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NEW ZEALAND: THE LAST BASTION OF TEXTBOOK OPEN-ECONOMY MACROECONOMICS*

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Abstract

Recent empirical research into the macroeconomic effects of fiscal policy shocks has generated a 'puzzle'. Both Keynesian and Real Business Cycle models predict that a fiscal expansion will lead to a real exchange rate appreciation. However, in almost all the countries that have been studied, positive shocks to government spending cause the real exchange rate to depreciate. Recent theoretical work suggests that this unexpected result might reflect incomplete international financial market integration. The country where the incomplete markets assumption is least plausible is New Zealand, because of its integration into the Australian financial system. We show that in New Zealand there is no puzzle, and the standard textbook result still holds. Our counterfactual results are consistent with the argument that the puzzle is to be explained by an absence of complete international financial market integration in most parts of the world.

JEL classification E62 · F41

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Recent empirical research using structural vector-autoregressive models (VARs) has generated a body of consistent evidence about the impact of government spending shocks on the real exchange rate. In almost all the countries studied – for example, in the United States, the United Kingdom, and Australia – a positive spending shock raises output and leads to a real exchange rate depreciation; see for example Corsetti and Müller (2006), Corsetti *et al*. (2009), Dellas *et al*. (2005), Enders *et al*. (2011), Kim and Roubini (2008), Kollmann (1998), Monacelli and Perotti (2010), and Ravn *et al*. (2007). The output response is consistent both with Keynesian macroeconomic models, in which sticky prices mean that aggregate demand shocks can affect output, and with Real Business Cycle models, in which a fiscal expansion creates an expectation of future tax rises and induces an increase in the labour supply. However, the real exchange rate response is a puzzle. In a Keynesian model, the rise in aggregate demand means that a nominal exchange rate appreciation is needed to clear the goods market, and with sticky prices this entails a real exchange rate appreciation. In a Real Business Cycle Model, the fall in private spending that accompanies a fiscal expansion leads to a real exchange rate appreciation, because consumption risk is assumed to be shared efficiently across domestic and foreign consumers. In no textbook model does a fiscal expansion cause the real exchange rate to depreciate.

Monacelli and Perotti (2010) suggest a number of ways in which the result might be reconciled with open-economy macroeconomic theory. Their first suggestion is that a fiscal expansion might trigger a real exchange rate depreciation in models without complete international risk sharing. This suggestion has been taken up by Kollman (2010), who shows that in such a model, it is in principle possible that the positive labour supply response following a fiscal expansion will be large enough to raise output so much that the terms of trade worsen, and this will cause the real exchange rate to depreciate.

This resolution of the puzzle entails a prediction: in a country where financial markets are very well integrated into those of the major trading partner(s), the textbook result should still hold, and a fiscal expansion should lead to a real exchange rate appreciation. There is a sliver of evidence consistent with this prediction in Monacelli and Perotti (2010): the one country in their study in which a fiscal expansion does not cause the real exchange rate to depreciate is Canada, where financial markets are relatively well integrated into those of the United States (Ehrmann and Fratzcher, 2009). Nevertheless, there is not complete integration of Canadian and US financial markets (King and Segal, 2010), and a fiscal shock in Canada does not lead to a significant real exchange rate appreciation. Therefore, in order to pursue this line of reasoning further, we apply two alternative fiscal VAR models to quarterly time-series data for New Zealand. The New Zealand stock market is very highly integrated into that of Australia (Janakiraman and Lamba, 1998; Dekker *et al*., 2001; Fraser *et al*., 2008). Moreover, among financially developed countries, New Zealand is unique in having no domestic banks of any significant size: over 99% of the domestic market is covered by foreign banks,[1] almost all of them Australian (Liang, 2008). Both capital and labour move freely between New Zealand and Australia, an economy over seven times as large as its neighbour. Approximately 10% of New Zealand citizens live in Australia, and the volume of trade with Australia is equivalent to around 10% of New Zealand GDP. Given the access that New Zealanders have to Australian financial

[1] The equivalent percentages for Australia, Canada, the United States, and the United Kingdom are 17%, 5% 19%, and 46% respectively. The only other financially developed country with a large foreign ownership share is Luxembourg (95%). Quarterly public expenditure data for Luxembourg are available in EUROSTAT, but date back only to 1999. Ten years of data does not constitute a large enough sample for the type of VAR model that we use in this paper. Some Eastern European countries also have a large foreign ownership share, but here the data are also lacking, and it is debatable whether such countries are as fully financially developed as the more established members of the OECD.

products, Australian jobs and Australian goods, the incomplete international risk-sharing hypothesis is unlikely to apply to New Zealand, and so the standard textbook result should hold there. The next section discusses the specification of the VAR models, and section 2 presents the results of applying these models to New Zealand data.

1. The Fiscal VARs

1.1 A VAR with Financial Variables

In modelling the response of the New Zealand economy to government spending shocks, we consider two alternative VARs. The first is similar in style to that used by Garratt *et al*. (2003) to model the impact of monetary policy shocks in the United Kingdom, including domestic and foreign interest rates and international oil prices. In this VAR, the interaction of financial variables with output and the real exchange rate following a fiscal shock is explicit. However, the number of theoretical restrictions imposed on the VAR is kept to a minimum. The restrictions are just sufficient to identify the effect of policy shocks on all of the variables in the system, but many other shocks are left unidentified. This minimizes the chance of imposing invalid restrictions on the model.

The model comprises the following quarterly variables. Those marked (¶) are extensions of series described in Buckle *et al*. (2007) up to 2010q3; those marked (§) are extensions of series described in Claus *et al*. (2006) and Dungey and Fry (2009).[2] Variables marked (‡) are provided by the Reserve Bank of New Zealand, downloaded from www.rbnz.govt.nz on 06/01/2011; further details are available on request.

[2] There are different ways of including government transfers in the model. Claus *et al*. fit alternative models using either tax revenue net of transfers, or gross revenue and transfers as separate variables; this distinction makes little difference to their results. We find that it makes little difference whether transfers are subtracted from tax revenue or added to government spending. The results below are based on the latter approach.

• Domestic real GDP (y_t).[¶]

• A trade-weighted index of foreign real GDP (y_t*).[¶]

• The domestic price level (p_t).[¶]

• A trade-weighted index of the foreign price level (p_t*).[‡]

• The domestic nominal 90-day interest rate (i_t).[¶]

• A trade-weighted index of the foreign nominal 90-day interest rate (i_t*).[¶]

• The nominal trade-weighted exchange rate expressed in terms of the relative value of the New Zealand Dollar (e_t). A rise in e_t constitutes a domestic currency appreciation.[‡]

• The domestic nominal M0 money stock (m_t) [‡]

• Real government spending (g_t).[§]

• Real tax revenue (r_t).[§]

• The rate of growth of the international petroleum price (π_t^{OIL}). This variable is constructed from the petroleum price index incorporated in the New Zealand Trade statistics provided by Statistics New Zealand and downloaded from www.statistics.govt.nz on 06/01/2011.

• An index of New Zealand climatic variations (c_t).[¶]

All variables are expressed in logarithms except the interest rates and oil price inflation. In the model, the money stock and the exchange rate are expressed in real terms, that is, $[m_t - p_t]$ and $[e_t + p_t - p_t^*]$, and the behavior of the nominal variables is implicit. For reasons discussed later, tax revenue is expressed as a fraction of GDP, that is, $[r_t - y_t]$. Since New Zealand is a very small open economy, the foreign variables and the international oil price are taken to be strictly exogenous, as is the climate. In this respect, the model differs from models of larger economies, such as Garratt *et al*. model. The dependent variables in the VAR are as follows: y_t, $[m_t - p_t]$, g_t,

$[r_t - y_t]$, $[p_t - p_{t-1}]$ (that is, domestic inflation, henceforth π_t), i_t and $[e_t + p_t - p_t^*]$. The exogenous variables are as follows: y_t^*, i_t^*, π_t^{OIL} and c_t.

The seven dependent variables are illustrated in Figure 1, which shows all available data (1982q2 – 2010q3). The marked difference between the 1980s (high inflation and interest rates, low GDP growth) and the 1990s and 2000s (low inflation and interest rates, high GDP growth) is evident in the figure. This difference reflects the institution of central bank independence in December 1989, and the subsequent period of monetary stability. The parameters of a model fitted to data beginning in the 1980s are significantly different from those of a model fitted to data beginning in the 1990s. Our sample period (not including lags) is 1990q4 – 2008q1. This sample also excludes the period of the Global Financial Crisis; what happens to the parameters of the model when the sample is extended beyond 2008q1 will be discussed later.

[Figure 1 here]

At least one lag of each variable is included in the unrestricted reduced-form VAR. Otherwise, the lag order of each variable is chosen to minimize the Schwartz Bayesian Information Criterion. The application of this criterion leads to two lags of g_t, $[r_t - y_t]$ and i_t, and one lag of the other variables. The model is as follows:[3]

[3] There are three substantial differences between this model and that of Garratt *et al*. (2003): firstly, the strict exogeneity of the international variables, New Zealand being a very small open economy; secondly, the addition of fiscal variables and absence of a restriction to identify monetary policy shocks (which are not of interest in this paper); thirdly, the stationarity of interest rates. One possible explanation for the difference with regard to stationarity is that we are looking at a much longer period of monetary stability, since the independence of the Reserve Bank of New Zealand predates that of the Bank of England by eight years, and our sample extends later into the 2000s. It means that in our model there are no cointegration restrictions corresponding to a Fisher Equation and an interest parity condition. Finally,

$$\begin{bmatrix} y_t \\ m_t - p_t \\ g_t \\ r_t - y_t \\ \pi_t \\ i_t \\ e_t + p_t - p_t^* \end{bmatrix} = B_0 \begin{bmatrix} Q_t^1 \\ Q_t^2 \\ Q_t^3 \\ Q_t^4 \\ t \end{bmatrix} + B_1 \begin{bmatrix} y_{t-1} \\ m_{t-1} - p_{t-1} \\ g_{t-1} \\ r_{t-1} - y_{t-1} \\ \pi_{t-1} \\ i_{t-1} \\ e_{t-1} + p_{t-1} - p_{t-1}^* \end{bmatrix} + B_2 \begin{bmatrix} g_{t-2} \\ r_{t-2} - y_{t-2} \\ i_{t-2} \end{bmatrix} + C_0 \begin{bmatrix} y_t^* \\ i_t^* \\ \pi_t^{OIL} \\ c_t \end{bmatrix} + C_1 \begin{bmatrix} y_{t-1}^* \\ i_{t-1}^* \\ \pi_{t-1}^{OIL} \\ c_{t-1} \end{bmatrix} + U_t \quad (1)$$

Here, B_0 is a 7 × 5 parameter matrix, B_1 is a 7 × 7 parameter matrix, B_2 is a 7 × 3 parameter matrix, C_0 and C_1 are 7 × 4 parameter matrices, and U_t is a 7 × 1 matrix of reduced-form residuals for quarter *t*. The Q_t variables are quarterly dummies.[4]

Two types of restrictions are imposed on the model. Firstly, there are some cointegration restrictions, because not all of the variables in the model are stationary. Secondly, there are restrictions to identify the effect of fiscal shocks. In Appendix 1, we discuss stationarity and cointegration tests for the variables. The null of non-stationarity can be rejected for three of the dependent variables, π_t, i_t, $[e_t + p_t - p_t^*]$, and three of the exogenous variables, i_t^*, π_t^{OIL} and c_t. The other variables, y_t, $[m_t - p_t]$, g_t, $[r_t - y_t]$ and y_t^*, appear to be difference-stationary, but with four cointegrating vectors. Since y_t^* is strictly exogenous, there is no need for any cointegration restriction in the equations for y_t, $[m_t - p_t]$, g_t and $[r_t - y_t]$. The equations for the stationary dependent variables, π_t, i_t and $[e_t + p_t - p_t^*]$, do embody some cointegration restrictions. These

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unlike Garratt *et al*., we can reject the restriction that domestic GDP is proportional to foreign GDP in the long run, and such a restriction is not imposed on the model.

[4] There is no significant autocorrelation in U_t. However, a Jarque-Bera test rejects the null that the residuals are normally distributed. The reason is a spike in $[m_t - p_t]$ in 1999q3-1999q4, which can be seen in Figure 1. The unusually high demand for liquidity at this time probably reflects worries about the Millennium Bug. Dummy variables for 1999q3 and 1999q4 can be added to the model; this makes no substantial difference to the estimated values of the equation (1) parameters.

restrictions are imposed before estimation, by first of all reformulating the first four rows of equation (1) as follows.

$$\begin{bmatrix} \Delta y_t \\ \Delta[m_t - p_t] \\ \Delta g_t \\ \Delta[r_t - y_t] \end{bmatrix} = \breve{B}_0 \begin{bmatrix} Q_t^1 \\ Q_t^2 \\ Q_t^3 \\ Q_t^4 \\ t \end{bmatrix} + \breve{B}_1 \begin{bmatrix} y_{t-1} \\ m_{t-1} - p_{t-1} \\ g_{t-1} \\ r_{t-1} - y_{t-1} \\ \pi_{t-1} \\ i_{t-1} \\ e_{t-1} + p_{t-1} - p_{t-1}^* \end{bmatrix} + \breve{B}_2 \begin{bmatrix} \Delta g_{t-1} \\ \Delta[r_{t-1} - y_{t-1}] \\ i_{t-2} \end{bmatrix} + \breve{C}_0 \begin{bmatrix} \Delta y_t^* \\ i_t^* \\ \pi_t^{OIL} \\ c_t \end{bmatrix} + \breve{C}_1 \begin{bmatrix} y_{t-1}^* \\ i_{t-1}^* \\ \pi_{t-1}^{OIL} \\ c_{t-1} \end{bmatrix} + \breve{U}_t \quad (2)$$

Equation (2) is fitted to the data, and then the following equilibrium correction terms are constructed:

$$\begin{bmatrix} ecm_t^y \\ ecm_t^m \\ ecm_t^g \\ ecm_t^r \end{bmatrix} = \widehat{B}_1 \begin{bmatrix} y_t \\ m_t - p_t \\ g_t \\ r_r - y_t \end{bmatrix} + \hat{C}_1 y_t^* \quad (2a)$$

Here, $\widehat{B}_1$ consists of first four columns of $\breve{B}_1$, and $\hat{C}_1$ consists of the first column of $\breve{C}_1$. Equations for the three stationary variables are then fitted to the data follows.[5]

$$\begin{bmatrix} \pi_t \\ i_t \\ e_t + p_t - p_t^* \end{bmatrix} = \tilde{B}_0 \begin{bmatrix} Q_t^1 \\ Q_t^2 \\ Q_t^3 \\ Q_t^4 \\ t \end{bmatrix} + \tilde{B}_1 \begin{bmatrix} ecm_{t-1}^y \\ ecm_{t-1}^m \\ ecm_{t-1}^g \\ ecm_{t-1}^r \\ \pi_{t-1} \\ i_{t-1} \\ e_{t-1} + p_{t-1} - p_{t-1}^* \end{bmatrix} + \tilde{B}_2 \begin{bmatrix} \Delta g_{t-1} \\ \Delta[r_{t-1} - y_{t-1}] \\ i_{t-2} \end{bmatrix} + \tilde{C}_0 \begin{bmatrix} \Delta y_t^* \\ i_t^* \\ \pi_t^{OIL} \\ c_t \end{bmatrix} + \tilde{C}_1 \begin{bmatrix} i_{t-1}^* \\ \pi_{t-1}^{OIL} \\ c_{t-1} \end{bmatrix} + \tilde{U}_t \quad (2b)$$

The fiscal shocks are identified in the manner of Blanchard and Perotti (2002). To begin with, assume for simplicity that the reduced-form residuals for government spending, tax revenue and

[5] It is also possible to fit equations (2-2*b*) simultaneously using a Maximum Likelihood estimator. However, it turns out that the log-likelihood function is very flat and so the parameter estimates are very imprecise.

GDP are orthogonal to the other residuals in the model. Denote the first, third and fourth elements of $\breve{U}_t$ in equation (2) – that is, the reduced form residuals in the equations for GDP, government spending and tax revenue – as u_t^y, u_t^g and u_t^r respectively. Denote the corresponding structural shocks as ε_t^y, ε_t^g and ε_t^r. The relationship between the government spending and tax revenue residuals and the structural shocks can be represented in the following way.

$$u_t^g = \alpha_1 \cdot u_t^y + \alpha_2 \cdot \varepsilon_t^r + \varepsilon_t^g \tag{3}$$

$$u_t^r = \beta_1 \cdot u_t^y + \beta_2 \cdot \varepsilon_t^g + \varepsilon_t^r \tag{4}$$

Here, the parameters α_1 and β_1 reflect the immediate response of the fiscal variables to unanticipated changes in GDP. In a quarterly model, it is unlikely that these responses are a consequence of changes in discretionary fiscal policy; the only plausible responses are automatic ones resulting from predetermined tax and spending rules. External information on government spending and tax elasticities can then be used to impose values for α_1 and β_1 on equations (3-4) and thus extract the structural shocks from the reduced-form residuals. Here, we follow Claus *et al*. (2006), who draw on Girouard and André (2005) to derive a New Zealand government spending elasticity of zero and a tax revenue elasticity of one. This entails that $\alpha_1 = 0$ and, since tax revenue is measured as a proportion of GDP, $\beta_1 = 0$. Identification of the structural shocks also requires values for α_2 and β_2. Here, we consider two alternative forms of identification: if spending is weakly exogenous to revenue, then $\alpha_2 = 0$ and β_2 can be estimated on the data; if revenue is weakly exogenous to spending, then $\beta_2 = 0$ and α_2 estimated can be on the data. There is no strong *a priori* reason for choosing one or other of these alternatives, so we will present two alternative sets of results; it turns out that these are very similar, because $u_t^{\,g}$ and $u_t^{\,r}$ are not highly correlated.

This identification scheme applies to a VAR that includes only three variables: government spending, tax revenue and GDP. Our model also includes inflation and interest rates, and while it is unlikely that these have an immediate direct effect on real government spending, they might affect tax revenue, for example by influencing consumer spending and indirect taxes, or through fiscal drag. Heinemann (2001) estimates the effect of inflation on different types of tax revenue relative to GDP in a panel of countries including New Zealand. The following inflation coefficients are reported: personal income tax, 0.134; corporate income tax, –0.800; indirect taxes, 0.173. New Zealand Treasury quarterly tax receipt data indicate that over the sample period, the share of these three types of tax in total revenue are 45.8%, 14.9% and 36.0% respectively. Using Heinemann's estimates, this implies an overall inflation tax elasticity of 0.004. On this basis, we will assume that unanticipated changes in total tax revenue relative to GDP are independent of unanticipated movements in inflation. (This is the reason for including $[r_t - y_t]$ in the VAR instead of r_t.) With regard to the interest rate elasticity, we draw on two pieces of evidence. Firstly, Goh and Downing (2002) present a model of quarterly New Zealand consumer expenditure in which the estimated short-run interest elasticity is 0.000. Household purchases, and therefore indirect tax revenue, are independent of the interest rate in the short run. Moreover, shocks to interest rates have no significant impact on GDP (Buckle *et* al., 2007), so the ratio of indirect tax revenue to GDP will be independent of the interest rate in the short run. Secondly, New Zealand Treasury quarterly tax receipt data indicate that over the sample period, direct taxes on interest income account for only 4.8% of total tax revenue. On this basis, we will assume that unanticipated changes in total tax revenue are independent of unanticipated changes in the interest rate.[6]

1.2 A VAR with Components of GDP and the Real Exchange Rate

Several fiscal VARs fitted to data for other countries (for example, the one used by Monacelli and Perotti, 2010) incorporate time series for components of GDP (consumer expenditure and net exports; the omitted category is private investment) and of the CPI real exchange rate (the domestic price of traded goods relative to the foreign price; the omitted category is the relative price of nontraded goods). Such VARs also provide useful information on the channels through which fiscal shocks impact on the economy. However, it is impracticable to add the components of GDP and the real exchange rate to equation (1): this would make the model too large for reliable parameter estimates on eighteen years of quarterly data. For this reason, we fit a second VAR to the data that excludes the interest rates (i_t and i_t*) but includes the GDP and real exchange rate components. Again, the lag order of the VAR is based on the Schwartz Bayesian Information Criterion. The model is as follows:

$$\begin{bmatrix} y_t \\ g_t \\ r_t - y_t \\ h_t \\ x_t \\ z_t \\ e_t + p_t - p_t^* \end{bmatrix} = B_0 \begin{bmatrix} Q_t^1 \\ Q_t^2 \\ Q_t^3 \\ Q_t^4 \\ t \end{bmatrix} + B_1 \begin{bmatrix} y_{t-1} \\ g_{t-1} \\ r_{t-1} - y_{t-1} \\ h_{t-1} \\ x_{t-1} \\ z_{t-1} \\ e_{t-1} + p_{t-1} - p_{t-1}^* \end{bmatrix} + B_2 h_{t-2} + C_0 \begin{bmatrix} y_t^* \\ \pi_t^{OIL} \\ c_t \end{bmatrix} + C_1 \begin{bmatrix} y_{t-1}^* \\ \pi_{t-1}^{OIL} \\ c_{t-1} \end{bmatrix} + U_t \qquad (5)$$

[6] One potential drawback of the Blanchard and Perotti identification scheme is that the estimated fiscal shocks may be partly anticipated by firms and households. If so, then the corresponding impulse responses will be incorrect (Perotti, 2007; Ramey, 2009). However, Mertens and Ravn (2009) and Fisher and Peters (2010) give reasons for believing that such effects do not lead to substantial biases in estimated impulse responses.

This model includes the following additional variables.

• The log of real private consumer expenditure (h_t), from Statistics New Zealand National Accounts data downloaded from www.statistics.govt.nz on 06/01/2011.

• The ratio of net exports to GDP (x_t), from the same source as h_t.

• An index of the price of New Zealand traded goods relative to a weighted average of traded goods prices in New Zealand's major trading partners (z_t). In constructing z_t, we use a traded goods price index for each country i which is defined as:

$$p_t^{i,T} = \theta_t^i \cdot p_t^{i,M} + [1 - \theta_t^i] \cdot p_t^{i,X} \tag{6}$$

Here, $p_t^{i,M}$ is the log of the US Dollar import price index, $p_t^{i,X}$ is the log of the US Dollar export price index, and θ_t^i is the ratio of imports to imports plus exports in quarter t. Data are taken from IMF International Financial Statistics, downloaded from www.imf.org on 06/01/2011. The relative price index is then constructed as:

$$z_t = p_t^{New\ Zealand,T} - [\Sigma_i \phi_t^i \cdot p_t^{i,T}] \tag{7}$$

Here, ϕ_t^i is the weight of the i^{th} trading partner of New Zealand in the index in quarter t. The weights are the same as those used to construct e_t published by the Reserve Bank of New Zealand.[7] Although fiscal policy is unlikely to affect the prices of individual traded goods, New Zealand being such a small country, it may affect import and export composition, and therefore z_t.

[7] The trading partners are Australia, Euroland, Germany (before the institution of the Euro), Japan, the United Kingdom, and the United States.

The tests reported in Appendix 1 indicate that the null hypotheses that x_t is difference-stationary can be rejected against the alternative that it is stationary; the same is true of z_t, but not of h_t. Therefore, we treat the dependent variables in the top four rows of equation (5) as difference-stationary, and the variables in the bottom three rows as stationary. The results in Appendix 1 indicate that there are four cointegrating vectors among the four difference-stationary dependent variables and y_t*, so there are no additional cointegration restrictions on the top four rows of equation (5). Cointegration restrictions are placed on the bottom three rows of the equation using a re-parameterization of the same form as the one in equation (2).

In order to identify the effect of fiscal shocks in the system represented by equation (5), we use restrictions analogous to those applied to equation (1). We also fit an alternative to equation (5) in which the net export ratio (x_t) is replaced by the log of the ratio of real private investment to GDP (k_t). The results from these two alternative specifications are not identical, because the national accounting identity does not hold exactly with the logarithmic transformation of GDP.

2. The Estimated Impact of Fiscal Shocks

2.1 The VAR with Financial Variables

The estimated parameters in equation (2) are reported in Appendix 2. Since these are reduced-form parameters, they do not bear any economic interpretation. However, in interpreting the VAR, it is informative to consider the correlations of the reduced-form residuals in the g_t equation with those in the other equations. These correlations are reported in the first column of Table 1. Note first of all that the table shows the correlation of the g_t and $[r_t – y_t]$ residuals to be small and statistically insignificant, so different assumptions about the weak exogeneity of government spending relative to tax revenue will not have a large effect on the estimated impulse responses. Secondly, the two large and statistically significant residual correlations are those for i_t and $[e_t + p_t - p_t^*]$. This means that the most substantial part of the immediate effect of a shock to government spending will be on the interest rate and the exchange rate. To the extent that government spending has any effect on the other variables in the system, it will be though the dynamic interaction of the different variables in subsequent periods.

More information about these effects is provided in Figure 2, which shows the impulse response profiles for all seven of the dependent variables in the model following a unit shock to government spending, as identified by the restrictions described in the previous section. The figure also includes impulse responses for the nominal exchange rate e_t implicit in the real exchange rate and inflation responses. The black lines in the figure indicate the estimated responses under the assumption that government spending (g_t) is weakly exogenous to tax revenue ($r_t - y_t$), and the grey lines the estimated responses under the assumption that $[r_t - y_t]$ is weakly exogenous to g_t. There is little difference between the two sets of responses. The dashed lines in the figure mark out the 95% confidence interval for each response, based on 10,000 bootstrap replications.

[Figure 2 here]

The figure shows that following a shock to government spending, there is no significant response in money demand, tax revenue or inflation. The most marked immediate response is in the real exchange rate, a 1% shock to government spending leading to a 0.5% appreciation. Given the absence of a significant domestic price response, there is a nominal exchange rate appreciation of a similar magnitude. These results are consistent with both a Keynesian model and a Real Business Cycle model, but differ from the results for most other countries. There is also a significant response in the domestic interest rate, a 1% shock to government spending leading to a fall of 0.1 percentage points. That nominal interest rates are lower during a period of exchange rate appreciation suggests that some interest parity condition is at work, although the fall in the interest rate is not exactly proportional to the appreciation.

There is no significant immediate response in domestic GDP. In the Real Business Cycle interpretation of the model, this implies that the elasticity of labour supply is very low, and that consumers are responding to higher future expected tax rates by reducing consumption rather than by working harder. In the Keynesian interpretation of the model, it implies that the short-run aggregate supply curve is very inelastic. Moreover, GDP begins to *fall* in the months following the shock, and by the third quarter, this effect is statistically significant. A 1% shock to government spending in quarter t entails a level of GDP that is about 0.15% lower in quarter t+3. Again this result contrasts with estimates for other countries, where there is a positive GDP response. The negative response of New Zealand GDP is also a feature of one of the three-variable VARs in Claus *et al*. (2006, Figure 6). The larger VAR of Dungey and Fry (2009, Figure 3), which incorporates many theoretical restrictions in order to identify a wide range of shocks, produces an initial rise in New Zealand GDP followed by a fall; the net effect of the spending shock on GDP over all quarters is negative.[8] One potential explanation for the fall in GDP is that private investment is crowded out by the increase in government spending, which eventually diminishes the capital stock. In order to pursue this possibility, we need to model government spending shock in a VAR that includes different components of GDP.

2.2 The VAR with Components of GDP and the Real Exchange Rate

Again, we begin with the correlations of the reduced-form residuals in the g_t equation with those in the other equations, which are reported in the second and third columns of Table 1. The

[8] Neither of these papers incorporates the real exchange rate in the VAR.

second column includes the correlations in the version of the VAR with net exports (x_t), and the third column the correlations in version with private investment (k_t). Once again, the table shows that the correlation of the g_t and $[r_t - y_t]$ residuals is small and statistically insignificant, so different assumptions about the weak exogeneity of government spending relative to tax revenue will not have a large effect on the estimated impulse responses. The two large and statistically significant residual correlations are those for k_t and $[e_t + p_t - p_t^*]$. This means that the most substantial part of the immediate effect of a shock to government spending will be on private investment and the exchange rate.

The version of the VAR with net exports (x_t) produces results very similar to those of the version with private investment (k_t), and the impulse response profiles in Figure 3 are based only on the former (except for the k_t impulse responses). As in Figure 2, the responses are calculated for a unit shock to government spending, using the identifying restrictions described in the previous section. Here, the correlation of government spending and tax revenue residuals is so small that the responses under the assumption that g_t is weakly exogenous to $[r_t - y_t]$ are virtually identical to those under the assumption that $[r_t - y_t]$ is weakly exogenous to g_t; only the former are shown. The reduced-form parameters on which these responses are based appear in Appendix 2.

The impulse responses for the real exchange rate in Figure 3 are very similar to those in Figure 2. Again, there is a significant real exchange rate appreciation following a government spending shock. The estimated response is marginally smaller in Figure 3 than in Figure 2. The dip in GDP in the months following the shock is also slightly smaller, and not quite significant at the 5% level. One difference between the two figures is that in Figure 3, the response of tax revenue to the government spending shock in subsequent months is significantly greater than zero.

Figure 3 shows that there is no significant change in private consumption following the government spending shock, which suggests that in New Zealand, the mechanism generating a real exchange rate appreciation may be a Keynesian one: in standard Real Business Cycle theory, the appreciation is tied to a fall in consumption. There is also no significant change in the relative price of domestic and foreign traded goods. However, there is a large and significant fall in private sector investment. Roughly, a 1% increase in government spending leads to a 1% fall in the ratio of investment to GDP. (This crowding out suggests that the interest rates at which firms are borrowing rise, even though the short-run rate falls. There is limited information on loan contracts for individual firms, so it is not possible to test this hypothesis directly.) Since the import component of private sector investment is typically larger than the import component of government spending, there is a corresponding rise in net exports, even though the exchange rate has appreciated. Figure 3 shows that this rise is statistically significant; for a 1% increase in government spending, the rise in net exports peaks at about 0.1% of GDP. Consequently, positive shocks to government spending *reduce* foreign debt.

3. The Global Financial Crisis

In Figures 4-5, we illustrate the effect on the fitted models based on equation (1) and equation (5) of extending the sample period up to 2010q3, incorporating the Global Financial Crisis. Figure 4 shows recursive plots of the estimated value of the impulse response at $t = 0$ for each variable in the equation (1) model, given a unit shock to government spending. Successive points in Figure 4 represent the estimated $t = 0$ response as the sample period is extended by a single quarter. That is, for each variable, all the points in Figure 4 correspond to the first point in Figure 2.

Figure 5 shows recursive plots using the equation (5) model. That is, for each variable, all the points in Figure 5 correspond to the first point in Figure 3. The dashed lines in Figures 4-5 mark out the 95% confidence interval for each $t = 0$ response, based on 10,000 bootstrap replications. In both figures, the responses are based on identifying restrictions with government spending weakly exogenous to tax revenue. The responses based on the assumption that tax revenue is weakly exogenous to government spending are very similar. In Figure 5, the responses are based on the model with net exports x_t instead of private investment k_t (except for the k_t response itself).

The most arresting feature in the two figures is the large increase in the standard errors of the estimated impulse responses. As the sample period is extended, the 95% confidence bands expand rapidly.[9] However, there is no significant change in any of the estimated responses: the responses for the full sample up to 2010q3 are within the confidence bands for the original sample ending in 2008q1. Although the pattern of innovations in macroeconomic variables during the Global Financial Crisis is atypical of the preceding two decades, which raises the standard errors in the model, there are no strong correlations between the innovations in this period, so the extension of the sample does not have a large effect on the estimated responses. It remains to be seen whether the return to global financial stability will lead to a reappearance of the historical mechanisms driving the response of the New Zealand economy to fiscal shocks.

[9] This feature of the responses does not depend on including in the sample the atypically large real exchange rate depreciation of 2008q4. (In this quarter, the real exchange rate depreciated by 12.5%, which is larger than any change in the main sample period.) Excluding data for this quarter produces results very similar to those in Figures 4-5.

4. Conclusion

Fitting different VAR models to New Zealand data for the 1990s and 2000s produces a conclusive result. In this period (although not during the subsequent Global Financial Crisis), positive government spending shocks lead to a real exchange rate appreciation. Domestic prices do not respond to the shock, so this also entails a nominal exchange rate appreciation. In no other industrialized country do the data support this textbook result. There are some surprises in the New Zealand data; for example, the crowding out of private investment (which is typically a relatively import-intensive component of domestic expenditure) is so large that the increase in government spending leads to an increase in net exports. However, the results for New Zealand are – uniquely – consistent with standard theory.

We conjecture that this unique result reflects the relatively large degree of financial market integration between New Zealand and its larger neighbour, Australia. In New Zealand – unlike many other industrialized countries – modification of standard theory to allow for incomplete financial market integration is unnecessary. Further investigation of this conjecture requires analysis of data from other economies where fiscal autonomy is combined with a high degree of financial market integration. Even if there are no other nation states which fulfill these criteria and publish adequate data, analysis of data from sub-national regions with some degree of fiscal autonomy, such as Scotland or the American states, may provide some answers.

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Table 1

Correlation of the Residuals from Each Equation with the Residuals from the g_t Equation

	Model					
	VAR with financial variables		VAR with GDP and RER components (i)		VAR with GDP and RER components (ii)	
	correlation	*t-ratio*	correlation	*t-ratio*	correlation	*t-ratio*
y_t equation	0.04	*0.33*	0.03	*0.28*	0.04	*0.33*
$[m_t - p_t]$ equation	-0.13	*-1.11*				
$[r_t - y_t]$ equation	-0.13	*-1.13*	-0.03	*-0.23*	-0.07	*-0.56*
h_t equation			0.14	*1.21*	0.14	*1.19*
π_t equation	0.06	*0.53*				
i_t equation	-0.30	*-2.65*				
x_t equation			-0.06	*-0.53*		
k_t equation					-0.30	*-2.64*
z_t equation			-0.03	*-0.25*	-0.01	*-0.11*
$[e_t + p_t - p_t^*]$ equation	0.27	*2.34*	0.22	*1.88*	0.20	*1.65*

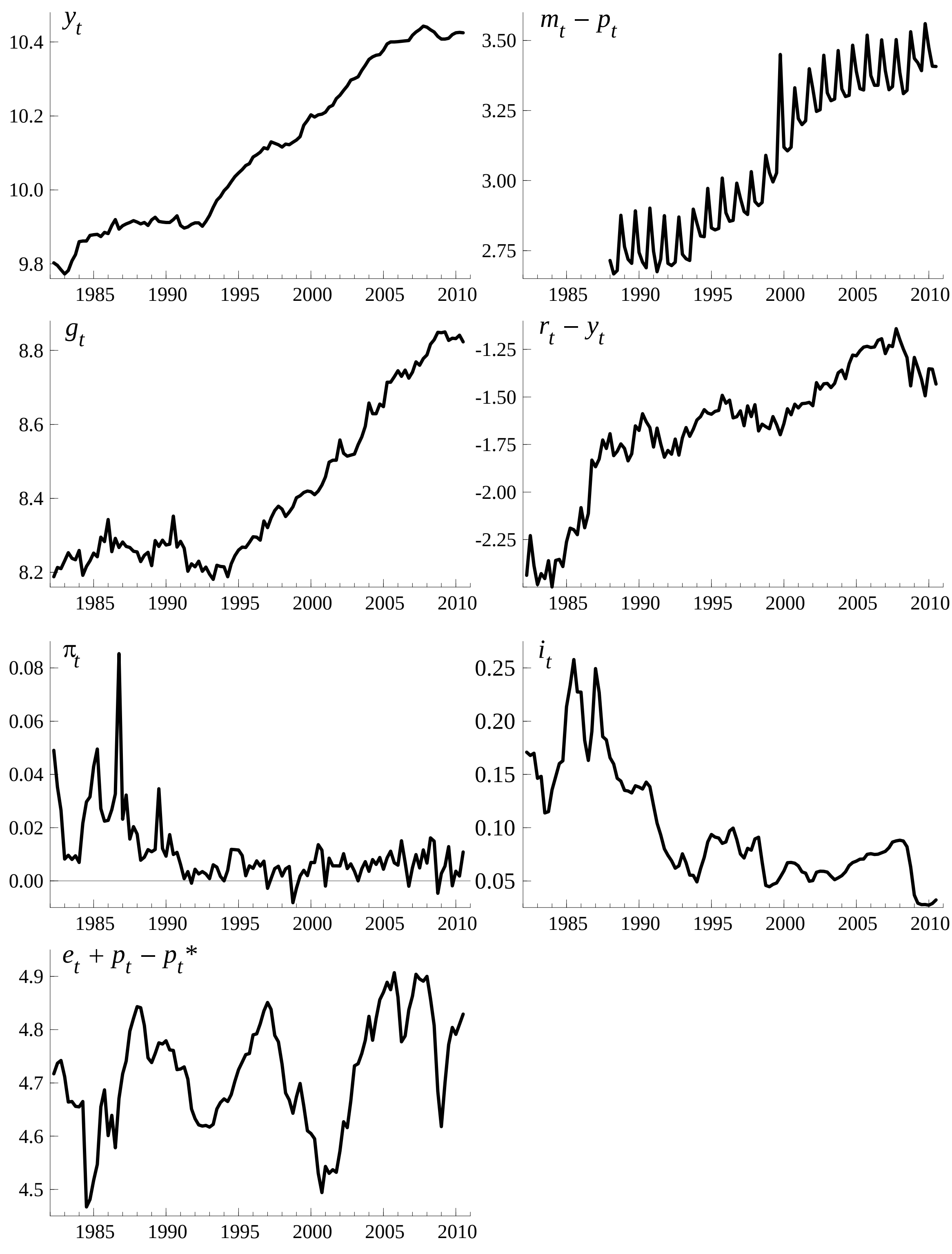

Fig. 1. *New Zealand Macroeconomic Time Series*

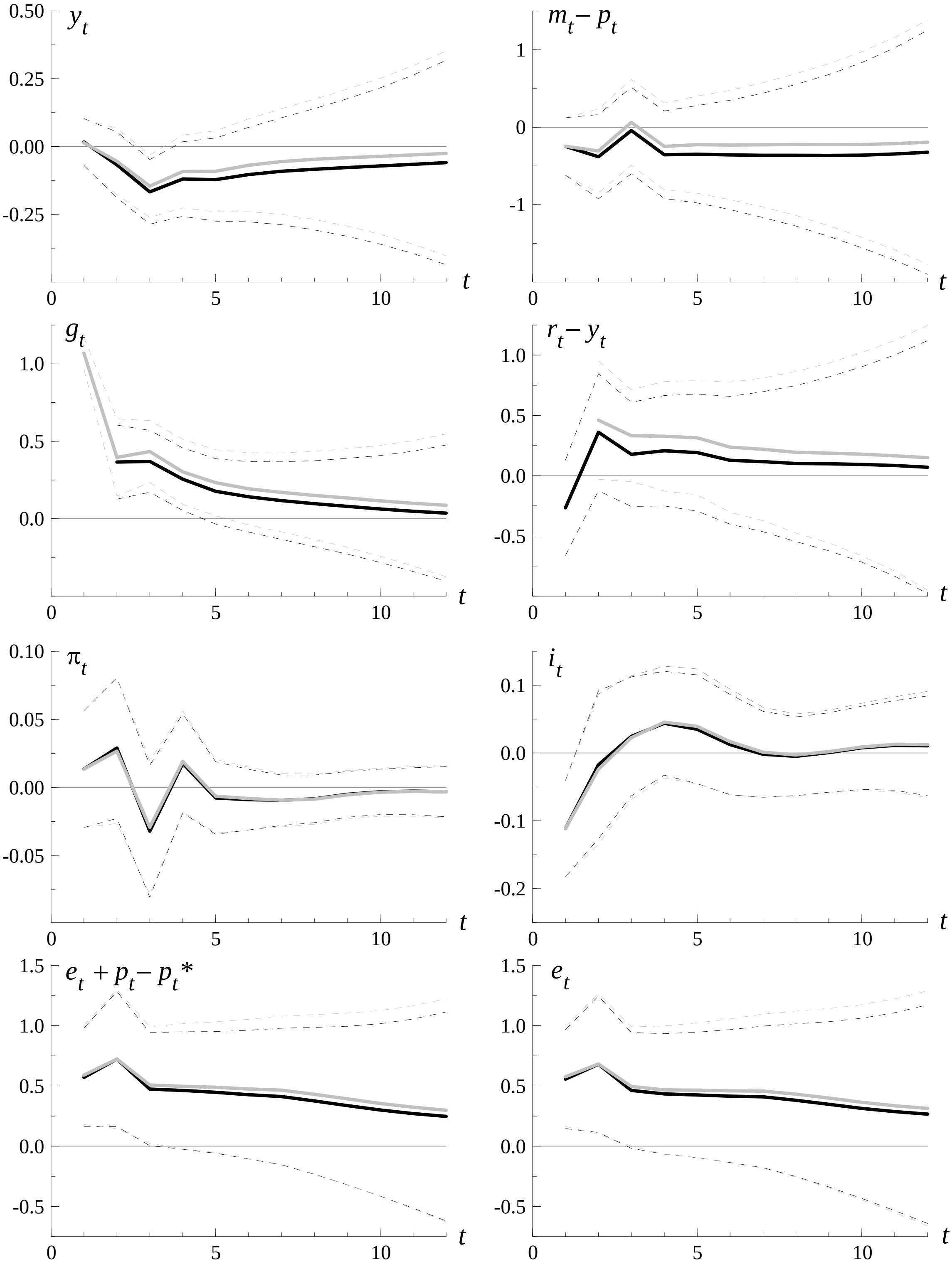

Fig. 2. *Impulse Responses for a Unit Shock to g_t Based on the Equation (1) VAR*

Black lines show responses assuming g_t is weakly exogenous to $[r_t - y_t]$, and grey lines responses assuming $[r_t - y_t]$ is weakly exogenous to g_t. Dashed lines show the 95% confidence intervals.

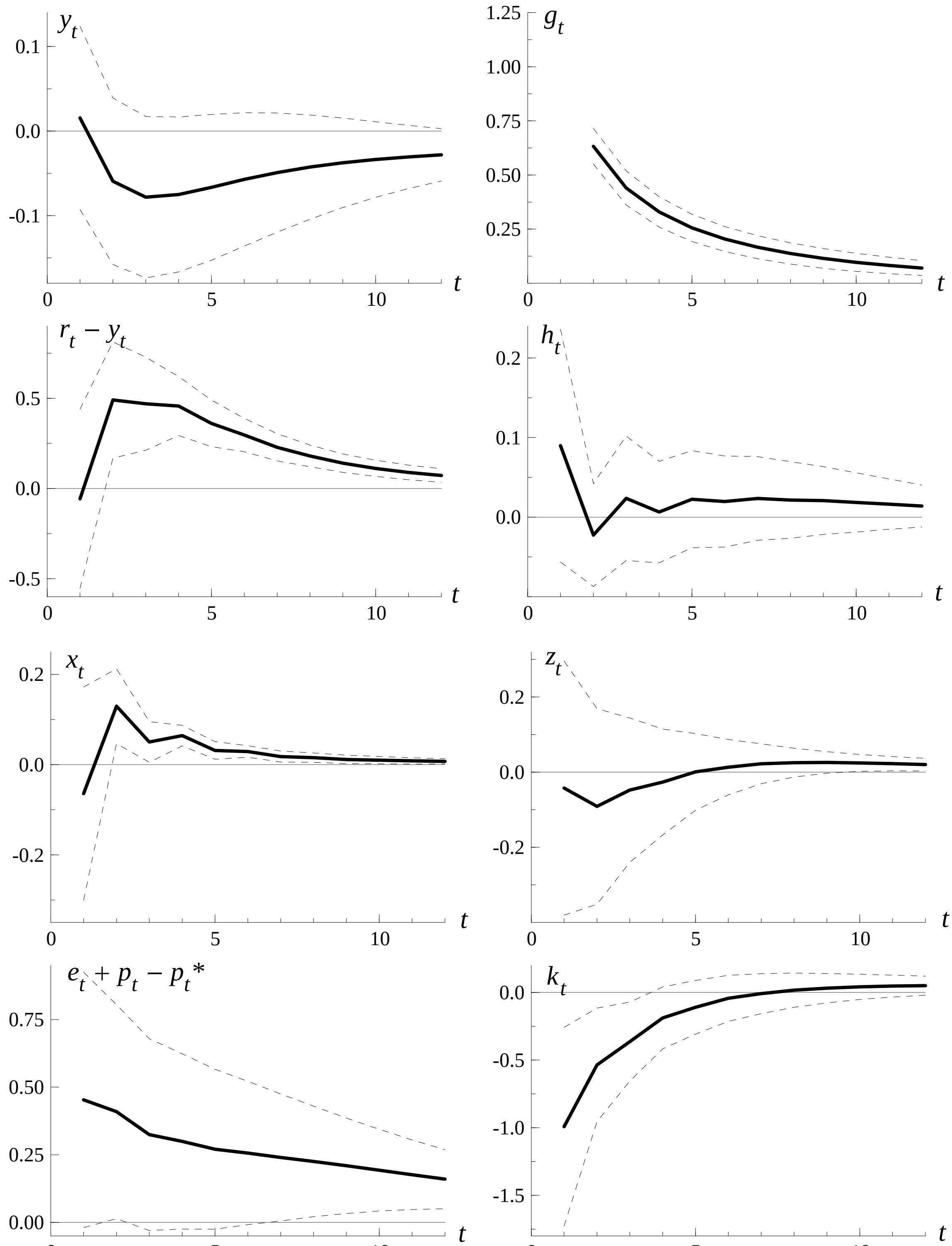

Fig. 3. *Impulse Responses for a Unit Shock to g_t Based on the Equation (5) VAR*

Dashed lines show the 95% confidence intervals.

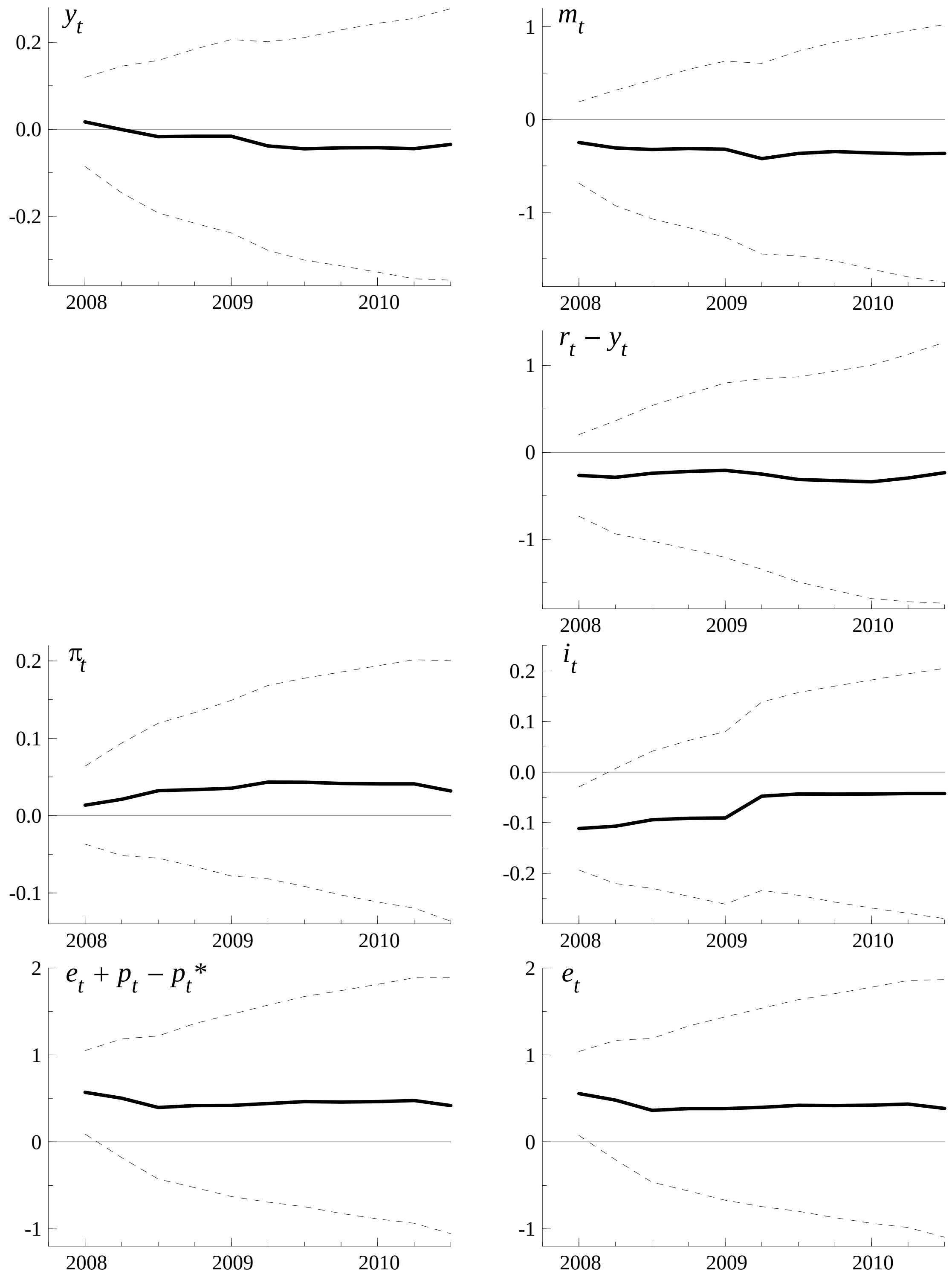

Fig. 4. *Recursive Plots of the t = 0 Impulse Responses as the Sample Period Is Extended*

Responses are based on the equation (1) VAR; dashed lines show the 95% confidence intervals.

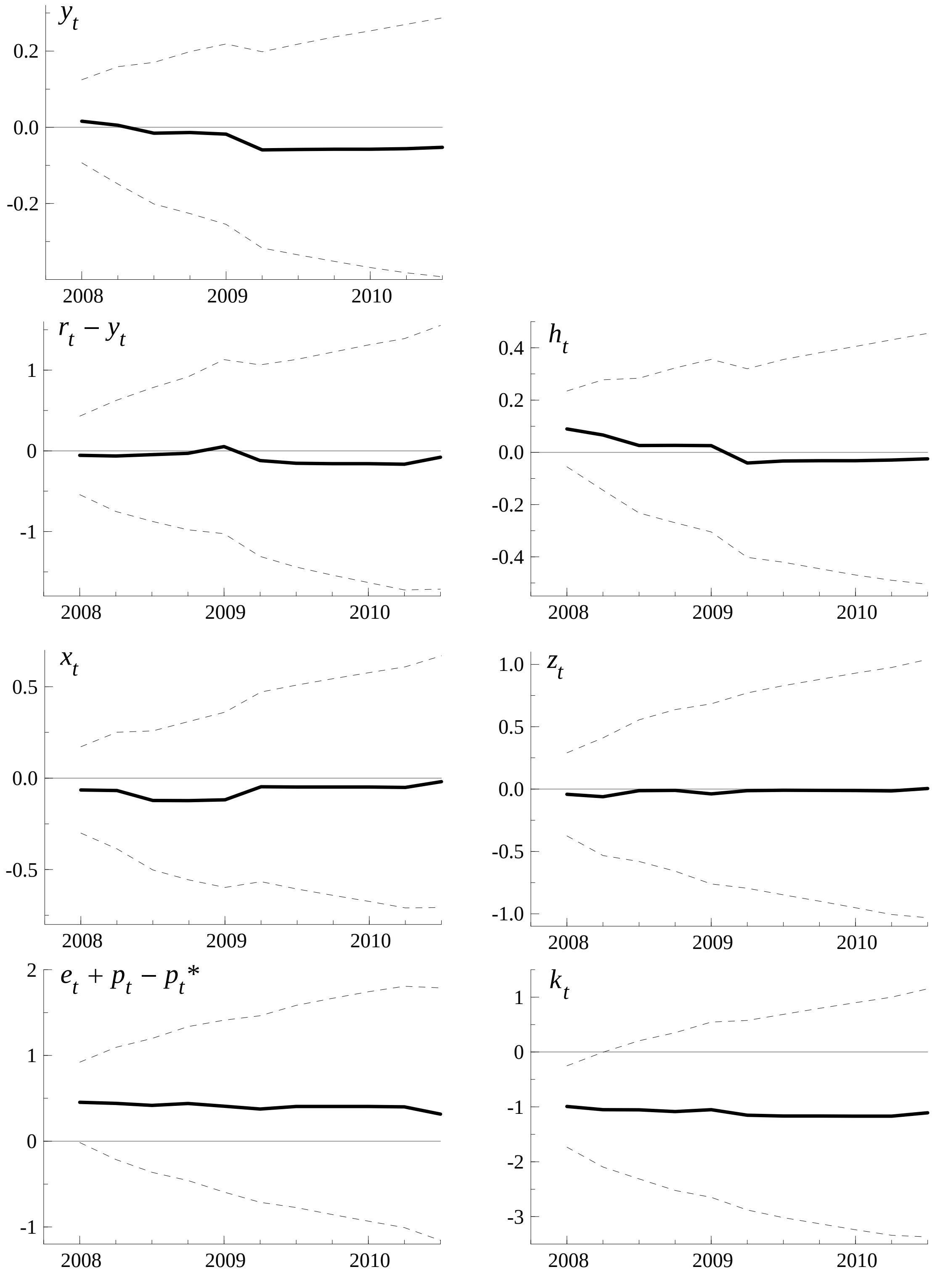

Fig. 5. *Recursive Plots of the t = 0 Impulse Responses as the Sample Period Is Extended*

Responses are based on the equation (5) VAR; dashed lines show the 95% confidence intervals.

Appendix 1: Stationarity and CointegrationTest Statistics

A1. Stationarity Tests

Table A1 includes Augmented Dickey-Fuller Test statistics for the variables in the equation (1) VAR and the equation (5) VAR. For each variable s_t, the regression equation is of the form

$$\Delta s_t = \gamma_0 + \sum_{i=1}^{i=p} \gamma_i \cdot \Delta s_{t-i} + \delta_1 \cdot s_{t-1} + v_t \qquad \text{(A1)}$$

where v_t is a white-noise error term, and the test statistic is the t-ratio on the parameter δ_1. The lag order p is selected on the basis of the Schwartz Bayesian Criterion. In the case of $[m_t - p_t]$, π_t and x_t, the regression equation also includes quarterly dummies. (There is no significant seasonality in any other variable.) For the financial variables (the interest rates i_t and i_t*, and inflation π_t), the sample period begins in 1990q4, excluding the era of monetary instability and high inflation. For the other variables, the sample period extends back as far as possible, and the starting date depends on data availability and the lag order chosen. For all variables, the sample period ends in 2010q3; excluding the Global Financial Crisis data for 2008q2-2010q3 does not make any substantial difference to the results.

The table indicates the sample period used for each test, the number of lags and the test statistic. Using a 5% confidence interval, the null that the series is difference-stationary can be rejected against the alternative that it is stationary in the case of π_t, i_t, i_t*, x_t, z_t, $[e_t + p_t - p_t^*]$, π_t^{OIL} and c_t. These variables are treated as stationary in the models discussed in the main text; the other variables are treated as difference-stationary.

A2. Cointegration Tests

In the equation (1) model, there are four endogenous difference-stationary variables: y_t, $[m_t - p_t]$, g_t, and $[r_t - y_t]$, plus one exogenous difference-stationary variable, y_t*. We test for cointegration by fitting a VAR that incorporates just these five variables. The VAR includes an unrestricted intercept and restricted seasonal dummies; y_t* enters as a restricted regressor. Three lags of the variables are required to ensure that the residuals are not autocorrelated. After fitting the VAR, Johansen Max Test and Trace Test statistics are calculated. These are reported in Table A2. The null of a rank less than four can be rejected at the 1% level in both tests. In the equation (5) model, there are also four endogenous difference-stationary variables (h_t replacing $[m_t - p_t]$), plus y_t*. We test for cointegration in the same way as for the equation (1) model, and the results are also reported in Table A2. Again, the null of a rank less than four can be rejected at the 1% level in both the Max Test and the Trace Test.

Table A1

Stationarity Test Results

variable	*sample period*	*lags*	*ADF t-ratio*
y_t	1982q4-2010q3	1	-0.40
$m_t - p_t$	1988q4-2010q3	1,2	-0.24
g_t	1982q4-2010q3	1	0.29
$r_t - y_t$	1982q4-2010q3	1	-2.45
h_t	1987q4-2010q3	1	0.22
y_t*	1983q1-2010q3	1,2	-2.19
π_t	1990q4-2010q3	none	-6.69
i_t	1990q4-2010q3	1	-4.37
i_t*	1990q4-2010q3	1	-2.86
x_t	1987q3-2010q3	none	-3.48
z_t	1987q3-2010q3	none	-2.81
$e_t + p_t - p_t$*	1989q3-2010q3	1,8	-3.02
π_t^{OIL}	1982q4-2010q3	1	-8.34
c_t	1982q3-2010q3	none	-7.97

Table A2

Johansen Cointegration Test Statistics

rank	*equation (1) variables* $\{y_t, [m_t - p_t], g, [r_t - y_t], y_t^*\}$ max test		trace test		*equation (5) variables* $\{y_t, g, [r_t - y_t], h_t, y_t^*\}$ max test		trace test	
0	273.90	$p < 0.01$	198.79	$p < 0.01$	315.69	$p < 0.01$	237.56	$p < 0.01$
1	75.11	$p < 0.01$	34.62	$p < 0.01$	78.13	$p < 0.01$	36.07	$p < 0.01$
2	40.50	$p < 0.01$	21.47	$p < 0.01$	42.06	$p < 0.01$	24.29	$p < 0.01$

3	19.03	$p < 0.01$	19.03	$p < 0.01$	17.77	$p < 0.01$	17.77	$p < 0.01$

Appendix 2: Reduced-form Parameter Estimates

Table A2

Parameters in the I(1) Variable Equations in the VAR with Financial Variables (Equation (1))

	y_t equation		$m_t – p_t$ equation		g_t equation		r_t - y_t equation	
	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
y_{t-1}	0.6926	8.3711	1.5948	4.4397	0.1134	0.5887	0.3313	0.8718
$m_{t-1} – p_{t-1}$	0.0540	3.4036	0.4120	5.9776	0.0261	0.7054	-0.0657	-0.9010
g_{t-1}	-0.1204	-3.7672	0.4497	3.2402	0.5828	7.8280	0.2551	1.7375
$r_{t-1} – y_{t-1}$	0.0975	3.8412	0.2477	2.2482	0.1242	2.1012	0.7521	6.4530
y_{t-1}*	0.0501	0.5645	0.1415	0.3670	0.2649	1.2811	0.2374	0.5822
Δy_t*	0.0949	0.8319	-1.1038	-2.2282	-0.2274	-0.8559	1.1286	2.1537
Δg_{t-1}	0.0968	2.1427	-0.5650	-2.8796	-0.2788	-2.6496	0.0691	0.3328
$\Delta[r_{t-1} – y_{t-1}]$	-0.0357	-1.4993	0.1106	1.0700	-0.0916	-1.6530	-0.4557	-4.1679
i_{t-1}	0.2022	1.6489	-1.4816	-2.7829	-0.4899	-1.7155	-0.4919	-0.8734
i_{t-2}	-0.0407	-0.3567	1.3508	2.7237	0.1635	0.6148	-0.5381	-1.0257
i_t*	-0.1007	-0.3639	1.5198	1.2645	-0.0129	-0.0200	0.4544	0.3574
i_{t-1}*	-0.2874	-0.8125	-2.6506	-1.7260	0.6183	0.7506	-0.0137	-0.0084
π_{t-1}	-0.3618	-1.6752	-0.3884	-0.4143	-0.4605	-0.9158	1.8759	1.8915
$e_{t-1} + p_{t-1} – p_{t-1}$*	0.0033	0.1972	-0.4477	-6.2560	0.0467	1.2157	0.0224	0.2958
π_t^{OIL}	0.0138	2.4244	0.0445	1.8059	-0.0299	-2.2638	-0.0530	-2.0349
π_{t-1}^{OIL}	-0.0037	-0.5941	-0.0692	-2.5866	-0.0299	-2.0839	-0.0481	-1.6986
c_t	-0.0001	-0.6008	-0.0007	-1.2683	-0.0007	-2.2768	-0.0010	-1.5858
c_{t-1}	-0.0003	-1.7898	-0.0002	-0.3413	0.0003	0.7475	0.0006	0.9233

$Q1_t$	0.0068	2.4890	0.0045	0.3812	-0.0038	-0.5969	-0.0024	-0.1913
$Q2_t$	0.0079	2.3832	0.0185	1.2798	-0.0013	-0.1665	-0.0042	-0.2768
$Q3_t$	0.0105	3.2347	0.1899	13.415	0.0051	0.6728	0.0001	0.0051
t	0.0021	2.9635	-0.0110	-3.5081	0.0010	0.5898	-0.0040	-1.2033
intercept	3.7543	4.6326	-15.917	-4.5240	1.1521	0.6105	-6.5748	-1.7666
1999q3 dummy	0.0228	4.0752	0.0667	2.7478	0.0169	1.2937	-0.0341	-1.3283
1999q4 dummy	0.0078	1.4128	0.2489	10.344	0.0011	0.0820	-0.1036	-4.0697

Table A3

Parameters in the I(0) Variable Equations in the VAR with Financial Variables (Equation (1))

	π_t equation		i_t equation		$e_t + p_t - p_t^*$ equation	
	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
ecm_{t-1}^{y}	0.0733	1.8804	0.2361	3.5192	0.1047	0.2724
ecm_{t-1}^{m}	-0.0031	-0.3925	0.0142	1.0492	-0.0272	-0.3503
ecm_{t-1}^{g}	-0.0047	-0.2957	-0.0314	-1.1496	-0.0164	-0.1049
ecm_{t-1}^{r}	-0.0442	-3.6734	-0.0599	-2.8894	-0.2845	-2.3970
Δy_t^*	0.0594	1.1487	-0.0449	-0.5046	1.0331	2.0279
Δg_{t-1}	0.0412	1.8378	0.0283	0.7349	0.0887	0.4019
$\Delta[r_{t-1} - y_{t-1}]$	-0.0280	-2.4945	-0.0351	-1.8190	-0.1829	-1.6547
i_{t-1}	0.2333	3.8474	1.0063	9.6426	-0.1261	-0.2109
i_{t-2}	-0.2419	-4.3892	-0.5811	-6.1263	0.5010	0.9221
i_t^*	0.0850	0.6176	0.2381	1.0057	-0.1450	-0.1069
i_{t-1}^*	-0.0605	-0.3798	0.0838	0.3058	-1.2409	-0.7909
π_{t-1}	-0.1665	-1.5527	0.0393	0.2129	0.7420	0.7019
$e_{t-1} + p_{t-1} - p_{t-1}^*$	-0.0257	-3.1579	-0.0054	-0.3881	0.8340	10.3901
π_t^{OIL}	0.0067	2.4292	-0.0083	-1.7548	-0.0541	-1.9888
π_{t-1}^{OIL}	0.0069	2.2450	-0.0055	-1.0517	-0.0196	-0.6512
c_t	0.0000	-0.7605	0.0001	0.7659	0.0001	0.1847
c_{t-1}	0.0000	0.0198	-0.0002	-1.6254	0.0006	0.8929
$Q1_t$	0.0029	2.1638	-0.0015	-0.6447	-0.0074	-0.5555
$Q2_t$	0.0028	1.6932	-0.0034	-1.1840	-0.0075	-0.4587
$Q3_t$	0.0020	1.2085	-0.0032	-1.1595	-0.0011	-0.0715
t	-0.0008	-2.4248	-0.0023	-4.0125	-0.0026	-0.8032
intercept	-0.5686	-1.4252	-2.3578	-3.4344	0.0035	0.0009
1999q3 dummy	-0.0020	-0.7319	0.0000	-0.0062	-0.0036	-0.1343
1999q4 dummy	-0.0068	-2.4567	-0.0004	-0.0777	-0.0283	-1.0465

Table A4

Parameters in the I(1) Variable Equations in the VAR with GDP and Real Exchange Rate Components (Equation (5))

	y_t equation		g_t equation		r_t - y_t equation		h_t equation	
	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
y_{t-1}	0.8495	10.880	-0.2052	-1.2007	0.4630	1.3048	0.1301	1.2207
g_{t-1}	-0.0618	-1.8828	0.6140	8.5455	0.4490	3.0103	-0.0601	-1.3418
$r_{t-1} - y_{t-1}$	0.0512	2.4709	0.0464	1.0237	0.5638	5.9876	0.0801	2.8335
h_{t-1}	0.0122	0.1170	0.3725	1.6327	-1.1239	-2.3726	0.6686	4.7013
y_{t-1}*	-0.1136	-1.8249	0.3686	2.7054	0.2841	1.0047	-0.1301	-1.5325
Δy_t*	0.0799	0.6980	-0.2886	-1.1513	0.8409	1.6158	0.0536	0.3430
Δh_{t-1}	0.0356	0.4265	0.0221	0.1211	0.7485	1.9741	-0.3545	-3.1145
x_{t-1}	0.0242	0.4313	0.2057	1.6766	-0.5218	-2.0485	-0.0267	-0.3492
z_{t-1}	0.0562	1.3483	0.0188	0.2063	-0.0562	-0.2967	0.0076	0.1333
$e_{t-1} + p_{t-1} - p_{t-1}$*	-0.0182	-0.9545	0.0068	0.1615	0.1420	1.6363	0.0233	0.8956
π_t^{OIL}	0.0179	3.1200	-0.0396	-3.1514	-0.0286	-1.0953	0.0126	1.6027
π_{t-1}^{OIL}	-0.0108	-1.7532	-0.0250	-1.8513	-0.0134	-0.4764	-0.0048	-0.5642
c_t	0.0000	0.0504	-0.0009	-2.6899	-0.0005	-0.7836	0.0000	-0.1735
c_{t-1}	-0.0004	-2.2879	0.0006	1.6214	0.0006	0.8861	0.0001	0.6657
$Q1_t$	0.0070	0.5950	0.0388	1.5075	-0.0004	-0.0072	0.0561	3.4979
$Q2_t$	-0.0025	-0.3696	0.0095	0.6360	-0.0333	-1.0693	0.0945	10.103
$Q3_t$	0.0019	0.4067	0.0200	1.9544	-0.0098	-0.4623	0.1272	19.947
t	0.0020	3.3184	0.0002	0.1929	0.0024	0.8825	0.0025	3.1225
intercept	2.4993	3.8489	0.2613	0.1838	-0.4849	-0.1643	2.7528	3.1070
1999q3 dummy	0.0204	2.8615	0.0149	0.9511	-0.0485	-1.4951	0.0094	0.9618
1999q4 dummy	0.0036	0.5805	-0.0033	-0.2430	-0.0750	-2.6887	0.0052	0.6189

Table A5

Parameters in the I(0) Variable Equations in the VAR with GDP and Real Exchange Rate Components (Equation (5))

	x_t equation		z_t equation		$e_t + p_t - p_t$* equation	
	coeff.	t-ratio	coeff.	t-ratio	coeff.	t-ratio
ecm_{t-1}^y	0.0380	0.2312	-0.0647	-0.2789	0.0357	0.1061
ecm_{t-1}^g	-0.1430	-2.0411	0.1731	1.7524	0.0606	0.4225
ecm_{t-1}^r	-0.0067	-0.1498	-0.1007	-1.5906	-0.1563	-1.7001
ecm_{t-1}^h	0.5162	2.5618	-0.1493	-0.5257	-0.1743	-0.4223
Δy_t^*	-0.1037	-0.4495	0.2683	0.8248	0.7042	1.4903
Δh_{t-1}	0.4116	2.5597	-0.1076	-0.4744	0.0916	0.2781
x_{t-1}	0.2516	2.0571	0.0612	0.3551	-0.2123	-0.8477
z_{t-1}	-0.0741	-0.8575	0.7612	6.2450	0.3189	1.8012
$e_{t-1} + p_{t-1} - p_{t-1}^*$	0.0464	1.2571	-0.0186	-0.3581	0.7942	10.517
π_t^{OIL}	0.0092	0.7389	-0.0047	-0.2653	-0.0696	-2.7240
π_{t-1}^{OIL}	-0.0083	-0.6553	-0.0017	-0.0958	-0.0360	-1.3797
c_t	-0.0001	-0.2462	-0.0004	-0.7996	0.0001	0.0810
c_{t-1}	-0.0004	-1.1274	-0.0005	-1.0629	0.0004	0.4987
$Q1_t$	0.0656	2.5504	-0.0041	-0.1144	0.0196	0.3724
$Q2_t$	-0.0262	-1.9773	0.0115	0.6157	0.0140	0.5148
$Q3_t$	-0.0049	-0.4871	-0.0037	-0.2590	0.0093	0.4515
t	0.0024	1.8510	0.0007	0.3695	-0.0019	-0.7297
intercept	2.9112	2.0409	0.9025	0.4488	-0.2208	-0.0756
1999q3 dummy	0.0170	1.1299	-0.0360	-1.6916	-0.0343	-1.1116
1999q4 dummy	-0.0093	-0.6911	-0.0064	-0.3385	-0.0321	-1.1616