

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

Giorgio Brosio, Juan Pablo Jiménez and Ignacio Ruelas

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).

Keywords

Renewable resources, tax revenues, local government, income, regional disparities, fiscal policy, Latin America, Argentina, Peru

JEL classification

Q380, H710, H770

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I. Introduction

A large and growing number of countries, including some in Latin America, are sharing non-renewable natural resource (NRNR) revenues asymmetrically with their local governments. Asymmetrical sharing may entail assigning a fiscal instrument, such as the right to levy royalties on oil and gas, exclusively to the governments of provinces where the resource is produced, as happens in Argentina. Alternatively, it may involve assigning a share of the revenue collected by the central government exclusively to the producing areas, as in the case of royalties in Brazil, or royalties and income tax in Peru.

Asymmetrical sharing is a non-necessary consequence of the spatial concentration of natural resources within countries. In practice, many countries do not use this arrangement, but prefer to share the revenue with all local governments. Asymmetrical sharing can create huge horizontal imbalances between different local government units, with impacts on equity, efficiency, and national cohesion.

Including NRNR in revenue equalization systems raises a number of issues and problems. These include the difficulty of defining the base on which the transfers are calculated; the high cost of equalization; the cyclicity of the revenues in question; the efficiency impact of including natural resource revenue in the equalization grants framework; and the fact that natural resources are exhaustible.¹

Although revenue from natural resources is one of the main sources of local fiscal inequality, it is never considered in the revenue-sharing formulas used in Latin America —possibly because this revenue was (and perhaps still is) not considered tax revenue, which in fact it is (see, for example, Martínez Vázquez and Sepúlveda, 2012; Tommasi Saiegh and Sanguinetti, 1999).

The article is structured as follows. Section II is the most substantive and starts with a short presentation of the principle of interjurisdictional equity, before examining the main issues and challenges posed by including NRNR in equalization schemes. Section III provides an illustration of the different systems of equalization transfers that can be used for NRNR, weighing the advantages and disadvantages of each one. Section IV discusses territorial inequality, the assignment of natural resource rents to subnational governments in Latin America, their importance and spatial concentration and the implications that arise for equalization transfers. Section V considers the cases of Argentina and Peru. The aim here is not to suggest specific reforms for these countries, but to illustrate the main options for equalization and discuss their merits and shortcomings. The final section summarizes the conclusions.

Before proceeding to the next section, some terminology needs to be clarified. Strict economic criteria are applied in the selection of revenue sources, taxes and fees subject to equalization, also including royalties that are sometimes and, in some places, classified as non-tax income. Basically, there are no economic differences between income taxes and royalties (the two most common instruments used to extract natural-resource rents), because the revenue they generate in each case is the product of a tax rate applied to a tax base.

II. Interjurisdictional equity principle and issues associated with the equalization of natural-resource revenue

The interjurisdictional equity principle provides the rationale for equalization transfers. A general statement of the principle is that persons in comparable circumstances should have access to comparable public

¹ Also, according to the Government Finance Statistics Manual (IMF, 2014), when a unit extracts a mineral or energy resource under an agreement in which the yearly payments are a function of the amount extracted, the payments (sometimes described as royalties) are recorded as rent.

services in all places (Boadway, 2015). In other words, in the intergovernmental framework, equity implies that place of residence should not create differences between citizens in their access to public services or in the cost of access. Nonetheless, there are different interpretations of this principle (see box 1).

Box 1

Interjurisdictional equity: strictest interpretation

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

$$\frac{\sum_1^t E_{c,d,e,f,\dots,j}}{R_{j,wy}} = k \text{ for each local jurisdiction } n \quad (1)$$

where:

- E is expenditure on service t ;
- R is the revenue that finances the service;
- c, d, e, f, \dots , is a set of characteristics determining the quality and quantity of service t ; impacting on expenditure. Standards are expressed in terms of these characteristics and may also coincide with them. They are also referred to as standards in the literature.
- w and y are the characteristics that determine the burden of taxes and/or levies imposed to finance the service. Naturally, these characteristics apply only when subnational governments have tax autonomy, in other words the faculty to determine the tax burden, at least partly. Examples would be tax rates, free public transport, or exemptions from health service payments for the elderly poor.
- j is the beneficiary group.
- k is the equity parameter.

Inter-jurisdictional equity is ensured by the equality of the k parameters —one for each group of individuals— across all jurisdictions. This would mean 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 expenditure, increasing the gap with respect to revenue (and *vice versa* for low parameter values). The lower the value of the parameters applied to revenues the lower also is the revenue intake.

The average national value of k across all groups of individuals and all subnational governments measures the existing vertical fiscal imbalance, which is defined as the proportion of local expenditure that is financed by local revenues.

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

$$T_n = \sum_1^t E_{c,d,e,f,\dots,j} - R_{j,wy} \quad (2)$$

Source: Brosio, G. and J. P. Jiménez (2015), "Equalization grants and asymmetric sharing of natural resources: options for Latin America", *Urban of Public Economic Review*, No. 2163, Santiago de Compostela, University of Santiago de Compostela.

Fully homogeneous service provision between jurisdictions requires very detailed constraints, in terms of standards defining 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 no longer be a rationale for having a decentralized system of government.

1. Which variable to equalize?

There are two major choices concerning the economic variable on which equalization is performed. The first is between actual revenue and fiscal capacity, and the second is between gross and net revenue. Actual revenue is the total amount collected by local governments from their various revenue sources. Although it is a very simple instrument in terms of information requirements, it does not provide the correct incentives to local government when used in equalization. For example, a wealthy local government that levies a property tax could be tempted to apply very low tax rates, thus reducing its revenue intake and becoming eligible for equalization transfers.

Fiscal capacity, which the literature also refers to as standardized revenue, is not the actual tax intake, but what a local government would collect by applying the average tax effort exerted by all other governments to its own tax base, and calculated as the average tax rate applied to different revenue sources (as illustrated below with reference to Canada). This means that transfers do not reward subnational governments that have a below-average tax burden, because their fiscal capacity, on which the transfer is determined, would exceed actual revenue. Fiscal capacity equalization is both equitable and efficient.

In principle, fiscal capacity equalization should be applied to all revenue sources and when subnational governments have tax autonomy. This may be a difficult exercise in the case of natural resource revenues, because of the large number of natural resources subject to taxation and the different characteristics impacting on price and revenue. For example, iron ore may have a different mineral content in different provinces, and a different value that would have to be taken into account when determining fiscal capacity. This can prove exceedingly difficult. Australia, however, has worked hard to estimate fiscal capacity for minerals (Searle, 2004), while Canada has decided to use the actual revenue intake instead (Boucher and McLure, 2015).

Secondly, there is the question of what to equalize —gross or net revenue. Raising revenue entails cost and requires effort, so gross revenue exceeds net. Also the difference between gross and net does not represent an element of fiscal capacity that requires equalization.

Revenues are never expressed in net terms for taxes and other levies not 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 assumption when all the subnational government units involved have access to the same tax bases, because collection costs should be broadly similar across the various areas.

In the case of NRNR, however, this no longer holds true. Although most of the investment for the exploitation of natural resources is done by the producer firms directly, additional investment in local infrastructure specifically related to natural resource exploitation is usually required. Roads to the mines and oil fields have to be built; airports and ports may need upgrading. The production phase usually attracts migrant workers and their families into the producing areas. These flows generate new costs for the destination governments in terms of the demand for services and the need for new infrastructure (schools, health, transport and social services).

Local governments thus operate as factors of production contributing to the creation of the natural resource rent. They bear a cost that does not usually exist in the case of general taxes. Accordingly, NRNR revenue needs to be calculated in net terms, to evaluate the amount of the additional fiscal capacity that their availability generates for the governments that have access to their revenue.

Two systems are used to net 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 production (roads for example) or for the provision of services to the new population, or also to avoid environmental damage. On the revenue side, gross revenue is used. The model will take into account both the expenditure requirements of producer areas and the need to redistribute revenue in favour of non-producers.

The second alternative is to act exclusively on the income side by deducting from gross revenue the additional expenditure needed for production and for the additional provision of services and to compensate for environmental damages caused. Although the outcome of the two systems is similar, the financial cost of equalization is lower in the second case, which amounts to lowering the peaks considered for equalization.²

² Canada has partly solved this problem by applying a factor to scale back natural resource revenues subject to equalization.

2. Revenue cyclicity

The large fluctuations that occur in natural resource prices mean that revenues also vary widely. In some taxes, oscillations are also exacerbated by progressiveness, such as the taxes on income and rent, used for rent extraction.

When a system of equalization transfers that redistribute NRNR revenues to the benefit of the subnational governments of the non-producing areas is introduced, the revenue fluctuations are extended to the whole set of local governments, thereby exacerbating expenditure efficiency problems and also creating severe funding problems for the central government in vertical and open-ended equalization systems.

There are various instruments for dealing with the impact of revenue fluctuations on equalization transfers. A *prima facie* simple instrument consists in acting directly on the oscillations by implementing stabilization funds for subnational revenues and then determining the transfers on the basis of the stabilized revenue than can be channelled to the budget, according to the rules of the stabilization fund.³

An alternative solution would be to change the standard for equalization over time, reducing it in years of high revenue and raising it in low revenue periods. This would make the system more manageable, but it would also mean that the revenue gap between the richest and the poorest jurisdictions will vary according to natural resource price cycles.

3. Highly skewed distribution deriving from the 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.

The expression in the denominator of the left-hand component of equation (1) in box 1, $R_{j,wy}$ describes a system of revenue sources, in which receipts derive from the application of centrally defined parameters, such as tax rates, to locally assigned tax bases. Local assignment of NRNR revenue, combined with a distribution that is highly skewed in favour of a few jurisdictions, can result in total revenue in these jurisdictions exceeding, perhaps greatly, the amount of expenditure determined in the numerator of the same equation. To fulfil interjurisdictional equity, or, more specifically, to keep the equity parameter k equal for all, the revenue of these jurisdictions needs to be curtailed, which means their equalization transfer becomes negative. Horizontal equalization schemes are the technically appropriate instrument for negative transfers, as will be seen below, although they will likely be resisted by the paying jurisdictions.

4. Efficiency issues

Efficiency issues have to be approached from two distinct points of view. The first refers to the impact of revenue on migration by firms and individuals, specifically labour. When NRNR revenue is not equalized, resource-rich jurisdictions will be able to attract firms and workers by providing them with additional services or reducing the tax take. These moves create inefficient patterns of location across the country

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

since migration would not be dictated by genuine economic location factors, such as proximity to market, or communication costs.⁴

The second efficiency problem refers to the impact of equalization transfers on the level of production of natural resources. In general, the existence of transfers induces the governments of the producing areas to reduce production, insofar as they have decision-making power over this. Here, a distinction needs to be made between equalization of actual revenue and equalization of fiscal capacity. In the case of actual revenue, the more a subnational government collects, the smaller the transfer it will receive. Hence, there is an incentive to reduce production; for example by denying exploration and operating permits.

When equalization is based on fiscal capacity, a variation in tax rates does not impact on transfers, thereby neutralizing the impact of equalization transfers on production. Underlying this second efficiency problem is the idea that the production level should be decided on the basis of broader criteria than the amount of individual transfers.

III. Approaches to equalization transfers

1. Interjurisdictional equity in the practice of decentralized systems

In the reality of most advanced equalization systems, equity is attained when transfers provide subnational governments with sufficient revenues to ensure that individuals in comparable circumstances have access to comparable public services in all localities after paying comparable levels of taxes and fees. In Canada this goal is explicitly stated 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 interjurisdictional equity principle is not mentioned in the Constitution; nor is it defined in legislation or described in any agreement between governments. Instead, 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 GST 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, 2010, p. 34).

2. Equalization of expenditure and revenue

Considering real-world examples, in Australia the standardized expenditure for each function is determined by applying a number of parameters (“relativities”) to the average per capita expenditure of the states for the various functions, which impact on the expenditure needed to provide the services at a level deemed adequate.

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

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

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

where:

- *SE* is standardized expenditure, in other words the expense needed to provide the same quality and quantity mix for each service, assuming a national average rate of efficiency;
- *SR* is standardized revenue, in other words the revenue that can be collected by applying the average national tax rate to the potential (not the assessed) tax base.

Interjurisdictional equity and efficiency require that all subnational expenditures and all revenue sources assigned to the subnational government be considered when calculating the equalization grant. Insofar as rents from NRNR are assigned to subnational governments and, as such, constitute a source of revenue, they need to be included in equalization schemes.

Systems of the Australian type, discussed below, are the most comprehensive. They are targeted to ensure full equalization, closing both expenditure and revenue gaps (Searle, 2004). On the expenditure side, they potentially also include the additional costs and needs associated with the extraction of natural resources, hence addressing the difference between gross and net revenue.

3. Revenue equalization only

Alternative systems that act on the revenue side alone can also have a substantial equalization impact, and are less demanding in terms of information and administration complexity. Some of these systems may also be developed through time into a full expenditure- and revenue-based equalization system.

With specific reference to NRNR rents, the main alternatives are the following:

- (a) Including rents obtained from natural resources in the set of revenues to be equalized, as in the Canadian system,

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

where:

- *TT* is the total grant;
- *T_n* is the grant made 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 equalization standard, for example, the national average across all provinces subject, of each revenue source to equalization, as in Canada today, or the average of a group of provinces (as in Canada initially); and
- *n* represents beneficiary provinces, that is those for which the difference in the parentheses is positive.

Also:

$$TT = \Sigma T_n \quad (5)$$

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

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

This is exactly what happened in Canada following the first oil shock. The huge hike in oil prices at that time inflated revenue in Alberta, where practically all Canadian oil production was concentrated. The standard tax base (the national average at that time) surged, requiring, *ceteris paribus*, a similar expansion in grants. Since the federal government had access to just 10% of oil revenues, keeping to the formula would have meant financing equalization payments out of its own tax revenues, thus facing a choice between incurring a deficit or squeezing its own expenditure.⁵

Over the years, Canadian governments have made basic corrections to the formula such as: (i) exclusion of the Alberta tax base from the equalization standard; (ii) outright exclusion from equalization payments of provinces, such as Ontario, that have a non-oil tax base above the national average; (iii) exclusion of a portion of the oil tax base from the equalization system; and (iv) imposition of a ceiling on the total amount paid in equalization.⁶ Canada currently includes 50% of NRNR revenues in the equalization base. In other words, it equalizes up to 50% of differences in NRNR revenues.⁷

(b) The second alternative is to use a separate equalization system for natural resources.

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

That is:

$$T_m = t_s \times (B_s / P - B_n / P_n) \times P_n \quad (6)$$

where t and B refer to natural resource revenues only.

In some countries, separate equalization systems are generally funded only by natural resource revenues and do not *consider* other income sources. This is not a necessity, however. When equalization systems are funded with NRNR revenues alone, they amount to reserving a share of total national NRNR revenue for jurisdictions that produce little or nothing in the way of natural resources, and distributing them either according to the gap between their NRNR revenue and the national average, or according to other needs or indicators related to revenue capacity.

4. Vertical and horizontal equalization

There are two versions of equalization mechanisms: the vertical equalization model, as exemplified by the Australian and Canadian systems, whereby grants are paid by central government to subnational governments; and the horizontal equalization model, used in Germany (*Länderfinanzausgleich*), in which grants are paid from relatively wealthier jurisdictions to relatively poorer ones, without central government funding (see Spahn, 2001). Horizontal systems are closed, requiring no central-government funding. The Chilean Common Municipal Fund (*Fondo Común Municipal*) is another example of a horizontal system (Ahmad, Letelier and Ormeño, 2015).

⁵ Furthermore, the disparity between Alberta and other provinces became so large that even wealthy provinces, such as Ontario, became beneficiaries of equalization transfers; although ultimately the transfer resulted from the federal government using the tax bases located in their jurisdiction (see Courchene, 1979 and 1988).

⁶ In addition to actual reforms, a wide variety of proposals have been advanced in Canada to contain the cost of natural resource revenue equalization. Gainer and Powrie (1975) suggested that rents, profits and interest accruing to provincial governments should be taxed in the same way as factor incomes generated in the private sector. Given an average 30% effective tax rate, roughly 70% of NRNR 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, under which only the portion of natural revenues that is used for budgetary purposes should be included in the equalization formula, which means that the portion syphoned off into non-budgetary heritage funds should be excluded.

⁷ Office of the Parliamentary Budget Officer (2014).

In the vertical model, the skewness of the distribution of revenues to be equalized influences the total amount of the grant. Specifically, in open-ended systems, such as Canada's, where there is no upper limit to the total amount disbursed by the federal government, whenever the standard tax base —on which revenues are equalized in the jurisdictions concerned— increases, the total amount of the grant is also bound to increase, *ceteris paribus*. This may put central government finances under such a severe strain that the formula has to be changed.

Horizontal models do not face the same constructional difficulties. The degree of equalization is built into the formula and is not imperilled by sudden changes in the total amount of natural resource revenue and/or in the skewness of their distribution. Moreover, potential strains on central government finances cannot arise if the standard is set at the national average, because the total grant from net payer jurisdictions is equal to the total received by the beneficiary ones.

A typical formula based on fiscal capacity equalization, which amounts to revenue standardization, would be:

$$TT_J = \beta_J [ts(TB_J - TB_s)] \quad (7)$$

and

$$TT_I = \beta_I [ts(TB_s - TB_I)] \quad (8)$$

where, in addition to the symbols defined previously: β_J are the equalization standards applied to the paying and receiving jurisdictions; J are the paying jurisdictions; and I are the beneficiary ones.

Thus,

TT_J is the total grant paid by the contributing jurisdictions according to the standardized tax rate ts and the grants required to attain the net national standardized average.

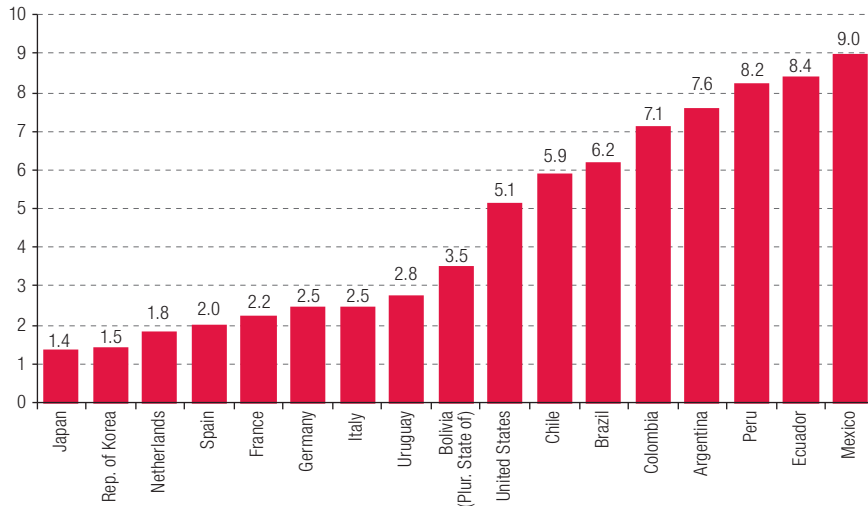
TT_I is the total grant received by the beneficiary jurisdictions according to the standardized tax rate ts and the grants required to align all regions to the net national average.

The stress is placed instead on the natural resource-rich jurisdictions, particularly if they represent a small share of the total national population. More specifically, the share of NRNR revenue they can retain is inversely related to their national population share. If equalization is designed to fully equalize per capita revenues, then the revenues shares retained by producer jurisdictions is the inverse of their population shares.

IV. Territorial inequality and fiscal disparities of NRNR in Latin America

One emerging issue that needs to be explored is territorial inequality within countries (ECLAC, 2017). The indicators most frequently used to gauge territorial differences in the same country include the ratio between the per capita GDPs of the wealthiest and poorest regions (in most cases measured at the level of major administrative divisions). In Latin American and Caribbean countries, the ratio between the highest and lowest regional per capita GDP generally exceeds 6:1 (except for Uruguay), while in developed countries it is seldom above 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 per capita GDP (max/min), 2012–2015



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).

On the other hand, the NRNR contribution to public revenues is very large in a number of Latin American countries, as much as 40% in the Bolivarian Republic of Venezuela, Ecuador, Mexico, and Trinidad and Tobago in 2005–2008 (see Gómez Sabaini, Jiménez and Martner, 2017).

The highly unequal regional distribution of revenue implies sharp fiscal disparities. This is true when subnational taxes are levied on highly concentrated tax bases, such as consumption (for example ICMS in Brazil, “gross incomes” in Argentina, selective taxes in Colombia), or payroll in Mexico (see Muñoz, Radics and Bone, 2017); but it is even more significant when the tax base is NRNR because the deposits in question are highly concentrated regionally.

Argentina, Peru and the Plurinational State of Bolivia provide telling examples of the impact of NRNR revenues on subnational finances. In Peru, NRNR generates 15% of departmental revenue and accounts for 25% of the country’s revenue inequality. In Argentina, a tiny share of provincial revenue generates around 18% of its fiscal inequality. In the departments of the Plurinational State of Bolivia, the direct hydrocarbons tax (IDH) —which is the main fiscal instrument used to extract hydrocarbon rent— plus other NRNR revenues (royalties) represents over 87% of total revenues and also generates more than 90% of inequality; almost 50% of NRNR is concentrated in Tarija which is the country’s wealthiest department in per capita GDP terms (see table 1 below).

Table 1
Selected countries (3): NRNR revenue and territorial inequality, 2012–2015

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

V. Equalization transfers: alternatives for Latin America

As indicated in the first part of this article, this section simulates an equalization transfer system (vertical model) for the regions of Argentina and Peru (provinces). The horizontal model is simulated only for the provinces of Argentina.

In the simulation for Argentina, equalization is performed with respect to fiscal capacity. The standardization of own taxes uses geographical GDP (INDEC, 2004=100) as the tax base, while NRNR production is used for royalties. In Peru, equalization is performed relative to fiscal capacity for own taxes, again using regional GDP, with reference to actual revenue for the canon and sub-canon (NNRR). The simulations are evaluated before and after equalization transfers, using the following indices relative to total revenues: coefficient of variation (CV), fiscal gap (max/min) and the Gini coefficient.

1. 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 Article 124 of the Constitution, Argentina's provinces are the original owners of the natural resources located in their territory. This means that the provinces are responsible for entering into contracts with firms and for collecting royalties. This has augmented their power to control the price of the resources and the measurement of production. Nonetheless, the federal government retains the power, derived from an ordinary law, to regulate the sector. More importantly, it is also constitutionally mandated to regulate the domestic market and domestic prices; in addition, it has exclusive jurisdiction over import and export taxes and access to company profit taxation (although it does not use specific taxes —such as a special profits tax or a rent tax— to extract rent from oil and gas).⁸

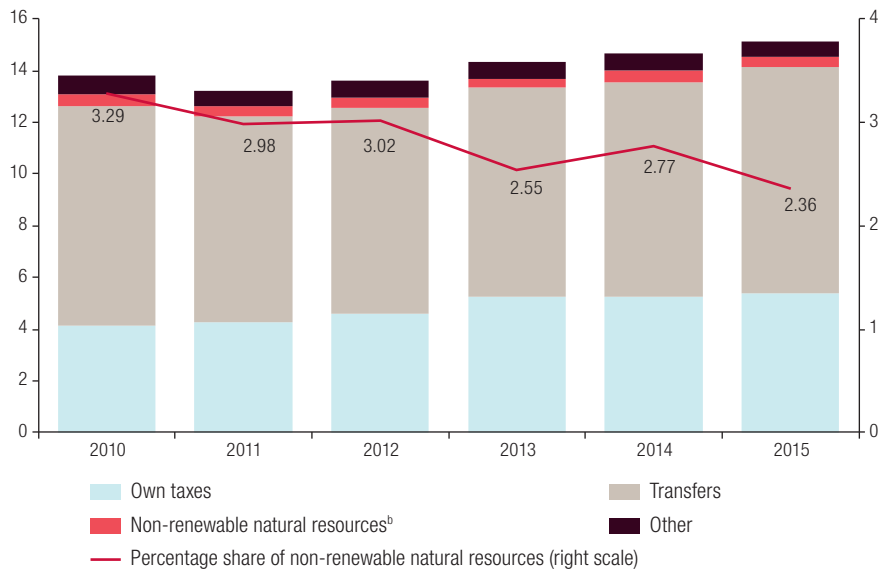
This peculiar cap on the amount of royalties that the producer provinces can raise has, to some extent, helped reduce disparities between producer and non-producer provinces; and it has attenuated the fluctuations in royalties revenue to between 2% and 3% of total revenues (see figure 2).

The huge geographical disparities in GDP (the maximum is more than six times the minimum, as reported in table 1), produce equivalent disparities in the intake of internally generated tax revenue. These disparities are partially corrected through the general transfer system and other grants. Inequalities are exacerbated by royalties that benefit the producer provinces only.

The impact of royalties fundamentally alters the ranking of provinces in terms of own revenues plus central government transfers. The top-ranked province becomes Santa Cruz, which receives the highest per capita allocation of royalties. The final impact of the combination of the various revenue sources is that, although no province is left with an unbearably low revenue level, interprovincial gaps remain extremely wide. Buenos Aires has a per capita revenue that is 1/5 that of the wealthiest province, Santa Cruz. Disparities of this magnitude would not be accepted in most federal systems.

⁸ For further details on the institutional framework or impact of asymmetrical sharing in Argentina, see Brosio and Jiménez (2015).

Figure 2
Argentina: evolution and composition of subnational government revenues and revenue share of non-renewable natural resources, 2010–2015^a
(Percentages of GDP and percentages of total revenue)



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

^a Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

^b Non-renewable natural resources revenues (royalties) are classified as rent (1415).

(a) Horizontal equalization model

Two alternatives are considered in this model. In the first, the revenues of all provinces are adjusted fully to the national average at least; in the second model, the equalization standard is set at 80% of the national average. Table 3 simulates how much producing provinces would contribute and how much other provinces would receive, along with the problems that the horizontal model would generate. The gap and surplus between the standard and standardized revenue of each province is shown in per capita terms; then both are multiplied by the population to calculate the revenues required to align all provinces to the national average.

In short, to adjust all provinces to the standard level would require Arg\$ 7.8 billion, which is more than would be available from the producing provinces when their revenue is adjusted to the national average, in other words Arg\$ 6.05 billion, as shown in table 2. This means that a horizontal close-ended model in Argentina would be unable, in the year of the example, to equalize —that is, align all provinces to the national average level. Only if the standard is set at 80% of national average would the horizontal closed-ended model work, since the total contributions from producing provinces would be equal to the transfers received by non-producing provinces. This is an important issue, because the higher the standard is set, the larger the transfer needed from the producing provinces, thus requiring interprovincial political agreements.

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.⁹

⁹ 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.

Table 2
Horizontal equalization transfer: revenues required according to national average

A. Basic criteria

Standard according to total royalties	
Total royalties (<i>pesos</i>)	8 999 191 732
National population	40 117 096
National average of gross royalties (<i>per capita</i>)	224.32
Alternative standard (80% of gross royalties)	179.46

B. Horizontal equalization: results
(*pesos*)

Provinces	National average		80% of national average	
	Revenues required to bring the producing regions down to the national average	Revenues required to align all provinces to the standard level	Revenues required to bring the producing regions down to the national average	Revenues required to align all provinces to the standard level
City of 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
Santiago 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: Prepared by the authors.

(b) Vertical equalization model

The more inclusive is the equalization, in other words the larger the number of revenue sources covered, the higher is the level of equality attainable, provided that the total amount of the transfers to be allocated is large enough to bridge the gaps. Moreover, the standard set for equalization is decisive.

The way vertical equalization of provincial taxes and royalties works is shown in table 3 below and also in annex tables 4–6, separately for own taxes, royalties and the sum of the two. In this latter case, the system equalizes the entire 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 grants allocated by the federal government (in this case, *coparticipación federal de impuestos* or federal revenue-sharing), which the new system intends to replace, at least in part.

In the simulation performed mostly for illustration purposes, the standard for own taxes is calculated as the average of the standardized revenues of the five wealthiest provinces excluding Buenos Aires (the wealthiest), namely Neuquén, Tierra del Fuego, Santa Cruz, La Pampa and Chubut.

The standard for royalties is the average of the standardized revenue of the five wealthiest provinces except Santa Cruz (the wealthiest) with a 20% reduction for costs (e.g. environmental damage and tax administration). In other words, revenue is netted. The wealthiest provinces are: Chubut, Neuquén, Tierra del Fuego, Río Negro and La Pampa. The standard for own revenue is relatively modest, since it excludes the wealthiest province. The standard for royalties is similar to that used for a long time in Canada, where the wealthiest province has also been excluded from equalization. The two standards make the comparison with the equalization capacity of the current 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).

2. 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 through two main revenue categories: ordinary/conditional revenues (*Recursos ordinarios*) and unconditional revenues. Conditional revenues are determined for (and allocated to) each region at the discretion of central government.¹⁰

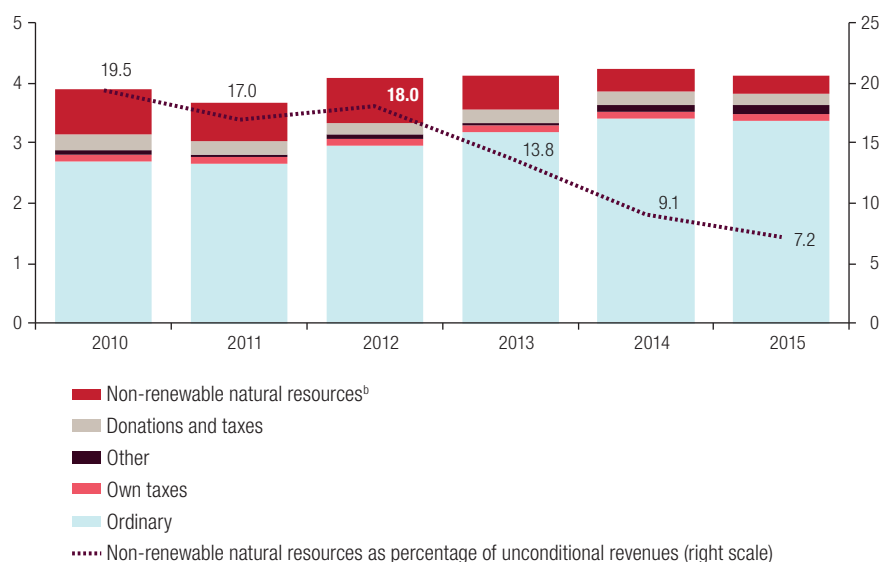
Unconditional revenues, which will only be mentioned here, include four different categories: (i) own revenues, consisting mainly of fees and receipts from the sale of services; (ii) transfers and donations, consisting mainly of grants from donors and international organizations; (iii) income from borrowing; and, lastly, (iv) a miscellaneous category (officially labelled *Recursos Determinados*) including natural resource revenue (the so-called mineral, oil and gas canon) and other additional fiscal instruments, mostly transfers, such as FED, FONIPREL and BOI¹¹ allocated to regions that are devoid of natural resources, and other revenue such as custom duties 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.

¹⁰ Conversely, regional governments have no autonomy over their use: basically, they serve to finance the regional branches of national ministries that have been regionalized. They are not labelled as regional revenues in the legislation and are not recorded as such in the official statistics, which makes it impossible to gain a complete picture of regional finances, let alone evaluate it. This is rather unusual and possibly stems from the initially supposed temporary nature of discretionary revenue (see also Letelier and Neyra, 2013).

¹¹ FED stands for *Fondo de Estímulo al Desempeño y Logro de Resultados Sociales* [Fund for the Stimulus of Performance and Achievement of Social Results]. BOI stands for *Bono de Incentivo por la Ejecución Eficaz de Inversiones* [Incentive Bonus for the Effective Execution of Investments] and FONIPREL stands for *Fondo de Promoción a la Inversión Pública Regional y Local* [Regional and Local Public Investment Promotion Fund].

Figure 3
Peru: evolution and composition of subnational government revenues and revenue share of non-renewable natural resources, 2010–2015^a
(Percentages of GDP and 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.

^a Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

^b Non-renewable natural resources revenues (royalties) are classified as rent (1415).

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 important, consequence of assigning natural resource revenues to subnational governments are the huge horizontal disparities produced, particularly when natural resource prices are high. While own revenues and grants are relatively evenly distributed, revenues deriving mostly from natural resources (*determinados*) generate a high level of inequality in total revenues, contributing almost one quarter of this (exactly 25% according to table 1). Consequently, small regions, such as Moquegua, but also relatively large ones, such as Ancash, Arequipa and Cajamarca, receive substantial per capita amounts.

A second characteristic of NRNR subnational revenue allocation is the large number (a sizeable majority) of beneficiary regions. This creates a huge political obstacle to any reform attempt, as has been experienced by the Peruvian government.

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

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

Fiscal capacity (standardized revenue) is calculated with reference to own revenues. Each region's GDP is taken as the base for the standardized tax rate, so the standard is determined, as was done

previously for Argentina, relative to the standardized per capita revenues of the wealthiest regions, such as Ica, Arequipa, Madre de Dios, Tacna and Cusco, while excluding Moquegua for 2011 and Moquegua and Lima for 2014, which are outliers.

Territorial revenue inequality is substantially reduced by 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 regions poor in non-renewable natural resources.

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 be to lower the standard to a level that can reasonably be expected to work without requiring changes during wide price fluctuations. This option considers a standard at 80% of the average of the five wealthiest regions after eliminating outliers. Obviously, this has a cost in terms of a lower level of implementation of the interjurisdictional equity principle.

The results of the vertical model for both countries, Argentina and Peru, are shown in table 3.

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 max/min)		Gini		Reynolds-Smolensky index
			Pre	Post	Pre	Post	Pre	Post	
Argentina	2012	Using royalties	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 (<i>determinados</i>) 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 (<i>determinados</i>) 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 (<i>determinados</i>) 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 (<i>determinados</i>) 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.

VI. Final remarks

This article has explored the issue of NRNR revenue equalization, when the revenue in question is shared asymmetrically between the central government and the subnational governments of the producing areas only. This is an increasingly important issue in many countries, including Latin American ones, where natural resources are spatially concentrated, and part of their revenue is allocated, asymmetrically, to the areas where production is taking place, or those affected by it.

Raising the issue of NRNR revenue equalization is not to underestimate its difficulties. Equalization may be very costly owing to revenue disparities; equalization also extends to the receiving governments the variations in revenue caused by fluctuations in the price of natural resources. Equalization is also

subject to political, legal and even constitutional difficulties. Nonetheless, the issue cannot be avoided. Inequality of natural resource revenue causes conflict between and within levels of government, even leading to secessionist pressures.

The article has explored the inclusion of NRNR revenue in different equalization schemes, distinguishing between vertical and horizontal models, and between models where natural resource revenue is equalized separately, and models where this is done in the framework of overall fiscal capacity equalization. The paper also provides a number of illustrative simulations with reference to Argentina and Peru; and it has considered fiscal capacity equalization models that are both equitable and efficient.

The results and their comments reveal, firstly, the huge degree of inequality produced by the asymmetric distribution of NRNR revenues. The main conclusion, deriving from the analysis for Argentina, is that vertical equalization systems that are comprehensive and encompass own taxes and natural resource revenue, have many attractive features. They are able to reduce inequalities at a lower cost than separate systems for own taxes and NRNR revenues, because they consider the interactions between these revenue sources. They are also politically more feasible, since their introduction and management require central government action only. Obviously, these conclusions assume the existence of substantial own and NRNR-dependent revenues, as in the case of Argentina, but not Peru, where natural resource revenues are relatively insignificant.

Nonetheless, when natural resource revenue disparities are huge, vertical equalization systems become very costly, because they place an unbearable burden on central government finances. Hence in those cases, horizontal equalization systems are called for; but, in this case, the political cost is likely to be very high and unsupportable, due to constitutional provisions and/or perceived entrenched rights.

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Annex A1

Table A1.1
Argentina (24 provinces): per capita fiscal revenues, 2012^a
(Pesos per capita)

Provinces	Total	Own taxes	Transfers	NRNR revenues ^b	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
Autonomous City of 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: Prepared by the authors, on the basis of official information from the Ministry of Economy and Finance [online] www.mef.gob.pe.

^a Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

^b Revenues from non-renewable natural resources (royalties) are classified as rent (1415).

Table A1.2
Peru (24 regions): per capita fiscal revenues, 2011^a
(Soles per capita)

Region	Total	Own taxes	Transfers	NRNR revenues ^b	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 Martín	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
Apurímac	249.0	22.8	88.9	2.2	135.1
Puno	207.2	16.3	92.6	81.6	16.7
Junín	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: Prepared by the authors, on the basis of official information from the Ministry of Economy and Finance [online] www.mef.gob.pe.

^a Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

^b Revenues from non-renewable natural resources (royalties) are classified as rent (1415).

Table A1.3
Peru (24 regions): per capita fiscal revenues, 2014^a
(Soles per capita)

Region	Total	Own taxes	Transfers	NRNR revenues ^b	Other
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 Martín	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: Prepared by the authors, on the basis of official information from the Ministry of Economy and Finance [online] www.mef.gob.pe.

^a Revenues are classified according to the Government Finance Statistics Manual (IMF, 2014).

^b Revenues from non-renewable natural resources (royalties) are classified as rent (1415).