General Equilibrium Resource Elasticity in an Open Resource-Abundant Economy

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ABSTRACT

This study investigates the sensitivity of macro and sectoral variables to natural resource revenues in a resource-abundant developing country. Here, different transmission mechanisms are in effect. The paper considers the exchange rate channel, financial sector channel, capital flow channel, public sector channel, and resource reallocation channel. I employ a large scale real-financial general equilibrium model with especial focus on fossil fuel energy, natural resources, financial sector interactions, inter-sectoral linkages, and public sector responses. The model is used to predict the likely changes in oil and gas exports in Iran. It causes more oil exports but at lower international prices. Our comparative static analysis indicates that resource elasticity for GDP is from +0.10 to +0.13; for public services is from +0.16 to +0.27; for import is from +0.42 to +0.45; for mineral extraction is from -0.50 to -0.10, and for the manufacturing sector is from -0.08 to -0.06. The simulation reveals extraction competition among natural resources.

Keywords: General equilibrium, natural resources, Dutch Disease, trade, non-tariff barriers.

JEL: O24, O13, Q33, C68

1 INTRODUCTION

An oil boom may affect the volume of government spending and the quality of public services (World Bank, 1997). It also may alter private propensity to spend (Gelb, 1988). In some cases, the increase in the expenditure of OPEC countries has been more than the increase in oil revenues (Leite and Weidmann, 1999; Gylfason, 2001). Oil boom promotes "white elephant projects" (Robinson and Torvik, 2005) and can destroy the rentier government fiscal discipline and, despite the oil revenues, double-digit budget deficits may occur. Algeria, Iran, Indonesia, Nigeria, Saudi Arabia, Ecuador, Libya, and Qatar are examples of oil-producing countries that have budget deficits for years. Another consequence of the oil boom is the expansion of the construction sector and services while shrinking in agriculture and industry (Corden and Neary, 1982; Fardmanesh, 1991). Overall, two main changes in resource allocation are expected. The first likely impact is a change in the allocation of resources between tradable commodities and non-tradable commodities. The second impact is a change in the allocation of resources between the private sector and the public sector. While the first channel is addressed well in the literature of resource curse (Gelb, 1988; Sachs and Warner, 1999; Robinson et al., 2014), the second is not well explored.

Resource abundant countries suffer from fluctuations in resource revenues. In this study, a small economy with abundant resources is considered. A Computable General Equilibrium model is customized focusing on natural resources. The model is calibrated based on the Iranian economy. However, this model may be applied for other countries like Algeria, Angola, Azerbaijan, Brazil, Congo, Colombia, Ecuador, Indonesia, Iraq,

Kuwait, Libya, Mexico, Nigeria, Norway, Qatar, Saudi Arabia, United Arab Emirates, Venezuela, and so on.

Specifically, this study investigates the sensitivity of macro and sectoral variables to resources revenues. The analysis considers different transmission mechanisms from resource revenue to the economy including the exchange rate channel, financial sector channel, capital flow channel, public sector channel, and resource re-allocation channel. I employ a large scale real-financial general equilibrium model with a focus on natural resources, financial sector interactions, inter-sectoral linkages, and public sector responses. The model is used to predict the likely impacts of exogenous export shocks. The counterfactual scenarios may cause a change in oil exports but in different international prices compared to the pre-shock state.

2 METHODS AND MATERIALS

This study introduces a Computable General Equilibrium (CGE) model borrowing features of Rutherford (1999), Hertel (1997), and van der Mensbrugghe (2008) approaches. The model works in MPSGE (Lanz and Rutherford, 2016) based on GTAP Data Base (Aguiar, 2016) and International Financial Statistics (IFS) of the International Monetary Fund (IMF). There are various modelling attempts on resource exporting countries. There are several related general equilibrium analysis in Iran (Gahvari & Taheripour, 2011; Gharibnavaz & Waschik, 2015; Jafari, Bakhshi Dastjerdi, & Moosavi Mohseni, 2014; Jensen & Tarr, 2003; Manzoor, Shahmoradi, & Haqiqi, 2010, 2012). However, it seems that Manzoor et al. (2012), and Haqiqi-Bahalou (2013) appropriate approaches for linking government to resource export revenues.

This study is an extension to a chain of studies focusing on various aspects of the problem. The economic model works based on the interactions between production activities, households, government, and financial sector through markets (Manzoor,

Shahmoradi, & Haqiqi, 2009; Manzoor et al., 2010; Shahmoradi, Haqiqi, & Zahedi, 2011; Manzoor et al., 2012; Haqiqi & Mirian, 2015). For modeling income distribution of households, 10 income categories for each urban and rural households are considered (Haqiqi & Mortazavi Kakhaki, 2012). Production requires labor and capital. The model assumes sector-specific capital as well as a mobile capital (Haqiqi, Manzoor, & Aghababaei, 2013; Manzoor, Haqiqi, & Aghababaei, 2013). The revenue of fossil fuel resources are modeled as a flow in the economy (Haqiqi, Aghanazari, & Sharzei, 2013; Manzoor & Haqiqi, 2012). The economy is also open to international trade (Haqiqi & Bahalou Horeh, 2013; Haqiqi & Bahador, 2015). The sectoral input demand as well as the sectoral production support by the government is considered (Manzoor, Aghababaei, & Haqiqi, 2011; Manzoor & Haqiqi, 2013). A module with leisure-labor optimization problem by income level will provide labor supply (Haqiqi & Bahalou, 2015). Each household has an initial endowment of labor. The utility optimization problem governs the demand for each commodity and supply of labor.

In this model, the revenue from exporting petroleum products belongs to a hypothetical Sovereign Wealth Fund (SWF). The SWF determines the allocation of resources revenue. A socially optimum allocation could be a basket of domestic investments and foreign financial investments (Hartwick, 1977). However, the SWF can transfer the revenue to the central government assuming not socially optimal behavior. In this paper, the SWF is not socially optimal. Also, the petroleum sector is linked to the government. The revenue of the oil and gas extraction sector is either from domestic sales of oil and gas or from exports of crude oil and gas. Part of this revenue is paid to cover extraction costs or is spent on compensation of employees and purchase of intermediate goods and services. Part of the surplus is paid directly to the government and the rest is the saving of the hypothetical SWF. State revenues are classified into two general categories: 1) income from capital; and 2) tax and transfer payment received. Capital

income is from oil revenues and the operating surplus of government owned firms. The government allocates part of the revenue to education, health, and infrastructure which are affecting future production levels. It allocates the remaining to cover the costs of white elephant projects, unnecessary provision of public goods, cash payment to people and institutions, and ambitious defense projects.

3 RESULTS

The resource elasticity of variable v is defined as the percentage change of v over the percentage change in resource exports. The analysis indicates that resource elasticity varies from +0.10 to +0.13 for GDP; from +0.16 to +0.27 for government size; from +0.42 to +0.45 for imports; from -0.50 to -0.10 for mineral extraction; and from -0.08 to -0.06 for manufacturing sector. The simulation reveals extraction competition among natural resources. It means more oil exports lead to lower mining activities and vice versa. Historical evidence also supports this finding.

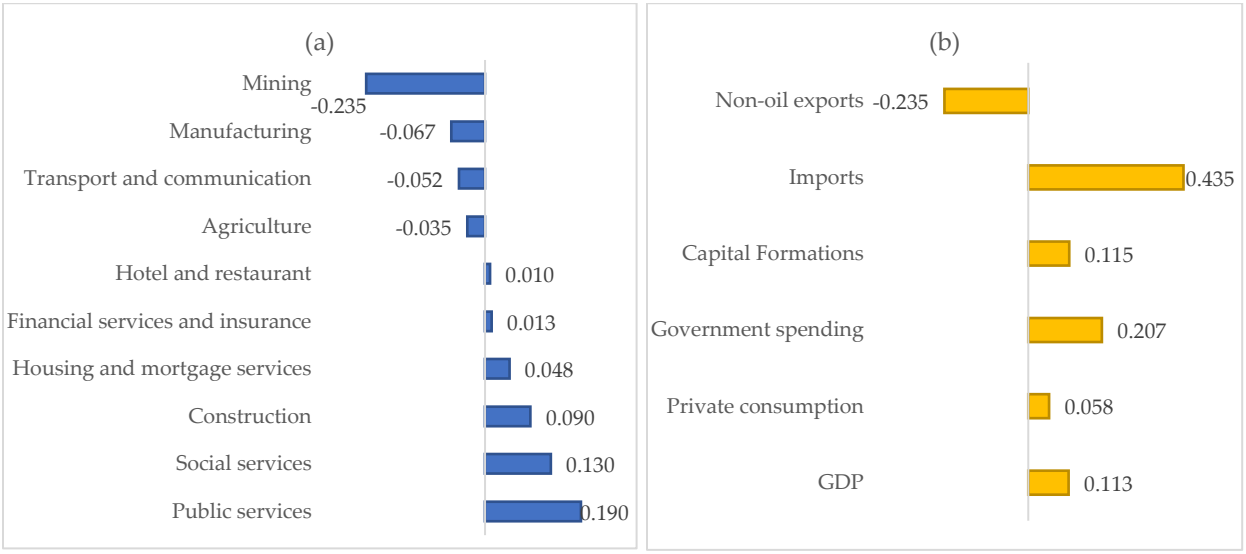

Figure 1. The elasticity of macro and sectoral variables to oil export

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