in various forms, including direct cash grants, interest-free loans, and low-interest loans.

These mechanisms provide immediate support for business innovation and are, in general, awarded to businesses by a public sector agency once an innovation or technology adoption project has been formulated, evaluated, and approved.[30] There are some points that should be highlighted:

a) Direct subsidies tend to reduce a firm's marginal capital costs, which could lead to an increase in the marginal rate of private returns related to innovation investments.
b) As general rule, the agencies require an interaction and collaboration with other actors, such as universities, to approve the finance.
c) The agencies only select projects that would have high social returns.

The downside of this tool is that firms without liquidity restrictions and/or appropriability problem could otherwise finance their own innovation projects.

Another shortcoming is that, since the size of a given loan is linked to the amount of subsidy, private entities simply try to increase the size of their innovation projects to receive more subsidies.

According to Crespi[31] these disadvantages could be mitigated by using:

i) Maximum limit to subsidy;
ii) The subsidy never covers the entire cost of the project;

[30] CRESPI, Gustavo. ***Op. Cit.***. p. 140
[31] CRESPI, Gustavo. ***Op. Cit.***. p. 141 and 142

iii) List of admissible costs, in general partial subsidies covers only variable costs such as researcher's salaries, research inputs and tertiary R&D inputs

iv) Another instrument is a competitive call for proposals that allow the public agency to identify the best proposals and allocate resources based on evaluation scores. The adjudicating committees are usually made up of government representatives and privates, academic and civil organizations to diminish the risk of rent seeking.

v) Public agency adjust the amount of the subsidy according to beneficiary, such as if the beneficiary is small enterprise would receive a greater proportional amount of co-financing, since they faces a greater intensity of market failures.

vi) If there is more than one beneficiary they would receive a greater proportional amount of co-financing too, given the greater chance of externalities.

Due this approach some capabilities are needed to successfully implement a partial subsidy, such as an institutional framework that allows policy experimentation, monitoring and evaluation, in order for a critical mass of human capital to be demanded from these agencies. Aside from this preliminary need, the subsidy payment must be able to be conducted in accordance with the complex regulation of govern disbursements.

There is another drawback mentioned by Crespi, it being that a general rule is to have the subsidy to be verifiable and implemented by ex-post disbursement of the admissible approved costs, so it is not inadequate for entrepreneurial innovators with severe liquidity restrictions. Sometimes these cash transfers must be backed by guarantees.

Regarding to the call proposals process, if they are not made over the course of the year, the firm will have to wait several months to include their project. It is an absolutely fundamental point when we are dealing with sectors where technological leadership is a key asset of competitiveness.

The third of these drawbacks is that in low development countries, sometimes firms have difficulty identifying an innovation opportunity subsequently codifying it in a coherent proposal. In order to alleviate this problem Crespi suggests a call of proposals divided in two steps. The first would be a call to conceptual notes, and second is a call for the proposal.

Following this general overview about the grants, we will now start to deal with tax incentives.

4.2 Tax Incentives.

Tax incentives aim to reduce the marginal cost of capital of the firm. It is design with several forms such as tax credits, tax deductions, accelerated depreciation of innovation-related investments and many times they are combined. A tax credit reduces the amount of tax

for which you are liable. Unlike a tax deduction, which reduces the amount of income subject to tax, a tax credit directly reduces your tax liability.

Accelerated depreciation refers to a method in which a fixed asset depreciates in such a way that the amount of depreciation taken each year is higher compared with the depreciation of similar assets in normal conditions. As a result, accelerated depreciation provides a way of deferring corporate income taxes by reducing taxable income in current years, in exchange for increased taxable income in future years. This is a valuable tax incentive that encourages businesses to purchase new assets.

One positive point that should be highlighted is that in general tax incentives consider the entire business innovation activities, and in this way the firm could obtain the reduction of the costs to all the entire project of innovation. It is different from direct subsidies where firms must submit one project (and not the entire project of innovation) for each proposed open by the public agency. Consequently tax incentives should reduce the firm's compliance costs, as well as the innovation agency's costs.

4.3 Differences between tax incentives and direct subsidies

Having already mentioned the main characteristics of each tool the state has to induce investment in innovation, let us now analyze the difference between direct subsidies and tax incentives. We are basing this discussion in two surveys, Gustavo Crespi for IDB did one, and another by Spanish researchers led by Elizabeth Bustom.

Gustavo Crespi describes three differences between direct subsidies and tax incentives. First, in areas where the tax burden is not so high, such as underdeveloped countries, direct subsidies tend to create more private innovation investments than do tax incentives. Second, direct subsidies fit well in promoting innovative investments in small and medium enterprises (SME). Finally, direct subsidies tend to harbor more projects that could generate positive externalities.

> From the perspective of innovation policies, there are at least three differences between the effectiveness of tax incentives and of direct subsidies. First, the impact of tax incentives on the marginal capital costs of innovation activities depends on the fiscal environment and will be less significant in a country with low taxes or for groups of actors that are often exempt from paying certain taxes or that contribute at a lower rate. Mainly for this reason, tax incentives are less effective as stimuli for innovation in regions with backward relative development (Harris, Li, and Trainor, 2009) or as stimuli for SMEs, given that simplified tax regimes usually entail lower effective tax rates for such businesses.[15] The fact that tax incentives are biased toward larger businesses is also worrisome, because bigger firms usually have the greatest ca- pacity to take advantage of the benefits of innovation, which might mean that they could manage with a lower incentive.

> Second, the impact of an incentive depends, to a large extent, on the fiscal position of the enterprise itself and on its capacity to generate earnings. As this capacity is typically limited for SMEs and, above all, for enterprises that just entered the market, this instrument has limited power to promote entrepreneurial innovation. In other words, insofar as only larger companies can benefit from the entire tax incentive, the use of such instruments will tend to be regressive.
>
> Third, and perhaps most importantly, the resulting innovation projects may differ, since firms receiving tax incentives generally decide which projects to invest in, whereas central planning authorities exercise greater control over which projects receive direct subsidies. In other words, it is certainly possible that projects financed by tax incentives are better aligned with maximizing private profits, whereas those supported by public subsidies may provide more social benefits. Since profits and social benefits do not always coincide, firms that receive tax incentives could end up executing practically the same projects they would have financed anyway, meaning those with the strongest market signals and less uncertainty, but which may not necessarily offer the greatest social return. [32]

Another interesting study was done by Isabel Busom, Beatriz Corchuelo and Ester Martinez, which used and analyzed data from a Spanish survey that collected innovation indicators over the years 2003-2005 and 2006-2008. Part of their conclusions is in line with the arguments of Gustavo Crespi.

The Spanish researchers found that tax incentives better adjust with firms that had previous R&D experience, and tend to be used by medium and large firms, firms in the knowledge intensive sector, and firms that a have high productivity and are able to protect their innovations. Instead of Direct Subsidies that are likely to be financially constrained firms, such as SMEs as Crespi said, tend to be used by firms not invested in R&D previously and with high human capital. The parameters are what is manly relevant, and indicates a option to tax incentives or direct subsidies are the previous R&D experience if the firm and thigh human capital, as we can see below.

> (…) We discuss the estimated average marginal effects we have obtained for the probability of using only tax credits and of using only direct support, as we expect the results of these two cases to offer a sharper picture of the differences between both tools. For SMEs, we find that being financially constrained reduces the probability of using only tax credits by about 4 percentage points, while it increases the probability of obtaining direct support also by about 4 percentage points. These results are consistent with the expected patterns. (…) firms that protect their innovations are more likely to generate profits and are therefore in a better position to claim tax credits. (…) With respect to previous in-house R&D experience, we find again opposite patterns across firms that use only one or the other tool: previous experience is positively correlated with using tax incentives only, and negatively correlated with using grants only. (…)
>
> (…) A high level of human capital increases the likelihood of using only direct support, suggesting that firms with high quality projects are more likely to use

[32] CRESPI, Gustavo. ***Op. Cit.***. p. 145 a 146

grants. A firm's relative productivity is positively correlated to the probability of using tax incentives only, but negatively with the probability of receiving subsidies. Firms in the smallest size intervals (less than 20 employees and between 20 and 50) are less likely to use tax incentives, while they do not show any disadvantage relative to larger firms in the use of subsidies. Finally, we find different patterns across industries. Firms in high-tech and medium-high technological intensity are more likely to use tax incentives only. It is remarkable that none of the other innovation barriers appears to be on average correlated with the use of public support.

(…)Having a high proportion of highly educated employees increases the likelihood of using both types of support; since this variable is not correlated with using only tax incentives, this result corroborates that at least for SMEs the public agency succeeds in selecting high quality R&D projects. The likelihood of not using any support is higher for firms without human capital, without previous R&D experience, low productivity and for non-exporters. These results are in line with Aw et al. (2011) and Takalo et al (2012). Smaller firms are also more likely to be in that group.

Results differ somewhat for large firms. We do not find a significant correlation between financing constraints or appropriability and the likelihood of using tax incentives only or subsidies only. Financing constraints are inversely related to the probability of using simultaneously both instruments, and directly related to using none. **We also find that the most distinctive difference between firms that use only tax incentives and firms that use only subsidies are the role of human capital and previous R&D experience.** Firms that do not have human capital are less likely to use tax incentives (the probability falls by 0.14 pp), while they are more likely to obtain subsidies (the probability increases by 0.11 pp). Subsidies appear in this case to be used to increase the innovative capabilities of some firms, a role that tax incentives do not perform. An finally, firms that have previous R&D experience are more likely to use tax incentives only or both forms of support, while firms without previous R&D experience are more likely to obtain direct subsidies, in line with the result obtained for SMEs.

(…)

On the whole, our results suggest that although some firms use both tools, tax incentives and subsidies are used to a great extent by different types of firms. **Tax incentives tend to be used by medium and large firms, firms that already invest in R&D, have high productivity and are able to protect their innovations, and firms from knowledge intensive industries.** We find that financing constraints do not increase, but rather decrease, the likelihood of using this tool. **Subsidies, instead, are more likely to be used by firms with high human capital that may or may not invested in R&D previously, and that are likely to be financially constrained**. R&D subsidies would hence be better suited to address market failures associated to genuine innovation and to induce new entrants into R&D. We think that by jointly estimating the use of direct support and of tax credits, and by discriminating by firm size, we have been able to characterize better the use of both tools and their association to financing constraints and appropriability. [33]

[33] BUSOM, Isabel; CORCHUELO, Beatriz; ROS, Ester Martinez. ***Tax incentives or subsidies for R&D? .*** Maastricht Economic and social Research Institute on Innovation and Technology. United Nations University. Netherlands. 2012. p. 25 to 27 and 31 to 32.

4.4 Brief conclusion of this chapter, and sample of some investment innovation dates of Brazil.

From the differences shown above, we conclude that direct subsidies and tax incentives are not mutually exclusive rather they are complementary, even though at some points direct subsidies present some advantages over tax incentives and vice versa.

It is important to note that we tend to think that neither of them should be neglected but heavily target the industry of firms that best fit the given options.

The world today has multiple market failures and informational asymmetries. When we look closely at the reality of Brazil we check there are a wide range of types of firms that still present a very low rate of investment in innovation.

We developed the following charts from the data obtained by the OECD database, collected from the web site of Ministry of Science Technology and Innovation of Brazil. We designed these graphics in order to make a comparison between Brazil and some countries in the rest of the world. Thus we compare both the absolute amount invested in R&D in one graphic, and in other graphic the relationship between investment in R&D and GDP.

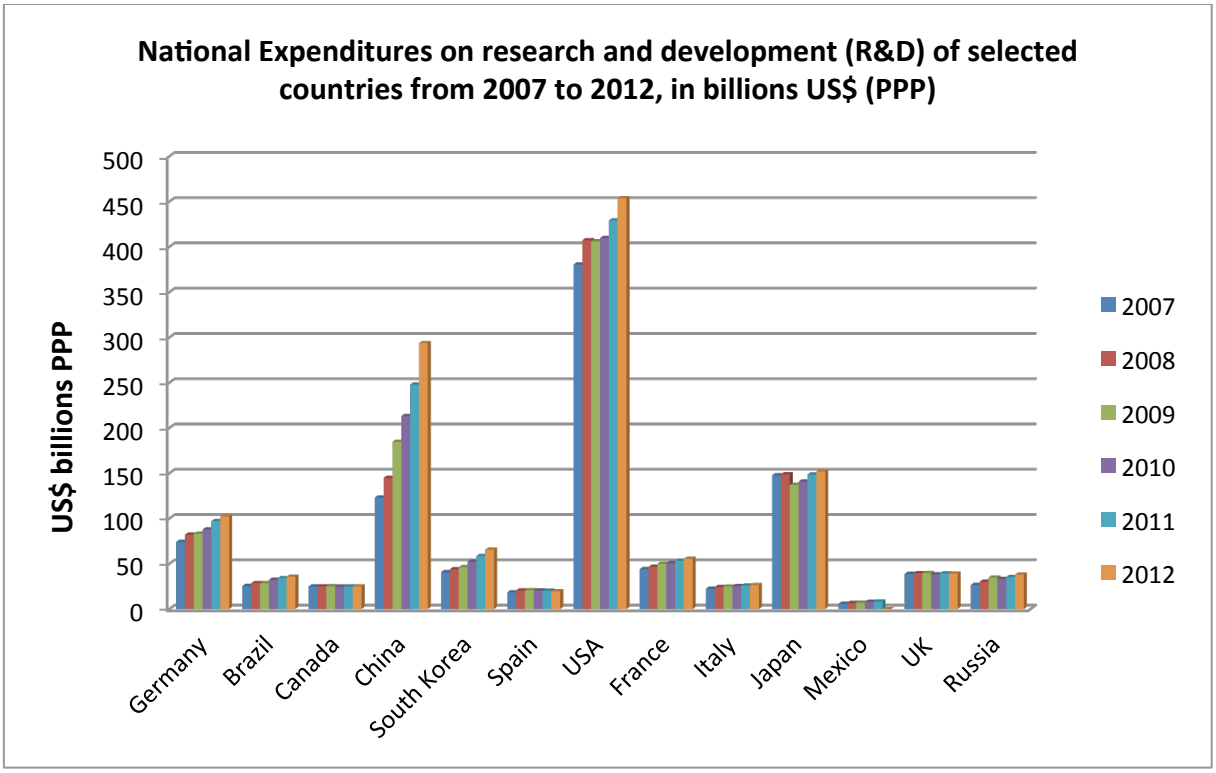


FIGURE 6 - ABSOLUTE NATIONAL EXPENDITURES IN R&D

Source: Developed based on OECD database

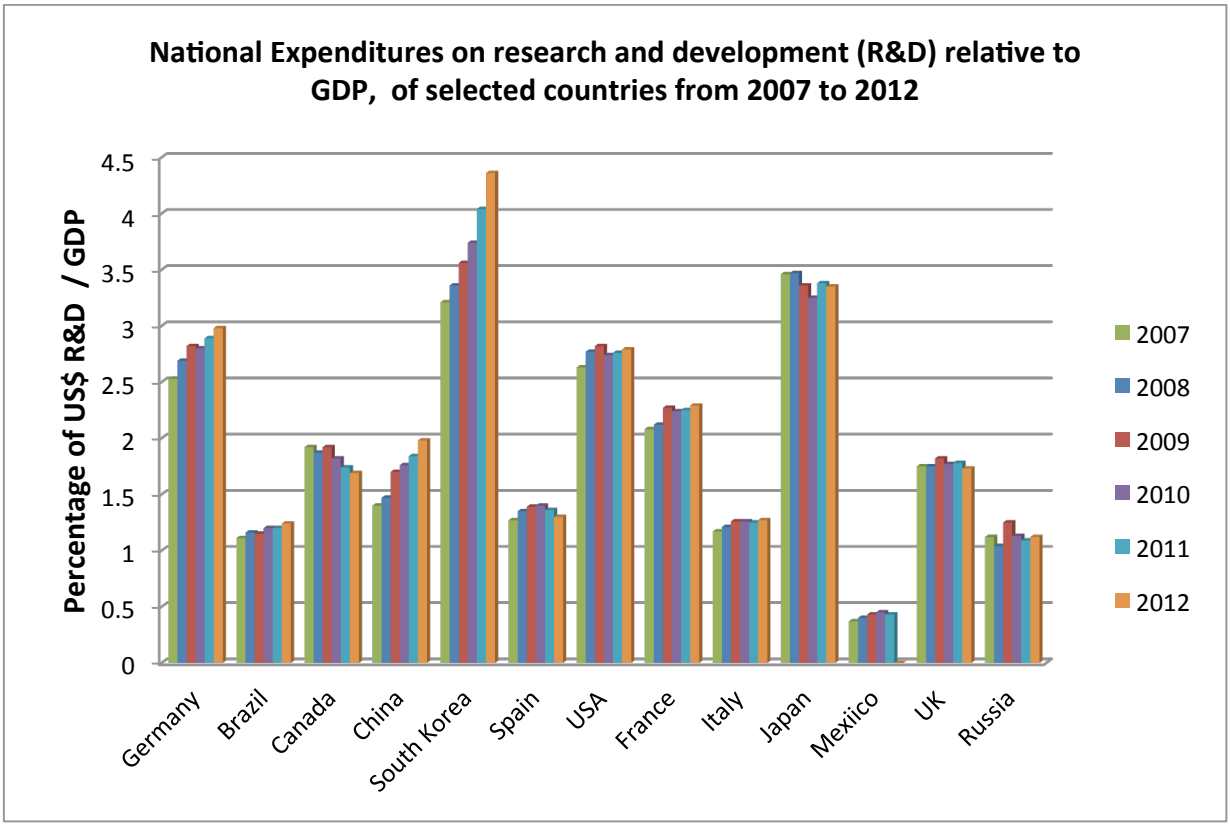


FIGURE 7 - NATIONAL EXPENDITURES IN R&D PER GDP
Source: Developed based on OECD database

The absolute amount invested in R&D in Brazil shows a lower level of investment (U$ 35,6 billions –PPP- 2012) in comparison to China, USA, France, Japan, South Korea and UK. In the other graphic the relationship between investment in R&D and GDP shows that the majority of countries that have an absolute level of investment lower or similar to Brazil, have a relatively greater investment in R&D per GDP than Brazil (1,24% - 2012), such as Canada, Spain and Italy. Only Russia and Mexico presents lower absolute and relative level of investment in R&D in comparison to Brazil.

The result shows the urgent need to leverage investments in R&D in Brazil. **The arguments described above pertaining to not giving up the tax incentives and boost these types of investments, become even more apparent when we are faced with the reality of underinvestment in R&D in Brazil. Also alerted by the OECD, Brazil must boost productivity and narrow their significant productivity gap with advanced economies, for only then can they finally reach OECD levels of average income.**

5 A GENERAL VIEW OF FISCAL INCENTIVES IN BRAZIL TO INDUCE INNOVATION.

In this chapter we will give an overview of the main direct subsidies and tax incentives used in Brazil to foster investments in Innovation.

5.1 The major tax incentives used in Brazil for induction of Innovation.

At the federal level there are two main tax incentives linked to incentive innovation policy. The tax incentive known and most widespread is found in Chapter III of Law No. 11.196, of November 21 of 2005, known as the *Good Law*. This authorizes the federal government to grant tax incentives, automatically, to companies that perform technological research and development of technological innovation.

The Law 11.196 / 2005 perfected the old tax benefits created by Law N^{o}. 8661, dated June 2, 1993. Note that this law does not require the prior formal request and approval of projects in R & D by the Ministry of Science Technology and Innovation (MCTI) fitting the taxpayer to conclude whether or not it meets the requirements of Law No. 11.196 / 2005. From then he prepares its accounts using or not the benefits, since it is not for the MCTI approve or disapprove projects of companies.

The verification of the correct use of incentives will be made a year later, when the tax payer completes is obliged to pay the MCTI, electronically, annual information on their programs of research and development for technological innovation, for which the deadline is July 31 of the year subsequent to each fiscal, and MCTI the latter makes a consolidation of information provided by companies in their forms and referring to the Internal Revenue Service (IRS) of Brazil. So the IRS prepares some tax audits from the received content.

The main real incentives in the Good Law are, in summary:

A) In determining the taxable income on the basis of calculation of Income Tax of Legal Entities and the basis for calculating the Social Contribution on Net Income, the company may exclude the value corresponding to 60% of the sum of expenditures made with P & D. This percentage could rise to 70% due to the increase of up to 5% in the number of employees who are hired exclusively for R & D activities; and 80% in the case of this increase is more than 5%. In addition, there may be also an exclusion of 20% of total expenditures made in R & D under patent is granted or if registered new variety of genetically improved plant species.

B) 50% reduction in expenditures on Industrialized Products Tax on equipment, machinery and instruments (domestic or imported) intended only for technological research

and development of technological innovation, not including spending on modernization of the industrial courtyard and other fixed installations that has no relevance to a project R & D.

C) Full depreciation, by deducting operating expenses, in the year of the acquisition of machinery, equipment, devices and instruments for use in R & D activities.

D) Accelerated depreciation in the computation period in which the expenditures for the acquisition of intangible assets, by deducting operating expenses as they are made, provided that such intangible assets are tied exclusively to technology research and development of technological innovation.

E) Reduction of the zero tax rate on income withholding in the occurrence of remittances abroad, intended for registration and maintenance of trademarks and patents.

The other tax incentive that the federal government uses to encourage investment in innovation are the *Laws of Informatics (Laws 8248/1991, 10171/2001 and 11,077/2004).* Through them, the government seeks to encourage the growth of R & D in the hardware industry and automation in the domestic industry.

This benefit is valid until 2019. It is worth noting that the benefit pertains to hardware and electronics, while software applications are not accommodated by the Act, because there is no incidence of IPI on them.

Fiscal incentives refer to the reduction of the IPI (Tax on Industrialized Products) for any item whose NCM (Mercosur Common Nomenclature) included in the list of products encouraged by the Act;

As an example, if only occur in Brazil manufacturing of goods listed in the Act:

-80% reduction in the IPI (for South and Southeast regions)

-95% reduction in the IPI (for North, Northeast and Midwest regions)

However, if the manufacturing but also the development of the country as well of goods listed in the act occurs in Brazil, there will be:

-95% reduction in the IPI (for South and Southeast regions)

-100% reduction in IPI therefore an exemption (for North, Northeast and Midwest regions).

It is important to note that these percentages apply until 2014, when they will be progressively reduced until their demise in 2019. To enjoy the benefits, the company has to mandatorily invest in R & D a total of 4% or 4.35% of the annual turnover of incentive products (depending on the region you are located), discounting taxes on the sale that would

be built into the price of products. It is worth mentioning that these values will be gradually reduced between 2015 and 2019.

This would be the main tax incentive for innovation in Brazil, but we could mention other smaller scale incentives like the Regional Incentives for Automotive Sector for Regional Development of Northern, Northeast, Midwest, given by Articles 11-A and 11-B of law 9440/1997, and also the INNOVATE-AUTO program given by Articles 40 to 44 of Law No. 12,715 / 2012.

5.2 The major direct subsidies used in Brazil for induction of Innovation.

As for direct subsidies there are numerous mechanisms that the federal government uses to encourage investment in innovation, and giving insight can be divided among non-reimbursable financing, repayable funding, and sector funds.

The first is the economic subsidy and there are two major related programs. The first is operated by Funding Authority for Studies and Projects (FINEP), which is a public company linked to MCTI, and currently, the main agency supporting innovation of products, processes and services in the country It works in partnership with companies, institutes and research centers to support innovative governmental agencies, international multilateral agencies, investors and third sector entities.

This program's resources are allocated to projects in the areas of information and communication technologies, biotechnology, health care, national defense and public security, energy and social development, which are subject to annual notices since 2006. Qualified companies receive public funds that are nonrefundable (that need not be returned) and thus the government can share with them the costs and risks inherent in such activities.

There is another form of subsidy provided for in Article 21 of the Law of Good to stimulate hiring by businesses, teachers and doctors to work on technological innovation activities. The grant is up to 60% of the remuneration of researchers to firms located in the North, Northeast and Midwest regions, and up to 40% in other regions. The stipulated maximum value is being subsidized both for doctors and for teachers, and the maximum term of the grant is up to three years.

Another direct subsidy of innovation includes another category of programs, known as reimbursable funding. These reimbursable funding finance charges vary according to the credit line, the design features, and the borrower's characteristic institution of credit.

We can cite two reimbursable funds given by FINEP:

- Inova FINEP Brazil and Zero Interest Program.

As reimbursable funding given by BNDES (National Bank for Economic and Social Development), we can mention:

- Innovator Capital Line;

- Line Technological Innovation;

- Program to Support the Development of the Pharmaceutical Productive Chain (PROFARMA).

- Programme for the Development of National Industry Software and Technology Services Information (PROSOFT);

- Support Program Engineering (PROENGENHARIA).

Finally, there are the Sector Funds (16) mostly managed by FINEP. These funds receive resources from the portion of the remittance of royalties exploitative of goods and services, and a portion of tax called contributions on sectorial economic domain (CIDE), whose law states that part of the sum should be applied in scientific and technological development of the country.

Thus, these resources are allocated funds for some Technology Centers through public calls. An interested company does not receive this feature directly, so they must go to the Technology Center that received the funds, and invest a financial contribution in projects that have benefited from the fund's resources.

The companies receive the benefit of a reduction in R&D costs, since they rely on the contribution of universities and research institutes and partners in the project, both of which received the sector funds.

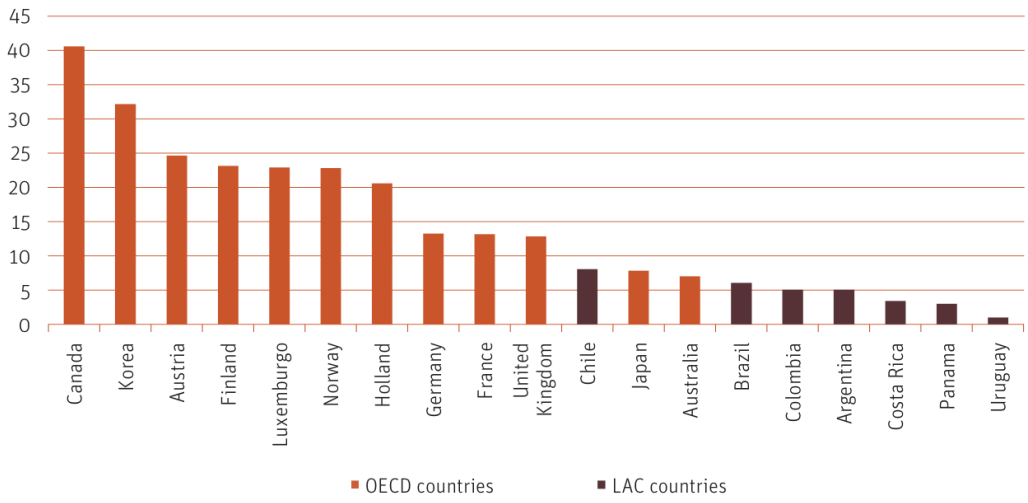
There are other direct subsidies also granted by subnational governments, but the main are stated above.

5.3 Brief conclusion of this chapter and a question to be answered in Chapter 6.

As we just pointed out, there are numerous direct subsidies used in innovation policy both at the federal and state levels. Beyond this there are also tax incentives at the federal level that uses two main instruments. Even with the presence of these instruments the investing in R & D is much less than desirable, as it was only 1.24% of GDP in 2012.

Furthermore according to Crespi the fact that some countries have fiscal incentives does not necessarily imply that their use is widespread. The figure below shows the penetration of these programs in terms of the number of enterprises that take advantage of them. It is clear that penetration rates in Brazil are lower than in the OECD countries. It is not,

however, only a matter of these rates being low; the volume of public resources mobilized is also particularly low.



Source: IDB (2010a).

FIGURE 8 – FIRMS THAT RECEIVED PUBLIC SUPPORT TO FINANCE INNOVATION

We can conclude that a national effort with the presence of the states must be given in order to leverage these indicators so that the country can achieve a level of investments in R & D that can help achieve the level of per capita income of developed countries, a fact that even we already noted in chapter 3 that had already been highlighted by the OECD.

Thus, we want to pose another question: *"Would it be possible for a state to contribute to the innovation policy drafting with regard to tax incentives? If yes, how to avoid an unfair dispute between the State to attract these kind of investments?"*

6 TAX WITHIN THE JURIDICTIONS OF THE STATES IN BRAZIL AND RULES TO GRANT TAX BENEFITS RELATED TO ICMS

To answer the question left in the end of chapter 5, first it is important to mention the major taxes that the Constitution of the Federative Republic of Brazil allows states to charge taxpayers. Let's see what is found in Article 155 of the Higher Law.

> ***Article 155.*** *The states and the federal district shall have the competence to institute taxes on:*
>
> *I – transfer by death and donation of any property or rights; (ITD)*
>
> *II – transactions relating to the circulation of goods and to the rendering of interstate and intermunicipal transportation services and services of communication, even when such transactions and renderings begin abroad; (ICMS)*
>
> *III – ownership of automotive vehicles. (IPVA)*

The first part of the question regarding the possibility of a state being able to contribute to the innovation policy drafting of a tax benefit can be answered by considering the state's relation to taxes, and whether or not it is in their jurisdiction to establish tax benefits by following the constitutional rules for during such. These rules related to the ICMS will be discussed in more detail below.

According to Article 155, item II of the Constitution, the states and the federal district are in charge of setting the so-called ICMS, Tax on Circulation of Goods and Services (*Imposto sobre Circulação de Mercadorias e Prestação de Serviços de Transporte Intermucipal e Interestadual e Comunicações*). The ICMS is the major tax charged by the states, for instance in the state of Rio de Janeiro it was responsible for almost 90% of all state collected taxes.

Month	ICMS	ITD	IPVA	Another taxes	Collection Programme	Additional due to late	Fine	TOTAL
Jan	2,905,286,099	38,463,400	510,220,963	1,550,111	58,056,752	29,246,292	7,982,870	BRL 3,550,806,487.22
Fev	2,626,384,290	34,743,970	532,123,312	1,089,120	56,259,357	26,382,637	7,284,171	BRL 3,284,266,857.36
Mar	2,547,930,469	43,886,538	201,729,111	1,310,584	102,871,706	31,115,140	7,560,150	BRL 2,936,403,698.87
Apr	2,724,451,600	46,721,565	185,947,518	1,436,217	54,287,762	34,934,727	7,940,835	BRL 3,055,720,223.48
May	2,606,150,723	46,207,595	90,206,552	1,550,253	57,901,412	33,644,687	8,032,260	BRL 2,843,693,481.95
Jun	2,894,800,520	42,379,875	69,871,901	1,360,544	54,348,431	32,425,462	9,225,922	BRL 3,104,412,655.27
Jul	2,504,074,126	60,050,921	70,279,172	1,542,095	55,413,766	35,794,129	8,605,380	BRL 2,735,759,589.77
Aug	2,525,426,886	47,354,520	56,454,076	1,346,973	55,170,338	29,172,105	6,096,504	BRL 2,721,021,401.39
Sep	3,008,824,868	45,165,409	45,141,005	1,164,126	52,379,671	37,322,680	6,752,833	BRL 3,196,750,591.54
Ouc	3,024,050,644	62,715,816	45,692,305	1,403,410	51,174,802	34,045,948	7,444,316	BRL 3,226,527,241.13
Nov	3,045,651,710	92,723,327	41,970,808	1,295,823	11,877,233	23,148,601	7,110,953	BRL 3,223,778,455.57
Dec	3,091,967,842	83,109,176	40,570,595	1,165,534	92,222,727	24,304,890	5,577,888	BRL 3,338,918,652.65

Total	33,504,999,778	643,522,113	1,890,207,318	16,214,790	701,963,959	371,537,298	89,614,082	BRL 37,218,059,336.20
%total	90.02%	1.73%	5.08%	0.04%	1.89%	1.00%	0.24%	100.00%

TABLE 1 - STATE TAX COLLECTION OF RIO JANEIRO IN 2013
Source: Finance Secretariat of the State of Rio de Janeiro[34]

The participation of ICMS by the collection of the states makes us suppose that anything related to ICMS tax benefits spark a lot of interest from the private sector. That way if the states choose to participate as inducers of a policy to encourage innovation using tax incentives, and if these tax incentives were related to ICMS, they could have greater chances of penetration in society than if they were in relation to other taxes statewide jurisdiction.

To better understand the constitutional and legal rules for granting tax benefits related to ICMS, it is important to mention that before the ICMS, there was the ICM—Tax on Circulation of Goods—which was designed in the 1960's to be very similar to the European value-added taxes. In 1988 the ICM, with its expansion of the assumptions of incidence such as intercity and interstate transportation, communication, fuel, electricity, and others, would become the ICMS.

Thereby in its original conception, the ICMS was considered a value-added tax, but Fernando Rezende[35] states that the mosaic of situations formed by the juxtaposition of various regimes adopted by the states to facilitate collection and reduce evasion is composed of packages that exhibit the traits of a value added tax and others that resemble a monophasic tax on the production of goods.

One large part of the ICMS is formed by a tax on industrial production; a portion charged in advance of the retail sale via tax substitution is assessed against a pre-established markup. In practice, in an economy in which prices are freely fixed in the market, the MVAs result from a negotiation with industrial sectors, supported by technical studies and taking into account the interests of the tax authority.

Another part of ICMS is a tax on sales by small and medium-size companies (SMEs). They still have another component that is a kind of customs tariff applied to the entry of products from other states in interstate sales.

It is important to mention that, though the states can charge the ICMS they must respect national supplementary laws regarding the establishment of general rules of ICMS,

[34] http://www.fazenda.rj.gov.br/sefaz/faces/menu_structure/servicos?_afrLoop=459145461209000&datasource=UCMServer%23dDocName%3A100672&_adf.ctrl-state=12g50wnmg0_234 (Accessed in: 11/10/2014).
[35] REZENDE, Fernando. ***Brazil's ICMS Tax Origin, Changes, Current Situation, and Paths to Recovery***. Discussion Paper. Inter-American Development Bank. Washington-DC. 2103. P. 04

according to paragraph 1 of article 24 combined with article 146, item III, both of Constitution of the Federative Republic of Brazil.

> ***Article 24.*** *The central government, the states and the federal district have the power to legislate concurrently on:*
>
> *I – tax, financial, penitentiary, economic and urbanistic law;*
>
> *(...)*
>
> *Paragraph 1. Within the scope of concurrent legislation, the competence of the central governement shall be limited to the establishment of general rules.*
>
> ***Article 146.*** *A supplementary law shall:*
> *(...)*
> *III – establish general rules concerning tax legislation, especially with regard to:*
>
> *a) the definition of tributes and their types, as well as, regarding the taxes specified in this Constitution, the definition of the respective taxable events, assessment bases and taxpayers;*

Another national supplementary law that the states must follow is based on the fact that fiscal benefits regarding ICMS given by one state can have significant consequences for another states and the national system, because it can instigate informal 'tax wars' among states that are competing for new businesses.

In this way, the Constitution requires the observation Supplementary Law number 24, of 1975 (LC 24/75) to curb competition among states when they are imposing these tax incentives to attract producers of goods.

> ***Article 155.*** *The states and the federal district shall have the competence to institute taxes on:*
>
> *II – transactions relating to the circulation of goods and to the rendering of interstate and intermunicipal transportation services and services of communication, even when such transactions and renderings begin abroad;*
>
> *Paragraph 2. The tax established in item II shall observe the following:*
>
> *XII – A supplementary law shall:*
>
> *g) regulate the manner in which, through deliberation by the states and the Federal District, tax exemptions, incentives and benefits shall be granted and revoked;*

The LC 24/75 made it requires that conventions must be signed between states when any kind of a tax benefit related to ICMS is granted. Theses conventions are built on meetings with the presence of representatives from most of the states. It is important to mention that LC 24/75 stipulated that the granting of benefits would always require the unanimous decision of the states represented, and that the total or partial repeal of a benefit would require approval of at least four-fifths of the representatives in attendance.

We saw states in relation to taxes within their jurisdiction may establish tax benefits if they followed the constitutional rules for granting benefits. And ICMS is the major tax charged by the states: It was responsible for 80-90% of all state collected taxes. So anything

related to ICMS tax benefit makes it attractive to the private sector, if the states wants to participate as inducers of a policy to encourage innovation using tax incentives, the tax incentives related to ICMS could have greater chances of penetration in society. However for tax benefits related to ICMS to be granted, conventions are required in the form of LC 24/1975, that must be built on meetings with the presence of representatives from most of the states and approved by the unanimous decision of the states represented.

7 DRAFT OF A TAX INCENTIVE LEGISLATION FOR BRAZILIAN STATES HELPS TO REDUCE THE UNDERINVESTMENT IN R&D IN BRAZIL

We arrived at the point of the paper where we will make the transition from theory to a practical approach. We choose to make this transition in order to bring some contribution that somehow can positively change a part of the reality of our country, and with that enforce all the knowledge learned in Minerva Program classes and research.

Thus, at this point we will present a draft of tax incentive legislation that allows Brazilians States to help reduce the underinvestment in R & D in Brazil.

Mentioned in the previous chapter is the major ICMS tax charged by the states. Thus, we chose to prepare a tax incentive that is related to this tax, believing that anything related to ICMS tax benefit can spark a lot of interest from the private sector, resulting in its greater penetration in society.

Thus, we prepared the draft agreement below noting that for a tax benefit related to ICMS be granted it requires agreements in the form of LC 24/1975.

AGREEMENT ICMS N °, OF 201__

Discipline the ICMS tax incentives to improve technology research and development of technological innovation.

The National Finance Policy Council – CONFAZ - at its ___ regular meeting held on _____ of 201__ in view of the provisions of article 9, §1^0, II and §2^0 of the Supplementary Law N^o. 87 of 13 September of 1996 and in articles 102, 128 and 199 of the National Tax Code (Law N^o. 5,172, of October 25 of 1966), solves conclude the following:

AGREEMENT

FIRST CLAUSE *- The States and the Federal District are hereby authorized to grant presumed tax credit of ICMS, under the conditions determined by this Agreement, to promote technology research and development of technological innovation.*

SECOND CLAUSE*: For purposes of this Agreement, is considered:*

I - Technological innovation: new product design or manufacturing process, as well as adding new features or characteristics of the product or process involving incremental improvements and effective gain in quality or productivity, resulting in greater market competitiveness;

II - Technological research and development of technological innovation activities:

a) Basic research directed: the work performed for the purpose of acquiring knowledge about the understanding of new phenomena, with a view to developing products, processes or systems;

b) Applied research: the work performed in order to acquire new knowledge in order to develop or improve products, processes and systems;

c) Experimental development: delineated from pre-existing knowledge systematic work aimed at proving or demonstrating the technical and functional viability of new products, processes, systems and services, or even an obvious improvement of already produced or established;

d) Basic industrial technology: those such as the measurement and calibration of machines and equipment, design and fabrication of specific measurement instruments, certification of compliance, including the corresponding tests, standards or technical documents generated and the patenting of developed product or process; and

e) Technical support services: those that are essential to the implementation and maintenance of facilities or equipment intended solely to project execution, research, development and technological innovation, as well as the training of human resources devoted to them;

III - Researcher hired: graduate researcher, postgraduate, technologist or technician average level, with formal employment relationship with the entity that operates exclusively on technological research and development of technological innovation; and

***Sole Paragraph**: For purposes of this article, are not considered as technological research and development of technological innovation, among others, the following activities:*

I - Project coordination and administrative and financial monitoring of projects of technological research and development and technological innovation in its various stages;

II - Personnel expenses in providing indirect services on projects of technological research and development of technological innovation, such as library and documentation services.

***THIRD CLAUSE**: For the use of tax incentives of this Agreement, the entity shall prepare a project of technological research and development of technological innovation with analytical control of costs and expenses for each project hit by this tax incentive.*

***Sole Paragraph**. For the allocation of costs to the project of technological research and development of technological innovation related in the caput, the legal entity shall use a uniform and consistent criterion over time, and recording detailed the individualized expenditures, including:*

I - The dedicated hours, the work developed and the costs of each project encouraged by the researcher;

II - The hours spent, the work developed and the costs of each employee technical support for project hit by tax benefit.

***FOURTH CLAUSE**: The legal entity shall be credited for purposes of determining the ICMS to be paid, according to the percentages defined in clause six, taking into account the amount corresponding to the sum of expenditures made during the month period with technological research and development of technological innovation, made in a establishment located in the Federated Unit that implement this Agreement, classified as operating expenses by the law of Income Tax of Legal Entities (Income Tax), or as expenditures as provided in §1st.*

§1st - The presumed credit referred in the heading of this clause also taking into account the expenditures for technological research and development of technological innovation in the country contracted with university or research institution located in the Federated Unit who implement this Agreement.

§2nd - In the calculation of outlays on technological research and development of technological innovation the legal entity must not count the amounts allocated as grant resources for organs and agencies of the Government.

§3rd - The amounts used or transferred to another entity for execution of technological research and development of technological innovation custom or contractors is not permitted to been used as incentives provided in Agreement, except as provided in the manner pursuant to the §1º.

§4th - Expenditure on the provision of technical services contracted, executed by another entity and performed in establishments located in the Federated Unit that implement this Agreement, such as laboratory tests, testing, are taking into account the to the heading sentence of this Clause, since they do not characterize transfer execution research, even partially.

§5th - The costs of depreciation or amortization of the assets used in technological research and development of technological innovation activities must not taking into account the to the heading sentence of this Clause.

***FIFTH CLAUSE** - For purposes of the Fourth Clause, may be considered the following expenditures:*

I - Wages and social and labor costs of researchers and staff to provide technical support services pursuant in the subsection II(e) and subsection III of Second Clause;

II - The training of researchers and technical support services pursuant in the subsection II(e) and subsection III of Second Clause.

§1st - For purposes of this article, may be considered as expenditure related to technological research and development of technological innovation costs due to researchers hired by the corporation without exclusive dedication, since that:

I – Expressively provided in his employment contract performance as a researcher in technological innovation activities developed by the employer;

II - The company has for the project object of the tax incentive a control of the activities and their hours worked.

§2nd - In the case of §1st only can be considered as expenditure related to technological research and development of technological innovation hours actually worked on the project object of the tax.

§3rd - It is also considered capital expenditures related to technological research and development of technological innovation the spending for the registration and maintenance of trademarks, patents and cultivars, while paid abroad

§4th – The following not be considered expenditure related to technological research and development of technological innovation:

I - The amounts paid as indirect compensation;

II -Spending on ancillary services personnel, although related with technological innovation activities, including expenditures with:

a) The departments of administrative and financial management; and

b) Security, cleaning, maintenance, rent and cafeterias.

SIXTH CLAUSE *- The legal entity for purposes of calculating the amount of the tax base of the presumed credit of ICMS of the month that occurring the expenditures with technological research and development of technological innovation, with the provisions of the clauses fourth and fifth, will take into account:*

I – 50% (fifty percent) of the sum expenditures with technological research and development of technological innovation occurred in that month, or;

II – 70% (seventy percent) of the sum expenditures with technological research and development of technological innovation occurred in that month, in the month of calculation there had expenditure on technological research and development of technological innovation contracted with university or research institution located in the Federated Unit that implement this Agreement, or;

III – 90% (ninety percent) of the sum expenditures with technological research and development of technological innovation occurred in that month, in the month of calculation there had expenditure on technological research and development of technological innovation contracted with public university or public research institution located in the Federated Unit that implement this Agreement.

SEVENTH CLAUSE *- The maximum amount of presumed credit admitted by this Agreement in a given month has the limit 6% (six percent) of the average monthly of ICMS paid in the previous civil year*

Sole Paragraph *- If the calculation given in the previous clause be greater than the limit mentioned in heading of this clause, the amount that exceed may be summed with the calculation result of the presumed credit of the following month and so on until they can become deductible, however they may not be subject to assignment or transfer to another legal entity.*

EIGHTH CLAUSE *– The Federated Unit that adopt this agreement shall stipulate the manner in which taxpayers will demonstrate the control of costs and expenses for each project hit by this tax incentive, including as regards the Digital Accounting Bookkeeping (ECD).*

NINTH CLAUSE *- This agreement shall come into force on the first day of the following month of its national ratification publication.*

For a better understanding of the proposed legislation submitted, we will comment each of the clauses of the Agreement:

a) First clause – The main goal is to avoid the so-called fiscal war. Thus, we can prevent that an increase of investment in R&D of a state represented a decrease in investment in R & D from another state, thus ruling out the occurrence of zero aggregate results.

b) Second Clause – Generically describes activities that may or may not be considered as expenditure on R & D for the purpose of enjoyment of tax incentive.

The Item I meant the definition of what we consider technological innovation activities for the purposes of the tax incentive. As mentioned in Item 2.2 we consider only two of the four species of innovation mentioned in the Oslo Manual - the product and process innovations. These species of innovation are more strongly connected to technological innovation and are more likely to be increased from incentives provided by tax policy

innovation. Furthermore, the largest share of research and development expenditures are more closely related to product innovation and process innovation.

Item II brings three activities that are encompassed by the term R & D, research and experimental development, according to the OECD Frascati Manual, also mentioned in item 2.2 (Basic Research, Applied Research, Experimental development). It also brings the definition of related activities such as Technical support services, which could be considered as expenditure on R & D for the purposes of tax incentive.

The Sole Paragraph mentioned activities that should not be considered as R & D according to the methodology of Frascati Manual.[36]

c) Third clause - For the purpose of enabling the tax audit and prove the expenses on R & D, it is necessary for the tax payer to have a control of costs and expenses for each project hit by this tax incentive.

d) Fourth and Fifth Clauses - It details how to calculate and what can be considered as expenditure on R & D.

e) Sixth Clause - It is the centerpiece of the proposed legislation, mentioning how to calculate the tax base of the presumed credit that is the mechanism that allows the taxpayer to reduce the tax payable.

The first characteristic is that not all the spending on R & D will become presumed credits, in other words the tax incentive does not cover the entire expenditure in R & D. This was built especially to encourage the entrepreneur to seek innovation to invest in projects with a certain degree of profitability, and to prevent firms without liquidity restrictions to finance innovation projects with zero additional costs.

The second characteristic is that the tax incentive tries to encourage interactions between the taxpayer and different actors of the innovation process such as universities and public research centers. Thus, the total expenditure on R & D that will be considered tax base presumed credit might increase from 50% to 90%, as there is more interaction with the taxpayer universities or public research centers.

f) Seventh Clause - Establishes a maximum amount that the taxpayer can use as deemed credit in a given month (6% of the average monthly of ICMS paid in the previous civil year). But this comes without prejudice to the taxpayer, because the value that may exceed this limit may be used in other months. It was designed in this way for purposes of

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[36] Idem. ***Frascati Manual****: Proposed Standard Practice for Surveys on Research and Experimental Development*., 6th Edition. Paris. 2002. p. 34

transparency and fiscal management, and to estimate, monitor and predict tax expenditures. Thus, this tax expenditure may be more accurately projected in the annual budget way.

g) Eighth clause- Establishes mechanisms to allow a better control by the tax-administration, such ah the Digital Accounting Bookkeeping.

8 CONCLUSION

During the exhibition of this work in previous chapters we seek to bring a definition for innovation aiding in the standardization adopted by OECD manuals, and the four species mentioned in the Oslo Manual (product innovation; process innovation; marketing innovation; organizational innovation). Also we emphasized that the draft legislation suggested in the final section of this paper only cover two kinds of innovation—product and process innovation—since these are more strongly connected to technological innovation and are more likely to be increased from incentives provided by tax policy innovation.

Moreover, we mentioned that after the first definition of innovation introduced by Joseph Schumpeter, a series of economic currents were triggered that sought to explain and understand what would lead nations to reach a certain degree of long-term development. We highlighted that since the economic model of Schumpeter, we witnessed the exogenous economic growth theory of Solow, passing through the endogenous economic growth theory of Romer, and ending with the evolutionary economic theory of Nelson and Winter—all have in common the fact that they highlight the technology development as a key issue to sustainable growth in the long-term.

Soon after we analyzed some reasons that would drive an entrepreneur to invest in innovation. These reasons seem to be inseparable from a good business strategy to survive in the market or magnify participation. However we begged the question: *Since there are so many important reasons that have led the entrepreneur to invest in innovation by itself, why would we need the presence of government functioning as an active role of an innovation policy?*

In order to answer this question we brought six arguments to justify government involvement as a promoter of innovation policy: first a theoretical argument relative to information asymmetry and moral hazard; second a argument relating that knowledge is considered as a public good; third a argument linked to the need of coordination institutionally mentioned by Cristian Koler; and a fourth argument linked to wage improvement, and we presented a study conducted by Mario Sergio Salerno and Luis Claudio Kubota that indicates that are a positive correlation between innovation and wages improvement, in turn corroborating with the teachings punctuated by Ludwig Von Mises, who in spite of his ideas existing over half a century ago, are perfectly applicable to our current situation.

The fifth argument is as follows: It is based on the OECD report *2014 Perspectives on Global Development* that states improving the productivity will be a key factor for developing economies like Brazil, closing the income gap with advanced countries. Also it mentioned and that productivity growth in a number of middle-income countries like Brazil, which are otherwise insufficient to close this gap.

Finally we mentioned the sixth and most relevant argument, based on a research conducted by Inter-American Development Bank (IDB) showing that there is a strong positive correlation between total factor of productivity and income per capita. Indeed almost 80% of variation in income per capita among sample countries can be explained by variation in levels of total factor of productivity. With this in mind, on the other hand there is a considerable positive correlation between total factor of productivity and investment in R&D, which at the end suggests that investment in R&D has high social return.

Considering all of these arguments, which justify the presence of government functioning as an active role of an innovation policy, we ask one more question: *What should be the main tools used by the government to resolve the market failures that hinder firms from investing in innovation and adopting new technologies?*

We answered the question by stating the main tools used: Direct Subsidies and Tax Incentives. We turned to underline the positive and negative points of these mechanisms. After presenting the main characteristics of each tool, we then analyzed the difference between direct subsidies and tax incentives, basing this discussion on two surveys, Gustavo Crespi for IDB did one, and another by Spanish researchers led by Elizabeth Bustom. We highlighted the relevant parameters, which indicates a firm's option to tax incentives or direct subsidies are the previous R&D experience and if the firm has thigh human capital.

We showed that we tend to think that direct subsidies and tax incentives are not mutually exclusive, but rather complementary, even though at some points direct subsidies present some advantages over tax incentives and vice versa. In this way, neither of them should be neglected but heavily target the industry firms that best fit the given options.

Hereupon we developed two charts from the data obtained by the OECD database, collected in the web site of Ministry of Science Technology and Innovation of Brazil. We made a comparison between Brazil and a sample of countries. In one graphic we showed the absolute amount invested in R&D, and in other graphic the relationship between investment in R&D and GDP.

The comparison in the two charts showed that Brazil faced with the reality of underinvestment in R&D and suggests an urgent need to leverage investments in R&D in Brazil, which corroborated with our previous conclusion in the sense to not giving up the tax incentives to help boost these kind of investment.

Thus we give an overview of the main direct subsidies and tax incentives used in Brazil to foster investments in Innovation. We showed that there are a numerous of direct subsidies used in innovation policy both at the federal level and state level, beyond this there are also few tax incentives at the federal level. However, we still had only 1.24% of GDP invested in R&D in 2012. We can conclude that a national effort with the presence of the states must be given in order to leverage these indicators. In this way, we pose another question: *"Would it be possible for a state to contribute to the innovation policy drafting with regard to tax incentives? If yes, how to avoid an unfair dispute between the State to attract these kind of investments?"*

In order to answer this, we discussed the major taxes that the Constitution of the Federative Republic of Brazil allows states to charge taxpayers, ICMS, ITD and IPVA. We talked about the fact that ICMS is the major tax charged by the states, as it was responsible to 80 to 90% of all state collect taxes. So we concluded that anything related to ICMS tax benefit arouse a lot of interest from the private sector, and if the states wants to participate as inducers of a policy to encourage innovation using tax incentives, the tax incentives related to ICMS could have greater chances of penetration in society.

Furthermore we emphasized that the Constitution of the Federative Republic of Brazil requires the observation of a Supplementary Law (LC 24/75) to curb unfair competition among states when they are imposing tax incentives related to ICMS. This Supplementary Law requires that agreements must be signed between states when any kind of a tax benefit related to ICMS is granted. Theses conventions are built on meetings with the presence of representatives from most of the states, and stipulated that the granting of benefits would always require the unanimous decision of the states represented.

From there we reached a point of the paper where we made a transition from all theory presented throughout to a more practical, applicable approach. Thus, we presented a draft of tax incentive legislation, a draft of an agreement of tax benefit related to ICMS that could allow Brazilians States to help reduce the underinvestment in R & D in Brazil. We chose to make that transition in order to provide some contribution that might positively change a part of the reality of our country.

We designed this draft bearing in mind the methodology of the Frascati Manual of the OECD to define part of what would or would not be expenditures in R & D. The main mechanism that allows the taxpayer to reduce the tax payable in this draft is a presumed credit.

In order to encourage the entrepreneur to seek to invest in innovations projects with a certain degree of profitability, we defined that not all the spending on R & D will become presumed credits, in other words the tax incentive does not cover the entire expenditure in R & D.

Furthermore to encourage interaction between the taxpayer and different actors of the innovation process (i.e., universities and public research centers), the tax base of presumed credit may increase from 50% to 90% of total expenditures on R&D, as there is more interaction with the taxpayer universities or public research centers.

Finally, for purposes of transparency and fiscal management, as well as to estimate, monitor, and predict tax expenditures of this incentive in the annual budget, we had set a maximum amount that the taxpayer can use of this presumed credit in a given month, equivalent to the value of 6% of the average monthly payment that ICMS made in the previous civil year. But without prejudice to the taxpayer, the value that may exceed this limit and may be used in other months.

9 BIBLIOGRAPHICAL REFERENCES

ABEL, Andrew B.; BERNANKE, Ben s.; CROUSHORE, Dean. ***Macroeconomics***. 8th Ed. 2014. Pearson.

ALERNO, Mario Sergio; KUBOTA, Luis Claudio. ***Estado e Inovação***. In: NEGRI, João Alberto De; KUBOTA, Luis Claudio (Coord). *Políticas de Incentivo à Inovação Tecnológica*, Brasília. 2008. IPEA- Instituto de Pesquisa Econômica Aplicada.

BROWNING, Edgard K.; ZUPAN, Mark. ***Microeconomics****: Theory and Applications*. 17th Ed. 2012. John Wiley & Sons.

BUSOM, Isabel; CORCHUELO, Beatriz; ROS, Ester Martinez. ***Tax incentives or subsidies for R&D?*** **.** Maastricht Economic and social Research Institute on Innovation and Technology. United Nations University. Netherlands. 2012.

CONFEDERAÇAO NACIONAL DA INDÚSTRIA (CNI). ***Mobilização Empresarial pela Inovação: Estratégia e Objetivos***. Available in: <http://www.cni.org.br/portal/lumis/portal/file/fileDownload.jsp?fileId=FF80808129F81234012A1AEF6F7D19F8>. (Accessed in: 09/23/2014).

CRESPI, Gustavo. ***Fiscal Incentives for Business Innovation***. In: Corbacho, Ana (Coord). Fiscal Institutions For Tomorrow. Washington-DC. 2012. Inter-American Development Bank.

CUNHA, André Moreira. ***O Enfoque Evolucionário da Firma***. Available in: <http://www.ufrgs.br/decon/publionline/textosdidaticos/Textodid13.pdf>. (Accessed in: 09/23/2014).

INTER-AMERICAN DEVELOPMENT BANK. ***Science, Technology, and Innovation in Latin America and the Caribbean*** **-** *A Statistical Compendium of Indicators*. Washington-DC, 2010.

KOHLER, Cristian; LAREDO, Philippe; RAMMER, Christian. ***The Impact and Effectiveness of Fiscal Incentives for R&D***.

MISES, Ludwig Von. ***Economic Policy***. 3rd edition. Alabama. 2006. Ludwig Von Mises Institute.

MORA, Rubens Guimaraes Togeiro; CORREIO, Helio Nogueira da Cruz. ***Teoria do crescimento endógeno e a inovação tecnológica no Brasil***. Revista de Administração e Inovação – RAI. Universidade de São Paulo. São Paulo – Brazil. Vol. 10. N. 3. July-September/2013

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. ***2014 Perspectives on Global Development***. Pocket Edition. Paris. 2014.

---------- ***Frascati Manual****: Proposed Standard Practice for Surveys on Research and Experimental Development*., 6th Edition. Paris. 2002.

---------- ***Oslo Manual*** - *Guidelines For Collecting And Interpreting Innovation Data,* 3rd Edition. Paris. 2005.

---------- Remarks by Angel Gurría, OECD Secretary-General, delivered at the press conference in 2 of July of 2014 at OECD in Paris.

PACHECO, Carlos Américo; ALMEIDA, Julio Gomes de. ***A Política de Inovação****: Texto para Discussão*. n. 219. May-2013. Economy Institute of Unicamp.

Schumpeter, Joseph A. ***Capitalism, Socialism, and Democracy***. 3rd ed. 1942. New York: Harper and Brothers, 1950.

SOLOW, Robert M.. ***Technical Change and the Aggregate Production Function***. Review of Economics and Statistics. Vol. 39. N. 3. (August 1957).

VARELLA, S. R. D.; MEDEIROS, J. B. S; SILVA, M. T. J.. ***O Desenvolvimento da Teoria da Inovação Schumpeteriana***. In: XXII Encontro Nacional de Engenharia de Produção. Bento Gonçalves, RS, Brasil, 15 until 18/october-2012.