Economic Modelling 32 (2013) 400–428

Contents lists available at SciVerse ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Oil dependency of the Russian economy: An econometric analysis

Andreas Benedictow [a,*], Daniel Fjærtoft [b], Ole Løfsnæs [c]

[a] Statistics Norway, Research Department, P.O.B. 8131 Dep., 0033 Oslo, Norway
[b] Sigragroup, Øvre Vollgate 6, 0156 Oslo, Norway
[c] Pöyry Management Consulting AS, Schweigaards gate 15B, Oslo, Norway

ARTICLE INFO

Article history:
Accepted 13 February 2013

JEL classification:
C51
E17
E52
E63
Q43

Keywords:
Russia
Macro econometric model
Oil price dependency
Fiscal and monetary policies
Dutch disease

ABSTRACT

A macro econometric model of the Russian economy is tailored to analyze the effects of changes in the oil price and alternative fiscal policies. Model simulations indicate that the Russian economy is vulnerable to large fluctuations in the oil price, but we also find evidence of significant economic growth capabilities in the absence of oil price growth. A higher oil price not only leads to higher economic growth and savings in the sovereign wealth fund, but also induces a rupture in the Russian economy. Public spending and household spending increase while the traditional export industries suffer from real appreciation, in line with the Dutch disease hypothesis. We also show that alternative policies for spending of the petroleum income may have considerable consequences for economic growth, the degree of crowding out of traditional export industries and wealth accumulation in the fund.

1. Introduction

The impact of higher oil prices on the Russian economy has some features that are similar to the effects in any oil consuming country. End user prices on energy increase, leading to substitution and income effects for non-oil producers and consumers. In general, the macroeconomic impact is lower GDP and higher inflation. The magnitude of these effects depends on the policy response of the authorities, including monetary and fiscal policy measures. However, in an oil and gas producing country such as Russia, there will be an additional, positive income effect. One could also expect a direct effect of the oil price on investments in the domestic petroleum sector, with second round effects through demand for input directed towards other parts of the economy.

In earlier model based analyses of the Russian economy, computable general equilibrium (CGE) models have often been applied. There is a number of studies that use CGE models of the Russian economy to assess impacts of trade policy options such as EU enlargement, Russia's WTO accession and the creation of the Common European Economic Space on Russian economy (see e.g., Alekseev et al., 2003; Jensen et al., 2004; Sulamaa and Widgren, 2004; Rutherford et al., 2005). BOFIT (Bank of Finland, Institute for Economies in Transition) used the multiregional general equilibrium model GTAP (Global Trade Analysis Project modeling framework) to study impacts of Russian energy policy instruments on the Russian economy (Kerkelä, 2004). The Central Bank of the Russian Federation (CBR) has a model framework closely related to the BOFIT models. CGE models are handy when modeling economies for which time series data are scarce, and are thus often applied on developing economies. In such models, strong, theoretical assumptions replace historical evidence.

Empirical modeling, on the other hand, constitutes a reality check on theory based assumptions. Data for macroeconomic variables are now available for a sufficient time period and of satisfactory quality to make possible the development of an empirical model of the Russian economy with desirable theoretical as well as statistical properties. In our view, there remains a need for empirically based

* Corresponding author.
E-mail addresses: andreas.benedictow@ssb.no (A. Benedictow), daniel.fjaertoft@sigragroup.com (D. Fjærtoft), ole.lofsnes@poyry.com (O. Løfsnæs).

0264-9993/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.econmod.2013.02.016

modeling of the Russian economy, of which we have found only a few examples in the literature. BOFIT has developed a vector autoregressive (VAR) model for the Russian economy (see Rautava, 2004), which is used for forecasting. Suni (2008) utilizes the global NiGEM model developed by the National Institute of Economic and Social Research which includes a simple representation of the Russian economy, to assess the oil price dependency of the Russian economy. Merlevede et al. (2009) estimate a somewhat more detailed macro econometric model of the Russian economy for the same purpose. These papers find evidence for significant oil price dependency.

We develop a macro econometric model of the Russian economy, containing 13 estimated equations – covering major national account variables, prices, the exchange rate, the money market interest rate and the labor market – and a number of identities. The model includes important channels through which the oil price affects the Russian economy. Direct effects are identified through oil exports, domestic inflation and government expenditures and revenues, and there are several indirect channels. Due to lack of sufficient data for petroleum investments, we have not been able to test the presence of a direct link from oil prices to petroleum investments explicitly in our model. Indirect effects of the oil price on petroleum investments are implicitly covered in the aggregate investment function. Furthermore, the model incorporates reaction functions for Russian fiscal and monetary policies. This provides us with the option of leaving economic policy endogenous, based on the estimated behavior of fiscal and monetary authorities. We also simulate counterfactual trajectories for interest rates and government spending.

In the model, increasing oil prices lead to higher growth in government revenues than in government expenditures, introducing a stabilizing element to the economy, as well as a means to be channeled into the sovereign wealth fund. In line with the Dutch disease hypothesis,[1] an increase in the oil price yields a real appreciation of the rouble in the model, leading to reduced non-oil exports.

Lacking a detailed description of the production side of the economy, the model contains effectively one production sector only. Thus, it is not possible to look directly at the impact of Dutch disease on production and employment in the non-oil export sector. However, oil exports and non-oil exports are modeled separately. Hence, non-oil exports may serve as an indicator for developments in production and employment in this sector.

Although the CBR's stated main tool conducting monetary policy has been to provide the economy with sufficient liquidity with concern to inflation and the exchange rate, we find evidence for a "lean against the wind" interest rate equation, where interest rates increase in the face of higher inflation and lower unemployment. Higher oil prices lead to higher inflation and a nominal appreciation of the rouble. Thus, rising oil prices are dealing non-oil export industries a double blow, through a real appreciation of the rouble and higher interest rates. Additionally, higher oil prices due to a supply side constraint may also induce a decline in international demand for Russian goods and services. On the other hand, higher oil prices could also be a result of increasing international demand.

The estimation period runs from 1995 Q1 to 2008 Q1. The estimated equations are interpretable in accordance with economic theory, and satisfy standard statistical tests of residual properties and parameter stability. The model explains history well, and facilitates analyses of effects of changes in a number of central macro variables, such as economic policy variables, the exchange rate, international demand and prices, including the oil price. Model simulations suggest an important role for the oil price in the Russian economy and imply vulnerability to negative shocks in the oil price. However, we also find indications that the Russian economy exhibits significant growth capabilities in the absence of growth in the oil price. Simulation of alternative fiscal policy rules illustrates that the government's choice of fiscal policy stance may have considerable consequences for economic growth and wealth accumulation in the sovereign wealth fund, and for the degree of crowding out of traditional export industries.

The paper continues with a discussion of vital aspects of the oil market and its importance to the Russian economy in Section 2. In Section 3, there is a general introduction to the model, followed by a discussion of the Russian macro economy in light of the econometric equations. Section 3 also presents data sources, estimation procedures and a statistical evaluation of overall model performance. Sections 4 and 5 discuss simulations of two counterfactual scenarios for the oil price and three alternative fiscal policy rules respectively. Section 6 concludes.

2. The Russian oil economy

Following the collapse of the Soviet Union, Russia engaged in an ambitious shock therapy privatization program under IMF guidance. Broken down supply chains, withdrawal of government demand and uncompetitive production led to widespread industrial insolvency and a collapse in government tax revenues. This, coupled with low oil prices and an IMF devised plan of pegging the rouble to counter inflation, led the government to accumulate large foreign loans in an attempt to offset capital outflows and cover the increasing budget deficit. The setup could not last and in 1998 the government defaulted on its foreign payments, floated the rouble and introduced capital restrictions. Departure from the artificially strong rouble gave Russian enterprises a chance to recover and in 1999 positive growth rates returned. For nine consecutive years, Russia stayed on a steady growth path (see Fig. 1) until the global recession in 2009.

Table 1 shows some indicators for the importance of oil exports to Russia's economic development. From 2001 to 2008, the oil's share of total exports increased by 50%, and as a share of government revenues it doubled. In contrast, as a share of employment it stayed fairly constant at a low level.[2]

The breakup of the Soviet Union was preceded by an abrupt fall in nominal crude prices in early 1986, from an average of USD 33 in the first half of the 1980s to hovering around USD 16 in the second half (see Fig. 2). Gaidar (2007), among others, claims that the drop in oil revenues was the prime trigger of the Soviet collapse. In more recent times, the economic boom of Putin's presidency with an average annual real GDP growth in excess of 7% in the period up to 2008 was accompanied by a substantial increase in oil prices. While the 2009 slump was preceded by a USD 100 drop in the oil price from July 2008 to January 2009, one should be careful to expect similar effects of oil price volatility today as those experienced by the Soviet Union. For the Soviet economy, hard currency oil income was the main remedy against systemic flaws that were making the socialist economy increasingly infeasible.

Russia ranks as the world's second largest oil producer and exporter, occasionally creeping up on and overtaking Saudi Arabia. Russian

[1] The Dutch disease hypothesis states that an increase in revenues from natural resources will lead to deindustrialization by raising the real exchange rate, and thus making the manufacturing sector less competitive. The term was introduced by The Economist in 1977 to illustrate the decline of the Dutch manufacturing sector following the discovery of large natural gas resources in the Netherlands in 1959. See for instance Van Wijnbergen (1984).

[2] Specific oil sector employment for Russia was not obtainable. As a proxy for oil sector employment we have therefore used employment in mining and quarrying, which comprises oil sector employment. The share of employment as presented in the table above is therefore in reality somewhat lower.