6 Oil prices and the exchange rate: Optimal monetary policy for oilexporting countries

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Introduction

In 2014, the oil price went from US\$115 per barrel to below \$30 per barrel in less than half a year. This oil price shock illustrates both the uncertainty and the volatility of oil prices. Such shocks present oil exporters with many policy challenges. In this chapter, I study those challenges that relate to how monetary policy should respond to oil price shocks. If an oil price shock is temporary, then the question is how monetary policy should smooth out the fluctuations caused by the shock until times are 'normal' again. If there is some persistence in the shock, however, then additional challenges present themselves. First, there is a need for a structural adjustment to make the economy less reliant on oil income, for example by diversifying into other industries that can act as alternative sources of foreign exchange earnings (or saving foreign exchange by replacing imports). Second, the use of fiscal policy to smooth the shock may, in such a case, be problematic since the fiscal position is weakened over time, actually calling for a less expansionary fiscal policy.

¹ This chapter is based on a presentation held at the Bank of Algeria seminar in 2016, and also draws from analysis done by the author for the Ministry of Finance in Norway to discuss policy responses after the oil price shock from 2014 (and onwards).

Macroeconomic policy in a two-sector model

Consider a small open economy, which faces given international prices of (traditional) traded goods and of oil, and where oil exports are a substantial source of income. Nominal wages are not allowed to adjust so as to achieve full employment in the short run. Figure 1 shows this economy before it is hit by the oil price shock. The left panel represents the non-traded sector, while the right panel represents the traded sector. In the left panel, the demand for non-traded goods is decreasing in their prices, since a higher price shifts demand towards traded goods and away from non-traded goods. The supply is increasing in the price. Since non-traded goods requires domestic demand to equal domestic supply, which establishes the equilibrium at the intersection of the demand and the supply curve in the left panel of Figure 1.



Figure 1 The model

Production in the traditional traded sector, on the other hand, is determined independently of domestic demand for traded goods, as shown in the right panel of Figure 1. Supply is increasing in the price of traded goods, but the price is given at the world market, as illustrated by the horizontal price line. Output is determined at the intersection of the supply curve and the price curve in the right panel of Figure 1.

Fiscal policy

The effect of an expansionary fiscal policy is shown in Figure 2. The initial equilibrium is at point A, but with expansionary fiscal policy the demand curve for non-traded goods in the left panel of the figure shifts to the right. This demand curve after the shift is represented by the dotted curve. In the non-traded sector, the new equilibrium at point B implies that the activity level and the price both increase. In the traded sector, neither the supply curve nor the price curve is affected, and thus the activity level, as well as the price, stay unchanged (i.e. point A before the fiscal expansion, and point B after the fiscal expansion, are the same). The policy increases aggregate output, and deceases unemployment, through the expansion in the non-traded sector.



It may be, however, that the wage responds to this new equilibrium. Workers face both higher prices and lower unemployment, both of which may generate a higher nominal wage level. In that case, an expansionary fiscal policy actually has a contractionary effect on the traded sector.

Monetary policy

The effects of an expansionary monetary policy - i.e. lowering the interest rate - are shown in Figure 3. The lower interest rate depreciates the exchange rate, shifting the price curve in the right panel of Figure 3 up to the dotted curve, and increasing

production in the traded sector from point A to point B. The lower interest rate, the higher price of traded goods, and the higher income generated in the traded sector all pull in the direction of increased demand for non-traded goods, shifting the demand curve in the left panel of Figure 3 to the dotted curve, increasing production and prices from point A to point B.



Figure 3 Expansionary monetary policy

Production non-traded

Production traded

Comparing fiscal and monetary policy, an expansionary fiscal policy is likely to have a contractionary effect on the traded sector, while an expansionary monetary policy increases the level of activity in the traded sector.

A three-sector model for an oil-exporting country

In two-sector models, an implicit assumption is that the effect of the oil sector is to contribute with income, but without affecting the factor inputs available for the rest of the economy. In most oil-exporting countries, however, a main effect of the oil sector is its backward linkages through demanding inputs from the domestic economy. This implies that a view of the traded sector as a homogenous sector severely limits the understanding of the intersectoral linkages, and may potentially produce not only invalid predictions, but also unsound policy advice. As an example, consider a negative oil price shock. In most oil-exporting countries, such a shock will result in a depreciation of the currency (to which we will return below). In a two-sector model such as the one analysed in the previous section, the prediction would be that this is good news for the

traded sector, since the depreciation will increase the activity in the sector. This may well be so for the parts of traded sector that are unrelated to the oil sector. In most oilexporting countries, however, there has been a shift *within* the traded sector away from producing traditional goods towards being more closely interlinked with the oil sector. For this part of the traded sector, it is clearly challenging to argue that a lower oil price is good news. If anything, the opposite is the case, since a lower oil price implies lower activity in the oil sector and reduced investments in oil extraction and exploration, in turn demanding less inputs from the oil supply industry. We thus now extend the approach to a three-sector economy.

The three-sector model is represented in Figure 4. The left and the middle panels reproduce the two-sector model above; the right-hand panel contains the oil supply industry. Here, demand for domestically produced services to the oil sector is decreasing in the price of the services, since this sector competes with alternative suppliers from other countries. The supply from the sector is increasing in the price the sector receives. The price, and the quantity produced by the domestic oil supply industry, are determined by the intersection of the demand with the supply curve in the right panel of Figure 4.





A lower price of oil

Consider now a negative oil price shock. The lower oil price reduces the level of activity in oil extraction, and especially the level of investment in oil extraction, meaning that for any price there is less demand for goods and services produced by the domestic oil supply industry. In Figure 5, this is represented by the leftward shift in the right panel, moving the price and activity in the oil supply industry from point A to point B. This resource movement effect – i.e. that there are fewer linkages from oil extraction to demand for domestic labour – has the direct effect of producing a contraction in the oil supply industry. This is not the full story, however. Since incomes and employment are reduced in the oil supply industry, the addition of the resource movement effect also implies that the spending effect becomes magnified. The economy moves from point A to point B in the left panel of Figure 5.





Fiscal policy response

Consider now the case where the government aims to combat the contraction with an expansionary fiscal policy, and consider first the case where the fiscal policy is so expansionary that demand for non-traded goods shifts back to its initial position. In Figure 6, we are then back at point A in the left panel of the figure. Is this sufficient to keep aggregate unemployment from increasing? Unfortunately, the answer to this question is no, and the reason is that we still have the contractionary effect of the resource movement effect. In terms of Figure 6, we are still at point B in the middle and in the right panels. Since employment in oil supply industry at point B is still below what is was before the oil price shock, the expansivity of fiscal policy required to avoid unemployment from increasing is stronger. Thus, to be able to combat the increase in unemployment, fiscal policy has to be even more expansionary, moving the demand curve in the non-traded sector to the right, and establishing an equilibrium at a point such as C in the left panel of Figure 6.



Note, however, that at point C even if employment is back at its original level, the prices of non-traded goods are pushed up. With flexible inflation targeting, this triggers a monetary policy response from the central bank. When the central bank increases the interest rate, the currency appreciates, affecting both the traditional traded sector and the oil supply industry, as seen in Figure 7. In the traded sector, the price curve shifts down to the dotted curve, establishing the equality between the price curve and the supply curve in the middle panel at point D. In the oil supply industry, the appreciation of the currency makes the industry less productive compared to its foreign competitors, shifting the demand directed against the domestic oil supply industry leftwards, pushing production down to point D. In the left panel of the figure, the response in the non-traded sector is shown as the movement from point C to point D. The appreciation of the currency, the lower level of activity in both the traded sector and in the oil supply industry, and the higher interest rate all push demand down.

Note that with flexible inflation targeting, point D has to be to the right of point A in the left panel in Figure 7. To see why this is the case, consider the case where point D in the left panel of Figure 7 is below and to the left of point A. If that were the case, both aggregate prices and aggregate employment would be below target. That, however, cannot be consistent with an optimal monetary policy. The reason for this is that by reducing the interest rate, prices and employment would both move closer to target. This is clearly favourable, and implies that in such a case the interest rate could not have been set at its optimal level in the first place. Thus the interest rate has to be set sufficiently low that point D in the left panel of Figure 7 is to the right of point A.

Figure 6 Expansionary fiscal policy



Figure 7 Expansionary fiscal policy + inflation targeting

To sum up so far, combatting the oil price shock with expansionary fiscal policy destabilises both the traded sector and the oil supply industry. A fiscal policy response expands the economy through a larger non-traded sector.

Monetary policy response

Consider now the case where, instead of a fiscal policy response, the oil price shock is met with a monetary policy response. The effects are shown in Figure 8. Again, after the oil price shock, and without any policy response, we have moved from point A to point B in all three panels. The resource movement effect makes employment and production lower in the oil supply industry. The spending effect, magnified by the lower employment and income in the oil supply industry through the resource movement effect, shifts demand in the non-traded sector down. The traded sector is not affected, and points A and B for this sector are therefore identical.

Under flexible inflation targeting, the central bank should not sit still. There are two reasons for this: first, aggregate employment has decreased; and second, prices have decreased. For both reasons, the optimal monetary policy response according to a flexible inflation target is a lowering of the interest rate. The lower interest rate depreciates the currency, making the oil supply industry more competitive and shifting the demand curve towards the right in the right panel of Figure 8. The impact effect from A to B is thus partly stabilised, bringing the activity level in the oil supply industry to a level indicated by point C. In the traded sector, the depreciation of the currency shifts

the price curve up, increasing prices and production from point B to point C. Finally, the resource movement effect leading to increased incomes in the oil service sector (from point B to C), the higher prices and income in the traded sector, the currency depreciation, and the lower interest rate all pull in the direction of increased non-traded demand. The demand curve in the left panel of the figure shifts to the right, pushing the level of activity up from point B to point C. Note that in Figure 8, the monetary policy response can be compatible with a stable aggregate price level, as the prices of non-traded goods have fallen while those of traded goods have increased.





Concluding remarks

Petroleum-exporting countries have faced considerable policy challenges due to oil price shocks. In this chapter, I have discussed the challenges related to stabilisation policy. Traditional two-sector models suggest that an expansionary fiscal policy contracts the traded sector, and expands the traded sector. This contributes with the opposite of diversification of the economy.

Extending the traditional two-sector approach to a three-sector model to deal with the domestic oil supply industry strengthens this conclusion. The impact of the oil price shock is now stronger, since the impact works not only through the spending effect, but also through the resource movement effect. The latter adds to the spending effect, making the initial contraction when the economy is hit by a negative oil price shock larger, and the need for a policy response stronger. Again, if such a shock is met with an expansionary fiscal policy, there is the danger that one is putting the economy on a

path that is in a different direction from what is needed over the medium and long term. If the shock is met with a monetary policy response, on the other hand, the economy is put on a path that is more sustainable should the oil price shock turn out not to be temporary.

About the author

Ragnar Torvik is Professor of Economics at the Norwegian University of Science and Technology. Professor Torvik studied economics at the University of Oslo, and has previously been employed at the University of Oslo and at Norges Bank, before moving to the Norwegian University of Science and Technology. He does research in political economy, development economics and macroeconomics. His main research interest is why some resource abundant countries do so well while others do so poorly. Global commodity markets have been in upheaval in recent decades. After years of high prices, a new era of lower ones, especially for oil, seems likely to persist. This will be challenging for resource-rich developing economies, which must cope with the decline in income that accompanies the lower prices and the potential widening of internal and external imbalances. The market for petroleum, the most important of the commodities, has been roiled by innovative recovery techniques that not only sharply increased oil production but have also made that production so resilient to price declines that oil price cycles almost assuredly will be shorter and more limited on the upside.

Leading economists from academia and the public and private sectors gathered in Algiers in May 2016 to examine this shifting landscape in commodity markets, particularly for oil, where global supply is not the only risk factor. Demand too is likely to be curtailed by both a slowdown in growth in developing economies and global efforts to reduce carbon emissions. In the contributions to this eBook, the economists assess the exchange rate, monetary and fiscal options available to policymakers seeking to make their economies less susceptible to the vagaries of commodity markets. But if resource-rich economies are to thrive in the long run, they must undertake structural transformation to make themselves decidedly less dependent on resources. To that end, the economists explore how finance and sovereign wealth funds can support the transition from a resource-dependent economy to one with a diverse set of productive sectors.

The common denominator of the research is that the countries must build and maintain a robust macroeconomic framework in the wake of the collapse in commodity prices while transforming their economies.

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