



DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

Fiscal Shocks, the Trade Balance, and the Exchange Rate

Faik Koray
Louisiana State University

W. Douglas McMillin
Louisiana State University

Working Paper 2006-02
http://www.bus.lsu.edu/economics/papers/pap06_02.pdf

*Department of Economics
Louisiana State University
Baton Rouge, LA 70803-6306
<http://www.bus.lsu.edu/economics/>*

FISCAL SHOCKS, THE TRADE BALANCE, AND THE EXCHANGE RATE

Faik Koray
Department of Economics
Louisiana State University
Baton Rouge, LA 70803-6306

W. Douglas McMillin*
Department of Economics
Louisiana State University
Baton Rouge, LA 70803-6306

March 2006

Abstract

This paper investigates empirically, using a VAR model, the response of the exchange rate and the trade balance to fiscal policy shocks for the U.S. economy during the period 1981:3-2005:3. The results indicate that positive shocks to real government purchases generate a persistent increase in the budget deficit, a transitory expansionary effect on output, and a long-lived positive effect on the price level, but reduce the real interest rate. Simultaneously, and consistent with interest parity, the real exchange rate depreciates, and the trade balance improves. Negative shocks to net taxes also generate a persistent increase in the budget deficit, and the effects on the model variables are generally in the same direction, but are almost never significant. Our results indicate it is inappropriate to attribute rising trade balance deficits to expansionary fiscal policy shocks, even though these shocks generate long-lived increases in the budget deficit.

JEL Classification: F42, E20

Key Words: Fiscal Policy, Trade balance, Exchange Rates, VAR Models

*Corresponding author is McMillin; email is eodoug@lsu.edu and fax is 225-578-3807. Email for Koray is eokora@lsu.edu.

1. Introduction

The U.S. current account deficit was about seven percent of GDP in the fourth quarter of 2005, and this resulted despite the depreciation of the U.S. dollar against major currencies during 2004-2005. The increasing U.S. fiscal deficits stemming from expansionary fiscal policy have been blamed for the rising current account deficits. The relationship between the current account and fiscal policy is of great theoretical and empirical interest in open economy macroeconomics, and it has also important policy implications for the role of fiscal policy in reducing the current account deficits.

Although discussions of the relation between budget deficits and current account deficits in the popular press often assign a causal role running from budget deficits to current account deficits, theoretical models don't provide a uniform view of the effect of fiscal policy actions on the real exchange rate and the current account. For example, models in the Mundell-Fleming tradition (Mundell (1963), Fleming (1962), Dornbusch (1976), Marston (1985), and Flood and Marion (1982)) predict that, in a floating rate regime and assuming wage and/or price rigidities and that the Marshall-Lerner condition holds, expansionary fiscal policy actions raise the real interest rate, lead to an appreciation of the real exchange rate, and a deterioration in the current account.

However, the effects of expansionary fiscal policy actions on the real exchange rate and the current account within dynamic general equilibrium models depend on whether the fiscal shock is permanent or temporary, whether international asset markets are complete or not, whether labor supply is fixed or variable, and how government expenditures are financed. For example, in Obstfeld (1981), under the assumption that government consumption does not enter into the household's utility function, a tax-

financed increase in government expenditure results in a current account surplus. In Baxter (1995), under the assumption that individuals can engage in consumption-smoothing, but not risk pooling (i.e., incomplete asset markets), and that prices are flexible, an unanticipated, permanent increase in government purchases financed by government borrowing in a small open economy with fixed labor input does not affect the current account. In a large economy with variable labor, however, there is a current account deficit. In Frenkel and Razin (1996) a temporary increase in government spending leads to a deterioration in the current account and an appreciation of the exchange rate.

Despite the popularity of the subject in policy analysis and the lack of consensus among different theoretical models, there is relatively little empirical evidence investigating the effects of fiscal policy on the exchange rate and current account. Vector Autoregressive (VAR) models, which have been used extensively to analyze the effects of monetary policy shocks, have recently been employed to analyze the effects of fiscal policy shocks on the economy¹, but there are only a few VAR studies that examine the effects of fiscal policy in open economy models. Rogers (1999) and Clarida and Prendergast (1999) investigate the effects of fiscal shocks on exchange rates, and Kearney and Monadjemi (1990) examine how budget deficits affect the current account. Only Kim and Roubini (2003) investigate how fiscal policy affects both the current account and the exchange rate.

The purpose of this paper is to investigate empirically how changes in fiscal policy affect the trade balance and the exchange rate. We focus on the trade balance rather than the current account since the trade balance is the driving force for changes in

the current account. Using data from 1980:1 to 2005:3 within a seven-variable VAR model of the U.S. economy, we investigate how shocks to real government purchases and real net taxes affect the real exchange rate and the trade balance, as well as output, the price level, and the real long-term interest rate. This paper is differentiated from previous work by employing a different set of macroeconomic variables that includes both output and the price level, as well as fiscal variables, the real interest rate, and the real exchange rate and the trade balance. The earlier studies of the effect of fiscal policy on the current account excluded the price level, which we believe, as explained below, is inappropriate when one wants to identify structural shocks to government purchases and net taxes. Hence, our identification scheme is different from previous studies. Further, unlike most earlier studies whose sample spans periods of both fixed and flexible exchange rates, we focus on the period of flexible exchange rates, but, following Perrotti (2002) who showed that the effects of fiscal policy differed significantly in a sample that included only data from 1980-2000 from a sample that used data from the 1960s and 1970s, we begin our sample in 1980. Choosing this sample period also allows us to analyze the role of fiscal shocks on the trade balance during a period which was characterized by increasing current account deficits and no current account reversals.

The remainder of the paper is organized as follows. Section 2 discusses the previous VAR studies that provide evidence on the empirical relationship between fiscal policy and the real exchange rate and the current account. Section 3 describes the data and methodology used in the paper. The empirical results are presented and discussed in Section 4. Section 5 provides some extensions and checks for robustness. The results are summarized in the conclusion.

2. Previous Empirical Studies

In this section, we focus on studies that use the VAR methodology to investigate the effects of fiscal policy on the current account and/or the exchange rate. Kearney and Monadjemi (1990) examine the response of the current account to an innovation in government expenditures for eight countries, including the U.S., for the period 1972:1-1987:4, using a VAR model identified by a Choleski decomposition. The VAR model for each country consists of 5 variables – government expenditures, tax revenues, money creation, the real effective exchange rate, and the current account. The authors order the variables for the decomposition based on their interpretation of the relative degree of exogeneity of the variables and compute impulse response functions (IRFs). They find that the current account deteriorates for about 3 years in response to unanticipated bond-financed and money-financed increases in U.S. government expenditures, followed by cyclical swings in the current account. After the initial deterioration, there is a prolonged current account surplus followed by a prolonged period of current account deficit and then another prolonged period of surplus. A balanced-budget positive shock to spending leads to a long-lived (three-year) current account surplus, followed by movement to deficit for three years and then movement back to surplus. Since confidence intervals are not presented, not much can be said about the statistical significance of these responses.

To investigate the contribution of various shocks in explaining the variation in the real pound-dollar rate, Rogers (1999) estimates a semi-structural two-country VAR model comprising real government consumption as a share of real GNP, real GNP, the real exchange rate, the money multiplier, and the real monetary base, using annual U.S.

and U.K. data that runs from 1889 to 1992. The variables are ordered as listed above, and identification is achieved by Choleski decomposition. IRFs indicate that the response of the real exchange rate to fiscal shocks is insignificant at all horizons.

Clarida and Prendergast (1999) analyze the response of the real exchange rate to fiscal shocks by estimating a semi-structural VAR model composed of the structural primary budget surplus relative to potential GDP, the output gap, the ratio of the actual primary budget surplus to actual GDP, and the multilateral real exchange rate for the G3 countries during the floating exchange rate period. The variables are ordered as listed above, and identification is achieved by Choleski decomposition. Clarida and Prendergast (1999) find that, in response to a shock that raises the U.S. structural budget deficit, the real exchange rate appreciates over the first several years. After three or four years, it depreciates for an extended period of time and, finally, appreciates and returns to its long run value. A surprising result is that it takes about 14 years for the real exchange rate to return to its long-run level following a shock. Since confidence intervals are not presented, it is not possible to say anything about the statistical significance of these responses.

Using a VAR model, Kim and Roubini (2003) analyze the effects of fiscal policy on the current account and the real exchange rate for the U.S. for the floating exchange rate period 1973:1-2002:1. Their basic model includes real GDP, the primary government budget deficit as a percentage of GDP, the current account as a percentage of GDP, the real 3-month interest rate, and the real exchange rate. Identification is achieved by Choleski decomposition, assuming a recursive structure where the variables are ordered as listed above. They also examine the effects of government expenditures and

net transfers separately and together by using government expenditures and/or net transfers instead of the primary government budget deficit variable.

Kim and Roubini (2003) find that, in response to a shock to the U.S. primary budget deficit, there is a permanent increase in real GDP, a permanent increase in the real interest rate, a very short-lived transitory depreciation of the real exchange rate, and a transitory improvement of the current account. When they include both government expenditures and net taxes in place of the government primary budget deficit, they find that a shock to government spending, which is ordered before net taxes, leads to a transitory decrease in real GDP, an ultimately transitory, but long-lived, decrease in the real interest rate, a permanent depreciation of the real exchange rate, and a permanent improvement in the current account. In response to a negative shock to net taxes, real GDP increases temporarily, the real interest rate rises permanently, there is a short-lived depreciation of the real exchange rate, and the current account improves temporarily. Expansionary shocks to government purchases and net taxes thus have very different effects on the macroeconomy—a positive shock to purchases reduces output temporarily whereas a negative shock to net taxes raises output temporarily; a positive shock to purchases leads to a long-lived decrease in the real interest rate but a negative shock to taxes leads to a permanent increase in the interest rate; and, although a positive shock to purchases and a negative shock to net taxes both lead to a depreciation in the currency and an improvement in the current account, the effect is permanent for purchases but only transitory for net taxes.

3. Data and Methodology

3.1. Data

The data used to estimate the model consist of quarterly observations for the U.S. for the period 1980:1-2005:3. After allowing for lags, the sample period for estimation of the model is 1981:3-2005:3. The data employed in this paper are obtained from Global Insight databases and from the Board of Governors of the Federal Reserve web site. The sources for, and definitions of, the model variables are found in Table 1.

3.2. Methodology

To investigate the response of the exchange rate and the trade balance to fiscal policy innovations for the U.S. economy, a VAR model is employed. The model comprises the following seven variables: real GDP (Y), the price level (P , the GDP deflator), the interest rate (r , BAA rate), real government purchases (G), real net taxes (T), the real exchange rate (RE , the real trade-weighted exchange rate), and the trade balance (TB , ratio of real exports to imports). A long-term interest rate is used in light of arguments that investment expenditures are responsive to variations in these rates. Although the nominal interest rate is included, the effects of fiscal policy on the real ex post interest rate are generated endogenously as described below. The sensitivity of the results to replacing the BAA rate with the real ex post real BAA rate (defined as the difference between the BAA rate and the year-over-year actual inflation rate) and to using alternative nominal interest rates is investigated, as is the sensitivity of the results to the inclusion of oil prices and a dummy variable designed to capture the effects of the 9/11 terrorist attack.

Following most of the previous studies that examine the effects of fiscal shocks, the model is estimated in levels², and the natural logarithms of all variables except the interest rate are used. A lag of four quarters was used in the estimation, but the sensitivity of the results to alternative lag lengths is investigated.

The VAR model is derived from the following structural model:

$$X_t = A_0 X_t + A_1 X_{t-1} + \dots + A_q X_{t-q} + \varepsilon_t$$

where $X_t = [P_t, G_t, Y_t, r_t, T_t, RE_t, TB_t]'$ = vector of endogenous variables, A_0 = coefficient matrix specifying the contemporaneous relations among the variables in the model, A_i , $i = 1, \dots, q$, are coefficient matrices on q lagged values of X , and ε_t = vector of structural shocks which are assumed to be uncorrelated. The VAR model is the reduced form of this structural model and can be written as:

$$X_t = B_1 X_{t-1} + \dots + B_q X_{t-q} + U_t$$

where B_i , $i = 1, \dots, q$, = $(I - A_0)^{-1} A_i$ and $U_t = (I - A_0)^{-1} \varepsilon_t$. U_t is the vector of reduced form residuals, and $U_t = [u_t^P, u_t^G, u_t^Y, u_t^r, u_t^T, u_t^{RE}, u_t^{TB}]'$. As can be seen from the definition of U_t , the elements of U_t will, in general, be correlated. Once the VAR model is estimated, the structural shocks can be recovered from the reduced form residuals by imposing restrictions on the contemporaneous relations among the model variables, i.e. by specifying the non-zero elements of A_0 .

In this paper, the primary way structural shocks to fiscal policy are identified is from a Choleski decomposition of the variance-covariance matrix. The Choleski decomposition imposes a recursive contemporaneous causal structure on the model, i.e.

A_0 is a lower-diagonal matrix with one's on the diagonal. The model variables are ordered in a particular sequence, and variables higher in the ordering are assumed to cause contemporaneous changes in variables lower in the ordering. Variables lower in the ordering are assumed to affect variables higher in the ordering only with a lag. To check the sensitivity of the results to the recursive ordering chosen, we estimate a structural model that allows some contemporaneous feedback among model variables.

The ordering used is: P, G, Y, r, T, RE, TB . Because spending appropriation bills in the U.S. typically specify government purchases in current dollar terms, the price level is ordered before real government purchases. With spending levels specified in nominal terms, variations in the current price level affect the real value of government spending in the current period. As expected, the contemporaneous correlation between u_t^P and u_t^G is negative. Previous studies that ignore this contemporaneous relationship may well misestimate structural shocks to government purchases. With G ordered after P , structural shocks to G are assumed to affect P only with a lag. Given the common presumption of short-run rigidities in prices, this seems to be a reasonable assumption. G is, however, ordered before Y which allows changes in G to have contemporaneous effects on output, but allows only a lagged discretionary response of G to movements in Y . Allowing a contemporaneous effect of G on Y is appropriate since government purchases are a component of Y and can also affect inventories in the current period. Given the nature of decision and implementation lags in fiscal policymaking, specifying a discretionary response of government purchases only to lagged output is generally a good assumption.

With regard to net taxes (T), P , G , Y , and r are ordered before T . Automatic stabilizers imply a contemporaneous response of taxes and transfer payments to changes in macro variables like P and Y , so placing T after these variables allows for automatic stabilizing effects, but constrains changes in net taxes to affect the macroeconomy only with a lag. Since the U.S. tax code and transfer payments are not perfectly indexed to the price level, variations in current prices can affect real net taxes, and previous studies that omit prices from the model thus ignore a source of feedback from the current state of the economy to net taxes and may consequently misestimate structural shocks to net taxes. Changes in r affect current interest payments on short-term debt that is rolled over, and since the measure of transfers used here includes interest payments on government debt, placing T after r allows changes in r to affect current net taxes. Changes in net taxes affect aggregate spending primarily by altering disposable income and hence consumption, and placing T after the macro variables implies a lag between a change in disposable income and the implementation of any resulting change in spending plans. Placing G before T implies that decisions about government purchases are made prior to decisions about taxes and that decisions about taxes and transfers affect government purchases only with a lag. This assumption is more controversial than ordering T after P , Y , and r since it is not uncommon for fiscal policymakers to simultaneously discuss plans for purchases and net taxes. The sensitivity of the results to this assumption is checked by estimating a structural VAR (discussed below) in which there is contemporaneous feedback between G and T .

The last two variables in the ordering are the real exchange rate and the trade balance. Since our focus is on the effects of fiscal shocks and since the real exchange

rate and the trade balance are ordered after both fiscal variables, the effect of fiscal policy shocks on the real exchange rate and the trade balance will be exactly the same regardless of whether the real exchange rate is ordered before the trade balance or whether the trade balance is ordered before the real exchange rate. The ordering chosen allows contemporaneous effects of fiscal policy, prices, output, and the interest rate on the exchange rate, and contemporaneous effects of these variables and the exchange rate on the trade balance.

The dynamic responses of output, the price level, the real interest rate, the real exchange rate, and the trade balance to shocks to government purchases and net taxes are analyzed by computing and plotting impulse response functions (IRFs) for a four year horizon. The IRF for the real interest rate is the difference between the IRF for the nominal interest rate and the year-over-year inflation rate implied by the IRF for the price level. Point estimates along with one standard deviation confidence intervals computed from Monte Carlo simulations employing antithetical acceleration and 10,000 draws are presented.

4. Empirical Results

Figure 1 presents the IRFs of the model variables to a positive innovation in real U.S. government purchases. The point estimates are the solid lines and the confidence intervals are represented by the dotted lines. We first note that the increase in government purchases is persistent. Government purchases remain above their initial level for approximately eleven quarters after the shock. However, the effect on net taxes is insignificant in all but two periods, which suggests that the shock to government purchases has a persistent effect on the government's budget deficit which dissipates only

after approximately three years. Output rises following the shock to purchases, and the effect is significantly different from zero for the first three quarters after the shock. However, output quickly returns to its initial level. The price level rises, and the effect becomes significant in the fourth quarter after the shock. The price level remains significantly above its initial value for an extended period, but slowly begins to return to its initial value. The real interest rate *falls*, with a significant response after the second quarter, and the decline is very persistent. Although the real interest rate begins to rise back towards its initial value after a year, the effect is significant for about four years, after which it returns to its initial value. The real exchange rate *depreciates* in response to a positive innovation in government purchases, and this response is significantly different from zero for an extended period of time. However, it eventually returns to its initial value. The response of the trade balance is positive in every period, and is significantly different from zero after one quarter. The trade balance begins to return to its initial value after four years.

As expected, an increase in government purchases has a transitory positive effect on output and a long-lived effect on the price level. What seems surprising, however, is the way the real interest rate responds to the government purchases innovation. A decrease in the real interest rate following an expansionary shock to government purchases has been found before in the literature; Eichenbaum and Fisher (2005) find a very transitory negative effect on the real interest rate, but our results are similar to Kim and Roubini (2003) in that we find a very persistent negative effect on the real interest rate. Neither Mundell-Fleming-type models nor dynamic general equilibrium models predict a fall in the real interest rate in response to an increase in government purchases.

The fall in the real interest rate, however, can be explained by the sticky-price intertemporal model of Obstfeld and Rogoff (1995), which is one of the building blocks of the New Open Economy Macroeconomics models. Obstfeld and Rogoff (1995) show that when current output increases relative to the long-run level of output in response to a permanent increase in domestic government spending, individuals decrease their current consumption. This is related to consumption smoothing. Individuals want to increase their savings in the current period so that they can increase their consumption when their income is going to be relatively lower in the next period. Therefore, the real interest rate declines as saving increases. The increase in government purchases in our model isn't permanent, but it is long-lived, and, consequently, we would expect some consumption smoothing to occur.

Mankiw (1987) examines the dynamic impact of government purchases in a general equilibrium model, with both durable and nondurable consumer goods as well as productive capital, and shows that increases in government purchases may cause reductions in real interest rates. In Mankiw (1987), output produced may be consumed as a nondurable, added to the stock of the consumer durable good, added to the stock of productive capital, or purchased by the government. The consumer gets utility from durable and nondurable goods. A permanent increase in government purchases raises the marginal utility of consumption. This leads to conversion of some of the stock of consumer durables to productive capital. Therefore, the marginal product of capital and the real interest rate fall. The marginal utility of consumption rises less in response to a temporary change in government purchases. Therefore, a temporary change in

government spending has a smaller impact on the real interest rate relative to a permanent change.

The finding that the real exchange rate depreciates in response to an increase in government purchases is also contrary to the predictions of Mundell-Fleming-type models and some dynamic general equilibrium models; however, it is consistent with the fall in the real interest rate. The fall in the U.S. real interest rate and the depreciation of the real exchange rate are consistent with the interest rate parity relationship.

The finding that the trade balance improves in response to a positive innovation to government purchases is counter to the belief that an increase in government purchases leads to twin deficits. A positive shock to government purchases leads to an increase in the government's budget deficit, but an improvement in the trade balance. However, the improvement in the trade balance in our model is consistent with the depreciation of the real exchange rate.

Figure 2 presents the IRFs of the model variables to a *negative* innovation in real net taxes. A shock to net taxes has a very persistent effect on itself, although net taxes return to their initial value after ten quarters. There are basically no significant effects on government purchases, so a negative shock to net taxes increases the government's budget deficit over the ten quarter horizon. In response to a shock to net taxes, output rises persistently after about eight quarters, but the effect is never significant. There is a significant transitory effect on the price level; the increase in the price level is significant beginning in the third quarter after the shock and continuing through ten quarters, but is insignificant thereafter, although the point estimate is always positive. The effect on the real interest rate is somewhat erratic. The real interest rate initially rises, and the increase

is barely significant in the fourth quarter after the shock. However, thereafter, the real interest rate falls, and the decrease is significant from quarters seven through eleven. The fall in the real interest rate after the fifth quarter following a positive shock to net taxes is similar to the negative effect of a shock to government purchases on the real interest rate, although the initial increase in the real rate for the net taxes shock is not. The point estimate of the effect on the real exchange rate indicates depreciation of the real exchange rate, although there is only one quarter in which this effect is barely significant. The point estimate of the IRF for the trade balance indicates a deficit; however, the effect is never significant.

The IRFs of the model variables for a shock to net tax innovations are more difficult to interpret than are the IRFs for a shock to government purchases. This may reflect the hybrid nature of the net tax variable which subtracts transfer payments from total tax collections. However, even though the effects of a shock to the net tax variable are often in the same direction as the effects of a shock to government purchases, these effects are almost never significant. In particular, there are essentially no significant effects of a shock to net taxes on the real exchange rate, and the lack of significance for the real exchange rate is consistent with no significant effect on the trade balance.

Our empirical results differ from the previous work in several ways, but since Clarida and Prendergast (1999), Rogers (1999), and Kearney and Manadjemi (1990) do not simultaneously estimate the effects of fiscal shocks on both the real exchange rate and the current account, it is most informative to compare our results to those of Kim and Roubini (2003) for the system in which they include both government purchases and net taxes. Although there are similarities in the results, for example, a positive shock to

government purchases lowers the real interest rate, leads to a depreciation in real exchange rate and moves the current account toward surplus, there are also differences. While we find that expansionary fiscal policy shocks, whether positive innovations to government purchases or negative innovations to net taxes, move output, the real interest rate, and the real exchange rate in the same direction, Kim and Roubini (2003) find that the responses of these variables to expansionary fiscal policy shocks to purchases and net taxes are asymmetric. The differences between our findings and the studies mentioned above may stem from the employment of different sample periods as well as from the use of different identification schemes.

5. Robustness of the Results

The robustness of the results reported in the previous section was checked in several ways. First, as noted earlier, the Choleski decomposition requires an assumption about whether government purchases decisions or net tax decisions are made first. In our ordering we assumed decisions about purchases were made before net tax decisions. We checked to see whether allowing decisions about purchases and net taxes to be made simultaneously had any effect on our results. In particular, we specified the contemporaneous relationships among the model variables (A_0) to be the following, assuming the same ordering of variables as before.

$$A_0 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & 0 & \alpha_{25} & 0 & 0 \\ \alpha_{31} & \alpha_{32} & 1 & 0 & 0 & 0 & 0 \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & 0 & 0 & 0 \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 & 0 & 0 \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & 1 & 0 \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & 0 & \alpha_{75} & \alpha_{76} & 1 \end{pmatrix}$$

We note that this specification allows a contemporaneous effect of G on T (α_{52} is allowed to be non-zero) and a contemporaneous effect of T on G (α_{25} is allowed to be non-zero). In order to achieve identification, one other specification change is made from the Choleski; the direct effect of the interest rate on the trade balance (α_{74}) is set to 0. This does not seem to be an unreasonable assumption. In the Choleski decomposition, this coefficient is not significantly different from 0. The CVMODEL routine with BFGS option in RATS was used to estimate the elements of A_0 . The coefficients α_{52} and α_{25} were both positive, but not significantly different from zero. (In the Choleski decomposition, the contemporaneous effect of G on T is also positive, but not significant.) When the IRFs for shocks to the fiscal variables were computed using the structural decomposition, the point estimates for these IRFs lay entirely within the confidence intervals for the Choleski decomposition with one minor exception in one period. Thus the previous results are robust to allowing contemporaneous simultaneity between G and T .

If fiscal policy is correlated with monetary policy, the results attributed to expansionary fiscal actions may instead reflect expansionary monetary policy actions, which could explain the negative effect of expansionary fiscal shocks on the real interest rate. To check this possibility, we estimated an 8-variable VAR model by adding the federal funds rate to our original model. Two orderings for the model with the federal funds rate were considered. One was $P, ffr, G, Y, r, T, RE, TB$, and the second was $P, G, Y, r, T, ffr, RE, TB$ where ffr = the federal funds rate. The first ordering places ffr before both fiscal variables and hence assigns credit for all contemporaneous correlation between ffr and the fiscal variables to ffr . The second places ffr after both fiscal

variables. Point estimates of the effects of shocks to the fiscal variables from the 8-variable model were, with one exception for one variable, always within the confidence intervals from the 7-variable model for both orderings, so it does not appear the earlier results reflect omission of the federal funds rate from the basic model.³

The robustness of the results was checked in several other dimensions as well. First, alternative long-term interest rates were considered. The 10-year U.S. government bond rate and AAA rate were substituted in turn for the BAA rate. IRFs from VARs containing the government bond rate and the AAA rate generated the same patterns of effects as the model with the BAA rate, and, with only a few small departures, the point estimates were within the confidence intervals for the model with BAA. Second, alternative lag lengths were considered. The model with the BAA rate was estimated with lags of 3, 5, and 6 quarters. The patterns of the IRFs from the alternative lag length models were essentially the same as for the 4-lag model, and the point estimates of the IRFs were almost always within the confidence intervals for the 4-lag model. The infrequent deviations from the confidence intervals were minor. Thus, the results are not affected in any significant way by considering alternative lag lengths. The 4-lag BAA model was also estimated with the current and 4 lagged values of the log of the real price of oil (producer price index for crude oil/chained price index for GDP) added as deterministic variables in every equation of the VAR. With only one minor exception, the point estimates of the IRFs for this model were always on or within the confidence intervals for the basic model. Finally, the current and 4 lagged values of a 9/11 dummy (value of 1 in 2001:3 and 0 elsewhere) were added as deterministic variables in every equation of the VAR. The point estimates of the IRFs for this model were almost always

within the confidence intervals for the basic model, and the few departures from the confidence intervals were minor.⁴

6. Summary and Conclusion

We examined the effects of expansionary fiscal policy shocks on macroeconomic activity within a seven-variable VAR model. The empirical findings in this paper indicate that, contrary to common perception, there is no link between expansionary fiscal policies and trade deficits. Expansionary fiscal policy shocks which lead to a significant depreciation of the real exchange rate also generate a significant improvement in the trade balance.

Our findings indicate that there is a transitory increase in output, a permanent increase in the price level, a persistent decrease in the real interest rate, a long-lived depreciation of the of the exchange rate, and a long-lived improvement in the trade balance in response to an expansionary shock to government purchases.

The finding on output and the price level is expected. However, the response of the real interest rate, the real exchange rate, and the trade balance is surprising. These results run counter to the conventional wisdom that expansionary fiscal policy raises the real interest rate, leads to an appreciation of the real exchange rate, and thereby precipitates deterioration in the trade balance. The crucial link in this chain of reasoning is the response of the real interest rate. An increase in the real interest rate is associated with an appreciation of the real exchange rate, which is related to the deterioration of the trade balance. What we find is just the opposite. However, the fall in the real interest rate is consistent with the depreciation of the real exchange rate and hence with the improvement of the trade balance. As mentioned earlier, the fall in the real interest rate is

consistent with a model based on dynamic optimization with price rigidities or a general equilibrium model with durable and nondurable consumer goods and productive capital.

As expected, we also find that both output and the price level rise in response to a negative innovation in net taxes, but the response of output is never significant and the effect on the price level is only transitory. The responses of the real interest rate, the real exchange rate, and the trade balance are more difficult to interpret than the responses of these variables to innovations in government purchases. The response of the interest rate is puzzling; it first rises briefly and then falls, with only transitory significant effects. The unusual behavior of the real interest rate in conjunction with only very transitory significant effects helps explain only a very transitory significant depreciation in the real exchange rate and no significant effect on the trade balance. The macroeconomic effects of the expansionary net tax shocks are thus much weaker than the effects of expansionary shocks to government purchases.

Endnotes

1. Using closed-economy VARs, Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Yuan and Li (2000), Fatas and Mihov (2001), and Gali, Lopez-Salido, and Valles (2004) examine the dynamic response of the economy to government spending shocks. Blanchard and Perotti (2002), Perotti (2002), De Arcangelis and Lamartina (2003), and van Aarle, Garretsen, and Gobbin (2003) investigate the effects of shocks to taxes and government spending on the economy.
2. Although it is not uncommon to test for unit roots among variables and then, based on the results of these tests, perhaps for cointegration, the power of unit root tests to distinguish between a unit root and a near unit-root process is not high. As noted by Hamilton (1994), estimating a VAR in levels yields consistent estimates even if the variables have a unit root. If the variables do not have a unit root, differencing is not appropriate since it imposes an invalid restriction. Hamilton also notes that a VAR estimated in differences is not appropriate if there is cointegration among the variables, but a VAR estimated in levels can be consistent with a cointegrated system.
3. The one exception was for the point estimate of the effect of net taxes on the trade balance—the point estimate is somewhat above the upper confidence interval after six quarters for the ordering with *ffr* before the fiscal variables.
4. Graphs of the IRFs for the robustness checks are available on request.

References

Baxter, M. (1995). International Trade and Business Cycles in *Handbook of International Economics*, V. III, G. M Grossman and K. Rogoff (eds.). New York: North Holland.

Blanchard, O. and Perotti, R. (2002). An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *The Quarterly Journal of Economics*, 117 (4), 1329-1368.

Clarida, R. and Prendergast, J. (1999). Fiscal Stance and the Real Exchange Rate: Some Empirical Evidence. *NBER Working Paper No. 7077*.

De Arcangelis, G. and Lamartina, S. (2003). Identifying Fiscal Shocks and Policy Regimes in OECD Countries. *European Central Bank Working Paper No. 281*.

Dornbusch, R. (1976). Expectations and Exchange Rate Dynamics. *Journal of Political Economy*, 84 (6), 1161-1176.

Edelberg, W., Eichenbaum, M. and Fisher, J. (1999). Understanding the Effects of Shocks to Government Purchases. *Review of Economic Dynamics*, 2 (1), 166-206.

Eichenbaum, Martin, and Jonas D. M. Fisher. (2005) Fiscal Policy in the Aftermath of 9/11. *Journal of Money, Credit and Banking*, 37 (1), 1-22.

Fatas, A. and Mihov, I. (2001). The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence. *CEPR Discussion Paper #2760*.

Fleming, J. M. (1962). Domestic Financial Policies under Fixed and under Floating Exchange Rates. *I.M.F. Staff Papers*, 9 (3), 369-379.

Flood, R. P. and Marion, N. P. (1982). The Transmission of Disturbances under Alternative Exchange-Rate Regimes with Optimal Indexing. *Quarterly Journal of Economics*, 97(1), 43-66.

Frenkel, J. A. and Razin, A. (1996). *Fiscal Policies and the World Economy*. Cambridge: MIT Press.

Gali, J., Lopez-Salido, J. D. and Valles, J. (2004). Understanding the Effects of Government Spending on Consumption. *European Central Bank Working Paper No. 339*.

Hamilton, James D. *Time Series Analysis*. (1994) Princeton University Press (Princeton, New Jersey).

- Kearney, C. and Monadjemi, M. (1990). Fiscal Policy and Current Account Performance: International Evidence on the Twin Deficits. *Journal of Macroeconomics*, 12(2), 197-219.
- Kim, S. and Roubini, N. (2003). Twin Deficit or Twin Divergence? Fiscal Policy, Current Account, and Real Exchange Rate in the US. *Mimeo*.
- Lane, P. R. and Perotti, R. (1998). The Trade Balance and Fiscal Policy in the OECD. *European Economic Review* 42 (3-5), 887-895.
- Mankiw, G. N. (1987). Government Purchases and Real Interest Rates. *Journal of Political Economy*, 95(2), 407-419.
- Marston, R. C. (1985) Stabilization Policy in Open Economies in of *Handbook of International Economics*, V. II, R. W. Jones and P. B. Kenen (eds.). Amsterdam: Elsevier SciencePublishers B. V.
- Mundell, R. A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *Canadian Journal of Economics and Political Science*, 29 (4), 475-485.
- Obstfeld, M. (1981). Macroeconomic Policy, Exchange Rate Dynamics and Optimal Asset Accumulation. *The Journal of Political Economy*, 89 (6), 1142-1161.
- Obstfeld, M. and Rogoff, K. (1995). Exchange Rate Dynamics Redux. *The Journal of Political Economy*, 103 (3), 624-660.
- Perotti, R. (2002). Estimating the Effects of Fiscal Policy in OECD Countries. *European Central Bank Working Paper No. 168*.
- Ramey, V. and Shapiro, M. (1998). Costly Capital Reallocation and the Effect of Government Spending. *Carnegie-Rochester Conference Series on Public Policy*, 48, 145-194.
- Rogers, J. H. (1999). Monetary Shocks and Real Exchange Rates. *Journal of International Economics*, 49 (2), 269-288.
- van Aarle, B., Garretsen, H. and Gobbin, N. (2003). Monetary and Fiscal Policy Transmission in the Euro area: Evidence from a Structural VAR Analysis. *Journal of Economics and Business*, 55 (5-6), 609-638.
- Yuan, M. and Li, W. (2000). Dynamic Employment and Hours Effects of Government Spending Shocks. *Journal of Economic Dynamics and Control*, 24 (8), 1233-1263.

TABLE 1
Definitions and Data Sources for the Variables Used

real gdp (gdpr) : b chained 2000 \$,saar, Global Insight US Central database.

real government purchases = real total government consumption + gross investment (gr): b chained 2000 \$,saar. Global Insight US Central database.

price level = GDP price index (jpgdp):, chained, 2000=100,saar, Global Insight US Central database.

BAA corporate bond rate (fybaac): Global Insight U.S. Basic database.

AAA corporate bond rate (fyaaac): Global Insight U.S. Basic database.

10-year federal govnt bond rate (fygt10): Global Insight U.S. Basic database.

producer price index crude oil (PW561): Global Insight U.S. Basic database.

real exports of goods & services (xr): b chained 2000 \$,saar, Global Insight US Central database.

real imports of goods & services (mr): b chained 2000 \$,saar, Global Insight US Central database.

nominal total government net taxes: \$b, constructed as total government receipts (grcptc) – gtransfers. grcptc Global Insight US Central database.

real government net taxes = nominal government net taxes/GDP price index

nominal total government transfers (gtransfers): \$b, constructed as total government current expenditures (gexpc) - total government consumption (gc).

nominal total government current expenditures, (gexpc): \$b,saar, Global Insight US Central database.

nominal total government consumption expenditures (gc): \$b,saar, Global Insight US Central database.

real trade weighted exchange rate, broad index (rtwexb): Board of Governors of the Federal Reserve web site.

real trade weighted exchange rate, major currencies index (rtwexmc): Board of Governors of the Federal Reserve web site.

Figure 1
Positive Shock to Real Government Purchases

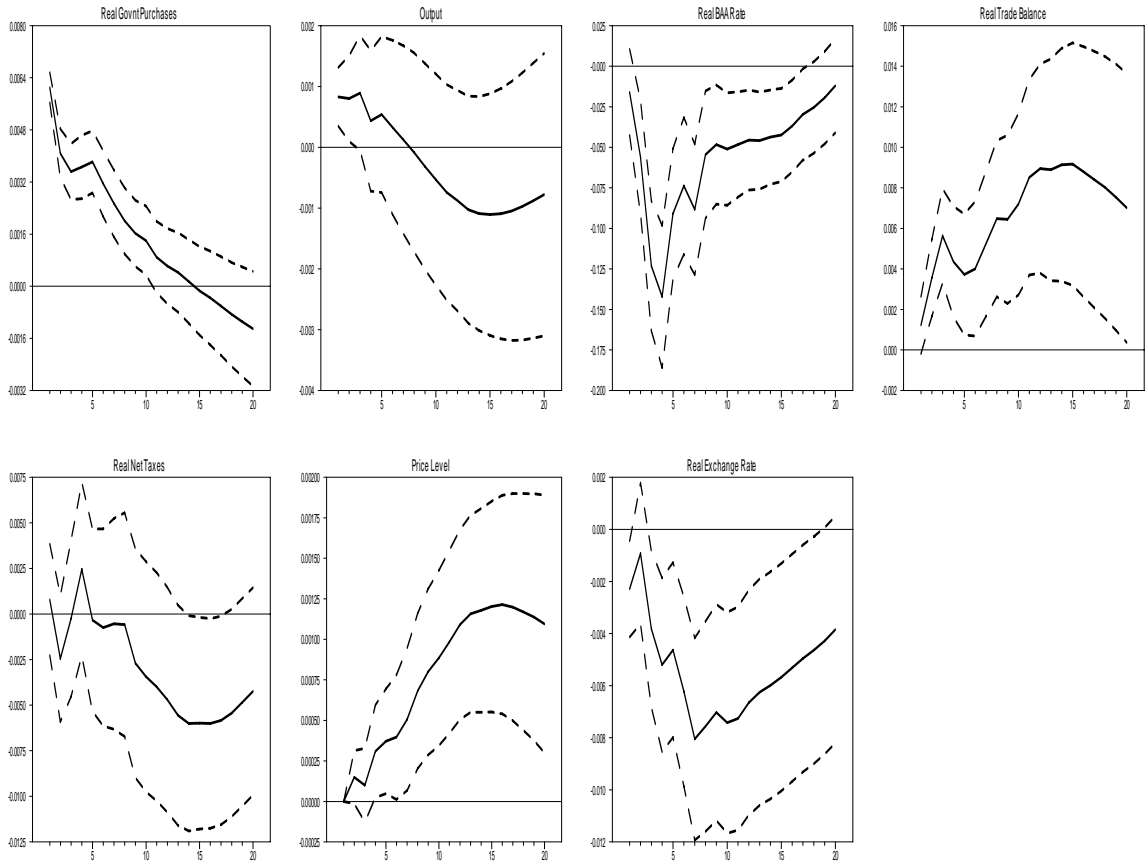


Figure 2

Negative Shock to Real Net Taxes

