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Territorial inequality, equalization transfers and asymmetric sharing of non-renewable natural resources in Latin America

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This document has been prepared by Giorgio Brosio, Consultant, Juan Pablo Jiménez, Economic Affairs Officer, and Ignacio Ruelas, Consultant, all of the Division of Economic Development, of the Economic Commission for Latin American and the Caribbean (ECLAC) within the activities of the ECLAC/AECID project "Territorial inequality, equalization transfers and asymmetric sharing of non-renewable natural resources in Latin America".

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Abstract

Non-renewable natural resources (NRNR) contribute a large share of tax revenue in Latin American countries; and the fact that these resources are concentrated in just a few regions generates a high level of territorial inequality. This paper aims to analyse how NRNR revenues could be included in equalization grants, and how countries are implementing adequate equalization grant systems, or could do so. Based on fiscal equalization theory, vertical and horizontal systems are evaluated with reference to mid-level governments in Argentina and Peru. The study identifies a variety of political and economic costs for different NRNR revenue systems, where: (i) the provinces own the resources in question (Argentina); and (ii) NRNR revenues are collected and distributed by central government to a large number of subnational governments under a fully asymmetrical scheme (Peru).

Introduction

A large and increasing number of countries, also in Latin America, are sharing asymmetrically with their local governments the revenue from non renewable natural resources (NRNRR). Asymmetrical sharing consists in assigning a fiscal instrument only to the sub national governments of the producing areas, such as the right of levying royalties on oil on gas assigned to the Provinces of Argentina. It can alternatively consist in the assignment to only the producing areas of a share of the revenue collected by the Central Government, as in the case of royalties in Brazil, or of royalties and income tax in the case of Peru.

Asymmetrical sharing is a non-necessary consequence of the spatial concentration on natural resources within countries. As a matter of fact, many countries do not use it, preferring to share the revenue with all local governments. Asymmetrical sharing can create huge horizontal imbalances among distinct local government units impacting on equity, efficiency, and national cohesion.

Including NRNNR in revenue equalization systems raises a number of issues and difficulties. They refer to the difficulty of determining the base on which transfers are determined; to the high cost of equalization; to the cyclicality of revenues; to the efficiency impact of including natural resource revenue in the equalization grants framework and, the exhaustible supply characteristic of natural resources.[1]

Revenue from natural resources is one of the main sources of local fiscal inequality, but it is never considered in the revenue sharing formulas of Latin America, possibly because this revenue was (and may be still is) not considered as a fiscal revenue, which in the reality it is. (see for example Martínez Vázquez and Sepúlveda, 2012; Tommasi Saiegh and Sanguinetti, 1999).

The paper is articulated as follows. The second section is the most substantive and starts with a short presentation of the principle of inter-jurisdictional equity and continues with the examination of the main issues and challenges deriving from the inclusion of NRNRR into equalization schemes. The third

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[1] Also, according to Government Finance Statistics Manual (IMF, 2014), when a unit extracts a mineral or energy resource under an agreement where the payments made each year are dependent on the amount extracted, the payments (sometimes described as royalties) are recorded as rent.

section provides an illustration of the distinct systems of equalization transfers that can be used for NRNRR, weighing the pros and cons of them. The fourth section discusses territorial inequality, assignment of natural resource rents to sub national governments in Latin America, their importance and spatial concentration and the deriving implications for equalization transfers. The fifth section is focused, respectively, on the cases of Argentina and Peru. The intent here is not to suggest specific reform options for these countries, but rather to illustrate the main options for equalization and their merits and shortcomings. The results are summarized in the conclusions.

Before moving to the first section a terminological clarification is needed. We follow strict economic criteria in the selection of revenue sources, taxes and fees, subject to equalization including also royalties that are sometimes and somewhere classified as non-tax revenue. Basically there are no economic differences between income taxes and royalties (the two most common instruments to extract natural resource rents) as the revenue they generate is the product of a tax rate applied to a tax base.

I.　Inter-jurisdictional equity principle and issues associated with equalization of natural resource revenue

The inter-jurisdictional equity principle provides the rationale for equalization transfers. A general formulation of the principle says that persons in comparable circumstances should have access to comparable public services in all localities (see Boadway, 2015). In other words, in the intergovernmental framework equity implies that residence should not create differences between citizens in their access to the public services and to the cost of access. There are, however, different interpretations of this principle (see box 1).

Box 1
Interjurisdictional equity: strictest interpretation

The strictest interpretation would mean that citizens in similar conditions should have access, wherever they reside, to exactly the same quantity/quality mix of services and pay the same amount of taxes.

$$\frac{\sum_1^t E_{c,d,ef,..j}}{R_{j,wy}} = k \text{ for each local jurisdiction } n \qquad (1)$$

where:

E is the expenditure for service *t*;

R is the revenue used for financing the service;

- c, d, e, f, …, is a set of characteristics determining the quality r quantity of the service t; impacting on expenditure. Standards are referred to these characteristics and may also coincide with them. They are also referred to in the literature as standards.

Box 1 (Conclusion)

- w and y are the characteristics that determine the burden of taxes and/or levies asked to finance the service. Quite obviously, these characteristics apply only when sub national governments have tax autonomy, i.e. the faculty of determining (at least part of) the burden. Examples would be tax rates, exemptions from public transportation fees, or from payment for health services for the elderly poor.

- j is the beneficiary group.

- k is the equity parameter.

Inter-jurisdictional equity is ensured by the equality of parameters *k* —one for each group of individuals— across all jurisdictions. This will lead to the result that individuals in comparable conditions, for example elderly people living alone, will be subject to the same proportional difference between what they receive in terms of health care and what they pay for it.

The higher the value of parameters c, d, e, f, the stronger is their upward impact on the expenditure, increasing the gap with revenue (and vice versa with low values of the parameters). The lower the value of parameters applied to revenues the lower also the amount of revenue collections.

The average national value of k across all groups of individuals and all sub national governments measures also the existing vertical fiscal imbalance. As a matter of fact the vertical fiscal imbalance is defined as the share of local expenditure financed by local revenues.

Full equalization implies that the transfer to each local government, Tn, is equal to the difference between expenditure and revenue:

$$Tn, = \sum_1^t E_{c,d,ef,..j} - R_{j,wy} \qquad (2)$$

Source: Elaboration on the basis of Brosio and Jiménez (2015).

Full homogeneity of service provision between jurisdictions requires the inclusion of very detailed constraints standards determining every relevant characteristic of quality and quantity. This would make the operation of a decentralized system of government analogous to that of a centralized system, but then there would be no more rationale to the existence of a decentralized system of government.

A.   What variable to equalize?

There are two big choices concerning the economic variable with regard to which equalization is performed. The first one is between actual revenue and fiscal capacity, while the second choice is between gross and net revenue. Actual revenue is the total amount collected by local governments from their various sources of revenue. It is a very simple instrument in terms of information requirements, but does not provide the right incentives to local government when used in equalization. For example, a rich local government that levies a property tax could be tempted to apply very low tax rates, reducing its actual collections and become eligible for equalization transfers.

Fiscal capacity, also usually referred in the literature as standardized revenue, is not the actual revenue received, but what a local government would collect by applying to its tax base the tax effort exerted on average by all other governments and calculated on the basis of the average tax rate applied to different sources of revenue (as illustrated later with reference to Canada). This implies that transfers do not reward subnational governments that exert lower than average tax effort. This is because their fiscal capacity, according to which the transfer is determined, would be higher than actual revenue. Equalizing fiscal capacity is both equitable and efficient.

Equalization of fiscal capacity in principle should be applied to all sources of revenue and when subnational governments have tax autonomy. This may be a difficult exercise in the case of natural resources revenue, because of the large number of natural resources subject to taxation and of different characteristics impacting on price and revenue. To make an example, iron ore may have, in different provinces, a different

mineral content and a different value that have to be taken into account when determining fiscal capacity. This can turn out to be exceedingly difficult. Australians, however, have worked hard to estimate fiscal capacity for minerals (Searle, 2004), while Canadians have decided to use instead actual revenue collected (Boucher and McLure, 2015).

Secondly, when discussing what to equalize, comes the choice between gross and net revenue. Raising revenue requires cost and effort making gross revenue higher than net revenue. Also the difference between gross and net does not represent an element of fiscal capacity needing equalization.

Netting revenues is never done for taxes and other levies non based on natural resources, such as personal income or property taxes In equalization systems it is assumed that there are no collection costs for the taxes that are included in the equalization process. This is a reasonable and simplifying solution, when all the concerned sub national government units have access to the same tax bases, as collection costs should be broadly similar across the various areas.

However, in the case of NRNR this is no longer true. Although most of the investment for the exploitation of natural resources is done directly by the producing companies, additional investment in local infrastructure specifically related to natural resources exploitation is usually required. Roads to the producing mines and oil fields have to be built; airports and ports may have to be upgraded. Exploitation usually brings migration of workers and of their families to the producing areas. These flows generate new costs to their destination governments by demanding services and creating a demand for new infrastructure (schools, health, transportation and social services).

In this sense, local governments operate as factors of production contributing to the creation of the rent from natural resources. They bear a cost that is not usually required for raising general taxes. This is why for NRNR netting of revenue is needed to evaluate the right amount of the additional fiscal capacity that their availability generates for the governments that have access to their revenue.

There are two systems of netting gross revenues. The first is to operate on the expenditure side by including, within an expenditure needs and fiscal capacity equalization model, the expenditure needed for the production (roads for example) or for the provision of services to the new population, or also to avoid environmental damages. On the revenue side gross revenue are inserted. The model will take into account both expenditure needs of the producing areas and the necessity to equalize revenue to the advantage of the non-producing areas.

The second alternative is to operate only on the revenue side by deducting from gross revenue the additional expenditure needed for production and for additional provision of services and the amount of environmental damages suffered. The outcome of the two systems is similar, while the financial cost of equalization is lower with the second system, which amounts to lowering the peaks considered for equalization.[2]

B.   Revenue cyclicality

Due to the large fluctuations of the price of natural resources, revenues are subject to ample fluctuations. In some taxes, oscillations are also exacerbated by their progressivity, such as the income and rent taxes, used for the extraction of the rent.

When a system of transfers that equalize NRNRR to the benefit of the sub national governments of the non-producing areas is introduced, the oscillations of revenue are extended to the whole set of local governments exacerbating the problems of the efficiency of spending and creating also severe funding problems for the central government in vertical and open-ended equalization systems.

There are various instruments for dealing with the impact of oscillations of revenue on equalization transfers. A *prima facie* simple instrument consists in acting directly on the oscillations with the introduction

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[2]   Canada has partly solved this problem by scaling back by a factor the revenues subject to equalization that derive from natural resources.

of stabilization funds for subnational revenues and then determining the transfers on the basis of the stabilized revenue than can be channeled, according to the stabilization funds rules, to the budget.[3]

An alternative solution would be to change the standard for equalization over time, reducing it in years of high revenue and increasing it in years of low revenue. This would make the system more manageable, but at the same time would mean that the distance in revenue between the richest and the poorest jurisdictions will vary along the cycles of prices of natural resources.

C. Highly skewed distribution deriving from spatial concentration of the resources

The heavy concentration of revenue in just a few jurisdictions poses a major challenge when implementing the principle of interjurisdictional equity, since it requires a system in which equalization transfers can become negative for the wealthiest jurisdictions.

Let's come back to the expression in the denominator of the left hand side component of equation (1) in box 1, $R_{j,wy}$. The expression describes a system of revenue sources, where collections derive from the application of centrally defined parameters, such as tax rates, to locally assigned tax bases. Local assignment of NRNRR combined with a highly skewed distribution in favor of a few jurisdictions can bring up the case where total revenue in these jurisdictions would exceed, even by far, the amount of expenditure determined in the numerator of the same equation. To comply with inter-jurisdictional equity, more specifically to maintain the equity parameter k equal for all, the revenue of these jurisdictions needs to be curtailed, meaning that for them the equalization transfer becomes negative. Horizontal equalization schemes are the technically appropriate instrument for negative transfers, as we will see below, although they are likely to be resisted by the paying jurisdictions.

D. Efficiency issues

The efficiency issues have to be approached from two distinct points of view. The first one refers to the impact of revenue on migration of firms and individuals, more precisely of labour. When NRR is not equalized resource rich jurisdiction will be able to attract firms and workers by providing them more services or asking less taxes. These moves create inefficient patterns of location across the country since migration is not dictated by really economic location factors, such as proximity to market, or communication costs.[4]

The second problem of efficiency refers to the impact on the level of production of resources deriving from the existence of equalization transfers. In general, the existence of transfers induces the governments of the producing areas to reduce the production in so far as they have a decision-making power on it. In relation to this we have to distinguish between equalization of actual revenue and equalization of fiscal capacity. With equalization of actual revenue, the more a subnational government collects, the lesser the transfer it will receive. Hence, there is an inducement to reduce production; for example by negating permits to exploration and exploitation.

When equalization is made with reference to fiscal capacity, variation of tax rates does not impact on transfers neutralizing the impact of equalization transfers on production. One has also to stress that behind this second problem of efficiency lays the idea that the level production should be decided on the basis of criteria wider than that of the amount of individual transfers.

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[3]   This option is not feasible in federal systems, where states, or provinces cannot be forced to have stabilization funds and, if they have them, are free to determine the rules governing the flows to and from the funds. In centralized systems, such as the Peruvian one, where natural revenues are collected by the central government and then transferred, the latter could not only introduce subnational stabilization funds, but also introduce a system of averaging the allocations of natural resource revenue over a medium term period.

[4]   A simple illustration of the efficiency problems is provided by Boadway and Flatters (1993).

II. Approaches to equalization transfers

A. Interjurisdictional equity in the practice of decentralized systems

In the reality of most advanced equalization systems, equity is reached when sub national governments are provided, through transfers, with enough revenues to ensure that persons in comparable circumstances can have access to comparable public services in all localities after paying comparable levels of taxes and fees. In Canada this goal is written explicitly in Subsection 36(2) of the Constitution Act of 1982: "Parliament and the government of Canada are committed to the principle of making equalization payments to ensure that provincial governments have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation". In Australia, the inter-jurisdictional equity principle is not referred to in the Constitution; neither is defined in legislation, or described in any agreement between governments. Rather, the definition has evolved over time, largely through —the Commonwealth Grants Commission (CGC). The current CGC definition of the goal of equalization transfers is as follows: *State governments should receive funding from the pool of goods and services tax revenue such that, after allowing for material factors affecting revenues and expenditures, each would have the fiscal capacity to provide services and the associated infrastructure at the same standard, if each made the same effort to raise revenue from its own sources and operated at the same level of efficiency. (*Commonwealth Grants Commission, *Report on GST Revenue Sharing Relativities*, 2010 Review, Vol 1, page 34).

B. Equalization of expenditure and revenue

Coming to real world examples, in Australia the standardized expenditure for each function is determined by applying to the existing average per capita expenditure of the States for the various functions a number of parameters ("relativities") that impact on the expenditure needed to provide the services at the level that is considered to be adequate.

Using symbols of equation (1) the Australian system can be described as follows:

$$\frac{\sum_1^t SE_j}{SR_j} = k \text{ for each local jurisdiction} \tag{3}$$

where:

SE is standardized expenditure, i.e. the amount of money that is needed to provide the same quality and quantity mix for each service assuming a national average rate of efficiency;

 SR is standardized revenue, i.e. the revenue that can be collected by applying to the potential (not the assessed) tax base the average national tax rate.

Inter-jurisdictional equity and efficiency require that all sub national expenditures and all the revenue sources assigned to the sub national government be considered in the determination of the equalization grant. Insofar as rents from NRNRR are assigned to sub national governments and, as such they constitute a source of revenue, they require inclusion in equalization schemes.

Australian type systems, now illustrated, are the most comprehensive. They are targeted to ensure full equalization, with filling the gaps on the expenditure and on the revenue side (Searle, 2004). Potentially, they include in the expenditure side also the additional costs and needs associated with extraction of natural resources hence addressing the difference between gross and net revenue.

C. Revenue equalization only

Alternative systems operating only on the revenue side are also able to perform a substantial equalization impact, and are less demanding in terms of information and administration complexity. Some of these systems may also be developed over time into a full expenditure and revenue based equalization system.

With specific reference to rents from NRNRR the main alternatives are the following:

1. Inserting rents from natural resources in the set of revenues to be equalized, as in the Canadian system,

$$T_n = t_{si} \times (B_{si}/ P - B_{ni}/ P_n) \times P_n \qquad (4)$$

where:

  – TT is the total grant;

  – Tn is the grant to province n;

  – t is the tax rate;

  ▪ B_i is the tax base of each of the *i* revenue sources subject to equalization;

  ▪ P is the population;

  ▪ *si is the standard for equalization, for example, the national average of total provincial of each revenue source subject to equalization as in Canada now, or the average of a group of provinces (as initially in Canada); and*

  ▪ *n represents beneficiary provinces, that is those for which the difference in the parentheses is positive.*

In turn:

$$TT = \Sigma \, T_n \qquad (5)$$

The total grant is financed with α, varying, share of central government revenue.

If the standard provinces get richer – for example, following a huge increase in the price of natural resources they exploit – the difference between them and other provinces will increase, forcing the central government to expand the total amount paid for equalization.

This is exactly what happened in Canada with the first oil shock. The huge increase of oil prices that took place at that time inflated the amount of revenue in Alberta, where practically all oil production was concentrated. The standard tax base (at the time the national average) took off, requiring, *ceteris paribus*, a

similar expansion of the grants. Since the federal government had access to only 10 per cent of oil revenues, sticking to the formula would have implied financing equalization payments with its own tax revenues, thus having to face the choice of either incurring a deficit, or squeezing its own expenditure.[5]

Over the years, the Canadian governments made basic corrections to the formula such as: (a) the exclusion of Alberta's tax base from the equalization standard; (b) the outright exclusion from equalization payments of those provinces, such as Ontario, that have a non-oil tax base above the national average; (c) the exclusion of a share of the oil tax base from the equalization system; and (d) the introduction of a ceiling to the total amount paid for equalization.[6] Presently Canada includes 50 per cent of NRR in revenue base to which equalization applies. In other words it equalizes up to 50 per cent of differences in NRR.[7]

2. The second alternative is using for natural resources a separate system of equalization

In this case only revenue from natural resources is equalized and equalization may also be funded only with NRNRR, implying no impact on other sources of revenue.

That is:

$$Tm = ts \times (Bs/ P - Bn/ Pn) \times Pn \qquad\qquad (6)$$

Where t and B are referred to natural resources revenue only.

In some countries separate equalization systems are generally funded only by natural resource revenues and do not consider other sources of revenue. This is not a necessity, however. When equalization systems are funded with NRNRR only, they amount to reserving a share of total national revenue from NRNRR to the non-producing, or little-producing, jurisdictions and to distributing them according to either the distance of their NRNRR from the national average or according to other needs or revenue capacity-related indicators.

D. Vertical and horizontal equalization

There are two versions of equalization mechanisms: the vertical equalization model, such as the Australian and the Canadian systems, whereby grants are paid by the central government to the subnational governments; and the horizontal equalization model, such as the German one (*Länderfinanzausgleich*), whereby grants are paid from relatively richer jurisdictions to relatively poorer jurisdictions, without central government funding (see Spahn, 2001). Horizontal systems are close-ended, requiring no funding from the central government. The Chilean *Fondo Común Municipal* (Ahmad, Letelier and Ormeno, 2015), represents another example of a horizontal system.

In the vertical model the skewness of the distribution of the revenues to be equalized influences the total amount of the grant. More precisely, in open-ended systems, such as in Canada, where there is no upper limit to the total amount disbursed by the federal government, whenever the standard tax base —the tax base of the jurisdictions with reference to which revenues are equalized— increases, the total amount of the grant is bound to increase also, *ceteris paribus*. Thus, central government finances may be subjected to such a severe strain, that they require a change in the formula.[8]

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[5] Furthermore, the gap between Alberta and other provinces became so large that even the rich provinces, such as Ontario, became beneficiaries of equalization transfers, although at the end the transfer came through the use, by the federal government, of the tax basis located in their jurisdiction (see Courchene, 1979 and 1988).

[6] In addition to actual reforms much-variegated proposals have been advanced in Canada to contain the cost of equalization of natural resources. Gainer and Powrie (1975) suggested that rents, profits, and interest accruing to provincial governments should be subject to taxation in the same manner as factor incomes generated in the private sector. In view of an average 30 per cent effective tax rate, approximately 70 per cent of resource revenues should be kept by the Provinces and contribute to the base on which equalization is calculated. A non-parametric solution has been advanced by the Parliamentary Task Force on Federal-Provincial Fiscal Arrangements, according to which only the portion of natural revenues that are used for budgetary purposes should be included in the equalization formula, meaning that the portion sequestered to non-budgetary heritage funds should be excluded.

[7] Office of the Parliamentary Budget Officer (2014).

[8] Vertical closed-end equalization systems, such as the Australian one —where, starting from the year 2001, the equalization system is funded by Goods and Services Tax (GST) collections— do not exert, by definition, a severe strain on the federal finances. However, when the distribution of revenues is highly skewed, their equalizing capacity faces the same problems as the open-ended systems.

Horizontal models do not have the same difficulties in construction. The degree of equalization is built into the formula and it is not imperiled by sudden changes in the total amount of natural resource revenue and/or in the skewness of their distribution. Nor, can possible strains on central government finances arise if the standard is set at the national average, because the total grant from net paying jurisdictions is equal to the total grant received by beneficiary jurisdictions.

A typical formula based on the equalization of tax capacity, which amounts to standardization of revenues, would be:

$$TT_J = \beta_J \ [ts(TB_J - TB_s)] \tag{7}$$

and

$$TT_I = \beta_I \ [ts(TB_s - TB_I)] \tag{8}$$

where, in addition to the previously mentioned symbols: β_{JI} are the standards of equalization applied to the paying and receiving jurisdictions, J are the paying jurisdictions; and I are the beneficiary jurisdictions.

Thus, TT_J is the total grant paid by the contributing jurisdictions according to the standardized tax rate ts and the grants required to bring down to the net national standardized average

TT_I is the total grant received by the beneficiary jurisdictions according to the standardized tax rate ts and the grants required to bring all regions at the net national average.

The stress is rather put on the natural resource-rich jurisdictions, particularly if they represent a minor share of the total national population. More specifically, the share of NRNRR they can retain is inversely related to the share of their population in the total national population. If equalization is geared to fully equalize per capita revenues, then the share of retained revenues for the producing jurisdictions is the inverse of the share of their population.

III. Territorial inequality and fiscal disparities of NNRR in Latin America

One emerging and important issue to explore is the territorial inequality within countries (ECLAC, 2017). One of the most common indicators used to gauge the differences among territories of the same country is the ratio between the gross domestic product (GDP) per capita of the richest region and that of the poorest region (measured in most cases at the level of major administrative divisions). In Latin America and the Caribbean, the ratio between the regions with the highest and lowest per capita GDP in the countries generally exceeds 6:1 —with the exception of Uruguay—, while in developed countries it is rarely more than 3:1 (see figure 1, ECLAC, 2017; Muñoz, Radics and Bone, 2016).

Figure 1
Territorial inequality in Latin America and OECD countries: ratio of regional GDP per capita, circa 2015
(Maximun/minimun)
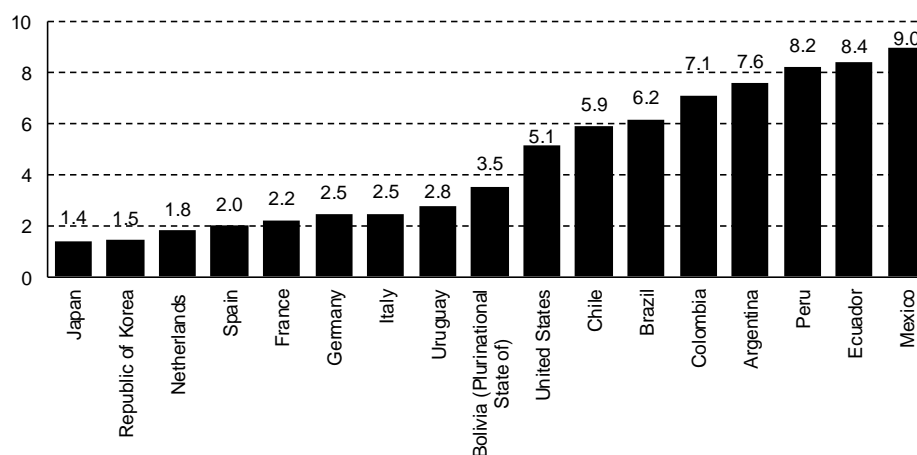
Source: Prepared by the authors, on the basis of official data from the Economic Commission for Latin America and the Caribbean (ECLAC) and the Organization for Economic Cooperation and Development (OECD).

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On the other hand, the contribution of NRNRR to public revenue is very large in a number of Latin American countries, reaching in 2005-2008 40 percent in Ecuador, Mexico, Trinidad and Tobago and Venezuela (see Gómez Sabaini, Jiménez and Martner, 2017).

The significant unequal regional distribution of income means sharp fiscal disparities. This is true when subnational taxes levy highly concentrated tax bases as consumption (ICMS in Brazil, *"ingresos brutos"* in Argentina, selective taxes in Colombia), payroll in México (see Muñoz, Radics and Bone, 2017); but is still more significant when the tax base are NRNR because their deposits are regionally very concentrated.

Argentina, Bolivia and Peru represent quite telling examples of the impact of NRNRR on sub national finances. In Peru, these resources represent 15 per cent of departmental revenue and contribute to 25 per cent of inequality of revenue. In Argentina, a tiny share of provincial revenue generates high inequality, around 18 per cent. In Bolivia departments, the IDH —that is the main fiscal instrument to extract the rent from hydrocarbons— plus other NRNRR (royalties) represents more than 87 percent of total revenues and, indeed, generates more than 90 percent of inequality; almost 50% of NRNRR is concentrated in Tarija that is the richest department (in per capita GDP) of Bolivia (see the next table).

Table 1
Selected countries (3): NRNRR and territorial inequality

Country	GDP gap	Wealthiest region	Poorest region	Fiscal instrument of NRNR revenues	NRNR revenues as percentage of subnational revenues	Inequality of subnational fiscal revenues (Gini)	NRNR revenues as percentage of subnational fiscal inequality (decomposition of Gini)
Argentina	7.6	Santa Cruz	Formosa	Royalties	2.7	0.238	18.0
Bolivia (Plurinational State of)	3.5	Tarija	Beni	Direct hydrocarbons tax (IDH) and royalties	87.3	0.541	99.2
Peru	8.2	Lima	Madre de Dios	Mining canon, sub-canon, royalties	4.8	0.327	25.0

Source: Own elaboration based on official data.

IV. Equalization transfers: options for Latin America

As indicated in first part, in this section we'll simulate the inclusion of equalization transfer system (vertical model) for Argentina and Peru regions (provinces). The horizontal model is simulated only for Provinces of Argentina.

In Argentina's simulation, equalization is made with reference to fiscal capacity. Standardization of own taxes uses geographical gross domestic product (INDEC, 2004=100) as the tax base, while for royalties we use non renewable natural resources production. In Peru equalization is made with reference to fiscal capacity for own taxes using again regional gross domestic product and we refer to actual revenue for canon and subcanon (NNRR). To evaluate the simulations, before and after equalization transfers, we use next indexes taking as reference total revenues: Coefficient of Variation (CV), Fiscal Gap (max/min) and Gini.

A. Argentina

Argentina's provinces finance themselves with their own taxes, general and specific transfers, royalties and other revenues. Internally generated tax revenues generate one third of total revenue on average, transfers over 3/5, while royalties account for a mere 2% (see annex).

According to Constitution (Article 124), Argentina Provinces have the original dominion over the natural resources existing in their territory. This implies that Provinces are responsible for establishing contracts with firms and for collecting royalties. This has expanded their power to control the price of the resources and the measurement of production. However, the federal government retains the power, derived from an ordinary law, to regulate the sector. More importantly, it has also, by constitutional mandate, the power to regulate the domestic market and internal prices in addition to the exclusive power on import and export taxes and access to company profit taxation (although it does not use it with specific taxes – such as a special profit tax or a rent tax, for extracting rent from oil and gas).[9]

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[9]   For more details about institutional framework or asymmetrical sharing impact of Argentina see Brosio and Jiménez (2015).

This peculiar cap in the amount of royalties that the producing provinces can raise has also somewhat contributed to reduce the disparities among producing and non-producing Provinces and has attenuated the fluctuations of royalties revenue between 2 and 3 percent of total revenues (see the next graph).

Figure 2
Argentina: evolution and composition of subnational government revenues and revenue share of non-renewable natural resources, 2010-2015
(Percentage of GDP and percentages of total revenue)
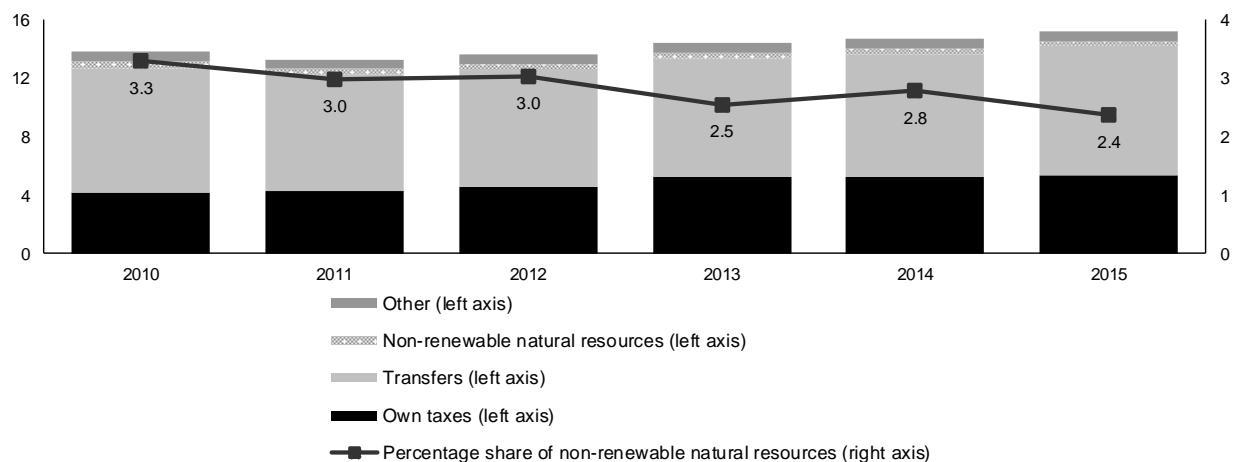
Other (left axis)
Non-renewable natural resources (left axis)
Transfers (left axis)
Own taxes (left axis)
Percentage share of non-renewable natural resources (right axis)

Source: Elaboration on the basis of official information (www.mecon.gov.ar). Revenues are classified on the basis of Government Finance Statistics Manual (IMF, 2014).
Note: Non Renewable Natural Resources Revenues (royalties) are classified as rent (1415).

The huge inequalities of geographical GDP (ratio max/min is more than six times, as reported in table 1), lead to equivalent disparities in the collections of own taxes. These gaps are partially corrected with the general transfer system and other grants. Inequalities are exacerbated by the royalties that benefit only producing provinces.

The impact of royalties alters fundamentally the ranking of Provinces deriving from own revenues plus central government transfers. The winner becomes Santa Cruz that benefits from the highest per capita allocation of royalties. The final impact of the combination of the various sources of revenue is that, although no Province is left with an unbearably low revenue level, interprovincial gaps remain extremely high. Buenos Aires has per capita revenue five times lower than that of the richest Province, namely Santa Cruz. These are disparities that are hardly accepted in most federal systems.

B.   Horizontal equalization model

Two options are considered in this model. In the first one, revenues of all Provinces are brought at least to the national average; in the second one the standard of equalization is set at 80 per cent of the national average. Table 3 simulates how much producing Provinces would contribute and how much other Provinces would receive and also —the problems that horizontal model would generate. The gap and surplus between the standard and standardized revenue of each Province is shown in per capita then both are multiplied by population getting the required revenues to bring all provinces at the national average.

In sum, to bring all the Provinces to the standard level would require 7.8 billion pesos. This amount is bigger than the amount that would be available from the producing Provinces when their revenue is brought to the national average, i.e. 6.05 billion pesos as shown in the table. This means that a horizontal close-ended model in Argentina would be not able, in the year the example is referred to, to equalize: i.e. bring all Provinces to the national average level. Only if the standard is set at 80% of national average the horizontal

closed-ended model works, since total contributions from producing Provinces are equal to transfers received by non-producing Provinces. This is an important issue because the higher the standard is set the larger are the resources from producing Provinces that are needed, requiring political agreements between Provinces.

Table 2
Horizontal equalization transfer: revenues required according national average

A.   Basic criteria of horizontal equalization transfers

Standard according to total royalties	
Total royalties (pesos 2012)	8 999 191 732.00
National population	40 117 096.00
National average of gross royalties (per capita)	224.32
Alternative standard (80% of gross royalties)	179.46

B.   Argentina (24 provinces): revenues required according to national standard

(In millions 2012)

Provinces	National average		80 percent of National average	
	Revenues required to bring the producing regions down to the national average	Revenues required to bring all the Provinces at the standard level	Revenues required to bring the producing regions down to the national average	Revenues required to bring all the Provinces at the standard level
Ciudad de Buenos Aires	0.0	648.3	0.0	518.7
Buenos Aires	0.0	3 505.1	0.0	2 804.1
Catamarca	0.0	82.5	0.0	66.0
Córdoba	0.0	742.3	0.0	593.8
Corrientes	0.0	222.7	0.0	178.1
Chaco	0.0	236.7	0.0	189.4
Chubut	1 693.8	0.0	1 716.6	0.0
Entre Ríos	0.0	277.3	0.0	221.8
Formosa	0.0	93.5	0.0	69.7
Jujuy	0.0	147.5	0.0	117.3
La Pampa	198.8	0.0	213.1	0.0
La Rioja	0.0	74.8	0.0	59.9
Mendoza	514.7	0.0	592.8	0.0
Misiones	0.0	247.1	0.0	197.7
Neuquén	1 664.5	0.0	1 689.3	0.0
Río Negro	411.0	0.0	439.7	0.0
Salta	0.0	84.7	0.0	30.3
San Juan	0.0	152.8	0.0	122.2
San Luis	0.0	97.0	0.0	77.6
Santa Cruz	1 353.3	0.0	1 365.6	0.0
Santa Fe	0.0	716.6	0.0	573.3
Sgo Del Estero	0.0	196.1	0.0	156.8
Tucumán	0.0	324.9	0.0	259.9
Tierra del Fuego	213.8	0.0	219.5	0.0
Total	6 050.0	7 849.8	6 236.5	6 236.5

Source: Own elaboration with collected data (see annex).

Needless to say, the producing provinces would oppose this equalization on political and constitutional grounds, unless the federal government gave them additional, potential, sources of revenue, possibly as part of a comprehensive reform of subnational finances.[10]

C. Vertical equalization model

The more equalization is inclusive, i.e. the larger the number of revenue sources subject to equalization, the higher is the level of equality attainable, provided that the total amount of the transfers to be allocated is large enough to fill the gaps. Also, the standard set for equalization is determinant.

The working of vertical equalization of provincial own taxes and royalties is presented in table 3 below using fiscal revenues presented in table A.1 in the annex, separately for the own taxes, for royalties and for their sum. In this latter case, the system does equalize the whole fiscal capacity of the Provinces represented again by standardized revenue. With a vertical system, transfers to individual provinces below the standard are not provided by those above the standard, but are funded by the grants (in this case, "*coparticipacion federal de impuesto*s") allocated by the federal government that the new system intends to replace, at least in part.

The standard for own taxes is, in the simulation made mostly for illustration purposes, determined as the average of the standardized revenue of the five richest provinces to the exclusion of Ciudad de Buenos Aires (the richest one). They are: Neuquén. Tierra del Fuego, Santa Cruz, La Pampa and Chubut.

The standard for royalties is the average of the standardized revenue of the five richest provinces to the exclusion of Santa Cruz (the richest one) with a reduction of 20 percent to consider costs (e.g. environmental damages and tax administration). In other words revenue is netted. The richest Provinces are: Chubut, Neuquén, Tierra del Fuego, Rio Negro and La Pampa. The standard for own revenue is relatively modest, since it excludes the richest province. The standard for royalties is similar to that used for a long time in Canada, where also the richest province has been excluded from equalization. Both standards make the comparison with the equalization capacity of the present system quite interesting.

In brief, vertical equalization has the potential to reduce fiscal disparities. As the table shows, after equalization, dispersion declines under all alternatives (CV); the ratio between the provinces with the largest and smallest fiscal resources (max/min) also falls; and inequality (Gini) decreases by between 12% or 33% depending on the instrument —or mix of instruments— applied (see table 3).

D. Peru

Among non-federal countries, Peru assigns one of the largest shares of NRNR revenues to its subnational governments. Fifty per cent of income tax revenue obtained from mining and oil companies is devolved to subnational governments, plus royalties.

Pending the completion of the decentralization process, regional governments in Peru are financed with two main categories of revenues: ordinary/conditional revenues *(Recursos ordinarios)* and unconditional revenues. Conditional revenues are determined for (and allocated to) each region at the discretion of the central government.[11]

Unconditional revenues, to which only we will refer here, include four different categories: (a) own revenues, consisting mainly of fees and receipts from sale of services; (b) transfers and donations, consisting mainly of grants from donors and international organizations; (c) revenues from borrowing and,

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[10] The next four columns show that by using —in other words extracting from the producing provinces— royalties that exceed the net national average, it would be possible to adjust the non-producing provinces to a level (the equalization standard) equal to 71% of the national average. With this standard, the total amount received by the below-standard provinces would be equal to the amount paid by those above the standard.

[11] Conversely, regional governments have no autonomy about their use: basically, they serve to finance the regional branches of the national ministries that have been regionalized. They are not labeled as regional revenues in the legislation and are not recorded as such in the official statistics, making impossible to have a complete picture of the regional finances, not to say an evaluation of it. This is rather unusual and possibly derives from the initially supposed temporary character of discretionary revenue (see also Letelier and Neyra, 2013).

finally, (d) a miscellaneous category (officially labeled as *Recursos Deteminados*) including natural resources revenue (the so-called mineral, oil and gas Canon) and other additional fiscal instruments, mostly transfers, such as FED, FONIPREL and BOI[12] allocated to the regions that are devoid of natural resources, and other revenue such as custom tariffs distributed to the main port of Callao.

Ordinary/conditional revenues still dominate financing in the regions, contributing between 60% and 80% of total revenues, as shown in figure 3. This fluctuating share does not depend on variations in their absolute amount, which is quite stable; instead it derives from the wide oscillations in the Canon and other NRNR revenues. The NRNR share of total revenue shrank from more than 19% of total revenues in 2010 to 7% in 2015 following the mineral and hydrocarbon price cycle.

Figure 3
Peru: evolution and composition of subnational government revenues and revenue share
of non-renewable natural resources, 2010-2015ª
(Percentage of GDP and percentage of total revenues)
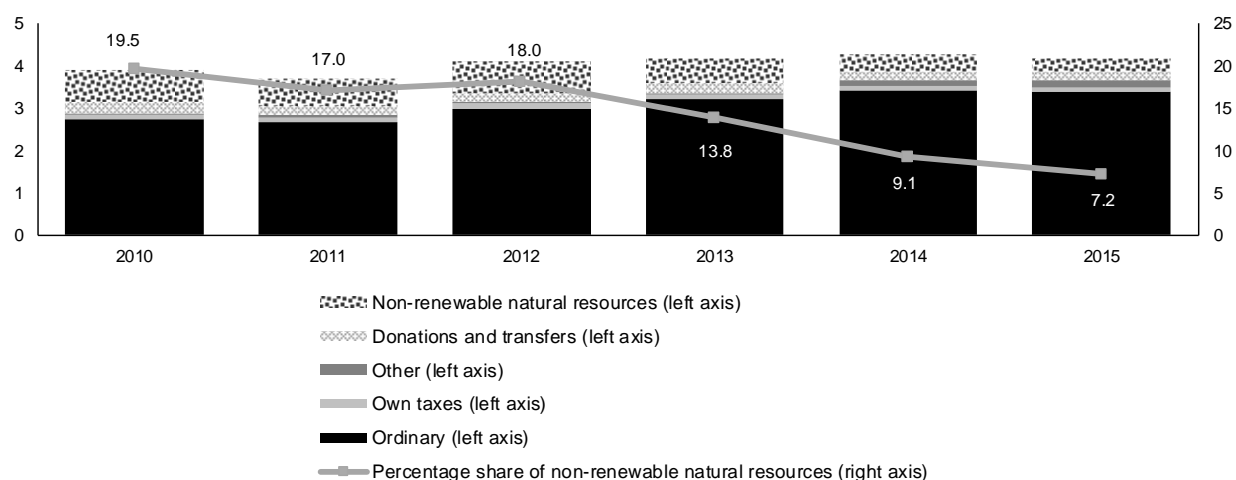
Source: Prepared by the authors, on the basis of official information from the Ministry of Economy and Finance [online] www.mef.gob.pe.
Note: Non-renewable natural resources revenues (royalties) are classified as rent (1415).
ª Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

The revenue intake from both income tax and royalties, which are assessed on the profit margin, are extremely sensitive to fluctuations in natural resource prices, and also to quantity variations. This renders this system of subnational allocation highly prone to wide fluctuations in the amount of revenue transferred.

A second more relevant consequence of the subnational assignment of natural resource revenue to governments is the huge horizontal disparities particularly during periods of high prices of natural resources. While own revenues and donations are relatively evenly distributed, revenues deriving mostly from natural resources (*determinados*) show a high inequality contributing to almost one quarter (exactly 25% according to table 1) of total revenues. In this sense, small regions, such as Moquegua, but also relatively large ones, such as Ancash, Arequipa and Cajamarca, receive considerable per capita amounts.

A second characteristic of NRNRR subnational allocation is the large number (more than a majority) of regions that it benefits. This creates a huge political obstacle to any attempt of reform, as already experienced by the government of Peru.

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[12]   FED stands for *Fondo de Estímulo al Desempeño y Logro de Resultados Sociales*. BOI stands for *Bono de Incentivo por la Ejecución Eficaz de Inversiones* and FONIPREL stands for *Fondo de Promoción a la Inversión Pública Regional y Local*.

Given the present system for financing regional government, simulations of reform options can apply only to the miscellaneous/discretionary category of revenues, going from own revenues to those from NRNRR.

The option explored is based on the equalization of revenue from own sources and from natural resources (*determinados*) with no increase of total revenue accruing to regional governments. As a consequence, equalization transfers are financed out of present regional revenues. In this first option that takes into account the difficulty in the present political circumstances to re-allocate natural resource revenue equalization transfers are financed out of donations and grants.

Fiscal capacity, i.e. standardized revenue, is calculated with reference to own revenues. Gross domestic product of each region is taken as tax basis getting standardized tax rate, so the standard is determined, as previously done for Argentina, with reference to the standardized revenues (in per capita terms) of the richest regions as Ica, Arequipa, Madre de Dios, Tacna and Cusco regions, excluding Moquegua for 2011 and Moquegua and Lima for 2014, that are outliers.

Aligning all regions to 100% of the selected standard absorbed in 2014, by using 85% of the pool of grants (donaciones and transferencias) to pay the necessary transfers to compensate the NRNR of poor regions, reduces territorial revenue inequality substantially.

Implementation in 2011 of the standard set for 2014 imposes a huge cost, owing to the high price of minerals and oil, making it impossible to fund the equalization scheme out of grants alone. Specifically, equalization would cost about one third more than the funds available. Without additional financing from central government, the pool of resources from grants only makes it possible to equalize 86% of the standard. In other words, a reasonable equalization target works in years of relatively low natural resource prices, such as 2014.

An alternative solution would consist in lowering the standard to a level that is reasonable expected to work without requiring changes also during high fluctuations of prices. This option consider standard at 80% of the average of the five richest regions after elimination of outliers. Obviously this has a cost in terms of a lower level of implementation on the inter-jurisdictional equity principle.

The results of vertical model for both countries, Argentina and Peru, are in the next table.

Table 3
Argentina and Peru: summary results of vertical model
(Coefficient of variation, fiscal gap and Gini coefficient of total revenues, per capita)

Country	Year of simulation	Equalization instrument	Coefficient of variation		Fiscal gap (per capita maximun/minimun)		Gini		
			Pre	Post	Pre	Post	Pre	Post	Reynolds-Smolensky index
Argentina	2012	Using royalites	0.502	0.449	5.3	4.0	0.238	0.209	0.028
	2012	Using royalties and own taxes	0.502	0.355	5.3	2.9	0.238	0.159	0.079
Peru	2011	Mining canon, sub-canon and royalties (*determinados*) at 80% of the national standard	0.783	0.630	41.8	9.0	0.397	0.306	0.091
	2011	Mining canon, sub-canon and royalties (*determinados*) at 86% of the national standard	0.783	0.611	41.8	8.0	0.397	0.291	0.105
	2014	Mining canon, sub-canon and royalties (*determinados*) at 100% of the national standard	0.640	0.567	32.0	9.8	0.327	0.278	0.048
	2014	Mining canon, sub-canon and royalties (*determinados*) at 80% of the national standard	0.640	0.582	32.0	16.3	0.327	0.287	0.040

Source: Prepared by the authors, on the basis of official data.

V. Final remarks

This paper has explored the issue of equalization of NRNRR, when this revenue is shared asymmetrically between the central government and only the sub national governments of the producing areas. This is a growing issue in many countries, including Latin America ones, where natural resources are spatially concentrated and part of their revenue is allocated, asymmetrically, to the areas where production is taking place, or which are affected by it.

Raising the issue of equalization of NRNRR does not amount to underestimate its difficulties. Equalization may be very costly due the disparities of revenue; equalization also extends to the receiving governments the oscillations of revenue deriving from the fluctuations of the price of natural resources. It has also to face political, legal and even constitutional difficulties. However, the issue cannot be avoided. Inequality of natural resource revenue originates conflict between and within levels of government, even leading to secessionist pressures.

The paper has explored the insertion of NRNRR into different equalization schemes distinguishing between vertical and horizontal models and between models, where the equalization of natural resource revenue is done separately, and models where it is done in the framework of overall fiscal capacity equalization. The paper also provides, for illustrative purposes, a few simulations with reference to Argentina and Peru. The paper has looked to models of equalization of fiscal capacity that are both equitable and efficient.

The results and their comments show, first, the huge degree of inequality produced by asymmetric distribution of NRNRR. The main suggestion, deriving from the analysis done for Argentina, is that systems of vertical equalization that are comprehensive, including own taxes and natural resource revenue, have many attractive features. They are able to reduce inequalities with a lower cost than separate systems for own taxes and NRNRR, because they take into account the interactions between these sources of revenue. They are also politically more feasible because their introduction and management requires only central government action. Obviously, these conclusions are subject to the existence of substantial own and NRNRR —dependent revenues, as in the case of Argentina, but not in the case of Peru, where the importance of these revenues is extremely small.

However, when disparities in natural resource revenue are huge, vertical equalization systems become very costly creating an unbearable burden on the finances of the central government. Hence in those cases horizontal systems are called for equalization, but their political cost is likely to be very high and unbearable due to constitutional provisions and/or perceived entrenched rights.

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Annex

Vertical equalization transfers: composition of fiscal revenues

Table A1
Argentina (24 provinces): per capita fiscal revenues, 2012
(In pesos per cápita)

Provinces	Total	Own taxes	Transfers	NRNRR	Other
Tierra del Fuego	38 052.7	5 849.0	19 141.7	3 102.3	9 959.7
Santa Cruz	32 454.5	4 817.4	13 353.8	6 648.9	7 634.4
Neuquén	21 944.7	4 709.9	6 961.7	4 833.9	5 439.2
La Pampa	19 198.8	3 083.1	11 419.4	731.9	3 964.4
Formosa	18 564.9	827.9	15 622.8	71.2	2 043.1
Chubut	18 046.8	3 126.6	6 452.0	4 661.3	3 806.9
Catamarca	17 626.5	1 477.7	13 766.6	415.0	1 967.2
La Rioja	15 492.6	933.3	13 975.4	0.0	584.0
Chaco	14 001.7	1 226.6	10 823.1	0.0	1 952.0
Entre Ríos	12 900.0	2 293.4	8 256.4	308.9	2 041.2
San Juan	12 752.8	1 715.4	9 415.7	487.1	1 134.7
San Luis	12 689.8	2 579.4	9 660.4	0.0	450.0
Río Negro	11 782.7	2 299.3	7 838.9	1 205.5	439.0
C.A. Buenos Aires	11 594.9	9 671.3	1 402.5	0.0	521.1
Jujuy	11 443.7	934.6	10 312.5	6.1	190.5
Santiago del Estero	10 756.9	978.0	9 563.5	2.7	212.7
Córdoba	10 653.9	2 633.8	5 167.6	0.0	2 852.6
Corrientes	10 182.6	1 017.0	7 349.8	46.7	1 769.1
Santa Fe	9 802.1	2 569.6	5 507.5	0.0	1 725.0
Misiones	9 788.6	1 671.8	6 957.4	114.4	1 045.0
Tucumán	9 686.7	2 225.8	7 133.7	0.0	327.2
Mendoza	9 255.9	2 619.7	4 887.9	682.9	1 065.4
Salta	8 358.2	1 388.6	6 484.4	235.3	249.9
Buenos Aires	7 121.3	2 952.2	2 672.4	0.0	1 496.8

Source: Elaboration on the basis of official information (www.mecon.gov.ar). Revenues are classified on the basis of Government Finance Statistics Manual (IMF, 2014). Non Renewable Natural Resources Revenues (royalties) are classified as rent (1415).

Table A2
Peru (24 regions): per capita fiscal revenues, 2011
(In soles per cápita)

Region	Total	Own taxes	Transfers	NRNRR	Others
Moquegua	1 324.1	51.6	114.4	949.4	208.8
Ancash	1 273.6	27.3	669.6	337.0	239.7
Tacna	965.8	153.3	209.6	589.6	13.3
Cusco	687.0	35.4	51.8	64.4	531.1
Pasco	612.4	22.1	37.9	394.8	157.7
Cajamarca	530.0	14.6	79.2	171.9	181.8
Loreto	526.9	86.9	71.7	0.0	281.1
Tumbes	525.0	31.6	34.8	0.0	458.6
Arequipa	462.2	54.0	185.5	192.2	30.5
Ucayali	412.7	41.0	26.7	0.0	345.0
Madre de Dios	402.2	99.3	48.7	0.3	253.8
Huancavelica	373.2	11.9	94.1	14.7	252.5
La Libertad	330.0	68.2	103.7	130.3	27.8
San Martin	292.2	24.0	29.1	0.5	183.2
Ayacucho	284.9	22.4	79.6	49.9	133.0
Ica	266.6	29.1	17.9	94.5	125.1
Apurimac	249.0	22.8	88.9	2.2	135.1
Puno	207.2	16.3	92.6	81.6	16.7
Junin	167.3	27.0	47.7	52.6	40.1
Piura	142.7	20.2	21.0	0.1	101.5
Amazonas	137.9	14.6	49.4	0.3	73.6
Huanuco	135.5	16.3	50.8	2.5	66.0
Lambayeque	108.1	31.7	15.5	0.2	60.8
Lima	31.7	3.3	3.9	10.9	13.6

Source: Elaboration on the basis of official information (www.mef.gob.pe). Revenues are classified on the basis of Government Finance Statistics Manual (IMF, 2014). Non Renewable Natural Resources Revenues (royalties) are classified as rent (1415).

Table A3
Peru (24 regions): per capita fiscal revenues, 2014
(In soles per cápita)

Region	Total	Own taxes	Transfers	NRNRR	Others
Cusco	899.5	42.8	65.7	24.0	766.9
Moquegua	842.2	79.6	138.1	412.8	211.8
Tacna	633.2	177.7	104.5	324.1	26.9
Tumbes	490.9	37.2	45.2	0.0	408.6
Ucayali	450.2	40.2	57.8	0.0	352.2
Loreto	447.7	25.7	74.2	0.0	347.8
Arequipa	389.1	89.2	60.7	88.7	150.5
La libertad	337.8	94.3	139.3	90.2	13.8
Apurimac	336.7	36.9	99.7	3.7	196.4
Ancash	328.7	30.5	136.9	149.0	12.3
San Martin	298.1	43.5	78.0	0.7	175.8
Ica	296.9	35.7	49.3	111.1	100.6
Ayacucho	286.9	33.7	117.5	7.6	128.2
Huancavelica	267.1	21.3	129.4	5.4	111.0
Cajamarca	246.5	13.9	77.0	92.6	63.0
Junin	244.7	30.3	54.9	9.0	150.5
Madre de Dios	221.9	102.0	68.5	2.3	49.1
Piura	213.5	28.4	28.6	0.5	155.9
Pasco	184.4	25.4	43.3	72.3	43.4
Amazonas	160.6	25.2	72.5	0.3	62.6
Puno	148.9	32.1	56.5	44.4	15.8
Lambayeque	124.5	77.3	42.2	0.0	4.9
Huanuco	116.0	19.9	85.0	0.4	10.7
Lima	28.2	3.9	5.3	3.6	15.5

Source: Elaboration on the basis of official information (www.mef.gob.pe). Revenues are classified on the basis of Government Finance Statistics Manual (IMF, 2014). Non Renewable Natural Resources Revenues (royalties) are classified as rent (1415).

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