



The current account and precautionary savings for exporters of exhaustible resources[☆]

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ABSTRACT

Exporters of exhaustible resources have historically exhibited higher income volatility than other economies, suggesting a heightened role for precautionary savings. This paper uses a parameterized small open-economy model to quantify the role of precautionary savings for exporters of exhaustible resources, when the only source of uncertainty is the price of the exhaustible resource. The parameterized model fares moderately well at capturing current account balances in both cross-section and time-series data. The results show that the precautionary motive can generate sizable external sector savings, the more so the greater the weight of exhaustible resource revenues in future income.

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1. Introduction

Exporters of exhaustible resources have historically exhibited considerably higher income volatility than other economies, suggesting a heightened role for the precautionary motive and related accumulation of buffer stock savings. Indeed, these exporters have accumulated sizable external savings over the last decade, contributing significantly towards global current account imbalances. How much of these savings can be attributed to the precautionary motive?

This paper documents the relevant empirical regularities and constructs a model that allows for estimation of the size of precautionary savings for exporters of exhaustible resources. To gauge the link between income volatility and savings, we use a representative agent small open economy model modified to account for an exhaustible resource sector with the price of the exhaustible resource as the only source of uncertainty. To focus on the external savings problem, the model abstracts from domestic investment and resource

extraction decisions as well as from explicit insurance against shocks to export prices. We argue that these considerations are not of primary importance, when estimating precautionary savings for exporters of exhaustible resources. The representative agent then solves a self-insurance problem, whereby accumulation of foreign assets diversifies income away from the volatile exhaustible resources. Precautionary savings are represented by the change in (external) savings due to this self-insurance motive. The model is parameterized to replicate the relevant country-specific characteristics of thirteen oil and gas exporting economies whose exhaustible resource sectors account for a significant share of economic activity.

The framework is shown to yield quantitative predictions about a range of phenomena.

The model fares moderately well at capturing historical external savings behavior in both time-series and cross-section data. Annual changes in current account balances in the model and data exhibit a positive correlation with a mean of 0.70. During the post-2000 price boom, the model generates 2/3 of the accumulated current account surpluses in data. In a cross-section, the correlation between changes in net foreign assets, as a share of GDP, in the model and data is 0.73.

The modeling framework allows for a decomposition of external savings into an intertemporal consumption smoothing component, which is present even in the absence of uncertainty, and a precautionary savings component. We find that the consumption smoothing motive is the main determinant of the size of the current account. At the same time, the precautionary motive can generate sizable additional external savings and improves the model's fit with data. These findings are robust to the choice of parameter values and

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modeling assumptions. In terms of quantitative results, precautionary savings in 2007 add up to 1% of the sample countries' GDP or 36 billion dollars. Results for other years are similar in magnitude. The importance of the precautionary motive varies considerably across countries and is driven by the weight of exhaustible resource revenues in expected discounted future income.

In addition to providing estimates for the size of precautionary savings, the paper contributes to the literature by developing a small open economy model with *aggregate* uncertainty, where the net foreign asset position in the stationary equilibrium is *not* restricted to some exogenous value. As has been repeatedly noted (e.g., Schmitt-Grohé and Uribe, 2003; Ghironi, 2007), the representative agent small open economy model with aggregate uncertainty exhibits unit root dynamics in net foreign assets and therefore does not harbor a well-defined stationary equilibrium. The model of this paper avoids this problem by assuming that the only source of aggregate uncertainty is the price of the exhaustible resource. Once the resource is exhausted, the model becomes deterministic. As a result, the value of net foreign assets in the stationary equilibrium is determined endogenously and depends on the model's initial conditions as well as the history of subsequent shocks.

This paper deviates from the extensive literature on precautionary savings (e.g., Caballero, 1990; Carroll, 2001 and references therein) along several dimensions. First, it deals with aggregate, as opposed to idiosyncratic, shocks. Second, the focus is on open economies, with savings taking place through the external sector. Third, while the previous literature has concentrated exclusively on advanced economies, the sample in this paper includes both developed and developing countries.

Two previous studies are closely related to our work. Ghosh and Ostry (1997) find that aggregate income uncertainty increases current account balances in a group of advanced economies. Fogli and Perri (2006) show that differences in precautionary savings, induced by lower income volatility in the US relative to the rest of the world, can explain a significant share of the US current account deficits since early 1980s. Both studies find that the link between aggregate income volatility and external savings is economically significant. For the more volatile and open exporters of exhaustible resources, this channel is likely to have added relevance.

Another strand of related literature deals with the intergenerational equity in exhaustible resource countries. In essence, consumption smoothing considerations in the deterministic version of our modeling framework are used to determine the intertemporal allocation of exhaustible resource income.¹ Such a model can generate the large current account surpluses observed in exhaustible resource countries. Our paper differs from this literature, since we explicitly model the effects of uncertainty on the external sector dynamics. In the presence of a precautionary motive, the deterministic model overestimates consumption and therefore underestimates the size of savings and the current account balance in the short run, more so the greater the uncertainty attached to the exhaustible resource wealth and the larger the weight of exhaustible resources in economic activity.

The structure of the rest of the paper is as follows. The next section summarizes the empirical regularities that motivate our study. Section 3 presents the model and its optimal solution. Section 4 discusses the parameterization procedure and examines the fit between the model outcomes and historical data. Section 5 decomposes external savings in the model into two components – consumption smoothing and precautionary savings. Section 6 performs extensive sensitivity analysis of the model results. Finally, Section 7 concludes.

¹ This modeling framework has been advocated in Davis et al. (2003) and applied by numerous studies (see, e.g., de Carvalho Filho, 2007 for an application to Trinidad and Tobago, Takizawa, 2005 for Kuwait, Bailen and Kramarenko, 2004 for Iran and Thomas et al., 2008 for a cross-country study).

2. Income volatility and channels of diversification

This section documents the high income volatility in exhaustible resource countries and the extent to which high income volatility is transmitted into volatility of consumption. We also examine the role of various channels in reducing the volatility of consumption. Throughout the paper the definition of exhaustible resources is restricted to oil and gas, for which there are country-level estimates available on historical resource extraction and the size of the remaining stock of resources.

The volatility of income in exhaustible resource countries has been 2–3 times higher than in other economies (see panel a in Fig. 1). This finding remains valid in sample sub-periods (see panel a in Fig. 2). Although income volatility has decreased in recent decades, exhaustible resource countries continue to stand out. As of 2007, the 10-year rolling income volatility in exhaustible resource countries was more than twice the volatility in other economies and substantially larger than in major non-fuel commodity exporting countries.

The finding of high income volatility in exhaustible resource countries is consistent with other results in the literature. Easterly et al. (1993) and Broda (2004) among others report a significant correlation between output volatility and terms of trade volatility, while Baxter and Kouparitsas (2006) find that terms of trade volatility is the highest in fuel-exporting countries. Heightened income volatility in exhaustible resource countries stems from a combination of more volatile exhaustible resource prices, even when compared to other commodities, and a larger share of the volatile oil and gas component in total income. It should also be noted that exhaustible resource prices exhibit considerably larger variation than extraction quantities. At an annual frequency, prices over the most recent oil price cycle, i.e., 1980–2007, were 2–3 time more volatile than country-level extraction quantities.²

In contrast to income volatility, differences in the volatility of consumption for exhaustible resource countries are less pronounced. Panels a–b in Fig. 1 show that over the last half-century, the difference in the volatility of income of exporters of exhaustible resources and other countries has been larger than the difference in the volatility of consumption. Moreover, the difference in the volatility of consumption has altogether disappeared from 1990s onwards (see panel b in Fig. 2), as the volatility of consumption in exhaustible resource countries decreased to levels comparable to the other economies. Panels c in Figs. 1 and 2 present further quantitative evidence for the gap between income and consumption volatilities in exhaustible resource countries. This group of countries has exhibited historical ratios of consumption volatility to income volatility in the range of 0.5–0.7. In other economies the same ratios have been close to 1. Finally, panel d in Fig. 1 reports the correlation between income and consumption. Again, exhaustible resource countries exhibit lower income–consumption correlations than other economies. These empirical results indicate that countries with exhaustible resources have been able to smooth consumption in the face of large income shocks.

Next we investigate the channels through which volatility of consumption is mitigated. In theory, a country could insure against exhaustible resource income volatility by locking in future sale prices or by altogether selling the remaining stock of the resource. But usage of such tools remains very limited. Contrary to the prescriptions of economic theory, domestic ownership of exhaustible resources in major oil producing countries has been on the rise in recent decades and markets for hedging resource price fluctuations remain very small. As of April 2009, the total open interest in exchanges and over-the-counter markets for hedging resource price fluctuations was estimated at only 4 weeks of world oil consumption and 0.18% of proven oil reserves (see Borensztein et al., 2009). Daniel (2001)

² If one excluded the two Gulf Wars, prices are 4 times more volatile than extraction quantities (British Petroleum, 2008).

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