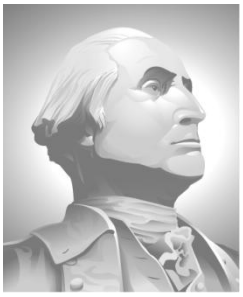

THE GEORGE WASHINGTON UNIVERSITY

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TAX REFORM TO FOSTER INNOVATION IN BRAZIL

GEORGE WASHINGTON UNIVERSITY SCHOOL OF BUSINESS

CENTER FOR LATIN AMERICAN ISSUES | MINERVA PROGRAM – FALL 2015

AUTHOR: FREDERICO OTTO VOGETTA NETO | ADVISOR: REID W. CLICK

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ABSTRACT

After a brief analysis of the Brazilian economy and the challenges it has been facing, as well a description of its current tax system and innovation policies, this research paper has sought to construct a theoretical base regarding innovation, in order to define key goals to be approached by a tax reform and then to suggest guidelines to implement them, aiming at long-term economic growth. Innovation and productivity are seen as the desired outcomes spurred by competition and entrepreneurship. By justifying the need for government interference in this field, this work proposes a taxation framework that is intended to induce those outcomes.

Key words: innovation, productivity, tax reform, long-term economic growth, green tax shift.

1. INTRODUCTION

Tax reform has been an imperative in Brazil. The tax system is considered to be one of the bottlenecks for the full development of Brazilian economy. In spite of this, a political consensus has not been achieved yet. As a consequence of this and other inabilities, topics like innovation, productivity, competitiveness, long-term economic growth and higher standards of life remain improperly neglected by the Brazilian government. Along with over taxation, massive and confusing tax legislation is built up on an everyday basis, putting businesses in unpredictable legal situations and excessive workload for tax compliance.

The neoclassical theory of economic growth improved by Richard Solow and the endogenous uptake of spillover effects from knowledge, the importance of the price system pointed out by Friedrich Hayek and the concept of creative destruction formulated by Joseph Schumpeter gather to form the theoretical background approached by this research. The intended goal was to build a broader perspective upon globalization processes, which have been enhancing specialization and shifting economies from price competition towards innovation competition. This paper seeks to highlight these ideas and propose a tax reform that can induce a sustainable long-term development with proper management of resources.

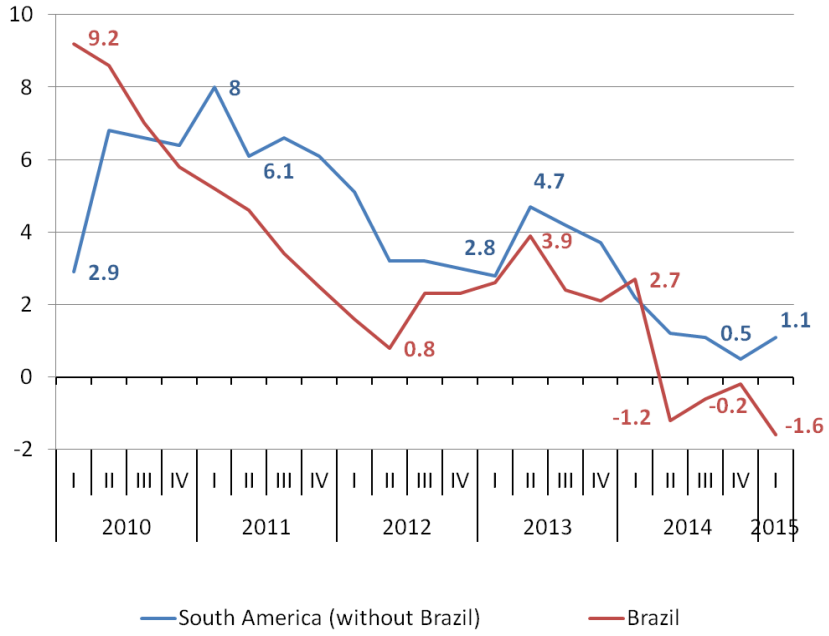
Among the next sections, overviews of Brazilian economy, tax system and innovation policies are depicted and confronted with the chosen theoretical frame. Despite the fact that an effective tax reform aiming at innovation needs to be coordinated with other public policies, especially regarding financial markets, social capabilities, institutions empowerment, education and labor training, some key goals for a tax reform were defined and some guidelines were suggested.

The premise for this paper is that fair, simple and clear taxation plays an essential role to achieve long-term economic growth. Moreover, providing competitiveness, legal certainty and institutional enforcement of property rights may optimize innovative efforts and enable a more dynamic allocation and reallocation of investments.

2. OVERVIEW OF BRAZILIAN ECONOMY: A CALL FOR MORE PRODUCTIVITY

Brazil is the world's fifth largest country in geographic size and population and seventh overall in gross domestic product (GDP), although it is considered middle income, with GDP per capita around USD 11,500. Brazil dominates South America in economic terms, presenting vast and mostly untapped natural resources, a large labor pool, and yet comparatively low investments and research and development (R&D) expenditures. The Brazilian economy is characterized by large and well-developed agriculture, mining, manufacturing and services sectors. Its USD 2.35 trillion economy has increasingly expanded into world markets over the last 20 years. However, among other developing countries, it has been facing a series of tough challenges, including the low investment level combined with an emerging prospect of higher loan costs in a new era of low prices for oil and other key commodities. This will result in a fourth consecutive year of disappointing economic growth, as it can be observed in the graph below. The final rate of decrease in GDP for 2015 is expected to be around -2.8%, according to Economic Commission for Latin America and the Caribbean (ECLAC).

FIGURE 1 – GDP GROWTH IN BRAZIL AND LATIN AMERICA - FIRST QUARTER OF 2010 TO FIRST QUARTER OF 2015 (In percentages, on the basis of dollars at constant 2010 prices)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of official figures.

Public expenditures have increased disproportionately more than GDP over the last two decades in Brazil, with a steeper ratio beginning in 2009, when the world financial crisis took over and was dealt by the government with counter cyclical measures, such as credit supply, cash transfers and low income housing programs. These policies stimulated aggregate demand. On the supply side, however, protective international trade policies and lack of competitiveness led to an undesirable outcome: decreased tax revenues, increased deficit on public accounts, inflation, contracting industries and increased unemployment. The investment rate has been around 20% of GDP, which is consistently low even if compared to neighbor countries like Colombia or Ecuador, where the ratio is close to 30%.

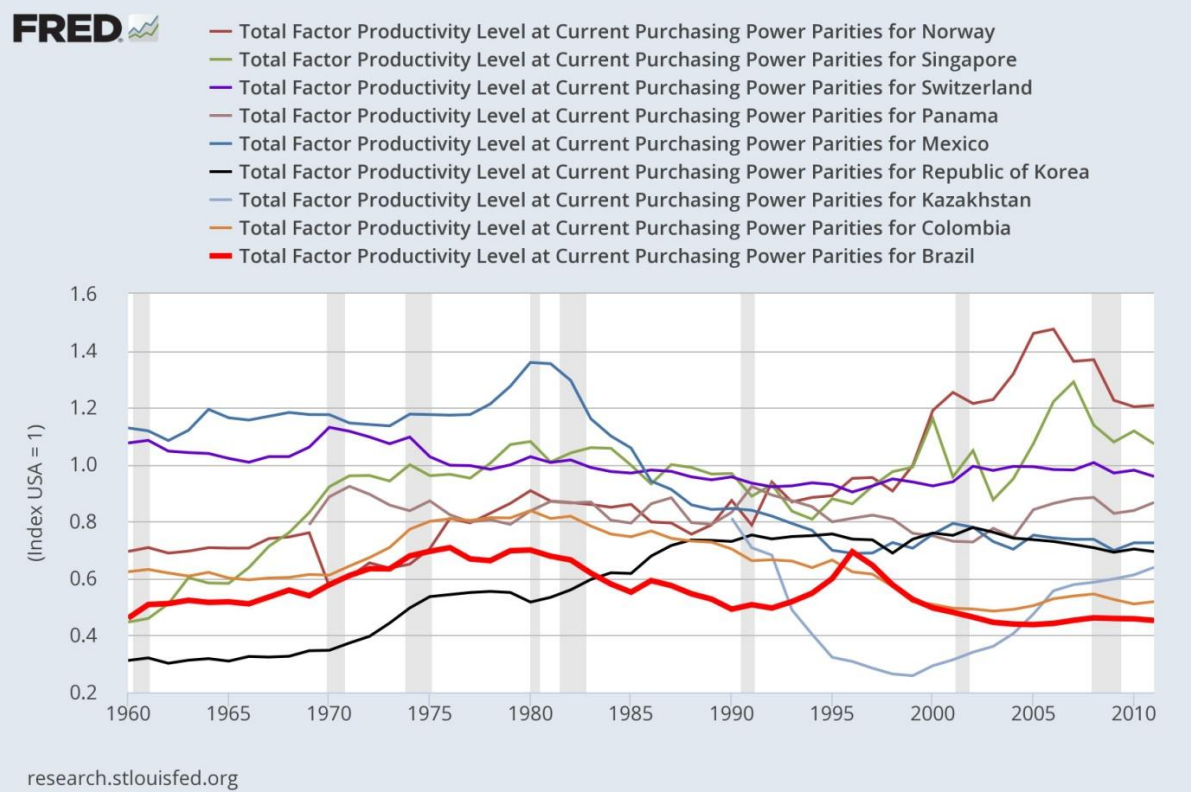
Public accounts are a major concern now, since future expenditures already approved by the Congress will cause the deficit to increase more in terms of percentage of GDP. Taking the already oppressive tax burden to a higher level is not likely to solve the problem. This would diminish already low private investments in a middle income country that presents the tax burden of a high income country: tax revenues rose from 25% of GDP in 1991 to 36% in 2014, while most developing countries kept them

between 20% and 30%. In the same period (1991-2014), the national income has increased 103%, while tax revenues have increased 184%. [1]

The federal government must build a consensus with state and local governments to promote a shift for a mature and better skilled economy. How to find the balance of inducing investments without compromising tax revenues and thus increasing the debt? The solution is probably the pursuit of a knowledge based society, one that collects revenues by dealing with the externalities[2] inherently produced by the economy.

Instead of augmenting the tax burden, Brazil needs to seek long-term economic growth in order to increase tax revenues. The key factors have proven to be innovation and productivity. The total factor productivity (TFP) was about 45% of United States' in 2011, even though it had reached 70% in 1996. The evolution of TFP for several countries can be observed in the figure below, all of them compared to United States:

FIGURE 2 – TOTAL FACTOR PRODUCTIVITY (TFP) LEVEL AT CURRENT PURCHASING POWER PARITIES COMPARED TO THE UNITED STATES OF AMERICA (INDEX=1) – FROM 1960 TO 2011. THE SHADED COLUMNS REPRESENT RECESSION PERIODS.



Source: FRED – Federal Reserve Economic Data (St Louis) | Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013), "The Next Generation of the Penn World Table". Available for download at www.ggdc.net/pwt.

[1] ALMEIDA JUNIOR, Mansueto; LISBOA, Marcos de Barros; PESSOA, Marcos. **O ajuste inevitável**. July, 2015.
[2] Externality is the cost or benefit that affects a third party who did not choose to incur that cost or benefit.

In a recent report, the Organisation for Economic Co-operation and Development (OECD)[3] argues that in order to obtain sustained development, developing countries need to enhance productivity and narrow their significant productive gap with advanced economies. While countries like Kazakhstan and Panama have increased their TFP recently - as it can be observed in Figure 2 - and are on track to reach OECD levels of average income by 2050, other middle income countries, such as Brazil, Mexico and Colombia, will take much longer considering their stagnated TFP - also observable in Figure 2 - and current growth rates. Mexico is an outstanding case because in 1980 its TFP was 1.3 indexed to United States', but due to oil prices dropping heavily and capital outflows, the economy was tossed to a crisis, followed by a turndown in productivity.

Figure 2 also highlights the TFP of Norway and Singapore, which have been consistently above United States' TFP in recent years (1.20 in 2011 with a peak of 1.47 in 2006 for the former; 1.07 in 2011 with a peak of 1.30 in 2007 for the latter). Switzerland also stands out for its productivity and Korea has provided a great increase between 1960 and 1990 (from 0.30 to 0.72), but has kept the average since then. Nevertheless, these countries have invested great deals in research and development, seeking for innovation and comparative advantages in global markets. Korea was one of the poorest countries after the Korean War and nowadays is one of the biggest and most innovative economies in the world.

The relations between productivity, R&D expenditures and high income per capita have been repeatedly addressed in textbooks and researches. The Inter-American Development Bank (IDB)[4] has recently indicated a strong correlation between TFP and per capita income, as well as a correlation between TFP and investment in R&D, in order to transitionally assume that there is also a positive correlation between R&D expenditures and per capita income, tying these three indicators as incubators of high social returns.

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

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

3. OVERVIEW OF THE CURRENT BRAZILIAN TAX SYSTEM: UNBEARABLE BURDEN

The Brazilian tax burden profile is mostly driven upon consumption of goods and services (51.28%), followed by payroll (24.98%), income (18.10%), property (3.93%), financial transactions (1.67%) and others (0.04%). The emphasis on consumption affects the low income earners by collecting revenues in a regressive way and interferes directly in the production and the allocations of resources. Payroll taxes have been overwhelming labor costs and causing an undesirable link between employment and government revenue.

In 2013, federal government collected about 68.92% of total tax revenues[5], while the 26 States and the Federal District[6] shared 25.29% and the 5,570 local governments took 5.79%. This picture denotes a weak federalism that takes away the power of regional authorities to handle local issues, as well as to create microeconomic environments to attract private investments. A reform towards decentralization is required.

In this section, the main taxes and levies that affect companies will be described and commented, regarding its effect on businesses, entrepreneurship, innovative endeavors and competition.

3.1 Federal taxes

3.1.1 Personal income tax (*Imposto de renda pessoa física - IRPF*)

It is levied on most kinds of personal revenue (compensatory payments, dividends and insurance payouts are exceptions). The rates are progressive and range from 15.00% to 27.50%, according to income brackets. There are some deductions, like limited medical and educational expenses. The taxpayers base is small (about 28 millions), since most of the population is exempted. One controversial point is that

[5] http://idg.receita.fazenda.gov.br/dados/receitadata/estudos-e-tributarios-e-aduaneiros/estudos-e-estatisticas/carga-tributaria-no-brasil/carga-tributaria-2013.pdf

[6] The Federal District is permitted to collect state and local government taxes.

dividends paid by companies are exempted from the tax base, although the interests paid on shareholders' capital is burdened with a rate of 15.00%. In 2012, the total amount of dividends earned by taxpayers was 208 billion BRL, while the net taxable earnings amounted to 965 billion BRL.

3.1.2 Corporate tax (*Imposto de renda pessoa jurídica - IRPJ*)

The tax base is corporate profit, which can be evaluated in three ways: real profit (net of costs, expenses and interests paid to shareholders and third parties), that is mandatory for companies with annual revenues over 78 million BRL; presumed upon the gross revenues; or arbitrated, in case of fraud or illicit procedures. The basic rate is 15.00%, but it is majored by an additional rate of 10.00% if the profit obtained is above 20,000 BRL per month of the evaluated period. The burden can be paid in a three monthly basis for all forms of evaluation or in a year basis for real profit evaluation.

3.1.3 Withhold income tax (*Imposto de renda retido na fonte - IRRF*)

Personal income paid by employers or earned at once and revenues earned by companies that provide services are taxable by withhold income tax. In the first case, the rates are the same from regular personal income, while in the second the rates are 1.00% or 1.50%. This mechanism transfers the responsibility to the payment source and allows the tax to be promptly collected. The adjustment form, once filled in, consolidates the calculation of due tax.

3.1.4 Social levy over net profit (*Contribuição social sobre o lucro líquido - CSLL*)

This is a special levy for financing the social security, although it could also be described as another additional rate of corporate tax, and is paid on a three monthly basis. The tax base is the net profit before provisioning for the corporate tax. The basic rate is 9.00%, but insurance and finance companies are burdened with a rate of 20.00%.

3.1.5 Industrialized products tax (*Imposto sobre produtos industrializados - IPI*)

It is due on operations that industrialize or manufactures goods, such as transforming, packaging, processing, assembling or renewing. It includes imported goods. Tax rates range from 0.00% to 300.00%, depending on the economic policy for each product. It is a non-cumulative tax, which means the taxpayer obtain tax credits on inputs that offset against the tax on outputs. Along with states value added tax, invoice levies and CIDE-fuels, it causes a multi-taxation on consumption and overburdens the value added to products.

3.1.6 Import tax & export tax (*Imposto de importação - II & Imposto de exportação - IE*)

Import tax is a tariff used for economic policy upon foreign competition. The tax rates are variable. However, during products or services import transactions, the importer must pay other taxes or levies: industrialized products tax and value added tax in case of products, or services tax in case of services, social levy for social security financing, social integration program levy, financial transactions tax and duty fees. The tax base for the value added tax includes all the other taxes summed. The tax base for the industrialized products tax includes the value for the import tax.

Export tax is also used for economic policies, but very few products are levied. The basic rate is 30.00% and can never be more than 150.00%. The tax base is the price the product would get in conditions of free international market.

3.1.7 Financial transactions tax (*Imposto sobre operações financeiras - IOF*)

It is due on credit, loan, exchange, bond, security and insurance transactions. Also used as a mechanism of economic policy. The basic rate is 0.38%, but for short term international loans the rate is 6.00%, and for insurance transactions it is 7.38%.

3.1.8 Invoice levies

It can be applied in a cumulative way (gross revenues) or in a non-cumulative way (costs, expenses, taxes and fees discounted) and must be paid monthly. Social levy for social security financing (COFINS) is burdened with a rate of 3.00% (cumulative) or 7.6% (non-cumulative), and social integration program levy/public server wealth program (PIS/PASEP) is burdened with a rate of 0.65% (cumulative) or 1.65% (non-cumulative). In case of financial revenues, the cumulative burden for COFINS is 4.00%. Besides indirectly burdening the consumption and affecting the economic decisions, the non-cumulative mode has raised a lot of judicial disputes for its lack of clear rules.

3.1.9 Payroll levies

It is applied on total amounts of wages paid to the workers, including some allowances, bonuses and premiums. The welfare system levy (INSS) is rated by 20.00% to employers (recently reduced to 8% in case of domestic employers), between 8.00% and 11.00% to employees and between 5.00% and 20.00% to freelancers. Labor accident risk levy (RAT) ranges from 0.50% to 6.00%, while the labor time warranty fund (FGTS) demands collections rated by 8.00%. A contribution for education is rated by 2.50% and, finally, a levy for entities that support the economic sectors (S System) is rated by 5.80%. Summing up, an employer may be bound to face an overwhelming rate of 42.30% applied to the wages of employees, apart from the employees' own rate.

3.1.10 Contribution for intervention on economic domain (*Contribuição de intervenção no domínio econômico - CIDE*)

There are two kinds of CIDE: one applied on remittances to foreign residents and companies overseas, such as royalties or payments for the use of patents, trademarks, licensed technologies, technical assistance and services delivery, which the rate is 10.00%; the other over the commerce and imports of fuels and its byproducts, which

has a per unit rate depending on the product. The revenues from the former are transferred to the National Fund for Scientific and Technological Development (FNDCT) in order to promote interactions between universities and companies, and to incentive innovation. The revenues from the latter are allocated to grant subsidies to ethanol, gas and petroleum byproducts industries, to finance transport infrastructure projects and environmental projects related to gas and oil industries.

3.2 State and local government taxes

3.2.1 Movement of goods and services tax (*Imposto sobre circulação de mercadorias e serviços - ICMS*)

This is the most important state tax, representing about 21% of Brazilian total tax revenues. It burdens each output in the supply chain, rather than being collected only at the final consumption stage. This value added tax is applied to all goods, but also to energy, interstate transportation and communication services. Companies get a full credit or deduction for payments on inputs, offsetting against the payments on outputs, so that the tax is continuously pushed to the final consumption, when the consumer will bear the full tax burden. It was introduced in Brazilian tax code in 1965, replacing a cumulative sales tax that had induced companies to produce and carry all the stages of production. However, it is by far the most complex tax to deal with, along with services tax from local governments, because in both cases each federative unit produces its own legislation, including different nominal rates and bases for same products. This combination has created almost 50 effective rates across outputs. In case of interstate transactions, the rate is lowered, so that the state where the final consumption occurs may charge the remaining rate.

The system of credits generates some big issues. Exports are immune to ICMS incidence, so exporter companies cannot take direct advantage of previously cumulated credits upon its output transactions. They must request refund and that is a tricky task, because a fiscal authority must evaluate the transaction chain before allowing it. The

process is usually slow and the payback is not financially updated by interests. Moreover, the painstaking is higher if the credits were generated in different states. Transferring the credits to other companies is constitutionally permitted but liable to goodwill, and some states have tried to create barriers for that, in order to avoid frauds. Other issue related to credits is that states provide tax benefits to attract companies, but the next company in the supply chain is not able to be fully credited in its input. These distortions cause unbalances between competitors, favoring bigger companies that have more capability to deal with accumulated credits.

Facing these contradictions, states have sought to simplify the monitoring. Tax substitution was the solution found, which consists in charging during the first stage of production chain the tax that would be charged through all its stages. The problem of early charging is that the value of subsequent operations is not known, so it has to be assumed. The fear of losing revenues led the States to assume slightly larger values of subsequent operations. As taxpayers started to require refunds when the subsequent operations were less valuable than the assumed, the States, again in fear of losing revenues, jointly denied them, based on the fact that they do not charge additional tax if the transaction occurs by greater value than the estimated. Many firms rushed to the courts, but have been disappointed, since the Supreme Court has ruled that states are not obliged to provide refunds if the subsequent operations are less valuable than the assumed. This decision is controversial and has been facing strong contest, also because it enables states to artificially increase revenues and dodge consequences of the Fiscal Responsibility Act.

3.2.2 Services tax (*Imposto sobre serviços de qualquer natureza - ISS*)

It is managed by local governments and applied to services that are not burdened by movement of goods and services tax (ICMS). The rates are established by each local government; however they must range from 2.00% to 5.00%, as determined by a federal law. As mentioned before, the fact that each federative unit creates its own legislation

puts the companies that are not restricted to one geographical area in complex situations to comply with the law.

3.3 The National Simple System (SIMPLES NACIONAL)

In 2006, the federal government implemented a simplified tax system for micro and small companies. It is called the National Simple System. Since 2012, the ceiling for their gross revenues is BRL 3.6 million. Under this system, federal, state and local taxes are paid through one single federal form and payment, and the revenues are transferred to other federative units. The rates are smaller and the tributary obligations are simpler to fulfill. The form includes: corporate tax (IRPJ); industrialized products tax (IPI) and movement of goods and services tax (ICMS) in case of products; services tax (ISS) in case of services; social levy on net profit (CSLL); social integration system/public server wealth program levy (PIS/PASEP); social levy for social security financing (COFINS); and employer's welfare system levy. There are several restrictions to the companies besides the revenues ceiling, such as: having another company as a partner or being partner of another company; being a branch, agency or affiliate of an international company; being a stock corporation; working in the finance, insurance, development, bond, security or banking markets.

Certainly, this kind of policy provides advantages for small entrepreneurs, since almost half of the 18.5 million companies registered in Brazil have being benefited with this simpler tax system, but also some disadvantages. When small business companies get next to the revenue ceiling and think of expanding their operations and revenues, the upcoming increases of tax burden and office work to comply with the general tax system may hold them back. This fact is enhanced if expansion plans are related to innovation and investment on research and development because the inherent risks will be increased. Another negative consequence of this system is that many entrepreneurs, with fraud intention, divide their capital in several establishments, simulating their operation in different companies and using fake partners to deceive the tax system.

Nonetheless, this simplified system clearly reveals that tax simplification is one important feature for all companies. And the benefits from this can be substantial. Brazilian companies spend an average of 2600 hours of work to comply with tax legislation, according to a research conducted by World Bank[7]. Brazil was ranked at last position, behind Bolivia, where companies spend 1025 hours of work for tax compliance.

The World Bank[8] also has concluded that a simpler tax system is shown to be associated with lower corruption in tax administration. Empirical findings show that "*the combined effect of a 10 percent reduction in both the number of payments and the time to comply with tax requirements can lower tax corruption by 9.64 percent. Similarly, the income level of countries plays an important role in determining the impact of tax simplification on tax corruption; specifically, the link is stronger for lower income level countries. The positive link between tax simplicity and lower tax corruption has useful policy implications."*

3.4 Legal uncertainty and red tape

Being able to predict all costs related to investments is essential for a more competitive economy. The Brazilian federal executive branch has been enacting provisional orders regarding text obligations, some of them majoring tax burden, without the due legislative process and proper time for companies to adjust procedures and reserve provisions. This mechanism, as constitutionally stated, should only be used for urgent and unpredictable topics. The legal instability caused by sudden increases in tax burden and the excessive delays in administrative procedures are two major sources of legal uncertainty, but there are others.

Every Brazilian federative unit has its own taxpayer reference database. It means that companies have to provide information for at least two databases about their operations, addresses, owners and so on. If the company operates in several states and cities (mixing goods and services) it must keep many databases updated, besides the

[7] http://data.worldbank.org/indicator/IC.TAX.DURS/countries
[8] AWASTHI, Rajul; BAYRAKTAR, Nihal. **Can Tax Simplification Help Lower Tax Corruption?** World Bank, Policy Research Working Papers, July 2014.

federal one. Another excessive workload is updating oneself about tax legislation, since new rules are published almost every day and frequently not compiled every year, as determined in the Constitution.

One final point to be highlighted is the addition of other taxes on a tax base, causing a cumulative effect that overburdens the taxpayers.

4. OVERVIEW OF INNOVATION STATUS IN BRAZIL: STILL LAGGING BEHIND

According to the Global Innovation Index[9], Brazil is the 70th most innovative country, although the total spending on R&D in Brazil ranks it in 10th position worldwide, slightly ahead of Canada, with USD 31 billion of Gross Expenditures on R&D (GERD) in 2013. Brazil's R&D spending accounts for more than 75% of the total R&D spent in South America. These statistics reflect a growing trend in Brazil for R&D investments over the past decade, when the rate increased from 0.90% to 1.30% of GDP between 2004 and 2013, while its economy has grown from USD 663.76 billion to USD 2.25 trillion during the same period, thereby increasing net R&D expenditures five-fold, even though carried out predominantly by the government. Most scientists work in public universities and research institutions, rather than in the business sector. Output indicators, such as the number of patents held abroad, suggest that there is much scope for improvement.

Despite the expenditures may seem substantial at first glance, the GERD per capita is still around USD 150, which indicates that the country is lagging behind when compared to countries like Switzerland, Germany, United States, Finland, Sweden, Japan or Korea, where GERD per capita floats between USD 900 and USD 1300.

The following tables 1 and 2 compare the expenditures in research and development and GDP per capita from Brazil and other countries, selected for their relevance to the context: big developing countries and developed economies that have invested great rates of their wealth in the production of new knowledge.

[9] **The Global Innovation Index** (GII) is an annual publication which features, among others, a composite indicator that ranks countries/economies in terms of their enabling environment to innovation and their innovation outputs. The GII surveys 143 economies around the world, using 81 indicators to gauge both their innovation capabilities and measurable results. Recognizing the key role of innovation as a driver of economic growth and prosperity, and the need for a broad horizontal vision of innovation applicable to developed and emerging economies, the GII includes indicators that go beyond the traditional measures of innovation such as the level of research and development.

TABLE 1 - TOTAL PERCENTAGE OF GDP EXPENDITURES IN RESEARCH AND DEVELOPMENT (2001-2013) - SOURCE: OECD AND WORLD BANK

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Brazil	1,040	0,980	0,960	0,900	0,970	1,010	1,100	1,110	1,170	1,160	1,210	1,300	1,300
China	0,951	1,070	1,134	1,230	1,325	1,388	1,396	1,470	1,702	1,759	1,836	1,982	2,083
Denmark	2,325	2,441	2,511	2,420	2,393	2,402	2,515	2,780	3,069	2,937	2,966	3,023	3,056
Finland	3,198	3,257	3,302	3,315	3,330	3,338	3,346	3,547	3,749	3,726	3,639	3,419	3,309
France	2,129	2,166	2,111	2,086	2,044	2,045	2,020	2,058	2,209	2,175	2,191	2,230	2,228
Germany	2,389	2,419	2,460	2,424	2,426	2,459	2,449	2,601	2,728	2,715	2,797	2,877	2,853
India	0,720	0,710	0,710	0,740	0,810	0,800	0,790	0,840	0,820	0,800	0,810	---	---
Israel	4,222	4,174	3,940	3,916	4,086	4,190	4,480	4,387	4,153	3,955	4,102	4,247	4,213
Japan	3,074	3,116	3,144	3,133	3,309	3,409	3,461	3,467	3,357	3,254	3,383	3,343	3,474
Korea	2,341	2,274	2,352	2,532	2,626	2,831	3,000	3,123	3,293	3,466	3,744	4,026	4,149
Mexico	0,353	0,391	0,389	0,394	0,404	0,373	0,368	0,404	0,431	0,455	0,426	0,432	0,501
Norway	1,562	1,631	1,680	1,545	1,483	1,456	1,565	1,556	1,724	1,651	1,628	1,620	1,654
Russia	1,178	1,248	1,286	1,151	1,068	1,073	1,116	1,044	1,252	1,130	1,091	1,125	1,123
Singapore	2,021	2,068	2,026	2,105	2,161	2,133	2,337	2,621	2,159	2,013	2,151	2,000	---
Sweden	3,914	---	3,614	3,391	3,390	3,500	3,257	3,495	3,416	3,216	3,224	3,281	3,302
Switzerland	---	---	---	2,677	---	---	---	2,729	---	---	---	2,964	---
USA	2,638	2,550	2,553	2,490	2,506	2,550	2,627	2,767	2,819	2,740	2,763	2,698	2,725

TABLE 2 – GDP PER CAPITA (TOTAL GDP DIVIDED BY MIDYEAR POPULATION) – US DOLLARS (2001-2013)
SOURCE: OECD AND WORLD BANK

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Brazil	3.136	2.810	3.044	3.598	4.733	5.809	7.241	8.700	8.462	11.124	13.042	11.922	11.711
China	1.047	1.141	1.280	1.498	1.740	2.082	2.673	3.441	3.800	4.514	5.574	6.264	6.991
Denmark	30.751	33.228	40.458	46.487	48.816	52.041	58.501	64.182	57.895	57.647	61.304	57.636	59.818
Finland	24.913	26.834	32.816	37.636	38.969	41.120	48.288	53.401	47.107	46.205	50.787	47.415	49.310
France	22.527	24.275	29.691	33.874	34.879	36.544	41.600	45.413	41.631	40.705	43.807	40.850	42.627
Germany	23.654	25.170	30.318	34.120	34.650	36.401	41.762	45.632	41.671	41.725	45.867	43.931	46.255
India	461	481	558	641	729	817	1.050	1.023	1.124	1.388	1.472	1.450	1.455
Israel	20.126	18.246	18.755	19.682	20.378	21.581	24.606	29.268	27.583	30.551	33.275	32.514	36.050
Japan	32.716	31.235	33.690	36.441	35.781	34.076	34.033	37.865	39.322	42.909	46.203	46.679	38.633
Korea	11.255	12.788	14.219	15.921	18.657	20.917	23.101	20.474	18.338	22.151	24.155	24.454	25.997
Mexico	6.952	7.023	6.673	7.115	7.894	8.680	9.223	9.579	7.661	8.861	9.730	9.721	10.200
Norway	37.786	37.726	38.991	43.202	48.370	54.720	56.901	62.421	56.205	58.775	62.738	66.358	65.635
Russia	2.100	2.375	2.975	4.102	5.323	6.920	9.101	11.635	8.562	10.675	13.323	14.078	14.487
Singapore	21.577	22.017	23.574	27.405	29.870	33.579	39.223	39.722	38.577	53.122	54.578	55.980	56.287
Sweden	26.969	29.571	36.691	42.442	43.085	46.256	53.324	55.746	46.207	52.076	59.593	57.134	60.364
Switzerland	38.538	41.336	47.960	53.256	54.797	57.348	63.223	72.119	69.672	74.277	88.002	83.295	84.733
USA	37.273	38.166	39.677	41.921	44.307	46.437	48.061	48.401	47.001	48.374	49.871	51.456	52.980

Although GDP per capita may be considered a measure that lacks accuracy, it is a proxy able to depict the gap between developing countries like Brazil and the developed countries with R&D intensive activities.

From all the data exposed, it is possible to notice that Israel and Korea are major investors in R&D in relative amounts to GDP (over 4%), while countries like Denmark, Sweden, Finland, Switzerland, Japan and Germany present substantial investments. Norway and Singapore, however, stand out from this picture, since both are major players in the productivity and innovation game, as seen before, have a high income level and present smaller, although regular and consistent R&D expenditures (about 2% of GDP). This inference clearly denotes that there are other factors to be considered.

Fagerberg and Srholec (2008) suggest that the explanation for this difference may be that innovative countries have well-developed social and technological capabilities for exploiting knowledge, identifying a series of measures to indicate a propensity to innovate, such as: number of scientific publications and patents; openness to trade; foreign direct investment; research cooperation and alliances with foreign partners; technology licensing; immigration; compliance to international standards (ISO) and total quality management (TQM); lean and just-in-time production; information and communication infrastructure; access to bank credit, stock-market and venture capital; primary, secondary and tertiary education; managerial and technical skills; perception of corruption, law and order; independence of courts; property rights; business friendly regulation; civic consciousness; trust, tolerance and religious ethics; attitudes towards technology. The conclusion is that innovation is inherent to a mature society, one that looks forward to climb the next step. As mentioned before, taxation policies must be embedded in a new perspective and tied to other policies to induce innovation. Financial markets, empowerment of institutions, liberation of economy, education and labor training must be dealt with a firm grasp as well.

After this comparison with other economies, in order to take back the current innovation status in Brazil, it is possible to cite two main tax incentives to innovation offered by the federal government. The most known and widespread is found in Chapter III of Law 11196/2005. It authorizes the federal government to grant tax incentives to companies that perform technological innovation. The incentives include:

- Deductions on corporate tax (IRPJ) and social contribution on net profit (CSLL) of expenditures on R&D and on any technological research that has been granted a patent or a register of new variety of genetically improved plant species;
- 50% break on industrialized products tax (IPI) levied on equipment, machinery and instruments (domestic or imported) intended only for technological research and development of technological innovation;
- Full depreciation of machinery, equipment, devices and instruments for use in R&D activities during the calculation of taxable profit (corporate tax and social contribution on net profit) for the year of acquisition;
- Accelerated depreciation of intangible assets upon deduction as operational expenditures, as long as they are tied exclusively to technology research and development of technological innovation;
- Zero tax rate on withhold profit sent abroad for registration and maintenance of trademarks and patents.

The other tax incentive provided by the federal government to encourage investments in innovation is a sequence of IT Laws (Laws 8248/1991, 10171/2001 and 11077/2004), which offer brakes on industrialized products tax to the hardware industry and to the automation in the domestic industry. Software applications are not benefited because there is no incidence of this tax on them. The percentages range from 80% to 100% and will be progressively reduced from 2014 to their demise in 2019. To take hold of the benefits, the company must invest in R&D from 4% to 4.35% of annual turnover with incentive products, depending on the region in which is located.

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

For non-reimbursable financing, there are two major related programs. The first is operated by Financing Authority for Studies and Projects (FINEP), which is an organization linked to Ministry of Science, Technology and Innovation, and the major supporter of innovation nationwide. It works in partnership with companies, institutes and research centers to support innovative governmental agencies, international

multilateral agencies, investors and third sector entities. Its resources are allocated to projects in the areas of information and communication technologies, biotechnology, health care, national defense, public security, energy and social development. The other non-reimbursable subsidy is provided for companies that hire teachers and doctors to work on technological innovation activities. The grants range from 40% to 60% of researchers' wages, according to the region in which the company is located. The maximum term of the grant is three years.

The second type of subsidy - reimbursable funding - is provided by institutions like FINEP and National Bank for Economic and Social Development (BNDES), which finance projects with interest rates that vary according to the specific credit line.

Finally, there are 16 Sector Funds, which are managed by FINEP and funded by revenues from industrialized products tax (IPI), contribution for intervention in economic domain (CIDE) and royalties due to the exploitation of natural resources. These resources are allocated to technology centers through public calls. The companies get the benefit of a reduction in R&D costs, since they rely on partnerships with universities and research institutes that receive these funds.

Regarding public policies to foster green practices and sustainable development, some few measures have been implemented in recent years, such as some grants or exemptions for conservancy or less destructive production in rural areas, environmental compensations, but they are not substantial or connected to higher innovative proposes. Other policies were proposed but not implemented yet, awaiting Congress approval or regulation, such as the ecological income tax (IR) scheme, which would set a tax deduction for expenses on projects with an environmental benefit.

Although not widely used by companies all these incentives reflect a step towards innovation and environmental improvements. The key is to enhance those tax and fiscal mechanisms to encourage technological changes. Incentive policies can be important tools for the development of new sources of renewable and cleaner energy, for instance, which is a field that encompasses innovation and green technology. Brazil needs policies that define what will be the energy portfolio in the future. The government has not given any medium or long-term signals to investors or consumers.

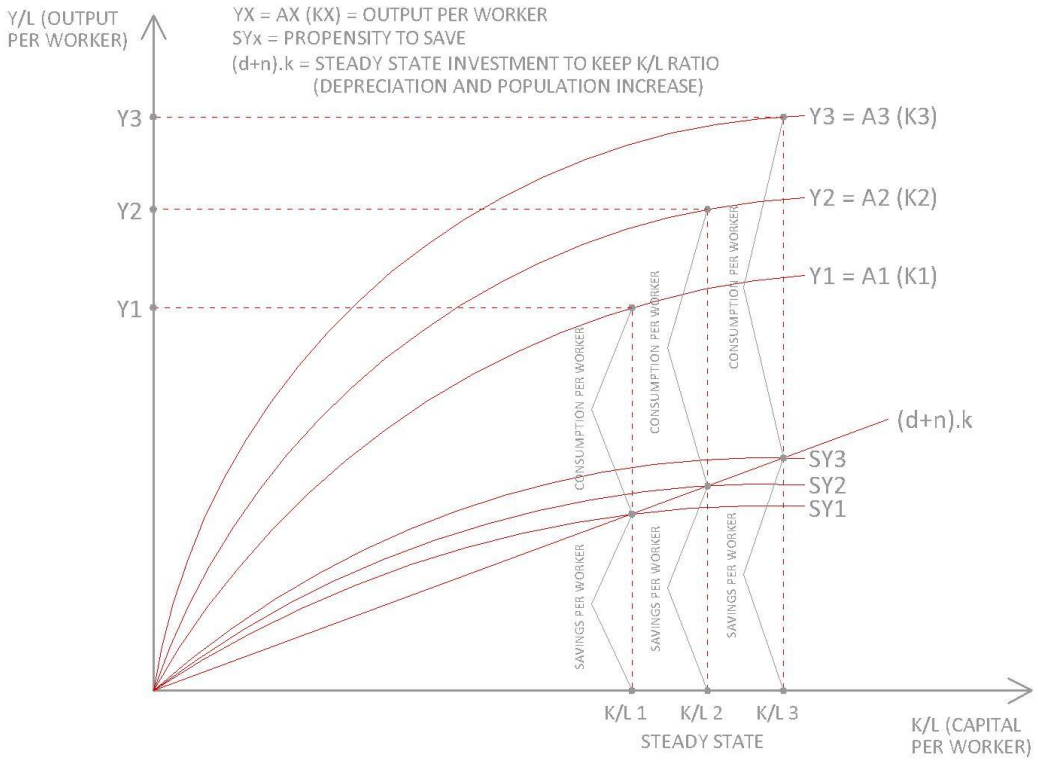
5. INNOVATION AND LONG-TERM ECONOMIC GROWTH

Economic growth is likely to occur as a result of four different processes, which can be isolated or combined: investments (gross fixed capital formation); commercial expansion (gains from domestic or international trade); scale or size effects (population increases, demographic bonuses, concentrated efforts to overcome indivisibilities or to reduce costs); and increases in the stock of human knowledge (technological processes, changes in institutions).

Any of these processes may be induced by public policies; however the most effective of them in the long run is the production of knowledge. Investments, commercial expansion and scale or size effects are able to leverage the social welfare in the short run, considering the current technological possibilities. Innovation and new knowledge, at the same time, breakthrough the technical restraints and create new cornerstones, new markets, engendering or being engendered by the so called dynamic competition, in which companies fairly compete and seek for differentiation, constantly aiming at a new monopoly. This dynamics is the real engine of economic growth.

Robert Solow (1956) have sought to understand the gap between wealthy and poor nations and developed a growth model based on the neoclassical economic theory, starting with the production function $Y = A \cdot F (K^{\alpha}, L^{1-\alpha})$, where Y is the output, A is the total factor productivity or the technology used, K is the capital stock, L is the number of workers available and α is the elasticity of output in relation to capital. The equation assumes that $0<\alpha<1$, since every marginal unit of capital or labor increases the output with diminishing returns to scale. The exogenous Solow model takes the productivity as given and analyzes investments, capital, output savings and consumption per worker, instead of its total values. It also defines that without changes of productivity, the economy demands investments only to keep the capital per worker ratio, considering the effects of depreciation of capital and increase of population – (d+n).k – and reaching a steady state in the long run, with savings, investment and consumption per worker constant.

FIGURE 4 – REPRESENTATION OF SOLOW GROWTH MODEL



If a new technology is introduced and the output per worker is increased, the propensity to save and to consume will also increase, and the economy will need to become more capital intensive, shifting towards a higher capital per worker ratio. As a result, a new steady state is achieved. The theory is useful to understand the effect of productivity growth on an economy, but it does not explain the dynamics underlying this essential element.

Endogenous growth theory advanced the Solow Model by embracing one concept of evolutionary economics: knowledge as a key factor. Spillover effects and appropriability issues were approached and policies were suggested: openness, competition and technological change to promote growth and deal with a system in constant flux, since new waves of innovation replace older ones, destroying established positions and demanding new allocations for the factors of production. Innovation occurs in cycles and forecasting the right moments when there are transitions will probably toss the first economies to perceive them to a higher state of economic and

social welfare. Conversely, policies that restrict or hold back change by protecting existing industries are likely to slow growth over time.

Upon this context, public sectors need to constantly promote competition and reinforce intellectual property rights. There are many cases of incomplete appropriability within the coverage offered, since it is always limited, especially when dealing with broad scientific knowledge that underpins technological innovations. Also there is a constant tension between competition and intellectual property rights, since the first seeks to avoid market power concentration and the second provides a property right that can lead to a substantial market power. Antitrust policies should eradicate anticompetitive conducts instead of simply outlawing monopolies, granting concise returns to innovation.

The fact to be highlighted is that the innovative agent is capable of promoting technological discontinuities that impact throughout the production chain. Managerial skills are developed to notice and capture new information, while the technological adoption promotes the diffusion process. Hence it is not surprising to observe a rising trend for R&D tax incentives and direct subsidies to encourage innovators and promote competition, especially between OECD countries.

5.1 Information asymmetry, moral hazard and information as public good

If innovation and knowledge are so important for the social welfare of a nation, why are both undersupplied and why does the innovation market need to be intervened by the government? There are three peculiar characteristics that lead this market to not achieving its socially optimal point and to generate deadweight losses:

- Information asymmetry: private financing institutions and investors do not get enough information about the projects and therefore are not able to properly measure risks. As a result of this perception of enhanced risk, the costs of loans are higher or simply not available. If the firm has enough cash flow and decides to use its own resources, it will choose the less risky projects, but generally the most risky ones have the potential to be more disruptive and innovative.

- Moral hazard: this feature is partly linked to the former. The motivation of managers or scientists and engineers is always uncertain for whoever invests in their work on R&D. Incompatibility between owners and R&D employees causes agency costs (when two parties have different interests and the agent has more information, so the owner cannot directly ensure that the agent is acting in his or her interest). An example is when managers invest in expanding the company to hinder operations and get higher wages, instead of investing in efficiency to increase share value. Another is when the R&D employee is not motivated enough to conclude the research or has secret interests.

- Information as public good: knowledge can be described as a non-excludable and non-rival good. If it is not possible to get all the returns associated with knowledge creation because it cannot be restricted and ends up spilling over the society and their competitors, potentially innovators will most likely avoid investing the socially desired amount. The spillover effects are even higher for basic research, even though its generic aspect may provide background to develop major innovations, which provide the highest social returns.

Arrow (1962) discusses inherent uncertainty and sub allocation of resources regarding innovation and R&D. The economic system has devices for shifting those risks, such as insurances, but they are limited and imperfect, inevitably leading to underinvestment. While it is worth to enlarge the variety of such devices to some extent, the moral hazard factor creates a limit for their potential, since researchers may not have the proper incentive to break through new grounds if there is any security scheme backing up possible failures.

5.2 Entrepreneurship, competition, externalities and price system

As pointed out and emphasized by Friedrich Hayek (1945), it would be nearly impossible to organize a capitalist economy without decentralization of information and decisions: *“If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these*

circumstances, who know directly of the relevant changes and of the resources immediately available to meet them." However, everything that happens anywhere might affect decisions to be taken, producing patterns of change to the larger economy. The price system is the mechanism to convey in the most efficient way the most relevant parts of the information. All market participants can have straightforward data to arrange their decisions, and therefore the whole problem is solved by "*constructing and constantly using rates of equivalence (or 'values', or 'marginal rates of substitution'), i.e., by attaching to each kind of scarce resource a numerical index that cannot be derived from any property possessed by that particular thing, but which reflects, or in which is condensed, its significance in view of the whole means-end structure. In any small change he will have to consider only these quantitative indices (or 'values') in which all the relevant information is concentrated; and by adjusting the quantities one by one, he can appropriately rearrange his dispositions without having to solve the whole puzzle* **ab initio***, or without needing at any stage to survey it at once in all its ramifications."*

Having confidence in the economy's ability to absorb and convey information, so that it can flow among producers and consumers, or in other words, relying in its effectiveness to respond with adjustable and correct prices to the specificities and changes of each market, is one essential feature to promote competition and entrepreneurship. This confidence raises the belief in the fruitful presence of entrepreneurial force and encourages the instinct to produce, innovate and create.

Therefore, the underneath logic of pricing system leads to the conclusion that every resource, input, output or production factor must be correctly priced, including negative externalities that are not internalized as costs by companies, such as pollution, and positive externalities that are not fully rewarded, such as knowledge and innovation. By doing so, economies may expect to enforce property rights to consumers, citizens and producers individually and jointly, and therefore to create a fertile environment for innovation and enhanced productivity.

5.3 Creative destruction and specialization in global markets

According to Joseph Schumpeter (1942), creative destruction refers to a "*process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one*". Hence, capitalist economic growth must be an evolutionary process based on cycles of creative destruction - the endless overlapping of technologies and organizational structures between business cycles. He stated that even within imperfect competition, large oligopolistic firms[10] have to face unknown threats and struggle to stand over grounds that seem to erode and rebirth suddenly. Potential rivals, known or unknown, present a major source of uncertainty.

Both entrepreneurship and competition are intrinsically related to creative destruction. Innovators introduce new products and technologies with a clear goal of profit maximization. New goods and services or new firms and industries compete with former ones in the marketplace, prospecting customers with lower prices, better performance, updated styling, faster service, more convincing marketing and so on. In a seemingly contradictory feature of creative destruction, the pursuit of self-interest engenders the progress that takes society to higher living standards. Producers survive by increasing productivity through new processes or creating valuable products that break through new grounds. Companies that do not keep up with the process eventually shut down. Revisiting Adam Smith's theory[11], the invisible hand moves resources from declining sectors to more valuable ones, leading workers, inputs and capital towards highest returns. This free and constant flux is the key to achieve economic progress.

Unfortunately, in developing countries like Brazil, this sort of natural selection within business and industries is not suitably carried on. The immediate effects of lost

[10] In his early work (1934), Schumpeter argued that innovation is promoted by the presence of innovators outside the firms. Later, in 1942, he stated that innovation is an endogenous process that occurs from large oligopolistic firms. This change in his focus may be attributed to the marked rising of large companies during World War II, when the demand for new military devices and reconstruction of cities was largely increased.

[11] The invisible hand refers to the self-regulating nature of the marketplace in determining how resources are allocated based on individuals acting in their own self-interest. The expression was used by Adam Smith's book "The Wealth of Nations", published in 1776.

jobs and shuttered companies are frequently avoided, while the long term payoff from the efficiency of creative destruction is unattained. The cost of keeping inefficient producers is high to consumers (inflation) and taxpayers (tax benefits and subsidies). The outcome leads to stagnation: resources take longer to be reallocated in response to new market demands.

The whole picture above was already evident after World War II and has been enhanced with globalization and worldwide competition. Firms are no longer self-sufficient; they have to do internally what they do best and outsource the rest, being part of a supply chain. The competition levels are overwhelming and the best strategy has been the engagement of alliances and partnerships in order to share risks, costs and uncertainties.

In global markets, the establishment of core competencies becomes essential. Firms need to be arranged in blocks of specialized partners that promote synergies and share resources. This flexible strategy allows them to accelerate returns in extremely dynamic markets, attain legal and political advantages in host countries and unbundle portfolios of assets to a safe cross-fertilization of ideas.

Governments should be part of this process by establishing strategies, fostering cooperative alliances and clusters of innovative enterprises, providing a suitable framework for innovation and competition, or in other words, making sure that there are no barriers for competitors to innovate and entry specific markets. A competitive tax system is one important feature that leaders can rely on.

5.4 Scale and scope effects on innovation

Innovation is an undersupplied good because its positive externalities are not fully appropriated and charged by the suppliers, leading the social welfare to a deadweight loss. Governments ought to rely on their prerogatives in order to converge interests, organize markets that present failures and tackle systemic failures across the economy. One efficient way to do this is fostering cooperative endeavors (scale effects)

and multidisciplinary or complementary projects (scope effects). Scale and scope effects might be able to dilute risks towards innovation.

As pointed out by Vonortas (2009), there are three main reasons for increasing returns with scale effects, and thus decreasing long-term average costs:

- Specialization: a finer division of labor leads to an optimized effort to innovate;
- Dimensional effects: larger units of capital produce disproportionally more results than smaller units;
- Indivisibilities: some inputs are available only in certain minimum sizes or portions, such as professional management and strategic planning.

Furthermore, scale effects offer more chances of interaction between researchers. On the other hand, there is one main possible reason for decreasing returns and increasing long-term average costs with scale effects: coordination and control complications of large-size operations.

Regarding scope effects, the idea is that the same research project can deal with different subjects, providing cross-fertilization of ideas under the same management, equipments and skills, or at least some of them. If the cost of dealing with two or more subjects at the same project is smaller than dealing with them separately, there is economy of scope. Multiproduct companies have a greater chance of capturing returns from discoveries, including those attained by basic research.

Although treated as different, scale and scope effects in research projects tend to occur together and end up promoting synergies and knowledge exchange between researchers and teams.

5.5 The role of the government in inducing innovation

In order to be a technology leader economy, R&D must be one of the most important investments for a country. During a technology cycle, the highest income goes to the countries that first rise, attaining bigger surpluses and higher purchasing power. Imitation strategies work relatively well during the consolidated phase of an innovation, but are only able to raise the income from that point, missing the earliest and most

generous income from the disruption. After a certain point, the spillover effects cause a great convergence and thus a demand for a new cycle. The reluctance must be overcome and the risk from the transition must be borne. At this moment, to raise R&D efficiency, corporations increasingly require access to R&D conducted by others. That is why the scale and scope effects stimulated and coordinated by an active government is essential to maintain an effective R&D network and attract global funds. This effectiveness is directly proportional to the value added to products and services and hence to the economic growth.

Since information is an intangible asset, it faces issues of unappropriability and indivisibility on the production side and uncertainty on the demand side. Knowledge is easily transmitted from its creator to prospective rivals and can be embodied in new processes and products at relatively low cost. Appropriable rewards may not be enough to justify innovative efforts.

The positive externalities inherently spilled over by innovation are difficult to handle by the forces of market themselves. Domestic companies do not easily feel encouraged to invest on innovation. That is why the government should intervene in this context and provide a tax system and tax incentives that are capable of attracting foreign direct investments (FDI) from multi-national companies (MNC) engaged in innovation development. The outcomes may include: boosting GDP and long-term economic development; increasing tax revenues; enhancing expertise and knowledge across the society; fostering competition between domestic firms and technology spillovers with multiplier effects; establishing forward and backward linkages in the supply chain between the MNC and domestic firms.

5.6 The role of the government in promoting environmentally friendly practices

Spillover issues apply equally to negative externalities generated by economic activities, such as pollution, greenhouse effects and other environmental damages. In this case, forces of market are unable to charge polluters and damagers for their social costs. Innovative processes concerning environmental management are required more

and more nowadays, as well as mechanisms that force polluters to internalize externalities and account for social costs. Upon this scenario, OECD (2010) states that:

> *Taxes on pollution provide clear incentives to polluters to reduce emissions and seek out cleaner alternatives. By placing a direct cost on environmental damage, profit-maximizing firms have increased incentives to economize on its use, just like other inputs to production. Compared to other environmental instruments, such as regulations concerning emission intensities or technology prescriptions, environmentally related taxation encourages both the lowest cost abatement across polluters and provides incentives for abatement at each unit of pollution. These taxes can also be a highly transparent policy approach, allowing citizens to clearly see if individual sectors or pollution sources are being favored over others.*

Facing this context, countries like Canada, Sweden, Australia, Ireland, Chile and Germany have promoted some levels of green tax shift or ecological taxation. Carbon tax has been proven to be one of the most effective attempts. Carbon is a component of every hydrocarbon fuel (coal, petroleum and natural gas) and once burnt, carbon dioxide (CO_2) is released, which is a greenhouse gas (GHG) that may cause a negative externality on the climate system, as opposed to non-combustible energy sources like wind, sunlight, hydropower, geothermal or even nuclear. However, there are other GHG emitted by economic activities, such as methane, nitrous oxide and sulfur hexafluoride. Therefore, a tax on all of these emissions could be levied at any point in the production cycle, imposing to emitters the full social costs of their actions. Taxes are usually more efficient than regulatory constraints, since the effects on price system are similar, but the revenue collection enables the government to finance its expenditures and provide direct incentives for companies to innovate in the management of resources.

Across all Brazilian corporative and household activities, there is an estimate that 3.24 billion tons of CO_2eq (equivalent carbon dioxide)[12] will be emitted in 2020[13]. A volunteered target to diminish these emissions to 2.07 billion by the same year was

[12] **Equivalent carbon dioxide** (**CO_2eq**) is a measure for describing how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide (CO_2) as the reference. Equivalent CO_2 (CO_2e) is the concentration of CO_2 that would cause the same level of radioactive forcing as a given type and concentration of greenhouse gas. Examples of such GHG are methane, perfluorocarbons, nitrous oxide and sulfur hexafluoride.

[13] http://www.mct.gov.br/upd_blob/0235/235580.pdf

settled within the Intergovernmental Panel on Climate Change – IPCC. Besides that, the Brazilian total energy mix[14] produced 305,6 MToe[15] (millions of tonnes of oil equivalent) in 2014, and it was based on petroleum (39.40%), sugarcane and byproducts (15.70%), natural gas (13.50%), hydropower and electricity (11.50%), firewood and vegetal coal (8.10%), mineral coal and byproducts (5.70%), uranium and byproducts (1.30%) and others (4.70%). Regarding only the generation of electricity, hydro electrical decreased from 70.60% in 2013 to 65.20% in 2014 (including imports from Itaipu power plant), as a consequence of drought, compensated by increases in sugarcane, wind, oil, coal and gas. Hydro electrical energy although renewable and GHG emission-free causes social and environmental damages. Renewable, non-combustion and clean sources like solar, geothermal and wind power, however, are still underused in Brazil (about 2.00% aggregate) and therefore need incentives to be further exploited.

Electronic waste recycling should also be tackled by governments, imposing fees on new purchases of electronic products. The fees should be used to pay for the future recycling of these products, as many contain hazardous materials, and to stimulate the industry to perform R&D for diminishing the impacts. Same idea should be applied to vehicles and factories that emit toxic gases like carbon monoxide, which increase public health expenditures. By providing incentives for companies and households to pollute less, government leaders become able to establish direct environmental policies that represent a necessary counter balance for long-term and sustainable economic growth.

6. KEY GOALS TO BE AIMED AT WITH A TAX REFORM

Considering the current tax system and innovation policies, and taking as a reference the conceptual background depicted in the previous section, the following goals were defined to support guidelines for a tax reform:

[14] http://www.mme.gov.br/documents/1138787/1732840/Resenha+Energ%C3%A9tica+-+Brasil+2015.pdf/4e6b9a34-6b2e-48fa-9ef8-dc7008470bf2

[15] The **tonne of oil equivalent** (**toe**) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil. It is approximately 42 gigajoules, although as different crude oils have different calorific values, the exact value is defined by convention; several slightly different definitions exist. The *toe* is sometimes used for large amounts of energy. 1 toe = 11.63 megawatt-hours

- ✓ Promoting a green tax shift to collect revenues from negative externalities produced by economic activities. As a counterpart, providing tax cuts to enhance competitiveness and incentives to foster innovation.
- ✓ Providing a favorable and steady taxation system to attract companies that are capable of generating higher value added goods and services and thus increasing Brazilian participation in global supply chain.
- ✓ Seeking long-term foreign direct investment, technology spillovers and domestic competition.
- ✓ Diversifying exports towards more valuable goods and services and less dependence on commodities.
- ✓ Reducing red tape, unfair costs and legal uncertainty.
- ✓ Easing people and capital mobility.
- ✓ Promoting cooperation and alliances, eliminating duplicated work and research.
- ✓ Creating standards and homogeneous markets.
- ✓ Converging Brazil towards developed economies by absorbing manufacturing technology from external sources. Building internal capabilities and comparative advantages to achieve competitiveness.
- ✓ Enhancing the current innovation policies by defining conditions for eligibility and consequently optimizing tax benefits or direct subsidies.

Economy of innovation puts knowledge and technology on the center of long-term economic growth, aiming at the rise of productivity instead of simply at the accumulation of capital. An endogenous model favors advanced manufacturing, which has increasingly demanded interdependencies and global supply chains supported by a complex network of research, education and finance infrastructures. Economies of scope and cooperation have become key concepts.

How could Brazilian government proceed in order to organize alliances and foster this competitive cooperation? An important step is providing simple, clear and fair taxation system that avoids overburdening entrepreneurs and innovators and opens the economy to cross-fertilization of capital, investments, technologies and human capital.

By doing so, the environment for innovation can be ignited and dialogues can be opened to boost competition, entrepreneurship and better allocation of resources.

Moreover, by affecting the structure of input prices, or otherwise changing the opportunity costs associated with the use of knowledge and natural resources, incentives are offered for companies to seek improvements in their production technology. Since markets often fail to put a price on these inputs and outputs, the price of many assets ends up to a large extent being formed by government interference. As a collateral effect, the revenues collected by raised prices on negative externalities can be used to counterbalance a shift in the tax system and promote positive externalities and innovative endeavors with financial support.

7. SUGGESTED GUIDELINES FOR A TAX REFORM

In this section, some guidelines for a tax reform are suggested, based on the concepts and discussions carried out and the key goals defined. As a rule of thumb, the guidelines implicitly convey that the total tax burden would remain approximately the same, since this research does not approach the decreasing of government expenditures, although it is strongly recommended. Notwithstanding this limitation, one main shift was sought: a more competitive tax system for the global markets, able to attract FDI and innovative corporations to generate technology spillovers into Brazilian economy. Other two supplementary shifts were sought: towards a stronger federalism with the increase of states and local governments' share and towards a tax burden profile less concentrated in consumption and payroll and extended to negative externalities produced by companies.

The proposal approaches specific taxes but also includes some general measures to mitigate legal uncertainty, red tape and costs for tax compliance. Most of the changes require constitutional amendments:

a) Implementation of a single value added tax managed by the states, in substitution to the following taxes driven upon consumption: movement of goods and services tax (ICMS), industrialized products tax (IPI), invoice levies and contribution for

intervention on economic domain (CIDE) over fuels. One single non-cumulative tax levied on value added to goods, transportation and communication services, for the sake of diminishing the tax burden on consumption, abolishing the multi-taxation and simplifying compliance procedures. This tax should be regulated by a federal supplementary law that establishes uniform rates, bases and exemption conditions for all states. By doing so, federal government would remain able to interfere on economic policies regarding specific products. A basic rate should be established for most products, but one majored rate could be defined for products like tobacco and alcoholic beverages and one minored rate for products from market basket. For interstate transactions, two different rates in order to keep tackling regional inequalities. The same supplementary law should establish the types of tax incentives that states may use once approved by majority of National Treasury Council, as well as the penalties for those who do not comply with this command, such as forbidding the violator state to contract loans with sovereign guarantees and levying the benefited company with the due tax plus fines and interests. The key is to allow fiscal competition, but disallow fiscal war.

b) Prohibition of tax base reduction for value added tax in order to avoid many effective rates, except for companies under the National Simple System and when taking advantage of credits from interstate operations with tax benefits. The following companies on the supply chain must be always entitled to be credited from inputs in order to avoid cumulative burden.

c) Enacting a new supplementary law to standardize rules, bases and rates for the services tax (ISS) among all local governments.

d) Merging the corporate tax (IRPJ) and the social contribution on net profit (CSLL) into a single corporate tax with phased decreasing to a final rate of 15.00% in the general system, instead of the current 34.00%. As a counterpart, including dividends paid by companies in the personal income tax base with the top rate of 27.50%, and maintaining the tax rate for the payment of interests on shareholders' capital in 15.00%. In the first case, to avoid bi-taxation, the shareholder should be allowed to use a

proportional credit from the corporate tax previously paid, and the company should be responsible to withhold the due tax. In the second case, the company should remain entitled to deduct the interests paid from its own tax base and responsible for withholding the due personal income tax. This trade-off between corporate and personal income tax would be almost balanced out, although the effect on corporate investments and competitiveness in domestic and global markets would be positive.

e) The government has recently proposed an Act for regulating the repatriation of non-declared corporate and personal income held overseas, according to which the taxpayer would have to bear a 17.5% income tax rate and a 17.5% fine. The tax revenue from this is estimated to be between 100 and 150 billion BRL and, once approved, could be used to compensate losses with industrialized products tax (IPI), invoice levies and also the corporate income tax (IRPJ), supporting its phased decreasing.

f) Increasingly broaden the National Simple System to reach companies with annual revenues up to the revenue floor for the real profit calculation on the general system (currently 78 million BRL), so that all companies with presumed profit calculation are benefited with this simpler taxation. By establishing brackets with progressive rates for all the taxes included in the system and making sure that the total tax burden in the last bracket is close to the one on the general system, it will continuously encourage investments and innovation between domestic firms. The base for the bundle of taxes is to be presumed by applying a specific percentage over the gross revenues, according to the type of economic activity (commerce, industry or services).

g) Implementation of environmental impact taxes, such as a carbon tax with a per unit rate for each ton of equivalent carbon dioxide and carbon monoxide emission. Considering only the former, if a rate of 150 BRL per ton is applied to a total emission between 2 and 3 billion tons of CO_2eq, the annual revenues could amount to between 300 and 450 billion BRL. These new taxes should be based on five principles: revenue neutrality (compensation for tax cuts and exemptions for low incomers), phased implementation, health and social security protection for families, broad coverage and

raising revenues for a sovereign wealth fund. The taxes should be jointly managed by federal and local governments, combining efforts to monitor the impacts in every sector and to collect the tax. The split could be 30% for local governments and 70% for the federal government. Every federative unit could choose the best way to apply its revenues, but the federal government should allocate part of the resources to the sovereign wealth fund. These taxes would represent a great incentive for companies to innovate in their production and use environmentally friendly technologies, mainly regarding renewable energy and waste products and at the same time the revenues could subsidize or finance innovative domestic firms.

h) The sovereign fund mentioned in the previous item should be directed to investments in stock and bond markets to generate wealth and help to pay pensions for current and future generations, providing long-term returns, transparency and governance. In addition, by partnering and fostering domestic innovation with subsidies, loan guarantees and venture capital, it should be an important mechanism to realize domestic innovation policies. Moreover, it could provide financial services for research institutes and joint ventures between universities and companies, such as selling bonds and securities linked to innovation projects and enterprises. Alternatively, companies could buy options of patents and copyrights to be produced by these entities, so that the risks are diluted between several players. By holding options and thus providing resources for the research to be conducted, companies have preference of purchasing the technology and lower royalties to do so in case of success, or smaller losses in case of failures.

i) Defining additional rules for companies to be entitled to the tax benefit regarded in Chapter III of Law 11196/2005, which authorizes the federal government to grant tax incentives to companies that perform technological innovation. The mentioned law should allow the benefit to be divided between companies that form alliances to perform R&D. However, the law that grants the benefit should state some conditions to eligibility: MNC that keep facilities and assets in Brazilian territory are eligible but bind to

contract with a minimal percentage of local suppliers and hire a minimal quantity of Brazilian workers; managers and researchers must be at least partially paid with shares, so that the agency costs and moral hazard are minimized; employees must be given the option to buy shares with discounted price (employee stock purchase plan) in order to increase efficiency and diminish payroll costs; corporate bylaws should include restrictions to buyout (antitakeover clauses). Since the government is willing to forgo revenues and invest in innovation, it is fair to impose conditions. The same criteria should be applied to the benefits to IT companies; however, in both cases, legislative acts should substitute the industrialized products tax for the new value added tax.

j) Gradual reduction of payroll levies in order to diminish labor costs. This shift would need to be made up for by environmental impact taxes revenues and tied to other policies regarding social security and labor rights. The overall goal should be to increase the competitiveness in the labor market.

k) Lowering international trade tariffs and financial transactions tax (IOF) over short term international loans; extinguishing the contribution on intervention of economic domain (CIDE) over remittances to pay international royalties and services. The openness to international capital and technology would stimulate domestic innovation and competition. Once the taxes on consumption and corporate profit are lowered, companies must in counterpart become more competitive and face global markets. The gap between effective rates and bound rates compromised by Brazilian government to the World Trade Organization (WTO) could also be decreased, in order to provide legal certainty and accurate cost calculation to trade flows. However, this improvement needs to be negotiated by means of free trade agreements with developed countries, based on lower tariffs for value added products as a counterpart from them.

l) Prohibition on provisional executive orders regarding new tax obligations (payments or ancillary obligations), except in case of war taxes. Conditioning new or increased taxes to be introduced only if enacted during the first semester of the

previous year. Prohibition on including the value of other taxes on a tax base, except for income tax, import tax and export tax.

m) Implementation of a single database of taxpayers' reference, shared by commercial registry, federal, state and local governments, in order to simplify procedures and harmonize information. This database should also provide the issuance of negative certificates regarding debts with all federative units, which are requested during bidding processes.

n) Establishment of penalties for the federative unit that does not comply with national tax code commands regarding the annual consolidation of tax legislation. Taxpayers must be easily aware of all changes in it.

o) Applying the same fees and interest rates used for taxes with delayed payment in case of refunding cumulated credits. The retained capital must be rewarded in both directions. Allowing compensation of taxes and debts with credits, even if from different taxes, as long as within the same federative unit. Providing clear rules for settlement of cumulated credits upon transference to third parts, as long as within the same federative unit.

8. CONCLUSION

As it became clear in section 3, the current Brazilian tax system is undoubtedly a barrier to its complete economic development. Besides the unbearable complexity for companies to comply with the laws, the tax burden which before the Real Plan and the stabilization of the economy was about 20.00% of GDP, has recently reached 36.00%. The burden is too concentrated on consumption and payroll and thus interferes on investments and economic allocation of resources. Moreover, during economic crisis, as consumption and employment decrease, tax revenues follow the same path. The pressure over the government budget leads to higher interest rates to finance the public debt and to short-term investments instead of FDI aiming at long-term results.

Therefore, these suggested guidelines for a tax reform draft an alternative framework that may promote competitiveness for Brazilian economy in global markets, dealing with externalities to take advantage of market failures, collecting revenues and investing in innovation domestically. By setting conditions to attract FDI from MNC, fostering cross-fertilization of knowledge, ideas, capital and promoting business linkages with domestic industries, the country may specialize itself in higher value added goods and services, develop capabilities and spread innovation through its economic sectors to generate long-term economic growth based on productivity and efficiency.

The globalization processes have become faster, stronger and irreversible since the 1990's. Capital has experienced total mobility and therefore the only way to retain it is to create an appropriate environment for its reproduction, understanding that each location in the world has to set competitive conditions to obtain further technological advances. Taxation is one of these conditions, but it must be attached to other institutional triggers that dissipate uncertainties about investments. Legal certainty was treated as an important topic in this paper, because it enforces property rights and allows accurate calculations of costs and profits. This is one of the foundations for a capitalist society. Reducing red tape and costs for tax compliance also have extremely positive effects, appreciating the equity value of companies that operate in a safer environment to produce and hence increasing their capacity to finance investments.

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