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A Review of critical issues on tax design and tax administration in a global economy and developing countries*

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1 Introduction

Governments from developing countries have long depended on revenue from foreign aid but the post-2015 international agenda on financing for development has focused more attention on the importance of domestic-resource mobilization (DRM). In particular, the new framework aims to promote reforms that have the potential to improve government tax revenue in Low Income Countries (LICs). The focus on LICs is motivated by the huge resource gap required to finance development needs in these countries. Moreover, improving the tax system is expected to generate indirect long-term gains. For instance, a well-functioning tax system is expected to enhance state building and strengthen the state-citizen relationships (Lieberman, 2002). Whereas increasing tax revenue is expected to be beneficial for LICs, the way this can be effectively achieved is, however, not clear. The issue here is how and whether one can increase tax revenue in LICs and at the same time respect a number of principles of efficient tax design in a globalized economy?

The recent explosion of globalization has followed a reduction of institutional barriers to the free movement of goods, services, and factors of production. The effect that this has upon trade between nations is dramatic: world GDP has increased by a multiple of five since 1960 but the volume of world trade has increased by a multiple of eleven. It has also become easier and cheaper to move production facilities and corporate headquarters between countries. This, in turn, allows taxable profits to be shifted between tax jurisdictions. The political landscape has also changed with national governments having to accept constraints upon their ability to unilaterally implement policy. These constraints can derive from membership of institutions such as the European Union (EU), from agreement to tax treaties, and from the mobility of the tax base.

In this paper, we propose a review of critical issues for tax revenue mobilization in developing countries. In the first section, we overview the actual situation of tax collection in worldwide economies by grouping countries according to World Bank's classification of the world's economies (see appendices). The three groups are the low, middle and high income countries[1]. These original illustrations are based on the new "ICTD Government Revenue Dataset" (ICTD GRD), which has data on some 40 sub-categories of revenue sources for 203 countries for 30 years (1980-2010) sources.

The second section provides a review of principles of tax design in a global economy that are much relevant for developing countries. This Section draws heavily on chapter 21 in Hindriks and Myles (2013).We first considers the characterization of international efficiency and emphasizes that efficiency has to be defined relative to mobility. One consequence of globalization has been the increased international mobility of capital. We look at the implications of mobility for the taxation of capital in general, and the corporation in particular. Increased internationalization of firms with production in many different coun-

[1]Developing countries refers jointly to LICs and MICs.

tries allows a firm to choose where to produce and, to some extent, where to earn profit. Firms can relocate profit through the transfer prices used to account for transactions between divisions. We analyze the effect of taxation on transfer pricing and assess policies used to mitigate the practice. The focus is then placed more directly on the issue of taxation and location choice. Some empirical evidence is reviewed. This section then moves onto the design of indirect taxes in an international setting. The benefits of harmonization are considered and alternative tax principles are assessed. The section is completed by a study of tariff policy and the role of trade agreements in liberalizing trade. The third section provides a review of some critical issues on corruption, enforcement and compliance that limit severely the capacity of developing countries to mobilize tax revenue, and that also limit the scope for growth. This section also provides some review of the instrument to fight corruption and to improve tax enforcement.

The fourth section discusses the methodology to evaluate the overall performance of government tax collection systems. It is essential for developing countries to estimate the potential tax revenue as a function of some primitives. It is then useful to assess the gap between the effective revenue and the potential revenue to provide some indicator on the government tax effort. On the basis of the existing methodology, we construct an original index of tax effort with a spacial dimension. The novelty of our analysis is twofold. First we introduce a geographic interaction dimension in the evaluation of tax effort. The tax performance of one country may depend on the tax performance of the neighboring countries. This is the geographical shift effect. Second, we decompose the tax effort index tax item by tax item. This is to capture the tax shift effect (for instance a country may decide to shift from trade taxes to VAT taxes). We will show that this decomposition approach produces finer and more relevant policy advices.

2 Stylized Facts on Government Revenue

It is straightforward that government revenues sharply vary according to the development level[2]. For instance, in 2000, HIC governments on average could count on 60 times more revenues per capita than could LIC governments[3]. However, this difference in the total revenue collection may hide strong differences in the structure of revenue collection both at the country level and the development level. In this section, we highlight those divergences through a benchmark analysis of the different revenue components. The first sub-section is dedicated to the non-tax revenues while the others sub-sections concern the tax revenues. There are three kinds of non-tax revenue: grants, resource revenue and non-resource revenue. For tax revenue, we distinguish direct taxes from indirect taxes. We first describe the composition of each of the revenue sub-categories,

[2]This has often been shown in the literature from Burgess and Stern (1993) to Fenochietto and Pessino (2013).

[3]In purchasing-power parity.

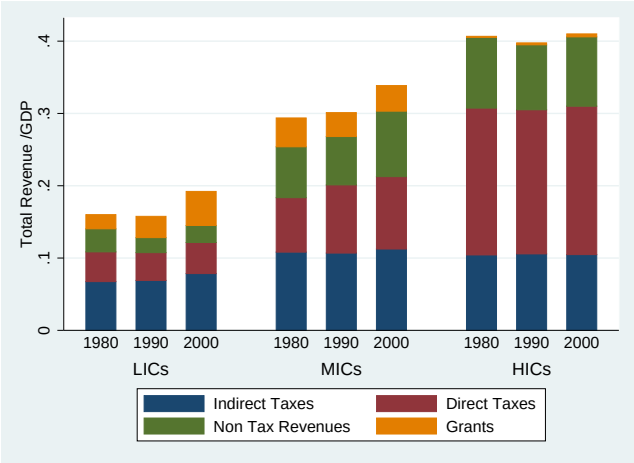

Figure 1: Total Government Revenue by country groups

define them, and then discuss the features that may explain the divergences between development levels.

	LICs (34 countries)		MICs (104 countries)		HICs (65 countries)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Grants	0.032	0.037	0.036	0.094	0.003	0.01
Non-Tax Revenues	0.025	0.029	0.077	0.086	0.094	0.113
Direct Taxes	0.040	0.037	0.092	0.060	0.202	0.084
Indirect Taxes	0.072	0.025	0.109	0.052	0.105	0.044

Table 1: Total Government Revenue by country groups

2.1 Non-Tax Revenues

2.1.1 Grants

Although grants are non domestic revenue, this source of revenue may have an impact on the mobilization of domestic revenue (see section X). Grants are generally the primary source of non-tax revenue of LICs. However, it is important to note that several MICs benefit more from grants than do LICs. This difference between LICs and MICs can be explained in part by the governance problems in the poorest countries (Piccolino et al., 2014), such as corruption,

governmental illegitimacy and bureaucratic failure[4]. The important average aid revenue among the MICs is borne out by a few countries (among them are Kosovo, Marshall Islands, Palau and The Gambia). Among "DGD partner countries", grant revenue is relatively high [5]. In 2010, Burundi was the DGD country most helped with grant revenue, which accounted for around 22% of its GDP. Mozambique, Rwanda, Tanzania and the Dem. Rep. of the Congo, completed this "top 5"with grant revenue of around 10% of their GDP in 2010.

2.1.2 Other Non-Tax Revenues

The other non-tax revenue include: revenue from state-owned enterprises, fines collected as penalties, and revenue from the sale of state assets. Natural-resource revenue (from taxes or not) is also included among this revenue component [6]. The *other non-tax* revenue increases with the income level of countries. Of course, the level of development of oil exporters has a strong impact on this result. The large oil exporters are generally HICs (Bahrain, Equatorial Guinea, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates). In those countries, government revenue is highly dependent on the export of the natural-resources. As a consequence, government revenue is particularly volatile (2). Among the DGD partner countries, hydrocarbon exporters have the highest non-tax revenue (i.e., Bolivia (gas), Ecuador (oil) and Algeria (oil and gas)). For Ecuador and Algeria this source of revenue is really important as it represents around 50% of total government revenue in the period studied (in Ecuador it reached until 80% of the total revenue in the 2000s).

2.2 Tax Revenues

Among the tax revenues, we distinguish the direct taxes from the indirect taxes [7]. The first category comprises taxes on income (personal and corporate), property, payroll and workforce and social security contributions while the second includes taxes on goods and services and trade taxes. Tax revenue relative to GDP increases with the income level. During the 2000s, HIC governments were still able to levy twice as much revenue per GDP than were LIC governments. In HICs, the direct and the indirect taxes are almost equal while developing countries rely relatively more on indirect taxes. In the following sections, we study each component of those two tax groups.

[4] Alesina and Dollar (2000) have pointed out that those signals have not always had the expected effect on donors behavior, which, in most cases, was driven by political and strategic considerations.

[5] The non-DGD LIC's average is around 5.5% while the DGD country average is around 8.2% of their GDP.

[6] We use the ICTD nomenclature for the natural resources. As explained by Prichard et al. (2014), this nomenclature allows one to distinguish the revenue coming from the agents from the revenue coming from natural resources.

[7] This nomenclature is proposed in the ICTD Government Revenue Database and is commonly accepted in the literature (see, for example, Acosta Ormaechea and Yoo (2012)).

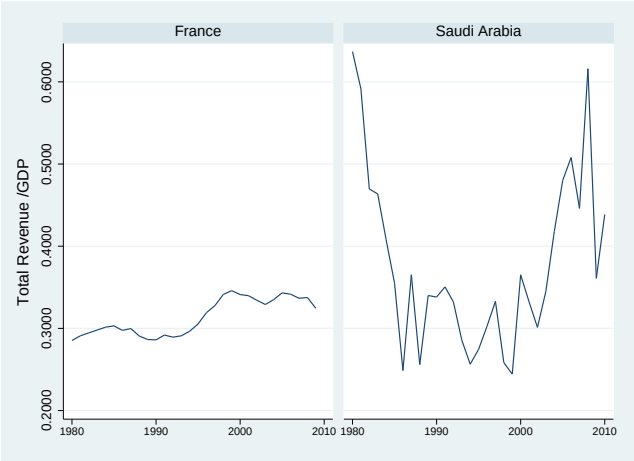

Figure 2: Evolution of Total Government Revenue (study case)

	LICs (34 countries)		MICs (104 countries)		HICs (65 countries)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
PIT	0.014	0.014	0.022	0.019	0.076	0.052
CIT	0.013	0.01	0.027	0.027	0.028	0.014
Property Tax	0.002	0.002	0.004	0.037	0.014	0.010
Payroll and Work Force	0.001	0.002	0.004	0.008	0.008	0.008
SSC	0.004	0.005	0.037	0.037	0.08	0.049

Table 2: Direct Taxes Collected by Country Groups

2.2.1 Direct taxes

Personal income tax (PIT) includes taxes payable by individuals on income, profits, and capital gains. PIT taxes are commonly progressive and may thus redistribute income[8].Social-security contributions (SSC) are flat taxes and their main aim is to maintain consumption after retirement and during periods of unemployment. PIT revenues are much higher in developed countries than in developing countries. Besides, we observe a clear declining trend of PIT revenue in the developed countries. This declining trend is occurring in a few HICs (such as Sweden, The Netherlands and New Zealand), which were characterized by high PIT revenues in the 1980s and have seen those revenues sharply decreasing over time. The case of New Zealand is without doubt the most striking. New Zealand has lost more or less 2/5 of its revenue from PIT over the last 30 years because of a major program of tax reform in the 1980s. The top marginal rate of

[8]It is possible to measure the tax progressivity by means of the "personal income flatness" ratio, i.e., the ratio of the economy-wide average income-tax rate to the top marginal income-tax rate (Becker and Mulligan, 1998).

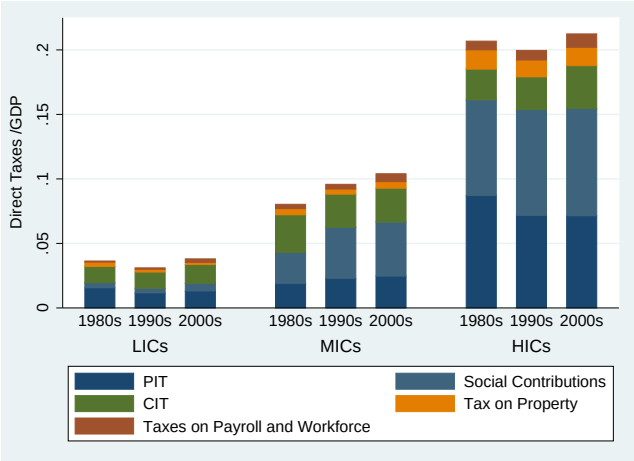

Figure 3: Direct Taxes Collected by Country Groups

PIT was halved in December 1987 from 66% to 33%[9]. Sweden has over the last decade organized a major tax shift from PIT to VAT. Among the MICs, PIT revenues are, on average, increasing. Countries that reflect this trend include Cabo Verde, Hungary, South Africa, Saint Lucia and Zambia. The case of Hungary is one of the most striking as its PIT revenues jumped from around 0.5% to around 6% of the GDP between 1988 and 1990[10]. This is contemporaneous with the introduction of a flat income tax with the Hungarian tax reform of 1988 (Hogye, 2010). Saint Lucia, Cape Verde and the Marshall Islands enjoy really large PIT revenues. These three countries share a common feature as they are described as "tax havens" by the IMF[11]. The PIT revenues of the LICs do not follow a common trend. Among the countries that have contemplated high fluctuations of their PIT revenues over the last 30 years, we find Zimbabwe for which PIT revenue almost totally disappeared during the socio-economic crisis of 2007[12]. Finally, PIT revenue is globally increasing among the DGD countries. This trend is borne out by three countries that have recently known high rate of growth: Morocco, Mozambique and Peru. Concerning the SSC, they are very low in developing countries (and in particular in the LICs), although they have increased in all countries over the three past decades. In the developing countries, the level of awareness of the importance of SSC is increasing over

[9]Source online: The Encyclopedia of New Zealand online http://www.teara.govt.nz/en/taxes/page-7

[10]Note that other ex-Soviet countries (Russia, Ukraine, Romania, and Macedonia) have introduced a flat tax on income in recent years, but the impact on PIT is not clear for these countries (Keen et al., 2008).

[11]Source online: http://www.reuters.com/article/2008/03/04/taxhavens-idUSL0423271120080304

[12]Just before this crisis, the PIT revenue in Zimbabwe was around 0.13% of the GDP.

time. Numerous social-security initiatives are flourishing[13], but the importance of the informal sector and international competition do not facilitate the set up of a social security system.

The taxation of corporate income (CIT) involves the transformation of profit into tax revenue. The level of CIT collected increase with GDP per capita level (3). Many developing countries rely heavily on corporate income tax. Despite the falls in statutory and effective tax rates, CIT revenues increased during the 2000s in developing countries, both as a proportion of GDP and as a proportion of tax revenue (Abramovsky et al., 2014). In 2010, CIT revenues represented about 20% of revenues in low-income countries compared with 15 percent in high-income countries. Thus corporate taxation is an issue that is particularly relevant for the mobilization of tax revenue in developing countries. Also important is the fact that the CIT is highly concentrated among a few large firms. According to Keen (2012) the largest 1 per cent of companies account for around 75 per cent of all tax payments in many developing countries. This tax concentration is also high in advanced countries. According to Devereux et al. (2014), in the UK the top 1 per cent of firms pay 81 per cent of UK corporate tax.

Among the HICs, Australia, Cyprus, Equatorial Guinea and Norway have achieved strong growth in their CIT revenue. The constant growth of CIT revenue in Australia over the last 30 years has compensated for the fall of other direct-tax revenue and has remained the primary source of revenue (accounting for around 60% of the total revenue). In Norway, the tax reform of 2006 may partially explain the contemporaneous increase of CIT revenue. Before 2006, the personal income tax rate was much higher than the corporate income tax, which contributed to profit shifting. In 2006, a tax on dividends and capital gains was introduced, and the top marginal personal income tax rate was reduced. The CIT revenue has sharply increased among different DGD countries for the 10 past years (i.e., Bolivia, Mali, Peru and South Africa). The increase of CIT revenues has been accompanied by a contemporaneous sudden GDP growth in those DGD countries.

Property taxes are divided into four groups: the tax on personal property (movable), the intangible property tax, the land tax and the tax on improvements to land (immovable). Property taxes are predictable and collected at the local level. If there is no land registry, the land tax (and taxes on land improvement) imply an important fixed cost of inventory and estate appraisal. However, it is also its lack of popularity that explains the disuse of this tax. Land being fixed there can be no supply response to the introduction of a land-value tax. The tax will thus immediately have a negative impact on the value of the land and thus affect directly the present landowners while the benefits will be spread over the present and future population (The Economist, 2014). Concerning movable property, the risk is that it discourages investment. The GDP level per capita allow to approximate the property tax collected (see figure 3).

[13]See for example the step-program from the ILO: http://www.ilo.org/public/english/protection/socsec/step/reslib/spubl.php.

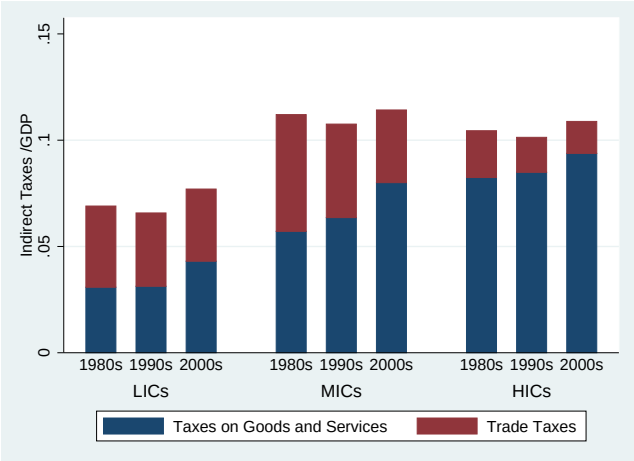

Figure 4: Indirect Tax Collection by Country Groups

	LICs (34 countries)		MICs (104 countries)		HICs (65 countries)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
GS Taxes	0.035	0.021	0.069	0.042	0.087	0.046
Trade taxes	0.035	0.02	0.042	0.042	0.017	0.026

Table 3: Indirect Tax Collection by Country Groups

Besides, this source of revenue is marginal in all of the country groups. Among the HICs, Belgium, France, Canada and Luxembourg have quite considerable property tax revenue (around 4% of GDP). In the MICs, it appears that South American countries have higher property tax revenues (especially Argentina and Bolivia). According to the data available, the best endowed LICs are Mali, Nepal and Tajikistan (around 1% of GDP).

The payroll and workforce taxes are proportional to the payroll or to the number of employees but exclude social benefits. Such taxes are far from being extracted in all countries and generally represent little revenue for the governments. The share of this tax increases with the GDP per capita. Among the HICs, Austria and Sweden collect revenues representing around 3.5% of their GDP through this tax. Among the developing countries, Belarus, Hungary, Jordan and Benin are the only countries that are able to collect a significant amount (around 1% of GDP).

2.2.2 Indirect Taxes

Trade taxes are composed of exports and imports tariffs, both collected on borders. Import tariffs generate much more revenue than export tariffs do (on average 90% of trade revenues). Historically, developing countries have relied

more on trade taxes than have the developed countries, but trade taxes have sharply decreased in the three country groups over the last 20 years and particularly in developing countries over the last decade. There have been no export tariffs in almost all of the developed countries for the 30 past years. Among the MICs, export tariffs represented a considerable amount of revenue in Costa Rica, Ghana, Malaysia, Mauritius and Sri Lanka (up to 5% of the GDP), and Argentina, Côte d'Ivoire and Pakistan still have substantial export tariffs (between 2% and 3% of the GDP). Among the LICs, we observe a strong decrease of this source of revenue, which was still important in Burundi, Comoros, Guinea and Uganda not so very long ago. Import taxes have been reduced considerably in the developed countries (in particular in Barbados, Cyprus and Malta), but a few HICs have still large import tariffs (Israel, San Marino and The Bahamas). Among the MICs, import tariffs are virtually non-existent except in Lesotho where this revenue is still extremely large (around 40% of GDP in 2008). In most DGD countries, the import tariffs have decreased over time. Mali has had a sharp reduction of its import revenue in the 2000s (a reduction of 6% of GDP between 2000 and 2010). Niger and Zaire were the only two DGD countries that increased their import tariffs in the 2000s. Data highlight that different developing countries have abandoned import tariffs and are now relying much more on taxes on good and services. This is a general trend of shifting from trade taxes to VAT and sales taxes.

Taxes on goods and servicesare described as flat taxes, i.e., taxes with a constant marginal rate. They include taxes on sales (i.e., sales taxes and VAT) and excise taxes. In Figure (4), we observe an increasing trend of the taxes on goods and services overall for developing countries. In developing countries, this increase is largely explained by the introduction of a VAT system. According to Tanzi and Zee (2000), the introduction of VAT over the past few decades has been the most visible tax reform undertaken by developing countries. Ebrill (2001) pointed out that VAT (or a VAT-like tax) can be found in 116 countries around the world in 1998. In Africa, 45 of the 54 countries of the continent rely on a VAT system, but VAT revenue is still marginal. In Africa, we can distinguish two types of VAT systems: the South African VAT system (very similar to the single-rate New Zealand GST) used among members of the South African Customs Union and the EU VAT systems (inspired by the Anglo-, Franco- or Lusophone versions)[14]. The EU VAT systems have more exemptions and are thus more complicated.

3 Principles of Tax Design in a Global Economy

3.1 International Efficiency of Factor Allocation

In a closed economy production efficiency is achieved when the ratio of the marginal products of any two inputs is the same in the production of all goods. When this condition is attained it will not be possible to reallocate inputs

[14] Cnossen (2014)

to increase the output of one good without reducing the output of another. The Diamond-Mirrlees production efficiency theorem demonstrated that this is achieved when final consumption goods are taxed but intermediate inputs are not. The key property of a value-added tax (VAT) is that it is designed to achieve precisely this outcome. With a VAT producers can reclaim the tax paid on the inputs they use so only the value added at each stage of the production process is taxed. At the end of the production process the sum of value added is equal to the final consumption value. This appealing property of VAT is one of the reasons for the increasing number of countries using the system. The US remains a notable exception.

In an international setting there are additional considerations that need to be taken into account in order to describe an efficient allocation. The criteria that must be satisfied for efficiency have to include the allocation of production and consumption within *and* across countries. The important additional point is that the characterization of efficiency across countries depends on the degree of mobility of factors and goods. To see this, consider an extreme case in which factors of production are absolutely immobile. In this case efficiency has to be defined with the initial factor allocation taken as given even if a reallocation of factors across countries could achieve an increase in world output. In contrast, if factors are freely mobile, then their allocation across countries must be determined as part of the description of an efficient location.

3.1.1 Mobility and efficiency

These points are now developed by considering a world with two countries A and B, and two inputs, K and L. The inputs are in fixed supply but may be mobile between the two countries. The total demand equals the total supply both for capital $K = K^A + K^B$ and for labour $L = L^A + L^B$. The inputs are used to produce a single output in each country using the production function $F(K^i, L^i)$. The efficient allocation of inputs (both labour and capital) is found by considering the decision problem of a central social planner. The constraints on the optimization reflect the mobility of factors. Let $F_K(K^i, L^i)$ and $F_L(K^i, L^i)$ denote respectively the marginal productivity of capital and the marginal productivity of labour in country i (with $i = A, B$) .

Assume initially that the inputs and the produced good are perfectly mobile between the countries. This implies it does not matter in which country production takes place. The efficient outcome is then described by the allocation of capital and labor to the two countries that maximizes the sum of outputs $F(K^A, L^A) + F(K^B, L^B)$. In this case production efficiency requires the marginal product of each input to be the same in both countries, that is $F_K(K^A, L^A) = F_K(K^B, L^B)$ and $F_L(K^A, L^A) = F_L(K^B, L^B)$. These are *arbitrage conditions* that require the identical returns on each input in the two countries and are a consequence of the mobility of the two factors. These conditions are more restrictive than the efficiency condition for the closed economy

involving the ratio of marginal products.

$$\frac{F_K(K^A, L^A)}{F_L(K^A, L^A)} = \frac{F_K(K^B, L^B)}{F_L(K^B, L^B)}. \tag{1}$$

The consequences of different assumptions on mobility can now considered. If one of the factors was immobile, then the efficiency condition for the other factor must be defined with respect to the fixed allocation of labour. For example, if labor was immobile then the international allocation is fixed $(\bar{L}^A, \bar{L}^B)$ and there is only the efficiency condition for capital

$$F_K(K^A, \bar{L}^A) = F_K(K^A, \bar{L}^B). \tag{2}$$

In this case the ratio condition (1) does not apply because the immobility of labor prevents the ratio of marginal products from being equalized.

These examples illustrate the general principle that the characterization of an efficient allocation depends on the mobility of factors of production and the final product. This observation is important for judging the efficiency, or otherwise, of tax systems and policies.

3.1.2 Multinational firm and efficiency

In a closed economy the operation of a competitive market ensures that an efficient outcome is achieved. The same claim is valid for an open economy provided that the market has the same degree of mobility of the factors and product as the planned outcome. This need not be the case. For example, capital may be mobile from the perspective of a world social planner but arbitrary regulations prevent it being mobile in the market setting. The market will then not achieve efficiency. In the absence of any differences in mobility it can be asserted that the competitive market will achieve a Pareto efficient equilibrium.

The extent to which efficiency is achieved when there is multinational (or any form of imperfect competition) needs a more detailed analysis. The mobility of the factors and the final product restrict the choices of the firm in the same way that they restricted the choices of the social planner.

Assume first that the product and the factors are both mobile. The total output of the multinational is divided between the two countries. The multinational firm chooses the allocation of inputs to maximize profit subject to the supply of factors. The assumption of a common rental rate for capital and wage rate for labor is a consequence of the mobility assumption: if the factors are mobile then the prices must be the same in the two countries. The optimization has following outcome. The multinational firm allocates the inputs it uses between the two countries using the same criterion as the social planner.

The allocation of inputs by a profit-maximizing multinational firm and the allocation by a social planner are characterized by the same efficiency conditions. Therefore, the inputs used by the multinational firm are allocated efficiently between countries. This does not mean that the multinational firm will achieve an identical outcome to the social planner because the multinational firm produces

less output than is efficient in order to increase price and extract a rent. More precisely, what the results show is that given the chosen level of output the multinational firm will efficiently allocate inputs.

3.1.3 Taxation and efficiency

It is now possible to assess the desirability of production efficiency when governments use commodity taxes to raise revenue. In a closed economy the Diamond-Mirrlees principle requires that production efficiency should be maintained.

This argument does not extend directly to an open economy. The reason for this is that each country has a separate government budget constraint. The effect of these budget constraints is to make it more difficult to find a direction of movement from a point inside the world production possibility set that benefits all consumers in all countries simultaneously. Since a potentially beneficial move may adversely affect the budget constraint of one or more governments, it will only be actually beneficial if the governments that lose can be compensated by those that gain. This problem does not arise in the single country case.

The production efficiency argument can only be established if compensatory transfers between countries are permitted. If there are no such transfers then production inefficiency may be desirable. It is interesting to observe in this context that the operation of the EU has the features of a transfer scheme between member states. The EU budget is funded by contributions from members states and is used to finance payments to member states. The net effect is equivalent to transfers between member states. There is no claim that the transfers made by the EU are the ones required to support production efficiency and justify VAT but it is interesting to observe the existence of a system that could deliver the compensation transfers. Regarding developing countries, we shall see later that deviation from production efficiency can be required to reduce tax evasion and tax administration costs (see Gordon and Li (2009)). This suggests a trade off between production efficiency and tax collection efficiency. We shall call this the efficiency -compliance trade-off. This explain why many developing countries have adopted simple turnover tax instead of pure profit tax (**?**). The argument is that the turnover tax base is harder to evade and that the tax base is broader so that the tax rate can be lower compared to a profit tax. The low turnover tax implies in turn only a small distortion to real production.

3.2 Capital and Corporations

The growth of globalization has particularly strong implications for the taxation of capital. Globalization has increased the mobility of capital which has increased the potential for tax competition to occur. Mobility has other implications. It can result in capital being invested in one tax jurisdiction but the return paid to an owner located in another. It can also result in a return being earned by the joint operation of capital located in several different jurisdictions. Such outcomes raise questions about which jurisdiction should have the right to tax the income flows from the capital to the owners.

3.2.1 Capital taxes

Capital taxes include taxes on corporate profit, on interest income, on dividends from the ownership of stock, and on the capital gains from asset ownership. It is important for capital taxation in a globalized world that income can arise from an asset located in one country and accrue to an individual located in another country. For example, a firm that is headquartered in the United Kingdom may earn profit by producing in China and pay a dividend to a shareholder who is resident in the United States. This multiplicity of international locations creates complexity in allocating capital income to tax jurisdictions.

Capital income can be taxed on either a source basis or a residence basis. When a *source-based* tax is in operation the income from capital is taxed in the country in which the income is generated. For example, a resident of the United States with funds deposited in a German bank account will pay tax in Germany on the interest added to the account. With a *residence-based* tax income from capital is taxed in the country of residence of the owner of the capital. For example, a United Kingdom resident who owns shares in a United States company will pay tax on the dividends in the United Kingdom. The alternative systems have different incidence effects. These effects are now demonstrated by considering a small open economy that takes the world return to capital as given.

The introduction of a *source-based* system implies that the return offered on investment in the country will have to rise by the amount of tax to ensure that the net-of-tax return is equal to the fixed world return. This can only happen if the capital stock in the country falls (so that the marginal product of capital, and hence the return, rise) which means that capital must flow out of the country. The owners of capital will not be affected by the tax since they always earn the world return. Instead, the incidence will fall upon the residents of the small open economy who earn income from non-mobile factors of production.

In contrast, the introduction of a *residence-based* tax will not affect the return earned by investors resident outside the country. This implies that the pre-tax return in the country has to equal the world rate. If it did not there would be an opportunity for international investors to increase returns by investing in the country. Consequently, the post-tax return for domestic investors will be reduced by the level of the tax. The cost of investment for the firms located in the country is not affected by the tax so investment decisions will not be affected. This places the incidence of the tax upon the owners of capital resident in the country.

The different effects of source and residence systems imply that they have different *neutrality* properties. A tax is defined as being neutral with respect to an economic choice when it does not change the relative values of marginal benefits and marginal costs involved with that choice. The choice involved here concerns the flows of capital into and out of a country, and how the imposition of a tax system affects the location of capital across countries. A source-based tax applies equally to all capital within a country regardless of its country of origin. Therefore, the source-based tax achieves *capital import neutrality*

provided that all countries exempt capital income earned abroad from taxation (which they will if they all operate a source-based system). Conversely, the residence-based system treats all capital income the same way regardless of where the income arises. It therefore achieves *capital export neutrality* provided all countries practice the system or the domestic country provides a full tax credit for foreign taxes.

The system of taxation in operation can also affect the international pattern of ownership of capital by altering relative return on assets across countries. In many cases the ownership pattern should not matter for the real choices of the corporation but it can do in some circumstances, such as when intangible assets are involved. When ownership patterns are not distorted the tax system is defined as satisfying *capital ownership neutrality*. This can be achieved if countries levy a residence-based capital tax.

The choice of system for capital taxation has become increasingly important with increased globalization and the enhanced mobility of capital. The ownership of corporations is more internationally diversified than ever before and an increasing number of firms are multinational. These changes have increased the number of issues that have to be taken into account in the design of the tax system. In a globalized world no country is isolated, and tax changes in one country can cause a reallocation of financial and productive capital that affects all countries.

3.2.2 Corporate taxation

Globalization has made corporations increasingly mobile across jurisdictions. If the tax system attempts to tax profit where it is generated then a multinational firm will have an incentives to change the location of profit to where it is the most advantageous from a tax perspective. This can be achieved either through changing the physical location of the firm (or parts of the firm) to earn profit in a different location or by restructuring financial flows to make it appear that profit is earned in a different location.

In an international setting the first step in allocating the tax base between jurisdictions is to determine where profit is generated. If this can be done, the next step is to decide whether profit should be taxed on the basis of where it is generated, or on some other basis such as where it accrues to owners. Both choices are possible when taxes are being designed. Tax design must also take into account the ability of the headquarters of a firm to move from one country to another. Production and office facilities can also move. The important feature of this mobility is that it often involves a discrete choice: the headquarters may be in the United States or in Germany, the plant in Vietnam or Thailand (but not a bit in both). Usually in tax analysis it is the effect of the marginal rate of tax upon marginal decisions that is important. The situation is different when a discrete choice has to be made. In such a case it is the average rate of tax that determines the chosen outcome.

These points can be related to the decisions that a company must make. The choice of where to produce is made by calculating the level of profit net

of tax liability in each of the alternative locations. The location delivering the highest profit net of tax will be chosen. It is for this choice that the average tax rate is relevant. Conditional on the choice of location the company must then select the level of output. This is a standard marginal decision for which the marginal tax rate is relevant. The final decision for the firm is to choose the location of profit. This is not the same as the real decision about where to produce, but refers to the nominal allocation of profit through accounting choices. The following discussion of corporate taxation will treat each of these issues. They will be discussed separately to isolate the key points but it is clear that they are inter-related. For example, a firm will choose to locate where the average tax rate is low, and will produce more at the location if the marginal rate is low. It will also choose to locate profit in that location to take advantage of the low tax rate.

Consider a corporation that operates divisions in two or more tax jurisdictions. Four of the alternative tax bases are now introduced and some of the issues relating to the choice of base are discussed. The four tax base alternatives are:

- *Source-based taxation*: corporate income earned in the country where productive activity takes place.
- *Residence-based taxation (corporate)*: income accruing to the residence country of the corporate headquarters.
- *Residence-based taxation (personal)*: income accruing to the residence country of the corporate headquarters or personal shareholders (residence-based taxation), or
- *Destination-based taxation:* the sales (net of costs) in the destination country where the goods or services are finally consumed.

The first significant point that needs to be made concerning the choice between these tax bases is that it is difficult to define the source of profit. This can arise even when a corporation has a simple structure but undoubtedly becomes more pronounced as corporate structure increases in complexity. A corporation may have many different functional units, such as management, production, marketing, finance, sales, and research and development (R and D), and each of these functions can be divided between different divisions of the firm in different jurisdictions. The problem confronting source-based taxation of the corporation is the allocation of profit across these functions and across the divisions. Each one of the functions is necessary for the operation of the firm so ultimately has a claim to be a source of profit. Neither the internal accounting of the firm nor the information observed by tax authorities will generally be adequate to allocate profit to sources.

One resolution to this difficulty is to define prices at which the products of one of the divisions are sold to another. If such prices exist then the profit can be distributed across sources. Some products may be traded within the firm, or may be sold outside as well as used inside. In these case observable prices will

exist. For other products there may be no observable price. For example, the supply of management services may not be priced within the firm. However, the distinction between these cases may not actually be that significant. What the tax authorities require are *arm's length prices* that represent the price that the product or service would be sold at between unrelated parties. Since the prices used within the firm may not represent arm's length prices (we explore why when we look at transfer pricing later) the observation of a price within the firm may not actually be much more helpful than having no price. A more fundamental problem is the possibility that no price can be defined for the transaction. To see this point, assume that the discoveries of two distinct R and D divisions are critical for the production process of the corporation, but neither discovery is of any value alone. The arm's length price is zero individually or positive when the discoveries are combined. However, pricing the combined discoveries does not assist with the identification of the source of profit.

These comments demonstrate the difficulties, both practical and conceptual, involved in allocating profit on a source basis. These problems would have to be faced by any implementation of a source-based tax. In practice, the problems are dealt with through rules that attempt to approximate what is economically correct and through occasional litigation.

At first sight, it might seem easier to identify a residence country than to identify a source country. Closer inspection shows that this is not necessarily the case. Defining the jurisdiction of residence of the headquarters of a multinational can be problematic. In practice, it is defined through the concept of the location of control and management. The ruling on this point in United Kingdom law summarizes the position as "the question where control and management abide must be treated as one of fact or 'actuality"'. In brief, this means there is no absolute principle but a judgement on the facts in each case.

Profits are usually taxed when they are repatriated to the parent company. Taxing on repatriation provides an incentive not to repatriate, which might mean that excessive investments are undertaken abroad. So, an alternative is to tax profits when they are accrued. The benefit of a residence based tax is that all that must be observed is the total profit of the company. It does not matter where it is earned. If all countries were to operate on the residence basis then companies would not benefit from shifting profit around using tactics such as transfer pricing. However there are two problems with this. First, the holding company of a multinational is mobile, and it may well move to take advantage of tax benefits. So consider a holding company located in a country but with all productive activity and sales taking place elsewhere, and the shareholders resident elsewhere. There is a serious question about the moral legitimacy of residence-based tax in this case, and possibly also considerable mobility of the holding company since it has no real connections to location. Second, a multinational may have many divisions across numerous countries. This is not a problem in theory but in practice it may be very difficult for the residence country to monitor the taxable activity across the range of divisions. Even though it is only the sum of profit that needs to be known this can only be monitored using information on the individual components going into that

sum.

An alternative is to tax the shareholders of a firm on a residence basis when they receive dividend payments. There are two sources of practical problems with this choice of tax base. The first problem confronting a tax authority is difficulty in observing the dividend income that arises from foreign shareholdings. There may be regulations requiring domestic corporations to report payments to the domestic tax authority but these need not extent internationally. This is made particularly problematic by the fact that countries have an incentive to offer lax regulations in order to attract corporate headquarters. Such tax havens do exist, and can play host to an exceptionally high numbers of firms. The second problem is that the country of residence of individuals is not always clear. People can be internationally mobile with their country of residence ill-defined and open to dispute.

In summary, both source- and residence-based systems of corporate taxation have to confront a range of practical and conceptual difficulties. These difficulties prevent the implementation of either system in a manner that conforms with the theoretical idea. This has led to proposals for the implementation of systems that approximate the ideal but can be applied in practice. One such proposal is now considered.

3.2.3 Formula Apportionment

A practical solution to the problems of implementing the source- or residence-based systems is to employ *formula apportionment* to allocate the tax base across jurisdictions. Formula apportionment aggregates the activities of a multinational regardless of location and then allocates the tax base across countries according to a pre-agreed formula. The formula can be chosen to approximate either system of taxation. The European Commission has proposed the use of formula apportionment using a common coordinated EU tax base. The apportionment proposed by the EU is based on the proportion of total sales that take place in each country. If the profit margin was constant and identical across countries then this would be a source-based system. Otherwise, it will provide an approximation to a source-based system. The consequences of using this version of formula apportionment are now investigated with the main focus placed on whether it is consistent with production efficiency and the effect it has on the choices of a corporation.

To explore the implications of this system, consider a monopolist producing in two countries using two internationally-mobile inputs. The output produced by the firm can also be transported costlessly between countries. There is a supra-national government (representing the EU) that implements formula apportionment.

With the proposed form of formula apportionment a proportion q of profit is taxed in country A and $1-q$ in country B. where q denotes the fraction of total sales that take place in country A. Given tax rates t^A and t^B the multinational firm maximizes its consolidated profit net of taxes. The important outcome is that such predetermined formula apportionment based on sales does not affect

the international efficiency of factor allocation. This is a point in its favor.

It should not be concluded that formula-apportionment is entirely distortion-free. Formula apportionment provides a motive to move profit to the low-tax country. This is achieved by directing more output to that country. If the demand function is the same in both countries then this implies the price must be lower in the low-tax country. Hence, a system of formula apportionment operates as a form of implicit tax in the high-tax country.

3.3 Transfer Pricing

A large source of missed revenue for developing countries is related to international corporations (mostly in the extractive sector) operating in those countries and involves mis-pricing goods and sevices that are transferred within the multinational corporation among subsidiaries, mainly with the aim of transfering out profits to low tax jurisdictions. This misprincing practice can also be driven by non-tax forces such by the fear of expropriation or confiscation of income, economic and political instability, fiscal uncertainty, financial repression or devaluation. There is also the possibility that money earned on legal activities leaves developing countries via the channel of fake transactions or illegal transactions (e.g. criminal activity) to generate kickbacks into foreign bank account. Therefore a weak state with endemic corruption is a serious cause of income shifting out the developing countries It is also worth noting that mispricing can also take place between unrelated parties. For instance, an exporter located in a low tax country and an importer in a high tax country could agree to increase the price of the transcation. This agreement could include a side-payment the exporter makes to the importer. Such a payment would have to be concealed from the tax authorities. It follows that it can be difficult to detetect mispricing simply by comparing transfer prices among related and unrelated parties.

Consider a multinational firm with divisions in two countries. Assume one of the firm's divisions produces a good while the other uses it, either as an input or for final sale. The price at which the good is transferred between the two divisions of the firm is known as the *transfer price*. For the division of the multinational firm that produces the good the transfer price determines revenue. Conversely, for the division that uses the good the transfer price determines costs. The transfer prices on the transactions between the divisions of the firm should guide resource allocation within the firm. From this perspective, the firm has an incentive to choose transfer prices that mirror the true costs of production.

The choice of transfer price also has another implication for the firm: it affects the international allocation of profit between the countries in which the different units of the firm are located. A high transfer price will raise the profit of the unit producing the good whereas a low transfer price will raise the profit of the user. If the countries in which the units of the firm are located have different corporate tax rates the firm can set the transfer price to ensure the largest possible profit is made in the low-tax country. This will increase net-of-tax profit by exploiting the tax differential. It also affects the tax revenues

of the countries and provides an incentive for countries to reduce corporate tax rates. The OECD Transfer Pricing Guidelines describe this in the following way "Transfer prices are significant for both taxpayers and tax administrations because they determine in large part the income and expenses, and therefore taxable profits, of associated enterprises in different tax jurisdictions."

To prevent firms from using transfer pricing to reduce tax liability many governments have adopted rules on transfer pricing. The central feature of the rules is the concept of an *arm's length price*. This is defined as the price that would be charged if the intermediate good was sold to an independent buyer. This is easy to apply if there is a market for the intermediate good and the transfer price can be compared to the price actually charged. If there is no market, which will be the case for many specialized intermediate inputs, the rules specify a process for determining what constitutes the correct arm's length prices. The rules typically allow the transfer price to be freely set, but permit the tax authorities to adjust that price when it falls outside what is judged to be a reasonable range for the arm's length price.

There are practical difficulties in operating the arm's length standard. It has already been noted that the good in question may not be openly marketed. It may also be the case that there is no sufficiently similar item on open sale to permit a price comparison, or that the terms and conditions of sale may vary among transactions. Transfer pricing rules usually allow the use of several methods for testing whether the transfer price is appropriate. The common methods include the use of comparable uncontrolled prices, cost-plus pricing, resale price or markup, and profitability-based methods.

Since developing countries lack appropriate tax enforcement as well as legal and administrative resources, they are generally seen to be more vulnerable to income shifting. There is a number of studies mostly produced by NGOs which estimate income shifting and revenue loss for developing countries. Those studies suggest massive revenue losses as we will discuss later.

Firms can use transfer pricing to obtain a favorable tax treatment of profit. If there is no limitation on the transfer price then the firm will set an extreme value in order to locate as much profit as possible in the low-tax jurisdiction. This process undermines the ability of jurisdictions to levy corporate taxes and encourages tax competition. To prevent this happening transfer price rules are needed. The rules typically make use of the concept of an arm's length price. Placing upper and lower limits are placed on the transfer price can cause a distortion if firm sees these limits as endogenous.

3.4 Location

Many developing countries are characterized by a lower productivity of capital. In response they use tax incentives like e.g. tax holidays or free economic zones which offer low or zero corporate taxes, to attract foreign investment. It is controversial whether these incentives are efficient from a national or global welfare point of view, but their revenue losses are substantial. One aspect of harmful tax incentives is that what one does not want to happen is member

states trying to attract firms from other member states. Even with the agreement the differences in tax treatment of corporations across member states still give rise to relocation with the media focusing on the role of taxation in these moves. This raises the question of the sensitivity of location choice to tax rates. The previous section considered the location decisions as given. This section goes one step further and looks at the issue of how taxation affects the choice of location.

For most economic choices at intensive margins, such as the decision to work a little bit more or less, it is the marginal tax rate that matters. The location decision of a firm is instead a choice at the extensive margin: it will either locate in one country or another. For such discrete choices it is the average tax rate that is important. This matters from the policy design perspective. It also matters from an empirical perspective since to analyze location it is necessary to construct effective average tax rates. This is a point to which we return after some theory.

3.4.1 Locational choice

Firms are able to extract rents from competing jurisdictions. The extent of the rent depends on the benefits to the jurisdiction and location-specific benefits for the firm. Controlling competition between jurisdictions will reduce the rent extracted.

Consider two countries, A, B, that will derive benefits Y^A and Y^B respectively if the firm decides to locate within their borders. The firm has a preference for country A since it earns an additional rent if it locates there. This location-specific rent could arise because of a skilled workforce in A or local availability of necessary inputs. For developing countries this is mostly the presence of natural resources. The location-specific rent for the firm in A is $\theta > 0$. The two countries compete by choosing the taxes that they will charge the firm.

Denote the tax levied by country i by T^i (so it is a subsidy if $T^i < 0$). The firm obtains $\pi + \theta - T^A$ in country A and $\pi - T^B$ in country B. The firm will locate in country A provided that

$$T^A \leq \theta + T^B. \tag{3}$$

The maximum subsidy in B must leave the country with a non-negative payoff so

$$Y^B + T^B \geq 0. \tag{4}$$

Given that country A wishes to minimize its subsidy (or maximize its tax) it will choose the level of tax $T^A = \theta - Y^B$. The tax can be positive or negative depending on the values of θ and Y^B.

With this value of T^A country A receives

$$Y^A + \theta - Y^B, \tag{5}$$

and the firm receives the payoff

$$\theta - T^A = Y^B. \tag{6}$$

If $T^A > 0$ then the location-specific rent is shared between the firm and country A (with $\theta > Y^B$). If $T^A < 0$ the firm extracts a payoff in excess of the location-specific rent (with $\theta < Y^B$).

This analysis illustrates how mobile firms are able to extract rents when countries compete to host them. The countries will compete to provide tax concessions, and the firm will choose the location that provides the highest payoff taking these concessions into account. The other message of the analysis is that when location is a discrete choice (either A or B) then it is the total tax payment or, equally, the average tax rate that matters for choice. This is in contrast to the usual focus upon the marginal tax rate. This observation is important for empirical analysis of location choice since the average tax rate is often very difficult to determine – it is often the consequence of a complex set of taxes and allowances – so has to be constructed. This is discussed further shortly. As said earlier, developing countries rely heavily on a myriad of tax incentives (tax holidays, tax exemptions, tax exceptions) that are difficult to control and that eventually result in low effective tax rates. However evidence shows that such tax incentives are not the key drivers of foreign investment (OECD June 2013). Investors are more likely to be driven into country by a stable economic and political environment, good infrastructure and availability of basic services. IMF (2012) show that in Sub-Saharan Africa "taxation is not a significant driver for the location of foreign firms, while other investment climate factors, such as infrastructure, human capital and institutions are". Therefore by providing tax incentives, governments in low-income countries forego substantial revenue that instead could be used to foster the elements that really drive foreign investment (education, infrastructure and electricity). Reducing tax incentives is usually seen as a low-hanging fruit in tax revenue mobilization. For instance, Mauritius removed most of the tax incentives for investments and the years following the tax reform both FDI and corporate income tax revenue have grown rapidly (OECD 2013). The issue is how to motivate them to do it. Hindriks et al. (2014) suggest that one interesting option is the use of public investment as a commitment device for developing countries to stop offering tax incentives. The idea is that eliminating tax incentives can be optimal (i.e. sustainable) only once government in developing countries have first chosen to foster public investment in items such as infrastructure, human capital and institutions, that really matter to attract capital and foreign firms. The message in Hindriks et al. (2014) is twofold. First, in an open economy with international market for capital, public investment (in infrastructure, education, R&D), unlike public consumption (such as public wages and transfers), can have important influence on the nature of competition. As a result, governments should look forward and anticipate the consequence of their commitment on public investment for competition. Second, public investment is not a reversible decision such as tax choices, it has long lasting effect and it displays strong commitment benefits. For that reason it is recommended to delegate the investment decision to a separate governmental agency and not to mix it with the fiscal authority. Furthermore when receiving a large amount of foreign aid, the government may consider to invest that transfer into public investment (rather than public consumption) so

as to boost its future capacity to tax capital and profit. Thus public investment is a powerful instrument of tax revenue mobilization in developing countries.

3.4.2 Agglomeration rents

In addition to taxation, location choices are also determined by other agglomeration and dispersion forces. The New Economic Geography, developed in the early nineties by Krugman and others, states that even when high corporate tax rates deter firms from locating in a country there can still be agglomeration rents that attract them.

The agglomeration force is the access to the market for inputs and outputs. The closer one is to the center of activity, then (a) the better the access to the market to sell output; and (b) the better the access to inputs and intermediate goods. Because of these factors firms want to locate close to their workers and workers want to locate close to firms. These agglomeration forces can result in *external economies of scale*: as more firms locate in a given region and aggregate industry output rises the average cost of production falls. External economies can be due to knowledge spillovers and access to intermediate goods and trained workers. This increases the incentive for further firms to locate in the same region. The location of computer chip manufacturers in Silicon Valley in California is an example of such agglomeration. There is no reason why the first chip manufacturer located there other than an accident of history, but once the process began it gathered its own momentum.

The attraction force of agglomeration is offset by the dispersion force that arises from the competition effect. The closer a firm is to center of activity, the tougher is the competition from other firms located in the same area. The proximity of location will result in products being close substitutes which enhances competition.

How the two forces are balanced depends on the level of transportation costs (or, equivalently, of trading costs). A key result of New Economic Geography is that increasing returns to scale (at the firm level) and imperfect competition combined with transportation costs may result in agglomeration. From this perspective corporate taxes deter firms from a location but agglomeration rents attract firms. So it is possible to tax the agglomeration rent to some extent without driving firms away. Tax differences across locations are explained by a countervailing gap in agglomeration rents. For both low and high transportation costs, the agglomeration rents are low. For intermediate transportation costs, the agglomeration rents are higher which implies that taxes can be set at a higher level in the center compared to the periphery of the economic activity. In this approach transportation is a proxy for trade costs and so the agglomeration rents is a bell-shaped function of the trade costs.

3.4.3 Evidence on profit-shifting

The discussion of the international tax treatment of capital assumed that firms will relocate profit or capital to take advantage of international tax differentials.

The practical significance of the effects we have identified depends on the extent to which firms do respond to taxation. There is a large literature that has analyzed the data to measure this responsiveness.

The movement of profit between locations is much easier than the physical movement of firms. It is therefore not surprising that there is ample evidence that international profit-shifting does indeed take place. This is despite the efforts of governments to contain it via transfer-pricing regulations. Evidence of profit-shifting has been found between the U.S. and various other countries and, more generally, within the OECD area. The typical evidence is that reported income within a country falls in response to a unilateral tax increase by that country. Most empirical studies on tax induced profit shifting are on OECD countries and use reliable data and rigorous econometric technique.Huizinga and Laeven (2008) analyze a sample of European multinational firms and find that the corporate tax base in Germany (highest tax jurisdiction in Europe) has decreased by 14% due to tax incentives to shift income to lower tax jurisdictions. In the US, de Boyrie et al. (2007) identify overpriced and under-priced import and export transactions via the price filter matrix of the US trade statistics. The result is that US imports are under-priced by about 12.5% of total imports whereas the value of US exports is overpriced by 5.5 % of total exports. As for developing countries, most empirical studies so far were done by NGOs. Christian Aid (2009) use the trade mispricing approach to argue that profit shifting out of developing countries in the period 2005-2007 was giving rise to a yearly tax revenue loss of US $ 121.8 billion per year. Obviously this approach may exaggerate the extent of profit shifting via trade mispricing. First because price differences within the same commodity code classification may reflect quality differences. Developing countries are morel likely to export low-price product and to import high-price products. Second, this approach only reports income shifting in one direction and disregards income shifting in the other direction. A more realistic estimate would have to take into account income shifting in both directions. For instance the overpriced exports and the underpriced imports of developing countries are ignored eventhough both would shift in income into the developing countries. Oxfam (2000) estimates that developing countries as a whole may be losing annual tax revenues of about US$ 50 billion as a result of profit shifting, tax incentives and the use of tax havens. To obtain this estimates, Oxfam uses the total stock of FDI in developing countries with an average estimates of the return on FDI in developing counties of about 20%. The authors then calculate the corporate income tax revenue using the nominal average tax rate of 35%. Comparing this potential tax revenue with the actual tax revenue, they obtain the revenue loss of US$ 50 billion. They argue that "tax competition and the implied threat of relocation, has forced developing countries to progressively lower corporate tax rates on foreign investors. Ten year ago these rates were typically around 35% broadly equivalent to most OECD countries. Today few developing countries apply corporate tax rates above 20 per cent. (...)If developing countries were applying OECD corporate tax rates their revenue would be at least US$ 50 billion higher".

The second issue is the response of the international location of real invest-

ment to differences in tax rates. This is a more difficult question to address. The chosen location is observed but the rejected alternatives are not, so the factors that entered the decision process of the firm cannot be observed directly. The choice of location depends on the average tax rate that a firm faces (controlling for agglomeration rents). This tax rate cannot simply be read from legislation for several reasons. First, the tax system may involve several marginal rates of tax that depend on the profit level. Second, there may be reductions in the marginal rate in special circumstances such as location in an enterprise zone or as a start-up incentive. Third, there can be allowances for R&D expenditures and special depreciation provisions. These factors make the average rate of tax potentially specific to the circumstances of each firm and have required that it is computed as part of an empirical analysis.

3.4.4 Evidence on effective corporate income tax rates

The analysis in section 3.4.1 considered a firm making a single-period location decision. In practice, a firm must assess how the choice of location affects its value as determined by the future flows of dividends to the owners. This flow of dividends is determined by both the investment policy and the financial policy of the firm over the future lifetime of the firm. The analysis of the lifetime decision problem is complex, but for the purpose of analyzing how taxation affects location choice it can be considerably simplified. The method for doing this is to use a perturbation argument: investment is increased by one unit at time t and reduced by $1-\delta$ units at time $t+1$, where δ is the depreciation rate of capital. This perturbation leaves the capital stock unchanged from period $t+1$ onwards so the flow of profit is only changed (or perturbed) in periods t (where extra investment is financed) and $t+1$ (where extra output is produced and investment reduced). The total effect of this perturbation can be summarized by calculating the net present value (NPV) of the additional costs and revenues.

For each potential location a NPV can be defined before tax (NPV^B) and after tax (NPV^A). The choice of location is determined by the comparison of the after-tax NPVs. This comparison can be related to taxation by using the NPV^A and NPV^B to define an *effective average tax rate* ($EATR$). The standard way to do this is to determine the net present value of the increase in revenues from the perturbation, NPV^R. The perturbation increases investment by one unit at t so raises capital by one unit at $t+1$. Assume the extra unit of capital produces additional output that earns revenue p at time $t+1$. The value of this additional revenue at t is $NPV^R = \frac{p}{1+r}$ where r is the interest rate. The $EATR$ is then defined by

$$EATR = \frac{NPV^B - NPV^A}{NPV^R}. \tag{7}$$

The reason for measuring the $EATR$ relative to NPV^R is that this will almost certainly be positive (because it is an increase in revenue without subtracting costs) whereas either of NPV^B or NPV^A could be zero (or negative) because they include the additional cost of investment. Broadly speaking the $EATR$

can be interpreted as the ratio between the present discounted value of taxes to the present discounted value of profits.

Computing the $EATR$ for each location provides a comparison of the level of taxes. Computing the $EATR$ over time for a given country gives the evolution of effective average tax rate in that country. The general trends for the CIT in OECD countries was a decline of the effective average tax rates that was less than the decline of the statutory tax rates. The interpretation is that those countries were cutting nominal rates to limit the profit shifting out of the country and to attract mobile foreign direct investment, while broadening the tax base to limit the impact on tax revenue (Loretz, 2008). A similar general trends was observed for developing countries. According to (Abramovsky et al., 2014), the average statutory CIT has decreased from 31 per cent in 1996 to 26 per cent in 2010. Moreover the fall in statutory rates was greater in smaller countries. Despite the fall in statutory and effective tax rates, the CIT revenues increased over that period in developing countries as well as in OECD countries, both as proportion of GDP and as a proportion of tax revenue.

One line of research has considered the effects of United States tax policy. It has been shown that companies that can claim tax credits against their home-country tax bill for state income taxes paid in the United States are less likely to avoid high-tax states. This is consistent with the theoretical prediction. In addition, the evidence demonstrates that United States firms shifted away from international joint ventures in response to the higher tax costs created by certain provisions of the United States Tax Reform Act of 1986.

A alternative line of research estimated the sensitivity of foreign direct investment (FDI) to changes in tax regimes. Many studies have been undertaken which suggest an elasticity somewhere in the range -0.6 and -1.5, with a value that varies across countries. Some studies have reported even higher figures.

The theoretical analysis shows how the mobility of firms can enable rent extraction. The empirical studies provide evidence that taxation does have a significant effect on the location of profit and of activity. The design of the international tax structure is therefore important. This is why there is so much concern about competition for the location of firms that will distort location choice.

3.5 Harmonization of Taxes

When applied to international tax policy the process of harmonization implies a reduction in the dispersion of tax rates, though not necessarily achieving, a common value for tax rates. Complete harmonization would replace a range of different tax rates across countries with a single tax rate. This could be, for example, the average of the initial tax rates. A partial harmonization would move the individual tax rates a little closer to a common target.

It is not immediately obvious that harmonization can raise economic welfare. Applying the Ramsey inverse elasticity analysis of commodity taxation provides a reason to believe that harmonization may well reduce welfare. Recall that the inverse elasticity rule demonstrates that tax rates should be differentiated across

goods to reflect the demand conditions for each. Extending this argument to countries suggests that VAT rates should be based on local demand elasticities. If these elasticities vary across countries then implementing a process of harmonization will move the system away from the efficient outcome. There are two reasons why this anti-harmonization argument may not apply. First, the existing tax rates need not be efficient. Second, there may be inefficiencies that are not resolved (or may even be enhanced) by the imposition of differentiated taxes. These arguments are now briefly explored.

It is always possible that the existing set of tax rates have been selected for reasons other than efficiency. They may have been the outcome of lobbying or of historical precedent. Whatever the case, if the tax rates are not efficient then harmonization may be able to raise welfare. Harmonization can even be improving if the tax rates have been chosen efficiently. This is because there is a distinction between what is efficient for each country and what is efficient for a set of countries. If each country chooses its tax rates to maximize national welfare then it will not take into account spillover effects on other countries. It is then possible that harmonization can move the tax rates closer to those that maximize aggregate welfare. We explore this argument in more detail below.

One form of inefficiency that has been the basis of a practical argument in favor of harmonization of VAT is cross-border shopping. Cross-border shopping is inefficient because it involves individual consumers being driven by tax differentials to personally transport commodities. The transport of commodities across borders by firms can exploit economies of scale; cross-border shopping by individuals does not. In addition, individual transportation increases congestion and environmental damage. These costs are avoided if VAT rates are harmonized because it removes the incentive to engage in cross-border shopping. More generally, harmonization lessens the distortion of trade patterns which may enhance the efficiency of trade.

These competing perspectives show that the question of whether harmonization can be beneficial is a significant one that does not have an immediately obvious answer. Insight into the question can be obtained by considering two countries that impose different rates of VAT. This permits a harmonization of the rates to be imposed and the welfare consequences determined. The question is whether such a harmonization can raise the welfare levels of both countries.

A case for harmonization can be constructed when countries choose tax rates independently and ignore the effects upon other countries. The source of the inefficiency comes from the dependence of the equilibrium price on the tax rates which means that domestic tax policy in one country affects the terms of trade for the other country. This is a form of externality between the countries. If the tax rates are chosen independently then this externality will not be internalized and the resulting trade equilibrium will be inefficient. Notice that this is a consequence of assuming that the countries are "large" in the sense that their actions have a significant effect on the world price. In contrast, if the countries were assumed "small" then the terms of trade would be perceived as fixed and the externality would not exist. In the presence of such externalities, tax harmonization can be desirable for both countries.

There are caveats to this argument. If one – or both – of the countries prefer independent taxation to the harmonized tax rates then harmonization will not raise welfare. Note that unlike the joint taxation solution, harmonization can make both countries worse off . We have also said little about the role of tax revenue. If tax revenue is used in a beneficial manner (for example, to provide a public good) then it will matter how the partial harmonization affects revenue. If it leaves revenue unchanged the argument holds as given. If it changes revenue then the argument will need to be extended to take this into account.

The argument for (partial) harmonization is enhanced if there are other inefficiencies – such as cross-border shopping – that are reduced by partial harmonization. It is also enhanced if there are other externalities between the countries generated by the taxes. One example could be the locational decisions of firms as described before. Despite the potential benefits of partial harmonization it is important to stress that it is very much a second-best policy if the jointly determined taxes are not uniform. In almost all cases there will be some method of combatting the externality that allows the countries to retain the right to set different tax rates.

3.6 Destination vs Origin Principles

The completion of the EU single market has raised some unanswered questions about how to operate the VAT system. Prior to 1993 the operation of the VAT system involved commodities being taken out of tax in the exporting country and brought into tax in the importing country. This was achieved by the zero-rating of exports, combined with subjecting all imports to VAT. In 1993 border controls within the EU were abolished to facilitate free trade and a level playing field between firms operating within and across member states in the EU. This undermined the operation of the VAT system and has lead to a search for a system that is consistent with the principles of the single market. The EU committed to introducing a "definitive" system by 1997 but this is still not in place.

When a commodity crosses a border between the place of production and the place of consumption the question of which country should levy tax is raised. Should it be the country where the good is produced or the country where it is consumed? VAT is fundamentally a system of consumption taxation. By design the (formal) incidence of VAT falls upon the final consumer. At each stage in the production process the VAT paid on inputs can be reclaimed, so that VAT is only paid on the value added. Only the final consumer is unable to reclaim VAT.

There are two distinct principles of taxation that correspond to the choice between levying taxes on consumption or production. Under the *destination principle* goods are taxed in the country of final consumption. Under the *origin principle* goods are taxed in the country of production. An important practical distinction between them is that the destination principle requires borders to monitor movement of goods whereas the origin principle does not. The EU system with zero-rating of exports reflects an application of the destination

	Good 1	Good 2	Wage
Country A	$w_A[1+t_A]$	$w_B[1+t_A]$	w_A
Country B	$w_A[1+t_B]$	$w_B[1+t_B]$	w_B

Table 4: Prices and wages in destination regime

	Good 1	Good 2	Wage
Country A	$v_A[1+t_A]$	$v_B[1+t_B]$	v_A
Country B	$v_A[1+t_A]$	$v_B[1+t_B]$	v_B

Table 5: Prices and wages in origin regime

principle. There have been numerous proposals that the EU should move to the origin principle to ensure that the tax system is compatible with the absence of internal borders. These proposals are often based on the observation that the two systems are *equivalent* in the sense that a switch from one to the other will not lead to any reallocation of resources. This equivalence is now demonstrated.

In a closed economy with no exports or imports the consequence of the circular flow of income is that consumption and production must be equal. Expressed formally, over any given period of time

$$\text{Value of consumption} = \text{Value of production.} \tag{8}$$

The equality between these two flows implies that it does not matter whether consumption or production is taxed. A tax at a fixed rate levied on final consumption will have exactly the same economic effects as the same tax levied on production. The interesting question is how this equivalence of a consumption tax and a production tax translates to an open economy engaged in trade. The key insight is that the same logic still applies but with one extra degree of complication.

To demonstrate the argument assume there are two countries (A, B) and two goods (1, 2). Good 1 is produced in A, good 2 is produced in B. The goods are produced with constant returns to scale using only labor as an input. The tax rate in country i is t_i. The wage rate in i is w_i with destination taxation and v_i with origin taxation. The prices with destination taxation are given in table 4. The prices with origin taxation are given in table 5.

The next step is to adopt the price normalization $w_B = 1$ and $v_B = 1$, and then express the prices of the two goods relative to the wage rates w_A and v_A. The real prices of the two goods are displayed in tables 6 and 7. It is these real prices that determine resource allocation.

Consider starting with the destination principle in operation. The real prices shown in table 6 must be the equilibrium prices that clear the markets for the two goods and labor in each country. Now switch to the origin principle. After the switch the wage rate in country A must adjust to the new structure of taxes to ensure that equilibrium is attained. The equivalence argument is completed by observing that the wage rate with the origin principle and the wage rate with

	Good 1	Good 2
Country A	$1+t_A$	$\frac{1+t_A}{w_A}$
Country B	$w_A[1+t_B]$	$1+t_B$

Table 6: Prices and wages in destination regime

	Good 1	Good 2
Country A	$1+t_A$	$\frac{1+t_B}{v_A}$
Country B	$v_A[1+t_A]$	$1+t_B$

Table 7: Prices and wages in origin regime

the destination principle must be related by

$$v_A = \left[\frac{1+t_B}{1+t_A}\right] w_A. \tag{9}$$

This relation must hold because it is the only one that ensures the real commodity prices are identical in tables 6 and 7: the initial real prices attained equilibrium so they must remain the same to attain equilibrium after the switch. This demonstrates that switching from one of these tax principles to the other does not change the equilibrium. Instead, the wage rate adjusts to compensate for the change in relative tax rates so as to leave the equilibrium unchanged.

This equivalence was described by the economist Tinbergen in a 1956 report for the European Steel and Coal Community (the forerunner of the EU). The result shows that borders can be eliminated inside a single market and a system of destination taxation replaced by a system of origin taxation. Real resource allocation will not change as a consequence of the change in tax system. The conditions under which the equivalence results holds are much more general than those in the example. All that is required for it to hold is that taxation within each country is uniform (so all commodities are taxed at the same rate) and that the wage rate (or the exchange rate in a monetary model) can adjust. The insight for policy is that origin taxation provides a viable alternative to destination taxation. The implementation of some form of origin system (though probably not the simple form used above) remains a "long-term goal" of the EU. There is no (publicly known) movement toward that goal at the present time. It remains a problem that has to be resolved in the construction of a "definitive" tax system.

The insight for policy is that the origin principle provides a viable alternative to the destination principle. An origin system would operate successfully in the single market. This has been recognized since before the founding of the EU. It would also allow EU member states the freedom to set their own tax rates without the intensity of tax competition that occurs with destination tax.

3.7 Tariff Policy

A tariff is a charge levied as a good crosses a border into a country. The advantage of tariffs over forms of taxation is that they are generally easy to collect. Recall that taxes are most easily collected when they are levied on observable activities that are public information. A good crossing a border is observable, particularly if the good is carried on a ship that must enter a port. Hence, tariffs can be used to raise revenue even if other parts of the tax administration are weak. Tariffs also offer protection to home industry relative to foreign industry since they make the price of imported goods more expensive relative to home produced goods. This makes tariffs attractive to countries wishing to encourage development. The drawbacks of using tariffs are that they are distortionary and may be met with retaliatory tariffs from trade partners.

3.7.1 Welfare cost of tariffs

The imposition of a tariff on a good raises the price faced by domestic consumers, increases the price received by domestic producers, and raises some revenue for the government. Since a tariff is a form of distortion it must be the case that it creates a deadweight loss. The allocation of this deadweight loss is more interesting, and it may even be the case that a country can gain by the introduction of a tariff.

The effects of a tariff depend upon whether the country is large or small . The meaning of large is that the policy actions of the country have an effect upon the price of traded goods on world markets. Conversely, small means that the country does not affect world prices. Therefore we can reasonably assume that small country refers to developing country and large country to advanced country.

We begin by analyzing the effect of a tariff levied by a small (developing) country. Assume that there are two goods. The country imports one of these goods and exports the other. The country is small so imports are arrived at the fixed world price p_M and exports can be sold at fixed world price p_X. The imposition of a tariff τ implies that the domestic price of the imported good is $q_M = p_M + \tau$. This is the price that is paid by domestic consumers and the price that is earned by domestic firms on domestic sales (domestic firms do not pay the tariff).

The effect of the tariff is as follows. The imposition of the tariffs increases domestic supply from s_0 to s_1, but reduces domestic consumption from d_0 to d_1. Imports fall from $d_0 - s_0$ to $d_1 - s_1$. The producer surplus of domestic firms is increased by the amount a and the revenue accruing to the government from the tariff is $b = (d_1 - s_1)\tau$. The fall in consumer surplus is $a + b$ due to the price increase , plus c due to the reduction of demand from d_0 to d_1. Hence, the tariff causes a deadweight loss equal to the area c representing the surplus loss for those consumers who can no longer afford to buy at the higher price. This is the standard result that the imposition of a tariff by a small (developing) country will reduce welfare.

There is a caveat to this result that should be noted. It was assumed implicitly that the two forms of surplus and government revenue are valued equally. The introductory discussion noted how tariffs are a practical form of policy to implement in a country with limited tax administration capability. In such a case it is likely that a social valuation would weight government revenue more highly than consumer surplus. An example would be a country which needed the tariff revenue to finance the provision of an essential public good (public infrastructure, basic education, basic health care). We will see in the growth section that minimal tax can be essential to secure a positive growth rate. This opens the possibility that the tariff could increase the welfare measure when the use of revenue is added to the analysis.

The welfare effect of a tariff in a large (advanced) country is potentially very different due to the effect of the policy upon world prices. When a large country introduces a tariff on an imported good this will encourage domestic firms to increase output. This raises world output and reduces the world price of the imported good. In addition, since domestic firms produce more of the imported good they must produce less of the exported good. The world price of the export increases as a consequence. The changes in world prices can be beneficial to the domestic country.

This discussion can be summarized using the concept of the *terms of trade*. The terms of trade measure the price of the exported good relative to the price of the imported good, $\frac{p_X}{p_M}$. An improvement in the terms of trade (meaning an increase in p_X relative to p_M) is advantageous for the domestic country since it allows more units of the import for each unit of export. The effect of the tariff is to improve the terms of trade and this can permit the domestic economy to gain from the imposition of a tariff. This does not have to hold in all circumstances since it depends on the size of the tariff and the extent to which the world price falls. However, there is one result that can be established: a large (advanced) country will always gain by introducing a small tariff. That is, starting from a position with no tariff the country can increase welfare if it implements a tariff that is just above zero. This is because the terms of trade effect dominates the loss of consumer surplus for a small tariff. It follows from this that there must be an optimal tariff, $\tau^* > 0$, which maximizes the welfare of the large country. This tariff is optimal conditional on other countries not changing their policies in response.

A tariff is always a distortion in the pricing system which must cause a deadweight loss. So, if a large country gains from the tariff, where does the deadweight loss arise? The answer is that the trading partners of the large country must lose. They suffer a deterioration in the terms of trade since the price of the good they import rises relative to the price of their export. This causes a welfare loss. Hence, the introduction of a tariff is always damaging for trading partners. Since the tariff must cause a reduction in world welfare, the trading partners always lose more than the large country gains.

3.8 Trade Agreements

In an attempt to protect the US economy during the depression the Smoot-Hawley Act of 1930 introduced heavy tariffs on imports. This was met by swift retaliation from Canada and reversed many years of trade liberalization. At the conclusion of the World War II pressure mounted for a reduction IN tariffs to secure the benefits of increased international trade. There have been numerous trade agreements since 1945 that have secured significant reductions in tariffs and ushered in the current era of globalization. There seems little doubt that these trade agreements have benefited developed countries but many would argue they have been to the disadvantage of developing countries.

A fundamental premise of economics is that voluntary trade is welfare-enhancing: if two parties choose to enter a trade then both must gain. In the absence of market failure this argument leads to the conclusion that unregulated trade will attain a Pareto-efficient distribution of resources. If correct, this implies that any government intervention to prohibit trade, restrict trade, or to levy taxes and tariffs creates a distortion and causes a loss of efficiency. Furthermore, these arguments are as relevant for trade between countries as they are to trade between individuals and provide the basis for seeking free trade.

The basic explanation for trade between countries is comparative advantage which is based on the rate at which one good is given up to get another. It is distinct from absolute advantage that measures quantity of inputs used to produce output. Comparative advantage exists even in the absence of absolute advantage. Trade allows countries to specialize in the goods they produce relatively efficiently. Specializing and trading increases welfare. The benefits of trade are enhanced when countries differ in endowments so can specialize in production of the goods which use their abundant factors intensively. Increased trade also expands market size which permits gains to be obtained from external economies of scale. Increased competition from abroad also forces domestic firms to be efficient. In the longer run the rate of economic growth can be increased through FDI and the import of innovation. The summary of these arguments is that free trade is superior to autarky (the position of no trade) and superior to an intermediate regime of trade restrictions.

It needs to be observed that the benefits of free trade rely on the assumption that market failure is absent. If there are pre-existing market failures then free trade may not lead to the benefits described. Involuntary unemployment due to market failure may be made worse by liberalization if labor market rigidity hinder redeployment of labor to the production of exports. Markets may be missing so that intermediate goods are not available for the production of final goods (but, conversely, free trade may allow the necessary intermediates to be imported). Countries may not have adequate financial markets to permit risk to be hedged so that liberalization can increase volatility. Such market failures undermine the argument for free trade but they do not prove that intervention is better: the benefits of intervention need to be demonstrated.

These comments provide background to what the trade agreements have

been trying to achieve and also help explain the current deadlock in the latest round. The successive rounds of talks are now described and there achievements documented.

There have been nine rounds of world trade talks. The first eight rounds were conducted under the General Agreement on Tariffs and Trade (GATT). The Doha Round are the current talks and began in 2001 but have not yet reached conclusion. GATT was a draft charter for the International Trade Organization (but the charter was not ratified by the US Congress) and became a multilateral treaty in 1948. GATT set principles for the negotiation of reduction in tariffs, the reduction in other impediments to trade, and the elimination of discriminatory practices. It also provided a forum for exchange of concessions and the settlement of trade disputes. The success of GATT in liberalizing world trade is clear from the substantial increase in world trade since 1948. In this sense at least, GATT was successful in promoting the liberalization of trade. GATT was succeeded by the World Trade Organization in 1995 which is now the body that overseas trade talks and arbitrates over trade disputes.

A strong argument can be made that the world trade system which has emerged from the successive agreements is tailored to suit developed countries. The fact that developing countries played little role in the first seven rounds is significant in this. Furthermore, Article XVIII of the 1947 agreement provided for "special and differential treatment" for developing countries. In principle, this was intended to assist developing countries by permitting them greater freedom in trade policy. The consequence in practice was that it marginalized those countries in negotiations.

The purpose of GATT was to reduce barriers to trade. This was achieved by negotiating tariff reductions and by the process of *tariffication*: changing non-tariff barriers (such as a quota) into an equivalent tariff that led to the same level of trade. Two arguments lay behind the process of tariffication. First, it made the size of the barrier explicit. Second, it was believed to be easier to negotiate future reduction in tariffs than it was to negotiate reductions in non-tariff barriers. The downside was that countries could exploit the tariffication process to set a high initial tariff which gave something that could be traded for in future concessions.

There is now doubt that the successive rounds of talks have significantly reduced the level of tariffs on goods traded between developed countries. This is demonstrated in table 8 which shows that the levels of tariffs are now on average very low after the successive rounds of trade talks. The average tariff on goods imported from other high-income countries is 0.8 percent. So, on trade between high-income countries, there is very little scope for further reductions. The position on imports from developing countries is worse but not by a great deal: the average tariff levied by high-income countries on manufactured goods from developing countries is higher at 3.4 percent. In contrast, developing countries on average levy higher tariffs and the highest average tariffs are on trade between developing countries. A different story emerges from table 9 which reports tariffs on trade in agricultural products. The average tariff is much higher than it is for manufactured products which is a reflection of the

	Importing region	
Exporting region	High-income countries	Developing countries
High-income countries	0.8	10.9
Developing countries	3.4	12.8
World	1.5	11.5

Table 8: Average tariffs on manufactured products

	Importing region	
Exporting region	High-income countries	Developing countries
High-income countries	15.9	21.5
Developing countries	15.1	18.3
World	15.6	20.1

Table 9: Average tariffs on agricultural products

focus of the early rounds of trade talks. What the two figures have in common is that it is the developing countries that levy the highest tariffs on average.

Further details of the protection offered to the agricultural sector, and the food sector more generally, is given in table 10. This shows that there can be high levels of tariff, significant export subsidies, and production subsidies. Each one of these is an impediment to free trade. It has been argued that the trade policies of developed countries impede development. One justification for this argument is that tariffs on processed food imports are 42 percent in Canada, 65 percent in Japan, and 24 percent in the EU. In contrast, the tariffs on the least processed food items are 3 percent, 35 percent, and 15 percent respectively. This tariff structure discourages developing countries from moving into food processing and limits the value added they derive from agriculture. A second justification can be found in the level of farm subsidies in developed countries. In 1986-88 OECD farm subsidies were equal to 51 percent of the value of farm production. Such subsidies have proved highly persistent: in 2002 they were still 48 percent of value. Subsidies of this level greatly reduce the ability of developing countries to compete in world agricultural markets.

The Uruguay Round that began in 1986 was characterized by a significant increase in the number of countries that participated. This round also extended the scope of the discussion. It included talks on services, Trade-Related Aspects of Intellectual Property and Trade-Related Investment Measures. The round was brought to a close in 1993 and was predicted to bring large welfare improvements for developing countries. Estimates since have suggested that

	Import tariff	Export subsidy	Production subsidy
Food grains	23	1	6
Feed grains	97	4	11
Oilseeds	4	0	9
Meat and livestock	17	8	2
Dairy	23	27	2
Other agriculture	11	0	0
Other food	1	0	0
Beverages and tobacco	18	0	0

Table 10: Protection to agriculture

developing countries actually suffered a loss as a result of the Uruguay round. Explanations for the difference between the expected and the actual outcome were that the agreement to remove barriers to trade in textiles was back-loaded so did not come into effect until several years after the round was completed. It has also been suggested that the benefits from tariffication were overestimated and the implementation of the agreement proved costly. Furthermore, the average OECD tariff on imports from developing countries remained four times larger than the average tariff on imports from developed countries.

The latest round of talks began in Doha in 2001. These aimed to set the mandate of the World Trade Organization (which replaced GATT in 1995) after the previous meeting in Seattle in 1999 ended in failure. The Doha Declaration outlined a framework for negotiations which focused on the promotion of economic development and led to it being given the name of "The Development Round". In 2003 the WTO convened a meeting in Cancun in Mexico. This ended without agreement because the developing countries felt that the EU and US had not given ground on agricultural subsidies. The developing countries also saw significant costs arising from the implementation of new regimes concerning competition policy, investment regulations, trade and customs procedures, and intellectual property rights.

The Doha talks were suspended in July 2008. The EU and India were blamed by the US for trying to exclude too many agricultural products from tariff cuts. China and India refused to lower barriers to imports of subsidized agricultural goods. For several West and Central African countries the US cotton subsidy is a primary issue. In negotiations the US refused to reduce the subsidy but offered more aid instead. This proved unacceptable. However, there are two additional arguments to consider. First, many agricultural exports from Africa are subsidized or benefit from artificially high international prices. Second, many African countries also have little to gain from a trade agreement because under the EU Everything But Arms programme African LDCs have duty free quota free access to the EU market. Many sub-Saharan countries have Duty Free Quota Free access to markets in developed countries under Economic Partnership Agreements. These facts limit the gains to be obtained from a successful trade agreement.

The reduction of tariffs and the growth of world trade are clear evidence that the rounds of trade talks have been successful. At least part of this success has arisen from the existence of mutual gains to be exploited. These gains have been realized in the trade between developed countries. The Doha Round intentionally set out to help developing countries. The interests of developed and developing countries can be very different so it may be hard to find mutual gains. More likely, aiding the developing countries will probably have to involve losses by the developed countries. It is therefore not surprising that the history of successful talks is now confronted with this round of talks that failed to make progress.

4 Corruption and Compliance

4.1 The effects of Corruption on growth

Corruption has clearly a negative impact on investment and growth. A payment of a bribe to get an investment license reduces the incentive to invest. Moreover, the bribe payment in the taxation system of many countries is not tax deductible from taxable investment. So bribe payment for investment is particularly harmful for risk-taking. Another adverse effect of corruption is that rent seeking crowds out productive investment. When tax revenues aimed for productivity enhancing infrastructure or human capital investment are diverted for politicians' private benefit, growth rate will decline. Even worse, higher bibes imply that productive investment becomes less profitable relative to rent seeking activity. Murphy et al. (1993) argue that in general when there is slow growth, the return to productive investment fall relative to rent seeking activity and the resulting expansion in rent seeking activities further slows down growth. Besides, investors and entrepreneurs are at the mercy of corrupt public officials to obtain permits and licenses for new products that are not needed for existing products. This is a serious barrier to innovation. Corruption as a tax on ex-post profits may stifle entry of new products and technology which require an fixed cost investment. Some of the adverse effects of corruption on growth have been confirmed empirically in the work of Mauro (1995). Using cross-country data on corruption rankings in 70 countries Mauro (1995) finds a negative correlation between corruption index and the investment rate or growth rate. Improving by one standard deviation the corruption index (i.e. less corruption) increases the investment rate by 3 percent of GDP. What about the impact of growth on corruption? It is fair to say that for some countries with the process of industrialization and growth, corruption may have got worst first for some time before getting better. This is a sort of inverted U-shaped curve of corruption similar to the Kuznets curve linking economic inequality to income per capita. There is also the environmental Kuznets curve positing an inverted U-shaped relationship between pollution and per capita income. The driving force is that as the economy expands in the earlier stages of development, the markets remain thin for many goods and services giving the opportunity to public officials

to milk the process for granting monopoly right, licenses and franchises. But belong a certain point in the economic expansion, the process of economic growth ultimately generates forces to reduce corruption. Rewards for productive investment relative to rent seeking activities increase when there is sustained growth. A richer economy can also afford to better pay its civil servants, reducing their motivation for corruption. The democratic reforms will set up institutions that build mechanisms of accountability and transparency at different levels which eventually trickle down the network of corruption. The result is a better of "enforcement" of laws and rules, even though the "making" of laws and rules remains under the influence of money.

4.2 The effects of Corruption on tax collection

Corruption has also adverse effect on the static efficiency of tax and revenue collection in developing countries. As the IMF (2012) suggests a major revenue loss is related to extractive sector. An increasing number of African countries are searching and discovering natural resources and how those resource revenue is shared between the government and the private investors is important for poor countries. The tax treatment of mining industries varies widely across countries by mixing royalties, taxes on rents and on business profits. The rent sharing agreement varies also a lot across countries with sometimes a very low share for the government. The IMF (2012) estimates that on average governments retain about 30% of the revenue in the mining sector. The fact that agreements in the extractive sector are often ad-hoc and not transparent is a major risk for corruption. Indeed when the deal is negotiated directly between politicians and big companies, outside the tax system and without accountability mechanisms (check and balance), the potential for corruption and for lower retention of revenue for the country, in exchange for political benefits, can be very high. It is therefore essential to design transparent rules and guidelines that prevents the proliferation of ad-hoc arrangements (e.g. the non discrimination rule). The purpose is to design fiscal regimes and rent sharing agreements that ensure a fair amount of revenue for the country that can be reinvested in the development of productivity-enhancing infrastructure, human capital and health care investments. The objective for tax administration in the tax enforcement is to ensure that the probability of detecting non-compliance and the penalty that is inflicted on the tax evaders are high enough to enforce compliance. At the same time effective enforcement policy must support and reflect general willingness to follow the rules and comply with the laws. The real difficulty is to pursue effective enforcement at the least cost to the taxpayer (compliance cost) as well as for the tax administration (administration cost). Collusive corruption between the inspector and the taxpayer may hinder tax enforcement. That form of corruption is more insidious and more difficult to detect because it is a secret arrangement between them to share some taxable income away from the government. This "collusive" corruption is also more contagious and persistent in the sense that it depends crucially on the number of other people we expect to be corrupt. The benefit of an honest official is higher when very few officials are corrupt, but it

declines as the number of corrupt officials increases. To put it simply it does not pay to be corrupt when everyone else is honest , but it does not pay to be honest when everyone else is corrupt. Suppose some administration hierarchy, the probability to be detected when corrupt and to be sacked diminishes with the general level of corruption in the administration. Corruption at each level of the hierarchy feeds on the other. The punishment declines as more officials become corrupt. To inverse this perverse circle we need a "crack down" policy to create the critical mass of honest officials in the hierarchy which in turn triggers a chain reaction by which honesty will progressively feed on the other officials. It is worth saying that this type of corruption goes beyond tax enforcement to include many cases of officials leniency with quality control, safety regulations in building, food and drug controls, pollution controls...

4.3 How to fight corruption

There are different solutions to combat corruption. The first is to eliminate excessive regulation and bureaucratic allocations of resources that feed corruption. Getting rid of many of the dysfunctional regulations. One of the most harmful form of corruption is predatory regulation. This is the process by which the government creates regulations that entrepreneurs have to pay bribe to get around. Because it raises the cost of production activity, this form of corruption is damaging the economy and slows down growth. This damage becomes larger when several government officials, acting independently, create separate regulatory conditions to economic activity so that each can collect a distinct bribe in return for authorizing the activity. When entrepreneurs face all these independent regulatory obstacles, they stop trying or move to underground economy to escape regulation altogether. Cutting down on the proliferation functions of government using vouchers and competition with private suppliers to serve a public need. In doing so we must trade off the benefit of reducing the corruption against the social value of the regulation itself. Food rationing can be organized by the public officials so that the poor can have access to it but with the risk of corruption. When organized by the market , the poor may lose access to this essential good. When fighting corruption with deregulation we should not lose sight of the social objective the regulation was supposed to serve. In that perspective, it is no surprising that structural adjustment programs in developing countries have been so unpopular when trying to eliminate the corrupt public administration in the food distribution. A second solution is to break down the monopoly power of the government by introducing competition and the possibility for people to vote with their feet. Also the overlapping involvement of local, state and federal agencies in controlling illegal activities may reduce corruption at each level. Obviously competition in the provision of public services has to be accompanied by more intense monitoring and auditing. A third solution to corruption is to set up various accountability mechanisms such as an independent office of public auditing, independent investigating agencies, watchdog committees providing information and monitoring services, a vigorous and independent press, making supervisors answerable for act of malfeasance by their

subordinates, procedures for encouraging"whistle-blowers", working on teams in facing a customer so that there is some check in the bargaining, periodic job rotation so that bureaucrat does not become too costly with a customer over time. A fourth solution is the important policy issue of incentive pay structure. This is one of the most effective ways of fighting corruption because to say simply you cannot give public officials power and require them to live in penury (see Klitgaard (1988)). The efficiency wage theory suggests to pay a wage premium above private wage so that the fear of job loss on detection may stiffen public officials resistance to temptation for corruption. International organizations when pushing for structural adjustment and budget cut in the public sector may trigger lower wages for public officials increasing their incentive for corruption. Hindriks et al. (1999) have shown that inducing honesty in the collection of progressive taxes can be costly, implying an additional source of inefficiency associated with the pursuit of equity. Intuitively, the government can levy progressive taxes without reducing its own revenue by creating countervailing incentives in the form of commissions: the tax inspector and the taxpayer are tempted to understate income to evade progressive taxes, and tempted to overstate income (extortion) to raise the commission payments. Striking a right balance between the two involves a real resource cost. In fact it is shown that a government that is concerned only to maximize revenue, eliminating altogether corruption and evasion, can do no better than set a proportional tax schedule and pay inspectors a fixed wage with penalties proportional to the extent of mis-reporting. The reason for such a simple incentive scheme is nothing to do with distortion on taxpayer effort or administrative simplicity: it is as a means of ensuring honesty in tax collection. The central message is that there is never any strict gain from paying commissions for tax collection. There is no commission just to deter the inspector from abusing his discretionary power through the threat of extortion to extract bribe from the tax payer. A last comment on corruption is about the role of the sate. Following the rent seeking approach, the sate is predatory by nature, and the less state there is the better. But this approach does not help to understand why corruption is more important in some countries than in others. In fact governments in some developing countries became predatory not because they were powerful, but because they were weak: the state could not enforce the laws and property rights that provides the minimal prerequisite of a market economy, and as a result the state increases the cynicism about corruption among public officials. Disrespect quickly led to dishonesty. Weak and fragmented governments can hardly control corruption.

4.4 The ghosts and the icebergs

The conventional wisdom is that informal activities are the main tax challenge in discussion of taxation and development. But as Kanbur (2009) pointed out this term lack a minimal conceptual clarity and coherence in the analytic literature and so that literature (on informality) as a whole is in a mess. The

reason is that it simply fails to evoke with much clarity and coherence the key issues of compliance that are the real challenge. To understand this point just consider the many small firms and street traders. They are mostly operating in the so-called informal sector defined in somewhat vague sense of not being subject to tax and other government restrictions. But in tax terms it is fare from obvious those firms should be taxed anyway. When balancing the revenue foregone by excluding them from tax against the administrative and compliance cost to the tax payer from including them, the final decision may well that they should not be taxed (excepted indirectly through taxes such as the VAT on their purchases). Thus the issue of informality is not that much important to the extent that the optimal tax by such small operators should be zero. More important for the tax agenda is the issue of tax evasion, both in term of revenue mobilization and of the fairness of the overall tax system. Those tax evaders are not in the informal sector at all but they are highly visible professionals such as civil servant, doctors, lawyers, architects and other highly qualified subject to a range of professional restrictions. They are also the medium and large corporations in the agricultural sector, the extractive sector and the banking sector. The informal sector issue is not very relevant nor useful to mobilize tax revenue in developing countries. More useful is the concentration on the hard-to-tax to stress that the real issue is non-compliance and its dependence on the tax policy and implementation. As suggested by Keen (2012), "it is necessary to probe deeper into the anatomy of non-compliance, and how tax design and implementation should reflect and address it. These are complex issues, but facing them head on at least points to potentially fruitful areas of inquiry and action" (p.16). It is useful to depart form the informal sector approach with the implicit assumption that there should be serious attempt to tax them all, to make a clear distinction between how to draw the line between the taxed and untaxed. In developed countries many transactions and citizens are not taxed. We do not call them informal activities. When dealing with the hard-to-tax in a wider context, it makes a difference whether non-compliance takes the form of "ghosts" (invisible taxpayers who do not register to tax) and "icebergs" (taxpayers who register but under report taxable income). Ghosts are much more prevalent in developing countries. Keen (2012) reports that in Uganda about 50 percent of firms were failing to register to tax administration. In the "ghosts" model the registration of the taxpayers is the critical issue and defining the optimal threshold to register is crucial both in terms of administration and compliance costs. In the "iceberg" model, the critical issue is to develop effective tax enforcement such as improving refunding for exporters and input purchases under VAT, tackling more effectively aggressive tax planning by large multinationals. Reinforcing tax compliance is not only a matter of tax administration, it is also a matter of tax policy. Tax exemptions and tax differentiation (across persons, sectors and firms) for example create opportunities for corruption. Another example is the use of withholding taxes and more advanced tax collection schemes that can collect indirectly some tax from those who may not be fully compliant, but also to the extent that withholding taxes are creditable against taxes they are failing to remit (see Boadway and Sato (2009)). This is part of the logic of

the value added tax: a retailer who chose not to register, for instance, escape all tax under retail sales tax, but only the tax on their own value added, provided it is charged by their suppliers, under a VAT. Many developing countries have a comparatively weak tax administration and tax enforcement is a serious issue. This implies that taxes should be simple with few scope for tax avoidance or evasion. Simple taxes are also relatively easy to collect and enforce. Taxes on profits, personal income taxes and value added taxes are all relatively complex and difficult to administer with many potential loopholes and special regimes. It is therefore not that surprising that many developing countries have set up simple minimum tax scheme on broad and harder to evade tax base. The best example is the turnover minimum tax schemes implemented in many developing countries (see (EY, 2013)).Kleven et al. (2014), using administrative data on bunching of taxpayers around the switching threshold between profit and minimal turnover tax scheme in Pakistan, they estimate that the turnover tax has reduced tax evasion by about 60 per cent of corporate income and increases revenue by 74 per cent without reducing total profits. The tax rate on the turnover tax is only 0.5% compared to a tax rate on profit of 35 per cent. However the turnover tax base is much larger than the profit tax base and harder to evade. Broader tax bases encourage lower level of tax avoidance and evasion. Obviously taxing turnover instead of profit introduces a distortion in the production due to the multiple taxation of the same items along the production chains. This is a violation of the Diamond-Mirrlees principle of production efficiency but the benefit is a reduction in the compliance cost. The so-called efficiency-compliance trade off can therefore justify some deviation of production efficiency to reduce the cost of collecting taxes.

5 Tax Collection Efficiency

As mentioned in the introduction, domestic resource mobilization in developing countries is at the center of the attention. It is thus essential for developing countries to define the sources of the tax collection effectiveness (to extend the taxable potential) and to be sure that the tax collection system is efficient (to avoid losses). Generally, authors focus on total tax collection to study the efficiency of a tax system. In this study we widen this approach by estimating the collection systems efficiency of the different taxes. The following sub-sections are dedicated to the construction of different efficiency indicators and to the analysis of these indicators.

5.1 Determinants of Tax Collection

The aim of a tax efficiency indicator is to determine if tax potential is fully exploited. In this perspective, it is crucial to assess correctly the tax revenue potential controlling for the the most important factors driving tax collection. Therefore, we construct a potential tax revenue as a function of the configurations of different factors. We then compare this potential tax revenue with the

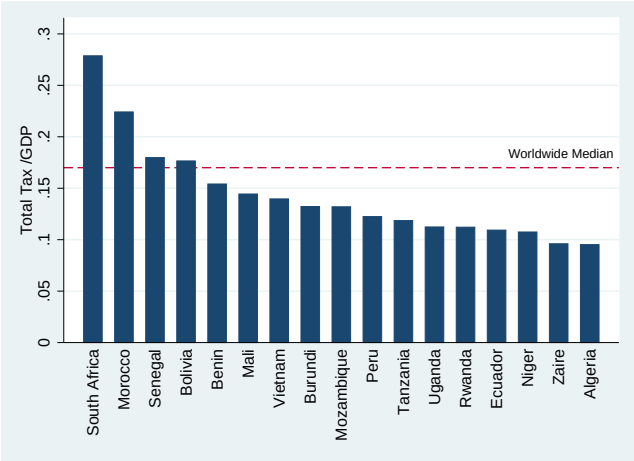

Figure 5: First Ranking for DGD's partner countries

actual tax revenues. Obvioulsy the quality of the efficiency indicator will depend on the relevance and the exhaustiveness of the factors taken into account in our analysis. In a first step, it is thus essential to review the key determinants of tax collection, that is those that are theoretically and empirically relevant and significant.

5.1.1 Nominal GDP

The nominal GDP is the first factor used to assess the potential tax revenue. It allows mainly to take into account the size of the formal economy. Only market transactions can be taxed. So expansion of the market economy increased GDP and tax revenue altogether. However, this input used independently does not give any robust information on the efficiency of the tax system. In other words, there are too many unknowns to conclude anything from this restricted benchmark approach. The figure (5) highlights the type of ranking that can be obtained from the tax system efficiency indicator constructed with the GDP as input. From this ranking we may presume that the South African tax system was the most efficient in the 2000s among the DGD's partner countries. However, this presumption is conditional to the absence of other inputs affecting the collection of the taxes. Poor conclusions may thus be drawn from this type of indicator.

The collection of the different tax components depends on other factors than the GDP level. It seems risky to draw conclusion simply from the comparison of the collection levels of the different tax components. A lot of studies follow this benchmark approach with the tax on goods and services' collection levels (Cnossen, 2014). The taxes on goods and services are flat taxes, i.e. taxes with a constant marginal rate. They include taxes on sales (i.e., sales taxes and VAT) and excise taxes. The VAT tax is designed to only tax the final consumer.

Having been recently introduced in most of the developing countries[15], this tax is in the center of the attention of the development organizations[16]. The *VAT Productivity* efficiency indicator is defined as the ratio of VAT collected to GDP level.The wide use of this simple indicator is made possible by the fact that it is commonly accepted that this tax is easier to administer than direct taxes (Piccolino et al., 2014). VAT revenues are also less sensitive to the size of the informal market[17] than are direct and other indirect taxes.

The graph (6) reflects the VAT productivity indicator for DGD's partner countries. The horizontal dashed line being the worldwide average, we observe that most of the DGD's partner countries have a VAT system less efficient than the worldwide average. On the other hand, Bolivia has a VAT system really efficient according to this indicator. Comparing to the graph (5), we observe that the two indicators are not similarly distributed. For example, the graph(5), suggests that the Beninese tax system is quite efficient while the VAT productivity displays low performance.

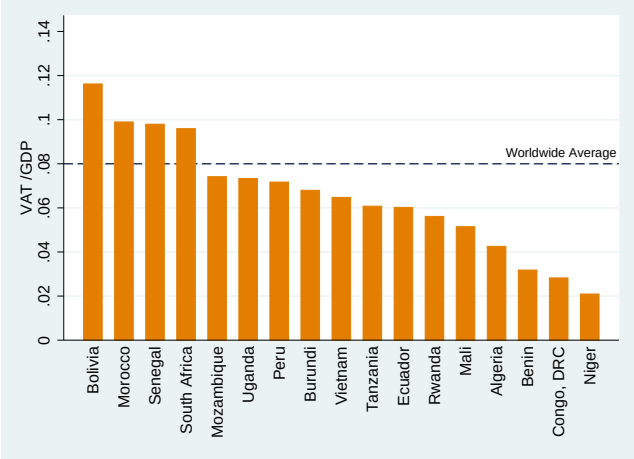

Figure 6: VAT Productivity

5.1.2 GDP per capita

As for the nominal GDP, it is reasonable to presume that the average GDP per capita affects the collection of taxes. Wealthier agents are expected to be able to contribute relatively more to tax revenue. More widely, the GDP per capita is a useful proxy of inputs impacting the tax collection such as the population growth, the capacities of the tax administration or the size of the informal sector.

[15] Ebrill (2001) pointed out that VAT (or a VAT-like tax) can be found in 116 countries around the world in 1998.

[16] According to Tanzi and Zee (2000), the introduction of VAT over the past few decades has been the most visible tax reform undertaken by developing countries.

[17] It enables the informal sector to be taxed on all the intermediary goods coming from the formal sector (Boadway and Sato, 2009).

This is double-edged argument, with the consequence of mixing up the effect of different factors. Used separately, this variable allows to explain approximately one third of the variation of the total tax revenue in proportion of GDP[18].

5.1.3 Spatial dependence

The map (7) suggests some spatial dependence in the distribution of tax revenue. This spatial dependence may be explained by the geographical trade agreements, as well as driven by the mobility and the local competition for goods, services and production factors. These external competition forces pushe for more tax convergence. Another explanation is the contagion effect of tax administration (in)efficiency. The efficiency of tax collection may depend on the tax system of the neighbor's countries. This argument may be illustrated by a simple example with the VAT tax. Let's imagine two countries (A and B) producing both goods bought by final consumers of country B. The country B has an efficient VAT system, controlling for the VAT collection at every stage of the production chain while the country A has a poor VAT system. In country B, the monitoring system between intermediary producers and the frequent controls allow to limit the incentive to avoid the VAT. In country A, the risk to be controlled is quasi nonexistent and intermediary producers avoid the VAT to push their sales. The price of the final good (ready to be sold to the final consumer) is equal to 1 in country A and equal to 1+VAT in country B. If the good of country A is illegally imported, the seller may thus increase substantially its profits. It may thus exist incentives to import goods illegally (without paying VAT on imports) from country A to country B impacting the effectiveness of the tax system in country B. This is related to the contagion effect discussed earlier in respect with corruption and compliance.

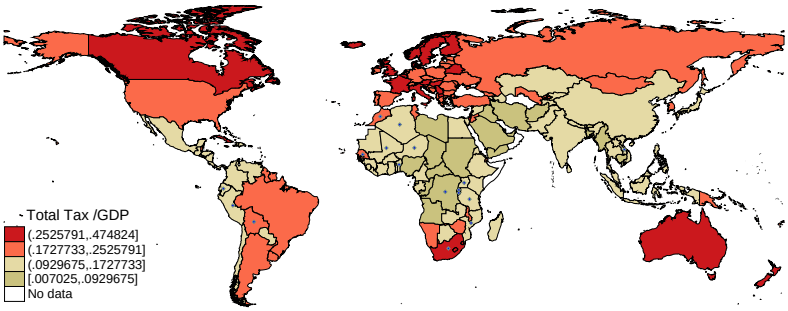

Figure 7: Tax Revenues Collected in the 2000s

The variable that we use to take into account the spatial dependence is called the "spatial lag". The idea is to construct for each geographical entity a fictive entity that summarize its neighborhood. The weight given to the neighbor

[18]We observe a R squared of 0.33 for a regression of 117 countries of the mean total tax revenue (in % of GDP) on the mean GDP per capita during the 2000s.

Variable	I coefficient	Z score	p-value
Total Tax	0.444	11.243	0.000
PIT Tax	0.430	9.592	0.000
Trade Tax	0.292	7.833	0.000
Tax on Goods and Services	0.506	12.415	0.000

Table 11: Moran'I statistic

entities is inversely proportionate to the distance that separate them to the studied entity. We use the Moran's I statistic to determine if a variable is significantly auto-correlated with its "spatial lag". The spatial dependence of the total tax revenue is statistically significant (see table (??)). In the efficiency equation the spatial dependence input is taken into account through the spatial lag of the total tax collected.

The decomposition of the tax structure allows to be more precise in regard to the policy advices concerning the efficiency of the tax systems. The table (??) shows that all the tax components are spatially dependent. However, the *I coefficients* are far from being equal. We see for example that the explanatory power of the goods and services' spatial lag is higher than the corporate taxes' spatial lag.

5.1.4 Non Tax Revenues

Governments can generally count on other sources of revenue than tax collection. Among those sources of revenues we distinguish two main groups: the grants and the natural resources revenues (from taxes or not). Those sources of revenue are suspected of having an impact on domestic revenue. We introduce the concept of "rentier state" to apprehend this problematic. According to Moore (2004), rentier states live largely off unearned income. Unlike fiscal or tax states, the rentier state is resourced with little organizational or political effort and has poor relations with its domestic population. Numerous authors have studied the impact of aid on tax effort although the conclusions are far from similar. First, many studies have concluded that aid discourages tax effort (Remmer (2004);Gupta et al. (2003); Gupta et al. (2003); Knack (2008); Crivelli et al. (2012)). Second, Gupta et al. (2003) have shown that the composition of the aid matters: loans that have to be repaid encourage tax effort whereas grants do not. Crivelli et al. (2012) have replicated and expanded this study with a larger dataset and found similar results. Moreover, they pointed out that the negative impact of aid is larger in weak institutional environments. Finally, some authors obtained divergent results and noted that aid has become positive since 1980s (Clist and Morrissey (2011) and Clist (2014)). In the same order of ideas, Piccolino et al. (2014) found that aid leads to democratization and that there is an indirect and mediated link between democracy and extractive capacity. Like grants, natural resources may have an impact on the exploitation of other sources of revenue. In the literature, it has been widely accepted that

Figure 8: GS Tax Revenues versus Import Tax Revenues

natural resources discourage tax effort (Bornhorst et al. (2008); Morrissey et al. (2014)). In the estimation of potential tax revenue this effect is is taken into account through a variable summing all the non-tax revenues.

The study of each component of the tax structure has to be accompanied with variables controlling for the potential tax shifting effect. A striking case is the tax shift from trade to goods and services tax that occurred in developing countries. Indeed, different developing countries have abandoned import tariffs and are now relying much more on taxes on goods and services. Among the DGD countries, Mali and Tanzania are examples of this shift. In Mali, the large increase of the taxes on goods and services was mainly due to an increase of the VAT revenues (+4%) but also to an increase of the excises revenues (+1.5%). This tax shift may be called a policy shift as it arises from a policy decision. On the other hand it is also possible to observe some compliance shifts. Those shifts emanate from the taxpayer. For example, if it exists large differences between PIT and CIT rates, companies may report personal income as corporate income in disguise to benefit from a lower CIT rate. (Tanzi and Zee (2000) and Arnold et al. (2011)).

5.1.5 Government Effectiveness

It is straightforward that the quality of the government affects the effectiveness of the tax system. We already discussed that point in the section on corruption and tax efficiency. By quality we mean the degree of independence the tax administration from political pressures but also the quality of policy formulation and implementation. For example, complex tax system, made up of many rate brackets, personal exemptions and deductions are generally less effective (Tanzi

and Zee (2000); Cnossen (2014))[19] . More widely, the quality of the administration will generally depend on the quality of human capital and on the available infrastructure (telephone, Internet, etc.).

The need in administrative capacities to collect tax vary also between tax items. For example, authors agree that indirect taxes are easier to administer than direct taxes (Piccolino et al., 2014). Direct taxes require an active bargaining with the taxpayers. This bargaining is not facilitated in economies with large informal sector composed of a high number of small establishments. This point is clearly confirmed by the tax reform in Pakistan where the switch from CIT to a simple turn over tax has increased revenue by about 70 percent without reducing production (see Kleven et al 2014).

5.1.6 Other factors

Briefly, several other inputs are presumed to have an impact on the tax systems effectiveness. First, the openness affects the tax collection (Rodrik (1996); Piancastelli (2001); Norregaard and Khan (2007); Aizenman and Jinjarak (2009)). The impact of openness may vary by type of tax. High openness index may damage the CIT collection because of the "rate race to the bottom" existing to attract firms while indirect tax collection may be favored because the international trade facilitates the taxation of goods[20]. Besides, the production structure may impact the effectiveness of the tax collection system. In the literature, it is commonly accepted that it is relatively harder to tax the agricultural sector. Subsistence farmers are also often exempted which limits the tax base and the tax collected (Leuthold (1991); Tanzi (1992); Piancastelli (2001)).

5.2 Tax Efficiency Indicator

The commonly used indicator of tax system efficiency is a cross-country comparison of the total tax collected as a share of GDP. However,Musgrave (1987) and Le et al. (2008) show that this approach is reasonable for group of countries with similar economic structure and the same level of development. In other words, other variables have to be taken into account to construct the efficiency indicator (those variables are listed in the previous sections). In addition, the decomposition of the tax structure allows to construct a more useful tool for the policy maker than the general approach. In this study, to construct the tax efficiency indicator, we first estimate the taxable capacity of each country. This taxable capacity is estimated with a regression analysis where the explanatory variables are the factors presumed to affect the tax potential[21]. The efficiency indicator is defined by comparing the tax potential with the actual tax collected. Different indicators result from this approach. For example, the ratio

[19] Note that, according to Keen et al. (2008), the complexity of the tax does not come from the number of brackets but from the number of exemptions.

[20] In an economy with important informal sector the easy to collect border taxes guaranteed a minimal taxation on goods.

[21] The regression approach has been used by different authors. See Lotz and Morss (1967), Bahl (1971), Le et al. (2008), Le et al. (2012).

between the actual tax and the potential tax is called the "tax effort" (see Le et al. (2008) and Le et al. (2012)). Our contribution to this approach is twofold. First, we take into account in the estimation the spatial variable to capture the geographic shift (contagion effect). Secondly, the decomposition of the tax structure enables us to capture the interaction between tax components due to policy shift (tax shifts). This approach, made possible by the existence of the new "ICTD Government Revenue Dataset" (ICTD GRD), covers a 10 years period (2000-2010) and includes 110 developing and developed countries. We perform cross-country regressions rather than panel regressions to avoid any spurious regression caused by the non-stationarity of the variables. In this way, we also avoid to deal with the black boxes generated by the country fixed effects.

5.2.1 Empirical Specification, Variables, and Methodology

In this study we propose models with different specifications to assess the efficiency of the total tax collection and its different tax components:

-The equation to estimate the taxable potential for the total tax system in the 2000s is:

$$\frac{TotTax_i}{Gdp_i} = \alpha_0 + \alpha_1 Gdpc_i + \alpha_2 W(dep)_i + \alpha_3 Open_i + \alpha_4 Agr_i + \alpha_5 Gov_i + \alpha_6 NonTax_i + \varepsilon_i$$

-The equations to estimate the taxable potential of the different tax components in the 2000s are:

$$X_i = \beta_0 + \beta_1 Gdpc_i + \beta_2 W(dep)_i + \beta_3 Open_i + \beta_4 Agr_i + \beta_5 Gov_i + \beta_6 NonTax_i + \sum \beta OTax_i + \varepsilon_i$$

The tax components denoted by X_i are:

PIT_i/Gdp_i is the average personal income tax revenue in percentage of GDP (sources: ICTD GRD, IMF WEO);

$Trade_i/Gdp_i$is the average trade tax revenue in percentage of GDP (sources: ICTD GRD, IMF WEO);

$GS_i/HCons_i$is the average tax on goods and services revenue in percentage of the nominal household consumption expenditure (NPISHs included) (sources IFS IMS).

For the various regressions we use the same set of independent variables. Obviously the estimates coefficients will vary for the different tax components.

$TotTax_i/Gdp_i$ is the average total tax revenue in percentage of GDP (sources: ICTD GRD, IMF WEO) ;

$Gdpc_i$ is the average GDP per capita in purchasing-power-parity (PPP). This variable is expressed in logarithm in the equations (source IMF IFS);

$W(dep)_i$ is the spatial lag of the dependent variable;

$Open_i$ is the average measures for trade openness (exports plus imports in percentage of GDP) (source: IMF IFS);

Agr_i is the average share of agriculture in the total production (source: World Bank);

Gov_i is the average measure for the governance effectiveness (It "reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." Governance effectiveness index are reported as index number from 1 to 6. While 1 indicates the lowest governance effectiveness, 6 indicates the highest governance effectiveness) (source: World Bank WGI);

$NonTax_i$ is the average of the Non-Tax Revenues. (sources: ICTD GRD);

$OTax_i$ stands for the average of tax revenues not included in the dependent variable;

The correlation matrix (see appendices) confirms the sign expected between our variables of interest. The total tax collection in percentage of GDP is positively correlated with the GDP per capita, its spatial lag, the trade openness and the governance efficiency [22]. On the other hand, it is negatively correlated with the agriculture share and the non-tax revenues. The personal income tax revenue in percentage of GDP is positively correlated with the GDP per capita, the governance efficiency, its spatial lag, the trade openness, the tax collection on goods and services, the SSC revenues and the CIT revenues. On the other hand, PIT collection is negatively correlated the agriculture share and the trade tax revenues. Finally, the GS revenues in percentage of the household consumption is positively correlated with the GDP per capita, its spatial lag, the trade openness, the governance efficiency, and all the other tax revenues excepted the trade tax revenues. The GS revenues are also negatively correlated with the agriculture share and the non-tax revenues. The regression is an ordinary least square regression for cross section. As mentioned by Bird et al. (2014) and Le et al. (2012) who use similar specification for panel data, it may exist a problem of endogeneity or dual causality within institutional variables and tax revenues variable. However, Bird et al. (2014) have tested and rejected any simultaneity of tax revenues and institutional variable.

5.2.2 Estimation of The Tax Potential

The estimations of the tax potential resulting from the specifications given in the previous equations are presented in the table (12). The tax potential has been estimated for the total tax as well as its three tax components (PIT, GS tax and Trade Tax). Excepted for Trade Taxes, we observe that the model has a good prediction power, in the sense that it can explain between 0.6 and 0.7 of the variance of the dependent variables (r-squared are comprise between 0.6 and 0.7). We do not consider the CIT because its tax potential is too difficult to predict[23]. The first equation of each model shows that the spatial dependence

[22] For the GDP per capita, the trade openness and the governance efficiency, the results are along the same lines as the correlation reported in Le et al. (2008) and Le et al. (2012). The other variables have not been used in those two reference papers.

[23] For CIT revenues, our model specification gives a r-squared below 0.25.

Dependent variable	Total tax	PIT	GS tax	Trade tax
Constant	0.206*	-0.014	0.131	-0.101
GDP per capita	-0.016	0.001	-0.009	-0.009
Spatial lag of dep.	0.736***	0.804***	0.490***	0.472***
Trade openness	0.018	-0.009	0.021*	0.033***
Non-Tax revenue	-0.151	0.061	-.0176**	-0.081
Governance efficiency	0.026***	0.017***	-0.000	-0.007
Agriculture value added	-0.002**	0.000	-0.001**	-0.001**
GS tax		0.158***		-0.173***
PIT			0.386***	-0.055*
SSC		-0.212***	0.218	-0.010
CIT		-0.201	0.736**	-0.055
Trade tax		0.099	-0.398***	
Observations	115	115	115	115
R-squared	0.60	0.67	0.71	0.44
*significant at 10%;** significant at 5%; *** significant at 1%				

Table 12: Determinants of Tax Collection in the 2000s

strongly impacts the tax collection. The main determinants of the tax collection are mostly the governance effectiveness and the economic structure. We see that the tax collection is lower in countries where primary sector's production represents an important share of the total production. Striking enough, the GDP per capita is not significant. This is explained by the introduction of the governance effectiveness variable that captures most of the explanatory power of the development level variable (Le et al., 2012). The variables impacting the the PIT collection are mostly the same as the variables impacting the total tax collection (i.e. the spatial dependence, the efficiency of the fiscal administration and the agriculture share). Moreover, we see that the collection of other taxes has also a strong incidence on the PIT collection. The collection of GS taxes impacts positively the PIT system while the collection of SSC seems to damage the PIT collection. This negative sign typically highlights the tax shift that may occur between those two comparable taxes. The model for the GS tax system gives the most striking results. First, the importance of the spatial dependence and the agriculture share is again confirmed. Secondly, the negative coefficient of the trade taxes collection highlights the importance to take account for the existence of tax shift between tax components. Third, the trade openness' coefficient is positive as expected. As already mentioned, international trade favors GS tax collection because GS taxes are easier to collect at the border. Finally, the negative coefficient of the non-tax collection variable highlights the revenue shifting that may occur in well-endowed countries.

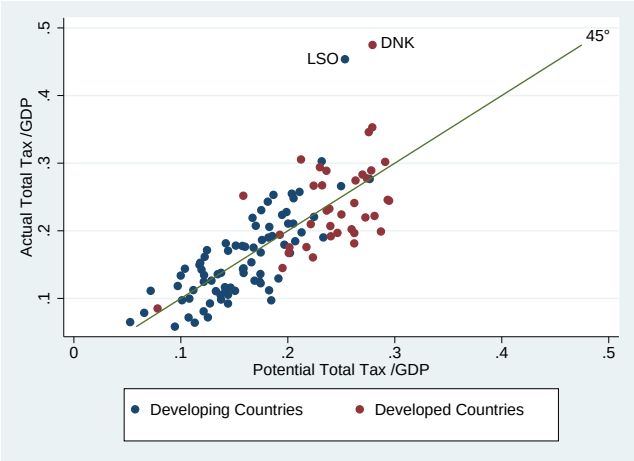

Figure 9: Actual and Potential Total Tax Collection, average over the 2000s

5.2.3 Estimation of the tax effort

Total Tax Collection Indicator The tax effort is the ratio of the actual tax to the potential tax. The ranking of the tax effort indicators are reported in the appendices.

In the figure (9), all the points under the 45° diagonal represent countries for which the total tax collection is under the taxable potential or in other words that may improve their collection tax effort. We observe that developing countries (LICs and MICs) have lower potentials and lower actual levels of total tax collection than developed countries. Several countries of the two group may improve the efficiency of their tax systems. The two best countries -i.e. with an actual total tax collection much over its predicted potential- are Denmark and Lesotho.

The figure (10) allows to classify DGD's partner countries into different groups, based on their tax effort and actual tax collection. Those groups are determined by the two perpendicular dashed lines. The horizontal line represents the median level of total tax collection for the 115 countries studied while the vertical line separate countries according to their average tax effort (below average or above average).

DGD's partner countries that collect few taxes and that lies below their respective tax potential are considered to under-perform in their tax collection. These countries are Mozambique, Peru, Tanzania, Uganda, Rwanda and Niger. Administration and fiscal reforms focusing on revenue enhancement should allow these countries to increase their tax revenues. On the opposite, countries that have high tax effort and high actual tax collection (typically Morocco) are considered to over-perform in tax collection. In their situation, an increase of the tax revenue may distort wastefully the economy. Finally, countries with high tax effort and still low actual tax collection (Mali, Benin and Burundi) suffer

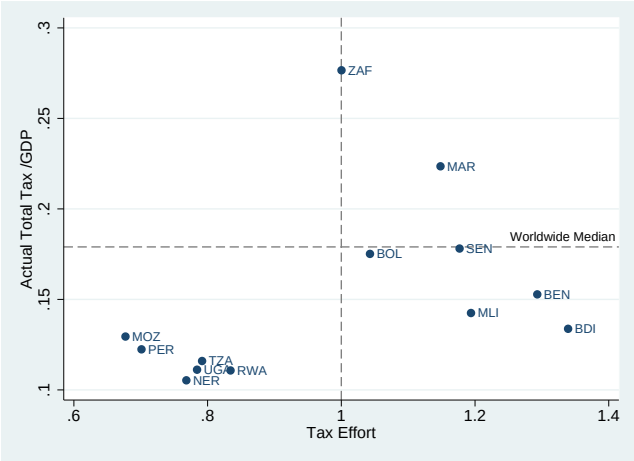

Figure 10: Tax Effort (Total Tax)

from evasion, inefficient administration and narrow bases. According to Le et al. (2012) those countries seem to fall into a "trap" and the "More likely explanation for this trap is the net over exploitation of some revenue sources through high tax rates used as a tool to overcome tax erosion resulted from a widespread preferential treatment to economic sectors and activities. A sustained approach to break this trap is to conduct important parallel reforms—creating favorable legal and regulatory environment to attract private investment and at the same time revamping the tax systems to cut collection costs and minimize tax-induced economic distortions and hurdle to investment; and most importantly focusing on reforms to improve the quality of governance".

PIT Collection Indicator The figure (11) shows that the potential PIT is very low for most of the developing countries. Different developed countries have actual PIT much higher than their potential. The study of this tax component give complementary information. For example, we can say that the efficiency of the Danish tax system may be partially explained by its good PIT collection system while it seems not to be the case for Lesotho.

GS Tax Collection Indicator In the figure (13), we observe that the distribution of the potential and actual GS taxes collection are not much depending on the development level. Besides, the high majority of countries collect too few taxes on GS while the most serious cases concern developed countries. About 10 countries have an efficient GS collection system and they are all developing countries.

Trade Tax Collection Indicator In figure (15), we observe that trade tax is the unique tax component for which the potential and the actual collection

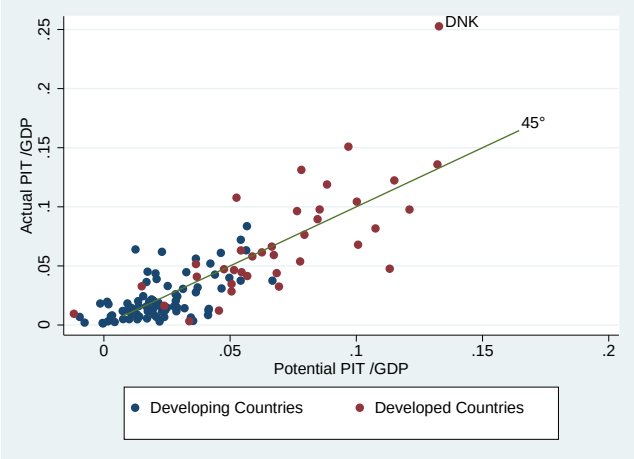

Figure 11: Actual and Potential PIT Collection, average over the 2000s

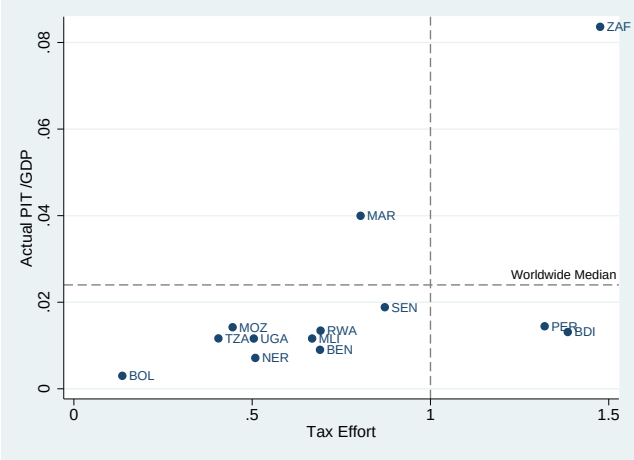

Figure 12: Tax Effort (PIT)

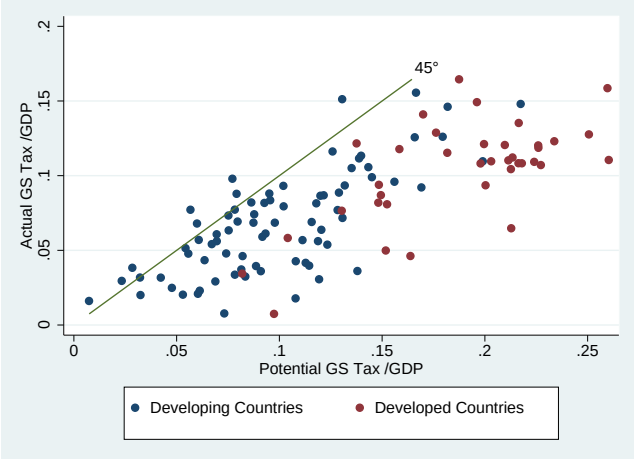

Figure 13: Actual and Potential GS Taxes Collection, average over the 2000s

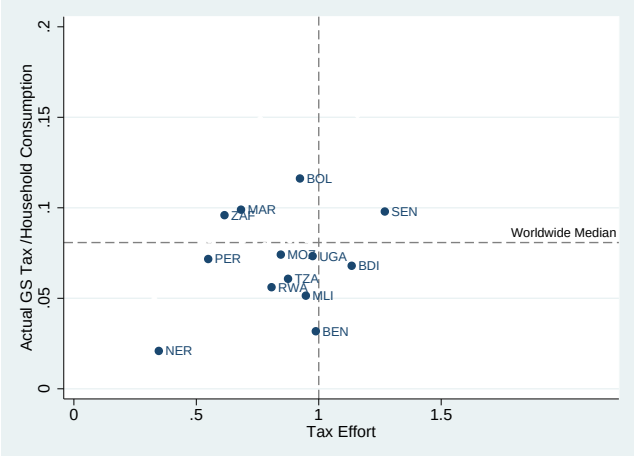

Figure 14: Tax Effort (GS)

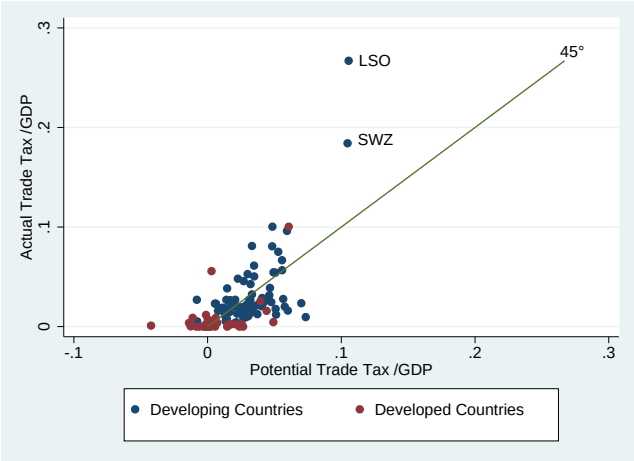

Figure 15: Actual and Potential Trade Taxes Collection, average over the 2000s

level is higher in developing countries than developed countries. The Lesotho and Swaziland have the highest trade tax collection peaking at more than 25% of GDP for Lesotho. Antigua-et-Barbuda and Russia are the only developed countries that count on high trade taxes collection.

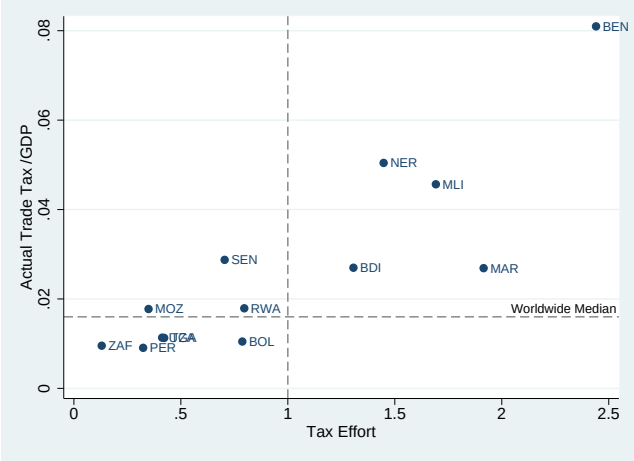

Figure 16: Tax Effort (Trade)

5.2.4 Special focus on DGD's partner countries:

Burundi: The Burundian's total tax collection is under the average of DGD's partner countries. The tax collection is deemed by a weak administration and a high share of agriculture in GDP. Besides, its tax effort index is the highest of

DGD's partners. In other words, in view of its weak resources, Burundi has a highly efficient tax collection system. Besides, we observe that Burundi makes strong efforts to collect each of the tax components studied. Especially, for a government of comparable quality, countries are not expected to collect so much PIT.

Benin: Benin and Brundi are quite comparable in term of level of tax collection and tax effort (Benin is slightly better endowed than Burundi and its total tax collection is higher). However, the efficiency indicators of the tax components show that Benin counts on a really efficient trade tax system. Its effort to collect the PIT being low, some increase of the tax collection may appear from a reform of the PIT system.

Bolivia: Bolivia collects more taxes than the majority of the DGD's partners and this is mainly explained by its better endowment (in term of structural characteristics). Besides, its tax collection level is slightly higher that what is expected for a comparable endowment. This high tax effort is mostly explained by the efforts done to collect GS taxes. On the opposite, the PIT system seems to be particularly inefficient in Bolivia. By reforming its PIT system, Bolivia may diversify its sources of revenues.

Morocco: The high level of tax collection in Morocco seems to be explained by both its structural characteristics and its tax effort. Considering the quality of its administration, Morocco seems to collect particularly high level of tax. As for Benin, this result is dependent on the trade tax collection. In other words, the tax effort is swollen by the important collection of trade taxes that do not really depend on the administration quality (see table 12). In fact, Morocco just need to re-allocate its resources (i.e. reform its PIT and GS systems) to collect more taxes.

Mali: The Malian's case is similar to the Beninese's case, i.e. large total tax effort and poor tax revenues. Its tax effort being also swollen by the trade taxes collection, Mali has the potential to increase its taxes collection by re-defining its PIT system. This reform may be enhanced by the Malian's neighbor countries that have much more efficient PIT systems. Besides, Mali having particularly weak administration, the expected impact would be much more important if the reform were accompanied by some improvements in this sense.

Mozambique: Mozambique collects few taxes and has a low tax effort index. There is some consistency among the tax effort indicators of Mozambique since they are all low. This country should concentrate its efforts in reforming the PIT and Trade taxes systems.

Niger: Niger collects few taxes and has a poor tax effort index. The country may significantly increase its tax collection by reforming its GS and personal income tax systems. In this case, the high level of trade tax does not really impact the total tax effort because the GS tax collection is really low.

Peru: Peru collects few taxes and has a low effort index. This country has a favorable production structure and a reasonably good administration but does not draw benefits from its structural advantages. Peru should firstly make efforts to reform its GS and trade tax systems.

Rwanda: Rwanda is characterized by few tax collection. This level of tax collection is explained by its important share of agriculture in GDP, the poor quality of its administration and its low level of trade openness. Rwanda is thus expected to increase its tax collection by working on its structural characteristics rather than by reforming the tax systems.

Senegal: Senegal has one of the most coherent tax system among the DGD's partner countries. This countries makes comparable effort to collect each of the tax components. It can thus count on different sources of taxes and avoid any dependency. The effectiveness of its tax system would be even enhanced if its neighbor would improve their tax systems. In this sense, Senegal may have incentive to lead a process of harmonization in the region.

Tanzania and Uganda: The Tanzanian's case is really similar to the Ugandan's one, i.e. poor tax collection but also poor tax efforts. In other words, those countries have the potential to increase their tax collection by reforming their different tax systems. The reform of the PIT system seems to be the most urgent.

South Africa: South Africa is characterized by the largest total tax collection among DGD's partner countries. This level of tax collection is firstly explained by the quality of its administration. Secondly, the country has a low share of agriculture production and benefits of its favorable neighborhood. The tax effort of South Africa is almost equal to one, meaning that the country allocate efficiently its resources to collect taxes. Besides, South Africa could make some stronger efforts to collect GS and Trade taxes to diversify its sources of revenue and release its dependency to PIT collection.

Conclusion: The effort indicator for total tax collection may be misleading. A high total tax effort index does not mean that all the taxes are efficiently collected. Among the DGD's partner countries, there are different examples of countries with high total tax effort but low PIT tax effort index. It concerns typically countries that remain with consequent trade tax system. PIT and trade taxes being not incompatible (see table 12), it should be really beneficial to reform the PIT system in those countries.

A World Bank's classification of the world's economies

Burundi	Korea, Dem. Rep.	Somalia
Afghanistan	Guinea	Nepal
Bangladesh	Guinea-Bissau	Niger
Benin	Haiti	Rwanda
Burkina Faso	Kenya	Sierra Leone
Cambodia	Liberia	Tajikistan
African Republic	Madagascar	Tanzania
Chad	Malawi	The Gambia
Comoros	Mali	Togo
Eritrea	Mozambique	Uganda
Ethiopia	Myanmar	Zaire
		Zimbabwe

Table 14: Low Income Countries

Georgia	Nicaragua	Ukraine
Armenia	Kiribati	Samoa
Bhutan	Kosovo	Senegal
Bolivia	Kyrgyz Republic	Solomon Islands
Cabo Verde	Lao P.D.R.	South Sudan
Cameroon	Lesotho	Sri Lanka
Côte d'Ivoire	Mauritania	Sudan
Djibouti	Micronesia	Swaziland
Egypt	Moldova	Syria
El Salvador	Mongolia	São Tomé and Príncipe
FYR Macedonia	Morocco	Timor-Leste
Ghana	Nigeria	Uzbekistan
Guatemala	Pakistan	Vanuatu
Guyana	Papua New Guinea	Venezuela
Honduras	Paraguay	Vietnam
India	Peru	West Bank and Gaza
Indonesia	Philippines	Yemen
Islamic Republic of Iran	Republic of Congo	Zambia

Table 16: Middle Income Countries

Barbados	Italy	Singapore
Brunei Darussalam	Kuwait	Spain
Andorra	Germany	Portugal
Antigua and B.	Greece	Puerto Rico
Aruba	Hong Kong SAR	Qatar
Australia	Iceland	Russia
Austria	Ireland	San Marino
Bahrain	Israel	Saudi Arabia
Belgium	Japan	Slovak Republic
Bermuda	Korea	Slovenia
Canada	Latvia	St. Kitts and Nevis
Cayman Islands	Liechtenstein	St. Martin
Channel Islands	Lithuania	Sweden
Chile	Luxembourg	Switzerland
Croatia	Macao SAR, China	The Bahamas
Cyprus	Malta	Trinidad and Tobago
Czech Republic	Monaco	Turks and Caicos Isl.
Denmark	Netherlands	United Arab Emirates
Equatorial Guinea	New Zealand	United Kingdom
Estonia	Norway	United States
Finland	Oman	Uruguay
France	Poland	

Table 18: High Income Countries

B Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Total tax (1)	1											
GDP per capita (2)	0.56	1										
Trade openess (3)	0.28	0.27	1									
Informality index (4)	-0.46	-0.62	-0.13	1								
Agriculture share (5)	-0.58	-0.69	-0.32	0.49	1							
Non-Tax revenue (6)	-0.09	0.32	0.12	-0.16	-0.21	1						
Gov. efficiency (7)	0.64	0.81	0.19	-0.71	-0.71	0.01	1					
GS tax (8)	0.71	0.68	0.26	-0.44	-0.61	-0.00	0.67	1				
PIT (9)	0.79	0.58	0.14	-0.53	-0.48	0.03	0.72	0.58	1			
SSC (10)	0.45	0.66	0.18	-0.45	-0.53	0.04	0.59	0.68	0.42	1		
CIT (11)	0.37	0.51	0.17	-0.32	-0.45	0.27	0.37	0.36	0.24	0.18	1	
Trade tax (12)	0.16	-0.37	0.22	0.20	0.16	-0.11	-0.35	-0.37	-0.16	-0.37	-0.15	1

C Tax Effort Indicators

C.1 Total Tax and PIT

Rank	Country	Tax Effort Total Tax		Country	Tax Effort PIT
1	Lesotho	1.790292		Kazakhstan	15.05352
2	Denmark	1.700796		Sierra Leone	9.610889
3	Russia	1.589875		Zimbabwe	5.10864
4	Sierra Leone	1.5503		Zambia	2.692316
5	Australia	1.438792		Central African Republic	2.671872
6	Togo	1.386677		Ukraine	2.607476
7	Kenya	1.377422		Bangladesh	2.500644
8	Belarus	1.356827		Russia	2.186446
9	Brazil	1.341005		Kenya	2.157356
10	Burundi	1.33919		Suriname	2.134605
11	India	1.320828		Italy	2.050696
12	Jamaica	1.31624		Pakistan	1.955774
13	Argentina	1.312378		Guinea-Bissau	1.932047
14	Swaziland	1.306993		Denmark	1.903724
15	Benin	1.293104		Cape Verde	1.86266
16	Italy	1.278314		Belgium	1.677584
17	Mongolia	1.278154		Gambia, The	1.597182
18	Cote d'Ivoire	1.273887		Jamaica	1.567491
19	Sweden	1.265433		Sweden	1.557871
20	Iceland	1.254896		Papua New Guinea	1.54108
21	Serbia	1.251476		Yemen	1.49118
22	Nigeria	1.236107		South Africa	1.475839
23	Canada	1.223271		Japan	1.414004
24	Macedonia	1.22089		Burundi	1.385043
25	Cape Verde	1.219846		Swaziland	1.369714
26	Gabon	1.21929		Australia	1.345145
27	Namibia	1.208167		Hungary	1.329929
28	Central African Republic	1.197203		Peru	1.320208
29	Mali	1.193951		Namibia	1.317338
30	Cyprus	1.189963		Malawi	1.306302
31	Thailand	1.182994		Austria	1.259628
32	Senegal	1.176862		Serbia	1.232749
33	Barbados	1.151515		Lithuania	1.162701
34	Morocco	1.148346		Burkina Faso	1.154938
35	Ukraine	1.145773		Malaysia	1.145084
36	Papua New Guinea	1.127556		Switzerland	1.143881
37	Suriname	1.126434		Lesotho	1.121317
38	Kazakhstan	1.10474		Trinidad and Tobago	1.110338

39	Malawi	1.102469		Thailand	1.107359
40	Equatorial Guinea	1.088598		Dominican Republic	1.081427
41	Hungary	1.065076		Canada	1.063368
42	Zimbabwe	1.059957		Germany	1.057797
43	Dominica	1.051749		Philippines	1.051
44	Austria	1.049718		United Kingdom	1.041586
45	Georgia	1.0448		Iceland	1.028323
46	Bolivia	1.042872		Spain	0.9972624
47	France	1.042242		Greece	0.9924762
48	United Kingdom	1.040375		Latvia	0.9868299
49	Belgium	1.037465		Estonia	0.9817437
50	Turkey	1.03639		Belarus	0.9753118
51	Fiji	1.026759		Turkey	0.9694158
52	Gambia, The	1.026452		France	0.9614186
53	Norway	1.013366		Nigeria	0.9517481
54	Sri Lanka	1.010275		Ghana	0.9314297
55	Korea, Republic of	1.008509		Georgia	0.9170421
56	Cameroon	1.005442		Barbados	0.9012283
57	Mauritania	1.001669		Slovenia	0.8797935
58	South Africa	1.000269		Mauritania	0.8747039
59	Bulgaria	0.9827114		Senegal	0.8719739
60	Ghana	0.9820138		Dominica	0.8573608
61	Croatia	0.9737083		Solomon Islands	0.8333929
62	Portugal	0.9727489		Poland	0.8188201
63	Nepal	0.9620448		United States	0.8069782
64	Zambia	0.961971		Morocco	0.8039926
65	Greece	0.9476725		Cameroon	0.7796854
66	Jordan	0.9285734		Mongolia	0.7698936
67	Armenia	0.9243039		Macedonia	0.7598547
68	Pakistan	0.923869		Ireland	0.7593212
69	Slovenia	0.9195493		Gabon	0.7506871
70	Albania	0.9119267		Czech Republic	0.7299634
71	Egypt	0.9111993		Azerbaijan	0.7174214
72	Solomon Islands	0.9075398		Tunisia	0.6928194
73	Spain	0.8962283		Rwanda	0.6917954
74	Grenada	0.8920955		Portugal	0.6917756
75	Uruguay	0.8712989		Benin	0.6902223
76	Dominican Republic	0.8673967		Korea, Republic of	0.6869256
77	Poland	0.8637618		Uruguay	0.6813383
78	Ireland	0.8378698		Netherlands	0.674691
79	Rwanda	0.834282		Mali	0.6681128
80	Japan	0.8329333		Bulgaria	0.6639324
81	Netherlands	0.8296612		Nepal	0.6556883

82	Mauritius	0.8277333		Cyprus	0.6415626
83	Burkina Faso	0.826129		Guatemala	0.5940418
84	Tunisia	0.8156672		Argentina	0.587278
85	Antigua and Barbuda	0.8093086		India	0.5700753
86	Germany	0.8064305		Slovakia	0.562253
87	Lithuania	0.7992702		Fiji	0.5621792
88	Latvia	0.7989577		Armenia	0.5146419
89	Tanzania, United Republic of	0.7917549		Niger	0.508817
90	Switzerland	0.7897742		Egypt	0.5086537
91	Uganda	0.7842373		Uganda	0.5045064
92	Costa Rica	0.7804489		Costa Rica	0.4928082
93	Estonia	0.7791058		Croatia	0.4685567
94	Niger	0.7682172		Mozambique	0.4451407
95	Czech Republic	0.7503372		Bhutan	0.4253668
96	Philippines	0.7478477		Norway	0.4205834
97	Trinidad and Tobago	0.7432287		Tanzania, United Republic of	0.4053289
98	Guatemala	0.7385495		Iran	0.3662885
99	Syria	0.7319365		Albania	0.3277402
100	Bhutan	0.7277414		Sri Lanka	0.3267509
101	Malaysia	0.7206353		Syria	0.3254947
102	Chile	0.7190711		Mauritius	0.3001845
103	Azerbaijan	0.7147128		Madagascar	0.2828208
104	Peru	0.701131		Chile	0.2681009
105	United States	0.6931217		Jordan	0.2046763
106	Slovakia	0.6920311		Grenada	0.1848313
107	Mozambique	0.6771471		Bolivia	0.1358565
108	Yemen	0.6698669		Brazil	0.0987129
109	Bangladesh	0.667282		Antigua and Barbuda	0.0955554
110	Haiti	0.6416537		Togo	-0.2702872
111	Guinea-Bissau	0.617784		Haiti	-0.7155449
112	Madagascar	0.6137515		Equatorial Guinea	-0.8011301
113	Cambodia	0.5744725		Panama	-3.419372
114	Iran	0.5674087		Cambodia	-3.870552
115	Panama	0.5268387		Cote d'Ivoire	-12.51956

C.2 GS and Trade Taxes

Rank	Country	Tax Effort GS Tax		Country	Tax Effort Trade Tax
1	Nigeria	2.184255		Cyprus	64.63048
2	Lesotho	1.360646		Russia	19.06776

3	Central African Republic	1.347503		Serbia	4.203267
4	Senegal	1.269784		India	3.655755
5	Sierra Leone	1.269515		Belarus	2.626621
6	Brazil	1.158155		Lesotho	2.531432
7	Burundi	1.134429		Benin	2.44057
8	India	1.109669		Sierra Leone	2.127471
9	Benin	0.9879498		Grenada	2.070246
10	Dominica	0.9865389		Albania	2.03616
11	Uganda	0.974996		Morocco	1.915145
12	Sri Lanka	0.9504456		Gabon	1.762843
13	Mali	0.9472573		The Gambia	1.762655
14	Cameroon	0.9379156		Swaziland	1.759235
15	Serbia	0.9345317		Mali	1.691894
16	Mauritius	0.9256504		Egypt	1.684267
17	Bolivia	0.9231839		Dominica	1.669066
18	Mongolia	0.9140995		Antigua & Barbuda	1.653772
19	Barbados	0.8838985		Namibia	1.619177
20	Malawi	0.8817975		Nepal	1.568339
21	Croatia	0.8777009		Chile	1.551106
22	Kenya	0.8746445		Niger	1.447731
23	Tanzania, United Republic of	0.8745644		South Korea	1.433531
24	Mauritania	0.8698528		Suriname	1.42088
25	Ghana	0.8583966		Iran	1.387808
26	Mozambique	0.845013		Nigeria	1.37366
27	Burkina Faso	0.8414401		Fiji	1.328013
28	Cyprus	0.8297397		Burundi	1.306654
29	Argentina	0.8110209		Central African Republic	1.206515
30	Rwanda	0.8071341		Togo	1.198447
31	Cote d'Ivoire	0.8071017		Australia	1.173949
32	Turkey	0.8039398		Macedonia	1.159991
33	Bulgaria	0.8035232		Syria	1.137142
34	Dominican Republic	0.7840751		Cape Verde	1.105606
35	Cape Verde	0.7786332		Cote d'Ivory	1.06797
36	Jordan	0.7774468		Madagascar	1.016092
37	Iceland	0.7608866		Azerbaijan	0.987155
38	Macedonia	0.757888		Jordan	0.9740186
39	Togo	0.7505509		Sri Lanka	0.9717271
40	Uruguay	0.7436452		Slovenia	0.8949147
41	Albania	0.737618		Pakistan	0.8858697
42	Portugal	0.7308396		Bangladesh	0.869692
43	Costa Rica	0.721527		Mauritius	0.8327512
44	Thailand	0.714571		Ghana	0.8286817
45	Fiji	0.7089047		Mongolia	0.8170388

46	Belarus	0.7024368		Tunisia	0.8049122
47	Guatemala	0.7007431		Rwanda	0.7964361
48	Armenia	0.6907293		Bolivia	0.7872261
49	Jamaica	0.6873507		Kenya	0.7585911
50	Nepal	0.682471		Cameroon	0.7509986
51	Morocco	0.6824468		Senegal	0.7046925
52	Hungary	0.6808234		Dominican Republic	0.6830469
53	Azerbaijan	0.6568931		Barbados	0.6497377
54	Swaziland	0.6465395		Guinea-Bissau	0.633832
55	Namibia	0.6440057		Jamaica	0.6319358
56	Greece	0.6347194		Papua New Guinea	0.6057492
57	Chile	0.6325583		Poland	0.6041692
58	Slovenia	0.6249612		Ukraine	0.589114
59	Guinea-Bissau	0.6194381		Solomon Is.	0.5890107
60	South Africa	0.6150289		Mauritania	0.5836233
61	Denmark	0.6107665		Burkina Faso	0.5825089
62	Poland	0.6071347		Canada	0.5783558
63	Georgia	0.5998721		Philippines	0.5691828
64	Zambia	0.5962244		Yemen	0.5512767
65	Korea, Republic of	0.5870668		Czech Republic	0.5328557
66	Russia	0.5821065		Armenia	0.5256858
67	Estonia	0.5748396		Cambodia	0.5160452
68	Pakistan	0.5622029		Malawi	0.5077737
69	Trinidad and Tobago	0.5601246		Haiti	0.4913393
70	Canada	0.5530071		Thailand	0.4359077
71	Ukraine	0.5510568		Tanzania	0.4221101
72	Peru	0.5485287		Uganda	0.4125452
73	Latvia	0.5466531		Bulgaria	0.4093132
74	Tunisia	0.5448215		Trinidad & Tobago	0.3593597
75	Lithuania	0.5398818		Costa Rica	0.3577527
76	Austria	0.5322422		Mozambique	0.3488579
77	Australia	0.5304614		Zambia	0.3475773
78	Zimbabwe	0.5294926		Georgia	0.3385698
79	Norway	0.5263594		Guatemala	0.3363333
80	Slovakia	0.5255555		Zimbabwe	0.3351543
81	Netherlands	0.5249426		Peru	0.3236714
82	Gabon	0.521917		Kazakhstan	0.3210823
83	France	0.5214565		Panama	0.2682307
84	Solomon Islands	0.5110942		Malaysia	0.2349038
85	Sweden	0.5092831		Bhutan	0.2038279
86	United Kingdom	0.5008084		Hungary	0.1684104
87	Ireland	0.4967729		Latvia	0.1455569
88	Germany	0.4908569		South Africa	0.1300773

89	Italy	0.4877249		Switzerland	0.1264199
90	Egypt	0.4728065		Slovakia	0.1145198
91	Czech Republic	0.4713567		Lithuania	0.1097089
92	Spain	0.4670841		Equatorial Guinea	0.0906241
93	Cambodia	0.4566624		United States	0.0152849
94	Grenada	0.4454779		Ireland	0.0005124
95	Kazakhstan	0.4363178		Sweden	-0.000247
96	Bangladesh	0.4303049		Portugal	-0.0006323
97	Belgium	0.4245314		Germany	-0.0023758
98	Madagascar	0.4239744		Greece	-0.0137676
99	Antigua and Barbuda	0.4202929		France	-0.0161503
100	Bhutan	0.3961732		Norway	-0.0236629
101	Suriname	0.3955671		Austria	-0.0291665
102	Haiti	0.388995		Spain	-0.0702952
103	Gambia, The	0.3832346		United Kingdom	-0.1540898
104	Yemen	0.3754839		Iceland	-0.2620372
105	Papua New Guinea	0.3691852		Brazil	-0.6743184
106	Philippines	0.3470794		Croatia	-0.7934358
107	Niger	0.3467043		Japan	-0.9961692
108	Japan	0.328696		Argentina	-3.343999
109	Switzerland	0.3044092		Turkey	-3.380436
110	United States	0.2821151		Uruguay	-9.834241
111	Malaysia	0.2622228		Denmark	n/a
112	Panama	0.2567631		Belgium	n/a
113	Syria	0.1653675		Italy	n/a
114	Iran	0.1059841		Estonia	n/a
115	Equatorial Guinea	0.0766357		Netherlands	n/a

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