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Three Essays on Current Account Dynamics

Cesar R. Sobrino

Dissertation Submitted to the
College of Business and Economics at
West Virginia University
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
In
Economics

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Productivity Shocks, Terms of Trade Shocks

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ABSTRACT

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Cesar R. Sobrino

Current account imbalances are always a concern for macro policymakers as they can lead to balance of payments crises. However, both governmental policy interventions and external economic fundamentals may affect the current account. This thesis empirically examines the effects of the policy interventions and shocks to external economic fundamentals on the current account.

In Chapter 1, I study the effect of the fiscal deficit on the current account in Peru. I test whether the twin deficit hypothesis holds after the stabilization program and structural reforms of 1991 took place. Even though the new regime was much more financially open, this hypothesis does not hold. Estimates imply that these policy reforms were not enough to generate a response of current account to fiscal shocks.

In Chapter 2, I reexamine the empirical hypothesis that states that the inflation targeting regime does not affect current account. Inflation targeting leads to a fall in real interest rate and lowers macroeconomic uncertainty by reducing exchange rate volatility and output volatility. Economic theory implies that all of these changes should worsen current account. The new estimates show that, consistent with economic theory, inflation targeting does affect current account negatively once global shocks are properly accounted for.

In Chapter 3, I examine the effects of permanent terms of trade shocks in Norway on current account and productivity. Using structural VAR analysis with long-run restrictions, the empirical results show an improvement in the current account of Norway following a permanent shock to terms of trade. However, the permanent shock to terms of trade has very little effect on output per capita growth. Overall, the evidence suggests that shocks that have permanent effects on terms of trade or output per capita do not have permanent effects on each other.

Chapter 4 concludes.

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Any errors are the sole responsibility of the author.

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Chapter 1

Openness and Twin Deficits Hypothesis: A Short-Run Analysis of Peru

1.1 Introduction

In 1990, to reduce and stabilize inflation, the new government of Peru, guided by IMF policies, was committed to diminish the fiscal deficit by reducing fiscal spending, increasing tax collection, eliminating tax exemptions, eliminating subsidies, and privatizing public firms. Later on, these policies were accompanied by trade and financial openness, and reforms in the social insurance and labor markets. Financial openness often makes a country vulnerable to balance of payments crises as the fiscal deficit or spending no longer crowd out investment by increasing the real interest rate.

The twin deficit hypothesis argues that fiscal deficits lead to current account deficits. This hypothesis is examined by Corsetti and Müller (2006), hereafter CM, in an intertemporal framework. CM argue that the short-run effects of fiscal deficit on current account depend on the openness of the economy and the persistence of fiscal spending shocks. Under those two conditions, the relationship between fiscal deficit and current account deficit is clearly positive and significant in the short-run. Their empirical findings show that this linkage is strong for Canada and the UK which are relatively open economies. This result should be even stronger for developing countries where fiscal spending often crowds in investment rather than crowding it out.

This chapter addresses whether the change in financial openness in Peru was sufficient to generate a differential response of current account to a fiscal shock. Using quarterly data, the relationship between fiscal variables on current account is fairly weak in Peru. The reforms of

1991 did not significantly modify this relationship. Increased openness did not alter the relationship between current account and fiscal deficit. This result is robust to using OLS estimation and VAR estimation. Two possibilities that potentially explain this result are: 1) opening of the economy was not large or broad enough to modify the relationship and/or 2) the relationship depends on institutional factors beyond trade and financial openness that did not change much across the two regimes.

The organization of this chapter is as follows. Section 1.2 briefly describes Peru's economic environment over the last thirty years. Section 1.3 discusses the theoretical background and empirical literature on the relationship between fiscal deficit and current account balance. Section 1.4 presents the basic model, data, and the regression estimates. Structural VAR specifications and results are discussed in section 1.5 and section 1.6 concludes.

1.2 Economic Changes in Peru

1.2.1 Economic Context Previous to 1990

In the late 1960s, the Peruvian government began to increase its role in the economy through not only expansionary fiscal policies, holding high import tariffs and capital controls, and controlling the exchange rate, but also by founding government owned telecommunication, mining, oil, and energy enterprises. Between 1978 and 1982, protectionism policies such as trade tariffs were relaxed to spur competitiveness which was supported by subsidies for exporters.

In 1985, when faced with high inflation and high external debt, the new Peruvian government began to use demand-side policies. Salaries and the exchange rate were controlled and high imports tariffs were imposed. The economic success of the first years began to vanish due to the lack of fiscal budget funds, a fall in private investment, and a limited export sector

which boosted inflation and caused a recession. In 1990, the economic scenario encompassed high inflation, sluggish output, negative fiscal and external balances, together with corruption and terrorism.

1.2.2 1990 Stabilization Policies and Structural Reforms

In August of 1990, after applying a drastic price shock, supported by IMF, the new government began to reduce the fiscal deficit by improving tax collection, reducing fiscal spending, and eliminating both subsidies and tax exemptions. In addition, the central bank set the money growth as a nominal anchor. At this point, the exchange rate was almost freely determined.

Along with these initial policies, shown in Table 1.1, the average tariff level was decreased from 66 percent to 17 percent in the first quarter of 1991 to decrease the price level and increase the competitiveness of the country. Moreover, in the same year, capital controls were eliminated to diminish financial costs, increase financial deepening and FDI. The averages of trade and financial openness are statistically different in the 1980s and 1990s, as shown in Table 1.2.

As part of long-term reform, the government privatized energy, mining, and telecommunication firms to reduce the fiscal deficit and to increase investment in these sectors. Moreover, to increase private savings, a new private retirement program began in 1993. Finally, the reform brought a more flexible labor market.

Central bank commitment to decrease inflation was successfully supported by small fiscal imbalances, as illustrated in Figure 1.1. Table 1.3 shows the statistical comparisons of several variables across the two regimes. Note that the averages of inflation are statistically different across the two regimes. Likewise, the average of budget balance surplus was also statistically different. In addition, even though the output fluctuations were reduced after

stabilization policies, the averages of the real GDP growth are not statistically different across regimes.

Figure 1.2 shows that in spite of the small fiscal imbalances, current account deficits were still present during the 1990s. However, across the two regimes, the current account average is statistically different, as shown in Table 1.3. These imbalances could have been caused by the appreciated real exchange rate¹ and trade openness. However, after 1998, there is a reverting tendency in the current account attributed to improvement in the terms of trade and the maturity of the long-term reforms as the new social insurance program was applied.

1.3 Theory and Past Empirical Literature

1.3.1 Twin Deficits Hypothesis

The twin deficit hypothesis, hereafter TDH, states that fiscal deficits induce current account deficits. There are two approaches that explain this hypothesis: the Ricardian Equivalence Hypothesis (REH)² and Mundell-Fleming Model (IS-LM). According to the former, if there is a change in tax policies, there is no link between the fiscal deficit and the current account deficit. However, other things equal, the TDH holds after an increase in government expenses.

According to IS-LM, assuming sticky prices and non-perfect capital mobility, a fiscal deficit increases the real interest rate which boosts private savings and dampens private investment. The final effect on the current account is unclear because it depends on the magnitude of the changes in public savings, private savings and private investment.

¹ In spite of the large depreciation of the nominal exchange rate (above 4,000 percent), price adjustment brought an appreciated real exchange rate. This was accentuated by financial openness.

² An extension is the overlapping generations model where a negative variation in taxes affects consumption and net wealth decisions, and a current account deficit is achieved (Obstfeld and Rogoff: 1996).

On the other hand, under sticky prices, perfect capital mobility, and a flexible exchange rate, the real interest remains unchanged implying no response in private savings and private investment to variations in public savings. The initial increase in the domestic real interest rate attracts foreign capital, which appreciates the exchange rate, deteriorating the trade balance. As the expansionary fiscal policy is offset by the fall in trade balance, the real interest rate returns to its initial level. Then, there is a positive linkage between the budget deficit and the current account deficit.

After extending the Mundell-Fleming approach and including inter-temporal decisions in a general equilibrium model with microfoundations, CM argue that the relationship between the current account deficit and fiscal deficit is more important in open economies than in closed economies. Two crucial conditions underlying this statement are: persistent fiscal spending shocks on domestic goods and openness³.

Persistent fiscal shocks on domestic goods have a lasting appreciation of terms of trade and increase the real interest rate, which boosts private savings and dampens private investment. This change in terms of trade increases the price of domestic goods relative to investment costs which, given the marginal product of capital, increases the real return to investment. So, in this framework, investment is affected by not only the real interest rate but also real return to investment. In closed economies, the former effect on investment is stronger than the latter. In this case, the TDH does not hold because of the indeterminate effect on the current account.

In open economies, given the marginal product of capital, the real return to investment increases by the amount of the increase in the price of domestic goods relative to investment costs which increases due to the lasting appreciation of the terms of trade and the degree of

³ This model does not distinguish between trade and financial openness. Moreover, since the exchange rate effect on the trade balance is ruled out, fiscal policies cannot affect the exchange rate.

openness. The more open the economy, the larger the effect of a fall in terms of trade is on the price of domestic good relative to investment costs. Finally, the current account deficit is entirely attributable to increased investment and reduced public savings⁴.

The evidence supports the predictions of the CM model. They find that in Canada and the UK, the TDH holds in the short-term. As being relatively open economies, Canada and the UK show persistent fiscal spending. The TDH does not hold for the US and Australia, because they are relatively closed economies. However, the evidence does not support the terms of trade response to fiscal shocks. Their innovative channel transmission does not match the evidence.

Peru opened its economy in the early 1990s. From 1980 to 2006, there were two regimes: 1) non-perfect capital mobility and high tariff barriers and 2) perfect capital mobility and low tariff barriers. For the 1980s, IS-LM and CM predict that the TDH does not hold because of non-perfect capital mobility and high tariff barriers. For the 1990s, the CM prediction depends on the persistence of fiscal spending shocks. In Table 1.2, the persistence of fiscal budget and government expenses remains low and similar across both regimes⁵. Therefore, the TDH would not hold in the 1990s.

1.3.2 Past Empirical Literature

There is a vast literature about the TDH. Using data for OECD countries in the period 1972-2003, Bartolini and Lahiri (2006) find that the TDH holds. Similarly, Chinn and Prasad (2003), using a larger data, find a positive relationship between the current account deficit and the fiscal deficit (coefficient is less than one). Extending and updating the previous article, Chinn and Ito (2007) analyze the “Saving Glut Hypothesis” and obtain similar estimates.

⁴ Specifically, CM present three scenarios: 1) complete international markets and inelastic labor supply; 2) incomplete international financial markets and inelastic labor supply; and, 3) incomplete international financial markets and elastic labor supply.

⁵ CM find that fiscal persistence values exist for: Canada (0.93), US (0.85), UK (0.77), and Australia (0.69).

For 21 OECD and G7 countries, Bussière, Fratzscher and Müller (2005) find that the contemporaneous effects of fiscal deficits on current account deficits are very small (only significant for OECD countries). Using a panel data model and extending the Glick and Rogoff's (1995) model, they include the primary budget balance in the current account equation and assume both Ricardian and non-Ricardian consumers⁶.

For the US, Erceg, Guerrieri and Gust (2005) analyze the effects of positive fiscal shocks on the trade balance. They use a calibrated model including both Ricardian and non-Ricardian consumers, in which known features of the US economy are included. Their findings indicate that the increase in government expenditures and the decrease in labor income tax rate have small negative effects on the trade balance.

On the other hand, using US quarterly data and an unconstrained VAR, Enders and Lee (1990) examine the REH. Their variance decomposition estimation shows that the main source of current account fluctuations is its own shock. Secondary determinants are government expenditures and public debt. The fiscal spending shocks induce a large and persistent current account deficit, and public debt shocks worsen the current account in the short-run.

Recently, business cycles have been isolated to control for co-movements between both balances because the budget balance is pro-cyclical and current account is counter-cyclical. CM, setting short-term restrictions, use a SVAR to study the transmission of fiscal shocks in Australia, Canada, the UK and the US. Here, the TDH holds for Canada and the UK which are open economies and where the fiscal spending is persistent.

Kim and Roubini (2008), also using an SVAR and imposing short-run restrictions, find that US data presents a twin divergence instead of the TDH. They explain that fiscal shocks negatively affect private investment and positively affect private savings which are caused by the

⁶ Glick and Rogoff (1995) assume Ricardian consumers. Therefore, tax policies cannot affect the current account.

increase of the real interest rate. Then, even though there is a fall in public savings, the current account is positively affected.

Finally, for Brazil, Islam (1998) uses Granger's test of causality. His estimates indicate that there is a bilateral causality between both current account deficit and fiscal deficit.

1.4 Basic Regression

To test the linkage between current account and fiscal balance, I employ a linear model. The current account surplus and fiscal surplus are the dependent and independent variables, respectively. The fiscal variable is presented through two multiplicative dummies to differentiate the two regimes (sub-samples). In addition, output gap is included to control the cyclical component of the current account and the fiscal balance. This "Gap" is also represented using two multiplicative dummies to differentiate the two regimes. This specification takes the following form:

$$CA_t = \beta_0 * D_t + \beta_1 * (1 - D_t) + \beta_2 * FS_t * D_t + \beta_3 * FS_t * (1 - D_t) + \beta_4 * Gap_t * D_t + \beta_5 * Gap_t * (1 - D_t) + \varepsilon_t$$

where CA_t is the current account – nominal GDP ratio, FS_t is the fiscal surplus – nominal GDP ratio; Gap_t is the output variable⁷, and ε_t is the stochastic term. D_t is the time dummy which is equal to one for the period 1980:1-1991:1, otherwise is zero. Since the financial and trade liberalizations started in March, the break point is the first quarter of 1991. When interpreting the estimates, the TDH holds in both regimes if β_2 and β_3 are positive. Moreover, if individuals are Ricardian, fiscal deficit effects on the current account are not relevant⁸. In this case, fiscal

⁷ Obtained from real GDP using HP filter.

⁸ Using Ricardian Equivalence, Balvers and Bergstrand (2002) point this out. If fiscal spending is financed by lump-sum taxes, budget deficit is not relevant. However, higher fiscal spending implies higher future taxes, concluding, there is no linkage between the external balance and the fiscal balance.

surplus is replaced by fiscal spending. Then, government spending explains current account imbalances. In this case, β_2 and β_3 should be negative.

In a closed economy, the movements in private savings and private investment might offset changes in public savings. In addition, despite openness, increases in private savings and decreases in private investments might also mitigate the effects of fiscal imbalances on current account. In this case, private investment-GDP ratio and private savings-GDP ratio are included as dependent variables as opposed to current account.

Finally, I employ an alternate regression beginning in 1993:1 to compare with the initial specification.

1.4.1 Data

Quarterly data from 1980:1 to 2006:3 was available from the Central Bank of Peru. Current account-GDP and fiscal budget-GDP are presented in Figure 1.2. In almost all years, the current account-GDP ratio is negative; and, for the 1990s, fiscal budget-GDP generally presents a surplus. In Figure 1.3, current account-GDP and fiscal spending-GDP are shown.

Descriptive statistics of the current account surplus and fiscal surplus are shown in Table 1.3. For both ranges, correlations are positive and the highest values correspond to the first sub-sample. In the second sub-sample, the correlation is positive but small in value. A causal glance finds no positive relationship between these imbalances in the second sub-sample when the economy is relatively open.

In Table 1.3, the descriptive statistics of fiscal spending are shown. The cross correlation of current account and fiscal expenditures is negative except for in the second regime. A first sight, there is no negative relationship between fiscal spending and the current account in the second sub-sample when the economy is relatively open.

1.4.2 Estimates using Fiscal Surplus

OLS results, shown in Table 1.4, indicate that for both regimes, fiscal surplus coefficients are not significant. Using Wald-Test, I cannot reject the null at the 5 percent level of significance that both coefficients are equal ($\beta_2=\beta_3$). This means that they cannot be differentiated across regimes. Hence, reforms did not alter current account behavior due to fiscal surplus.

Regarding private investment regressions, the fiscal surplus coefficient is positive and significant at the 5 percent level in the first regime. For the second regime, the fiscal surplus coefficient is negative and not significant. In addition, I reject the null at the 5 percent level of significance that both coefficients are equal. The results imply that the effects of fiscal surplus on private investment can be differentiated across regimes. However, there is evidence that the fiscal surplus affects investment in the first regime which means that changes in investment offset any change in fiscal surplus.

Regarding the savings regressions, estimates are not significant. Finally, using private investment as the dependent variable, *Gap* estimates are positive and significant across regimes. For current account specifications, coefficients are negative and significant in the first regime and, for private savings specifications, coefficients are not significant.

1.4.3 Estimates using Fiscal Spending

Results for current account specifications presented in Table 1.4 indicate that the public spending coefficient is negative and significant at the 10 percent level in the first regime and not significant in the second regime. These estimates can be differentiated across regimes. Then, despite openness, the TDH does not hold.

Estimates regarding the private investment regressions indicate that the coefficient is positive and significant at the 5 percent level in the first period. For the second regime, this

coefficient is positive and significant at the 1 percent level. These outcomes cannot be differentiated across regimes ($\beta_2=\beta_3$). Therefore, reforms did not alter investment across regimes. Peruvian data shows that fiscal spending crowds in investment across regimes. However, in spite of this crowding in, the TDH does not hold in the 1990s.

Regarding private savings specifications, the evidence indicates that the coefficient is positive and significant at the 5 percent level in the first regime. However, the estimates cannot be differentiated across regimes.

1.4.4 Estimates for Post Structural Reforms

Using the sample 1993:1-2006:3 for current account regressions, the estimates, shown in Table 1.5, indicate that neither fiscal surplus nor fiscal spending affect the current account. These outcomes are identical to those reported in Table 1.4 (0.18 and 0.17, respectively) implying that the initial break point is a reasonable date and the residuals are generated by similar processes.

Setting private investment as the dependent variable, the results do not show that fiscal surplus affects the current account. This outcome is equal to that reported in Table 1.4 (-0.05). Likewise, the fiscal spending coefficient is positive and significant at the 1 percent level and equal to that reported in Table 1.4 (0.59) as well.

Private savings estimates show that fiscal surplus does not affect private savings. This outcome is again equal to that reported in Table 1.4 (-0.06). Also, the fiscal spending coefficient is positive and significant at the 10 percent level which is identical to that reported in Table 1.4 (0.35). In this case, households increase private savings since increased fiscal spending would imply a higher future tax level (REH).

In summary, the TDH does not hold in the first regime because the fiscal surplus crowds out investment. When fiscal spending is the independent variable, the TDH holds in the first

regime which will be corroborated with SVAR estimates. The TDH does not hold in the second regime because despite the crowding in effect that matches CM, there an increase in private savings.

1.5 Structural VAR Technique

Structural VAR specifications can be used to examine the dynamics of the current account. In this approach, current account surplus, fiscal surplus, and output fluctuations are set. Output fluctuations are included to control cyclical fluctuations. For just-identify systems, three short-term restrictions are established. The SVAR system is as follows:

$$\begin{bmatrix} 1 & 0 & 0 \\ h_{21} & 1 & 0 \\ h_{31} & h_{22} & 1 \end{bmatrix} \begin{bmatrix} Gap_t \\ FS_t \\ CA_t \end{bmatrix} = H^0(L) \begin{bmatrix} Gap_{t-1} \\ FS_{t-1} \\ CA_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_G \\ \varepsilon_F \\ \varepsilon_C \end{bmatrix}$$

ε_G , ε_F and ε_C are the short-term innovations of Gap_t , fiscal surplus or fiscal spending(FS_t), and current account (CA_t), respectively⁹. $H^0(L)$ is the matrix of the lag polynomials.

1.5.1 Impulse-Response and Forecast Error Variance Decomposition

Over 20 quarters, impulse-response indicates that in the first quarters, the response of current account to fiscal surplus shocks is very small. The initial responses are different in sign for both regimes. For the first regime, there is a positive effect on current account after fiscal innovations (Figure 1.4). For the second regime, the result is negative. The only responses that are significant are in the last quarters and only in the first regime.

Table 1.6 shows the variance decomposition results. For the first sub-sample, fiscal shocks play a minor role in current account fluctuations. Gap innovations are an important source of current account variations which justifies the inclusion of two multiplicative dummies

⁹ Unit root results indicate that all these processes are stationary. I use the Augmented Dickey-Fuller test (ADF), setting intercept and twelve lags.

in the linear specification. Cyclical shocks are more important than fiscal innovations in the closed economy. In the second regime, fiscal shocks are more important than cyclical shocks on current account fluctuations. For the sub-samples, specifically the second, current account shocks play a larger role in current account variations.

On the other hand, using fiscal expenses instead of fiscal surplus (Figure 1.5), over 20 quarters, there is a small negative effect of the fiscal spending shock on the current account in the first ten quarters of the first regime. For the second regime, there is almost no response and all responses are not significant. This evidence does not corroborate the estimate reported in Table 1.4 for the first regime.

In Table 1.7, variance decomposition outcomes using fiscal spending innovations are shown. The fiscal spending shocks play a more important role in influencing current account movements in the first regime than in the second regime. For the same sub-sample, *Gap* shocks play a larger role than fiscal spending innovations in current account variations. For the second period, cyclical and public spending variations play only a minor role in current account fluctuations. For both sub-samples, current account shocks are the most important source of current account movements.

In summary, in both regimes, current account fluctuations do not respond to fiscal surplus and fiscal spending shocks. Fiscal surplus estimates specifically are different from CM results, at least for the 1990s. CM identify a strong relationship between both balances in a relatively open economy whereas my estimates do not.

1.6 Conclusions

One of the key elements of the IMF stabilization package for Peru in 1991 was liberalization of the Peruvian financial sector. Financial openness often makes a country vulnerable to balance of payments crises as the fiscal deficit or fiscal spending no longer crowds out the investment through an increase of the real interest rate. This chapter explores whether newfound financial openness in Peru was sufficient to generate a differential response of current account to a fiscal shock. Results show that the linkage between fiscal variables and current account is fairly weak. The reforms of 1991 did not significantly change the relationship. Results are robust to using both OLS and VAR estimation techniques. Two possible explanations are: 1) Openness was not large or broad enough to modify the relationship and/or 2) the relationship depends on institutional factors beyond trade and financial openness which did not change much across the two regimes.

Chapter 2

The Effects of Inflation Targeting on the Current Account: An Empirical Approach

2.1 Introduction

Empirical studies have found that adoption of inflation targeting reduces the domestic real interest rate, lowers inflation rate, reduces the volatility of output growth and also reduces exchange rate volatility. Economic theory suggests that, these “stylized facts” should worsen current account through reduction of savings and increases in investment. However, Rose (2007) reports very little empirical association between inflation targeting and current account. The study found no significant difference between targeters and non targeters. A casual look at the current account data for targeters in Figure 2.1 indeed suggests an improvement in the current account after the adoption of the inflation targeting regime. The issue is crucial for policymaking as some of the countries like Brazil, Thailand and South Korea did adopt inflation targeting after a balance of payments crisis.

The goal of this chapter is to examine the effects of inflation targeting on the current account in more detail. Taking the Chinn and Prasad’s (2003) empirical model as a benchmark model, I use a 35 year unbalanced panel dataset for 19 inflation targeting countries to examine how the current account behaves after a country adopts inflation targeting. Moreover, I account for global shocks such as US growth rate, global real interest rate movements and oil price changes to identify pure targeting effects on the current account.

The estimates show that after appropriately accounting for global shocks, inflation targeting does have a negative effect on current account, a result consistent with macroeconomic theory. The magnitude of negative change in current account is somewhere from 1.2 percent to

1.8 percent of GDP. Further examination suggests that the negative effect on the current account manifests itself through lower output volatility in the short- and medium-term and increased financial openness in the medium-term.

The organization of this chapter is as follows. Section 2.2 describes and discusses the characteristics of inflation targeting policy and its empirical stylized facts. Section 2.3 briefly discusses the transmission channels of inflation targeting on the current account. Section 2.4 presents the empirical model, a brief description of the targeters, and estimates; and, section 2.5 concludes.

2.2 Inflation Targeting

2.2.1 An Overview

There are five elements that define a full-fledged inflation targeter. According to Mishkin (2000), these elements are: “(i) the public announcement of medium-term numerical target for inflation; (ii) an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; (iii) an information-inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for deciding the setting of policy instruments; (iv) increased transparency of the monetary-policy strategy through communication with the public and the markets about the plans, objectives, and decisions of the monetary authorities; and (v) increased accountability of the central bank for attaining its inflation objectives”¹⁰.

¹⁰ Mishkin and Schmidt-Hebbel (2000) indicate that targeters present different characteristics according to target price index, target width, target horizon, escape clauses, accountability of target misses, goal independence, and transparency and accountability with respect to leading of policy under inflation targeting.

The above discussion implies central bank commitment, policy independence, absence of fiscal dominance, and other nominal anchors such as money growth and exchange rate¹¹ in full-fledged inflation targeters. According to Corbo and Schmidt-Hebbel (2002), Fraga, Goldfajn and Minella (2003), and Mikek (2004), fiscal discipline is important to increase the confidence of the private agents of the new regime.

The mechanism of inflation targeting is based on Taylor's rule. Taylor (1993) indicates that central banks should change the policy rate in response to output and inflation deviations. For a targeter, the policy response should be accordingly adjusted only with respect to inflation. Ball (1998) and Svensson (2000) suggest that in open economies, Taylor's rule should be modified to account for exchange rate fluctuations as well.

2.2.2 Empirical Stylized Facts

According to Levin, Natalucci and Piger (2004), inflation targeting has played a significant role in anchoring long-term expected inflation. Their estimates indicate that current inflation changes have very little effect on the long-run expected inflation. This means that economic agents believe central bank announcements. According to Neumann and von Hagen (2002), inflation targeting results in stable and lower inflation, stable and lower interest rate¹², and a stable growth rate. Petursson (2004) finds that inflation targeting brings lower inflation levels, stable inflation, lower inflation expectations, reduced inflation persistence and lower short-run nominal interest rate. However, Levin et al. (2004) and Gürkaynak, Levin and Swanson (2006) do not find supporting evidence on reduction in output growth volatility between targeters and non-targeters.

For Latin America, Corbo and Schmidt-Hebbel (2002) find that targeters have achieved lower inflation levels lower sacrifice ratios and decreased output volatility. For Brazil, Chile, and

¹¹ Bernanke and Mishkin (1997).

¹² According to Geraats, Eijffinger and van der Cruysen (2006), transparency causes a decrease in short- and long-term nominal interest rates because private agents can predict future inflation.

Mexico, Schmidt-Hebbel and Werner (2002) indicate that there are lower sacrifice ratios and also lower output volatility levels after the adoption of inflation targeting. OECD data used by Ball and Sheridan (2005) does not indicate that inflation targeting improves economic performance. Although inflation, short-term interest and annual growth rates are less volatile for the targeting period, inflation targeting does not cause the lower volatility levels in inflation, interest rate and growth rate.

In addition, Calvo and Reinhart (2002) find that relative exchange volatility is lower in developing countries using a managed float regime than in developed countries using a floating regime. For Brazil, Chile, and Mexico, Schmidt-Hebbel and Werner (2002) find that the absolute volatility of the exchange rate is very similar to that of Australia, Canada and New Zealand¹³.

The basic inflation targeting stylized facts are stable and lower inflation, stable and lower interest rates, and a stable output growth rate. In addition, there could be lower inflation persistence, an anchored long-term expected inflation rate, and lower exchange rate volatility. However, one reason for the drop in the real interest rate might be highly integrated financial markets that, in most cases, are adopted by targeters.

An initial look at the data in Table 2.1 suggests that for almost all targeters the real interest rate is lower after the adoption of inflation targeting. However, Hungary, Israel, Norway and Switzerland experience a rise in the real interest rate after the adoption of inflation targeting. For Brazil, Korea, Mexico and Thailand, the data confirms the Levin et al.'s (2004) result of lower real interest rate after the implementation of inflation targeting.

¹³ According to Corbo and Schmidt-Hebbel (2002), most developing countries apply a dirty float regime due to pass-through effects on inflation and large risks of exchange adjustment when individuals have debts in foreign currency and wealth in domestic currency. Likewise, private banks, having a high level of liabilities in foreign currency, are overexposed to drastic changes in the exchange rate.

2.3 The Transmission Channels of Inflation Targeting on the Current Account

Inflation targeting should affect the current account since output deviations are part of both the targeting rule and the fundamental equation of the current account. The initial evidence shows less output growth volatility, shown in Figure 2.2 and increasing growth rate after the adoption of inflation targeting. In this sense, according to Mishkin (1999), once low inflation rates are achieved, inflation targeting is not harmful to the real economy. Therefore, given the output growth rate in targeting countries, inflation targeting controls inflation and promotes economic growth. According to Milesi-Ferreti and Razin (1996) and Calderon, Chong and Loayza (2002), the output growth rate is negatively related to the current account because output growth primarily spurs future investment.

The absence of fiscal dominance is important because it increases the confidence of the private agents. Theoretically, assuming non-Ricardian consumers, a fall in the budget deficit implies an improvement in public savings which, other things equal, positively affects the current account. However, an increase in fiscal savings also leads to a lower real interest rate which encourages both consumption and investment. Thus, the net effect on the current account is ambiguous.

The lower real interest rate positively affects consumption and investment, thereby negatively affecting the current account. According to Obstfeld and Rogoff (1996), the two important effects on consumption after a real interest rate change are substitution and the difference between wealth and income effects. The substitution effect is always negative because an increase in the real interest rate makes savings more attractive and induces people to reduce present consumption. Present consumption is more expensive, and future consumption is cheaper. The income-wealth effect is related to the intertemporal terms of trade and its effect on

consumption after changes in the real interest rate. The total effect on consumption is negative if individuals are net borrowers in period 1. In contrast, it is positive if individuals are net creditors in period 1, and the income-wealth effect is larger than the substitution effect.

On the other hand, stable inflation may decrease macroeconomic uncertainty which leads to a lower level of precautionary savings and an increase in investment. This leads to a fall in the current account. For the US, the UK, Japan and Canada, Ghosh and Ostry (1997) assess the effects of macroeconomic uncertainty on precautionary savings and the current account. In their framework, macroeconomic uncertainty dampens investment and encourages precautionary savings, improving the current account.

Finally, following Nadal-De Simone (1997), Ball (1998) and Svensson (2000), another possible transmission channel is the real exchange rate. If there is an increase in the exchange rate, it positively affects inflation. Given the target rule, the monetary authority responds by increasing the policy rate in order to appreciate the exchange rate which negatively affects the current account. According to Leiderman, Maino, and Parrado (2006), the low exchange rate volatility would indicate that, for a stable exchange rate, central banks are sacrificing competitiveness. This implies a negative effect on the current account.

Controlling for the global shocks such as the global real interest rate, oil prices and the US growth rate, inflation targeting policy might negatively affect the current account through increases in consumption and investment due to a lower real interest rate. Moreover, less macroeconomic uncertainty may dampen precautionary savings and encourage investment which also results in a negative effect on current account. The stable exchange rate would indicate a less competitive economy, worsening the current account. Finally, the stable output growth rate should spur future investment, also worsening current account.

2.4 Panel Data Model and Estimates

Following the Chinn and Prasad's (2003) specification, I use the empirical model:

$$CA_{it} = \theta_0 + \theta_1 ITD_{it} + \sum_j \theta_j K_{jit} + e_{it}$$

where CA_{it} is the current account-GDP ratio for country i at time t ; ITD_{it} is an inflation targeting dummy: Country i in targeting period is one, otherwise it is zero (Table 2.2); K_{jit} is the set of control variables for country i at time t which include fiscal balance-GDP ratio, net foreign asset-GDP, financial deepening, inflation volatility, relative income, relative income squared, terms-of-trade volatility, financial openness, trade openness, output growth rate, lag of current account-GDP ratio, lag of change in real exchange rate. If θ_1 is negative, it means that the net impact of inflation targeting on the current account is negative.

Chinn and Prasad (2003) have medium- and long-term (5-year average and 25-year average samples, respectively) motivations about current account movements. For their annual estimates, fiscal balance, net foreign assets, financial deepening, terms of trade volatility, and the lag of the current account-GDP ratio are significant. For industrial economies, the lag of the change of the real exchange rate is significant at the 5 percent level. For developing countries, relative income and relative income squared are significant. For the full sample, without Africa, trade openness is significant at the 10 percent level. Financial openness is not significant. In addition, following Calderon et al. (2002), I include inflation volatility to control for the effects of precautionary savings. Finally, unlike Rose (2007), I include time effects to isolate the effects of worldwide shocks on the current account because they affect targeters and non targeters, similarly.

Other things equal, if the twin deficits hypothesis holds, the absence of fiscal dominance should increase the current account. Financial deepening increases the current account because it

should be an important determinant of savings¹⁴. According to Calderon et al. (2002), the effect of output growth on current account should be negative. There are two proxies for macroeconomic uncertainty: inflation volatility and terms of trade volatility¹⁵. Both proxies encourage precautionary savings and discourage investment¹⁶. The stable exchange rate implies a negative impact on the current account. Trade and financial openness are related to the effects of tariff barriers on the trade balance and the effects of capital controls on the capital account. Reducing tariff barriers should decrease the costs of import goods and reduce the effect of those barriers on the consumer price index. Finally, financial openness should decrease financial costs and the domestic interest rate.

To estimate θ_I , for annual and 5-year average samples, there are three specifications: 1) pooled OLS; 2) pooled OLS and global shocks; and 3) imposing time effects. In these simple regressions, the second and third outcomes will be compared to see the pure effects of inflation targeting on the current account and determine the sign of *ITD*.

The next step is to identify the transmission channels of inflation targeting on the current account. Including all control variables and using annual and 5-year average samples, the specifications are related to avoiding fiscal balance, financial openness, inflation volatility, terms of trade volatility, real exchange rate, trade openness, output growth and financial openness. Excluding and including those variables, six specifications are set: 1) including all control variables; 2) not including inflation and terms of trade volatilities; 3) avoiding real exchange rate and trade openness; 4) not using fiscal balance and financial openness; 5) avoiding output growth rate; and, 6) not including output growth rate and financial openness.

¹⁴ However, it could also be interpreted as a borrowing constraint and discourage savings (Chinn and Prasad (2003)).

¹⁵ Chinn and Prasad (2003) set terms of trade volatility as a proxy of macroeconomic uncertainty.

¹⁶ Svensson and Razin (1983) indicate that positive temporary terms of terms shocks increase the current account through an increase in savings.

The data frequencies are: annual and 5-year average. In the latter case, if the *ITD* average is bigger than 0.5, the inflation targeting dummy is equal to 1, otherwise it is zero. Cross effects are not imposed because, according to Chinn and Prasad (2003), it is possible to lose information about the interdependence among current accounts.

2.4.1 Targeters

New Zealand introduced this regime in March, 1990. Chile followed in September, 1990. Other targeters include: Canada in February, 1991; Israel in January, 1992; the United Kingdom in October, 1992; Sweden in January, 1993; Australia in April, 1993; Peru in January, 1994¹⁷; Korea in April, 1998; Mexico in January, 1999; Colombia in September, 1999; Switzerland in January, 2000; Thailand in May, 2000; Iceland in March, 2001; Hungary in January, 2001; and, Norway in March, 2001¹⁸.

In Table 2.3, the descriptive statistics of current account are shown. Comparing between the non-targeting and targeting periods, excluding for Hungary, Iceland, and Poland, the means of the current accounts are higher in the targeting regime than in the non-targeting regime. However, the averages are not statistically different for Brazil, Colombia, Iceland, Mexico, Peru, Poland, South Africa and the United Kingdom.

Finally, current accounts display a lower volatility in the targeting regime than in the non-targeting period. Likewise, Figure 2.1 suggests the improvement of the current accounts across regimes. On average, the current account of targeters is higher in the targeting regime.

¹⁷ There is no consensus about the exact year that Peru adopted inflation targeting. According to Corbo and Schmidt-Hebbel (2002), Peru started a partial regime in 1994. It was not a full-fledged targeter until 2002. For that reason, Fracasso, Genberg and Wyplosz (2003), Levin et al. (2004) consider 2002 the inflation targeting adoption year.

¹⁸ Spain and Finland adopted inflation targeting in 1994, but both countries joined the European Central Bank in 1999. The Czech Republic (January 1998) is not included due the lack of data. Philippines (January 2002) is the latest targeter.

Those averages are statistically different at ten percent. Therefore, on average, inflation targeting positively affects the current account.

2.4.2 Model Estimates

2.4.2.1 Simple Regressions

To test the sign of the variable *ITD*, only a constant and the inflation targeting dummy are included. In Table 2.4, for the pooled OLS (section *A*), in the short-term, the coefficient of *ITD* is positive and significant at 5 percent which explains the improvement in the current account across regimes. In the medium-term (5-year averaged sample), that coefficient is positive but not significant. However, setting time effects (section *B*), in the short- and medium-term, the *ITD* coefficient turns out negative, 1.5 and 1.8 percent of GDP, respectively. These values are significant at 5 and 10 percent, respectively.

When global shocks are accounted for in the pooled OLS regression (section *A*), in the short- and medium-term, the *ITD* coefficient is negative and significant at 10 percent. The estimates are 1.2 and 1.8 percent of GDP, respectively, which are very similar to those after imposing time effects. Eliminating outliers (section *C*); the *ITD* is still negative in the short- and medium-term, however, in both cases, θ_I is not significant.

These estimates indicate that, for almost all targeters, the improvement in current account across regimes is mainly driven by global shocks such as a lower global real interest rate, higher oil price, and US output growth rate. For all countries in the sample, inflation targeting worsens the current account by about 1 to 1.5 percent of GDP in the short- and medium-term. This outcome matches the “stylized facts” quite well, but is unlike that of Rose (2007).

2.4.2.2 Specifications including control variables

At this point, I track the transmission channels of the effects of this regime on current account, dropping the variables associated with the stylized facts to compare these estimates with the evidence, shown in Table 2.4. In Table 2.5, setting time effects (section *A*) and including all control variables (1st column), the *ITD* coefficient is negative and not significant in the short- and medium-term. Dropping inflation and terms of trade volatilities, the *ITD* coefficient is negative and not significant in both the short- and medium-term. Excluding the real exchange rate and trade openness, the *ITD* coefficient is negative but not significant in the short- and medium-term. Not including financial openness and fiscal balance, the *ITD* coefficient is negative (1.5 percent of GDP) and significant in the medium-term. In addition, excluding the output growth rate, the *ITD* is negative (1 percent of GDP) and significant at 10 percent in the short-term. Finally, without including output growth rate and financial openness, the *ITD* coefficient is negative (below 2 percent of GDP) and significant at 5 percent in the short- and medium-term.

For the pooled OLS including global shocks (section *B*) and including all control variables, the *ITD* coefficient is negative (below 1 percent of GDP) and significant at 10 percent in the short-term. Ignoring inflation and terms of trade volatilities, the *ITD* coefficient is negative and not significant in the short- and medium-term. Not including the real exchange rate and trade openness, the *ITD* coefficient is still negative and not significant in the short- and medium-term. Dropping financial openness and fiscal balance, the *ITD* coefficient is negative and significant in the short- and medium-term. In addition, not including the output growth rate, the *ITD* is negative (1.1 percent of GDP) and significant at 5 percent in the short-term. Finally, excluding output growth rate and financial openness, the *ITD* coefficient is negative and not significant in the short- and medium-term.

Dropping output growth rate and comparing sections *A* and *B*, the *ITD* coefficients are significant and similar in the short-term. In addition, dropping output growth rate and financial openness and comparing sections *A* and *B*, the estimates are similar in the medium-term. For both channels, the outcomes almost match the estimates presented in Table 2.4. Therefore, *ITD* might be capturing output growth effects on the current account in the short- and medium-term, and financial openness effects on the current account in the medium-term.

The stable and positive output growth rate after the adoption of inflation targeting might positively affect investment, worsening the current account. Moreover, for almost all targeters, financial openness has dampened the domestic real interest rate which might have boosted consumption and investment in the medium-term. Even though financial openness is a global trend, for targeters, it has played an important role to diminish the real interest rate.

Summarizing, for most targeters, the improvement in the current account is mainly driven by global shocks. Indeed, this monetary regime worsens the current account which contradicts Rose's (2007) findings but matches the "stylized facts" quite well.

2.5 Conclusions

Macroeconomic theory suggests inflation targeting policy should worsen the current account balance. Rose (2007) shows that there is very little difference between current account averages of targeting and non-targeting countries. Using a panel data set for 19 targeting countries, I show that current account balances of the countries do worsen after adoption of inflation targeting once global shocks are accounted for. This result is supportive of the theoretical predictions. The results also suggest that output growth and financial openness are the most likely transmission channels. For almost all targeters, financial openness decreases the domestic real interest rate

which boosts consumption and investment. The policy implication of these findings is that balance of payments crises should not automatically lead to the adoption of the inflation targeting regime.

Chapter 3

Current Account, Productivity and Terms of Trade Shocks in Norway

3.1 Introduction

Living standards and productivity in small open economies are tied to fluctuations in the country's terms of trade. Norway is an interesting example because it is the third largest oil exporter, seventh largest oil producer, and it faces a fair amount of terms of trade fluctuations led by oil price changes. In 1990, it created a Petroleum Fund, shown in Figure 3.1, to accumulate its current account surpluses and to avoid the Dutch Disease type of reallocation of resources. In contrast to Russia and Saudi Arabia, where oil revenues have mainly enriched oligarchs and the royal family, Norway's standard of living, shown in Table 3.1, and productivity growth, shown in Figure 3.2, have clearly improved over the long-run.

This chapter examines the effects of permanent shocks to terms of trade on the current account and output per capita growth of Norway. A related field of literature examines whether terms of trade shocks can be interpreted as productivity shocks given their close positive relationship with the standard of living of a country in the long-run. However, Obstfeld and Rogoff (1994), Baxter (1995), and Backus and Crucini (2000) argue that they are not similar because productivity shocks worsen the current account, whereas terms of trade shocks do not. This chapter also examines this issue by allowing the permanent shocks to terms of trade to have both a transitory and permanent effect on output per capita growth. Using a structural VAR setup and a multiple long-run restrictions scheme based on Blanchard and Quah's (1989) model, hereafter BQ, I examine the sensitiveness of the results to alternative structural assumptions. The

first set of restrictions follow Ahmed and Park (1994), who allow the permanent shocks to terms of trade to have permanent effects on output growth.

The empirical results show that permanent shocks to terms of trade improve the current account surplus of Norway. Permanent shocks to output per capita growth have very little effect on current account. Finally, permanent shocks to terms of trade have very little effect on the output per capita growth of Norway. This is true for both sets of long-run restrictions. Moreover, an over-identifying test, that restricts the permanent shocks to terms of trade to have only temporary effects on output per capita growth, cannot be rejected as well. Overall, the evidence suggests that the shocks that have permanent effects on terms of trade or output per capita growth do not have permanent effects on each other.

The organization of this chapter is as follows. Section 3.2 explains the nature of the terms of trade shocks and their effects on the external balance. Section 3.3 discusses the data and present Specification I and its estimates. Section 3.4 presents Specification II and its estimates and section 3.5 concludes.

3.2 Literature: The Nature of the Terms of Trade Shocks

According to economic theory, in a small open economy, living standards and productivity are positively correlated and tied to terms of trade fluctuations. In fact, the terms of trade shocks affect real income not only through the volume of output, but also the trading value of that output. The effect on real output implies a productivity shock which is mainly driven by the efficient reallocation of the resources in the economy. The persistence of terms of trade shocks matters because it affects the magnitude of reallocation. In Norway, the Petroleum Fund has been

sterilizing recent oil price fluctuations on the economy. As a result, positive terms of trade shocks would affect real income without affecting real output in the long-run.

Many theoretical studies have modeled the effects of permanent shocks to term of trade on the current account, most of them emphasizing the persistence of those shocks on national income as shown in Table 3.2. Harberger (1950), and Laursen and Metzler (1950), hereafter HLM, show that a fall in terms of trade worsens the current account through a decrease in savings and a fall in the purchasing power of exports worsens the economy's real income.

Svensson and Razin (1983) extend HLM by including intertemporal patterns. They state that terms of trade effect on the current account depends on whether permanent shocks to terms of trade have temporary effects on national income (temporary terms of trade shocks). Using a two-good model, a negative transitory terms of trade shock leads to a current account deficit because households smooth their consumption by decreasing savings. A negative permanent terms of trade shock implies a lower permanent national income resulting in no impact on the current account due to consumption-smoothing.

Edwards (1989) extends Svensson and Razin's insights by using a three-good model. Assuming that there is no investment, he argues that the impact of negative temporary terms of trade shocks on the current account is ambiguous because there are three effects: consumption-smoothing (HLM), consumption-tilting, and real exchange rate effects. In this scenario, where domestic agents consume non-tradables and importables, there is a switch between present and future consumption of importables. Moreover, consumers substitute importables for non-tradables. These two effects increase the current account. However, the final impact on the current account is ambiguous since the consumption-smoothing effect causes a current account

deficit. Finally, for permanent terms of trade shocks to income, there is also an ambiguous effect on the current account.

On the other hand, terms of trade disturbances can be interpreted as productivity shocks, as well. Given the import content of capital goods, Serven (1999) argues that positive permanent terms of trade shocks do not affect the consumption- and investment-based real interest rates. However, for a high import content of capital goods, the marginal product of capital in terms of foreign goods rises above its real user cost, which increases investment. Since savings remain unaffected, there is a current account deficit.

In addition, assuming zero domestic content in consumption, a positive temporary terms of trade shock influences investment through two channels: the real interest rate in terms of capital goods and the import content of capital goods. A higher import content of capital goods leads to a higher marginal product of capital, increasing investment. However, higher substitutability of investment switches present investment to future investment. For zero domestic content, the real interest rate remains unchanged, worsening the current account through the second channel. For zero import content, there is an improvement in the current account because investment falls due to a higher real interest rate resulting in increased savings¹⁹. The final effect on the current account is ambiguous because of the unclear effect on investment.

According to Kent and Cashin (2003), permanent shocks to terms of trade shocks occur in productivity innovations because the elasticity of the capital stock with respect to the terms of trade is equal to the elasticity of the capital stock with respect to productivity. For a small economy, temporary terms of trade shocks improve the current account through increased

¹⁹ However, when consumption has some domestic content, it will be affected by the higher present real interest rate, causing a substitution between present and future consumption. An increase on savings results when there is a shorter-lived shock and a larger elasticity of intertemporal substitution.

savings. Permanent terms of trade shocks deteriorate the current account through an increased investment.

In this approach, when permanent shocks to terms of trade are permanent to output, it increases investment and worsens the current account²⁰. When the terms of trade innovations are temporary and less persistent, it affects savings, improving the current account. When the terms of trade shocks are transitory and persistent, the effect on the current account is unclear because this disturbance raises savings and investment, simultaneously. For some degree of persistence, the two effects cancel each other out (null impact on the current account).

Analyzing HLM, for fifteen OECD and forty developing countries, Otto (2003) sets a three variable-VAR specification, imposing BQ's restrictions. The three variables are: terms of trade in first differences, real GDP growth rate, and trade balance. Here, permanent shocks to terms of trade are permanent to output growth and trade balance, and permanent shocks to output growth are only permanent to trade balance. Then, in the long-run, neither output growth nor trade balance shocks affect the terms of trade. He concludes that HLM holds in Norway.

Using a three-variable VAR and analyzing US, UK, Canada, New Zealand, and Australia, Cashin and McDermott (2002) also model permanent shocks to terms of trade as permanent to output growth and current account, and permanent shocks to output growth as permanent to current account. In both empirical articles, terms of trade shocks act as productivity shocks.

The interpretation of the permanent shocks to terms of trade as permanent to output growth comes from Ahmed, Ickes, Wang, and Yoo (1993) and Ahmed and Park (1994). Extending BQ and setting a 4-variable VAR, Ahmed and Park assume that, for small open

²⁰ This prediction is consistent with Obstfeld and Rogoff (1994) and Baxter (1995).

economies, in the long-run, shocks to foreign output growth, world real interest rate²¹, or terms of trade (if there is an oil importer) are permanent to domestic output growth and the trade balance. So, those shocks implicitly occur in productivity disturbances.

However, for Norway, is it realistic to assume that permanent shocks to terms of trade always occur in productivity innovations as is shown in the standard analysis mentioned above? The descriptive statistics, shown in Table 3.3, indicate that terms of trade are positively correlated with the current account and almost uncorrelated with the output per capita growth. This means that the theory and the data do not match. If permanent shocks to terms of trade are productivity innovations²², there is a current account deficit and a positive long-term effect on output growth (Obstfeld and Rogoff: 1994).

To examine the effects of the terms of trade on the current account and output per capita growth, I present two specifications: 1) following Ahmed and Park (1994), Otto (2003), and, Cashin and McDermott (2002), the permanent shocks to terms of trade that are allowed to have permanent effects on output per capita growth and the external balance, and 2) permanent shocks to terms of trade that have transitory effect on output per capita²³.

3.3 Specification I

The terms of trade in first differences, the real GDP per-capita growth rate, and current account are represented by the following reduced form VAR:

$$X_t = C(L)X_t + \eta_t \quad (\text{a.1})$$

²¹ For Canada, Kano's (2008) uses a three-variable VAR with global interest rate, output growth and current account.

²² For Norway, Kent and Cashin (2003) classify the terms of trade shocks as temporary shocks.

²³ Jimenez-Rodriguez and Sanchez (2005) find that positive oil price shocks positively affect GDP growth in the short-run.

where X_t is a column vector whose components are: terms of trade in first differences, output per capita growth, and current account; $C(L)$ is the (3x3) matrix of lag polynomials; and η_t is the column vector of “observed disturbances”.

The Vector Moving Average (VMA) system in (a.1) is:

$$X_t = \sum_{L=0}^{\infty} D(L)\eta_{t-L} \quad (\text{a.2})$$

The “observed disturbances” have mean zero and are serially uncorrelated. However, they are cross-correlated: $E(\eta_t) = 0$; $E(\eta_t \eta_s') = 0$, $t \neq s$; and, $E(\eta_t \eta_t') = \Omega$. These statistics are obtained from the linear combination of the “observed residuals” of the reduced form and the “unobserved innovations” (structural innovation matrix) of the structural form:

$$\eta_t = B(0) \epsilon_t \quad (\text{a.3})$$

where $B(0)$ is the (3x3) matrix of contemporaneous effects.

The assumptions of the structural innovation matrix are: $E(\epsilon_t) = 0$; $E(\epsilon_t \epsilon_t') = I$; (orthonormal assumption); and, $E(\epsilon_t \epsilon_s') = 0$, $t \neq s$. Then, $\Omega = B(0)B(0)'$.

Hereafter, the notations of the permanent shocks (assumed positive) to terms of trade, output per capita growth and current account are S_t^1 , S_t^2 , and S_t^3 , respectively. They are elements of the structural innovation matrix.

$$\epsilon_t \equiv \begin{bmatrix} S_t^1 \\ S_t^2 \\ S_t^3 \end{bmatrix}$$

Plugging (a.3) into (a.2), I get the following form:

$$X_t = \sum_{L=0}^{\infty} D(L)B(0) \epsilon_{t-L} \quad (\text{a.4})$$

To identify (a.4), I set BQ's restrictions²⁴. Since there are three variables, I set up the following long-run restrictions:

$$\left[\sum_{L=1}^{\infty} D(L)B(0) \right]_{(1,2)} = 0, \left[\sum_{L=1}^{\infty} D(L)B(0) \right]_{(1,3)} = 0, \text{ and } \left[\sum_{L=1}^{\infty} D(L)B(0) \right]_{(2,3)} = 0$$

According to these restrictions, S_t^1 (external shock) is allowed to have permanent effects on output per capita growth²⁵ and current account, S_t^2 (permanent supply shock) is allowed to have permanent effects on current account, and S_t^3 (temporary demand shock) is allowed to have temporary effects on terms of trade and output per capita growth.

3.3.1 Data

For the period 1981:1- 2006:2, quarterly data is obtained from the International Financial Statistics at the IMF and from Norway Statistics web page. The current account is represented by the current account-GDP ratio, and the terms of trade is the log of export price divided by import price. I used the real GDP and population to calculate real GDP per-capita growth rate. All variables are seasonally adjusted. Shown in Table 3.3, the descriptive statistics indicate that the oil price (terms of trade) and the current account are positively correlated and there is almost no correlation between the oil price (terms of trade) and the output per capita growth.

In addition, using the Augmented Dickey-Fuller test (ADF), the unit root test results, shown in Table 3.4, indicate that the current account variable is a stationary process including intercept and trend, terms of trade is non-stationary, including either intercept or intercept and trend, and the Real GDP per capita growth rate is stationary, including not only intercept but also trend and intercept.

²⁴ Blanchard and Quah (1989) set two kinds of disturbances: supply and demand shocks regarding output and unemployment innovations. In this framework, the demand shock does not affect output in the long-run.

²⁵ Otto (2003), and, Cashin and McDermott (2002) employ output growth instead of the output per capita growth.

Current account-GDP, terms of trade, and real GDP per-capita growth rate paths are shown in Figures 3.3, 3.4 and 3.5, respectively. Finally, based on AIC, the structural VAR includes three lags (Table 3.5).

3.3.2 Estimates

3.3.2.1 Impulse-Response Function

Figure 3.6 shows the response of the output per capita growth over twenty quarters. The output per capita growth only responds to its own disturbance (S_t^2). Neither S_t^1 (external shock) nor S_t^3 affects the real GDP per capita growth rate. This implies that the terms of trade innovations do not matter to output per capita growth, which suggests that they are not productivity shocks as stated by Kehoe and Ruhl (2008).

Figure 3.8 shows the response of the current account to all shocks. The response of the current account to S_t^1 is positive. It increases up to the fourth quarter and reaches its steady state at the nineteenth quarter. This estimate matches Otto's (2003) where the response of the current account to positive terms of trade shocks is positive²⁶. However, this evidence does not match the theory because, according to Obstfeld and Rogoff (1994) and Baxter (1995), a positive permanent shock to terms of trade (allowed for productivity shocks) worsens the current account.

The response of the current account to S_t^2 is negative but small, which agrees with the intertemporal current account approach (Obstfeld and Rogoff: 1994). The duration of the response is nine quarters up to its steady state. Moreover, there is a positive response of the current account to S_t^3 . In this case, individuals smooth their consumption after the transitory increase in the output through higher savings.

²⁶ HLM holds. Then, the standard theory would say that the terms of trade innovation (allowed productivity shocks) will lead to a positive effect on savings and the current account.

3.3.2.2 Forecast-Error Variance Decomposition

Table 3.6 shows the sources of the terms of trade, output per capita growth and current account fluctuations. Focusing on output per capita growth over twenty quarters, S_t^1 does not play any role because the output per capita growth fluctuations are mainly driven by their own shock (S_t^2). The importance of S_t^2 to output per capita growth variations is around 99 percent.

On the other hand, regarding the current account fluctuations, S_t^1 and S_t^3 play the largest roles, with different tendencies. S_t^1 is around thirteen percent in the first quarter and around fifty-five percent in the twentieth quarter; and, S_t^3 is around eighty-six percent in the first quarter and around forty-three percent in the twentieth quarter. S_t^2 plays only a minor role because it is around 0.08 percent in the first quarter and around 0.3 percent in the twentieth quarter. According to these results, the permanent shock to terms of trade (S_t^1) and domestic temporary shock (S_t^3) play the largest roles in current account fluctuations.

At this point, can S_t^1 be assumed as a productivity shock for Norway? Or, given that the Petroleum Fund is discouraging the reallocation of resources in the economy, the permanent shocks to term of trade should be assumed transitory to output per capita growth. I will examine the sensitiveness of the initial outcomes to a different identifying assumption on S_t^1 .

3.4 Specification II

This specification switches the terms of trade in first differences and the output per capita growth. In this interpretation, S_t^2 (home productivity shock) is allowed to have permanent effects on terms of trade and current account, S_t^1 is allowed to have transitory effects on output

per capita growth and permanent effects on current account, and, S_t^3 is still defined as in Specification I. Therefore, there are two temporary shocks to output per capita growth. The structural matrix is as follows:

$$\bar{\epsilon}_t \equiv \begin{bmatrix} S_t^2 \\ S_t^1 \\ S_t^3 \end{bmatrix}$$

Equation (a.4) now becomes:

$$\bar{X}_t = \sum_{L=0}^{\infty} \bar{D}(L) \bar{B}(0) \bar{\epsilon}_{t-L} \quad (\text{a.5})$$

where $\bar{X}_t$ is a column vector whose components are: output per capita growth rate, the terms of trade in first differences, and the current account.

To identify (a.5), the following BQ's restrictions are set:

$$\left[\sum_{L=1}^{\infty} \bar{D}(L) \bar{B}(0) \right]_{(1,2)} = 0, \quad \left[\sum_{L=1}^{\infty} \bar{D}(L) \bar{B}(0) \right]_{(1,3)} = 0, \quad \text{and} \quad \left[\sum_{L=1}^{\infty} \bar{D}(L) \bar{B}(0) \right]_{(2,3)} = 0$$

3.4.1 Estimates

3.4.1.1 Impulse-Response Function

Figure 3.7 shows the response of the real GDP per capita growth rate. The output per capita growth only responds to its own shock (S_t^2). In the long-run, I assume real GDP per capita does not respond to S_t^1 and S_t^3 .

In Figure 3.9, the estimates show that the current account does not respond to S_t^2 , which implies that domestic productivity shocks do not affect the current account. However, the current account positively responds to S_t^1 . The duration of the response is nineteen quarters until it reaches its steady state. The positive response of the current account to the terms of trade shocks

fits with Svensson and Razin's (1983) framework, where households smooth their consumption though increases in savings after terms of trade innovations (non-productivity shocks).

These results also fit with Kent and Cashin's (2003) as (low persistent) positive terms of trade shocks increase the current account because changes in savings dominate changes in investment. However, in this case, persistence does not matter because the petroleum fund is sterilizing term of trade fluctuations. Hence, HLM holds and/or terms of trade shocks only increase the real income (accumulating net foreign assets) but do not increase the real output (Obstfeld and Rogoff: 1994).

Finally, the current account positively responds to S_t^3 . In this case, private agents smooth their consumption after the transitory increase of the output by increases in savings. This alternate interpretation fits with the theoretical approaches.

3.4.1.2 Forecast-Error Variance Decomposition

Table 3.7 gives the estimates for the second specification over twenty quarters. S_t^1 and S_t^3 play the largest roles in current account fluctuations. Increasing over time, the terms of trade shocks are around thirteen percent in the first quarter and around fifty five percent in the twentieth quarter. Decreasing over time S_t^3 is around eighty-six percent in the first quarter and around forty-three percent in the twentieth quarter. Real GDP per capita growth shocks play only a minor role, S_t^2 is around 0.02 percent in the first quarter and around 0.2 percent in the twentieth quarter. In contrast to the first specification, both transitory shocks play a larger role in current account fluctuations. This outcome is consistent with intertemporal current account predictions as in Obstfeld and Rogoff (1994), where temporary innovations to output play a major role in current account variations. Overall, the empirical results show that permanent shocks to terms of

trade improve the current account and permanent shocks to output per capita growth have no effect on current account fluctuations. The results are robust in both specifications.

3.4.2 Over-identifying Specifications I and II

The different interpretation of terms of trade shocks (transitory to output) presented in this chapter is supported by including an additional restriction in both specifications. Using Roberts (1993), I apply four restrictions for three equations. The additional restrictions are:

$$\left[\sum_{L=1}^{\infty} D(L)B(0) \right]_{(2,1)} = 0, \text{ and } \left[\sum_{L=1}^{\infty} \bar{D}(L)\bar{B}(0) \right]_{(2,1)} = 0$$

For Specification I, restriction (2,1) indicates that terms of trade shocks do not affect the real output per capita in the long-run, which is similar to restriction (1,2) in Specification II. For Specification II, restriction (2,1) indicates that output per capita growth shocks do not affect the terms of trade in the long-run, which is the standard assumption presented in the literature²⁷.

Regarding the impulse-response functions and variance decompositions, the estimates are practically the same. In Table 3.8, for the Likelihood Ratio test of over-identification, the p-value is greater than 0.05 (0.2356), so I cannot reject the null which asserts that the identifying restrictions are valid. Therefore, null hypothesis of the one over-identifying restriction was not rejected. The robustness of the evidence is obtained. This evidence suggests that shocks that have permanent effects on terms of trade or output per capita growth do not have permanent effects on each other.

²⁷ Ahmed and Park (1994), Otto (2003), and Cashin and McDermott (2002).

3.5 Conclusions

This chapter examines the short-run effects of permanent shocks to terms of trade on current account and output per capita growth of Norway. It also examines whether terms of trade shocks can be interpreted as productivity shocks. Using a structural VAR setup and a multiple long-run restrictions scheme based on Blanchard and Quah's (1989) model, I examine the sensitiveness of the results to alternative structural assumptions. The empirical results show that permanent shocks to terms of trade improve the current account surplus of Norway. However, it has very little effect on productivity growth. This is true for two alternative sets of long-run restrictions. Moreover, an over-identifying test, that restricts the permanent shocks to terms of trade to have only temporary effects on output per capita growth, cannot be rejected. Overall, the evidence suggests that shocks that have permanent effects on terms of trade or output per capita do not have permanent effects on each other. This suggests that terms of trade shocks are not permanent productivity shocks.

Chapter 4

Concluding Remarks

This dissertation studies some issues related to current account imbalances. This study contributes to the literature that analyzes how current account responds to fiscal and monetary interventions and external economic shocks. Chapter 1 examines the effects of the fiscal policy on the current account during IMF's liberalization policies. Chapter 2 analyses the effects of inflation targeting on current account and Chapter 3 examines the relationships between shocks to terms of trade and home productivity shocks, and terms of trade and current account. Chapters 1 and 3 have analyzed some theoretical issues and empirical evidence for Peru and Norway, respectively. Chapter 2 tracks the effects of the new monetary regime on the current account due to non-conventional monetary interventions as transparency, commitment, and accountability, which increase the central bank's credibility.

IMF policies regarding economic stabilization often include an aspect that liberalizes the financial sector of the associated country. This liberalizing element is often criticized since the effect of the fiscal deficit on the current account depends on both the financial openness of the economy and the persistence of fiscal spending shocks. Corsetti and Müller (2006) argue that under these two conditions, the relationship between fiscal deficit and current account deficit is positive in the short-run. After being a relatively closed economy for many years, Peru opened its economy in the early 1990s. In the first chapter, the empirical evidence shows that fiscal surpluses and spending changes do not affect the current account across these two regimes. For Peru, difference in financial openness alone is not sufficient to generate different effects of fiscal shocks to the current account in the short-run.

In Chapter 2, the empirical findings that inflation targeting leads to a fall in real interest rate, macroeconomic uncertainty, exchange rate volatility, and output volatility, suggest that these elements lead to a rise in investment and a fall in private savings. However, Rose (2007) reports very little association between current account and inflation targeting. The results show that, consistent with economic theory, inflation targeting does negatively affect current account once global shocks have been properly accounted for. This evidence implies that exchange rate and balance of payment crises do not necessarily lead inflation targeting *per se*.

In Chapter 3, economic theory suggests that a permanent rise in terms of trade should result in a permanent rise in the standard of living. Part of that rise comes from a permanent increase in productivity following an efficient reallocation of resources. Using a structural VAR framework with long-run restrictions, the empirical results show an improvement in the current account of Norway following a permanent shock to terms of trade. However, the permanent shock to terms of trade has very little effect on output per capita growth. Moreover, an over-identifying test that restricts the permanent shocks to terms of trade to have only temporary effects on output per capita growth cannot be rejected. Overall, the evidence suggests that those shocks that have permanent effects on terms of trade or output per capita growth do not have permanent effects on each other.

Some future extensions can be made to Chapters 2 and 3. In the first case, one can extend the data to use a VAR system and analyze the responses of the current account to the policy interest rate. In the second case, further research should be connected to the analysis of what factors are spurring output per capita growth. For Norway, if terms of trade do not explain the output per capita growth, what other factors do?

TABLES AND FIGURES

Table 1.1 Stabilization Policies and Structural Reforms of Peru in the 1990s

I-) Stabilization Policies	
1-) Monetary Policy	<ul style="list-style-type: none"> -Independence of the Central Bank. -Monetary Aggregate as nominal anchor. -First goal: inflation control. -Target: money growth. -New legal framework for the banking system. -No control for interest rates.
2-) Exchange Rate Policy <i>Feb 1991</i>	<ul style="list-style-type: none"> -Liberalization (dirty float). -One exchange rate (multiple exchange rates in the 80s).
3-) Fiscal Policy	<ul style="list-style-type: none"> - Subsidies eliminated. - Tax exemptions eliminated.
4-) External Debt	<ul style="list-style-type: none"> -Aug. 1990:negotiation to return to the international financial system. -Support Group and Renegotiation.
II-) Structural Reforms	
1-) Trade openness <i>Mar 1991</i>	<p>Average tariff from 66 percent to 17 percent.</p> <p>Objectives</p> <ul style="list-style-type: none"> <i>i-Higher competitiveness in tradable sector.</i> <i>ii-Lower tradable-good prices (short-run).</i> <i>iii-Increase in fiscal income.</i>
2-) Financial Openness <i>1991</i>	<ul style="list-style-type: none"> -Elimination of capital controls. -No charge to open accounts in foreign currency. <p>Objectives</p> <ul style="list-style-type: none"> <i>i-Increase in financial deepening.</i> <i>ii-Decrease in transaction costs.</i>
3-) Fiscal Sector	Higher tax base and fewer taxes.
4-) Privatizations <i>1993</i>	<p>Reasons:</p> <ul style="list-style-type: none"> <i>i-Inefficient public enterprises.</i> <i>ii-Decapitalization.</i> <i>iii-Lack of investment.</i> <i>iv-Source of fiscal deficit.</i>
5-) Labor Market	More flexible (low firing costs).
6-) Social Insurance <i>1993</i>	<ul style="list-style-type: none"> -Before: Pay-as-you-go. -Mixed: Pay-as-you-go, Fully funded.

Source: Pasco-Font (2000)

Table 1.2 Statistics of Trade and Financial Openness and Fiscal Persistence

	1980-1990	1991-2005	T-Test
Trade Openness (Average)	23.90	32.29	-5.90 P-value= <.0001
Financial Openness Index (Average)	-0.71	1.97	-6.68 P-value = <.0001
	1980:1-1991:1	1991:2-2006:3	
Fiscal Surplus Persistence	0.52*** (0.09)	0.44*** (0.08)	
Fiscal Spending Persistence	0.57*** (0.12)	0.63*** (0.12)	

Note: See Appendix for Trade and Financial Openness. The null hypothesis of the T-test is “means are equal across periods”. Coefficients of persistence are the first lag of fiscal surplus and government expenses (AR(1) processes), respectively. The numbers in the parentheses are Newey-West heteroskedasticity and autocorrelation consistent standard errors.

*** significant at 1 percent.

Table 1.3 Descriptive Statistics of Current Account Surplus, Fiscal Surplus, Fiscal Spending, Output Growth, and Inflation

		<i>Fiscal Surplus/GDP</i>	<i>Current Account/GDP</i>	<i>Fiscal Spending/GDP</i>	<i>Real GDP Growth</i>	<i>CPI (% change)</i>
<hr/>						
Full sample	<i>Mean</i>	0.00	-0.04	0.15	0.006	0.17
	<i>SD</i>	0.02	0.03	0.02	0.05	0.31
	<i>Correlation</i>	0.27		-0.21		
1980:1-1991:1 Sub-sample 1	<i>Mean</i>	-0.01	-0.05	0.15	3.24E-05	0.37
	<i>SD</i>	0.03	0.04	0.03	0.06	0.41
	<i>Correlation</i>	0.3		-0.35		
1991:2-2006:3 Sub-sample 2	<i>Mean</i>	0.01	-0.04	0.14	0.0105	0.03
	<i>SD</i>	0.01	0.03	0.02	0.04	0.05
	<i>Correlation</i>	0.08		0.06		
T-Test		-2.94	-2.39	2.14	-0.99	5.39
P-value		0.0047	0.0192	0.0359	0.3223	<.0001

The null hypothesis of the T-test is “means are equal across periods”.

SD: Standard deviation

Table 1.4 Estimates Using Fiscal Surplus or Fiscal Spending

Regressors	<u>Fiscal Surplus</u>			<u>Fiscal Spending</u>		
	<i>F – Test</i>			<i>F – Test</i>		
	<i>H₀: β₂=β₃</i>			<i>H₀: β₂=β₃</i>		
<i>Dependent Variable: Current Account</i>						
<i>FS*D</i>	0.18	(0.19)	<i>F</i> =0.00	-0.34*	(0.21)	<i>F</i> = 3.90
<i>FS*(1-D)</i>	0.18	(0.37)		0.17	(0.17)	
<i>Gap*D</i>	-0.22***	(0.06)		-0.22***	(0.06)	
<i>Gap*(1-D)</i>	-0.08	(0.17)		-0.01	(0.17)	
<i>R</i> ²	0.21			0.23		
<i>F-Test</i>	6.65			7.5		
<i>Dependent Variable: Private Investment</i>						
<i>FS*D</i>	0.53**	(0.26)	<i>F</i> =3.64	0.57**	(0.25)	<i>F</i> =0.004
<i>FS*(1-D)</i>	-0.05	(0.16)		0.59***	(0.10)	
<i>Gap*D</i>	0.15**	(0.07)		0.06	(0.08)	
<i>Gap*(1-D)</i>	0.35***	(0.08)		0.28***	(0.07)	
<i>R</i> ²	0.21			0.26		
<i>F-Test</i>	6.65			8.78		
<i>Dependent Variable: Private Savings</i>						
<i>FS*D</i>	-0.14	(0.25)	<i>F</i> =0.03	0.64**	(0.26)	<i>F</i> =0.83
<i>FS*(1-D)</i>	-0.06	(0.39)		0.35	(0.26)	
<i>Gap*D</i>	0.05	(0.12)		0.02	(0.08)	
<i>Gap*(1-D)</i>	0.42	(0.13)		0.38**	(0.13)	
<i>R</i> ²	0.56			0.6		
<i>F-Test</i>	31.8			37.5		

Note: *FS* stands for fiscal surplus or fiscal spending. The numbers in the parentheses are Newey-West heteroskedasticity and autocorrelation consistent standard errors.

*** significant at 1 percent.

** significant at 5 percent.

* significant at 10 percent.

Table 1.5 Estimates for Post Structural Reforms (1993:1-2006:3)

<i>Regressors</i>		
	<i>Fiscal Surplus</i>	<i>Fiscal Spending</i>
<i>Dependent Variable: Current Account</i>		
<i>FS</i>	0.18 (0.35)	0.17 (0.16)
<i>Gap</i>	-0.08 (0.16)	-0.09 (0.16)
<i>R</i> ²	0.01	0.01
<i>F-Test</i>	0.43	0.42
<i>Dependent Variable: Private Investment</i>		
<i>FS</i>	-0.05 (0.15)	0.59 *** (0.09)
<i>Gap</i>	0.36*** (0.07)	0.28*** (0.07)
<i>R</i> ²	0.32	0.5
<i>F-Test</i>	14.1	29.78
<i>Dependent Variable: Private Savings</i>		
<i>FS</i>	-0.06 (0.37)	0.35* (0.21)
<i>Gap</i>	0.42*** (0.12)	0.38*** (0.12)
<i>R</i> ²	0.56	0.1
<i>F-Test</i>	31.8	2.95

Note: *FS* stands for fiscal surplus or fiscal spending. The numbers in the parentheses are Newey-West heteroskedasticity and autocorrelation consistent standard errors.

*** significant at 1 percent.

* significant at 10 percent.

Table 1.6 Forecast Error Decomposition of Current Account due to Fiscal Surplus Shock

<i>Horizon (quarters)</i>	<i>Full Sample</i>			<i>Sub-Sample 1</i>			<i>Sub-Sample 2</i>		
	<i>Gap Shock</i>	<i>Fiscal Surplus Shock</i>	<i>Current Account Shock</i>	<i>Gap Shock</i>	<i>Fiscal Surplus Shock</i>	<i>Current Account Shock</i>	<i>Gap Shock</i>	<i>Fiscal Surplus Shock</i>	<i>Current Account Shock</i>
1	5	3	92	12	7	81	3	3	94
2	15	6	79	29	5	66	2	5	93
3	18	6	76	38	5	57	3	9	88
4	18	5	77	39	6	55	3	8	89
5	17	5	78	39	7	54	2	9	89
10	15	5	80	39	9	52	2	11	87
15	15	4	81	39	9	52	2	13	85
20	15	4	81	39	9	52	2	13	85

Note: Full sample (1980:1-2006:3); Sub-Sample 1 (1980:1-1991:1); and Sub-Sample 2 (1991:2-2006:3).

Table 1.7 Forecast Error Decomposition of Current Account due to Fiscal Spending Shock

<i>Horizon (quarters)</i>	<i>Full Sample</i>			<i>Sub-Sample 1</i>			<i>Sub-Sample 2</i>		
	<i>Gap Shock</i>	<i>Fiscal Spending Shock</i>	<i>Current Account Shock</i>	<i>Gap Shock</i>	<i>Fiscal Spending Shock</i>	<i>Current Account Shock</i>	<i>Gap Shock</i>	<i>Fiscal Spending Shock</i>	<i>Current Account Shock</i>
1	3	8	89	9	22	68	3	2	95
2	13	9	78	24	19	58	2	2	96
3	17	13	71	34	18	48	2	2	95
4	16	14	70	35	21	44	2	3	96
5	16	15	69	36	22	42	2	3	96
10	14	18	68	36	25	39	1	3	95
15	13	19	67	35	27	38	2	5	93
20	13	20	67	35	27	38	2	6	92

Note: Full sample (1980:1-2006:3); Sub-Sample 1 (1980:1-1991:1); and Sub-Sample 2 (1991:2-2006:3).

Figure 1.1 Inflation and Output Growth

Note: Set in 1991:1, vertical dash-line divides both regimes

Figure 1.2 Fiscal Surplus-GDP ratio and Current Account -GDP ratio paths

Figure 1.3 Fiscal Spending-GDP ratio and Current Account -GDP ratio paths

Note: For Figures 1.2 and 1.3, set in 1991:1, vertical dash-line divides both regimes

Figure 1.4 Response of Current Account to Fiscal Surplus Shock

Note: Sub-sample 1: 1980:1-1991:1
 Sub-sample 2: 1991:2-2006:3
 One S.D. Innovations $\pm$ 2 S.E.

Figure 1.5 Response of Current Account to Fiscal Spending Shock

Note: Sub-sample 1: 1980:1-1991:1
 Sub-sample 2: 1991:2-2006:3
 One S.D. Innovations $\pm$ 2 S.E.

Table 2.1 Short-Term Domestic Real Interest Rate and Financial Openness: prior to and after Inflation Targeting Adoption

<i>Targeter</i> (<i>adoption year</i>)	<i>Short-term Domestic Real Interest Rate</i>									<i>Financial Openness</i> ³	
	<i>Average</i> ¹		<i>Levin, Natalucci and Piger's (2004) scale</i> ²							3 years prior to adoption	after adoption
	the year prior to adoption	after adoption	-3	-2	-1	0	1	2	3		
Australia (1993)	5	3.1								2.6	1.8
Brazil (1999)	28	11.8	15.3	31.2	35.9	13.4	11.6	13.7	13.4	-1.55	-0.58
Canada (1991)	7.9	3								2.6	2.6
Chile (1991)	12.9	5								-1.77	-0.63
Colombia (2000)	20.7	9.5								-1.1	-1.1
Hungary (2001)	1	2.1	6.3	6.4	3.5	4.1	4	7	NA	-0.06	1.91
Iceland (2001)	6	3.9								1.23	1.23
Israel (1992)	-5.5	3.7								-1.1	0.44
Korea (1998)	10.2	3.7	NA	8.8	11.7	2.6	-0.1	2	0.8	-0.76	-0.51
Mexico (1999)	9.4	4.1	9.2	4.7	13.1	4.8	6.3	1.3	1.2	1.23	0.88
New Zealand (1990)	8	5.2								2.51	2.6
Norway (2001)	3.7	4.8								2.51	2.6
Peru (1994)	65.3	25.8								0.54	2.36
Poland (1999)	10.3	9.9								-1.1	-0.46
South Africa (2000)	7.9	3.4								-1.1	-1.1
Sweden (1993)	10.4	3.7								1.23	2.37
Switzerland (2000)	0.4	1.2								2.6	2.6
Thailand (2000)	1.7	0.6	10.6	-1.8	-1.3	-1.1	0.5	-0.1	-0.5	-0.06	-0.06
UK (1993)	6.2	3.4								2.6	2.6

1. - The real interest rate for the year prior to adoption is the difference between the average of the nominal interest rate the year prior to adoption and average inflation the year prior to adoption. The real interest rate after adoption is the difference between the average interest rate after adoption and average inflation after adoption. Petursson (2004) provides the average inflation and average interest rate the year prior to adoption; and, average inflation and average interest rate (3-month Treasury bill rates, money market rates, and discount rate) after adoption. He uses quarterly data 1981:1-2002:4 from IFS and Econ Win. Because Petursson (2004) set 2002 as the adoption year for Peru, I present the ex-ante real interest rate from the difference between the monthly money market interest rate – expected inflation one year in the future, setting inflation targeting adoption in 1994 for Peru. This information was taken from Central Bank of Peru's web page.

2. - They define the ex-ante real interest rate as the difference between the policy rate and the expected inflation one year in the future. Their scale is related to three years prior to inflation targeting adoption (zero), and three years after inflation targeting adoption (zero).

3. - Chinn and Ito's (2008) index (See Appendix).

Table 2.2 Inflation Targeting Dummy (*ITD*)

Australia	1993-2004=1
Brazil	1999-2004=1
Canada	1991-2004=1
Chile	1991-2004=1
Colombia	2000-2004=1
Hungary	2001-2004=1
Iceland	2001-2004=1
Israel	1992-2004=1
Korea	1998-2004=1
Mexico	1999-2004=1
New Zealand	1990-2004=1
Norway	2001-2004=1
Peru	1994-2004=1
Poland	1999-2004=1
South Africa	2000-2004=1
Sweden	1993-2004=1
Switzerland	2000-2004=1
Thailand	2000-2004=1
United Kingdom	1993-2004=1

Note: If the regime begins in the first (second) semester, *ITD* =1 begins in the current (next) year.

Table 2.3 Descriptive Statistics of Current Account Surplus

	<i>Australia</i>	<i>Brazil</i>	<i>Canada</i>	<i>Chile</i>	<i>Colombia</i>	<i>Hungary</i>	<i>Iceland</i>	<i>Israel</i>	<i>Korea</i>	<i>Mexico</i>
<i>Non-Targeting Period</i>										
Mean	-0.03	-0.02	-0.02	-0.06	-0.02	-0.04	-0.03	-0.06	-0.01	-0.01
SD	0.02	0.02	0.02	0.04	0.04	0.04	0.03	0.06	0.04	0.01
<i>Targeting Period</i>										
Mean	-0.04	-0.02	0	-0.02	-0.01	-0.07	-0.04	-0.02	0.04	-0.01
SD	0.01	0.03	0.02	0.02	0.01	0.01	0.04	0.02	0.03	0
T-test	2.05	-0.49	-2.79	-3.48	-1.6	2.84	0.49	-3.07	-3.42	-0.99
P-value	0.0485	0.6366	0.0135	0.0021	0.1229	0.0104	0.6264	0.0047	0.0046	0.3254
	<i>New Zealand</i>	<i>Norway</i>	<i>Peru</i>	<i>Poland</i>	<i>South Africa</i>	<i>Sweden</i>	<i>Switzerland</i>	<i>Thailand</i>	<i>UK</i>	
<i>Non-Targeting Period</i>										
Mean	-0.06	0.01	-0.04	-0.03	-0.01	-0.01	0.05	-0.04	-0.01	
SD	0.05	0.06	0.04	0.03	0.04	0.02	0.03	0.05	0.02	
<i>Targeting-Period</i>										
Mean	-0.04	0.13	-0.04	-0.04	-0.01	0.03	0.11	0.06	-0.01	
SD	0.02	0.02	0.03	0.02	0.01	0.03	0.03	0.01	0.01	
T-test	-1.76	-7.96	-0.38	1.07	0.11	-4.77	-4.88	-7.93	1.57	
P-value	0.093	<.0001	0.704	0.3042	0.9147	0.0002	0.0028	<.0001	0.1273	

Note: The current account is represented by the current account-GDP ratio. Targeting period: Australia: 1993-2004; Brazil: 1999-2004; Canada: 1991-2004; Chile: 1991-2004; Colombia: 2000-2004; Hungary: 2001-2004; Iceland: 2001-2004; Israel: 1992-2004; Korea: 1998-2004; Mexico: 1999-2004; New Zealand: 1990-2004; Norway: 2001-2004; Peru: 1994-2004, Poland: 1999-2004; South Africa: 2000-2004; Sweden: 1993-2004; Switzerland: 2000-2004; Thailand: 2000-2004; UK: 1993-2004. The null hypothesis of the T-test is current account means are equal across regimes.

SD: Standard deviation.

Table 2.4 Effect of Inflation Targeting on Current Account: Simple Regression*Including Global Shocks*

Dependent variable: current account/GDP		
<i>A-) Pooled OLS</i>		
Short-Term	0.014** (0.004)	-0.012* (0.007)
R-squared	0.02	0.05
F-test	11.91	3.26
Medium-Term	0.014 (0.009)	-0.018* (0.010)
R-squared	0.03	0.08
F-test	3.29	1.54
<i>B-) Time Effects</i>		
Short-Term	-0.015** (0.007)	
R-squared	0.12	
F-test	2.32	
Medium-Term	-0.018* (0.010)	
R-squared	0.12	
F-test	2.33	
<i>C-) Robust Regression</i>		
Short-Term		-0.008 (0.006)
R-squared		0.03
F-test		2.15
Medium-Term		-0.014 (0.012)
R-squared		0.04
F-test		0.7

Note: Annual data (1970-2004) is used to get short-term estimates (35 years and 19 targeters). For medium-term estimates, five-year average frequency is used (7 periods and 19 targeters). In this case, if IT dummy (*ITD*) average is greater than 0.5, *ITD* =1, otherwise =0.

Global shocks are worldwide real interest rate, oil price and US growth rate.

White-heteroscedasticity consistent standard errors in parentheses

** significant at 5 percent

* significant at 10 percent

Table 2.5 Effects of Inflation Targeting on Current Account

		<i>Without inflation volatility and terms of trade volatility</i>	<i>Without real exchange rate and trade openness</i>	<i>Without financial openness and fiscal balance</i>	<i>Without growth rate</i>	<i>Without growth rate and financial openness</i>
Dependent variable: current account/GDP						
<i>A-) Time Effects</i>						
Short-Term	-0.008 (0.005)	-0.006 (0.005)	-0.008 (0.005)	-0.006 (0.005)	-0.010* (0.006)	-0.011** (0.005)
R-squared	0.69	0.73	0.68	0.66	0.66	0.65
F-Test	17.21	23.35	16.92	18.81	15.88	16.64
Medium-Term	-0.009 (0.009)	-0.011 (0.010)	-0.007 (0.009)	-0.015* (0.009)	-0.011 (0.009)	-0.017** (0.009)
R-squared	0.36	0.43	0.34	0.32	0.35	0.35
F-Test	1.95	3.15	2.07	2.12	1.96	2.29
<i>B-) Pooled OLS + Global Shocks</i>						
Short-Term	-0.008* (0.004)	-0.006 (0.004)	-0.007 (0.004)	-0.004 (0.004)	-0.011** (0.004)	-0.008* (0.005)
R-squared	0.83	0.85	0.83	0.74	0.78	0.73
F-Test	58.70	81.98	65.92	51.16	44.58	38.67
Medium-Term	-0.003 (0.009)	-0.008 (0.010)	-0.003 (0.009)	-0.015 (0.011)	-0.005 (0.009)	-0.016 (0.011)
R-squared	0.55	0.62	0.53	0.42	0.51	0.46
F-Test	2.79	4.97	3.18	2.29	2.64	2.45

Note: The control variables are: M2-GDP, the first lag of current account (only used in the short-term), net foreign assets-GDP (for the medium-term, it is used the first year (initial stock) of the 5-year average); the first lag of the change in real exchange rate, financial openness, trade openness, output growth rate, relative income (only used in the medium-term), relative income square (only used in the medium-term), inflation volatility, terms of trade volatility, fiscal budget-GDP (surplus). Annual data (1970-2004) is used to get short-term estimates (35 years and 19 targeters). For medium-term estimates, five-year average frequency is used (7 periods and 19 targeters). In this case, if IT dummy (*ITD*) average is bigger than 0.5, *ITD* =1, otherwise =0.

White-heteroscedasticity consistent standard errors in parentheses.

** Significant at 5 percent.

* Significant at 10 percent.

Figure 2.1 Current Account/GDP - Mean across Non-Targeting and Targeting Periods

Note: AU: Australia; BR: Brazil; CA: Canada; CH: Chile; CO: Colombia; HU: Hungary; IC: Iceland; IS: Israel; KO: Korea; MX: Mexico; NO: Norway; NZ: New Zealand; PE: Peru; PO: Poland; SA: South Africa; SN: Sweden; SD: Switzerland; TH: Thailand; UK: United Kingdom. For each regime, the dash-line indicates the average of current account means. For non-targeting and targeting regimes, the averages are -0.0243 and -0.0005, respectively. Those averages are statistically different at 10 percent (P-value = 0.0905).

Figure 2.2 Real GDP Growth Rate - Standard Deviation across Non-Targeting and Targeting Periods

Output Growth Rate Volatility

Note: AU: Australia; BR: Brazil; CA: Canada; CH: Chile; CO: Colombia; HU: Hungary; IC: Iceland; IS: Israel; KO: Korea; MX: Mexico; NO: Norway; NZ: New Zealand; PE: Peru; PO: Poland; SA: South Africa; SN: Sweden; SD: Switzerland; TH: Thailand; UK: United Kingdom. For each regime, the dash-line indicates the average of current account means. For non-targeting and targeting regimes, the averages are 0.03428 and 0.02102, respectively. Those averages are statistically different at 5 percent (P-value = 0.0111).

Table 3.1 Norway- Real GDP per capita (2000 US\$) comparison wrt G7 countries

1980		1990		2003	
Japan	23,897	Japan	33,252	Norway	40,482
Norway	23,148	Norway	28,886	Japan	40,482
US	22,568	US	28,263	US	35,566
Canada	16,578	UK	19,733	UK	25,742
France	15,810	Germany	19,461	Canada	24,222
Germany	15,727	Canada	19,250	Germany	22,868
UK	15,541	France	19,167	France	22,723
Italy	12,998	Italy	16,176	Italy	19,090

Source: World Bank

Table 3.2 The Response of the Current Account to Terms of Trade Shocks

<i>Article</i>	<i>Framework</i>	<i>Type of Shock</i>	<i>National Savings</i>	<i>Investment</i>	<i>Current Account</i>
Svensson and Razin (1983)	HLM effect (export and import sectors)	Temporary	+	0	+
		Permanent	0	0	0
Edwards (1989)	HLM effect (tradable (exports and imports) and non tradables sectors)	Temporary	?	0	?
		Permanent	?	0	?
Serven (1999)	High investment in imported capital goods	Temporary	+	?	?
		Permanent	0	+	-
Kent and Cashin (2003)	Terms of Trade shocks=Productivity Shocks	Temporary and Low Persistent	+	0	+
		Temporary and Highly Persistent	+	+	?
		Permanent	0	+	-

Note: HLM stands for Harberger (1950), and Laursen and Metzler (1950).

Table 3.3 Descriptive Statistics

	<i>Output Per Capita Growth</i>	<i>Terms of Trade</i>	<i>Current Account</i>
Mean	0.01	-0.27	0.05
Standard Deviation	0.02	0.22	0.07
Correlations			
Terms of Trade	-0.02		0.74
Output per capita Growth			0.01
Oil Price	-0.02	0.91	0.68

Table 3.4 Unit Root Test

	[1]	[2]
<i>Terms of Trade</i>		
Levels	0.267	-0.846
First Difference	-8.261***	-8.479***
<i>Current Account</i>		
Levels	-1.966	-3.264*
First Difference	-11.187***	-11.228***
<i>Output per capita Growth</i>	-18.544***	-18.472***

Note: Numbers were obtained using an ADF test including intercept [1], and, intercept and trend [2]. Twelve lags.

Null Hypothesis: process has a unit root.

*** significant at 1 percent

* significant at 10 percent

Table 3.5 Optimal Lag Tests

<i>Number of lags</i>	<i>AIC</i>
1	-12.77
2	-12.70
3	-12.82
4	-12.75
5	-12.63
6	-12.55
7	-12.49
8	-12.38

AIC: Akaike Information Criterion.

Table 3.6 Specification I - Sources of the Terms of Trade, Real GDP per capita Growth Rate, and Current Account Fluctuations

Horizons (Quarters)	S_t^1	S_t^2	S_t^3
<i>Terms of Trade in First Differences</i>			
1	98.81	0.73	0.46
2	96.09	0.75	3.16
3	95.37	0.85	3.78
4	94.82	1.15	4.03
8	94.15	1.50	4.35
20	93.95	1.51	4.54
<i>Real GDP per capita Growth Rate</i>			
1	0.11	99.56	0.33
2	0.12	99.54	0.34
3	0.44	99.13	0.43
4	0.45	99.05	0.50
8	0.48	99.01	0.51
20	0.49	99.01	0.51
<i>Current Account</i>			
1	13.12	0.08	86.80
2	26.57	0.69	72.75
3	36.18	0.67	63.15
4	40.78	0.69	58.53
8	50.66	0.49	48.84
20	56.03	0.38	43.58

Note: S_t^1 is the permanent shock to terms of trade (assumed permanent to output per capita growth and current account); S_t^2 is the permanent shock to output per capita growth (assumed permanent to current account); and S_t^3 is the domestic temporary shock. These assumptions are similar that those of Ahmed and Park (1994), Otto (2003), and Cashin and McDermott (2002).

Table 3.7 Specification II - Sources of the Terms of Trade, Real GDP per capita Growth Rate, and Current Account Fluctuations

Horizons (Quarters)	S_t^2	S_t^1	S_t^3
<i>Real GDP per capita Growth Rate</i>			
1	97.36	2.32	0.33
2	97.32	2.34	0.34
3	97.31	2.26	0.43
4	97.25	2.26	0.50
8	97.22	2.27	0.51
20	97.22	2.27	0.51
<i>Terms of Trade in first differences</i>			
1	0.11	99.43	0.46
2	0.11	96.73	3.16
3	0.19	96.02	3.78
4	0.93	95.04	4.03
8	1.20	94.45	4.35
20	1.20	94.26	4.54
<i>Current Account</i>			
1	0.02	13.18	86.80
2	0.08	27.17	72.75
3	0.07	36.78	63.15
4	0.05	41.42	58.53
8	0.12	51.03	48.85
20	0.2	56.21	43.58

Note: S_t^2 and S_t^3 are still domestic permanent and temporary shocks, respectively; and, S_t^1 is the permanent shock to terms of trade permanent to output per capita growth and temporary to the output per capita growth rate. This is a within country-analysis.

Table 3.8 LR Test for over-identification

Chi-square (1)	P-Value
1.406489	0.2356

Figure 3.1 Norway - Accumulated Assets in Petroleum Fund

Source: Norges Bank (2001) *The Government Petroleum Fund: Annual Report*.
Note: Data for 2002 and 2003 are projections.

Figure 3.2 Norway - Productivity Growth

Source: Norges Bank

Figure 3.3 Current Account-GDP ratio

Figure 3.4 Log of Terms of Trade

Figure 3.5 Real GDP per capita Growth Rate

Impulse-Responses of Output per capita Growth (GRPER)

Figure 3.6 Specification I

Figure 3.7 Specification II

Impulse-Responses of Current Account-GDP

Figure 3.8 Specification I

Figure 3.9 Specification II

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Appendix

Chapter 1

The range of the sample is 1980:1-2006:3. Data was obtained from the Central Bank of Peru Web Page (<http://www.bcrp.gob.pe/bcr/ingles/>). All processes are seasonally adjusted.

1. The current account surplus is represented by current account surplus –GDP.
2. Fiscal surplus is represented by fiscal surplus-GDP.
3. Fiscal spending is represented by government expenditures-GDP.
4. Output gap is obtained from Real GDP using the Hodrick-Prescott Filter.
5. Private Savings is represented by private savings-GDP.
6. Private Investment is represented by private investment-GDP.
7. The Inflation is log of CPI in first differences.
8. Output growth is log of real GDP in first differences.
9. Trade Openness obtained from Penn World Table Version 6.2, September 2006. It is exports plus imports divided by Real GDP (up to 2003).
10. Financial openness is represented by the Chinn Ito's (2008) index. This index tabulates the restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. The higher this index the higher degree of financial openness. The data is available at <http://web.pdx.edu/~ito/>.

Chapter 2

The range of the sample is 1970-2004. Mainly, the data was obtained from IFS (International Financial Statistics).

1. The current account surplus is represented by the current account surplus –GDP ratio. Some countries do not have data for the full range: Chile (1975-2004), Hungary (1982-2004), Iceland (1976-2004), Israel (1976-2004), Korea (1976-2004), New Zealand (1972-2004), Norway (1975-2004), Poland (1980-2004), Switzerland (1977-2004), and Thailand (1975-2004). The current account data of Brazil, Mexico and Peru was obtained from Central Bank web pages of the respective countries.
2. The real exchange rate is the log of real cost in US divided by real cost in targeter. For all targeters, the full sample is available.
3. The index of terms of trade is the division between exports price index (1990=100) and import price index (1990=100). It is in log-form. The full range of data is available for all countries except for Brazil (1980-2004), Chile (1980-2004), Iceland, (1970-1998), Korea (1971-2004) Poland (1979-2004) and Switzerland (1977-1987). The terms-of-trade volatility is obtained by using the Hodrick-Prescott Filter. For Mexico and Peru, the data was obtained from their Central Banks' web pages.
4. Financial openness is represented by the Chinn Ito's (2008) index. This index tabulates the restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. The higher this index the higher degree of financial openness. The data is available at <http://web.pdx.edu/~ito/>.
5. Trade openness at constant prices is in log-form. It was obtained from Penn World Table Version 6.2, September 2006. It is defined as exports plus imports divided by real GDP and

- available up to 2004. The full range is not available for Brazil (1970-2003), Colombia (1970-2003), Peru (1970-2003) and Thailand (1970-2003).
6. Fiscal budget surplus is represented by the fiscal balance-GDP ratio. The full sample is only available for Colombia, Peru, South Africa and Switzerland. The data collected is: Australia (1970-2002), Brazil (1970-1994;1997-1998), Canada (1970-2001), Chile (1970-2000), Hungary (1981-2004), Iceland (1970-2004), Israel (1970-2001), Korea (1970-1997), Mexico (1980-2004), Norway (1970-2003), New Zealand (1970-1988;1990-2001), Poland (1984-1988;1994-2004), Sweden (1970-2000; 2002-2004), Thailand (1970-2003), and UK (1970-1999).
 7. For financial deepening, I calculate the proxy variable, M2-GDP ratio, which is also used by Chinn and Prasad (2003). For all targeters, the full sample is available except for Chile (1997-2004), Hungary (1990-2004), Iceland (1972-2004), New Zealand (1994-2004), Poland (1980-2004), and Sweden (1998-2004).
 8. Net foreign assets are represented by the net foreign asset-GDP ratio. Chinn and Prasad (2003) also use this proxy. Colombia (1970-1985; 1987-1988; 1990-2004), Hungary (1982-2004), Norway (1970-2003), and Poland (1980-2004) are countries with missing data.
 9. Output growth rate is the log of the real GDP at time t minus the log of the real GDP at time $t-1$. The real GDP is the nominal GDP divided by the GDP-deflator. The full sample of data is available except for Hungary (1971-2004), Israel (1980-2004) and Poland (1981-2004).
 10. Relative income is defined as real GDP per capita (at constant prices (2000): Laspeyres) of the targeter divided by real GDP per capita (at Constant Prices (2000): Laspeyres) of US. Real GDP per capita is in international dollars. Relative income was obtained from Penn

World Table Version 6.2, September 2006. The full sample is available for all countries except for Brazil (1970-2003), Colombia (1970-2003), Peru (1970-2003), and Thailand (1970-2003).

11. Inflation volatility is obtained using the Hodrick-Prescott Filter. CPI percent change (monthly) is divided by 100. For Australia and New Zealand, CPI percent change is quarterly. The full range of data is available except for Brazil (1980-2004), Hungary (1976-2004), Iceland (1983-2004) and Poland (1971-2004). This process is seasonally adjusted.
12. The global shocks are: the world real interest rate which is the GDP weighted average of the real interest rate of the US, Italy, France, Japan and Germany; the oil price (annual average Crude Oil Price, dollar per barrel adjusted for inflation to January 2007 dollars); and, the US growth rate.

Chapter 3

The range of the sample is 1981:1- 2006:2. Data was obtained from the International Financial Statistics at the IMF and from Norway Statistics web page (<http://www.ssb.no/english>). All processes are seasonally adjusted.

1. Current account surplus is current account surplus deflated by GDP.
2. Terms of Trade is log of export price over import price.
3. Output per capita Growth is log of real GDP over population in first differences.
4. Oil price is log of price of barrel in dollars adjusted by US CPI.

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