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Fiscal expansion, interest rate risk premia, and wage reactions: Some illustrative simulations with NBNZ-DEMONZ

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Fiscal Expansion, Interest Rate Risk Premia, and Wage Reactions:

Some illustrative simulations with NBNZ-DEMONZ

Viv B Hall and David Rae*

Abstract: The macroeconomic implications of fiscal expansion in a small open economy are examined using the NBNZ-DEMONZ macroeconometric model. The model has been extended to include an endogenous interest rate risk premium (IRRP), and a forward-looking fiscal policy reaction function. An income tax cuts package shows more damped real GDP and underlying inflation paths than does an expenditure increases equivalent; the postulated IRRP proxying financial market mechanisms can contribute at least as much as the monetary policy reaction function to maintaining price stability; the time period over which the fiscal expansion is implemented is vital to outcomes; and the inflationary and real sector impacts of a personal income tax cut package depend heavily on how the cut is 'shared' between firms and workers.

Key Words: Fiscal Policy, Monetary Policy, Interest Rate Risk Premium, Forward-looking Reaction Functions, New Zealand Macroeconometric Modelling

Journal of Economic Literature Classifications: C53, E47, E62, E63

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1. Introduction

New Zealand's credit rating for government long term debt was AAA prior to 1983, but by January 1991 this had been downgraded in 3 stages to a relatively low AA- on the Standard and Poor's scale. However, by January 1996, Standard and Poor's had raised New Zealand's long-term foreign currency credit rating to AA+, citing 'prudent fiscal and monetary policies' as a key reason for the upgrade. A month later, Moody's followed suit by raising New Zealand's rating to AA1. New Zealand's net public debt-to-GDP ratio, which peaked at around 52 percent in fiscal 1991/92, has been reduced to around 32% for fiscal 1995/96; and the government operating balance (excluding net foreign-exchange losses/gains) has been turned around from a deficit of 4.6 percent in 1991/92 to an estimated surplus of 5.0 percent for 1995/96.

In its December 1995 Economic and Fiscal Update, New Zealand's government foreshadowed a two-year fiscal expansion package, including both substantial income tax cuts and increased expenditure in priority areas. This intention was confirmed by the Minister of Finance in the Budget Policy Statement of 13 February 1996 and details were presented six days later in 'Tax Reduction and Social Policy Programme - Details'.

Against this background, our paper utilises the NBNZ-DEMONZ model (Rae, 1996) to examine the implications of several different expansion packages equivalent in size to around 3 percent of GDP. We are *not* trying to mimic the fiscal package defined in February 1996, nor are we attempting to provide forecast outcomes. The aim of the paper is to examine several issues connected with how to design an effective fiscal expansion package of approximately the same *size*, but not composition, of the government's announced package. Particular interest is in the questions of:

- Does it matter whether an expansion package is implemented primarily via expenditure increases or labour income tax cuts?

- How crucial to macroeconomic outcomes are the relative strengths of financial market responses and monetary policy reactions? In NBNZ-DEMONZ, the former are now proxied through an endogenously specified interest rate risk premium[1], and the latter through a forward-looking monetary policy reaction function. The results in this area may therefore throw indirect light on the extent to which fiscal and monetary policy do or do not put additional pressure on each other, and the extent to which ongoing financial market movements may take pressure off the Reserve Bank of New Zealand to formally change one or more of its monetary policy instruments at more frequent intervals.

- Does the speed of implementation of an expansion package matter?

- In the case of income tax cuts, how crucial to inflation and economic growth outcomes are wage rate reactions?

Our paper differs from other fiscal policy simulation work done for the New Zealand economy in recent years (e.g. Brooks and Gibbs,1991; Featherstone *et al.*,1993; Hall, 1996; and Orr and Osborne,1996). For example, Brooks and Gibbs, and Featherstone *et al.* utilised versions of the now non-operational RBNZ XII model in which expectations were neither (rationally) endogenous nor forward looking[2]. In the context of appraising NZ's economic growth performance over the past decade, Hall (1996) utilised an earlier version of NBNZ-DEMONZ to examine the effects of a hypothetically stronger fiscal contraction package, under conditions of no explicit feedback mechanisms from financial markets and monetary policy. More recently, for a postulated labour income tax based fiscal expansion package similar in size to that used in this paper, Orr and Osborne have used the NZ Treasury's NZM model

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1 It should be noted that in this paper we are focusing on interest rate risk premia associated with underlying economic fundamentals, and that no explicit account is taken of risk premia directly or indirectly attributable to political risk.

2 The long run properties, including the role of expectations variables, in RBNZ XII have been evaluated in Hall (1992).

(Murphy, 1995) to look at the question of a trade-off between tax cuts and public debt repayments. NZM incorporates an endogenously-determined interest rate risk premium similar to what we use, but it has a nominal GNE based monetary policy reaction function which is distinctively different from the underlying inflation based function incorporated in NBNZ-DEMONZ. So, the work reported in this paper differs from previous work in that it addresses different questions, it explores a wider range of fiscal shocks, and it models financial market and forward looking monetary policy reactions somewhat differently.

In what now follows, section 2 explains very briefly some key features of the NBNZ-DEMONZ model. Then, section 3 provides results for our 'core' government expenditure based fiscal expansion simulation. Sections 4 to 7 provide illustrative simulation results designed to shed light on the issues of: tax cuts versus spending increases; the potential role of the endogenous interest rate risk premium, relative to forward looking monetary policy reactions; whether the same sized expenditure based package provides radically different responses if implemented quite quickly over two years rather than rather slowly over eight years; and how different the responses would be if the wage rate reactions to an income tax cut package were for a 25/75 'sharing' between firms and workers, instead of the benefits being captured 100 per cent by workers. Our summary and conclusions are presented in section 8.

2. Key Features of NBNZ-DEMONZ

NBNZ-DEMONZ is a small macroeconometric model, designed for short-term forecasting and for policy analysis of New Zealand's small, open and largely de-regulated economy. As described in Rae (1996), it consists of 28 behavioural equations and 72 identities. Its long run properties include balanced steady state growth and financial neutrality, and its firms and households behave in certain 'Keynesian' ways in the short run.

Other key features include firms as basically price takers in world markets, but having some market power in domestic markets, deregulated financial sector markets with completely mobile international capital, and the capacity to have forward-looking

monetary policy aimed solely at an underlying inflation target. Financial market participants have rational expectations, and fiscal policy is designed to be sustainable in the long run. Fiscal imbalances are assumed to be bond financed in the short run, and over the long run public debt sustainability is achieved through changes in government spending.

The model's behavioural equations have been estimated from quarterly data, with the sample period for all equations ending at the fourth quarter of 1993 or the closest possible date before that. Most series start in 1965 and all series begin before 1978. Results to date suggest that the model is dynamically stable but with relatively long (20 to 30 year) dynamic responses, although this can vary substantially with the type of shock. At present, the steady-state growth rate is assumed to be three percent per annum, and all nominal variables are assumed to grow at four percent in the steady state: three percent real growth and one percent inflation.

For the purposes of this paper, the equations in three areas require specific explanation. They involve the operation of monetary policy and the feed-forward monetary policy reaction function (MPRF), the endogenous interest rate risk premium, and the forward-looking fiscal policy reaction function (FPRF).

The operation of **monetary policy and the MPRF** reflect the unique nature of the monetary policy framework in New Zealand. The Reserve Bank targets the underlying inflation rate. Monetary policy is forward-looking in the sense that it responds to expected future inflation rather than current or past inflation. If inflation is projected to rise above the target level (chosen for modelling purposes as one percent per annum), the Reserve Bank will wish to encourage an appreciation of the nominal exchange rate to choke off some of the inflationary pressures, and conversely if inflation is expected to fall below the target. NBNZ-DEMONZ assumes, in a slightly simplified way for modelling purposes, that the RBNZ sets short term interest rates to ensure the exchange rate is at a level consistent with its inflation goal. Specifically, the desired exchange rate is given by the following feed-forward rule:

$$\Delta log\ TWI = 2 \times \left[\{0.5\ E(INF_{t+4}) + 0.5\ INFE\} - MGOAL \right] / 400 + (IW - MGOAL) / 400 \quad (1)$$

where *TWI* is the TWI exchange rate, *IW* is the steady-state rate of world inflation (which may not equal New Zealand's steady-state inflation rate) and *MGOAL* is the middle of the inflation target (1 per cent). The Reserve Bank responds to expected future inflation, which is a weighted combination of expected inflation over the coming year ($E[INF_{t+4}]$), and the expected 'medium-term' inflation rate (*INFE*). If inflation is forecast to be above its target level the Reserve Bank will engineer an appreciation of the exchange rate by changing short term interest rates. It uses the uncovered interest parity relation to calculate what short term rates must be in order to achieve the desired exchange rate level. In the steady state underlying inflation will be at its target level, monetary policy will be neutral, and the nominal exchange rate will appreciate at a rate equal to the difference between domestic and world inflation.

As explained in Rae (1996), the TWI exchange rate and the 90-day interest rate are constrained by an interest arbitrage condition assuming uncovered interest parity (UIP), modified by an exogenous exchange-rate risk premium (*JRISK*):

$$\left(1 + \frac{J3M - JRISK}{400}\right) = \frac{TWI}{E_t[TWI_{t+1}]}\left(1 + \frac{J3MF}{400}\right)$$

where $E_t[TWI_{t+1}]$ is this period's expectation of next period's *TWI*. As the desired level of the *TWI* is assumed determined from the above MPRF, then the UIP condition is used to solve for the short term (90 day) interest rate (*J3M*). *J3MF* is the foreign 90 day interest rate.

As foreshadowed above, a further **interest rate risk premium** variable treated as exogenous in Rae (1996) has been endogenised for our simulations. Specifically, a risk premium is added to long term (five year) bond rates (*J5Y*) in the following way:

$$J5Y_t = (1-\lambda)\sum_{i=0}^{\infty} \lambda^i E(J3M_{t+i}|t) + INTRISK \qquad (2)$$

where λ is a constant (equal to 0.9) and $E(J3M_{t+i} \mid t)$ is the conditional expectation of the 90-day rate in period $t+i$, given information available at time t. As explained in Rae (1996), this equation is just a simplified version of a standard term structure equation in which future short rates enter with geometrically declining weights. The role of the risk premium is to push long term rates above the level that would be consistent with the expectations theory of the term structure.

The risk premium varies in the following way:

$$INTRISK = -15\,CAB^* - 15\,GBAL^*$$

where *CAB** is a 12-quarter moving average of the current account balance (as a proportion of nominal GDP), and *GBAL** is a 12-quarter moving average of the fiscal balance (as a proportion of nominal GDP). The coefficients imply that a one percentage point worsening of the current account or fiscal balance will raise long rates by 15 basis points.

In Rae (1996) long run fiscal closure was achieved through a FPRF which was 'backward-looking' in nature. Government was assumed to adjust its 'discretionary' spending (*GDISC*) to ensure that its actual debt-to-GDP ratio converged on its long-run target debt-to-GDP ratio (*RDEBTG*). The particular rule specified was a combination of proportional and differential control, with proportional control ensuring that spending will be adjusted whenever the debt-to-GDP ratio moves away from its *RDEBTG*, while the differential control ensures (roughly speaking) that the fiscal balance cannot move 'too far' either into deficit or surplus.

Here, however, against the more forward-looking medium term stance of New Zealand's Fiscal Responsibility Act, and the fact that New Zealand's fiscal expansion package should be modelled as an anticipated rather than an unanticipated shock, we have modified the FPRF to make it more **forward-looking**:

$$\Delta GDISC^{*} = -0.05\,DGAP - 0.1\Delta_4 DEBTG^{*} \qquad (3)$$

where

$$GDISC^{*} = \frac{GDISC}{\sum_1^8 GDPZ_{t-i}/2},$$

$$DGAP = \sum_0^{\infty} \lambda^i (DEBTG^{*} - RDEBTG)_{t+i}, \qquad \lambda = 0.9$$

$$DEBTG^{*} = \frac{DEBTG}{\sum_1^8 GDPZ_{t-i}/2},$$

*DGAP** represents the expected future gap between actual and desired debt-to-GDP ratios, with geometrically declining weights. *DEBTG** is the current debt-to-GDP ratio.[3]

3. The Core Simulation

The 'core simulation' represents a 3 percentage point increase in the government's target debt-to-GDP ratio, using the following model options: monetary and fiscal policy both 'switched on' and 'forward looking', and the interest rate risk premium being endogenous (i.e. varying throughout the simulation). In this simulation, the fiscal target is achieved by altering government spending, rather than taxation. It will become apparent later why we choose these options as the base case.[4] All simulations begin in the September quarter of 1996.

The results, expressed as deviations from the National Bank's 'baseline' simulation, are summarised in Table 1 and Figure 1. As indicated in Section 2, the fiscal reaction function determines the speed of adjustment to the new target. In this case the adjustment is relatively gradual. In the first year, discretionary spending (*GDISC*) is

[3] The forward-looking and backward-looking fiscal rules lead to relatively similar outcomes, although real and nominal variables are slightly more stable under a forward-looking rule.

raised by $681m, which represents 0.66% of baseline GDP. However, because some of the spending is 'clawed back' due to higher tax receipts, government savings fall by only $486m, or 0.5% of GDP. After two years, *GDISC* is 0.95% above baseline. It takes approximately six to eight years for the debt ratio to reach its new target level.

The key result is that the fiscal loosening is *initially* expansionary, despite the interest rate risk premium being free to vary. After the first year, real GDP and household consumption are both up by approximately 0.25%. GDP peaks at 0.4% above baseline after two years, and is back at baseline after four years. This reflects the significant cyclical forces that are inherent in NBNZ-DEMONZ.

Fuller interpretation of the results requires an understanding of the basic transmission mechanisms of the model. The shock has two direct impacts - a rise in output and a rise in household incomes - and these ricochet through the model in different directions. The initial impact of the rise in government spending is an increase in the **output of the domestic good**, which jumps by 0.40% in the first year and a further 0.35% in the second year. This pushes up the **price of the domestic good** and triggers increased **labour demand** and **business investment**. Employment tends to lag output by approximately a year and thus the first-year impact on the labour market is negligible. After two years, employment is 0.3% higher and peaks in the third year at 0.45% above baseline. This corresponds to a drop in the unemployment rate of nearly 0.2 percentage points. The employment gains are eliminated, however, after six years. The second direct impact of the shock is to raise **household incomes** as government transfers (excluding the unemployment benefit) rise directly in line with the increase in discretionary spending. This triggers an increase in **household consumption**. Consumption rises relatively quickly because the consumption function is partly forward-looking and households anticipate that their incomes will be higher still in the second and third years of the simulation.

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[4] The 'core' simulation should not be confused with the 'baseline' simulation. The baseline represents the National Bank's latest macroeconomic forecasts; the 'core' simulation gives a fiscal policy shock to this baseline.

The economic expansion kicks off an **investment cycle**, and the unwinding of this cycle has a significant impact on the behaviour of the model in the middle years of the simulation. Business investment is 0.12% higher after a year, partly boosted by an initial fall in long term real interest rates. This occurs because long term inflation expectations rise quicker than long term interest rates. However, the business sector's capital stock ends the simulation 0.3% lower which means that investment must fall below baseline and stay there for a considerable length of time.[5] In fact, it stays below baseline from year-three onwards. This explains why the GDP gains are only temporary.

The inflationary impact of the shock is extremely mild. **Underlying CPI inflation** barely moves in year-one, and peaks at only 0.1% per annum above baseline in the fourth year of the simulation. The *level* of the CPI rises 0.27% over a five year period, before drifting below baseline and ending the simulation approximately where it began. The rise in inflation has both direct and indirect causes. The direct cause is the rise in the price of the domestic good (recall that domestic producers are imperfectly competitive price-makers), and the indirect cause is the (delayed) increase in **wages**. Wages rise in response to *anticipated medium-term inflation* and the increase in employment. Overall, the muted price response partly reflects the fact that the fiscal expansion itself is postulated to be relatively slow and steady. In addition, it reflects a forward-looking monetary policy tightening by the central bank. The rise in inflation is anticipated, and thus the nominal exchange rate (TWI) is pushed up progressively to try to choke off the inflation. As inflation pressures begin to unwind, so too does the exchange rate.

The behaviour of the **interest rate risk premium** reveals a great deal about the dynamics of the simulation. It is above baseline for the entire period. Government debt is, of course, higher but this is partly offset by a fall in private sector debt, at least in the first six years of the simulation. For example, government debt is $1,350m higher after four years, while private sector debt is $308m lower. Thus, the fiscal expansion leads to *some* crowding-out of the private sector, but it is far from

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5 The structure of the model will ensure that, in the very long run, the capital stock will return to its baseline level.

complete. Consequently, *total* debt rises and the current account balance "worsens" by 0.24% of GDP. The result is a rise in the risk premium on long term interest rates. An extra 13 basis points are added to long bonds after four years, although this slowly drifts back over the remainder of the simulation.

To sum up, the fiscal expansion is initially expansionary but neutral in the long run, the inflationary consequences are mild, and the degree of crowding-out is less than full.

To the enquiring reader, this simulation will have raised many more questions than it has answered. The next four sections therefore investigate a number of the possibly more important ones:

(a) Are the dynamics different if the fiscal expansion is brought about via a cut in taxes rather than a rise in spending?

(b) How much is the endogenous risk premium contributing to the dynamics and to the long run response? In particular, does it help or hinder monetary policy?

(c) What happens if the fiscal expansion is pushed through much quicker, over two years rather than eight years?

(d) To what extent do the results depend on the assumption for wages? In particular, what happens if tax cuts are 'shared' between workers and firms, as might be expected in a wage bargaining framework?

4. Tax Cuts or Spending Increases?

To examine whether a fiscal expansion brought about by tax cuts has a different impact compared with spending increases, the fiscal reaction function was rewritten so that the wage and salary tax rate (TWR) adjusts in an analogous way to the GDISC rule specified above in equation (3). The feedback coefficients are adjusted to ensure

that the tax rule has the same 'strength' of feedback to a given disequilibrium as does the spending rule. That is, the two rules will have the same direct impact, in dollar terms, on the fiscal balance.

So, the tax-based reaction function is:

$$\Delta TWR = 0.48\,DGAP + 0.96\,\Delta_4 DEBTG^*$$

where

$$DGAP = \sum_0^\infty \lambda^i \,(DEBTG^* - RDEBTG)_{t+i}, \qquad \lambda = 0.9$$

$$DEBTG^* = \frac{DEBTG}{\sum_1^8 GDPZ_{t-i}/2},$$

The same shock as was used in the core simulation is applied to the model, with monetary policy again being forward-looking and the interest rate risk premium being endogenous. The results are summarised in Table 2. Figure 2 compares the impacts of the tax rule and the spending rule.

The key difference between altering taxes and altering spending is that the tax simulation leads to an adjustment path that is considerably more smooth, although *qualitatively* quite similar. As before, the initial impact of the fiscal loosening is expansionary, but the joy is relatively short-lived as GDP returns to baseline after four years. GDP follows the same pattern as in the core simulation, but has only half the amplitude. It peaks at 0.2% above baseline, compared with 0.4% for the spending rule. Correspondingly, the trough in output - after eight years - is considerably less severe.

The major reason for the different dynamic responses of the two policy rules is that a tax shock does not have such a direct impact on output, compared with the spending shock. Instead, the shock works primarily through the consumption function and consumption smoothing ensures that spending does not rise by the full amount of the

shock. This is partly because the short run marginal propensity to consume is less than unity, and partly because households respond to expected future income and thus take the future path of the economy into account when making their spending decisions. Consumption smoothing implies that the tax cut will lead to some increase in household savings, at least initially, and this can be seen in the private debt figures and the current account balance, both of which imply higher savings than in the core simulation, for at least the first five years.

Because the tax cut has no *direct* effect on output, the production of the domestic good rises considerably less in this simulation. It is 0.44% above baseline after two years, compared with 0.75% for the spending rule. This considerably weakens the price-output-employment transmission mechanism discussed in Section 3. The price of the domestic good rises less, the inflationary impact is much smaller, and consequently monetary policy does not have to tighten as far. Thus, the TWI rises only 0.25% at its highest point, compared with 0.39%. The smoother inflation profile translates into smoother long term real interest rates, which helps avoid the more pronounced investment cycle that dominated the dynamics of the core simulation.

However, even though the dynamics are different, the long run impacts are very similar. This can be seen by a casual inspection of the graphs, but also by looking at the interest rate risk premium. As discussed in Section 2, the risk premium responds to *five year moving averages* of the government balance and the current account balance. Taking a medium term average smooths out much of the differences in dynamics and thus the risk premium behaves in a very similar way under the tax rule compared with the spending rule. The risk premia in the two simulations are within a basis point or two of each other throughout the whole period.

An obvious further exercise would be to analyse the impact of some *combination* of spending increases and tax cuts. Our experience with NBNZ-DEMONZ suggests that, to a first approximation, the model is close to being linear. Thus, the approximate impact of a combined spending/taxation fiscal package could be gauged by taking a weighted average of our tax and spending simulation results.

5. The Impact of the Risk Premium

In this section we look at whether endogenising the risk premium on long term (5 year) bond rates significantly alters the results. The formulation of the risk premium is based on the empirical results of Orr, Edey, and Kennedy (1995). Their study used a pooled cross-section time-series analysis of 17 OECD countries (including New Zealand) over a twelve year period. The main findings relevant here are that, on average across countries:

(a) each percentage point worsening of the 'smoothed' current account balance (measured relative to GDP) will raise the risk premium on long bonds by 15 basis points. In this context, 'smoothed' refers to a five-year moving average;

(b) each percentage point worsening of the *fiscal* balance (as a proportion of GDP) will raise the risk premium on long bonds by 15 basis points.

These estimates are used to calibrate the risk premium equation in NBNZ-DEMONZ. The only major difference between the current NBNZ-DEMONZ model, and Orr, Edey, and Kennedy's study, is that the former also takes a five-year moving average of the fiscal balance in order to minimise the degree of short-term noise in the risk premium. The core simulation had this risk premium equation 'switched on'; in this section we switch it off (i.e. keep the risk premium constant) and compare the results.

In practice, the risk premium helps monetary policy in the following sense. In the growth phase of a business cycle the current account deficit tends to rise, pushing up the risk premium. The fiscal balance also tends to improve as tax receipts rise and unemployment benefits fall, but the increase in government savings is not sufficient to offset the fall in private savings. Consequently, inflation and the risk premium tend to rise together. An increase in the risk premium helps choke off some of the economic boom, and in this sense is self-stabilising. It therefore reduces the amount of work that monetary policy needs to do over the cycle.

To untangle the separate effects that the risk premium and monetary policy have, we compare and contrast results from the following simulations:

(a) monetary policy **off**, risk premium **constant** (see Table 3)
(b) monetary policy **off**, risk premium **endogenous** (see Table 4)
(c) monetary policy **on**, risk premium **endogenous** (i.e. the core simulation in Table 1)

By "Monetary policy off" we mean that the TWI feed-forward rule (equation 1) is disabled, so that the TWI no longer responds to deviations of inflation from its target. That is, the nominal TWI is exogenised (forced to follow its baseline path).[6] Given the uncovered interest rate parity relation, this implies that short term nominal interest rates are also held fixed to their baseline path. Results for all three runs are summarised graphically in Figure 3.

A first point to note is that run (a), with no interest rate and exchange rate feedbacks of any kind, has a substantially larger inflationary impact than the core simulation. The annual underlying inflation rate peaks at 0.34% above baseline after 4 years, compared with 0.1% in the core simulation. One implication of this is that, provided inflation starts off near the centre of the 0-2% band, a fiscal expansion of this magnitude *and quite slow speed* should not (*ceteris paribus*) present undue problems for monetary policy. But it also means that if underlying inflation were close to the top of the 0-2% band during the relevant period, and if the speed of implementation of the fiscal expansion were faster (as illustrated below in section 6), commensurately stronger pressure would be placed first on interest rates and the exchange rate, and then on monetary policy.

[6] It is a moot point what "monetary policy off" or "constant monetary policy" actually means in the real world. In NBNZ-DEMONZ we take it to mean no change in the nominal exchange rate and the short term nominal interest rate. Countries that use, for example, money growth as their main instrument may regard "constant policy" as an exogenous money growth path, independent of the paths of the endogenous variables in the model. This could be labelled a "freely floating exchange rate" for want of a better name. However, this framework is not an accurate reflection of the monetary policy framework in New Zealand, and consequently the money supply is endogenously determined in NBNZ-DEMONZ.

When comparing the results of run (a) with run (b) (i.e. to isolate the role of the endogenous risk premium), a second result of note is that the risk premium and its subsequent effects substantially alter the dynamics of the economy. In particular, the amplitude of cycles of both real and nominal variables is significantly reduced. The initial rise (instead of 2 year fall) in interest rates brought about by the economic expansion is sufficient to dampen the real GDP and inflation cycles by approximately a half. Underlying inflation now peaks at 0.18% above baseline (instead of 0.34%), and GDP peaks at 0.37% after two years (instead of around 0.7%).

Third, additionally switching monetary policy on (i.e. examining run (c) outcomes relative to run (b)) leads to a further reduction in inflation. However, there is no appreciable extra damping down of real variables such as GDP and consumption. A TWI appreciation which reaches 0.4% above baseline after 4 years is sufficient to knock an extra 0.1% off the peak inflation rate. Interestingly, the simulations "monetary policy off, risk premium endogenous" and "monetary policy on, risk premium constant" lead to remarkably similar inflation outcomes. This suggests that a well-functioning risk premium based on market mechanisms can contribute at least as much as monetary policy to the task of controlling inflation.[7]

The differences between these simulations are largely due to the different profiles for long term real interest rates, and thus the different investment paths. The lowest interest rates and highest investment tracks in the first half of the simulation belong not surprisingly to run (a), with no monetary policy reaction and a constant risk premium. The core simulation, in which monetary policy is tightened to offset the rise in inflation, sees the largest increase in interest rates. This also affects dwellings investment, the most interest-sensitive part of the economy.

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[7] More precisely, it can contribute as much as "reasonable" monetary policy; of course, an arbitrarily strong monetary policy reaction could be simulated and would have a much bigger impact than the variations in the risk premium.

6. Does Speed of Implementation Matter?

The previous simulations have changed the target public debt-to-GDP ratio and relied on the fiscal reaction function to determine how quickly policy tries to reach it. In practice, this has meant that the new target is phased in over a six to eight year period. This may well reflect an unrealistic degree of patience on the part of fiscal policymakers. In this section, therefore, we adjust the fiscal reaction function to force the new target to be reached within two years. Apart from the speed with which the shock is imposed, the simulation is the same as the core simulation.[8] The results are summarised in Table 5 and Figure 4.

Clearly, a more sudden shock leads to substantially different dynamics. This is not surprising, but what is interesting is the *magnitude* of the difference. Economic cycles are now very significantly less damped. For example, consumption peaks at 2.7% above baseline after two years instead of 0.9% after 3 or 4 years, while GDP rises 1.5% instead of around 0.4% after 2 years. Employment growth is now approximately 1.5% higher a year later, pushing down the unemployment rate by a full 0.6 percentage points.

The quicker shock leads to a much larger and quite rapid current account blowout. The current account balance 'worsens' by approximately $1billion. Add to this the large drop in government savings, and the risk premium on New Zealand's long term real interest rates rises by 43 basis points. Once the impact of the monetary policy response is taken into account, real long term rates are 67bp higher at their peak. However, the risk premium falls back to baseline after five years once the subsequent contractionary effects have been fully felt.

The impact on the inflation rate is interesting. We noted above that the inflationary impact of the core simulation was quite small, partly due to the slow and steady nature of that shock. However, the significantly quicker fiscal expansion sees underlying inflation peaking 0.35% above its baseline level. There is a considerable difference

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8 In other words, monetary policy and the endogenous risk premium are 'switched on.'

between the tradeable and non-tradeable sectors, however. Inflation in the domestic good hits 0.66%, while export and import price inflation falls by 0.4% in New Zealand dollar terms. This is caused by the necessary tightening in monetary policy that accompanies the rise in underlying inflation.

Even though the additional inflationary impact appears relatively small in percentage point terms, the results of Section 5 suggest that the inflation track will have been substantially reduced by monetary policy and by variations in the risk premium. To get a more accurate gauge of whether the fiscal expansion will lead to considerable pressure on monetary policy, we ran two variants of this simulation. First, monetary policy was switched off.[9] In this case, underlying inflation peaks at 0.55% above baseline.

The second variation was to hold the risk premium constant at the same time as keeping monetary policy switched off. This would represent a 'worst case scenario.' In this case, underlying inflation would peak after 3 years at approximately 0.9% above baseline. This clearly would pose a problem for any central bank with a tight target band and/or being close to the top of its band over the relevant period. Thus, if financial markets did not push up the risk premium on New Zealand's assets in response to this particular fiscal expansion then the Reserve Bank would be forced to tighten monetary policy considerably in order to ensure inflation stayed within a target range commensurate with price stability.

7. The Wage Assumption

Some wage bargaining models predict that real wages will be affected by the rate of tax on labour income, or more precisely by the *wedge* between the real labour cost to the firm and the real post-tax consumption wage of the worker (see Layard, Nickell, and Jackman, 1991, pp 209-211 for a discussion). However, this potentially important factor is not present in NBNZ-DEMONZ's wage function. So, the aim of this section is to adjust the wage equation to test the sensitivity of the results to this wedge.

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[9] That is, the nominal exchange rate and short-term nominal interest rates are fixed at their baseline levels.

The simulation results in this section are based on a fiscal expansion brought about by a tax cut (see Section 4). We additionally assume that the tax cut is shared between firms and workers in such a way that a quarter of the tax cut is captured by firms (employees lower their wage demands by a quarter of the value of the tax cut) while three-quarters is retained by workers. Thus, wage pressures are lower, *ceteris paribus*, for as long as the wage and salary tax rate remains below baseline, which in this case is approximately eight years.[10] The assumption of a 25/75 split between firms and workers is conservative, as international evidence suggests that the split tends to be closer to 50/50 and relatively long lasting.[11] Note that we make no adjustment to firms' behavioural functions;[12] they can pass on lower wage costs to consumers if they wish, and in fact will do so over the very long run.

The results are summarised in Table 6 and Figure 5. On the price side, the reduction in wage pressure is sufficient to reverse the initial inflationary impact of the shock. Underlying inflation now falls *below* baseline for the first three years of the simulation, troughing at -0.13%. Business sector profits rise, but some of the increase in profitability is passed on in the form of lower prices - the price of domestically produced output falls 0.5%. Clearly, the inflationary impacts of a tax cut depend heavily on the assumption of how this cut is shared between firms and workers. A relatively low degree of sharing can cause a substantial inflation off-set.

The effect on the real sector of the reduction in wage pressure is also interesting. A drop in wages is, on balance, expansionary. That is, the positive supply-side effects on employment of a wage cut more than offset the negative demand-side effects on incomes. GDP is above baseline for the entire simulation, peaking at 1.4% above baseline after five years. Employment rises 2% and the unemployment rate falls by approximately 0.75 percentage points. Much of this is driven by a sharp increase in business investment, triggered by higher profitability in the face of lower real wages.

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10 In practice this means that wage pressures are lowered by a *cumulative* 2 per cent, spread over eight years, and with the same time-profile as the tax cuts.

11 The OECD (1990) presents evidence that on average, for 16 OECD countries, a 1 per cent rise in the wedge leads to an *immediate* 0.5 per cent rise in labour costs. At least a half of this effect remains after five years.

8. Summary and Conclusions

The NBNZ-DEMONZ model has been used to examine the macroeconomic implications of an illustrative fiscal expansion package equivalent in size to about 3 per cent of GDP. The package has been implemented in several different expenditure and income tax based ways, and under various financial market, monetary policy and wage reaction conditions.

The 'core simulation' results, expressed as deviations from the National Bank's latest macroeconomic forecasts, reflect **government expenditure** being expanded to achieve a rise in the target public debt-to-GDP ratio of 3 percent over a 6 to 8 year period. The results show real GDP rising above baseline in the short run, peaking after about 2 years, and then after 4 years moving below baseline for a considerable number of years. The short term expansionary impact comes about primarily through increased consumption expenditure, but also from a smaller shorter-lived expansion in fixed investment. The initial additional pressures on underlying inflation are relatively mild, peaking after 4 years at 0.1 percentage points above baseline. Key transmission mechanisms contributing to the inflation and other outcomes are the relatively long-lived reduced fiscal surpluses and increased current account deficits, quite quickly putting upwards pressure on New Zealand's interest rate risk premia and real interest rates, and contributing to a lengthy period of net appreciation of the (TWI) exchange rate.

But suppose the aim had been to achieve the same public debt-to-GDP target solely through cuts in wage and salary **income tax rates**. The dynamics of real GDP and inflation were similar to the dynamics under an expenditure increase, but followed noticeably more damped paths. The much reduced 4-year real GDP expansion is now completely dominated by increased consumption expenditure, offset in the first 3 years by reduced business investment.

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[12] This assumption is consistent with the wage bargaining models discussed above.

Much more important implications emerged, however, when we investigated the relative roles of interest rate risk premia and monetary policy reactions, the implementation of the expenditure related package over 2 rather than 8 years, and allowance was made for illustratively different wage rate reactions.

Movements in the interest rate risk premium (which we alternatively interpret as a crude proxy for ongoing financial market adjustments) are shown to be crucial to the overall positive outcomes from the government expenditure and personal income tax simulations. The **risk premium/financial market and monetary policy** mechanisms seem equally important in dampening by approximately a half the real GDP and underlying inflation cycles which would otherwise have resulted in the early years of the simulations. They therefore lessen considerably the likelihood of underlying inflation moving outside the 0 to 2 percent band. This work also suggests that a well-functioning risk premium based on financial market mechanisms can contribute at least as much as monetary policy to the task of maintaining price stability. This is through reducing the need for more frequent, more sizeable, and perhaps more destabilising monetary policy changes.

The time period over which the fiscal expansion is implemented is also vital. Implementing the expenditure package over **2 rather than 8 years** produces cycles in real GDP and inflation of much greater amplitude. The expansion peak for real GDP after 2 years is now 1.5 rather than 0.4 percent above baseline, but there is a much deeper subsequent trough of around -1.5 rather than -0.45 percent, and it comes after 5 rather than 8 years. Real interest rate increases therefore need to be over twice as great to keep the inflation peak after 4 years at a still potentially awkward 0.35 percentage points higher than the relatively benign 0.1 percentage points higher for the 8 year horizon. The potential awkwardness would, of course, be greater if underlying inflation in the baseline simulation inflation were around the top of the band during the relevant quarters rather than near the middle of the band.

Finally, it is shown that the inflationary and real sector impacts of the personal **income tax cut** package depend heavily on the assumption of how the cut is **'shared' between firms and workers**, i.e. on the extent to which employees reduce wage

demands relative to baseline. The greater the "sharing", the lesser the inflationary pressures and the better the real GDP and unemployment outcomes.

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Table 1. Core simulation - Fiscal Expansion via Spending Increase

		Years					
		1	2	3	4	5	10
GDP	%	0.23	0.38	0.29	0.10	-0.12	-0.40
Consumption	%	0.29	0.69	0.91	0.91	0.74	-0.21
Business Investment	%	0.12	0.09	-0.24	-0.47	-0.62	-0.63
Underlying Inflation	%pa	0.00	0.04	0.09	0.10	0.03	-0.08
5-Year Real Interest Rate	bp	0	4	11	19	24	7
TWI Exchange Rate	%	0.06	0.17	0.32	0.39	0.34	-0.21
Fiscal Balance	% of GDP	-0.47	-0.68	-0.59	-0.47	-0.38	-0.14
Current Account	% of GDP	-0.05	-0.16	-0.22	-0.24	-0.23	-0.11
Unemployment Rate	pp	-0.05	-0.14	-0.17	-0.13	-0.05	0.17
Risk Premium	bp	3	8	13	13	12	5

Table 2. Fiscal Expansion via Tax Cut

		Years					
		1	2	3	4	5	10
GDP	%	0.12	0.22	0.17	0.07	-0.05	-0.27
Consumption	%	0.39	0.73	0.85	0.83	0.71	0.03
Business Investment	%	-0.03	-0.06	-0.24	-0.36	-0.46	-0.52
Underlying Inflation	%pa	0.00	0.03	0.05	0.06	0.02	-0.05
5-Year Real Interest Rate	bp	3	5	9	13	16	8
TWI Exchange Rate	%	0.03	0.10	0.19	0.25	0.23	-0.08
Fiscal Balance	% of GDP	-0.70	-0.64	-0.49	-0.41	-0.33	-0.17
Current Account	% of GDP	-0.05	-0.14	-0.19	-0.20	-0.20	-0.14
Unemployment Rate	pp	-0.03	-0.08	-0.10	-0.08	-0.04	0.10
Risk Premium	bp	4	9	13	11	10	6

Table 3. Monetary Policy off, Constant Risk Premium

		Years					
		1	2	3	4	5	10
GDP	%	0.38	0.67	0.73	0.67	0.56	-0.14
Consumption	%	0.34	0.86	1.23	1.42	1.47	0.78
Business Investment	%	0.51	0.65	0.54	0.56	0.58	-0.15
Underlying Inflation	%pa	0.04	0.16	0.29	0.34	0.24	-0.16
5-Year Real Interest Rate	bp	-16	-20	-19	-13	-3	14
TWI Exchange Rate	%	0.00	0.00	0.00	0.00	0.00	0.00
Fiscal Balance	% of GDP	-0.46	-0.68	-0.60	-0.48	-0.42	-0.23
Current Account	% of GDP	-0.07	-0.21	-0.30	-0.35	-0.37	-0.35
Unemployment Rate	pp	-0.08	-0.22	-0.31	-0.34	-0.33	-0.04
Risk Premium	bp	0	0	0	0	0	0

Table 4. Monetary Policy off, Risk Premium Endogenous

		Years					
		1	2	3	4	5	10
GDP	%	0.20	0.37	0.35	0.26	0.14	-0.30
Consumption	%	0.28	0.65	0.86	0.91	0.85	0.19
Business Investment	%	-0.01	0.02	-0.13	-0.16	-0.16	-0.52
Underlying Inflation	%pa	0.02	0.08	0.16	0.18	0.10	-0.14
5-Year Real Interest Rate	bp	1	1	3	7	12	16
TWI Exchange Rate	%	0.00	0.00	0.00	0.00	0.00	0.00
Fiscal Balance	% of GDP	-0.49	-0.68	-0.58	-0.45	-0.37	-0.20
Current Account	% of GDP	-0.05	-0.15	-0.21	-0.23	-0.23	-0.18
Unemployment Rate	pp	-0.04	-0.12	-0.17	-0.17	-0.13	0.07
Risk Premium	bp	3	8	12	13	11	7

Table 5. Quicker Expenditure Shock

		Years					
		1	2	3	4	5	10
GDP	%	0.85	1.53	0.54	-0.70	-1.29	-0.26
Consumption	%	1.14	2.70	2.65	1.50	0.26	-1.33
Business Investment	%	0.34	0.36	-1.07	-1.85	-1.62	0.14
Underlying Inflation	%pa	0.01	0.17	0.35	0.28	-0.13	-0.04
5-Year Real Interest Rate	bp	3	18	43	64	63	-37
TWI Exchange Rate	%	0.19	0.58	1.00	0.99	0.40	-0.93
Fiscal Balance	% of GDP	-1.88	-2.92	-1.04	0.19	0.29	0.12
Current Account	% of GDP	-0.20	-0.61	-0.71	-0.50	-0.28	0.05
Unemployment Rate	pp	-0.19	-0.55	-0.54	-0.14	0.29	0.26
Risk Premium	bp	12	34	43	29	8	-4

Table 6. Tax Simulation, with 25/75 Wage Sharing

		Years					
		1	2	3	4	5	10
GDP	%	0.04	0.41	0.75	1.05	1.27	1.17
Consumption	%	0.29	0.56	0.80	1.11	1.45	2.06
Business Investment	%	0.10	1.24	1.77	2.08	2.26	1.19
Underlying Inflation	%pa	-0.08	-0.13	-0.09	0.02	0.09	0.06
5-Year Real Interest Rate	bp	13	3	-8	-14	-14	1
TWI Exchange Rate	%	-0.18	-0.33	-0.35	-0.22	-0.04	0.49
Fiscal Balance	% of GDP	-0.69	-0.59	-0.47	-0.41	-0.37	-0.24
Current Account	% of GDP	-0.01	-0.05	-0.08	-0.10	-0.12	-0.21
Unemployment Rate	pp	-0.02	-0.17	-0.36	-0.53	-0.66	-0.62
Risk Premium	bp	4	8	11	9	8	8

Note: All numbers in the tables and graphs are in deviations from baseline form.

Figure 1: The Core Simulation

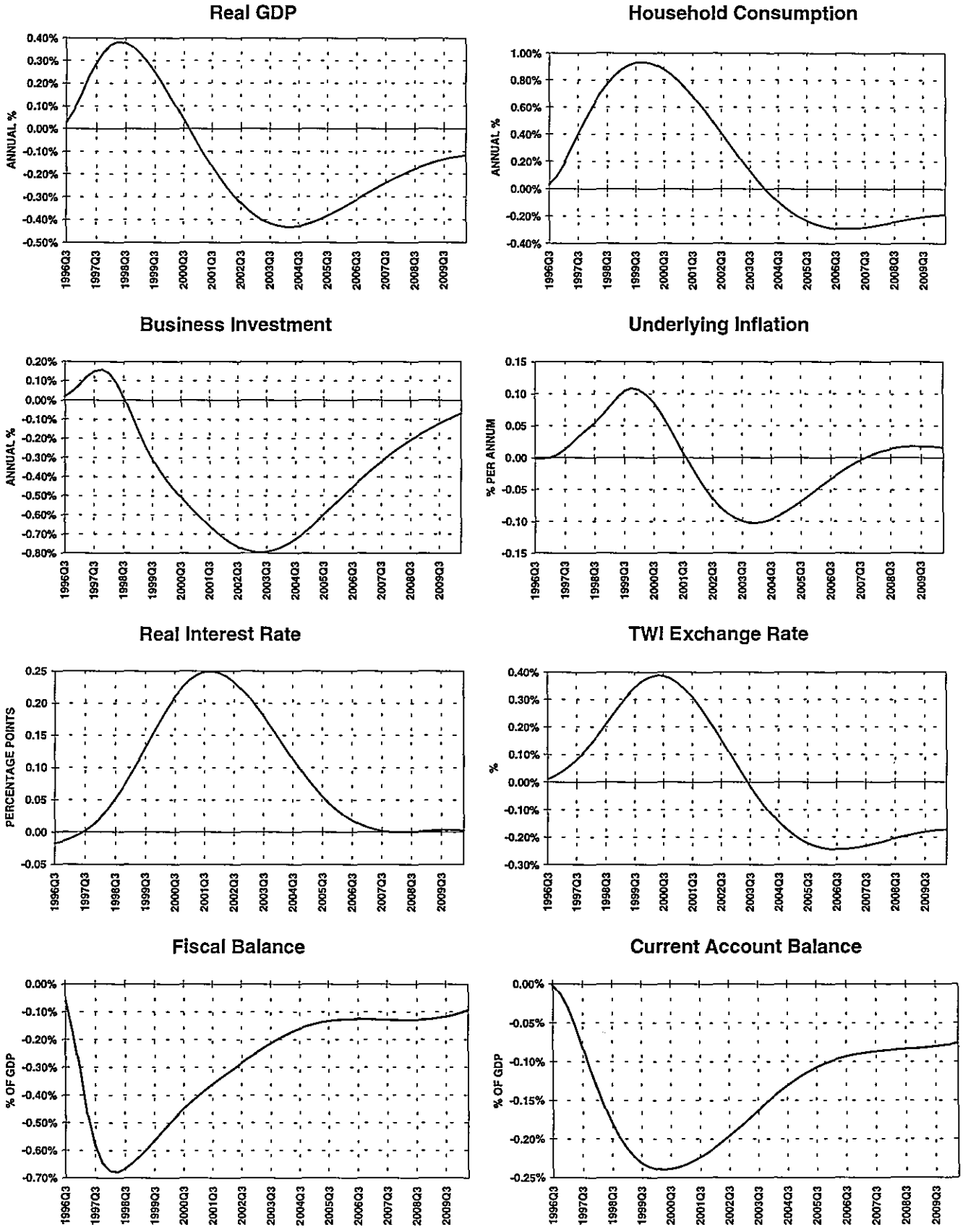


Figure 2: Fiscal Expansion via a Tax Cut

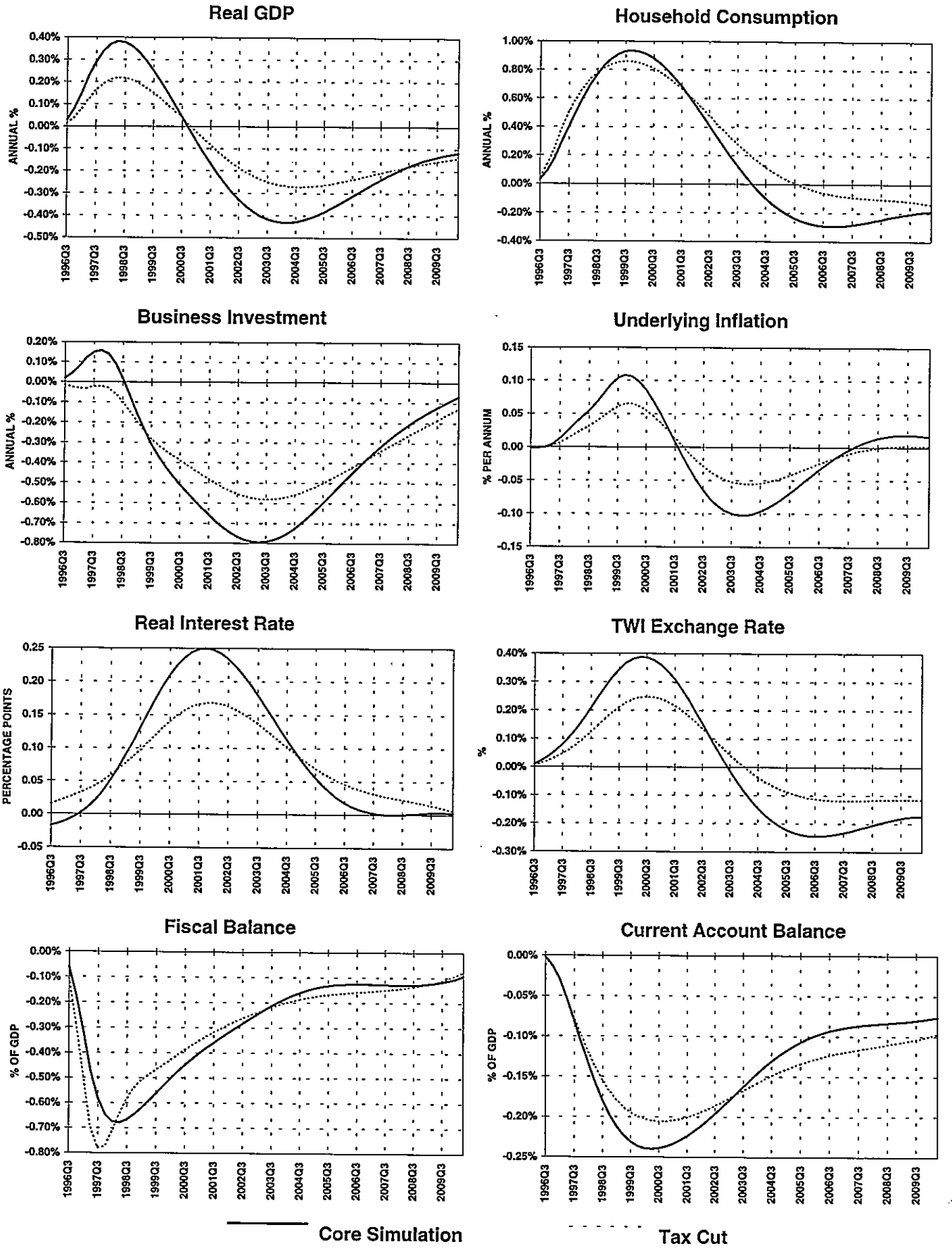


Figure 3: Impact of the Risk Premium

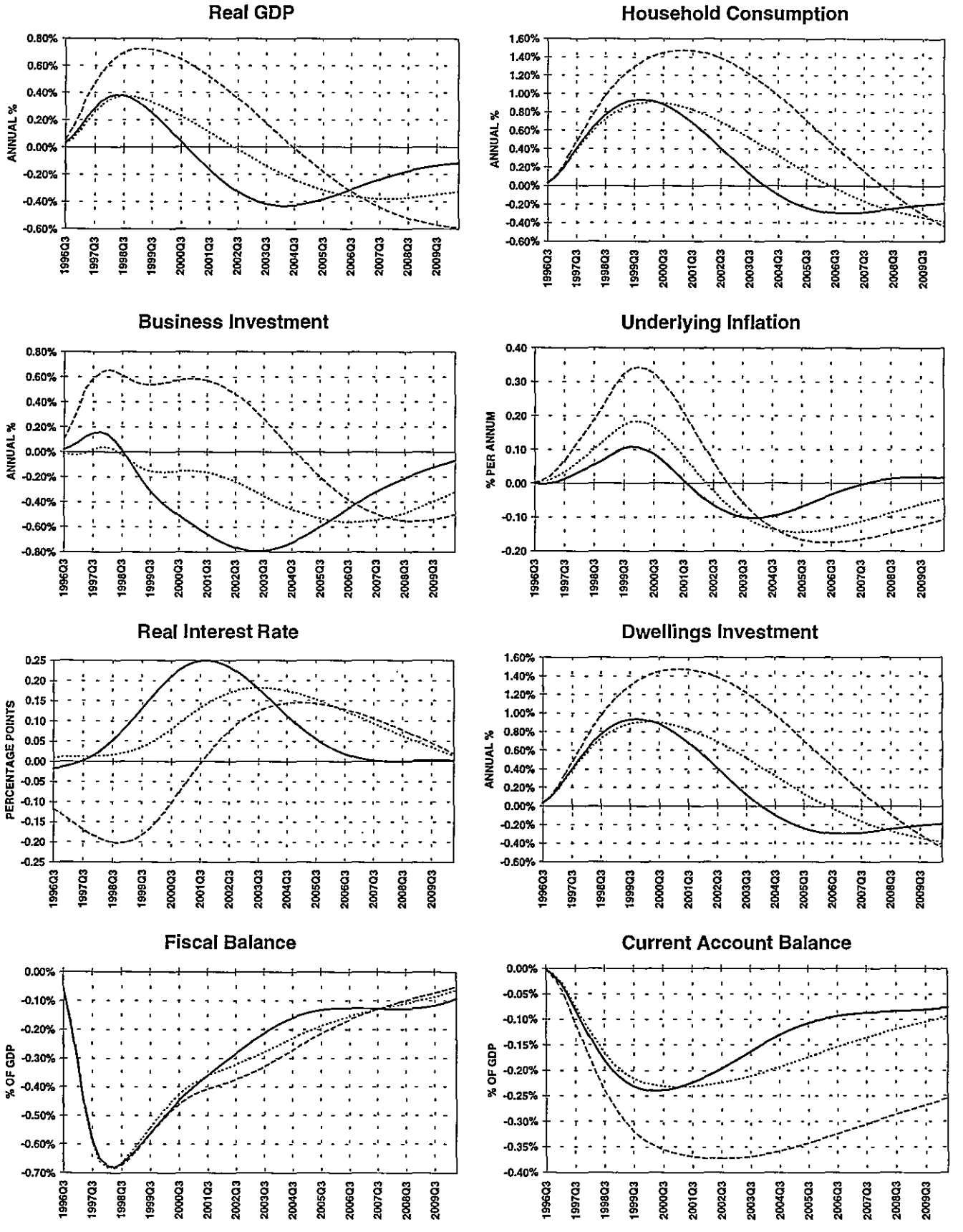


Figure 4: Speed of Adjustment

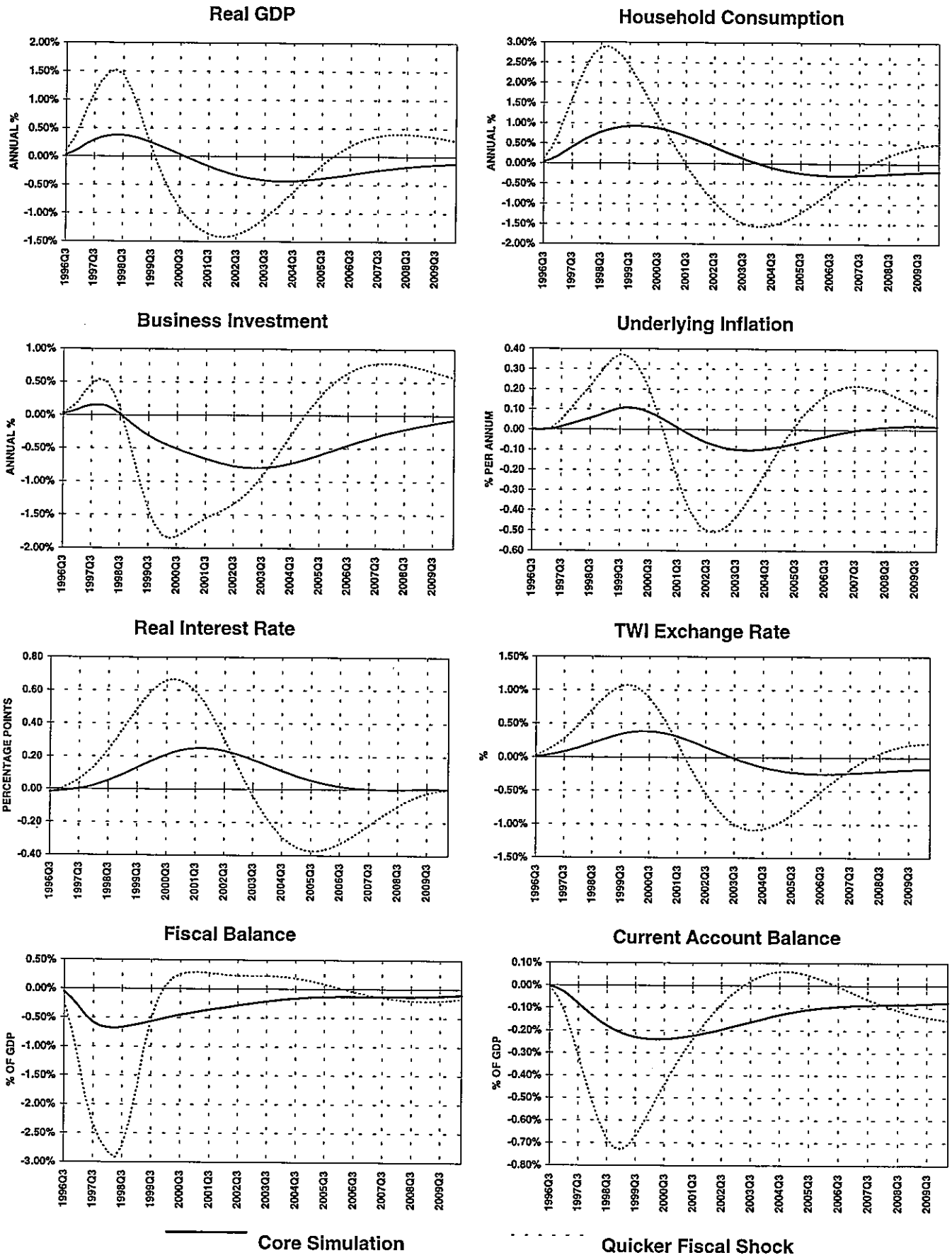
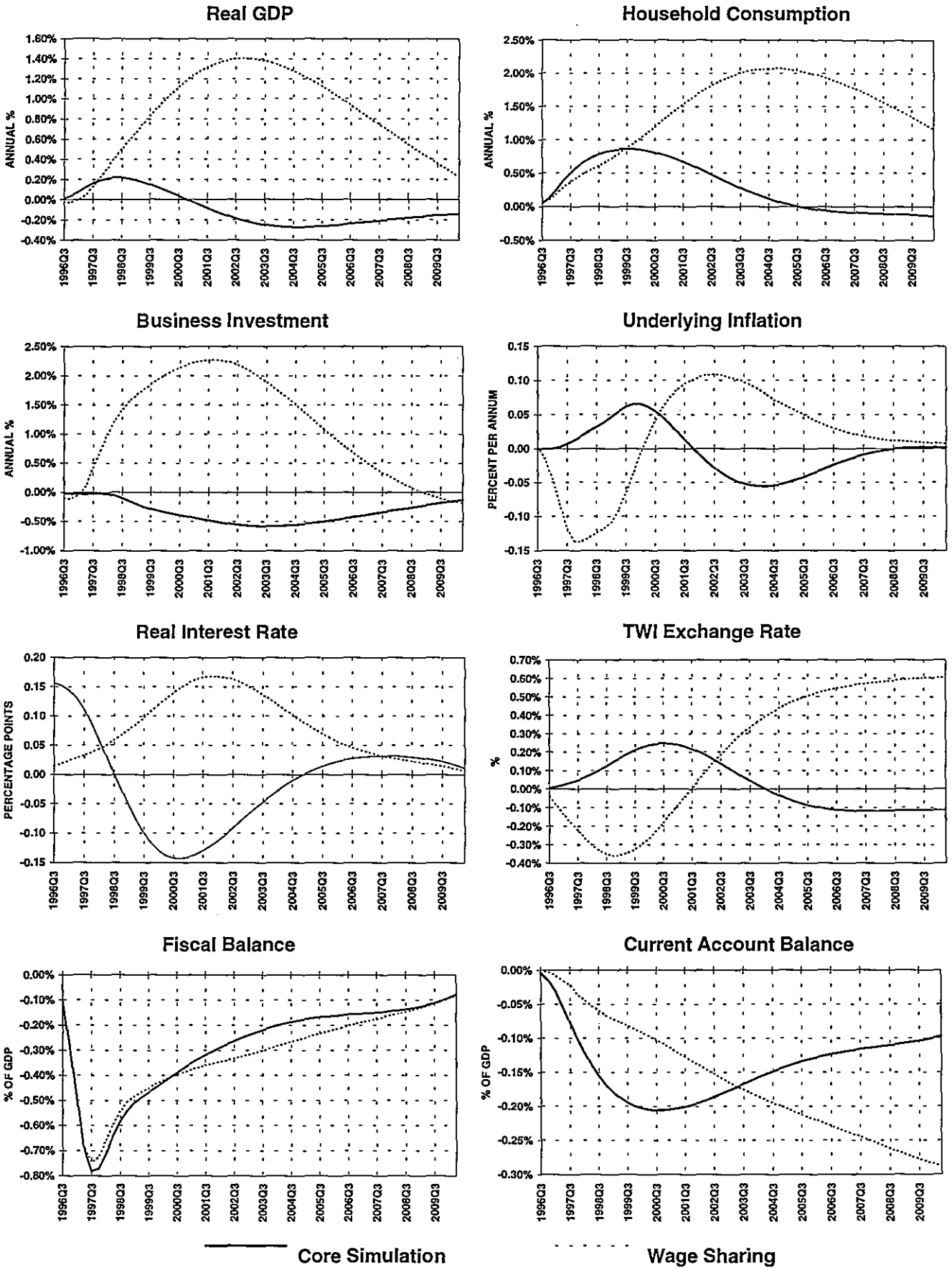


Figure 5: Alternative Wage Rate Assumptions



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