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The marginal cost of public funds of mineral and energy taxes in Peru ☆

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ABSTRACT

We estimate the Marginal Cost of Public Funds (MCPF) for Peru using a detailed computable general equilibrium (CGE) model. Revenues from all major sources (including taxes on factors of production, natural resources such as energy and minerals, consumption, and imports) are examined. Our focus is on the efficiency implications of mineral and energy taxes, given their importance to Peruvian public finance. The primary data are from the Global Trade Analysis Project (GTAP) as modified to include detailed tax information from the Peruvian Ministry of Economy and Finance and the Peruvian Internal Revenue Service. Consistent with the theories of public finance, we find that the MCPF is greater for activities that face high or widely varying tax rates. The taxes on energy and mineral activities represent a clear illustration of this relationship. The results presented in this paper indicate opportunities to improved efficiency in the current tax mix, and also indicate the financing costs of proposed expenditures that would be funded with taxes on energy and natural resources.

Introduction

One of the most important contemporary and challenging issues under debate regarding the international mining and energy industries is taxation. As a consequence of high commodity prices, many mining and energy companies are investing in exploration and development activities in countries where taxation is unstable. In this context, governments seek to formulate appropriate and stable tax regimes for the mineral and energy industries. Market booms often result in large extractive-industry profits, which are an attractive source of public revenue. A measured approach to taxation is advised, however, that does not introduce high levels of distortion. We examine energy and mineral taxes in Peru in the context of the overall tax regime, and find that the energy and mineral taxes are among the most distortionary.

The application of taxes can introduce (or correct) distortions in the allocation of resources, and much of the theoretical and empirical research in Public Economics is concerned with measuring the relative and absolute welfare costs (or excess burdens) of the tax systems. Many examples can be found for developed countries.[1] The motivation for much of this literature is an examination of the types of taxes that are used to finance public goods and their effects on allocative efficiency. These examinations can be helpful in revealing the distortions and in guiding policy makers toward appropriate reforms. We are within this tradition but specifically focus our attention on the taxation of mining and energy industries in the developing world, with Peru as a case study.[2]

Peru is an appropriate choice for our analysis given the mineral and energy share in the overall Peruvian economy and Peru's dependence on tax revenues from these sectors. According to the USGS (2010), Peru is currently a major producer of gold, silver, and basic metals. Peru is the second largest world copper producer with a global market share of 8.00%.[3] It is the largest producer of silver with 18.22% global market share. It is the sixth largest producer of gold worldwide with a market share of 7.68%. It is the fourth largest producer of lead, and the second largest producer of zinc with market shares of 7.81% and 13.22%, respectively. In addition, Peru is currently developing large

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[1] See for example Ballard et al. (1985), Browning (1976), and Triest (1990). Dahlby (2008) provides a survey of the relevant empirical studies. Specifically see Table 3.1 (p. 79) for studies focused on commodity taxes, Table 5.3 (p. 137) for studies focused on labor taxes, and Table 7.5 (p. 200) for studies focused on capital taxes.

[2] Other authors have also focused on developing countries including Ahmad and Stern (1984) for India; Ahmad and Stern (1990) for Pakistan; Devarajan et al. (2002) for Bangladesh, Cameroon, and Indonesia; and Warlters and Auriol (2005) for 38 African economies.

[3] Market shares are 2009 data from the USGS (2010).

reserves of natural gas in order to satisfy increasing domestic energy demand and the export market (García and Vásquez, 2004). Furthermore, Peru is fostering large investments in exploration and development of oil reservoirs in the Peruvian rainforest (Finer and Orta-Martínez, 2010). Davis (1995) includes Peru as a mineral-dependent economy due to its high level of mineral and oil exports as a percentage of total merchandise exports and the significant contribution of its oil and mining industries to total GDP.[4]

In terms of public finance, mining and oil industries are a significant source of government revenues. Despite having a 5.4% share in GDP in 2007 (BCRP, 2010), the mineral and oil industry generated approximately 25% of total government revenues (including tax collections and contributions like mineral and oil royalties) according to the Peruvian Internal Revenue Service[5] (SUNAT, 2010). This means that these nonrenewable sectors are key sources to support public finance in Peru.[6] In addition, given Peru's heavy reliance on energy and mineral taxes, the efficiency effects of mineral and energy taxation are also important aspects of overall Peruvian public policy.

An interesting research question that arises in this context is how distortionary are mineral and energy taxes in a resource-dependent economy like Peru. We are not aware of any available study that measures the welfare distortions generated by the tax system applied to the mining and energy industries in South America, particularly in Peru. The lack of research on the Peruvian tax system, and how it might be improved, is also noted by Barrantes et al. (2008) in their comprehensive literature review regarding economic research in Peru. With respect to taxation and fiscal policy, the authors point out that:

> *In a country like ours, where almost half of the population survives below the poverty line, taxation constitutes a fundamental issue.* [However,] *there is a lack of studies concerning the optimality of the income tax to guarantee an adequate revenue collection, the differences in the effects of direct and indirect taxes, and the expansion of the tax base. In particular, we need more empirical analysis regarding the costs and benefits of tax-exemption regimes, as well as the* [costs and benefits of] *the tax system.* (2008: 47)[7]

Thus, there is currently an open research agenda regarding the welfare effects of taxes in Peru and, in particular, regarding the effect of mineral and energy taxation. Knowing the welfare implications of mineral and energy taxation in Peru can provide important tax policy insights for other developing resource-dependent economies in South America and help answer important policy questions like: what social rate of return should public projects be required to achieve in South America? How can a tax reform be implemented in this region? One relevant piece of information that is necessary to answer this kind of questions is a measure of the marginal cost of public funds (MCPF).

As Warlters and Auriol (2005) suggest, estimates of the MCPF provide directions for reforming the tax structure and guidelines for the appropriate rate of return on public projects. Slemrod and Yitzhaki (2001) offer a comprehensive perspective on the MCPF (and its expenditure-side counterpart, the Marginal Benefit of Public Projects). Despite the importance of the MCPF for public policy, estimating a set of MCPF for Peru is challenging. First, the calculations require the development and calibration of an economy-wide computable general equilibrium (CGE) model that takes into account the multiple interactions of many tax instruments across various markets. Second, once the model is built, it is necessary to have first-hand information regarding the set of tax and royalty rates that apply not only on mining and energy activities, but also on the rest of the sectors in the economy.

We examine Peru as a case study of a South American mineral-dependent economy. Our objective is to develop a CGE model that allows us to measure the MCPF for the most important taxes in Peru, with a special emphasis on energy and mineral taxes. We use a modified version of the GTAP-data based CGE model proposed by Rutherford (2005) to evaluate the welfare effects of a comprehensive set of taxes. We update the GTAP accounts to March 2009 using tax rate information from official Peruvian sources. Our estimated set of MCPFs is useful in suggesting possible directions of reform in Peru, and possibly other similar developing economies heavily dependent on minerals and energy.

The rest of the paper is divided into five sections. In the following section we explain the concept of marginal cost of public funds. In the section following it we briefly explain the features of the CGE model. In the fourth section we discuss the data, with a focus on the additional information necessary to update the tax rates for Peru. We discuss the results in the penultimate section, and finally we present our conclusions in last section.

Marginal cost of public funds: an explanation

Taxes can alter the allocation of resources in an economy because they affect taxpayers' consumption, labor supply, and investment decisions. Hence, taxes usually generate a less efficient allocation of resources to the extent that they affect households' and firms' decision making. However, in an economy with public goods, externalities, and multiple distortions, taxes can enhance efficiency by correcting existing distortions and internalize externalities (commonly known as the "second best" considerations).[8] In fact, when taxes apply to pure rents (and there are no behavioral responses), they may not affect efficiency. When taxes do impact behavior this can be translated into a measurable change in outcomes. To assess the efficiency cost of the tax system economists often turn to specific, well defined, measures such as the Marginal Cost of Public Funds (MCPF), which is used in this study.[9]

According to Dahlby, "the marginal cost of public funds measures the loss incurred by society in raising additional revenues to finance government spending" (2008: 1). Ballard and Fullerton (1992) defines the MCPF as the cost to consumers

[4] In Peru the share of mineral and oil commodities in total merchandise exports was equal to 62% in 2007. A decade earlier, in 1996, minerals and oil fuel products constituted an important component of total exports, but those commodities only represented 45.6% of total exports (INEI, 2008). The participation of the mineral and oil industries in Peru's real GDP has risen from 3.69% in 1987 to 5.4% in 2007 (BCRP, 2010).

[5] http://www.sunat.gob.pe/.

[6] Following Davis (1995), we calculate Auty's (1990) mineral dependence index for Peru, which is the mean percentage contribution of mineral and oil industries to GDP, merchandise exports, and government revenues. Our result using the available information for 2007 is 30.7%, which is above the threshold of 20% established by the author to indicate mineral dependence. This result confirms Davis' findings regarding the mineral status of the Peruvian economy.

[7] The translation is ours.

[8] See Corden (1997) for further details regarding the theory of the second best in the context of international trade.

[9] Other common names for this and related measures found in the literature are *the marginal welfare cost of taxation*, *the marginal social cost of taxes*, *the marginal welfare effect of taxes*, *the social cost of raising government's revenues*, *the marginal proportional deadweight loss*, *the deadweight loss of raising an extra dollar of tax revenue*, *the marginal cost of raising revenues*, *the marginal cost of extra revenue*, and *the marginal revenue cost of increasing taxes* (the inverse of the MCPF). Analyzing the large literature about the MCPF is not an easy task because of the many ways to describe similar or closely related concepts to the marginal cost of public funds.