

Acknowledgement

The process of writing this thesis has been somewhat challenging as I started out with a too broad problem. I did several analysis's which I didn't end up using. So, naturally I spent a lot of time on reading different papers in an attempt to find something that could help me confine my problem. But now, when I'm finally done, it feels very rewarding, mostly because I have learnt a lot more in the process in a wide perspective of subjects within econometrics (in practice) and open economy macroeconomics.

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Chapter 1 Introduction

The current account is regarded an important leading indicator of the health of a nation's economy. Movements in the current account convey information about the actions and expectations of all economic agents in an open economy. The distinctive feature of an open economy is the ability to lend or borrow in international capital markets. Economic agents are likely to respond to cyclical disturbances in an attempt to smooth consumption and investment flows. From a policymakers viewpoint one could determine if domestic economic goals are in line with a sustainable external position with more success if we have a better understanding of both the short- and longer-run adjustment paths of the factors that influence the development in the current account. Understanding the long-run effect of shocks in current account determinants like the domestic and foreign business cycle, could therefore be of importance within the field of open economy macroeconomics.

This thesis aims to explore the dynamic impacts of shocks in domestic and foreign business cycles on the current account balance in a panel of OECD countries. The business cycle can be described as the simultaneous fluctuation in activity in most parts of an economy over time. It refers to periods of expansions and contractions in the level of economic activities around the long-run growth trend. The cycle can shift from periods of rapid growth to periods of stagnation or even decline (recession). In early literature the business cycles were thought to be very regular and to have quite predictable durations. Today they are widely believed to be irregular, varying in frequency, magnitude and duration (Chatterjee, 2000). The business cycles can be expected to affect the current account balance through adjustments in both the trade balance and the net international investment position (in – and outflows of capital related to investment and saving activities). In the literature, we find a number of theoretical models that try to explain the behavior of the current account. The models give different predictions about the factors determining the current account balance, and also different signs and magnitudes of the relationships between these determinants and the current account. In most earlier empirical works, the authors are looking at the short- or medium-run adjustments of the current account. The methodological approaches that have been adopted in the existing empirical literature have a major focus on cross-section and panel data analysis. Many of them are employing a broad set of potential

determinants and ignoring endogeneity problems, while some are trying to solve these problems by using advanced instrumental variable methods like GMM-estimation¹ with relatively weak instruments. One thing most of them have failed to take into consideration is the possible presence of non-stationary variables in their analysis something which could make their regression results spurious. Hence, undertaking an empirical analysis of dynamics using a one-step error correction model, which would correct for possible non-stationary variables and also give a good understanding of dynamics whether or not variables are found to be stationary, could help shed light on the longer-run adjustments of the current account balance following cyclical disturbances. My main focus in this thesis will be to empirically investigate how domestic and foreign business cycles affect the current account position in both the short- and (especially) over the longer-run using the one-step error correction approach. I will use these results to examine the length of the adjustment period and total long-run effects of business cycle shocks in form of impulse response functions. Further I will investigate country characteristics that might influence the adjustment in size and time. Please note that this paper is not related to any earlier literature regarding current account adjustment as they refer to current account adjustment as reversals in the current account following long/large deficit spells whilst I refer to adjustment as the dynamic effect following business cycle fluctuations.

This thesis is divided into six chapters. In chapter 2 I will start out by describing the various approaches to the current account balance, then I will present some results from earlier empirical literature related to the current account, its determinants and shocks followed by a description of my own empirical approach. In chapter 4 I will present the data sample and the variables I use in my error correction model, further I also explain how these variables are theoretically related to the current account balances. Chapter 4 presents the methodology used for the empirical analysis, the econometric background for my error correction model and the model specification. I will also review some econometrical challenges and the solutions I have chosen to minimize these problems. In chapter 5 I will

¹ Generalized Method of Moments (GMM) is estimation procedure using instrumental variables that allows economic models to be specified while avoiding often unwanted or unnecessary assumptions, such as specifying a particular distribution for the errors.

present the model estimates, predictions for individual countries, simulation results and a sample-heterogeneity analysis where the goal is to identify characteristics in groups of countries that affect the adjustment in response to business cycle shocks. A conclusion of the work is provided in chapter 6. I have also included three appendices which contain additional information regarding data (appendix A), statistical results (appendix B) and figures (appendix C).

Chapter 2 Related Literature and Theoretical Focus

2.1 Approaches to the Current Account

Obstfeldt (2005) defines the current account in the following manner: *“A country's current-account balance over any time period is the increase in residents' claims on foreign incomes or outputs, less the increase in similar foreign-owned claims on home income or output. Thus, in theory, the current account includes not only exports less imports (broadly defined to include all the income on and payouts on cross-border assets: Dividends, interest payments, insurance premia and payments, etc.), but also net capital gains on existing foreign assets.”* (p. 1731).

The current account balance is generally viewed as either the sum of the trade balance and net international investment income or as the difference between savings and investment. The first view is often referred to the elasticity approach and the latter the absorption approach. These views do not pose any theoretical conflict with each other, because each identity can be derived from the other in the framework of a nations income- and product accounts.

In the trade elasticity framework developed by Mundell and Fleming in the 1960s the current account was mainly thought of as the net export balance of a country. Consequently, this focus led economic thinkers to view relative international prices as key in determining the current account. **The elasticity approach** only looks at the traded goods market, and ignores interactions of other markets in an economy. For an example, the approach treats financial account transactions as passive responses to current-account transactions. It is therefore incapable of analyzing shocks that initially drive only the financial account. Thus, the nature of the model can make it limited in ability to explain long-run dynamics and long-term equilibrium current account positions.

Alternatively, **the absorption approach** views the current account as the difference between domestic savings and domestic investment:

$CA = S - I$ where CA = the current account, S = savings and I = investment.

Absorption in this setting could be defined as a nation's total expenditure on goods and services (consumption, government spending, investments and imports). This approach focuses on the macroeconomic factors that determine savings and investment, and it

especially emphasizes a nation's real income as an important determinant of the current account balance. The current account is herein determined by the difference between real income and what is absorbed (internal consume).

The very popular **intertemporal approach** to the current account which was first proposed by Sachs (1981) and later extended by Obstfeldt and Rogoff (1995, 1996) is anchored in the absorption approach. In comparison to the elasticity approach based on Keynesian economics², the intertemporal approach to the current account puts less emphasis on international price competitiveness and relative demand in explaining current account movements. The intertemporal model is viewing the current account as the outcome of forward-looking dynamic saving- and investment decisions. It is built upon a representative consumer who is maximizing his/her utility by smoothing consumption over time. In this framework business cycle shocks are expected to have a little or no effect on the current account if these shocks are viewed as somewhat permanent, because the economy would adjust by reducing or increasing consumption immediately after a shock. If a shock is temporary however the economy will run a current account deficit or surplus by borrowing or lending on the international capital markets to keep consumption at a constant level over time. In addition, empirical works based upon a standard intertemporal current account model (e.g. Glick and Rogoff 1995) have shown that global shocks have a tendency to have little or no effect on the current account.

These expectations are built upon assumptions of perfect capital markets³ and no intertemporal distortions. In reality however these assumptions can, or most probably will be erroneous. I will on the grounds of this empirically investigate the dynamic effects of domestic, foreign and global cyclical shocks based on my own simple empirical model.

² Keynesian economics is a direction in economic theory where aggregate demand is given the center of attention.

³ Agents are perfectly rational and they pursue utility maximization. There are no direct transaction costs, regulation or taxes, and all assets are perfectly divisible. There is perfect competition in product and securities markets. All agents receive information simultaneously and it is costless, further all information is either certain or risky.

2.2 Related Literature

There are three main directions in the related empirical literature in this field. In one direction researchers have tried to identify the determinants of saving instead of the actual current account (e.g. Hussain & Brookins, 2001; Schmidt-Hebbel et. Al, 1991). Some of these works have also included the current account as an independent variable that determines saving. Another direction in the empirical literature has been identifying test strategies in regard of a standard intertemporal model (e.g. Glick & Rogoff, 1995). The third direction, which I use as a starting point have tried to identify specific determinants of the current account in both the short- and longer run (Chinn & Prasad, 2003; Debelle & Faruqee, 1996; Hung & Bronowski, 2002; Calderon et. Al, 2002).

One of the earliest attempts to identify current account determinants was done by Khan & Knight (1983). They used ordinary least squares on a pooled cross-series data base on 32 non-oil producing countries over a time period spanning from 1973 to 1980. They observed some external and domestic factors (real exchange rates, growth rate in industrial countries, terms of trade, government budget balances) that were relevant and influenced the current account in the sample. They did not however control for endogenous or non-stationary variables in their models.

Elliot and Fatas (1995) analyze the transmission of productivity shocks across countries and how the responses of investment and the current account differ depending on the degree of dispersion of the shocks. The authors explore estimate a structural model for the Japanese, German and US economies where productivity shocks spread through trade. The authors find that there is a strong asymmetry in the dispersion of shocks. Shocks to the US spread quickly to the other two economies while shocks in Germany and Japan have little impact on other countries' productivity. The authors explore the responses of investment and the current account to each of these shocks, and their main finding is that productivity increases lead to domestic investment booms and current account deficits. Even when the shock is purely national, the authors find that foreign investment tends to have a positive reaction to productivity shocks. They argue that this result contradicts the predictions of a standard open-economy model with perfect capital mobility where, in response to country-specific shocks, domestic and foreign investment should move in opposite directions.

Debelle and Faruquee (1996) investigated a panel of 21 industrial countries and also an extended dataset where they included 34 more developing countries in the timespan 1971-1993. They attempted to identify the factors that could have a long-run influence on the current account.

They tried to explain the current account developments by using both cross-sectional and panel data models. Their main findings in the cross-sectional estimation were a significant effect of relative income, government debt and demographics, but they did not find a significant effect of the government budget balance, terms of trade and capital restrictions. A country with a more advanced economy (measured in higher relative income), is more likely to run a smaller deficit/larger surplus. One last finding was that those countries having a dependency ratio⁴ higher than average tended to run a larger deficit.

Loayza et al. (2000) carried out a similar empirical analysis using an unbalanced panel consisting of 44 developing countries with data in the timespan 1966-95. Using pooled-time series and cross-sectional methods they identified the relationships between main determinants and the current account within and across countries by using separate GMM-estimation methods to exclude endogeneity problems like simultaneity. Their main findings were that current account deficits were relatively persistent and that domestic growth had a positive effect on the current account deficits both within and across countries. For developing countries they found that an appreciation in the real exchange rate would lead to an increase in the deficit.

Hung and Bronowski (2002) modeled the US current account from an absorption based perspective viewing the current account balance is the difference between national savings and investment. They used an error correction model to estimate both the short- and long-run adjustments of the current account with respect to a set of variables including the domestic- and foreign output gap. They instrumented endogenous variables with lagged quarter values of the respective variable in an attempt to remove endogeneity problems. They found evidence in the data that the domestic and foreign activities, the share of dependents in the foreign population, real domestic and foreign interest rates and domestic

⁴ Number of dependents (people who are too young or too old to work) in relation to the workforce in an economy.

corporate profit were significant contributors to the adjustment in the current account. However, they did not find a significant effect of the domestic budget balance in the case of the United States. The long run coefficients on the domestic and foreign output gap variables were estimated respectively to -0.45 and 0.45. They argue that models based on the savings- investment approach models the current account better than models based on the elasticity approach.

Chinn and Prasad (2003) have in their paper viewed the current account balances as the outcome of various structural and macroeconomic determinants that influence the saving- investment balance. They involve a rich set of potential determinants of current account variation that originates from cross-country growth-, saving- and investment studies of the past. They extended the work of DeBelle and Faruqee (1996) by including developing countries and a wider range of static and dynamic specifications, and also let these undergo extensive robustness test. The full sample used consisted of 89 countries whereas 18 were industrial countries and 71 developing countries. They used both cross-sectional and panel data approaches. The main results from the panel data approach can be summarized as follows; the government budget balances have a strong positive relationship with the current account balances, initial net foreign assets position and indicators of financial deepening seem to be positively correlated with current account balances. Results from the full sample, fixed effects regression show that a 1 percentage point increase in the government budget balance (in ratio to GDP) would increase the current account balance to GDP by 0.376 percentage points. An increase in the net foreign assets to GDP by 10 percentage points would increase the current account balance in terms of GDP by 0.17 percentage points.

Downes and Moore (2004) examined the behavior of the current account when actual output deviated from potential output using annual data for Barbados over the period 1975-2002. They compared non-structural and structural estimates of the output gap, which in turn was regressed on the current account balance. When using the aggregate production function estimate used by the IMF and OECD (wherein potential output is derived as the level of output that should be obtained when all factors of production is fully utilized), the coefficient for the output gap regressed on the current account was -0.54. A one percentage point increase in the output gap in percent of potential GDP ratio would give a reduction of

0.54 percentage point on the current account to GDP ratio. Using a Hodrick-Prescott filter to estimate the output gap the regression results yielded a coefficient of -0.43 and using a simple linear time trend to estimate the output gap the corresponding coefficient was estimated at -0,151. Even though the main objective of their work was to evaluate different estimation methods of output gap, their regression results could be of relevance to me for comparison reasons.

Chinn and Ito (2005) analyzed the determinants for current account balances in industrial and developing countries. They also empirically controlled for differences in institutional environment across countries. Their data covered a large, heterogeneous group of 117 countries over a 7 year period (1997-2003). This paper extended the work of Chinn and Prasad (2003) with an incorporation of legal and institutional effects. Based on the different specifications, they found that the budget balance is an important determinant of the current account balance in almost all groups of countries. In the baseline specification the current account to GDP ratio responded by increasing 0.18 to a one percentage point increase in the budget surplus to GDP ratio. This response could range up to 0.40 in a fixed effects regression. This is a finding that the advocates of fiscal inefficiency must take in consideration; it is clear from these results that fiscal policy could affect the current account. There are some other results that are interesting in their paper, the variable for financial deepening⁵ failed to exhibit a significant association with current account balances in the full sample regressions. Presumably one should think that the financial deepening variable would have reduced the current accounts in developing and emerging countries, but in the results this is not the case. However it appears to be significant in the case of the industrialized countries. When looking at developed economies they found that higher income growth is associated with large current account deficits.

Morsy (2009) investigated the determinants of current account balances in oil-exporting countries using dynamic panel estimation techniques. The author raised concerns about the applicability of the estimated coefficients in earlier studies to oil-producing countries. It extends earlier studies by including an oil-wealth variable, the oil balance and a proxy for the

⁵ Financial deepening is a measure of financial development and it can be referred to as liquid money in an economy. Usually it is proxied by the ratio of money supply to GDP.

degree of maturity in the oil production. The other variables included in the model were; the fiscal balance, demographic factors (the dependency ratio and population growth both measured in deviation from their averages), net foreign assets and economic growth. The model was estimated using pooled time series, fixed effects regression and the GMM-approach which controls for endogeneity and corrects for bias arising from including the lagged dependent variable and other endogenous variables in the fixed effects estimation. The main results from the GMM-regressions are a significant impact (at the 5% level) of the lagged current account (0.41) also referred to as persistence, the oil balance (0.35), the fiscal balance (0.51), the age dependency ratio, oil wealth and the degree of maturity in oil production. The most noteworthy results are that there seems to be a high degree of persistence in the current accounts and that the oil balance is a significant contributor to current account development.

2.3 My Approach

In the literature we find a number of theoretical models that try to explain the behavior of the current account. The models give different predictions about the factors determining the current account balance, and also different signs and magnitudes of the relationships between these determinants and the current account. In most of these works the authors are looking at the short- or medium-run adjustments of the current account. The methodological approaches that have been adopted widely in the existing empirical literature have a major focus on cross-section and panel data analysis. Many of them are employing a broad set of potential determinants and ignoring endogeneity problems, while some are trying to solve these by using advanced instrumental variable methods like GMM-estimation with relatively weak instruments. One thing most of them have failed to take into consideration is the presence of non-stationary variables something which would make their regression results spurious. A spurious⁶ result is when an OLS⁷ regression indicates a

⁶ The term was first used by Granger and Newbold (1974) after simulating regressions between independent $I(1)$ variables and finding the regressions statistically significant a large percentage of the time, when they should not be.

⁷ OLS – Ordinary Least Squares, a standard estimation method used to estimate the unknown regressors in a linear regression model. It estimates the best linear unbiased estimates when certain assumptions regarding the error term are true (Wooldridge 2009).

relationship between variables, even though there is no sense in which the variables are related. Therefore, checking for non-stationary variables and later undertaking an empirical investigation focusing on only (to avoid further simultaneity bias) the current account and the domestic and foreign activity levels could help shed light on the dynamic adjustment in the current account following cyclical shocks.

My investigation of current account dynamics is only loosely based on a theoretical model, because there are so many ambiguous effects on the current account balance following business cycle fluctuations, making it hard to predict an effect from such models. Different economic theories give contrasting predictions from the effects of fluctuations in economic activity on the current account balances.

An improving business cycle is associated with increasing business confidence which induces increases in wages, prices and employment, thus an increase in domestic income. Hung and Bronowski (2005) argue that an improvement in the domestic business cycle will reduce the savings ratio because disposable income and the share of the consumption tend to increase during an expansion. This is somewhat contradicted by growth theories (Friedman 1957; Modigliani, 1970) though, where savings is actually expected to increase during expansions.

An improving domestic business cycle is also expected to increase the share of investment because consumer demand tends to increase during an expansion, boosting demand-led investment. Foreign capital could also be expected to flow into the domestic economy as it has become more attractive to foreign investors.

From a trade-viewpoint we would expect the trade balance to worsen during an expansion, because inflationary pressures at home could make consumers substitute domestic goods with relatively cheaper foreign goods, which would lead to a weakening current account position. Thus imports are viewed to be pro-cyclical. Exports though, are not as straightforward because they also heavily depend on other countries' events, but the level of exports are generally expected to decrease as a result of higher prices on domestically produced goods.

It can be argued that the effects of the business cycle on savings- and investments behavior would depend on a numerous amount of factors and assumptions; which can range from

how the change is perceived by the households (do they expect the good/bad times to be short-lived or somewhat lasting) to demographics and government policies. Thus, when we look at the current account we cannot make any strong a priori suggestions on the responses to business cycle fluctuations because both savings and investment might move in the same direction. I am assuming it exist a long-run equilibrium in the current account given by variables left outside of my model that is afflicted by both the domestic and foreign activity levels. It could be argued that the net effects of the business cycle fluctuations' influence on current account balances can only be resolved empirically. The empirical specification I will use is a generalized one-step error correction model with the current account as a dependent variable and a proxy for both the domestic and foreign business cycle as regressors which I will come back to in Chapter 4. First I will describe my data.

Chapter 3 Data

The basic data set used in this thesis is an unbalanced panel with annual data for 23 OECD countries covering the time period 1990-2010. The countries and sample period were selected due to data availability. Panel data can be described as a dataset in which we can observe the behavior of entities over time, and an unbalanced panel is a dataset where there are some missing observations (Wooldridge, 2009). The use of panel data allows me to take advantage of a larger number of observations and it also allows use of methods like fixed effects which can reduce some of the endogeneity problems and thus improve the efficiency of my estimates. The primary sources of data used in this thesis are the World Bank's World Development Indicators (WDI) and the International Monetary Fund's (IMF) International Financial Statistics (IFS).

The list of countries included in the sample can be found in appendix A-1.1.

3.1 Variables

The inclusion of the following variables has its roots in earlier literature regarding the current account balance. As mentioned before authors of earlier empirical literature have included a lot of potential determinants of current accounts in their models. Many of these are thought to be endogenous variables. Some of the papers have ignored this fact and has presented potentially biased results, while others have used different instrumental variable methods to handle the endogeneity problem. I have tried to avoid including more endogenous variables than necessary and rather focus on investigating the dynamics of the current account balance resulting from the domestic and foreign business cycles modeled in an error correction approach. Data sources can be found in appendix A-1.2. In addition all extra variables used in the thesis (for robustness checks and construction of subsamples in the heterogeneity analysis) can be found Appendix A-1.3 and A-1.4.

3.1.1 Dependent Variable

The dependent variable is the **current account balance in ratio to GDP**. It is defined as the sum of net exports of goods and services, net income, and net current transfers in percentage of GDP. Below I will give a description of the independent variables and why and how they are expected to influence the current account balance.

3.1.2 The Output Gap in Percentage of Potential GDP

The output gap variable is defined as actual GDP less potential GDP as a percent of potential GDP.

When actual GDP lies above potential GDP, there is a positive output gap. In such a situation we would experience inflationary pressures and we would expect income to increase. This often happens at the end of a period of sustained economic growth above the long-run average growth. Therefore I will take advantage of some growth theories to give an insight in how the output gap could be expected to influence the current account.

There are many empirical studies that have noted a high degree of correlation between economic growth and the savings rate. But the causality is not clear. Growth theorists usually assume that the causality moves from saving to physical and human capital and then to growth (i.e. Romer, 1986). On the other hand, consumption theories could explain the opposite notion.

Modigliani (1970) showed by using a very simple life-cycle model that higher income growth would cause more saving on an aggregate level. The life-cycle model predicts that the saving rates should be increased by the growth rate. This happens because the lifetime income of the young generation is high relative to the old generation when there is high economic growth. Thus, the saving by the young generation more than offsets the dissaving of the old generation. He found support for his theoretical prediction using cross-country data. One could also argue that the growth rate could increase public saving through the tax-effects of the higher income.

Another theory on the subject is the permanent income hypothesis, first developed by Milton Friedman in 1957. The idea behind the hypothesis is that an individual's consumption depends on his or her expected earnings over a distinguished period of time. As in the life-cycle hypothesis, people smooth out fluctuations in their income so that they spend during periods of low income relative to what they believe is their normal income and save during periods of unusually high income.

Consumption patterns are viewed to be largely driven by changes in permanent income, rather than change in temporary income.

When focusing on the current account we know that it is primarily driven by saving and investment. I have now listed literature regarding growth and savings, but what about the investment levels? Increased economic growth would be followed by a corresponding increase in the level of investment through what is known as the accelerator effect (Bernanke and Gilchrist, 1999). A change in aggregate economic activity causes a change in the agents' net worth (there is a positive correlation between them) and the economic agents' net worth has an inverse relation to the external finance premium (the price of external borrowing). This inverse relation between output changes and the external finance premium would make borrowing more expensive during bad times than during expansionary periods. Coric (2011) argues for example that any negative economic shock that might lead to a decrease in economic agents' net worth would also increase the external finance premium. Consequently, due to higher costs, and/or reduced ability to borrow, the overall level of agents' investments, spending and production could decrease even more.

On the basis of these empirics and arguments, there should be little doubt about including the output gap variable as a determinant for the current account. But can we make any expectations about the effect of the output gap on the current account balance? We would expect savings to increase if we are in a situation where there is an improvement in the business cycle. However, we cannot draw an a priori expected sign on the effect on the current account, because we would also expect investment to increase through the accelerator effect. Any a priori expectation would have to be based on earlier empirical literature, where most find that the effect on investment dominates (e.g. Downes and Moore, 2004; Hung and Bronowski, 2005), thus the current account balance is expected to worsen.

3.1.3 The Foreign Output Gap in Percentage of Potential GDP

This variable is defined in the same way as the domestic output gap. When using panel data it is somewhat of a problem constructing any measure of the foreign output gap. Usually for individual countries the common practice is to map the largest trade partners to that economy and construct a geometric average of trade-weighted output gaps in these countries. In my analysis however, I have used (due to data availability) the United States

output gap as a measure of the foreign output gap. My intention was that the United States could act as a proxy for the foreign sector, being one of the largest economies in the world. I also chose it due to the findings of Elliott and Fatas (1995), where US productivity shocks were found to spread to other countries and not the other way around. This could signal its position as a heavyweight in the global economy.

An increase in the foreign output gap could reduce a country's net capital inflows for two reasons. First it could reduce foreign savings, which in turn would lower gross capital inflows to the domestic economy. Second it will increase the attractiveness of investment in foreign economies for the domestic country, and thereby increasing gross capital outflows.

Following the mindset of diversification in international portfolio theory (Stonehill et. Al. 2007) investors can gain significantly by investing abroad. Investors would like their expected returns to be high and the combined risk of their portfolio to be low. In theory they could get both by investing in a foreign country (assuming an increase in foreign output gap is associated with higher rates of return and there is different nonsystematic risk in the two countries).

Chapter 4 Methodology

I will be focusing on the domestic and foreign business cycles and their relation with current account adjustments in this thesis. This will be modeled using panel data estimated in a one-step error correction model, which makes it possible to analyze short-run dynamics between the dependent and the independent variables while simultaneously attend to a possible long-run equilibrium. The estimated model will be used for in-sample predictions, domestic- and foreign business cycle shock simulations and it will also be estimated for different subsamples to check for heterogeneity between groups of countries. All estimations and statistical tests in the thesis are performed in the statistical package STATA while the simulations are executed in Microsoft Excel. To avoid spurious results, I first have to investigate whether the variables I have included are stationary or not.

4.1 Stationarity

A stochastic variable is stationary if the probability distribution is stable over time. To keep the following assumptions and the description of the error correction approach below simple, I ignore the panel portion and focus on a normal time series variable. For a time series to be stationary, the following assumptions must hold:

- 1) $E[X_t] = \mu$, for all t
- 2) $Var[X_t] = \sigma^2$, for all t
- 3) $Cov[X_t, X_{t+k}] = \rho$, for all t and for all $k \neq 0$

If this is not the case, then X_t is not stationary. Very often we will find that macro economical time series do not match the requirement of stationarity, even though they in theory should be (Carlaw et al. 2009). It is therefore necessary to test whether the current account to GDP ratio and the two proxies for the domestic and foreign business cycle are stationary or not. If I were to regress non-stationary variables through OLS-estimation I would obtain spurious results. Non-stationary variables can in some cases be transformed to become stationary, so that we can use OLS estimation techniques to estimate them. The most common transformation is a first difference transformation. For an arbitrary variable X , the first difference can be written $\Delta X_t = X_t - X_{t-1}$. Where Δ is a difference-operator. If

the variable becomes stationary after first differencing it is integrated by order 1. A process X_t is integrated by order d ($I(d)$), if it has to be differenced d times to obtain stationarity. A stationary variable is per definition $I(0)$.

I will be using an Augmented Dickey Fuller Test to test for stationarity. The test is designed to check for unit-roots⁸ in stochastic variables. The normal Dickey Fuller test has the following AR(1) process as a starting point:

$$(4.1.1) X_t = \rho X_{t-1} + e_t.$$

where X_t is the observed initial value of the variable. The null hypothesis in the Dickey fuller test is that X_t has a unit root:

$$H_0: \rho = 1$$

And the alternative hypothesis is the following:

$$H_1: \rho < 1$$

We are mostly interested in the one-sided alternative because if $H_1: \rho > 1$ then the variable would be explosive (it would have an exponential trend). We can conveniently test this by subtracting X_{t-1} from both sides of the AR(1) equation, and define $\beta = \rho - 1$.

$$(4.1.2) \Delta X_t = \alpha + \beta X_{t-1} + e_t$$

From here we can straightforward test $H_0: \beta = 0$ against $H_0: \beta < 0$, but we cannot do perform this test with the normal critical values and the t-statistic, we have to use an asymptotic distribution of the critical values known as the Dickey Fuller distribution after Dickey and Fuller (1979). Extending this to include more advanced dynamics, we obtain what is called the Augmented Dickey Fuller Test. This is done by expanding the AR model with additional lags. When using annual data, like I do in this analysis, Wooldridge (2009) suggests including 1 or 2 additional lags. I chose to use 1 lag. The test equation will then be as follows:

⁸ A unit root in time series could be described as a highly persistent process where the current value equals last periods value plus a weakly dependent disturbance.

$$(4.1.3) \Delta X_t = \alpha + \beta X_{t-1} + \gamma \Delta X_{t-1} e_t$$

The test procedure is the same as described above, we test the estimated β with the Dickey Fuller critical values. If we reject the null-hypothesis we can conclude the variable is (most probably) stationary. If the variable is found non-stationary, the next step is to difference it and then repeat the procedure to find out which order the variable is integrated.

4.2 Error Correction Models

Error Correction Models (ECM) makes it possible to analyze short-run dynamics between the dependent and the independent variables and simultaneously attend to a possible long-term equilibrium. On a general basis we assume there is a long-run relationship between two variables X and Y given by the following equation:

$$(4.2.1) Y_t = AX_t^{\beta_1}$$

Where A and β_1 are constants. β_1 is the long-run elasticity of Y with respect to X . If we denote the variables on a logarithmic scale with small letters we can write equation (4.2.3) as :

$$(4.2.2) y_t = \beta_0^* + \beta_1 x_t$$

Where $\beta_0^* = \ln(A)$

Provided that X stays on a constant level Z for a sufficient time period, Y will converge to the value $\beta_0^* + \beta_1 z$. We can then define the extent of disequilibrium, ED_t also known as the error correction mechanism as:

$$(4.2.3) ED_t = y_t - \beta_0^* - \beta_1 x_t.$$

If Y and X are in a long-term equilibrium, the condition where $ED_t = 0$ has to be valid. Since very few economical systems are in long-term equilibrium this term is often referred to as the disequilibrium term or the equilibrium error. Changes in Y will not only depend on a change in X , but also of the size of the disequilibrium in the preceding period.

Since X and Y rarely are in equilibrium, it is usual to estimate a dynamic model where we can have lags of both the dependent and independent variables as explanatory variables. As an example I now consider the simple two-variable ADL-model⁹ containing two of my variables:

$$(4.2.4) \quad Ca_t = b_0 + b_1Gap_t + b_2Gap_{t-1} + \mu Ca_{t-1} + \varepsilon_t$$

where Ca is the current account balance to GDP ratio and Gap is the output gap to potential GDP ratio.

The main reason why I am not just estimating the parameters in the ADL-model in equation (4.4.4) is that it is easier to capture the long-run dynamics over the full adjustment cycle when using a generalized one-step error correction model and that some of the variables might be non-stationary. By implementing this method I can simultaneously extract information about both the short- and long-run adjustments and also a adjustments toward a possible long-run equilibrium. Further, the use of this estimation technique also solves a possible non-stationarity problem. By first differencing equation (4.4.4), I can subtract Ca_{t-1} on both sides of the equation to obtain:

$$(4.2.5) \quad Ca_t - Ca_{t-1} = b_0 + b_1Gap_t + b_2Gap_{t-1} - (1 - \mu)Ca_{t-1} + \varepsilon_t$$

From here I can also add and subtract b_1Gap_{t-1} on the right hand side of the equation:

$$(4.2.6) \quad Ca_t - Ca_{t-1} = b_0 + b_1Gap_t + b_2Gap_{t-1} + b_1Gap_{t-1} - b_1Gap_{t-1} - (1 - \mu)Ca_{t-1} + \varepsilon_t$$

This result can be presented as:

$$(4.2.7) \quad \Delta Ca_t = b_0 + b_1\Delta Gap_t + (b_1 + b_2)Gap_{t-1} - \lambda Ca_{t-1} + \varepsilon_t$$

Where $\lambda = 1 - \mu$.

From here I now re-parameterize equation (4.4.7) as the following:

⁹ Autoregressive Distributed Lag model: A model where the regressors may include lagged values of the dependent variable and both current and lagged values of one or more explanatory variables (Wooldridge, 2002).

$$(4.2.8) \Delta Ca_t = b_1 \Delta Gap_t - \lambda (Ca_{t-1} - \beta_0 - \beta_1 Gap_{t-1}) + \varepsilon_t$$

Where $\beta_0 = b_0 / \lambda$ and $\beta_1 = (b_1 + b_2) / \lambda$.

Both β_0 and β_1 are long-run parameters, while b_1 and λ are short-run parameters. The parameter b_1 measures the effect of a one unit change in the output gap has on the current account in the short-run. The parameter λ is called the adjustment parameter and it estimates the speed of convergence towards the equilibrium when we have had a deviation from equilibrium between the output gap and the current account balance. This parameter has to be negative between 0 and 1 for the model to return to equilibrium. If the adjustment parameter has a value of 0, there is no long-term relationship between the two.

β_1 estimates the long-run effect a one unit change in the output gap have on the current account balance. This long-run effect will be distributed over the subsequent time periods according to the error adjustment speed, λ .

The equilibrium error in the previous period can be written

$$(4.2.9) ED_{t-1} = Ca_{t-1} - \beta_0 - \beta_1 Gap_{t-1}.$$

Inserting this into equation (4.2.10) we obtain

$$(4.2.10) \Delta Ca_t = \beta_1 \Delta Gap_t - \lambda ED_{t-1} + \varepsilon_t$$

4.3 Estimating Error Correction Models

Error correction models can be estimated by OLS, but they cannot be estimated from the result in equation (4.4.8). The method I will use when estimating error correction models in this thesis is called the generalized one-step error correction method. It is a transformation of an autoregressive distributed lag (ADL) model (Banerjee et. al. 1998). The model may be used to estimate relationships among both unit root processes as well as stationary processes. Unlike other methods like the Engle-Granger two-step method, using the dynamic one-step error correction model we can estimate the long-run relationship, the short-run dynamics and the disequilibrium in one setting.

By multiplying out the equation in (4.4.8) we obtain

$$(4.5.1) \Delta Ca_t = b_1 \Delta Gap_t - \lambda Ca_{t-1} + \lambda \beta_0 + \lambda \beta_1 Gap_{t-1} + \varepsilon_t$$

If we rewrite this and substituting out for our variables we get:

$$(4.5.2) \Delta Ca_t = a + b_1 \Delta Gap_t + c Ca_{t-1} - d Gap_{t-1} + \varepsilon_t$$

where $a = \lambda \beta_0$, $b = b_1$, $c = -\lambda$ and $d = \lambda \beta_1$.

If we regress ΔCa_t on ΔGap_t , Ca_{t-1} and Gap_{t-1} , we obtain the estimates for a, b, c and d. Since $\lambda = -c$, it follows $\beta_0 = -a/c$ and $\beta_1 = -d/c$, we can now interpret the short- and long-run effects of the parameters which is be used for simulations. We can also extend this model with more variables without altering the methodology and interpretations. My main error correction model is specified in equation (4.5.3) below, where I have only expanded the example above with one more variable, namely the foreign output gap to potential GDP ratio.

$$(4.5.3) \Delta \frac{Ca}{GDP}^i = \beta_1 \frac{Ca}{GDP}^{i-1} + \beta_2 \Delta \frac{Gap}{PotGDP}^i + \beta_3 \frac{Gap}{PotGDP}^{i-1} + \beta_4 \Delta \frac{Gap^*}{PotGDP}^i + \beta_5 \frac{Gap^*}{PotGDP}^{i-1} + \varepsilon_i$$

where Δ is a difference operator, Ca is the current account balance, Gap is the domestic output gap and Gap^* is the foreign output gap and $i = 1, 2, \dots, j$ and $t = 1, 2, \dots, T$

4.4 Main Econometrical Challenges

In addition to the possible problem with spurious relationships that are already solved by using the error correction approach there are a couple of other potential econometrical pitfalls left to deal with.

4.4.1 Endogeneity

My simple model is based on the framework in Hung and Bronowski (2000) where savings and investment are determined simultaneously. When using simultaneous equations models we are bound to have some endogenous variables. That is, some of the variables are correlated with the error term in the model which could bias the results. Having a look at the variables included in my baseline model it is clear that both the domestic- and foreign output gap might be determined simultaneously with the current account balance. Other sources of endogeneity are the exclusion of significant variables, creating an omitted variable bias, measurement error in the proxy for the foreign business cycle and also the inclusion of a lagged dependent variable in the model.

Using instrumental variables methods like the Two-Stage Least Squares¹⁰ (2SLS) or the more complex Generalized Method of Moments (GMM) would be appropriate solutions when encountering such endogeneity problems. In theory they are effective and will give consistent estimators, but in most practical cases it is difficult or almost impossible to find valid instruments. When using panel data this process is even more difficult and also very time consuming because one would have to match each panel with an adequate instrument. The most feasible solution to the endogeneity problems documented in earlier literature would be to exclude as many endogenous variables from their models as possible. I implement both country- and time-fixed effects in my regressions to further reduce the possible endogeneity bias. If we consider a fixed-effects model: (4.6.2)

$$y_{it} = x_{it}\beta + (\alpha_i + \varepsilon_{it}), \quad t = 1, 2, \dots, T; \quad i = 1, 2, \dots, N$$

The terms inside the parentheses are unobserved, while y_{it} and x_{it} are observed. x_{it} is a vector of regressors, β is a vector of parameters, α_i is the country specific part of the error term while ε_{it} is an idiosyncratic part of the error term. When using the fixed effects estimator I transform the model in a way that eliminates the country specific error term α_i .

Even though my estimates might be somewhat biased, I still hope to capture the main dynamics of the current account originating from business cycle fluctuations.

4.4.2 Heteroskedasticity

When estimating nominal-variable equations there is often a larger chance of encountering heteroskedasticity problems, therefore I normalize all variables to ratios of GDP or potential GDP in an attempt to tackle this problem. Even though there is a presence of heteroskedasticity, it is not a fatal problem for the results.

When estimating equations with heteroskedasticity present we will still obtain unbiased coefficients, but we might have problems with inference from tests based on the residuals

¹⁰ An instrumental variable estimation technique that uses instrumental variables that are uncorrelated with the error terms to compute estimated values of the problematic variables (the first stage), and then uses those computed values to estimate a linear regression model of the dependent variable (the second stage). Since the computed values are based on variables that are uncorrelated with the errors, the results of the 2SLS model are optimal. (Wooldridge, 2009)

(Wooldridge, 2009). I will further attend to this possible problem by estimating my equations with heteroskedasticity-robust standard errors.

4.4.3 Serial Correlation

When error terms from adjacent time periods are correlated, we say that the error term is serially correlated. Hence, serial correlation occurs in time-series studies when the errors associated with a given year carry over into future time periods. Like heteroskedasticity, serial correlation does not affect the unbiasedness or consistency of my OLS estimators, but it will affect their efficiency. With positive serial correlation, the OLS estimates of the standard errors will be smaller than the true standard errors. This will lead to the conclusion that the parameter estimates are more precise than they really are. Since my error correction model is including the lagged dependent variable as a regressor, I would expect serial correlation in the error terms. I test for serial correlation in my analysis with a test procedure proposed by Wooldridge (2002). The reported test results can be found in Appendix B-1.3. However I have not found a way to correct for serial correlation in my regressions, because the normal solution, taking advantage of a Feasible Generalized Least Squares (FGLS) estimation method is hard to do in an error correction approach using **unbalanced panel data** with both country- and time-fixed effects. I could only correct for either heteroskedasticity or serial correlation because my panel is unbalanced, and I choose to correct for the former in my regressions in the next chapter containing my results. I will however report the serial correlation corrected FGLS estimation estimates in appendix B-1.4. Take note that there are only marginal differences in the standard errors, and both the heteroskedasticity robust regressions and the FGLS regressions yield the same conclusions on significance tests.

Chapter 5 Results

5.1 General Results

In theory all variables in my model should be stationary:

- The current account balance is considered stationary because a transversality or non-ponzi-scheme condition should be met. It is not possible for a country to borrow infinitely without its creditors to stop lending and claim down-payments, which causes a mean reversion process.
- The output gap to potential GDP is constructed in a way such that it is not possible for it to be non-stationary over longer periods of time. It is measured as a deviation from a long-term trend.

However, for samples used in empirical works, it has been shown that this might not always be the case. Clausen and Kandil 2009 found the current account balance for 6 out of 9 countries they investigated (Canada, Denmark, France, New Zealand, Sweden and the UK) to be non-stationary, while Hung and Bronowski (2005) found the US current account to be non-stationary. Further, Fanelli (2005) finds that the output gap to potential GDP is a non-stationary variable for aggregate European data in the time-period 1972-1998.

In table 1 I have tested the variables for stationarity using augmented Dickey-Fuller tests for panel data. We observe that all variables are stationary in my panel, rejecting the null-hypothesis of unit roots for all variables. Hence all variables are classified as $I(0)$ - variables.

Table 1: Augmented Dickey-Fuller Unit Root tests

Fisher Type Unit Root	H0: All panels contain unit roots		The results are suggesting variables are integrated of order
Augmented Dickey fuller tests	Ha: At least one panel is stationary		
Number of panels			
23			
ADF regressions: 1 lags	No Trends		
Variable	Statistic	p-value	
Current account to GDP ratio	69.6477	0.0138	I(0)
Output gap to potential GDP ratio	197.0951	0.0000	I(0)
Foreign Output Gap to GDP ratio	83.8538	0.0000	I(0)

When estimating the base ECM I first test the model for fixed versus random effects. Looking at the results from the Hausman-test¹¹ we can discard the null-hypothesis (of no correlation between the unique error term and the regressors) at all levels of significance which suggest that the fixed effect specification is the appropriate specification. I have also included time dummies to control for time-fixed effects. Thus, the regression can be regarded as capturing the effects of the explanatory variables on an average country's current account balance in an "average" year. Individual countries though, may have different coefficients on at least some of the variables. The initial possible endogeneity bias will be reduced as I implement the fixed effects, because I have now controlled for omitted variables that differ among countries but are fixed over time and also for omitted variables that vary over time but not between countries. But the fixed effects approach does not correct the biases due to the presence of the lagged dependent variable and the simultaneity and measurement-error issues. In table 3 we observe the reported results from estimating the error correction models using the one-step error correction method using country- and time-fixed effects with heteroskedasticity-robust standard errors (I have estimated two models, one including only the domestic output gap and one with both the domestic and the foreign output gap). Keep in mind that the estimates could be biased as a result of the endogeneity and also; because of the serial correlation present, the efficiency might be lower than what is reported.

The coefficient on the lagged current account variable is also called the adjustment parameter and it estimates the speed of convergence from a disequilibrium and back to the equilibrium between the variables. The estimated adjustment parameter is negative and almost takes the similar value in both models, estimated at a value of approximately -0.215. Since the absolute value of the parameter is between 0 and 1, there is no explosive behavior between the variables and the error correction approach is appropriate to use. The estimated coefficient suggests there is a quite slow adjustment from a disequilibrium position back to equilibrium in the current account.

¹¹ The Hausman-test results can be found in the Appendix section B-1.2

We notice that the all three parameters in model 1 (M1), which is excluding the proxy for the foreign business cycle, enters the regression significantly. All are significant at a high confidence level ($> 0.99\%$).

In the main model all variables, except the lagged foreign output gap are significant at the 95 % confidence level. Although there seems to be an insignificant long-run effect of the foreign output gap (just outside of the 90% confidence level), I will still use this model to perform my analysis of the dynamic impact of business cycle shocks on the current account balance.

The regression results from the two models imply that for a 1 percentage point increase in the output gap to potential GDP ratio the current account to GDP ratio will immediately decrease by 0.365 and 0.426 percentage points respectively. And then further decrease by 0.116 in the simplest model and 0.107 percentage points in the main model through the first year (the transition growth effect). The negative sign on the output gap variable could reflect a dominating effect of investment (the accelerator effect) over the expected increase in savings when the consumers' income rises. Further it could also be attributed to a worsening trade balance as a result of increasing imports. An improvement in the business cycle is expected to increase demand. Following the trade elasticity approach we would expect increases in demand to fall on both tradable and non-tradable goods. The real interest rate cannot adjust to clear the goods market as it has to ensure no arbitrage. If total home supply is given by the equilibrium in the labor market, the increased demand can only be satisfied if it is met out of imports. Only tradables can be imported, thus demand is redistributed from non-tradable to tradable goods which requires the former to become relatively more expensive which would also result in a real exchange rate appreciation and a loss in competitiveness.

The sign on the output gap variable are in line with other empirical studies (Hung & Bronowski, 2002; Downes & Moore, 2004) using the output gap as a regressor. The additional effect besides the immediate effect in the long-run are estimated to -0.534 and -0.498 (calculated using the framework from the one-step error correction approach;

$$-\left(\frac{-0.116}{-0.215}\right) = -0.534 \quad \text{and} \quad -\left(\frac{-0.107}{-0.215}\right) = -0.498 .$$

So, the total long-run effect of the 1 percentage point increase in the domestic output gap ratio would therefore amass to a decrease of 0.905 percentage points in the current account

to GDP ratio over the full (theoretical) response cycle in the simple model whilst in the base model its estimated effect will be only slightly larger (0.924 percentage points). Take note that there is not a large difference in either the total long-run effect of the domestic output gap or the adjustment speed between the two models.

Table 2: One-step error correction model estimates

VARIABLES	Model1 D.ca	Model2 D.ca
L.ca	-0.215*** (0.0307)	-0.215*** (0.0307)
D.gap	-0.365*** (0.0469)	-0.426*** (0.0545)
L.gap	-0.116*** (0.0443)	-0.107** (0.0499)
D.gap*		0.151** (0.0700)
L.gap*		0.0507 (0.0482)
Constant	-0.0621 (0.0910)	-0.0580 (0.0938)
Observations	431	431
R-squared	0.303	0.342
Number of cid	23	23
Country-fixed effects:	Yes	Yes
Time-fixed effects:	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The sign on short term coefficient of the foreign business cycle is positive and significant at the 95 % confidence level. The expectation from an improvement in the foreign business cycle was less inflows to and larger outflows from the domestic economy, hence an increase in the current account to GDP ratio like we observe. A positive change in the foreign cycle is estimated to immediately improve the domestic current account balance by 15.1 percent of the initial change in the foreign output gap ratio. In the long-run, the total increase in the current account to GDP ratio would amount to 38.68 percent of the initial change in the foreign output gap ratio. The long-run effect is not found to be significant though, being just outside the 90% confidence level.

Since both the domestic and foreign business cycles are related to capital flows in and out of countries and that the aggregate current account on world basis should equal zero, I would've expected less divergence on the absolute values on the coefficients, something in line with the results found by Bronowski and Hung (2002). Some possible reasons for the lower absolute effect on the current account from a change in the foreign business cycle than for the effect of the domestic business cycle could be; home bias investing (even though one could obtain larger returns investing in foreign economies, investors tend to have a larger share of domestic assets), but most importantly it could be the fact that I have used the US economy as a proxy for the foreign sector. With respect to the trade balances, there are lots of important countries excluded when using only the US as the foreign sector which could distort the results originating from the foreign sector. Hence, this could be viewed as a measurement error in the analysis further biasing the results.

In appendix B-1.5 I have included some more variables (seen to be exogenous drivers of the current account) and lags in the error correction model for robustness checks. Based on the results found in both this chapter and in the robustness regressions, the estimates for the effects of the domestic and foreign cycle could be seen as fairly robust, even though the parameters deviate some (e.g. the coefficient measuring the speed of adjustment from -0.206 to 0.237 and the short coefficient for the domestic business cycle effect from -0.365 to -0.446).

It has to be pointed out that the all the long-run effects I have described in the above sections only are theoretical, as we would expect the output gap ratios to revert before the full effect is reached because of the stationary nature of the variables itself. I will comment briefly on this in the section containing the shock simulations.

5.2 In-sample Prediction

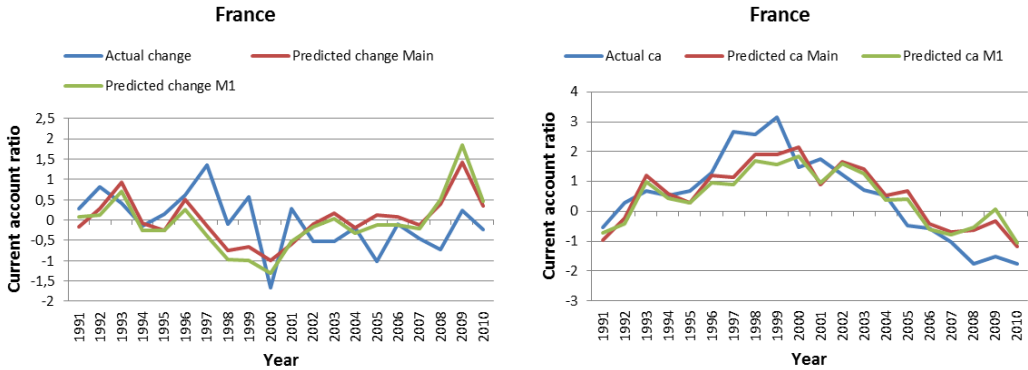
Here I present the error correction predictions versus the actual data graphically. I do not use the calculated predicted current account as a lagged value in the subsequent year, but real data. Hence, this will only give me the expected change and the expected current account for one year at the time. I have selected some countries in the sample which I will display below. The selection is based on the countries where the main model fits best and worst in terms of average under/over-prediction. I will try to give an insight in why the

model fits better for some countries than others based on some characteristics in their economic history. I have also included the prediction from the one-variable error correction model (the model without the foreign output gap variable), which I have denoted M1 in the figures. The model predictions for the rest countries (excluding countries with missing values in some of the variables) in the sample can be found in appendix C-1.1.

5.2.1 France

The country where the model has the best fit in terms of the lowest average under/overprediction is France. The model slightly over-predicts the actual French current account balance, but the average deviation is only 0.05 percentage points. Belessiotis and Carone (1997) argues that three factors contributed to the external performance of France in the early 1990s; the cyclical position of France relative to their trade partners and relative price movements and supply improvements which have promoted export expansion and import substitution.

Figure 1: In-sample prediction for France¹²



In a sustainability report prepared for the G-20 summit in Cannes by the International Monetary Fund from 2011, the deterioration of the current account in the early 2000s are also attributed to the cyclical position; where stronger domestic demand in France relative to its key trading partners, notably Germany, resulted in worsening net exports. From a savings/investments point-of-view the deterioration could be ascribed to higher investment in construction and services. The keyword in

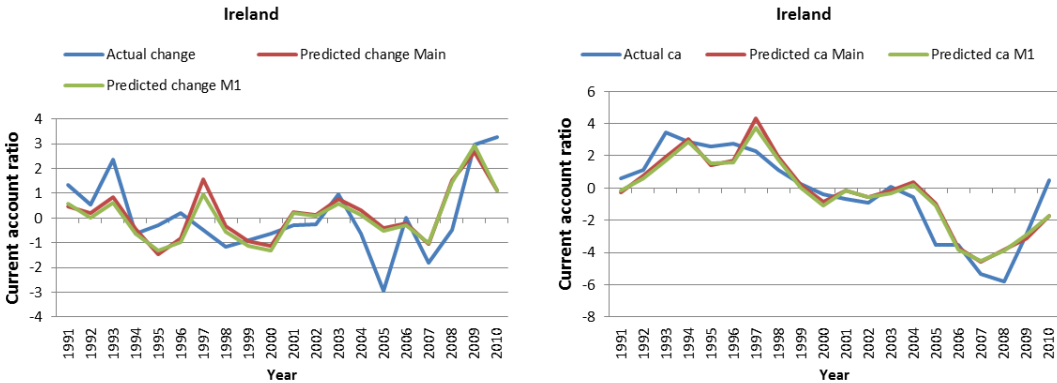
¹² In the first chart the predicted percentage point change in the current account to GDP ratio from the two models are displayed together with the actual change in the current account to GDP ratio. The second chart is showing the predicted current account balance to GDP ratio values in comparison to the actual values in the sample period. This explanation also applies to figures 2-4.

both the study and the IMF report is cyclical, which is also congruent with the good fit of my regression model.

5.2.2 Ireland

For the Irish current account balance the model is overpredicting the current account balance to GDP ratio by only 0.086 percentage points on average. It could be argued that fluctuations in the domestic and foreign business cycle seems to be of importance for the development in Irish current account balance. The external trade in Ireland in the sample period is associated with trade surpluses driven by primarily export of manufactured goods and in later years an increasing share of services (Mac Coille, 2011). Although the trade balance is positive we do observe some periods of negative current account balances. These periods can be explained by large inflows through foreign direct investment. Foreign investment has thrived under a liberal industrial regime since the 1960s and the Irish corporate tax policy on manufacturing and financial services has been reliable, transparent and consistent over decades (Fortin, 2001). In addition the Irish economy has experienced a large steady growth in most part of the sample period, which is also attracting these investors. Hence, both the trade balance and the net international investment position could, *ceteris paribus* in institutional factors, be expected to be driven largely by the domestic and foreign business cycle.

Figure 2: In-sample prediction for Ireland

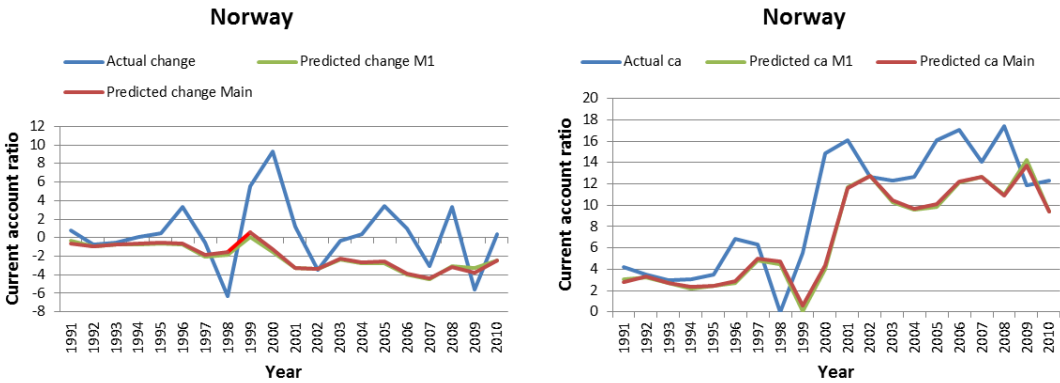


5.2.3 Norway

When looking at the specific case of Norway the model seems to have a very poor fit. The model is generally underpredicting the actual current account to GDP ratio on average by almost 2.5 percentage points. It would seem that business cycles alone does not have a large

influence on the movements in the Norwegian current account. Looking at the figures we notice large outliers in the change in the current account. Morsy (2009) found the oil balance (oil exports minus oil imports) to be a large and significant contributor to the current account balance ratio in a panel of oil producing countries. Therefore it could be safe to assume that a portion of this volatility might have been caused by developments in the oilprice. In the mid- to late 1990s the oilprice plummeted as a result of the ongoing Asian financial crisis, but in from 1998 to 1999 the price of oil more than doubled as a result of a cut in OPEC production¹³. In the period from 1998 to 2000 the value of the Norwegian oil exports rose from 12 billion USD to an excess of 29 billion USD¹⁴, which might explain a large portion of the observed massive increase in the of the Norwegian current account balance in the late 1990s.

Figure 3: In sample prediction for Norway



5.2.4 Portugal

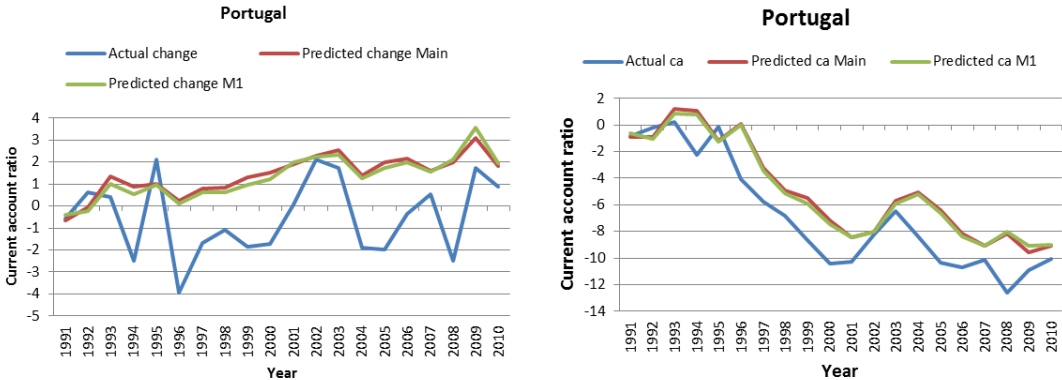
The country that ranks second in the worst fit category is Portugal. On average the model is overpredicting the current account balance by 1.88 percentage points. The portuguese current account balance has mainly been in deficit over the sample period. Blanchard and Giavazzi (2002) attributes the deficits mainly to low private savings due to financial liberalization and better growth prospects. They argue that low savings and higher investment, though at a lesser extent, seem to be the main drivers of the current account in Portugal. Blanchard (2007) further blames a low productivity growth in combination with

¹³ Sourced from WTRG Economics: <http://www.wtrg.com/prices.htm>

¹⁴ Sourced from the IMF World Economic Database

fast nominal wage growth for a loss of international competitiveness and the observed persistent and increasing deficits in the current account balance. Also the composition of exports in combination with these higher unit labor cost has left Portugals exports vulnerable to competition from low-cost producers like China. In addition a lag in the qualification of Portugals workforce in recent decades has caused earlier inflows of foreign direct investment to seek new harbours, especially to the East-European countries. The main culprit for the bad fit of my model in this environment though, is most probably the development in the portuguese private savings rate. According to data from the independent portuguese statistics agency Pordata¹⁵, the private disposable income in Portugal for the sample period has increased by 202% but gross private savings has only increased by 77 %.

Figure 4: In-sample prediction for Portugal



5.3 Shock Simulations

Using my model I will simulate transitory domestic, foreign and global business cycle shocks and observe the dynamic impact on the current account ratio over their lifespan. Permanent shocks are not possible to simulate in my framework because of the nature of the time series variables I am modeling, both my output gap to potential GDP variables are stationary, thus they will have mean reverting processes that will exclude any possibility for permanent shocks in real life. All shocks are simulated as improvements in the business cycles. A negative shock would just be a mirror image of the positive shocks. The shocks are designed to last for 2 years, with a 1 percentage point increase in the respective output gap to

¹⁵ Http link: <http://www.pordata.pt/en/Portugal/Household+income+and+savings-78>

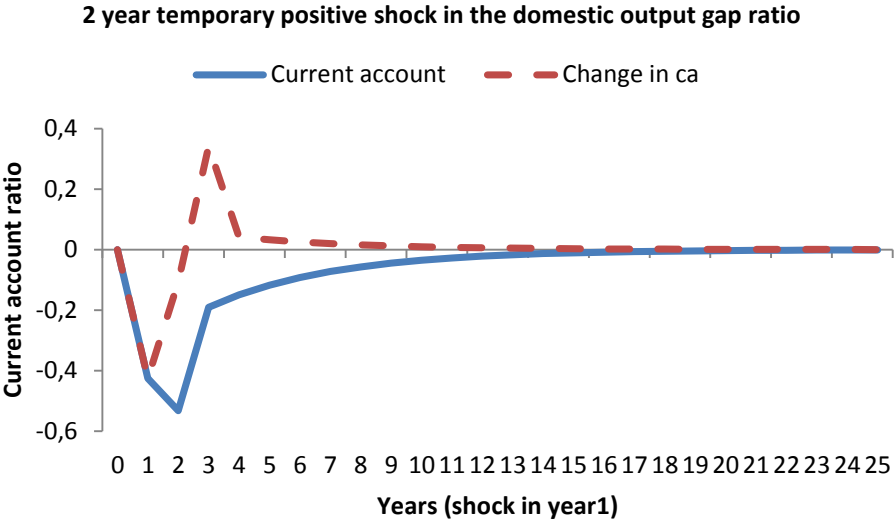
potential GDP ratio in year 1 before it reverts and decreases by the same amount in year 3. I will be focusing on the total long-run dynamics via impulse responses and the 99% pass-through (which I define as a full adjustment) from the turning point of the shocks. I calculate this 99% pass-through from the minimum value observed (at the third year when the output gap is dropping back to its initial level). Since the model I am using is very simple I cannot discriminate between the actual sources of the business cycle shock (e.g. productivity or demand driven shocks) which could have been done with a more extensive model. My model however, will give an insight on a more general basis in how the current account will respond dynamically.

All shocks are occurring from an equilibrium position of the current account balance and its long term determinants. For convenience, I have set the initial equilibrium in the current account balance ratio to zero.

5.3.1 Temporary Asymmetric Shocks

In figure 5 I am assuming a unexpected temporary shock in the **domestic business cycle** that lasts for 2 periods before reverting. In year 1 the domestic output gap ratio increases by 1 percentage point, this immediately afflicts the current account ratio which responds by dropping by the value of estimated short-run coefficient (-0.426). The agents in the economy react by increasing both their savings and investments, with the latter dominating the former. From a trade-elasticity viewpoint one could expect net exports to decrease with increasing prices (often associated with an improvement in the business cycle) on domestically produced goods. Through the first year after the shock the current account ratio drops further by the first year transition effect (-0.107). Businesses are becoming more profitable and business confidence rises, which in turn drives up the present value of new investment projects, leading to an investment boom and further deterioration of the current account balance. But in year 3 the output gap ratio drops back to its original value (dropping by exactly the value of the initial shock, 1 percentage point), making the current account immediately increase by 0.426 percentage points.

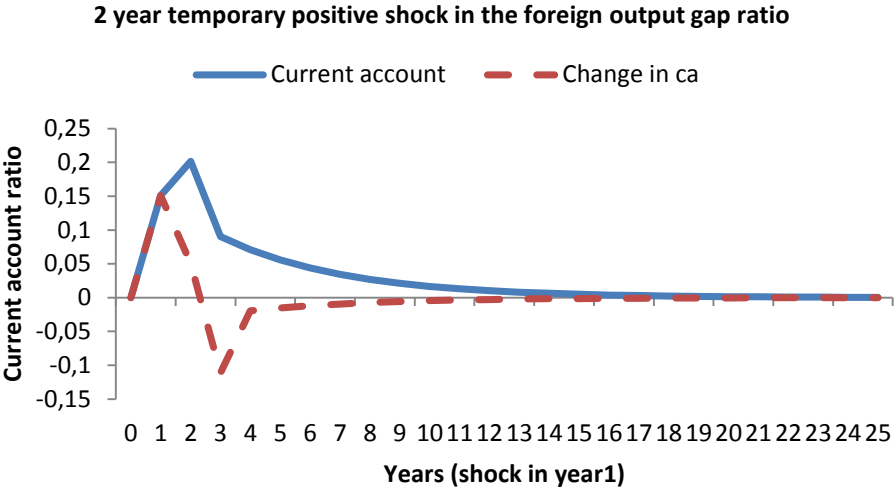
Figure 5: Temporary domestic business cycle shock



Now business confidence is declining amongst the economic agents, which increases net saving through a larger decrease in investment than in the savings (which might also be increasing). The second year transition effect from the initial shock reduces this effect slightly. These transition effects could be viewed as small multiplier effects from the initial shock. One reason for the observed long period of adjustment might be that the multiplier effects continue to influence the investment and saving levels over time. From here the current account increases steadily until it finally stabilizes at its original equilibrium level after approximately 17 years.

A positive temporary shock in the **foreign business cycle** is displayed in figure 6. The shock is assumed to increase the foreign output gap ratio by 1 percentage point. As foreigners increase their income and business confidence, we would expect the domestic economy to improve its trade balance because of inflationary pressures in the foreign economy (foreign goods become relatively more expensive). We would also expect foreign direct investment from the domestic economy in the foreign economy to increase, hence increased savings. In the opposite direction there would be a decline in inflows from the foreign sector to the domestic economy.

Figure 6: Temporary foreign business cycle shock

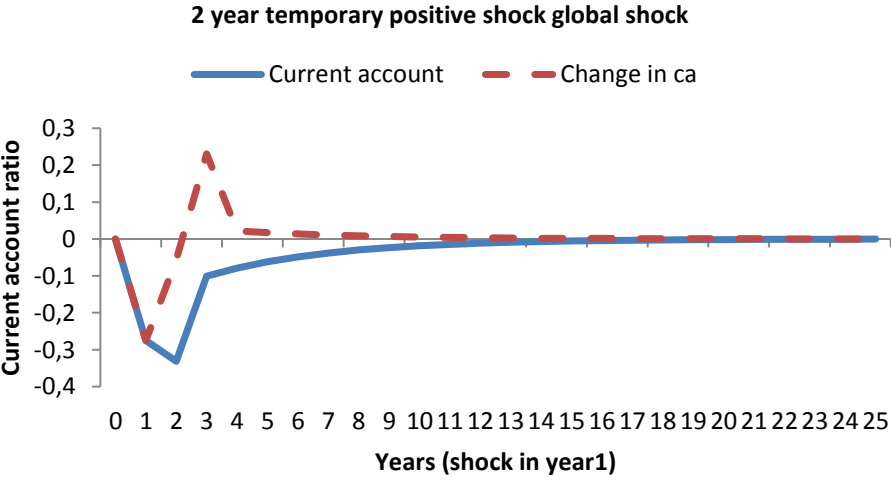


The initial immediate effect on the current account to GDP ratio is a 0.151 percentage point increase which is further increasing to a total of 0.202 before the foreign output gap reverts and causes a drop in the current account balance back towards the old equilibrium over time. As with the domestic shock it takes about 17 years before the shock stabilizes at its equilibrium current account ratio position.

5.3.2 Temporary Global Shocks

Below I have constructed a global shock, where both the domestic and foreign proxies for the business cycle increase by 1 percentage point. This is just the equivalent of adding the two separate shocks I have reviewed together. As the negative estimated effects from the improvement in the domestic business cycle dominates the positive effects from the foreign there is an overall negative effect on the current account balance. If we look at Glick and Rogoffs (1995) results where global productivity shocks have no effect on current account balances in comparison to my result below, we observe that a global general *business cycle* shock actually could have a small effect on the current account balance. However, this finding might be due to the mentioned measurement error from using the United States as a proxy for the foreign sector.

Figure 7: Temporary global business cycle shock



The above “global” shock could be a bit unrealistic in real life; countries seldom experience the same events or react identically to such events. Nevertheless, since the start of the 20th century, globalization in the world economy has increased at a rapid rate. This globalization has tied the countries more closely together in various ways. To start with, it has led to closer trade linkages across the globe and also an increased financial integration between countries. Studies (e.g. Dées & Zorell, 2012; Böwer & Guillemineau, 2006) have shown that both trade integration and financial integration affects business cycle synchronization. Shocks in the business cycle in one economy consequently could in some occasions be expected to propagate to other economies. Below I have identified the correlation between

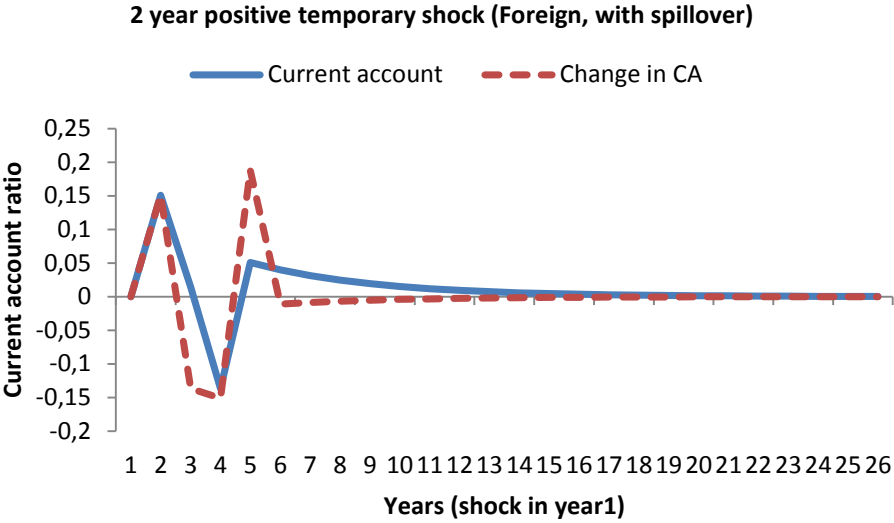
the lagged foreign business cycle proxied by the US output gap and the sample countries in table 4, which I use to construct a different kind of shock.

Table 3: Business cycle correlation between sample countries

Correlation between lagged output gap in the US and the output gap the following year in the OECD sample of countries			
US vs Australia	0,307868833	US vs Japan	0,136374
US vs Austria	0,691521577	US vs Korea	-0,02026
US vs Belgium	0,224496945	US vs Netherlands	0,617266
US vs Canada	0,675105758	US vs New Zealand	0,370798
US vs Denmark	0,716404288	US vs Norway	0,595446
US vs Estonia	0,398825965	US vs Portugal	0,363833
US vs Finland	0,63738978	US vs Slovak Republic	0,159828
US vs France	0,757439265	US vs Slovenia	0,140248
US vs Germany	0,521663394	US vs Spain	0,621672
US vs Greece	0,135732329	US vs Sweden	0,559801
US vs Ireland	0,580811841	US vs United Kingdom	0,621381
US vs Italy	0,721765095	Average	0,446258

In figure 7 I have simulated a 1 percentage point shock in the foreign output gap, assuming it will propagate to the domestic economy in the following year. It is not a global shock in a one to one perspective but a shock where a portion of the initial shock is distributed to the other economy in the following year. Some of the initial shock in the foreign country diminishes because of unspecified factors in the domestic economy (e.g. elements in the economic infrastructure). I have used the average correlation ratio as the portion that is propagated into the domestic economy (it also corresponds to the regression estimate from a fixed effects regression where the dependent variable is the domestic output gap and the lagged foreign output gap is the explanatory variable). The shock is assumed to last for 2 years in both the foreign and domestic economy.

Figure 7: Semi-global business cycle shock



As mentioned I have defined the shock as a 1 percentage point unexpected drop in the output gap ratio in the foreign economy. This is influencing the domestic economy the subsequent year which then absorb almost 45 percent of the initial shock. At year 1 in figure 7 the initial effect from the foreign shock on the current account is equal the estimated short-run coefficient which implies an increase in the current account ratio of 0.115 percentage points. In the second year there are two factors influencing the current account ratio, one is the negative first year transition effect from the foreign shock, the other is the positive effect from the “spillover” reducing the domestic output gap. In sum, the total effect on the current account moves from positive to negative because of the larger effect originating from the spillover to the domestic sector. In year 3 the foreign output gap drops back to its initial value causing the current account ratio to decrease further. Finally, in the fourth year the shock dies out in the domestic sector as well, with the output gap ratio returning to its initial value. The current account balance ratio reacts to this by increasing by approximately 0.19 percentage points. From this point in time the current account will adjust steadily back towards its initial equilibrium value by the transition effects dictated by the speed-of-adjustment parameter in the model. It takes about 17 years for the current account to fully adjust to the initial foreign business cycle shock that were assumed to also influence the domestic activity.

5.4 Sample Heterogeneity

Since my error correction model is a fixed effects model and therefore the results can be viewed as the impact of fluctuations in the domestic and foreign business cycles on an average country's current account, I have therefore constructed some dummies to look for heterogeneity between groups within the country sample. From the dummies I generated new samples from within the main sample where the observations matched the criteria specified in the dummy variable. The criteria's were picked with respect to findings in other studies which I thought could alter the results estimated by my model. These dummies and their sources are explained in appendix A-1.3. The goal here is to explore how some country characteristics influence the size and the speed of adjustment back to equilibrium in the current account ratio following fluctuations in the business cycles. I will still use the 2-year temporary shocks as I did in the shock simulations in the discussions of the results regarding adjustment times.

Table 5 displays the regression results for different subsamples within the sample with the following characteristics:

- 1) The sample used in H1 consists of only observations where the countries have been running current account deficits consecutively for more than 2 years.

Milesi-Feretti and Razin (1998) points out that reversal in current account imbalances are more likely to occur in countries that have run persistent current account deficits. Running persistent current account deficits are same as continually reducing a country's net foreign assets position and possibly building up liabilities to the rest of the world. This could be viewed as problematic in the long-run for both the public and private sector in the domestic economy, causing changes in future expectations which in turn could lead to a change in consumption behavior. An expansion in the domestic economy is normally expected to increase the current account balance deficits, but could countries running persistent current account deficits be more restrictive in their response to such an event? Obstfeldt and Rogoff (2011) argue that consumers with perceived low wealth will be reluctant to borrow even in the face of temporarily low income. Borrowing might leave them vulnerable to further negative

income shocks that might force them to consume nothing in order to respect an intertemporal budget constraint.

- 2) The sample used in H2 contain only observations from countries and years where there has been reported a fiscal deficit. A standard prediction of textbook models is that fiscal consolidation leads to an increase in national saving and thus improves the current account. A number of empirical studies, however, find only a small effect from fiscal policy on the current account. A majority of studies find that a 1 percent of GDP fiscal consolidation improves the current account balance in the specter of 0.1 to 0.4 percent of GDP (Chinn & Ito, 2007; Chinn & Prasad, 2003; Bussière et.al, 2010). Tujula (2004) finds a negative relationship between the output gap and fiscal balances in OECD. This could reflect anti-cyclical policies aimed at stabilizing the economic growth. In an expansion, businesses and households usually spend more and save less. But the increase in demand drives down unemployment which causes income tax revenue to rise and spending on things like unemployment insurance to decrease. In this case, the expansion may result in a decrease in the budget deficit. Since the is fiscal balance respond negatively to business cycle fluctuations and the current account in turn responds positively to the fiscal consolidation I would expect the size of a current account adjustment to decrease in this sample.
- 3) The subsample in H3 contains observations for countries with a high degree of trade openness. Chinn and Prasad (2003) found that trade openness is negatively related to the current account position. Further, Chinn and Wei (2009) argue that greater trade openness makes it easier for the trade balance to respond to real exchange rate changes. Thus, higher trade openness can be associated with a faster current account adjustment. On the basis of this I would expect the adjustment time to decrease when looking at countries with a high degree of trade openness.
- 4) The sample used in H4 contain only observations in countries running twin deficits (both the current account and the fiscal balance are in deficit).Twin deficits has been given substantial attention in literature (mainly due to the internal and external positions of the United States in the last decades). So I wanted to see if I could observe a difference in the adjustment in countries fulfilling this characteristic.

Based on the same arguments as in sample H1 and H2 I would expect the coefficients and total effects of domestic and foreign shocks to decrease.

- 5) The sample H5 consists of countries that are part of the European Monetary Union (EMU). Even though the Euro currency is not fully fixed, we could view a single country in the EMU as having a somewhat fixed exchange rate. According to Friedman (1953), a flexible exchange rate regime should facilitate current account adjustment while a fixed exchange rate regime should delay the adjustment process. In the case of the EMU countries, they have to rely on internal price adjustment mechanisms to produce corrective movements in their current accounts. Since price changes are viewed to be more rigid than exchange rate changes, this internal adjustment channel could yield delays in current account adjustments, thus I would expect to observe an increasing adjustment time when estimating the model for this subsample.
- 6) The sample in H6 consist of countries the rest of the countries in the main sample (not in the EMU). I chose to estimate the model for these countries to investigate whether we can observe a clear difference in adjustment time in comparison to the sample in H5.

At a first glance we notice that all of the all of the samples (except the sample containing only European Monetary Union countries) represent some characteristic that increases the speed of adjustment back to an equilibrium position after a shock, in comparison to the main model (earlier presented in table 3). We do however notice large fluctuations in significance on the short- and long-run effects of the business cycles; this might be due to the decrease in the amount of consecutive observations in the panel for some of the subsamples. The effect and expected sign on the domestic business cycle seems fairly robust, while the foreign business cycle seem very weak and looks to have little or no effect on the current account balances in the subsamples. This result may be due to measurement error as I have noted earlier though. Since most of the foreign business cycle effects in the samples were found to be insignificant and the differences in adjustment time are not very large, I only focus on the adjustment following domestic shocks in the following section.

Table 4: Base model estimates for the different subsamples in heterogeneity analysis

	H1	H2	H3	H4	H5	H6
VARIABLES	D.ca	D.ca	D.ca	D.ca	D.ca	D.ca
L.ca	-0.337*** (0.0612)	-0.265*** (0.0561)	-0.451*** (0.0721)	-0.455*** (0.0981)	-0.192*** (0.0394)	-0.247*** (0.0510)
D.gap	-0.670*** (0.0663)	-0.111 (0.1094)	-0.491*** (0.0862)	-0.419*** (0.1208)	-0.390*** (0.0661)	-0.433*** (0.1022)
L.gap	-0.274*** (0.0492)	-0.122* (0.0790)	-0.255** (0.0989)	-0.336*** (0.0937)	-0.125** (0.0594)	-0.082** (0.0965)
D.gap*	0.098 (0.0680)	0.243** (0.1267)	0.162 (0.141)	-0.047 (0.1546)	-0.030 (0.0950)	0.255** (0.1075)
L.gap*	0.097* (0.0468)	0.0484 (0.0878)	-0.0623 (0.0828)	0.145 (0.0686)	-0.036 (0.0621)	0.158** (0.0785)
Constant	-1.374*** (0.287)	-0.338** (0.158)	0.655*** (0.180)	-2.018*** (0.442)	-0.260** (0.131)	-2.018*** (0.442)
Observations	170	139	151	123	251	180
R-squared	0.498	0.335	0.432	0.568	0.292	0.338
Number of cid	18	17	14	21	14	9
Country-fixed effects:	Yes	Yes	Yes	Yes	Yes	Yes
Time-fixed effects:	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In column H1 (heterogeneity 1), the base model is estimated for countries having run current account deficits for more than 2 consecutive years. I wanted to check how countries running persistent current account deficits reacted in both size and adjustment speed in comparison to the average sample country with respect to the business cycle shocks. Notice how the effects of a foreign business cycle gap do not enter the regression significantly at the 95% confidence level, making it probable that foreign business cycle fluctuations might have a less significant effect on the current account balances in a country running persistent current account deficits. We do however observe a significant, large and relatively faster adjustment with respect to fluctuations in the domestic business cycle. It seems that the current account balances of countries running consecutive current account deficits are relatively more affected by fluctuations in the domestic business cycles than to an average sample country. The (absolute) overall effect on the current account balance ratio of a 1 percentage point change in the domestic output gap to GDP ratio is 0.56 percentage point

higher than in the full sample. This is not in line with my expectations that the overall negative effect could be somewhat reduced as a response to the accumulated debt (151 of the 170 observations have negative net foreign assets). Following the intuition of a life-cycle model the consumers could wish to accumulate a buffer of assets to be run down in case of negative income shocks. Greater uncertainty about the future will increase the propensity to acquire such a buffer. However, this precautionary behavior may be less important in countries with higher wealth levels (like those found in my sample of OECD countries). Also some part of my finding of a larger coefficient might be explained by “The Lucas Paradox¹⁶” since all the countries in my sample are high-income OECD countries. However, since I have viewed this as an improvement in the business cycle, we could turn it around and say that these countries respond to *negative* business cycle shocks by reigning in spending and increasing saving more than the average country. This view supports my expectations. Looking at the speed of adjustment it is increasing significantly compared to the main sample. The adjustment time of a domestic business cycle shock is now reduced by 5.5 years (from 17 years to 11.5 years). It might reflect urgency to tame large deficits, on another side it might also reflect shared unobserved saving- and investment characteristics of the countries included in the sample.

In column H2 I am looking at a subsample of countries running fiscal deficits. However, I do only find a significant effect of the adjustment-speed parameter and the short-run effect of the foreign business cycle in model. This is making it impossible for me to draw any firm conclusions from the results. Significant or not, the results do however suggest that the size of a current account adjustment is decreasing following an expansion in this sample, which is in line with the expectations. Look at figure 8 to see the quite clear difference in the size of the effect in comparison to the other subsamples. The adjustment speed is the same as in the main sample.

¹⁶ The Lucas Paradox could be described as the observed “up-hill” flows of excess savings from developing countries with high rates of return to rich countries with low rates of return, despite the fact that classical economic theory predicts that capital should flow from rich to poor countries (Lucas 1990).

Column H3 is representing results from countries with a high degree of trade openness. We notice that the speed-of-adjustment parameter increases in comparison to the base model, from -0.215 to -0.451. The new adjustment time of the domestic business cycle shock is now just 8.5 years. The foreign business cycle does not enter significantly, and also the sign of its long-run coefficient takes a negative value. It looks like countries with a higher openness to trade experiences a slightly larger long-run effect of domestic business cycle fluctuations and also a relatively quick adjustment (the shortest adjustment time of all the subsamples) in the current account balance following a shock. This might be caused by the fact that in well integrated economies, only a small relative price change will be needed to induce consumers to switch from domestic to foreign goods, thus worsening the trade balance (and the current account). A more market based economy could therefore be expected to facilitate quicker and larger adjustments in the current account versus less open countries through trade balance adjustments.

Column H4 is the estimated results for a subsample consisting of countries with both internal- and external deficits. The speed-of-adjustment parameter is estimated to -0.455, suggesting a relatively quick adjustment. It might be that agents in these economies perceives the changes in activity levels as opportunities to reducing their negative position and therefore act faster with respect to saving- and investment decisions. We also observe an increase in both the short- and long-run parameters measuring the effect of the domestic business cycle from the main sample. However, the theoretical total long-run effect of the domestic business cycle is smaller in absolute value than for the sample where we only look at persistent current account deficits (the total theoretical long-run effects are respectively estimated to -1.15 and -1.48). There are no significant effects of the foreign business cycle. The 99% pass-through of a temporary shock could be expected in little less than 9 years.

Column H5 shows the results from countries in the European Monetary Union (EMU). Take notice that the speed-of-adjustment parameter decreases somewhat in comparison to the base model which makes the adjustment time increase to 20 years. This could be giving support to the suggestions made by Friedman in 1953, that exchange rate rigidity hinders adjustments in the current account. Under a flexible exchange rate system, where the exchange rate is allowed to vary freely, a rising current account deficit would induce the

depreciation of domestic currency, which, in turn, leads to an increase in exports, a decrease in imports, and a rapid convergence to a balanced current account. In the case of fixed exchange rate regimes, where exchange rates are not allowed to vary, countries have to rely solely on internal price adjustment mechanisms to produce corrective movements in their current accounts. Since price changes are less flexible than exchange rate changes, this internal adjustment channel tends to yield delays in current account adjustments. There are still no significant effects from foreign business cycle fluctuations, while the domestic business cycle enters significantly in both the short- and long-run. The size of the effect is quite similar to the estimated full sample effect.

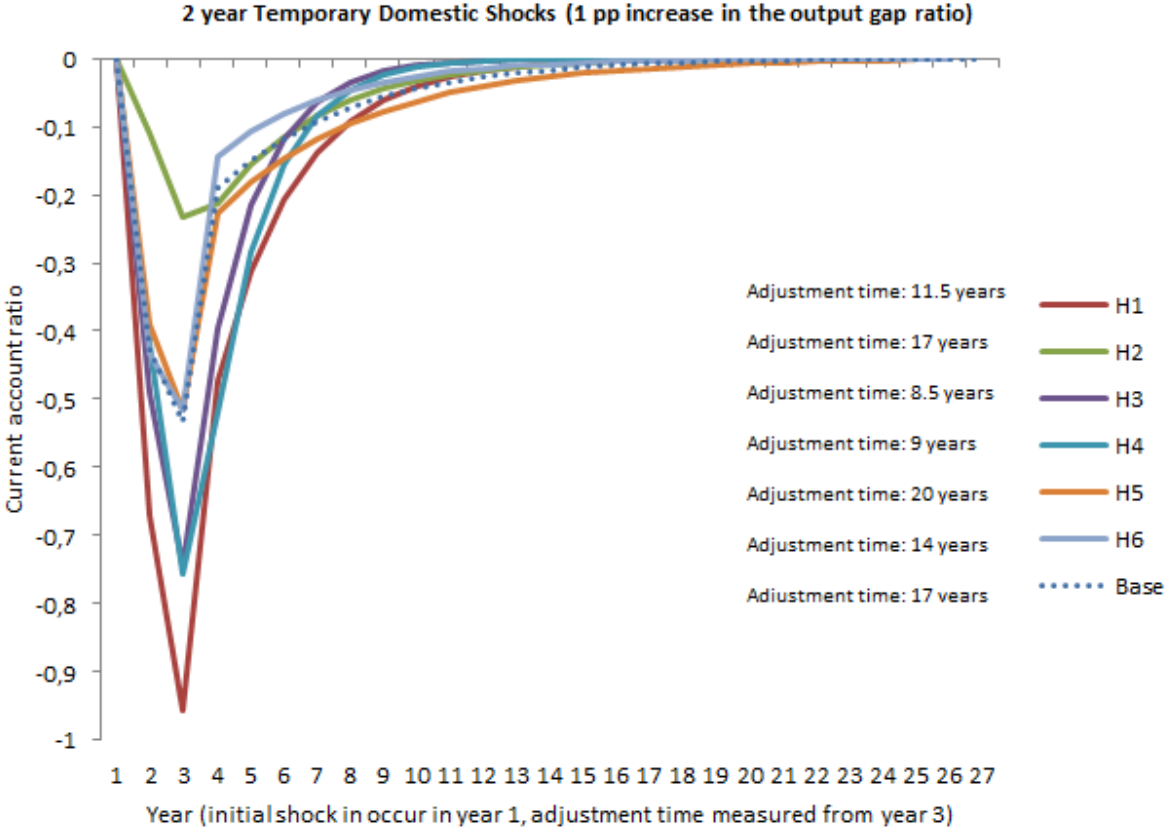
Since I estimated the model in the EMU sample and found a slower adjustment which was what I expected, I wanted to see if the countries outside of the EMU also had a shorter adjustment time. The results for all countries not in the EMU, all having different kinds of flexible exchange rates, are shown in H6. One striking feature in this subsample is that the foreign business cycle has a significant effect on the current account balances in contrast to the results from the other samples. This could reflect that exchange rate movements following fluctuations in the foreign activity level facilitates changes in the composition of the domestic country's trade and investment positions better.

The total long-run effect of the domestic business cycle is lower than the average country and also lower than in any of the other subsample results (its estimated effect is -0.765 in comparison to the -0.92 in the full sample). The adjustment time for a flexible exchange rate country is 14 years in comparison to 20 years for an EMU-country. This could be an indication that exchange rate regimes affect the speed of current account adjustments following business cycle shocks. Although some studies (e.g. Chinn and Wei, 2008) have shown that exchange rate regimes does not alter adjustment in the current account on general basis, it still looks like Friedman's arguments back in the 1950s could be applicable more than half a century later when we look at adjustments caused by business cycle fluctuations.

In figure 8 I have presented the different adjustment periods in the subsamples following a domestic cyclical shock. The figure shows the estimated level (in deviation from the initial equilibrium value) of the current account over the adjustment period. The shocks occur in

year 1, making the current account ratio to experience its minimum value before reverting in year 3. It is from this point I have calculated the adjustment times from a 99% pass-through approach. The longest adjustment period is 20 years for the subsample with EMU countries, while the shortest adjustment time is observed for the sample of more open economies which is estimated to 8.5 years.

Figure 8: Comparison of adjustment cycle between subsamples



Chapter 6 Concluding Remarks

One of the main findings in this thesis is that the current account balance seems to react to very slowly to cyclical shocks. For an average country in the base sample it is estimated it will take the current account approximately 17 years to fully adjust to a shock in either the domestic or foreign business cycle. It seems that the domestic business cycle has a relatively larger effect on the current account balance than the foreign business cycle, with the total theoretical long-run effect of the domestic business cycle being estimated to -0.924 while the total effect of the foreign business cycle is estimated to 0.387.

The results from the heterogeneity analysis also suggest that foreign business cycles could have a very limited effect on the current account balances, with insignificant effects of both the short- and long-run parameters in the model for most of the samples. While Hung and Bronowski (2002) found the foreign output gap to be a significant contributor to current account movements, I do not observe the same in my samples, except for the subsample with flexible exchange rate countries. My lack of findings supporting a significant effect of foreign business cycle on the current account balance, may be caused by the large portion countries in my sample that have somewhat fixed exchange rates, being members of the European Monetary Union making it harder for the current account to adjust with respect to the foreign activity levels. But most probably it is due to the variable I have used as a proxy for the foreign business cycle; the US output gap to potential GDP. Although the US economy is a large economy, it may not be fit as a perfect proxy for the sample countries trade- and investment partners.

Further, results from the heterogeneity analysis shows some differences with respect to both adjustment speed and the size of the effect from business cycle shocks between groups of countries within the main sample. My results from the heterogeneity analysis may be viewed to give support to Friedman's (1953) claims that a more flexible exchange rate facilitates adjustments in the current account. Further, a country's openness to trade could be viewed an important factor for current account adjustments following cyclical shocks.

Even though my analysis is very simple and the regression results potentially have some endogeneity bias, my empirical results could serve as a reminder that the current account

might react quite slowly to changes in the activity levels. This observation is most probably caused by a number of multiplier effects and rigidities in the economy.

In retrospect I would not classify the approach in my thesis as very interesting for further work though, as I have omitted lots of relevant current account determinants of the current account which could bias the results. In addition, to my knowledge no one else has carried out a similar analysis, suggesting the approach might not be that relevant. A suggestion for additional research on the topic though, would be to expand the sample of countries and increase the time series, include more determinants and also try to find valid instruments to solve the endogeneity problems in earlier literature, although I reckon this last remark might be problematic. Expanding the sample of countries could be interesting as my sample of high-income OECD countries have a majority of countries where the net foreign assets positions are negative (414/483 observations), and also the proxy for the foreign sector (the United States) are a net borrowing country, possibly making the sample “too” homogeneous. Thus, I have no idea how my results hold up in developing countries. It could also be interesting to find out whether the foreign business cycle has a more significant effect on the current account adjustments in a setting where we have a better proxy for it. This could be done in a time-series analysis on single countries, constructing a trade-weighted foreign output gap for each of those countries and re-estimate my base model or an extension of it. With such an approach it could also be easier to find valid instruments to solve endogeneity issues while simultaneously correcting for both serial correlation and heteroskedasticity. However, one would lose the ability to use fixed effects estimation and would only obtain estimates for a single country when doing so. In addition there might be a problem finding data for a long enough time-period.

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APPENDIX A-1 Data

A-1.1 Sample Countries

My sample consists of 23 OECD countries, all chosen due to data availability. The countries are: Australia, Austria, Belgium, Canada, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Japan, South-Korea, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom. Initially I also had the United States in the data set, but since I had trouble finding a proxy for the foreign business cycle I had to exclude it from the sample and use the US output gap to potential GDP as the proxy.

A-1.2 Variables

The current account balance to GDP variable is sourced from the World Development Indicators Database at the World Bank and is defined as the sum of net exports of goods, services, net income, and net current transfers in percentage of GDP.

The output gap to potential GDP variable is sourced from the IMF World Economic Outlook database. The variable is defined by IMF as: *“Output gaps for advanced economies are calculated as actual GDP less potential GDP as a percent of potential GDP.”*

Both the potential output and the output gap are unobserved variables which are estimated by the IMF. When the IMF are estimating potential output they are not using a standardized methodology, but rather allow for country specific factors to determine which methodology to employ (De Masi, 1997). These estimates of output gaps are therefore subject to a significant margin of uncertainty.

The foreign output gap to potential GDP variable is proxied by the US data for the above variable.

A-1.3 Variables used in the Robustness Check

The **pcgdp** variable – is the ratio of private credit from deposit money banks to the private sector which is a measure of financial deepening. Financial deepening has been found to be significantly influencing the current account balance in a number of studies. Some argue that this variable can be seen as an exogenous variable while others that a high degree of

financial integration might reflect a strong demand for financing rather than exogenously determining savings and investment. I view this as an exogenous variable. The variable is sourced in a dataset by Beck, Demirgüç-Kunt and Levine (2001) which can be found in the data and research section at the World Bank website¹⁷.

The **dep** variable or dependency ratio variable – is a measure of demographic effects. It is defined as the ratio of nonworking age population to the working age population (working age population is defined as everyone between the age of 15 and 65). Masson et al. (1998) have shown that the dependency ratio is one of the key determinants of private saving. The variable is sourced from the World Bank. The variable is estimated by World Bank staff from various sources including census reports, the United Nations Population Division's World Population Prospects, national statistical offices, household surveys conducted by national agencies, and ICF International.

A-1.4 Dummies used to create the subsamples in the sample heterogeneity analysis

The current account deficit dummy was constructed from the current account balance to GDP variable, taking a value 1 if the country had multiple (more than 2) consecutive observations of negative current account balances and 0 otherwise.

The fiscal deficit dummy is created from the cash surplus/deficit (% of GDP) variable sourced from the World Development Indicators Database from the World Bank, taking a value of 1 if negative and 0 otherwise.

The trade openness variable used to construct the dummy in the analysis is defined as the sum of exports and imports in relation to GDP. I have calculated this from domestic currency denominated sources in the World Development Indicator Database by the World Bank. To create the dummy I assigned the value 1 to every observation that was higher than the 75 percentile in the data and 0 to the rest of the observations.

¹⁷ http link:

<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>

The dummy I used to construct the **twin-deficit** subsample is taking a value 1 if both the current account and the government budget balance (cash surplus/deficit) are negative at the same observation and 0 otherwise.

The last two subsamples were constructed by a dummy reflecting whether the country were a **member of the European Monetary Union or not**.

Appendix B-1 Tests, descriptives and additional regression results

B-1.1 Descriptive Statistics of the Variables

Current Account Balance to GDP					Domestic Output Gap to Potential GDP				
Percentiles	Smallest				Percentiles	Smallest			
1%	-12.643	-15.928			1%	-7.006	-9.797		
5%	-9.698	-15.391			5%	-3.586	-8.485		
10%	-6.544	-15.039	Obs	459	10%	-2.565	-7.620	Obs	470
25%	-3.455	-14.623	Sum of Wgt.	459	25%	-1.285	-7.143	Sum of Wgt.	470
50%	-0.523		Mean	-0.360	50%	-0.167		Mean	0.0047
		Largest	Std.Dev.	5.082			Largest	Std.Dev.	2.4518
75%	2.710	16.116			75%	1.297	9.219		
90%	5.469	16.116	Variance	25.829	90%	2.746	9.388	Variance	6.011
95%	7.421	17.106	Skewness	0.1516	95%	3.716	9.938	Skewness	0.390
99%	14.902	17.457	Kurtosis	4.1291	99%	8.926	10.868	Kurtosis	6.057

Foreign Output Gap to Potential GDP				
Percentiles	Smallest			
1%	-5.559	-5.559		
5%	-4.475	-5.559		
10%	-2.16	-5.559	Obs	483
25%	-0.939	-5.559	Sum of Wgt.	483
50%	0.347		Mean	0.198
		Largest	Std.Dev.	2.309
75%	1.591	4.356		
90%	2.494	4.356	Variance	5.330
95%	3.753	4.356	Skewness	-0.671
99%	4.356	4.356	Kurtosis	3.594

B-1.2 Hausman Test for Model Specification

	(b) Fixed	(B) Random	(b-B) Difference	sqrt (diag(V_b- V_B)) S.E
L.ca	-.2151705	.0591314	-.1560391	.0243097
D.gap	-.4264544	.4433534	.0168989	-
L.gap	-.1068915	.0828707	-.0240208	.011867
D.forgap	.1506952	.1504391	.0002561	-
L.forgap	.0506606	.038318	.0123426	-

b = consistent under H_0 and H_a ; obtained from xtreg
 B = inconsistent under H_a , efficient under H_0 ; obtained from xtreg

Test: H_0 : difference in coefficients not systematic
 $\chi^2(5) = (b-B)' [(V_b - V_B)^{-1}] (b-B) = 41.07$
 Prob > χ^2
 = 0.0000
 ($V_b - V_B$ is not positive definite)

We discard the null hypothesis; hence the test results imply that use of country fixed effects is appropriate.

B-1.3 Test for Serial Correlation

Wooldridge test for autocorrelation
 in panel data (xtserial)

H_0 : no first order autocorrelation
 $F(1, 22) = 185.736$
 Prob > F = 0.0000

With a lagged dependent variable included as a regressor we would expect serial correlation to cause a problem for our inference tests. Using the Wooldridge test for serial correlation I can conclude the presence of serial correlation in the base model.

B-1.4 FGLS Regression Results

VARIABLES	FGLS M1	FGLS Base
	D.ca	D.ca
L.ca	-0.215*** (0.0297)	-0.215*** (0.0297)
D.gap	-0.365*** (0.0454)	-0.426*** (0.0527)
L.gap	-0.116*** (0.0429)	-0.107** (0.0483)
D.forgap		0.151** (0.0677)
L.forgap		0.0507 (0.0466)
Constant	-0.902** (0.427)	-0.892** (0.426)
Country-fixed effects:	Yes	Yes
Time-fixed effects:	Yes	Yes
Observations	431	431
Number of cid	23	23

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The FGLS regressions are showing serial correlation-corrected standard errors. There is not a large difference from the heteroskedasticity-robust standard errors used in the analysis, hence the inference tests based on the residuals will be the same whether I correct for heteroskedasticity or serial correlation. However, the optimal would be to correct for both simultaneously, so the inferences drawn regarding significance should not be fully trusted.

B-1.5 Robustness Check

VARIABLES	rob1 D.ca	rob2 D.ca	rob3 D.ca	rob4 D.ca
L.ca	-0.206*** (0.0325)	-0.228*** (0.0328)	-0.216*** (0.0341)	-0.237*** (0.0310)
D.gap	-0.444*** (0.0570)	-0.421*** (0.0547)	-0.446*** (0.0572)	-0.438*** (0.0584)
L.gap	-0.0877 (0.0536)	-0.110** (0.0506)	-0.102* (0.0551)	-0.170*** (0.0597)
D.forgap	0.104 (0.0765)	0.134* (0.0715)	0.0958 (0.0770)	0.152* (0.0826)
L.forgap	0.0994* (0.0562)	0.0376 (0.0499)	0.0898 (0.0570)	0.123* (0.0708)
D.pcgdp	-0.0387*** (0.0134)		-0.0372*** (0.0136)	
L.pcgdp	0.00424 (0.00343)		0.00559 (0.00380)	
D.dep		-0.318 (0.341)	-0.403 (0.372)	
L.dep		0.0312 (0.0443)	-0.0185 (0.0472)	
L2.gap				0.111* (0.0642)
L2.forgap				-0.0324 (0.0927)
Constant	-0.371 (0.338)	-1.598 (2.164)	0.378 (2.398)	-0.0960 (0.105)
Country-fixed effects:	Yes	Yes	Yes	Yes
Time-fixed effects:	Yes	Yes	Yes	Yes
Observations	391	431	391	409
R-squared	0.375	0.392	0.413	0.415
Number of cid	23	23	23	23

Standard errors in parentheses

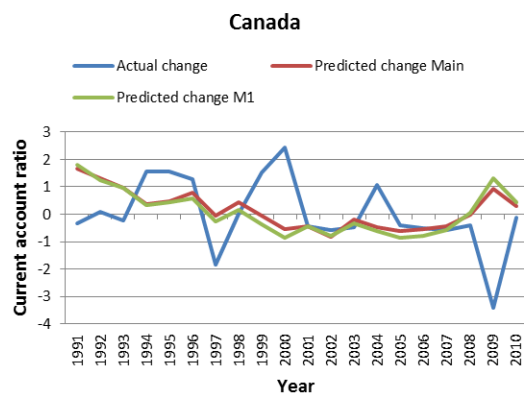
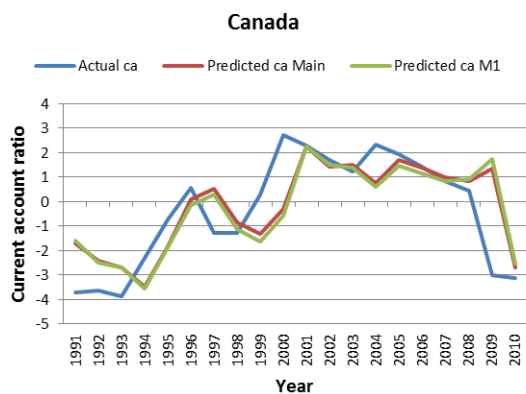
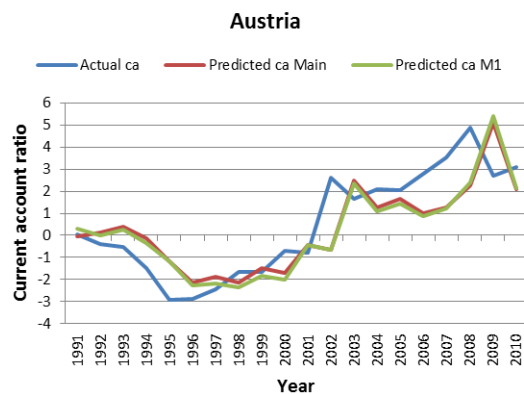
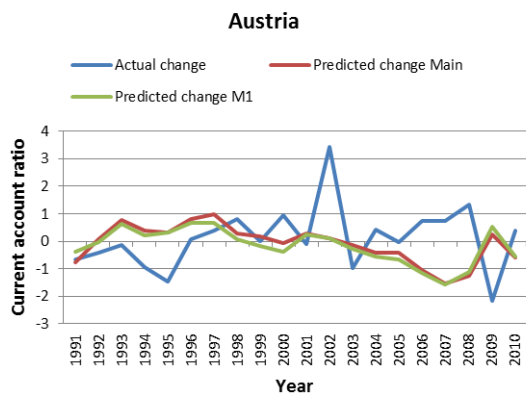
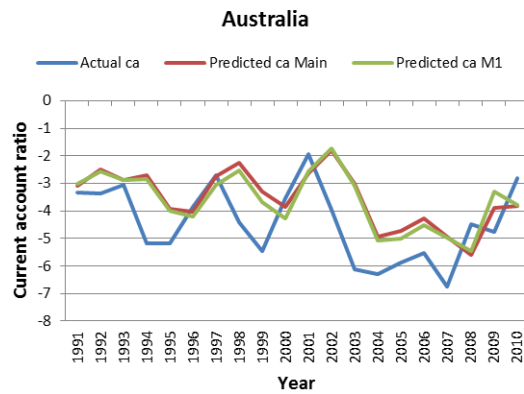
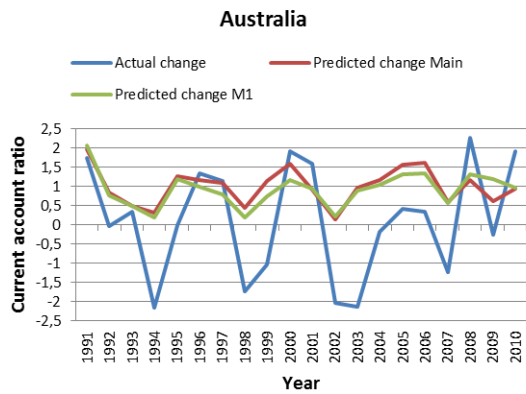
*** p<0.01, ** p<0.05, * p<0.1

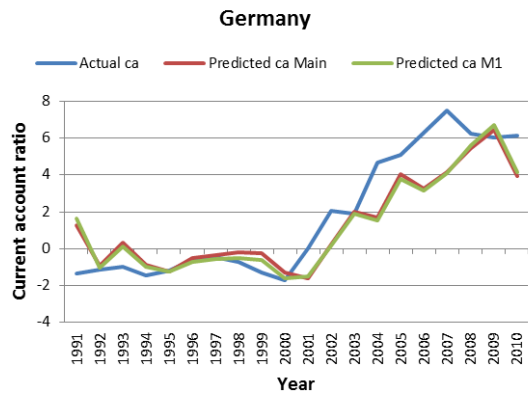
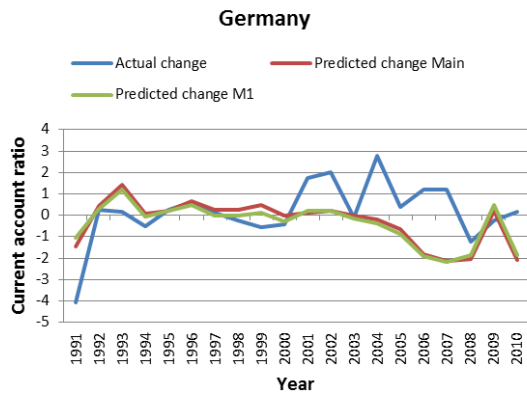
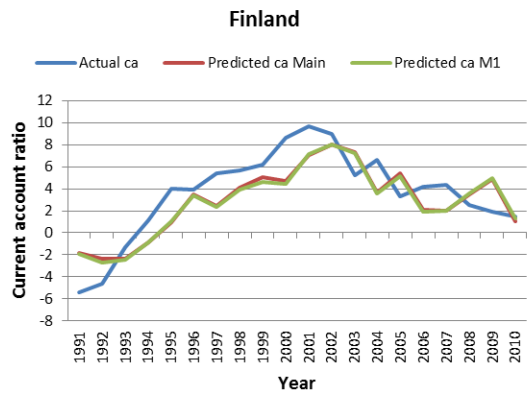
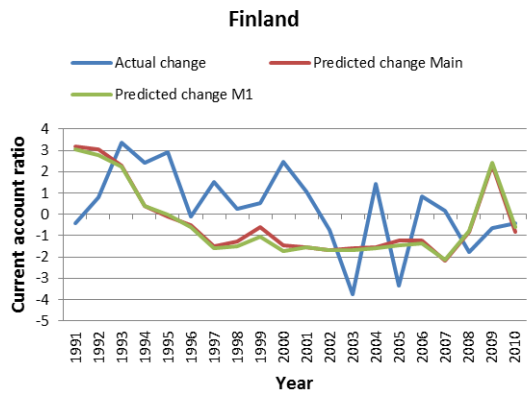
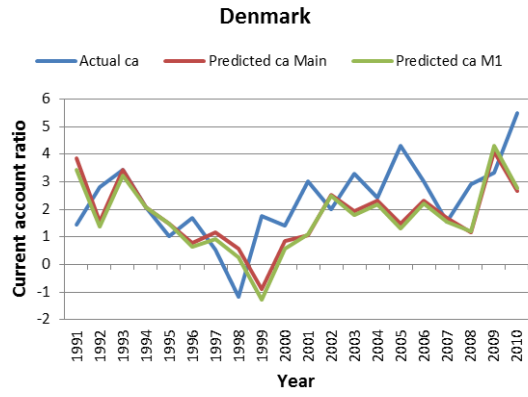
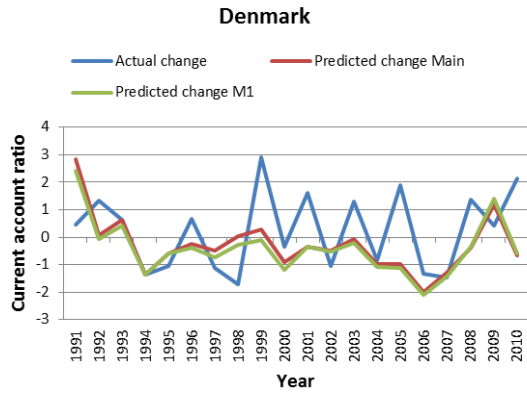
The models above are including a couple more variables which are seen as exogenous determinants of the current account in related literature and the last model is including more lags on the domestic and foreign output gap variables. We see that the inclusion or exclusion of such variables do not alter the coefficients for neither the error correcting term or the short- and long-run effects of the domestic and foreign business cycle very much. Hence we may view the estimates as fairly robust when including and excluding variables.

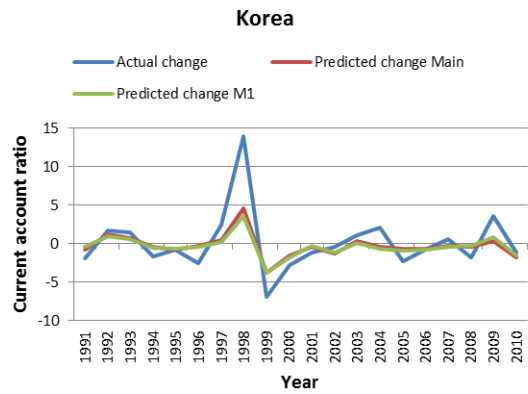
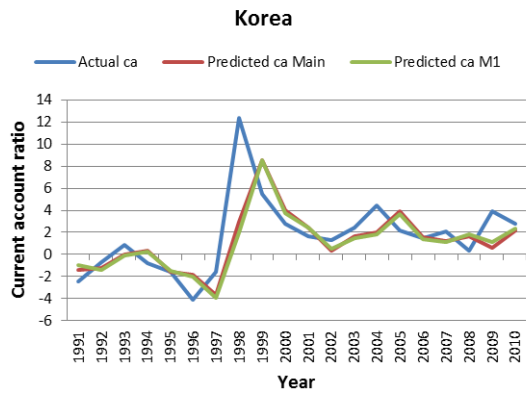
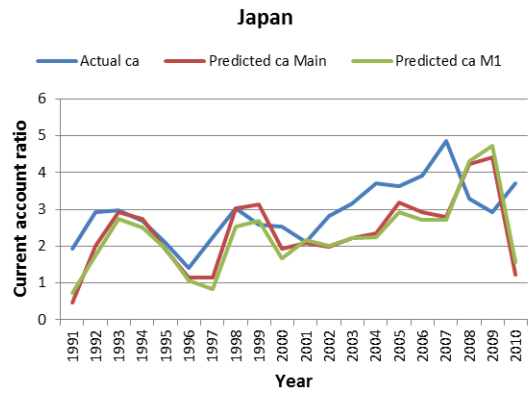
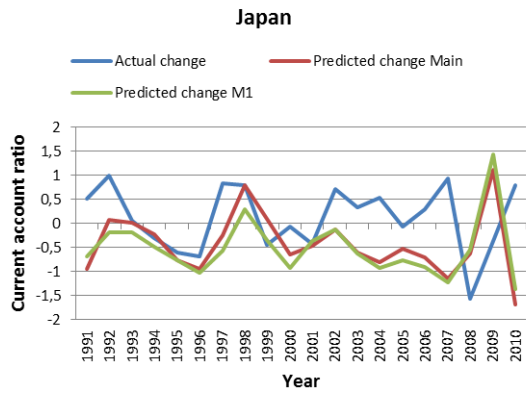
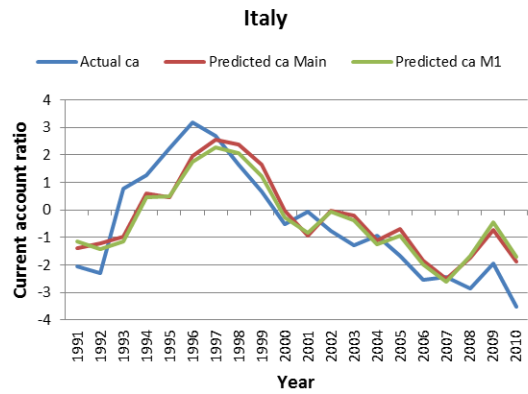
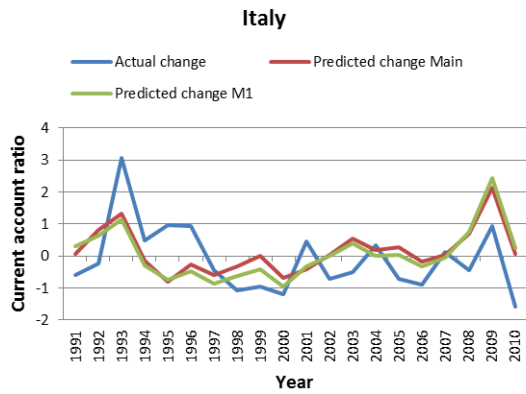
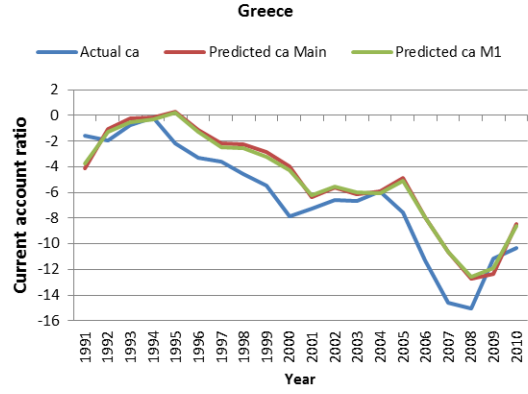
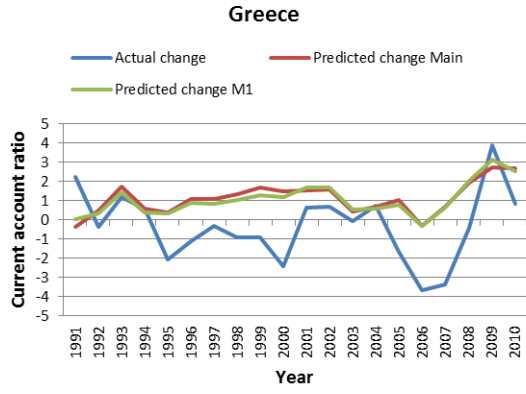
Appendix C-1 Additional Figures

C-1.1 In-sample predictions

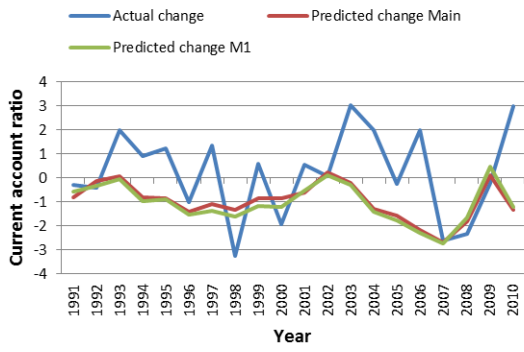
Charted below are all the model predictions for each country in the sample (only for countries with enough observations on the three variables to estimate them).



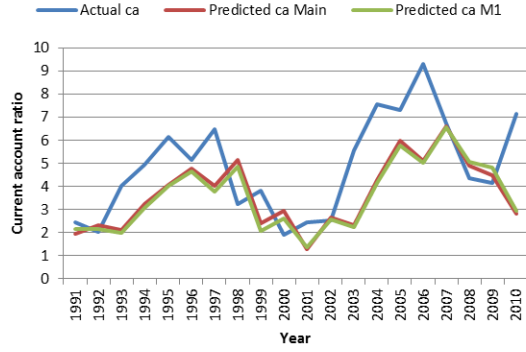




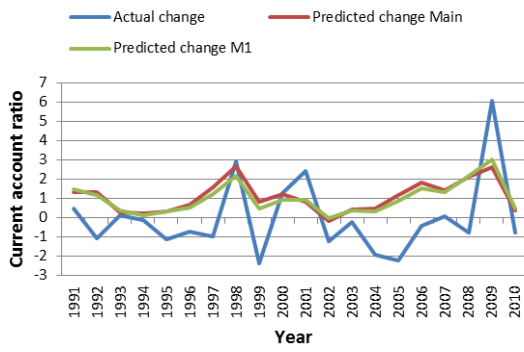
Netherlands



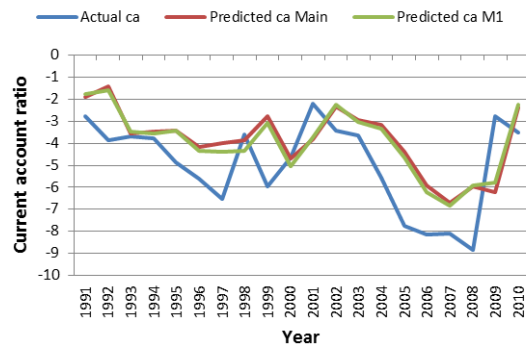
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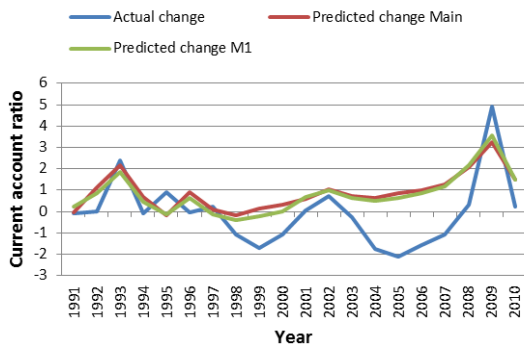
New Zealand



New Zealand



Spain



Spain

