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**TRADE DETERMINANTS AND
CURRENT ACCOUNT FORECASTS**

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List of Abbreviations

Adj.	adjusted
AWM	area wide model
bn.	billion
DIW	Deutsches Institut für Wirtschaftsforschung
DOTS	Direction of Trade Statistics
ECB	European Central Bank
EEG	Erneuerbare-Energien-Gesetz (Renewable Energy Sources Act)
e.g.	exempli gratia (for example)
et al.	et alii (and others)
GDP	gross domestic product
G7	group of seven
GVAR	global vector autoregressive model
i.e.	id est (that is)
IEA	International Energy Agency
IFS	International Financial Statistics
IMF	International Monetary Fund
JB	Jarque-Bera Criterion
LM	Lagrange Multiplier Test
LogL	Log-Likelihood
LR	likelihood ratio

NBER	National Bureau of Economic Research
NIESR	National Institute of Economic and Social Research
NIID	normal independent and identically distributed
No.	number
Obs.	observation
OECD	Organization for Economic Cooperation and Development
Prob.	probability
R&D	Research and Development
REER	real effective exchange rate
RMSE	root mean squared error
SC	Schwarz Criterion
SE	standard errors
Stand. Dev.	standard deviation
StrEG	Stromeinspeisungsgesetz (Electricity Feed Act)
UK	United Kingdom
US	United States of America
VAR	vector autoregressive model
WEO	World Economic Outlook

Chapter 1

Introduction

The question of what are the main drivers of international trade is one of the longest standing debates in macroeconomics. Fluctuations in net exports lead indeed to output growth volatility, which can be substantial depending on the degree of openness of the considered economy. As changes in the trade balance entail crucial information about the overall economic performance of a country, they are closely monitored by policymakers and are subject to revealing research analyses.¹

In particular, the sharp contraction in global trade in the wake of the financial and economic crisis of 2008 - 2009 attracted a lot of attention in policy circles and academia alike, triggering renewed interest in the key determinants of international trade and the relevance of trade forecasts in the policy making process. In this context two main issues reemerged: The first one relates to the factors that caused the downturn in global trade.

¹More recent studies concentrate on the magnitude of the US dollar depreciation that would accompany an adjustment in the US trade balance as well as the expected changes in output in the US and the rest of the world (Obstfeld and Rogoff, 2005, 2006; Blanchard et al., 2006)

More precisely, questions such as to what extent would a decline in foreign demand or the appreciation of the domestic currency affect the magnitude of a country's exports are prevalently brought to the foreground. The second issue concerns the accuracy and the rationality of trade forecasts. As trade forecasts entail important information about the anticipated trade reversals or trade adjustment episodes, they allow policymakers to react to the changing economic environment in a forward-looking manner (Frenkel et al., 2012). Several studies on reversals of current account deficits show that the adjustment process typically includes a significant real depreciation of the domestic currency and a slowdown in real GDP growth, private consumption, and investment (Milesi-Ferretti and Razin, 1998; McKinnon, 2001; Freund, 2005; De Haan et al., 2008). If reversals in trade flows are anticipated by market participants, policymakers can implement preventive measures if necessary and, thereby, mitigate the negative economic effects. Hence, accurate forecasts are important policy tools and can serve as early indicators (Eijffinger and Goderis, 2007).

The purpose of this thesis is to make a contribution to research analyses on the key determinants of international trade on the one hand and the performance of macroeconomic forecasts on the other. To shed more light on international trade determinants the thesis focuses on German merchandise exports. Germany has traditionally been one of the most successful export nations in the world with an export-to-GDP ratio of over 40 percent. This is remarkably high if compared to other industrialized countries like the United States, Japan or France where exports account for less than 30 percent of GDP. Hence, an analysis on the key determinants of Germany's exports provides valuable insights into how industrialized countries can successfully stimulate exports and eventually trigger an expenditure-switching effect away from imported goods.

To find out more about the driving forces of Germany's exports, the thesis goes beyond the standard export demand function and tests a wider range of determinants and a longer time period than has typically been analyzed. Traditionally, the demand for exports is specified as a function of a country's price competitiveness and a foreign economic activity variable (Goldstein and Khan, 1985). The improvement in price competitiveness or a rise in foreign demand is expected to lead to an upsurge in exports. While the results of previous studies suggest that traditional determinants are essential, substantial unexplained residuals remain pointing towards unobserved and omitted variables in the traditional export demand function (Hooper et al., 2000; Meurers, 2004).

It is the aim of this thesis to identify some of the factors which in addition to the traditional determinants are essential in explaining German exports. Based on the arguments of the new trade theory and the endogenous growth theory conducted by Krugman (1983, 1985) and Grossman and Helpman (1991), the thesis concentrates on factors, such as the internalization of supply chains and quality differentials. In particular, the fragmentation of production processes across a range of countries increasingly allows firms to optimally exploit the comparative advantages of different locations and, thereby, improves a firm's productivity (Yi, 2003; Kimmura et al., 2007; Baldwin and Taglioni, 2011). To the extent that German firms more progressively segment different production stages if compared to their competitors, the internalization of supply chains might have benefited Germany's export sector. Similarly, quality differentials of traded goods which are not captured by the real effective exchange rate might have contributed to Germany's export success.

To assess the relative importance of the determinants, the multivariate estimation technique of Johansen (1988, 1992) is employed. In contrast to the two-step residual based methodology developed by Engle and Granger (1987) the Johansen procedure allows to test for more than just one cointegration vector in a multivariate setting and is based on a simultaneous estimation of the long-run relationship and the short-run adjustment process of the variables under consideration. The thesis also examines the contribution of different determinants to the development of German exports over the period 2000-2010.

While econometric analyses on the key determinants of international trade entail crucial information for policymakers, trade forecasts are also essential in order to decide on the future course of action (Gorten et al., 2010). In this respect, especially forecasts of or expectations about current account movements can be inevitably important. To this end, international organizations like the IMF and the OECD regularly publish current account forecasts. However, Batchelor (2001) and Blix et al. (2001) show that international organizations provide less accurate forecasts compared to the private consensus forecast. This suggests that private sector forecasts should be taken into account when assessing future trade developments.

In order to shed more light on the formation process of private sector forecasts, the thesis analyzes data from the Consensus Economics Forecast Poll and explores the characteristics of more than 60.000 forecasts of key macroeconomic variables. In a first step, the thesis concentrates on current account forecasts and studies the rationality, heterogeneity, and accuracy of these forecasts. In addition to the test of traditional unbiasedness and orthogonality criteria for forecast rationality, it sheds some light on questions

about the herding behavior of current account forecasters. Bernhardt et al. (2006) suggest an empirical test for herding and anti-herding that is applied to this question. In a second step, the thesis explores the strategic behavior of private sector forecasters with respect to forecasts published by international organizations, such as the IMF and the OECD. In particular, it analyzes whether private sector forecasters herd towards the projections published by these international organizations. The results of this analysis do not only provide insights on how forecasters form their expectations, but also have important macroeconomic implications. For instance, economic agents who use private sector forecasts should be aware of the issues concerning rationality, heterogeneity, herding and accuracy of forecasts.

The remainder of the thesis is structured as follows. The next chapter analyzes the key determinants of Germany's exports. Based on the Johansen cointegration estimation technique numerous determinants are systematically examined for their ability to explain Germany's merchandise exports. Besides, the dynamic contribution of different determinants to the evolution of German exports is examined for the period 2000-2010. Chapter 3 sheds light on how current account forecasters form their expectations. In order to explore whether heterogeneous current account forecasts represent rational projections of the future current account balance, two widely applied criteria to study the rationality of forecasts (unbiasedness and orthogonality) are performed (Ito, 1990; MacDonald and Marsh, 1996; Elliott and Ito, 1999). Moreover, an empirical test for herding and anti-herding of private sectors forecasters is applied. This allows for inferences about a strategic behavior of current account forecasters. The question of whether there is a systematic link between forecast accuracy and the strategic behavior of forecasters is also examined. Chapter 4 analyzes the interlinkages between individual

private sector forecasts and forecasts published by the IMF and the OECD. In particular, the question of whether private sector forecasters are influenced by forecasts of international organizations is explored. Finally, chapter 5 summarizes the main results and concludes.

Chapter 2

What Drives Germany's Exports?

This chapter reviews a number of different hypotheses that aim to explain the development of German merchandise exports. Based on the cointegration estimation technique numerous determinants are systematically examined for their ability to explain German exports during the period 1991-2010. The estimation results indicate that besides the traditional determinants (world demand and price competitiveness) other determinants, such as energy prices and the increasing fragmentation of production processes are also crucial in explaining German exports.

2.1 Introduction

The question of what drives exports at the country level is one of the longest standing discussions in international macroeconomics. Especially in Germany which has traditionally been one of the largest export nations in the world, fluctuations in merchandise exports represent indeed a substantial component of its economic growth volatility and are, therefore, closely monitored by policymakers.

Given Germany's export dependence and recent changes in the world economy, it seems highly relevant to analyze which factors other than the traditional export determinants (price competitiveness and foreign demand) are crucial in explaining Germany's export performance. To find out more about the driving forces of Germany's exports, our study goes beyond the standard export demand function and tests a wider range of determinants and a longer time period than has typically been analyzed. To assess the relative importance of the determinants, we employ the multivariate estimation technique of Johansen (1988, 1992). This approach allows for a simultaneous estimation of the long-run relationship and the short-run adjustment process of the variables under consideration. Our study also examines the contribution of different determinants to the development of German exports over the period 2000-2010.

The remainder of the chapter is structured as follows. Section 2.2 provides an overview of the existing literature. Section 2.3 discusses alternative hypotheses about the determinants of Germany's exports and describes the data set. Section 2.4 lays out the econometric modeling strategy. Section 2.5 presents the empirical results. Section 2.6 examines the contributions of the key determinants to Germany's export performance. Section 2.7 provides some robustness tests. Section 2.8 summarizes the main findings of the study and concludes.

2.2 Literature Overview

Traditionally, the demand for exports is specified as a function of a country's price competitiveness and a foreign economic activity variable (Goldstein and Khan, 1985). The improvement in price competitiveness or a rise in foreign demand is expected to lead to an upsurge in exports. Several studies

estimate export demand elasticities for Germany and find the absolute values of the long-run price elasticity to range between 0.2 - 1.0 and the long-run income elasticity to range between 0.8 - 1.6 (Senhadji and Montenegro, 1999; Hooper et al., 2000; Strauß, 2000; Meurers 2004). Although the results of these studies suggest that traditional determinants are essential in explaining German exports, substantial unexplained residuals remain. This outcome points towards the existence of crucial unobserved or omitted variables in the traditional export demand function. It is the aim of this study to identify some of the factors which in addition to the traditional determinants are essential in explaining German exports.

So far, there are only a few studies that go beyond the traditional export demand function and test the relevance of variables other than foreign economic activity and price competitiveness (Carlin et al., 2001; Danninger and Joutz, 2008). Based on the arguments of the new trade theory and the endogenous growth theory conducted by Krugman (1983, 1985) and Grossman and Helpman (1991) the studies mainly concentrate on factors such as globalization and quality differentials of traded goods.

To capture the effects of globalization the introduction of linear trends and dummy variables into the regression models has become predominant in the literature (Stephan, 2005; Barell et al., 2007). Although there seems to be a consensus about the overall positive effect of globalization on German exports, the interpretation of the estimated coefficients is to a large extent intuitive and indirect. For instance, a statistically significant trend in the export demand function can be attributed to different causes and leaves, therefore, lots of room for interpretation. Hence, it is of paramount importance to concentrate on isolated aspects of globalization in order to

provide concrete economic reasoning for the estimation results. In this study we concentrate on the ongoing fragmentation of production processes across the world as one potential determinant.

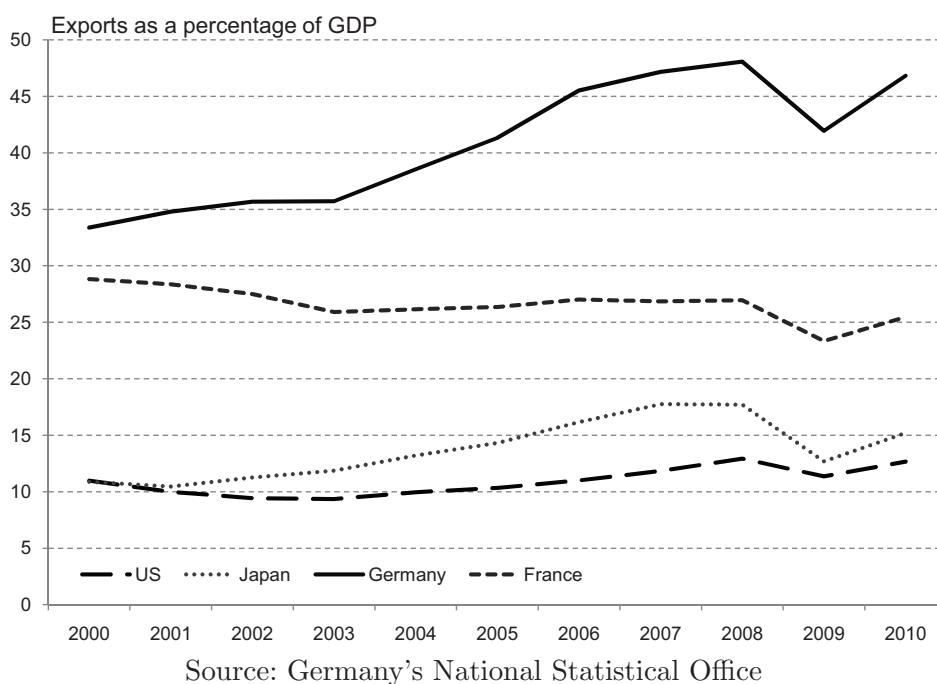
With respect to quality differentials of traded goods, Grossman and Helpman (1991) highlight the importance of technological competitiveness in explaining trade flows. They argue that spending more on innovation enhancing activities enables firms to improve their product quality which inevitably leads to an increased market share relative to their competitors. To control for quality differentials some empirical studies introduce specific R&D measures or patenting activities to the traditional export demand function (Carlin et al., 2001). The findings of the existing studies, however, do not yield conclusive results for the case of Germany. Therefore, it seems appropriate to further investigate the importance of quality aspects for the German export performance.

So far, empirical studies have yielded little consensus about which factors are most important in explaining German exports. Most of them have examined either the effects of globalization or the effects of quality differentials as potential determinants. The objective of this study is to combine the two strands of literature into one empirical analysis in order to derive more conclusive results and make a contribution to explaining a part of the large residuals of the traditional German export demand function. Besides, our analysis goes beyond the already existing explanations and also includes aspects of energy efficiency which is a characteristic often ascribed to German products.

2.3 General Hypotheses and Data Set

Germany has traditionally been one of the most successful export countries in the world with an export-to-GDP ratio of over 40 percent. This is remarkably high when compared to larger industrial countries like the United States, Japan or France where exports account for less than 30 percent of GDP. Hence, Germany is a relatively open economy which, on the one hand, performs well in international markets, but, on the other hand, highly depends on its export sector.

Figure 2.1: Export-to-GDP Ratio in Advanced Economies



In this study we empirically examine the driving forces of Germany's merchandise exports. We argue that besides traditional determinants a number of other factors also significantly affect their development. Before turning to the empirical analysis, we briefly discuss our hypotheses and define the data set.

1. Price Competitiveness and Foreign Demand

Traditionally the development of exports is determined by changes in relative prices and foreign demand. More precisely, an improvement in price competitiveness stimulates sales abroad whereas a fall in foreign demand leads to a decline in exports.

From the empirical point of view, numerous indicators exist in order to control for the effects of price competitiveness. Some studies use relative export prices in their export demand equation (Pain et al., 2005; Fagan et al., 2001). Although this measure is frequently used in the literature the drawback of it is the sharp increase in the number of estimated parameters in the model. This implies a significant loss of the degrees of freedom in the empirical analysis which can be substantial depending on the number of observations considered. Given the limited time horizon in our analysis we use the real effective exchange rate instead which does not require a separate estimation of relative prices and has also been extensively used in the empirical literature (Carlin et al., 2001; Danninger and Joutz, 2008; Bussière et al., 2009). Besides, it is more prominent in the policy debate and allows to assess the real exchange rate fluctuations on export developments directly (Boyd et al., 2001).

The real effective exchange rate is typically defined as a weighted average of a country's currency relative to an index or basket of other major currencies adjusted for the effects of inflation. A rise in the real effective exchange rate implies a worsening in international price competitiveness for a country vis-à-vis its main trading partners. In our empirical analysis we use the real effective exchange rate based on unit labor costs in the manufacturing sector

(*REER*) to control for Germany's price competitiveness. This measure seems to be most appropriate, as German export goods mainly represent manufactured products.

To model foreign demand empirical studies usually use the volume of world trade, foreign real GDP or, in some rare cases, the demand for investment goods (Sawyer and Sprinkle, 1999; Stephan, 2005; Strauß 2004).¹ More recent studies, however, discuss the advantages of using export market trends calculated on the basis of import activities of the trading partner countries to measure the economic activity (Stahn, 2006; Danninger and Joutz, 2008). Based on their arguments, we too use real imports of Germany's main trading partners weighted by the average export share to measure foreign demand (*Demand*).

2. Quality Aspects

The real effective exchange rate entails important information concerning the competitive position of a country. However, it does not capture all aspects of competitiveness. While improvements in productivity are directly reflected in the real effective exchange rate based on unit labor costs, it neglects important factors which can not be attributed to changes in productivity. For example, higher prices could reflect superior design or reliability of goods. When output is deflated by these higher prices, the country appears to be less productive than its competitors, while in reality consumers' willingness to pay is increased by higher product quality (Madsen, 2004).

¹A somewhat related argument is examined by Martínez-Zarzoso et al. (2009) who study the relationship between foreign development aid and exports.

Grossman and Helpman (1991) highlight the importance of technological competitiveness in explaining trade flows. In their studies they stress the importance of innovation in developing new products that are of higher quality than similar goods available on the market. They argue that spending more on innovation enhancing activities, such as R&D, enables firms to improve the product and, thereby, move up the quality ladder relative to competitors. To control for quality aspects we use R&D expenditure as a proxy variable. More specifically, we employ the gross R&D expenditure share in GDP relative to this share of Germany's main trading partners (*R&D*) in our empirical estimations.

3. Energy Efficient Technologies and Alternative Energy Sources

Albeit the label "Made in Germany" is seen by many as synonymous with high-quality goods, German products are increasingly said to also be exceptionally energy-efficient. With energy resources becoming more and more scarce and, hence energy prices rising notably, the world demand for energy-efficient products and alternative energies has drastically increased.

With regard to energy-efficient technology and new energy solutions, Germany is one of the global market leaders. In particular, Germany's Renewable Energy Sources Act has helped the economy to become the world leader in using solar photovoltaic and solar thermal systems and to develop a thriving manufacturing and R&D industry in this field.² According to the

²The Renewable Energy Sources Act (EEG) draws on more than 16 years of experience. It has its origin in The Electricity Feed Act (StrEG) which became effective in 1991. In 2004 this act was replaced by The Renewable Energy Sources Act (EEG). According to the International Energy Agency (IEA 2008) it is the most important and successful instrument to promote the expansion of renewable energies in the electricity sector.

German Renewable Energy Federation (2008), the world market volume for renewable energy sources has doubled from euro 30 to euro 60 billion, since the turn of the century and is estimated to increase further to euro 400 billion by 2020. To our knowledge, no studies have yet examined the effects of energy prices on German exports. Using the petroleum crude price index as an indicator of energy prices in general (*Energy*) we investigate the relationship between the oil price and German exports.

4. Fragmentation of Production Processes

One explanation that seems worthwhile to be examined further is based on the ongoing internalization of supply chains around the globe. In particular, the increased openness of capital markets and the integration of emerging markets into the world economy allows firms to geographically segment different production stages across a range of countries in order to optimally exploit the comparative advantages of different locations (Feenstra, 1998; Jö, 2001; Yi, 2003; Baldwin and Taglioni, 2011). Hence, parts and components that make up a final good are increasingly manufactured in different countries (Hummels et al., 2001; Kimura et al., 2007).

In Germany these developments led to increased trade in intermediate products while at the same time the domestic value added decreased (Sinn, 2006). To the extent that German firms more progressively segment different production stages than their competitors, they might have improved their productivity and increased their export market share.

In order to draw conclusions about the fragmentation effect, we include the amount of domestic value added as a percentage of total production output (*Fragmentation*) into our empirical model. A decline in domestic value added is a reflection of an increase in the share of intermediate goods. Therefore, a negative relationship between this variable and exports can be interpreted as evidence for increased specialization.

2.4 Empirical Methodology

We develop two econometric models of German merchandise exports. The first one represents the traditional export demand function which captures information on price competitiveness and foreign demand. The second one represents an extended version of the export demand function which in addition to traditional determinants entails information on aspects discussed in the previous section.

Details on the variables used in the study are given in Table 2.1. All estimations are based on quarterly observations between 1991Q1 and 2010Q4. Data prior to 1991 are either missing or are dropped due to unification-related fluctuations in the series. All variables are transformed into natural logarithms. Since seasonally unadjusted data are used, constant and centered seasonal dummies are included in the estimations. Summary statistics of the variables are given in Table 2.2.

Table 2.1: Description of the Variables: Sample 1991Q1 - 2010Q4

Variable	Description	Source
Exports	Germany's total merchandise export volumes Index 2005=100	German Federal Statistical Office
REER	Real effective exchange rate based on unit labor costs in the manufacturing sector Index 2005=100	International Monetary Fund, International Financial Statistics (IFS)
Demand	Real imports of Germany's main trading partners weighted by the average export share of the respective country $Demand_t = \sum_t (x_i M_{it})$ With $x_i = X_i/X_G$ where x_i are Germany's exports to country i and X_G are Germany's total merchandise exports. The ratio is averaged over the period 2000-2005. M_{it} are real imports of country i in period t . Index 2005=100	International Monetary Fund, Direction of Trade Statistics (DOTS)
R&D	Germany's gross expenditure on R&D as percentage of GDP relative to gross expenditure on R&D as percentage of GDP of Germany's main trading partners Index 2005=100	OECD International Financial Statistics (IFS)
Energy	Crude oil price index Index 2005=100	International Monetary Fund, International Financial Statistics (IFS)
Fragmentation	Domestic value added as percentage of total production output	German Federal Statistical Office

Note: Main trading partners refer to the first 15 destinations for Germany's exports over the period 1991Q1 - 2010Q4.

Table 2.2: Summary Statistics of Variables Used in the Study

	Obs.	Mean	Stand. Dev.
Exports	80	4.29	0.37
REER	80	4.01	0.12
Demand	80	4.24	0.37
R&D	80	4.59	0.02
Energy	80	4.03	0.64
Fragmentation	80	4.62	0.04

Note: All variables are transformed into natural logarithms.

Ideally, we should have worked with a fully specified export model which captures demand and supply side influences separately while appropriately allowing for the possibility of a simultaneous integration involved in the determination of quantity and prices. Unfortunately, high-frequency data are not available for this purpose. However, the simultaneity issue is not a binding constraint because the econometric procedure that is applied in this study permits us to test for a cointegration relationship between the variables under consideration. Theoretically the export demand function is a component of a structural model which reflects a long-run steady state relationship. From an econometric point of view, this implies a cointegration relationship of the variables under consideration.

In line with the standard practice in time series econometrics, we first test the time series property of the data. Table 2.3 contains the results of the Augmented Dickey-Fuller test. According to the test results, all variables are non-stationary in levels and stationary in first differences.

Table 2.3: Augmented Dickey-Fuller Test

Variables	Levels		First differences	
	Constant, trend		Constant	
	t-statistics	p-values	t-statistics	p-values
Exports	-2.24	0.46	-7.30	0.00***
REER	-1.39	0.86	-8.94	0.00***
Demand	-2.62	0.27	-3.23	0.02**
R&D	-2.46	0.35	-12.82	0.00***
Energy	-2.98	0.14	-7.06	0.00***
Fragmentation	-3.89	0.02*	-5.01	0.00***

Note: *** (**) [*] denotes significance at a 1 (5) [10] percent significance level.

In a second step we follow the general to specific approach to estimate the different specifications of the export demand model. The advantage of this approach is that it allows to reduce the intensity of serial correlation of the residuals by considering a sufficient number of lags in a general to specific modeling framework (Hoover and Perez 1999). The methodology starts with an estimation of a simple unrestricted vector autoregressive model (VAR) with an initial number of lags being more than necessary. To achieve parsimony one lag is subsequently dropped while testing for the sufficient number of lags that can reasonably explain the dynamics in the model by avoiding an over-parameterization. Therefore, we start our analysis by estimating different specifications of a simple unrestricted vector autoregressive model (VAR) of the following general form:

$$(2.1) \quad z_t = \prod(L)(z_{t-1}) + \psi D_t + \epsilon_t,$$

with $\prod(L) = I_n - \sum_{i=1}^{\rho} \Pi_i L^i$ and ϵ_t are NIID(0; Ω) errors. Where the vector z_t is a n-dimensional process of I(1) series included in the respective model and D_t represents the set of stationary exogenous variables including seasonal dummies. To determine the number of lags, we first perform the VAR

models with the maximum number of lags which is equal to four and then subsequently reduce the model by one lag while continuously testing for the appropriate lag length. According to the Schwarz selection criterion we apply a lag structure of one for both model specifications. The inclusion of further lags would lead to a loss of the degrees of freedom and is likely to produce an over-parameterized model. The results of the tests are given in Table 2.4

Table 2.4: Lag Length Selection

No. of lags	Traditional Model		Extended Model	
	LogL	SC	LogL	SC
0	121.49	-2.34	556.82	-12.94
1	420.93	-9.70*	975.03	-21.90*
2	429.92	-9.43	1033.44	-21.38
3	438.21	-9.14	1094.81	-20.95
4	468.11	-9.41	1188.05	-21.35

Note: * indicates lag order selected by Schwarz information criterion.

Finally, we apply the Johansen procedure (1988, 1992) to explore the cointegration relationships between the variables. In contrast to the two-step residual based methodology developed by Engle and Granger (1987) the Johansen procedure allows to test for more than just one cointegration vector in a multivariate setting. Therefore, we transform the VAR models in levels into representations in first differences of the following general form:

$$(2.2) \quad \Delta z_t = \alpha\beta'(z_{t-1}) + \sum_{i=1}^{\rho-1} \Gamma_i \Delta z_{t-1} + \psi D_t + \epsilon_t.$$

If z_t is cointegrated of order (1,1) with r cointegrating vectors, there exist $n \times r$ matrices α and β of rank r such that $\prod(1) = -\alpha\beta'$. The columns of β

span the cointegrating space and the elements of α are the corresponding adjustment coefficients with ρ indicating the lag length of the model.

To test the number of the cointegration relationships in the considered model we perform the Trace test and the Maximum-Eigenvalue test using the small-sample correction as suggested by Reimers (1992). Table 2.5 contains the results of the Johansen cointegration procedure including the long-run relationship which can be interpreted as a structural export demand function.

2.5 Empirical Results

The objective of the vector error correction analysis is to identify the statistically significant determinants of Germany's export demand. We begin with the traditional export demand model (Traditional Model) consisting of two explanatory variables, *Demand* and *REER*. Subsequently, we extend the Traditional Model in order to analyze the relevance of additional, potential determinants (Extended Model).

According to the results of the Trace test and the Maximum-Eigenvalue test there exists one cointegration vector in both model specifications. Given the weak exogeneity of the determinants this outcome allows us to analyze the models in a single equation error correction setup. Compared to a multivariate system of equations, the analysis of a single equation model is usually less efficient, because useful information is being dropped. However, if the explanatory variables for exports can be regarded as weakly exogenous, this disadvantage disappears (Stephan, 2005). Besides, the long-run relationship of a conditional single error correction model can be interpreted as a structural export function.

Table 2.5: Reduced Rank Cointegration Relation

Test for cointegration	Traditional Model		Extended Model	
	Trace test [Prob]	Max test [Prob]	Trace test [Prob]	Max test [Prob]
H0: rank				
0	63.54*** [0.00]***	45.62*** [0.000]***	124.73*** [0.00]***	61.78*** [0.00]***
1	17.92 [0.10]	12.95 [0.14]	62.95 [0.16]	21.61 [0.64]
2	4.97 [0.29]	4.97 [0.29]	41.34 [0.18]	20.53 [0.31]
Test for weak exogeneity				
	LR statistics [Prob]		LR statistics [Prob]	
$\alpha_{Demand} = \alpha_{REER} = 0$	0.08 [0.96]			
$\alpha_{Demand} = \alpha_{REER} = \alpha_{R\&D}$ $= \alpha_{Energy} = \alpha_{Fragmentation} = 0$			5.36 [0.25]	
Reduced rank cointegration relations				
	β - Vector (SE)	α - Vector (SE)	β - Vector (SE)	α - Vector (SE)
Exports	1	-0.24*** (0.03)	1	-0.22*** (0.03)
REER	0.35*** (0.07)		0.33*** (0.09)	
Demand	-0.78*** (0.04)		-0.71*** (0.05)	
R&D			-0.61 (0.70)	
Energy			-0.11*** (0.03)	
Fragmentation			1.19*** (0.35)	
Adj. R^2	0.92		0.98	
SE	(0.06)		(0.06)	
LM(4)	[0.66]		[0.17]	
JB	[0.74]		[0.60]	

Note: *** (**) [*] denotes significance at a 1 percent significance level. Standard errors are given in parentheses and p-values are given in brackets. A negative reduced rank cointegration relation implies a positive relationship between exports and the respective variable.

The reduced rank cointegration relations are given in Table 2.5 with the numbers in parentheses and brackets representing the standard errors (SE) and the p-values [Prob], respectively. Table 2.5 also shows the adjusted R^2 which is higher for the Extended Model if compared with the Traditional Model. This outcome indicates that our model explains some of the unexplained residuals of the traditional export demand function. Further, the table shows the results of the Breusch-Godfrey-LM test for autocorrelation (LM(4)), and the normality test using the Jarque-Bera criterion (JB). The results suggest that in both models the residuals are normally distributed at the 1 percent significance level and are not autocorrelated up to the fourth order.

The adjustment coefficient of the models suggests that over 90 percent of the disequilibrium is corrected in four quarters, which is a common outcome when analyzing export demand models (Danninger and Joutz, 2008). Further, the traditional determinants are highly significant and have the expected signs in both models. These results are also robust to changes in model specifications.

The price elasticity is around 0.35 percent, indicating that a 2.9 percent real depreciation of the Euro will lead to a one percent increase in exports. The demand elasticity is around 0.78 in the Traditional Model and 0.71 in the Extended Model, respectively. Hence, given that everything else remains unchanged, a one percent increase in global demand leads to an increase in German exports of more than 70 percent. Furthermore, the estimation results indicate that two out of three additional determinants are crucial in explaining German exports.

The energy variable turns out to be highly significant. An increase in oil prices by one percent leads to an increase in exports by 0.11 percent.

This outcome can be interpreted as some evidence for the increasing demand for alternative energy solutions and energy-efficient products. Since Germany is the world market leader in these industries, the scarcity in natural energy resources and the high oil prices benefit the German export sector.

The estimation results further suggest that increased specialization by the ongoing fragmentation of production processes benefits the German export sector. In the long-run a one percent decline of the share of domestic value added in total output increases German exports by more than one percent. This reflects that German manufacturers optimize their value chain of production in such a way as to optimally exploit the comparative advantages of different locations.

While the energy variable and the fragmentation variable turned out to be statistically significant, the quality variable seems to be statistically insignificant in explaining German exports. Hence, we do not find support for the hypothesis according to which Germany-specific quality aspects are crucial in explaining German export performance. Even in the case when the R&D variable enters the export demand equation in its lagged representation because of the argument that contemporaneous effects of quality variables are unlikely, the results do not change. One reason for this outcome might be linked to the fact that R&D expenditure only entails information about the input to innovation but not information about successful research and, therefore, does not appropriately capture all quality aspects.

2.6 Contributions of the Individual Determinants

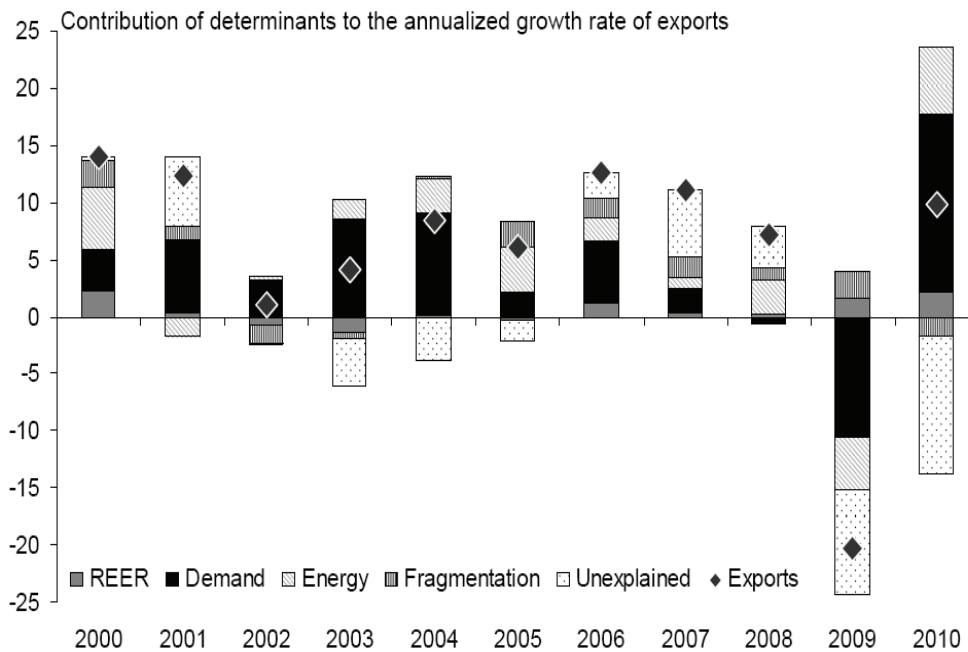
We now use the long-run coefficients of our Extended Model to assess the quantitative contributions of the individual determinants. The advantage of this procedure is that it combines the estimated elasticities with the actual data and, therefore, allows to quantify the impact of the determinants to the evolution of exports in any given period (Allard et al., 2005). Figure 2.2 presents the results of the respective contributions of the individual determinants on a yearly basis. For the period 2000-2010, our Extended Model predicts an annual average export growth rate of almost 6.1 percent, while the actual growth rate was around 6.4 percent. This indicates that over 90 percent of the actual export growth can be explained by the determinants we find to be statistically significant.

The demand variable explains more than 50 percent of export growth and is, therefore, the main determinant of German merchandise exports. The large contribution of the country-specific demand effect is consistent with previous findings and confirms that German exporters are benefiting from growth of their trading partners (Danninger and Joutz, 2008; Allard et al., 2005). Likewise, German exporters experience a harsh relapse if global demand decreases, as was the case during the world wide financial and economic crisis. According to our estimation results 65 percent of the downturn in exports in 2009 can be explained by the downturn in global demand.

The real effective exchange rate explains around 11 percent of export growth. At first glance, the price effect seems to be very small given the prolonged wage moderation during the period under consideration. However,

one has to take into account that the influence of wage moderation on international price competitiveness is probably muted by the large effective nominal appreciation of the euro during the period 2003-2008. If one takes this offsetting exchange rate adjustment into consideration, the pure price effect turns out to be higher.

Figure 2.2: Dynamic Contribution of Determinants



The sizeable contribution of the oil price in explaining German export growth is particularly interesting. Our model suggests that more than 20 percent of the annual export growth rate is explained by the oil price. At first glance, this result might be counterintuitive, as rising energy prices are usually attributed with higher production costs, especially in the manufacturing sector. However, if one takes into account the rising global demand for energy-efficient technologies because of energy resources becoming scarce,

the positive demand effect can overcompensate the negative supply effect in those countries that have a comparative advantage in these products. Hence, our results support the argument that with rising energy prices and natural resources becoming scarce the demand for energy-efficient products and alternative energy technologies increases. German manufacturers and the export sector highly benefit from this effect. Further research is, however, necessary to shed light on whether this effect becomes even more striking for specific export sectors, i.e. the capital goods sector.

Interestingly the fragmentation effect plays a crucial role in explaining German merchandise exports. According to our results it accounts on average for about 13 percent of total export growth. Hence, the separation of different production stages across the world is one of the key drivers of German exports. Our findings support the view that the increasing import content of exports overall benefits the German export sector.

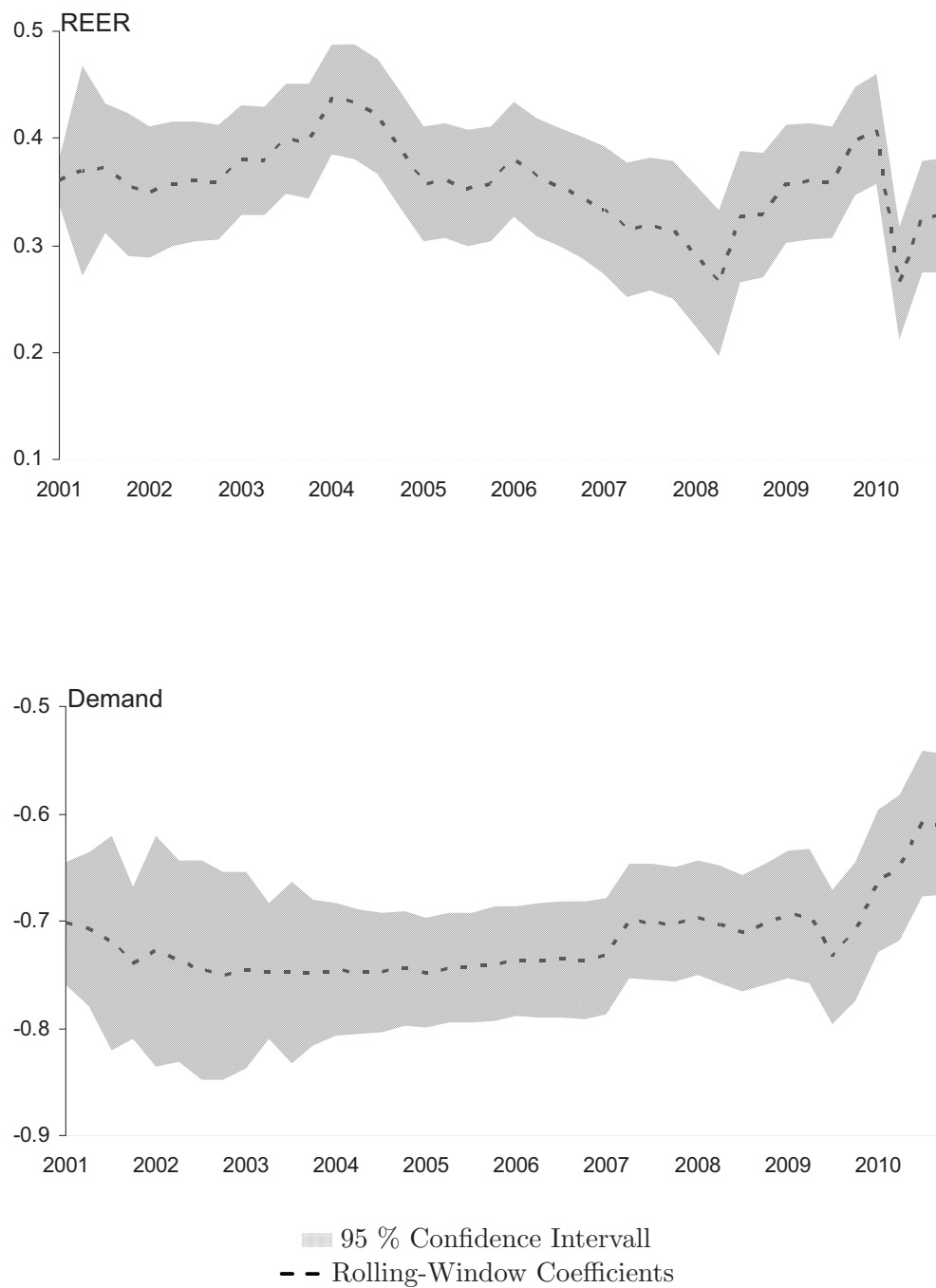
The impact of the residuals in certain periods deserves special attention. While we were able to improve the model fit by including additional determinants to the traditional export demand model, unexplained influences remain. Apart from data issues this reflects the existence of crucial factors, such as non-price competitiveness or sectoral orientation of exports, which are not captured in our estimations. Especially in the aftermath of the financial and economic crisis in 2009 and 2010 unexplained factors accounted for a large portion of Germany's export growth. This, however, might be due to crisis-specific one-off effects, i.e. increasing financing costs for the manufacturing sector. In fact, Briconge et al. (2010) find that French exporters who strongly depend on external financing were the most affected by the crisis.

2.7 Robustness Tests

Shifts in the German economy, labor market reforms and the introduction of a single currency could all have impacted the cointegration relationship among the variables under consideration. In particular, these events could have caused instability or structural breaks in the data generating process for Germany's exports. To analyze the robustness of our results we, therefore, test the temporal stability of the estimated coefficients by means of a rolling-window estimation.

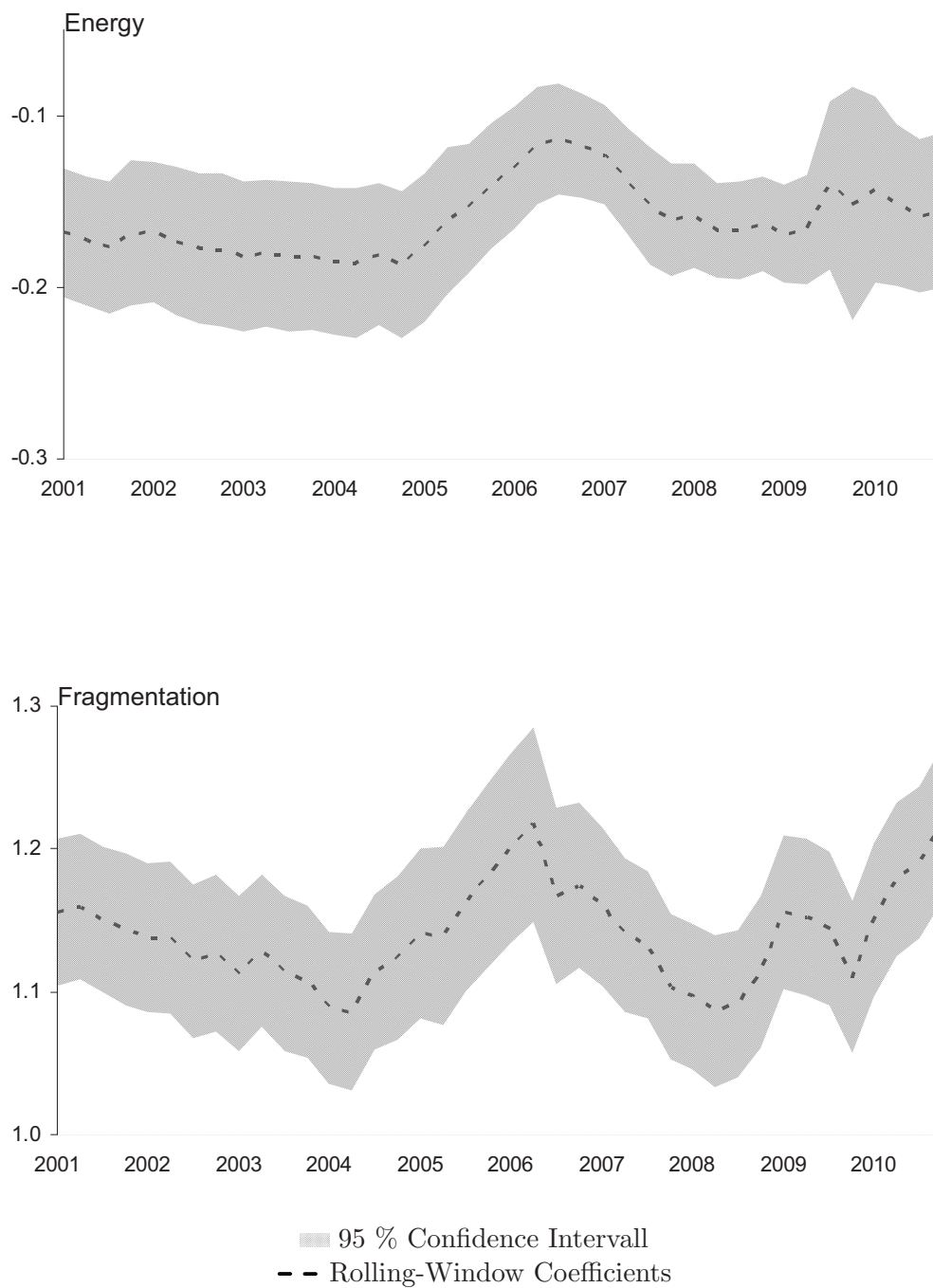
Starting with an estimation window of 10 years, we constantly forward the estimation window by one observation and drop (add) one observation at the beginning (at the end) of the time series. We continue this process of dropping and adding observations until we reach the end of the sample period. Figure 2.3 and 2.4 show the results for the previously identified significant determinants. In all cases the sign of the estimated coefficient does not change in the respective period and the models pass the 1-step Chow and N-down Chow tests at a 5 percent level. While the 1-step Chow test takes the sequence of one period ahead prediction from the recursive estimation into account, the N-down Chow test derives the test statistic over the sample scaled by a 5 percent critical value and can be interpreted as a forecast stability of test. The results of the 1-step Chow tests and the N-down Chow test cannot reject the null hypothesis of no structural break. Therefore, our results support the view that the estimated coefficients are not subject to a specific period which reflects the robustness of our results.

Figure 2.3: Rolling-Window Coefficients 1



Note: This figure shows the rolling-window coefficients (dotted line) and the corresponding 95% confidence interval for an estimation window of 10 years.

Figure 2.4: Rolling-Window Coefficients 2



Note: This figure shows the rolling-window coefficients (dotted line) and the corresponding 95% confidence interval for an estimation window of 10 years.

2.8 Conclusions

In this study different hypotheses are systematically examined for their ability to explain German merchandise exports during the period 1991-2010. The estimation results of the single equation error correction model indicate that world demand, price competitiveness, energy prices and the fragmentation of production process are the main factors explaining Germany's exports. By contrast, there is no conclusive evidence of exports being determined by Germany's R&D expenditure.

The long-term parameters of the identified determinants are used to quantify their individual contributions to Germany's export growth during the period 2000-2010. The results suggest that world demand is the main driver of exports explaining almost 50 percent of the increase. Price competitiveness plays a comparatively smaller role in explaining export growth. Even though prolonged effort in containing costs through wage moderation was significant, the effect is diluted by the nominal appreciation of the euro during the period 2003-2008.

Germany's export performance has also benefited from the ongoing fragmentation of production processes. Due to the fact that German companies have optimized their value chain of production in such a way as to make use of the comparative advantages of individual firms and locations, they were able to increase their merchandise exports.

The results for the relationship between the oil price and exports are of particular interest. At first glance, the positive relationship between exports and energy prices might be counterintuitive, as rising oil prices are usually

attributed with higher production costs, especially in the manufacturing sector. However, if one takes into account the rising global demand for energy-efficient technologies because of energy resources becoming scarce, the positive demand effect can overcompensate the negative supply effect in those countries that have a comparative advantage in these products. Since Germany is leading in these industries, German manufacturers and the export sector strongly benefit from this development.

Chapter 3

Do Current Account Forecasters Herd? – Evidence from the Euro Area and the G7 Countries

We use data from the Consensus Economics Forecast Poll to analyze how current account forecasters form expectations. Our results suggest that forecasts do not satisfy traditional unbiasedness and orthogonality criteria for forecast rationality. In addition, we find anti-herding behavior among forecasters for the euro area and G7 countries. We also show that the cross-sectional heterogeneity in anti-herding is associated with cross-sectional heterogeneity in forecast accuracy. More specifically, we find some evidence indicating that forecasters who tend to herd provide more accurate forecasts than their colleagues who follow an anti-herding strategy.¹

¹Parts of this chapter are published in a refereed journal: Frenkel M., Ruelke J-C. and L. Zimmermann, 2012, Do Current Account Forecasters Herd? Evidence from the Euro Area and the G7 Countries, *Review of International Economics* 20 (2), 221 – 236.

3.1 Introduction

During the past decade, global external imbalances have received considerable attention by both economists and politicians. The sizable US current account deficit in particular has renewed academic discussions on the possible risks to macroeconomic and financial stability stemming from current account deficits and the ensuing build-up of international liabilities. In this context, a number of theories have been advanced explaining the interlinkages between global external imbalances and the financial and economic crisis of 2008/2009. Caballero et al. (2008) argue that the large capital flows from Asia to the US which were motivated by storing value in relatively safe and liquid financial markets, significantly contributed to the worsening of lending and regulatory standards which ultimately triggered the crisis. Therefore, an assessment of global current account positions appears to be very important.

Temporal current account imbalances both deficits and surpluses are regarded as neither good nor bad but as a mere reflection of differences in cyclical and structural factors between economies. However, unsustainable and persistent current account imbalances, particularly in the form of deficits, can eventually create the need for considerable economic adjustment involving painful economic changes in many cases (Berger et al., 2008; Chinn and Ito, 2008; Engler et al., 2009). Several studies of reversals of current account deficits show that the adjustment process typically includes a significant real depreciation of the domestic currency and a slowdown in real GDP growth, private consumption, and investment (Milesi-Ferretti and Razin, 1998; McKinnon, 2001; Freund, 2005; De Haan et al., 2008). Hence, it is important for policymakers, financial market participants, and researchers

alike to focus on the current account as a crucial macroeconomic variable. Moreover, policymakers are better prepared for frictions resulting from adjustment measures, when they can anticipate such necessary changes. Market expectations – if accurate – can be early indicators of these changes (Eijffinger and Goderis, 2007).

In this respect, especially forecasts of or expectations about current account movements can provide valuable information for policymakers. To this end, international organizations like the IMF and the OECD regularly publish current account forecasts. However, Batchelor (2001) and Blix et al. (2001) show that international organizations provide less accurate forecasts compared to the private consensus forecast. This suggests that private sector forecasts should be taken into account when assessing future current account developments. A number of studies analyze the impact of private sector forecasts on the financial market. For example, Nickel et al. (2009) show that government bond yields respond to forecasts of country fundamentals. Prati and Sbracia (2010) find that currency crises can be provoked by changes in particular forecasts, such as current account forecasts. They show that speculation in the foreign exchange market is linked to uncertainty measured by the dispersion within the Consensus Economic Forecast Poll. An interesting question is whether the dispersion of current account forecasts solely reflects uncertainty about the countries fundamentals or whether the heterogeneity among forecasters is due to strategic or irrational behavior. Therefore, the aim of this study is to analyze whether current account forecasts provide valuable information about future developments.

To the best of our knowledge, this study is the first to analyze private sector current account forecasts. To this end, we use data from the Consensus

Economics Forecast Poll to explore the characteristics of more than 65,000 private sector forecasts of the current account for the euro area and G7 countries. In particular, we study the rationality, heterogeneity, and accuracy of these forecasts. In addition to the test of traditional unbiasedness and orthogonality criteria for forecast rationality, we also shed some light on questions about herding behavior of forecasters.

The remainder of this chapter is organized as follows. In Section 3.2, we describe in detail the data used in our empirical analysis. In Section 3.3, we study the rationality of current account forecasts for the euro area and the G7 countries. In Section 3.4, we explain a test for herding and anti-herding. In Section 3.5, we examine whether it is possible to trace back the forecast heterogeneity to any herding or anti-herding behavior of forecasters. In addition, we shed some light on the implications of strategic behavior of forecasters for forecast accuracy. In Section 3.6, we offer some concluding remarks.

3.2 The Data

We analyze survey data for the euro area and the G7 countries compiled by the Consensus Economics Forecast Poll on a monthly basis. In this survey, professional forecasters are regularly asked to submit their forecasts of several financial and macroeconomic variables, including GDP growth, private consumption, investment and the current account balance. Our data cover forecasts for the G7 countries for the period October 1989 to December 2009 and forecasts for the euro area for the period December 2002 through December 2009. The forecasters participating in the survey work

with institutions such as investment banks, large international corporations, economic research institutes, and universities in the euro area or a G7 country. The number of forecasters of a particular country varies between 37 (Canada) and 68 (UK).

In comparison with other survey data, the data of Consensus Economics Forecast Poll have the advantage that the participants forecast the level of macroeconomic variables and not just the direction of the annual year-on-year change. Another interesting feature of the Consensus Economics data is that not only the individual forecasts are published, but also the corresponding name of the forecasting institution. Thus, an evaluation of the accuracy of a particular institution's forecast is relatively easy to conduct so that participating in the survey can affect the reputation of the institution with respect to its forecasting activities. Finally, the Consensus Economics survey data contain forecasts for different forecast horizons, that is, for the current year and the next year. We can, thus, analyze short-term forecasts and medium-term forecasts.

Table 3.1 provides summary statistics of the monthly survey data and the actual values. Over the sample period, the forecasters expected on average a current account surplus of about € 30 billion for Germany which is close to the actual average value of about € 34 billion. This also applies to a number of other countries in the sample. For Japan, for instance, the expected current account surplus was close to ¥ 13 trillion while the actual value was somewhat above ¥ 12 trillion. However, this does not necessarily mean that the forecasts were accurate or rational.

Table 3.1: Summary Statistics for the Current Account Balance

Short-Term	Canada bn. C\$	France bn. €	Germany bn. €	Italy bn. €	Japan tr. ¥	UK bn. £	US bn. \$	Euro Area bn. €
Mean of Forecast	-1.29	4.77	29.86	-3.19	12.85	-16.73	-362.37	4.08
Standard Deviation of Forecasts	(.37)	(.36)	(.72)	(.41)	(.08)	(.16)	(3.92)	(.99)
Mean of Actual Current Account	-0.32	5.74	34.39	-8.04	12.25	-19.55	-348.90	-15.30
No. of Observations	3,650	3,597	5,993	2,856	4,509	6,848	4,661	1,886
No. of Periods	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	38

Medium-Term	Canada	France	Germany	Italy	Japan	UK	US	Euro Area
Mean of Forecast	-0.94	4.01	32.97	-2.18	13.17	-17.69	-371.61	9.34
Standard Deviation of Forecasts	(.34)	(.39)	(.73)	(.42)	(.10)	(.17)	(4.05)	(.98)
Mean of Actual Current Account	-0.32	5.74	34.39	-8.04	12.25	-19.55	-348.90	-15.30
No. of Observations	3,615	3,135	5,505	2,648	3,529	6,530	4,294	1,612
No. of Periods	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	38

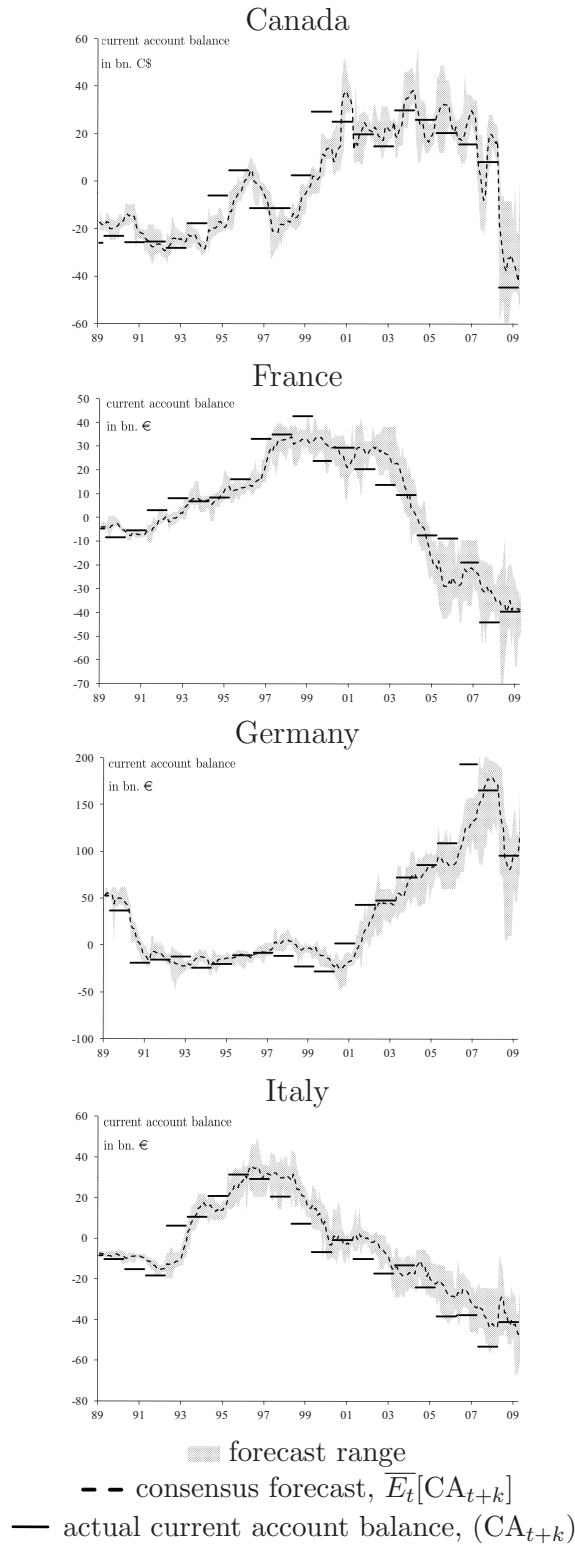
Note: Actual current account balances are taken from the International Monetary Fund database.

In order to examine the time-series dimension and the cross-sectional dimension of the survey data, Figures 3.1 and 3.2 plot time series of (i) the cross-sectional mean values of the short-term current account forecasts (dashed lines), (ii) the actual current account balance (solid lines), and, (iii) the cross-sectional heterogeneity of forecasts as measured by the cross-sectional range of forecasts (shaded areas). The vertical distance between the dashed line and the solid line can be interpreted as the cross-sectional forecast error.

These cross-sectional mean values move in tandem with the respective actual values, at least as far as end-of-year values are concerned. These results are intuitive because forecast accuracy should increase as the forecast horizon decreases. Another important information is that the cross-sectional heterogeneity of forecasts is substantial, especially during and in the aftermath of the financial crisis in 2008/2009. For instance, in April 2009, the forecasts of the US current account deficit for 2009 range between \$ 250 billion and \$ 625 billion indicating a substantial degree of uncertainty among the forecasters. In this respect, forecasts of the current account resemble forecasts of, for example, exchange rates.² To the best of our knowledge, the cross-sectional heterogeneity of the current account has not yet been documented in the literature. Given this heterogeneity, the following sections study in more detail individual forecasts of the current account.

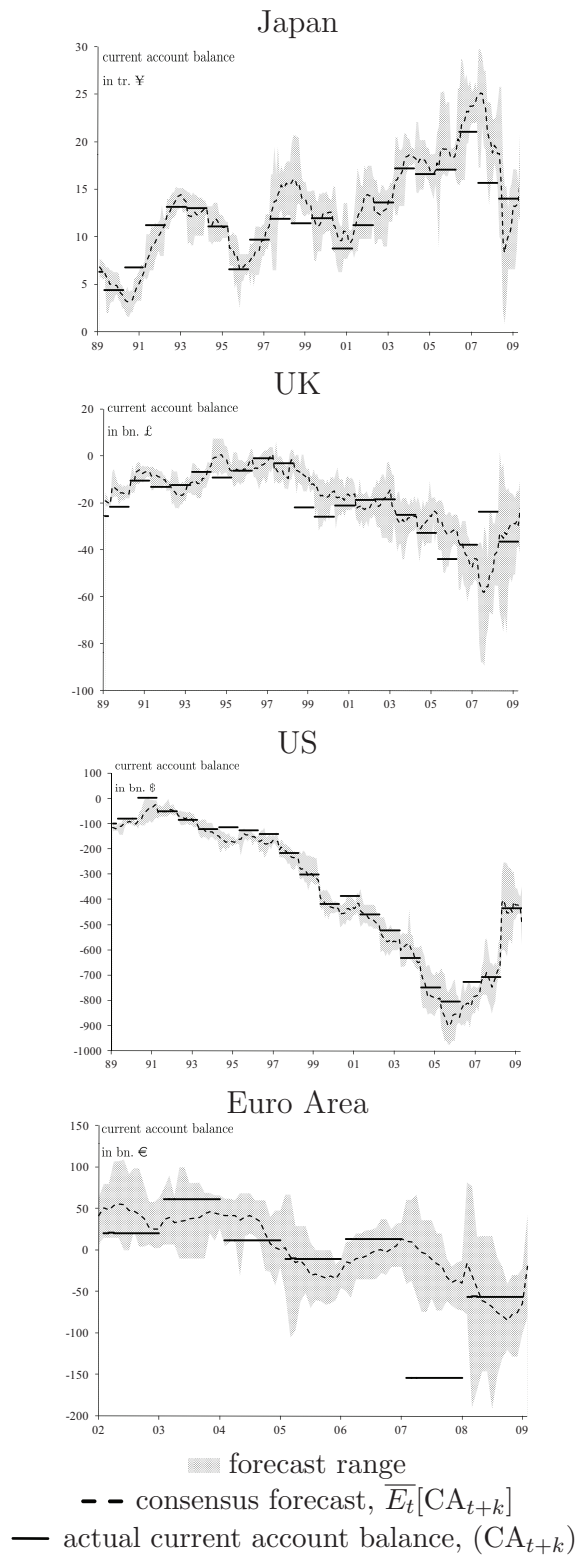
²Cross-sectional heterogeneity of forecasts of exchange rates has been widely documented in the recent literature (see, e.g., Benassy-Quere et al. 2003).

Figure 3.1: Expected and Actual Current Account Balance 1



Note: This figure shows the cross-sectional mean of the short-term current account forecasts (dashed line), the actual current account balance (solid line), and the forecast range (shaded area). The vertical distance between the expected and the actual current account reflects the forecast error. Actual current account balances are taken from the International Monetary Fund database.

Figure 3.2: Expected and Actual Current Account Balance 2



Note: This figure shows the cross-sectional mean of the short-term current account forecasts (dashed line), the actual current account balance (solid line), and the forecast range (shaded area). The vertical distance between the expected and the actual current account reflects the forecast error. Actual current account balances are taken from the International Monetary Fund database.

3.3 Rationality of Heterogeneous Forecasts

Building on earlier research by Ito (1990), MacDonald and Marsh (1996), and Elliott and Ito (1999), we use two widely applied criteria to study rationality of heterogeneous forecasts: the criterion of unbiasedness of forecasts and the criterion of orthogonality of forecasts. In order to explore whether heterogeneous forecasts represent unbiased predictors of the future current account balance, we use the following regression model:

$$(3.1) \quad CA_{t+k} = \alpha + \beta E_{i,t}[CA_{t+k}] + \epsilon_{i,t+k},$$

where CA_{t+k} ³ denotes the actual current account balance in period $t+k$ and $E_{i,t}[CA_{t+k}]$ denotes the current account forecast for period $t+k$ made by forecaster i in period t . In addition, $\epsilon_{i,t+k}$ denotes an error term. Forecasts are unbiased if $\alpha = 0$ and $\beta = 1$. If forecasts satisfy the unbiasedness criterion, forecasts are not necessarily accurate, but forecast errors do not show any systematic pattern.

The estimation results for each individual country, the euro area, and the pooled G7 countries are summarized in Table 3.2. They indicate that the constant term α is not significantly different from zero only in the cases of Canada, Germany (short-term) and Canada, France, Japan (medium term). In all the other cases, it is either significantly positive (Germany for the medium-term, France, Japan, the US and G7 for the short-term) or significantly negative (Italy, UK, euro area, the US, and G7 for the medium-term, Italy, UK, and the euro area for the short-term).

³The index k denotes the forecast horizon expressed in months (with $k = 12, 11, \dots, 1$ for short-term forecasts, and $k = 24, 23, \dots, 13$ for medium-term forecasts).

Table 3.2: Test for Unbiasedness of Forecasts

Short-Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	-.27 (.46)	1.83** (.01)	.14 (.67)	-4.68** (.50)	.02* (.01)	-7.77** (.45)	6.46** (2.13)	.74* (.26)	-14.60** (3.29)
β	.87** (.02)	.92** (.02)	1.09** (.02)	.96** (.02)	.92** (.01)	.62** (.03)	.96** (.01)	.95** (.00)	.74** (.05)
$H_0 : \beta = 1$	.00	.00	.00	.07	.00	.00	.00	.00	.00
$H_0 : \alpha = 0 \ \& \ \beta = 1$	.00	.00	.00	.00	.00	.00	.00	.00	.00
R^2	.77	.83	.88	.82	.90	.53	.97	.98	.25
No. of Observations	3,650	3,789	5,993	2,856	4,509	6,848	4,661	32,338	1,886
No. of Periods	245	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	357	36
Medium-Term									
α	-.09 (.90)	1.45 (.03)	4.81** (1.41)	-7.99** (.87)	-.01 (.03)	-7.84** (.51)	-27.63** (4.74)	-1.35* (.50)	-29.70** (4.79)
β	.69** (.03)	.83** (.05)	.98** (.04)	.89** (.04)	.63** (.02)	.58** (.03)	.90** (.01)	.94** (.01)	.68** (.10)
$H_0 : \beta = 1$	.00	.00	.59	.00	.00	.00	.00	.00	.00
$H_0 : \alpha = 0 \ \& \ \beta = 1$	.00	.00	.00	.00	.00	.00	.00	.00	.00
R^2	.37	.58	.62	.61	.58	.42	.88	.94	.13
No. of Observations	3,615	3,296	5,505	2,648	3,529	6,530	4,294	29,275	1,612
No. of Periods	245	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	357	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (1): $CA_{t+k} = \alpha + \beta E_{t,t}[CA_{t+k}] + \epsilon_{i,t+k}$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level. For parameter restrictions, the table shows p-values of the null hypothesis (H_0)

The slope coefficient β is significantly different from unity in all cases and for both forecast horizons, except for Germany for the medium-term. Provided that all β coefficients are positive, the results indicate that forecasters correctly forecast whether the current account balance shows a surplus or a deficit. For short-term forecasts, the slope coefficient for almost all countries is significantly closer to unity than the slope coefficient that is estimated for medium-term forecasts, reflecting that the forecast accuracy is higher with respect to the current year than the next year. Given that the constant term α is significantly different from zero and the slope coefficient β is different from unity in nearly all cases, the hypothesis of unbiasedness of forecasts has to be rejected.⁴

The orthogonality criterion concerns the question whether heterogeneous forecast errors are uncorrelated with information available to forecasters at the time they form their expectations. In order to assess the individual information set of forecasters, we use the institutions' forecasts of other macroeconomic variables. This research strategy is applicable because the Consensus Economics Forecast Poll publishes the current account forecasts along with several forecasts of other macroeconomic variables, such as the GDP growth rate, the growth rate of private consumption and the growth rate of investment. Because modern economic theory views current account imbalances as an outcome of intertemporal consumption, and investment choices, our research strategy formalizes the idea that GDP growth, private consumption, and investment are major determinants of the current account (Sachs, 1981; Obstfeld and Rogoff, 1994; Freund, 2005). Then, orthogonality implies that

⁴Violation of the traditional criteria does not necessarily imply that forecasts are irrational, but could indicate, for example, that forecasters do not have a quadratic loss function. Laster et al. (1999) lay out a model of forecaster anti-herding in which forecasters do not have a traditional quadratic loss function.

current account forecasts should be tightly linked to contemporaneous forecasts of these macroeconomic variables. By the same token this means that the forecast error and contemporaneous forecasts of these macroeconomic variables should be uncorrelated. Accordingly, we estimate the following regression model for the forecast error:

$$(3.2) \quad CA_{t+k} - E_{i,t}[CA_{t+k}] = \alpha + \beta E_{i,t}[GDP_{t+k}] + \gamma E_{i,t}[C_{t+k}] + \delta E_{i,t}[I_{t+k}] + \epsilon_{i,t+k},$$

where $E_{i,t}[GDP_{t+k}]$ denotes the expected GDP growth for period $t+k$ made by forecaster i in period t . Accordingly $E_{i,t}[C_{t+k}]$ and $E_{i,t}[I_{t+k}]$ represent the expected private consumption and investment growth rates, respectively. The orthogonality criterion is satisfied if the parameter restriction $\alpha = \beta = \gamma = \delta = 0$ cannot be rejected. Tables 3.3 and 3.4 summarize the estimation results. Although the scaling in equation (2) differs between the variables, the interpretation is straight forward: For instance, the value of the coefficient δ of 2.0 (0.11) for the United States (Japan) reflects that the actual current account is higher than expected by \$ 2.0 billion (¥0.11 trillion) if a forecaster expects a one percent increase in real domestic investment. Hence, the forecast error is correlated with the information set of the forecasters. Indeed, for nearly all countries and time horizons, the orthogonality condition can be rejected. This also applies when we pool all G7 countries and express the current account forecasts as ratios of actual GDP. The latter is useful, since the current account forecasts are denominated in different currencies.

Table 3.3: Test for Orthogonality of Forecasts (Short-Term)

Short-Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	-2.62** (.81)	.56 (1.18)	8.73** (1.21)	-5.14** (.78)	-1.42** (.14)	-2.96** (.62)	27.51** (4.09)	-.02 (.24)	-54.29** (7.94)
β	2.43** (.37)	-.48 (.58)	-.09 (.78)	5.65** (.61)	-.95* (.12)	.33 (.40)	-17.25** (2.95)	.11 (.15)	-3.20 (6.39)
γ	-1.79** (.33)	.58 (.76)	-6.56** (.72)	-2.88** (.51)	1.23** (.12)	.50 (.30)	9.94** (2.49)	-.48** (.15)	43.67** (7.71)
δ	.38** (.07)	.28 (.16)	.47* (.22)	-1.91* (.22)	.11** (.02)	-.08 (.11)	2.00** (.33)	.16** (.03)	-7.63** (2.52)
$H_0 : \alpha = \beta = \gamma = \delta = 0$	.00	.53	.00	.00	.00	.10	.00	.00	.00
R^2	.18	.01	.09	.16	.11	.01	.04	.01	.08
No. of Observations	3,650	3,597	5,993	2,856	4,509	6,848	4,661	31,574	1,886
No. of Periods	245	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	357	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (2) $CA_{t+k} - E_{i,t}[CA_{t+k}] = \alpha + \beta E_{i,t}[GDP_{t+k}] + \gamma E_{i,t}[C_{t+k}] + \delta E_{i,t}[I_{t+k}] + \epsilon_{i,t+k}$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level. To pool the G7 countries we express the current account forecasts in terms of GDP, i.e. we divided the current account forecast by the actual GDP and multiplied this ratio by 1000 for readers' convenience.

Table 3.4: Test for Orthogonality of Forecasts (Medium-Term)

Medium-Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	-6.60* (2.79)	.53 (2.12)	22.30** (5.02)	-9.02** (1.92)	-2.31 (.34)	-3.21** (1.18)	78.81** (9.82)	.04 (.64)	20.09 (11.76)
β	4.05** (1.49)	3.99* (1.70)	-15.21** (3.29)	16.09** (1.62)	.11 (.25)	.615 (.60)	9.94 (8.02)	.71* (.40)	-43.55** (12.65)
γ	-4.52** (1.62)	-6.58** (1.53)	-5.03* (2.07)	-10.19** (1.23)	.97** (.25)	-.21 (.52)	-30.21** (7.64)	-1.85** (.38)	-13.07* (7.57)
δ	1.08** (.20)	1.22** (.37)	4.44** (.75)	-3.72** (.56)	-.00 (.04)	.52** (.13)	-3.22** (1.24)	.47** (.08)	17.73** (4.33)
$H_0 : \alpha = \beta = \gamma = \delta = 0$	.00	.00	.00	.00	.00	.42	.00	.00	.00
R^2	.06	.05	.08	.17	.09	.03	.08	.01	.08
No. of Observations	3,615	3,135	5,505	2,648	3,529	6,530	4,294	28,538	1,612
No. of Periods	245	245	245	245	245	245	245	245	85
No. of Forecasters	37	39	55	38	55	68	65	357	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (2) $CA_{t+k} - E_{i,t}[CA_{t+k}] = \alpha + \beta E_{i,t}[GDP_{t+k}] + \gamma E_{i,t}[C_{t+k}] + \delta E_{i,t}[I_{t+k}] + \epsilon_{i,t+k}$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level. To pool the G7 countries we express the current account forecasts in terms of GDP, i.e. we divided the current account forecast by the actual GDP and multiplied this ratio by 1000 for readers' convenience.

The coefficient γ of about $-.48$ implies that if the forecasters expect the real growth rate to increase by one percentage point, the expected current account in terms of GDP ratio is lower by $.48$ percentage points than the actual ratio. The orthogonality restriction can also be rejected for the pooled G7 countries. Only for the UK and France (short-term), the orthogonality condition cannot be rejected. Interestingly, the relatively low fit of equation (2) indicates that the orthogonality restriction imposes a too strong restriction on the rationality of the current account forecasts. However, the relatively low fit also indicates that other factors, might influence the forecast error. For instance, Pierdzioch et al. (2010) show that the forecast error in the housing market is correlated with boom and bust cycles.

In sum, our results indicate that current account forecasts do not satisfy traditional criteria for unbiasedness and orthogonality. Since the forecast horizon decreases over the course of the year, the forecast error might be serial correlated. To check for robustness, we use forecasts published only in a specific month, which eliminates the serial correlation problem. The results of a specific-month analysis for the unbiasedness criterion are not qualitatively different and are presented in Tables 3.5 and 3.6. Except for Germany (January forecasts) we can reject that current account forecasts are rational. The results of a specific-month analysis for the orthogonality criterion also indicate that the decreasing forecast horizon does not change the results qualitatively and are available upon request.

Table 3.5: Test for Unbiasedness of Forecasts (January)

Short Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	1.22 (.82)	.94 (.81)	1.39 (1.37)	-6.77** (1.11)	4.98** (.31)	-8.28** (.72)	6.36 (4.71)	.40 (.54)	-23.34** (3.99)
β	.88** (.03)	.92** (.03)	1.04** (.03)	.94** (.03)	.57** (.02)	.56** (.04)	.98** (.01)	.97** (.00)	.61** (.10)
$H_0 : \beta = 1$	.00	.03	.19	.15	.00	.00	.00	.00	.00
$H_0 : \alpha = 0 \text{ \& } \beta = 1$	.00	.07	.25	.00	.00	.00	.00	.00	.00
R^2	.62	.78	.77	.74	.61	.45	.95	.97	.11
No. of Observations	307	315	503	247	370	567	388	2,697	163
No. of Periods	21	21	21	21	21	21	21	21	8
No. of Forecasters	37	39	55	38	55	68	65	357	36
Medium Term									
α	.27 (1.24)	-.55 (1.96)	7.59** (2.98)	-10.46** (1.80)	8.00** (.36)	-7.74** (.71)	-29.61** (8.23)	-1.85* (1.01)	-37.18** (6.48)
β	.65** (.05)	.88** (.05)	.96** (.04)	.87** (.05)	.40** (.03)	.60** (.03)	.90** (.02)	.95** (.02)	.83** (.19)
$H_0 : \beta = 1$	.00	.03	.29	.00	.00	.00	.00	.00	.37
$H_0 : \alpha = 0 \text{ \& } \beta = 1$	.00	.08	.03	.00	.00	.00	.00	.00	.00
R^2	.31	.55	.54	.58	.41	.42	.85	.92	.19
No. of Observations	272	194	385	206	198	520	323	2,098	121
No. of Periods	21	21	21	21	21	21	21	21	8
No. of Forecasters	37	39	55	38	55	68	65	357	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (1): $CA_{t+k} = \alpha + \beta E_{i,t}[CA_{t+k}] + \epsilon_{i,t+k}$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level. For parameter restrictions, the table shows p-values of the null hypothesis (H_0).

Table 3.6: Test for Unbiasedness of Forecasts (December)

Short Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	-.69* (.39)	2.17** (.40)	-.56 (.33)	-2.78** (.40)	2.61** (.17)	-5.92** (.40)	18.07** (1.46)	1.02** (.31)	-9.02** (2.32)
β	.91** (.01)	.92** (.02)	1.07** (.01)	.96** (.02)	.74** (.01)	.80** (.03)	.98** (.01)	.95** (.00)	1.27** (.06)
$H_0 : \beta = 1$	.00	.00	.00	.05	.00	.00	.00	.00	.00
$H_0 : \alpha = 0 \ \& \ \beta = 1$	.00	.00	.00	.00	.00	.00	.00	.00	.00
R^2	.91	.88	.95	.92	.86	.73	.99	.99	.57
No. of Observations	320	332	529	248	389	583	422	2,823	170
No. of Periods	21	21	21	21	21	21	21	21	8
No. of Forecasters	37	39	55	38	55	68	65	357	36
Medium Term									
α	-.27 (.93)	1.46* (.86)	3.55* (1.70)	-6.29** (1.22)	6.77** (.27)	-7.20** (.59)	-10.64* (5.74)	-.46 (.57)	-22.57** (3.74)
β	.83** (.04)	.95** (.03)	1.00** (.03)	.90** (.04)	.45** (.02)	.65** (.03)	.95** (.01)	.97** (.01)	.56** (.08)
$H_0 : \beta = 1$	.00	.09	.99	.00	.00	.00	.00	.00	.00
$H_0 : \alpha = 0 \ \& \ \beta = 1$	.00	.06	.09	.00	.00	.00	.00	.00	.00
R^2	.54	.75	.71	.70	.44	.48	.94	.97	.11
No. of Observations	305	312	509	239	369	561	402	2,697	151
No. of Periods	21	21	21	21	21	21	21	21	8
No. of Forecasters	37	39	55	38	55	68	65	357	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (1): $CA_{t+k} = \alpha + \beta E_{t,t}[CA_{t+k}] + \epsilon_{i,t+k}$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level. For parameter restrictions, the table shows p-values of the null hypothesis (H_0).

Thus, our estimation results suggest that the hypothesis of rationality of forecasts can be rejected when traditional rationality criteria are applied. An explanation for the biasedness of current account forecasts can be that forecasters tend to herd or anti-herd. This could mean that they do not have the incentive to publish an accurate forecast but rather announce strategic forecasts. The next section investigates whether current account forecasters follow such behavior.

3.4 A Test for Herding and Anti-Herding

The fact that the number of analysts participating in the Consensus Economics Forecast Poll is quite large raises the question whether an individual forecaster is influenced by the forecasts of others, i.e., whether there is any herding or anti-herding behavior among them.⁵ Bernhardt et al. (2006) suggest an empirical test for herding or anti-herding that can be applied to our question as well. This involves studying the relationship between individual forecasts, the mean of the cross-sectional forecasts, and the actual current account. The test is based on the following considerations. With new information arriving, every forecaster combines all available information in order to update his forecast and to form a posterior distribution over current account balances. The mean of this distribution is the forecaster's best estimate of the current account and represents his unbiased forecast. Herding occurs when forecasters, being aware of the consensus forecast, place their forecast closer to the consensus than they would have done otherwise. In this

⁵Our analysis concerns the cross-sectional herding or anti-herding of forecasters. In the empirical literature, researchers use the term "herding" to characterize the time-series properties of forecasts (Lakonishok et al., 1992). Our usage of the term herding, thus, should not be confused with the terminology used by other researchers who utilize the term herding to describe, for example, destabilizing trend-extrapolative forecasts in a time series context.

case, forecasters bias a forecast away from their best estimate and towards the consensus forecast. Likewise, anti-herding occurs when forecasters bias their forecasts further away from the consensus than they would have done otherwise. Our finding of significant cross-sectional heterogeneity of forecasts in sections 3.2 and 3.3 could suggest that anti-herding is particularly prevalent among analysts participating in the Consensus Economics Forecast Poll.

If an analyst issues his best estimate of the current account as his forecast, he submits an unbiased forecast. In this case, he is not influenced by the consensus forecast of the participating analysts. We use the previous-month mean forecast as the consensus forecast, because the current-month mean forecast is not available to the forecasters.⁶ If an analyst does not herd or anti-herd and, hence, issues an unbiased forecast, i.e., his best estimate, the probability that his forecast $E_{i,t}[CA_{t+k}]$ exceeds (falls short of) the actual current account, CA_{t+k} , is equal to 0.5, both unconditionally, and conditional on anything in the information set available to the forecaster, including the average forecast of all individual forecasters of the previous month, $\bar{E}_{t-1}[CA_{t+k}]$.

On this basis, the test for the herding or anti-herding behavior of forecasts, as proposed by Bernhardt et al. (2006), can be applied as follows: Under the null hypothesis of no herding and no anti-herding, the conditional probability, P , that a forecast of the current account overshoots (undershoots) the actual current account is 0.5, regardless of the consensus forecast. Accordingly, the

⁶To identify herding for, e.g., the short-term January forecasts with the forecast horizon being twelve months, we use the consensus of the medium-term forecast of December which has a forecast horizon of thirteen months. Hence, we combine short-term and medium-term forecasts in this case. However, we drop the medium-term January forecasts from the analysis, as a reference value is not available to us.

conditional probability of overshooting the actual current account, given that the forecast is higher than the consensus forecast, is

$$(3.3) \quad P(CA_{t+k} < E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] > \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) = 0.5.$$

Likewise the conditional probability of undershooting the actual current account, given that the forecast is smaller than the consensus forecast, is

$$(3.4) \quad P(CA_{t+k} > E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] < \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) = 0.5.$$

The two conditional probabilities, thus, average 0.5. This is not the case under the alternative hypothesis of herding or anti-herding. If a forecaster herds and, thus, biases his forecast towards the consensus forecast, the forecast will be located between the unbiased private forecast and the consensus forecast. In the case that the forecast exceeds the consensus forecast, the conditional probability of overshooting the actual current account is smaller than 0.5. Similarly, if the forecast falls short of the consensus forecast, the conditional probability of undershooting is also smaller than 0.5. This means that

$$(3.5) \quad P(CA_{t+k} < E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] > \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) < 0.5$$

and

$$(3.6) \quad P(CA_{t+k} > E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] < \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) < 0.5.$$

If forecasters herd the average of the two conditional probabilities is smaller than 0.5. If forecasters anti-herd, in contrast, the average of the two conditional probabilities is larger than 0.5.

In this case the forecast overshoots the unbiased private forecast of the current account in the direction away from the consensus forecast. This means that

$$(3.7) \quad P(CA_{t+k} < E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] > \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) > 0.5$$

and

$$(3.8) \quad P(CA_{t+k} > E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] < \bar{E}_{t-1}[CA_{t+k}], CA_{t+k} \neq E_{i,t}[CA_{t+k}]) > 0.5.$$

The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities used in Equations (5) – (8). Bernhardt et al. (2006) show that the test statistic, S , has an asymptotic normal distribution and is robust to various problems arising in the case of, e.g. correlated forecast errors, market-wide shocks, and optimism or pessimism among forecasters. It is this averaging that makes the test robust under the null hypothesis. For example, “bubble-like” swings in the current account in 2008/2009 may give rise to a preponderance of positive unexpected market-wide shocks to the current account. Such shocks raise (lower) the probability that the subsequently realized current account exceeds (falls short of) forecasts, given any conditioning information, but leave the average of the conditional probabilities unaffected under the null hypothesis. Market-wide shocks and the resulting positive cross-correlation of forecast errors do not bias the mean of the S statistic but only reduce its variance below the one obtained in the case of zero cross-correlation of forecast errors. In other words, the test statistic S is conservative, because positive unexpected shocks make it more difficult to reject the null hypothesis of unbiasedness when we should do so (Type II error).

Finally, it is relevant for our analysis to note that outliers and large disruptive events like the impact of the financial crisis 2008/2009 on the current

account should have a minor effect on the conditional probabilities (i.e., empirical frequencies of events). The test statistic, S , is robust to such events.

3.5 Herding and Forecast Accuracy

Table 3.7 summarizes the results of the herding test for the short-term and medium-term. For all countries, we find strong evidence of an anti-herding behavior of current account forecasters. For instance, for the US (short-term), we estimate a test statistic of $S = 0.66$. With the standard deviation of 0.007, the test statistic significantly exceeds its unbiased forecast value of 0.5. Since any year is surveyed in a total of 24 poll, i.e. in 12 short-term forecasts and 12 medium-term forecasts, we combine short-term and medium-term forecasts, which increases the number of forecasts from 12 to 24 for every year. The results of the herding test reported in Table 3.7 indicate that the test statistic again significantly exceeds its unbiased forecast value of 0.5. To check for robustness, we again use forecasts published only in a specific month, which eliminates the serial correlation problem. The results of a specific-month analysis for the unbiasedness criterion are not qualitatively different and are presented in Tables 3.8 and 3.9.

Table 3.7: Test for Herding

Short-Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
S-statistic	.579	.637	.621	.597	.679	.627	.662	.601	.685
Stand. Dev.	.008	.008	.007	.010	.007	.006	.007	.004	.012
Lower 99 %	.557	.615	.604	.572	.660	.611	.642	.592	.654
Upper 99 %	.600	.658	.638	.621	.699	.643	.681	.610	.715
Medium-Term									
S-statistic	.616	.585	.576	.574	.674	.648	.652	.536	.611
Stand. Dev.	.009	.009	.007	.010	.008	.006	.008	.004	.013
Lower 99 %	.594	.562	.559	.548	.652	.632	.632	.526	.579
Upper 99 %	.638	.608	.594	.600	.696	.664	.673	.546	.644
Short- and Medium-Term									
S-statistic	.586	.615	.619	.585	.709	.616	.613	.579	.637
Stand. Dev.	.007	.007	.006	.008	.006	.005	.006	.003	.010
Lower 99 %	.567	.596	.605	.564	.690	.602	.596	.572	.610
Upper 99 %	.605	.633	.634	.606	.724	.630	.630	.587	.664

Note: The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities given in Equations (5) - (8). If forecasters do not herd or anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd, the test statistic assumes a value $S > 0.5$. The test statistic, S , has an asymptotic normal distribution.

Table 3.8: Test for Herding (January)

Short Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
S-statistic	.637	.632	.594	.585	.681	.641	.658	.557	.572
Stand. Dev.	.029	.028	.022	.032	.026	.021	.025	.012	.039
Lower 99 %	.562	.555	.536	.501	.613	.586	.591	.525	.469
Upper 99 %	.712	.707	.653	.668	.749	.696	.725	.589	.675

Medium Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
S-statistic	.600	.614	.548	.555	.641	.629	.641	.511	.684
Stand. Dev.	.030	.036	.026	.035	.036	.022	.028	.014	.045
Lower 99 %	.520	.520	.481	.463	.549	.571	.568	.473	.564
Upper 99 %	.680	.709	.615	.646	.736	.687	.714	.548	.803

Note: The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities given in Equations (5) - (8). If forecasters do not herd or anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd, the test statistic assumes a value $S > 0.5$. The test statistic, S , has an asymptotic normal distribution.

Table 3.9: Test for Herding (December)

Short Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
S-statistic	.590	.665	.621	.625	.659	.578	.568	.664	.739
Stand. Dev.	.028	.028	.022	.032	.025	.021	.024	.011	.038
Lower 99 %	.516	.593	.564	.541	.592	.524	.504	.634	.638
Upper 99 %	.663	.737	.678	.708	.725	.633	.632	.694	.840
Medium Term									
S-statistic	.641	.610	.597	.590	.675	.644	.655	.531	.637
Stand. Dev.	.029	.028	.022	.032	.026	.021	.025	.012	.040
Lower 99 %	.566	.535	.539	.505	.606	.588	.590	.499	.530
Upper 99 %	.717	.648	.656	.675	.743	.699	.721	.563	.744

Note: The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities given in Equations (5) - (8). If forecasters do not herd or anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd, the test statistic assumes a value $S > 0.5$. The test statistic, S , has an asymptotic normal distribution.

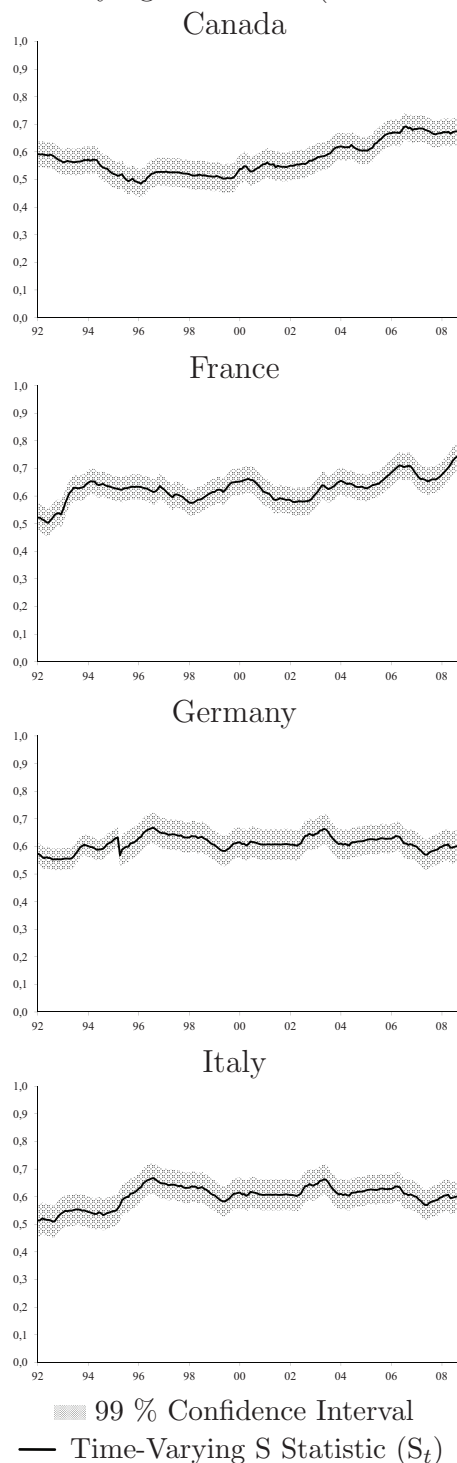
Due to substantial fluctuations in the current account caused by the financial and economic turmoil of 2008/2009, we also analyze the temporal stability of our results by means of rolling-window estimates of the test statistic, S . The results, which are given in Figures 3.3 and 3.4, are based on a window lengths of four years and indicate that the time-varying test statistic always significantly exceeds its unbiased forecast value of 0.5. Hence, the anti-herding behavior of current account forecasts is not associated with a special period but is rather a phenomenon over the whole sample period. This supports the robustness of our results.

Our empirical results imply that forecasts tend to be biased and that most of the forecasts display anti-herd behavior. These two empirical results lead to the question of whether there is a systematic link between forecast accuracy and anti-herding of forecasters. In order to analyze this question, we proceed in two steps. First, we calculate the forecaster-specific Root Mean Squared Error ($RMSE_i$) as a measure of forecast accuracy for each forecaster over all forecasting periods covered by the Consensus Economics Forecast Poll data. Second, we compute the forecaster-specific herding coefficients (S_i). Subsequently, we run the following regression in order to assess the significance of this correlation in more detail:

$$(3.9) \quad RMSE_i = \alpha + \beta S_i + \epsilon_i$$

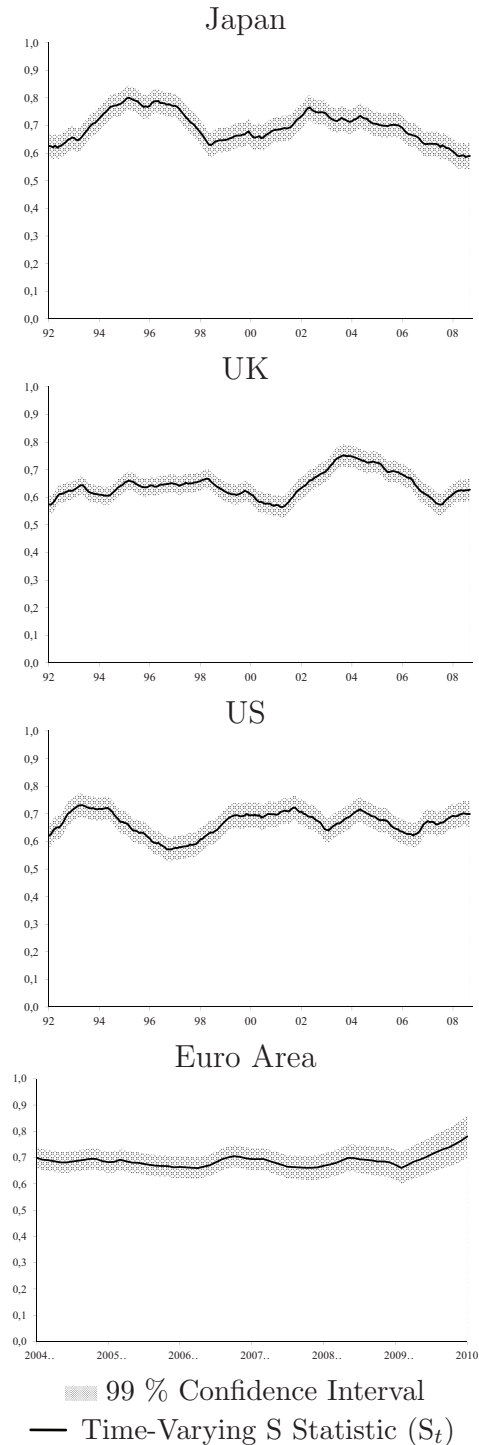
Table 3.10 reports the estimation results. For most cases, there is a statistically significant positive correlation between anti-herding and forecast accuracy.

Figure 3.3: Time-Varying S Statistic (Short Term Forecasts) 1



Note: This figure shows the time varying S statistic (S_t). The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities given in Equations (5) - (8). If forecasters do not herd or anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd, the test statistic assumes value a $S > 0.5$. The shaded area reflects the 99 % confidence interval.

Figure 3.4: Time-Varying S Statistic (Short Term Forecasts) 2



Note: This figure shows the time varying S statistic (S_t). The test statistic, S , is defined as the average of the sample estimates of the conditional probabilities given in Equations (5) - (8). If forecasters do not herd or anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd, the test statistic assumes value a $S > 0.5$. The shaded area reflects the 99 % confidence interval.

Table 3.10: Forecast Accuracy and Herding

Short-Term	Canada	France	Germany	Italy	Japan	UK	US	G7	Euro Area
α	4.73 (3.01)	19.85 (36.74)	15.37** (5.40)	21.09* (8.66)	-46.33 (27.47)	2.32 (2.42)	8.14 (10.28)	-7.00 (7.94)	22.98 (12.91)
β	10.70* (5.09)	69.05 (57.80)	23.41** (8.39)	-6.53 (14.48)	136.72** (41.53)	10.39** (3.83)	53.58** (15.68)	59.32** (12.51)	47.29* (19.23)
R^2	.13	.01	.13	.01	.21	.11	.16	.07	.14
Forecaster	37	39	55	38	55	68	65	307	36
Medium-Term									
α	6.10 (4.05)	103.73** (32.02)	31.53** (8.18)	16.69* (7.15)	60.67* (23.39)	5.73* (2.37)	29.48 (24.89)	35.82** (9.81)	44.80** (14.27)
β	19.43** (6.63)	-66.63 (55.36)	30.71* (14.31)	15.21 (12.19)	-33.57 (34.51)	6.67 (3.65)	84.09* (37.90)	9.28 (15.63)	44.21 (23.29)
R^2	.22	.01	.10	.06	.00	.04	.09	.00	.11
Forecaster	37	39	55	38	55	68	65	286	36

Note: This table shows estimation results based on the Newey-West estimator given in Equation (9) $RMSSE_i = \alpha + \beta S_i + \epsilon_i$. Robust standard errors are given in parentheses. ** (*) indicates significance at a 1 (5) percent significance level.

Our results support the view that forecasters who tend to herd have higher forecast accuracy than their colleagues who deliberately place their forecasts farther away from the consensus.⁷ For instance, the slope value for the short-term forecasts of about 137 in the case of Japan means that if the individual herding coefficient is smaller by about 0.01, the forecast is on average closer to the actual value by about ¥ 1.37 trillion.

3.6 Conclusions

In this study, we use monthly data from the Consensus Economics Forecast Poll for the euro area and the G7 countries to analyze the properties of current account forecasts. Given the significant cross-sectional heterogeneity of forecasts, our analysis of more than 65,000 individual forecasts provides interesting results on how forecasters arrive at their forecasts.

Our main results can be summarized as follows: First, current account forecasts do not satisfy traditional unbiasedness and orthogonality criteria for forecast rationality. Second, anti-herding behavior can be observed among forecasters. This result is robust with respect to different time horizons and countries examined. Third, the cross-sectional heterogeneity of forecasts with regard to anti-herding is associated with cross-sectional heterogeneity in forecast accuracy.

Our results do not only provide insight into how forecasters form their expectations, but can also be valuable for economic agents. Policymakers,

⁷The higher accuracy of forecasts of those who herd as compared to forecasts of those who anti-herd does not imply that the former are more “successful” than the latter. Forecaster success, when viewed from the perspective of forecasters, depends on the forecaster’s loss function and not necessarily on the forecast accuracy. Anti-herding, thus, can be a rational strategy even if it leads to lower forecast accuracy, as some forecasters might put more weight on publicity resulting from submitting more extreme forecasts than on accuracy (Bernhardt et al. 1999; Laster et al. 1999).

for instance, consider current account forecasts of the private sector in their economic analyses, as these contain important information on the market perception with respect to the external developments of a country. In particular, foreign exchange market participants might base their trading decisions on current account forecasts. However, our results demonstrate that economic agents who use private sector forecasts should be aware of the issues concerning rationality, heterogeneity, herding and accuracy of current account forecasts. Whether international organizations, such as the IMF and the OECD, also publish strategic forecasts provides an interesting field for future research.

Chapter 4

Do Private Sector Forecasters Chase After IMF or OECD Forecasts?

We use data from the Consensus Economics forecast poll to explore the strategic behavior of private sector forecasters with respect to forecasts published by the IMF, and the OECD. In particular, we use forecasts of four key macroeconomic variables for the G7 countries to analyze whether private sector forecasters herd towards the projections published by these international organizations. Our empirical results show that an anti-herding strategy of private sector forecasters is prevalent for G7 countries, i.e. they intentionally place their forecasts away from the forecasts published by the IMF and the OECD. In addition, we find that the strategic behavior of private sector forecasters with respect to the forecasts of international organizations lasts roughly three months.¹

¹Parts of this chapter are resubmitted to a refereed journal: Frenkel M., Ruelke J-C. and L. Zimmermann, 2012, Do Private Sector Forecasters Chase After IMF or OECD Forecasts?, *Journal of Macroeconomics*.

4.1 Introduction

Over the past ten years, private sector forecasts have received considerable attention from policymakers, financial market participants, and researchers alike. While policymakers and financial market participants use the forecasts to decide on the future course of action (Gorter et al., 2010), researchers assess the performance of the forecasts by analyzing their accuracy, rationality, and efficiency (Ito, 1990; Elliott and Ito, 1999). The properties of private sector forecasts and forecasts published by international organizations have extensively been analyzed (Loungani, 2001; Batchelor, 2001, 2007; Blix et al., 2001, Dovern and Weisser, 2011; Artis, 1988, 1997; Kreinin, 2000; Glück et al., 2000; Glück and Schleicher, 2005; Ashiya, 2006). However, there is a lack in literature analyzing the interlinkages between individual private sector forecasts and forecasts published by international organizations, such as the IMF and the OECD. In this study we contribute to closing this research gap by exploring whether private sector forecasters are influenced by forecasts of the IMF and the OECD.

An evaluation of the private sectors' perception of international organizations is highly relevant because forecasts of international organizations are the only *quantitative* measure reflecting their view of the expected development of any economy. Since private sector forecasters use new information to update their forecasts, they might interpret the projections of international organizations as a signal and incorporate them into their forecasts (Isiklar et al., 2006). This is a reasonable argument as the reports in which the forecasts are published receive considerable attention. In fact, Fratzscher and Reynaud (2011) find that sovereign spreads of emerging markets economies respond to the release of the IMF's article IV report. In

this study, we *directly* test whether the release of economic projections from the IMF and the OECD transmits into private sector forecasts.

Such an analysis has important macroeconomic implications. If international organizations can influence the private sector's perception by their forecasts, they can act as a stabilizer when communicating sound forecasts. This raises the question about the characteristics of these forecasts. Batchelor (2001) shows that IMF and OECD provide strategic forecasts. Aldenhoff (2007) reports that the IMF projections for developing countries are strongly biased towards optimism. He concludes that the significant relationship between forecast errors and IMF net credit flows to a region supports the hypothesis that the IMF staff tries to legitimize its lending activities with overly optimistic forecasts. This is supported by Dreher et al. (2008) documenting a systematic political bias in the IMF's growth and inflation forecasts. Hence, it is highly relevant to analyze whether the IMF and the OECD can actually influence and convince the private sector of their macroeconomic projections.

To this end, we use data from the Consensus Economics forecast poll, the IMF, and the OECD to explore the strategic behavior of private sector forecasters with respect to forecasts published by international organizations. In particular, we use forecasts of four key macroeconomic variables for the G7 economies to analyze whether a herding behavior of private sector forecasters towards forecasts published by the IMF or the OECD is prevalent.

The remainder of this chapter is organized as follows. In Section 4.2, we describe the data we use for our empirical analysis. In Section 4.3, we introduce and apply a test for herding and anti-herding to examine whether private sector forecasters publish their forecasts irrespectively of the

forecasts published by the IMF and the OECD. In Section 4.4, we present our empirical results. Section 4.5 investigates whether IMF and OECD forecasts become stale over time. In Section 4.6, we summarize our findings and offer some concluding remarks.

4.2 The Data

To analyze whether forecasts provided by international organizations affect private sector forecasters, we use more than 60,000 forecasts for the G7 countries published in the Consensus Economics forecast poll. Since October 1989, Consensus Economics have asked private sector forecasters to submit their forecasts of several financial and macroeconomic variables on a monthly basis. The forecasters participating in this poll work with institutions such as investment banks, large international corporations, economic research institutes, and universities. The number of forecasters of a particular country varies in our sample between 37 (Canada) and 68 (UK). To cover an extensive database, we focus on the G7 countries and four key macroeconomic variables, namely the real growth rate, the inflation rate, the fiscal balance, and the current account balance. These are, at the same time, central variables of the four economic sectors that are typically discussed in a report (e.g., of the IMF) on macroeconomic developments of a country, i.e., the real sector, the monetary sector, the fiscal sector, and the external sector.

In comparison with other survey data, the Consensus Economics forecast poll has the advantage that the name of the forecasting institution is published along with the individual forecasts. Thus, an evaluation of the accuracy of a particular institution's forecast is relatively easy to

conduct, which may impinge back on the reputation of the institution with respect to its forecasting activities (Keane and Runkle, 1990). This should increase the incentive for an institution to submit its best forecast. Another interesting feature of the Consensus Economics survey data is that it contains forecasts for different forecast horizons, that is, for the current year and the next year. Consensus Economics publishes the survey during the second week of the month. In addition to the individual private sector forecasts, Consensus Economics also publishes the most recent forecasts of the IMF and the OECD in its survey. This allows to easily identify and monitor the difference between these and the private sector's projections.

Further, we use forecasts provided by the IMF and the OECD. Both international organizations have a large staff of economists who publish economic forecasts twice a year. The IMF forecasts appear in the World Economic Outlook which is regularly published in spring and fall and the OECD forecasts are reported in the Economic Outlook which is published in summer and winter. Both publications entail forecasts of exactly the same forecast horizon, namely for the current year and the next year. They cover the same major economic variables as provided by the private sector forecasters, including the growth rate, the inflation rate, the fiscal balance, and the current account balance. While the first two variables are measured as annual growth rates, the latter two variables are expressed in billions of national currency.

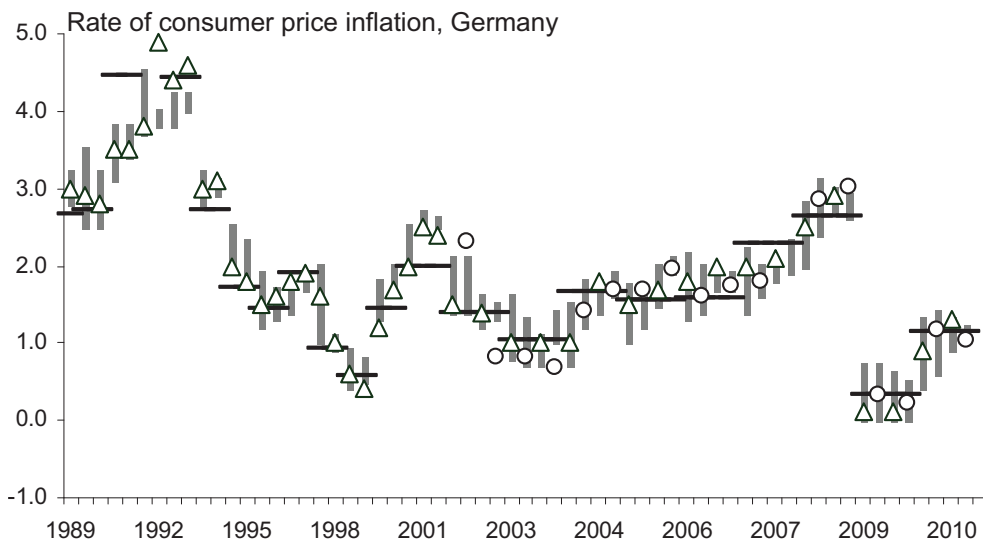
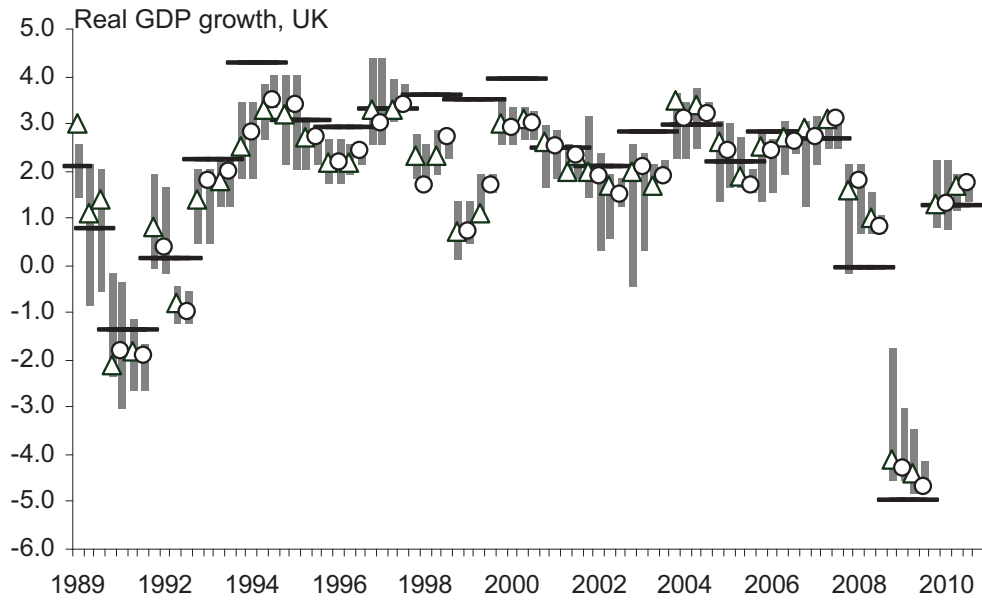
Provided that the private sector forecasts are published on a monthly basis and the organizational forecasts are published biannually, we only use the individual private sector forecasts which are published subsequently to the releases of the World Economic Outlook and the Economic Outlook,

dropping the rest of the private sector forecasts. Hence, both types of forecasts differ only in the timing of the forecast but basically not in the information set available to the forecasters. The forecasts of the international organizations are released roughly two weeks prior to the forecasts of the private sector.

In the case of the IMF forecasts, our sample period for the growth rate, the rate of consumer price inflation, and the current account balance starts in 1989. For the fiscal balance, our sample period starts in 2003. In the case of the OECD forecasts, our sample period starts in 1991 for the growth rate and current account balance. For the fiscal balance the sample period starts in 1999 and for the rate of consumer price inflation in 2002. In all cases our sample period ends in 2010. In order to examine the time-series dimension and the cross-sectional dimension of our data set, Figures 4.1 and 4.2 plot, for selected countries,² the time series of (i) the cross-sectional heterogeneity of private sector forecasts for the current year as measured by the cross-sectional range forecasts (shaded areas), (ii) the current year forecast of the IMF (triangles) and the OECD (circles), and, (iii) the actual value (solid lines) taken from the national statistical offices.

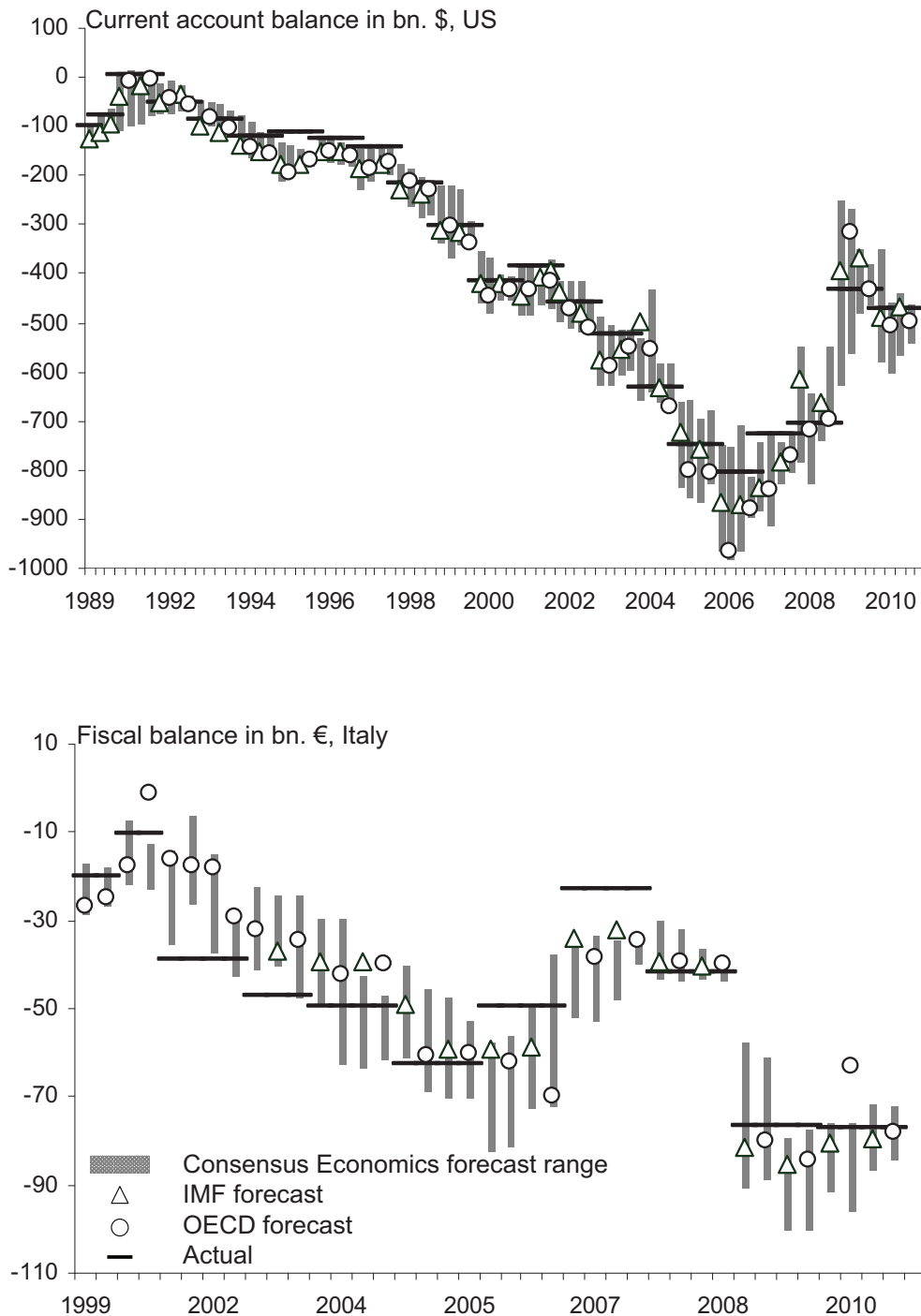
²In principle we can plot for each country under consideration four diagrams as shown in Figures 4.1 and 4.2. For the purpose of brevity, we limit the presentation to just a few and make the remaining figures available upon request.

Figure 4.1: Forecasts by International Organizations and Individuals for Selected Variables 1



Note: This figure shows the cross-sectional current-year forecast range of the Consensus Economics forecasts (shaded area), current-year forecasts of the IMF (triangles), current-year forecasts of the OECD (circles), and the actual values (solid line). The actual values are taken from the respective national statistical offices.

Figure 4.2: Forecasts by International Organizations and Individuals for Selected Variables 2



Note: This figure shows the cross-sectional current-year forecast range of the Consensus Economics forecasts (shaded area), current-year forecasts of the IMF (triangles), current-year forecasts of the OECD (circles), and the actual values (solid line). The actual values are taken from the respective national statistical offices.

Interestingly, in almost all cases the organizational forecasts are inside the range of the private sector forecasts. However, the dispersion of individual private sector forecasts seems to be substantial, especially during the financial crisis in 2008-2009. For instance, in April 2009 the current year forecasts of UK's growth rate ranged between -1.8 and -4.5 indicating a substantial degree of uncertainty among the forecasters. The same applies to the current year forecasts of the US current account balance in April 2009 which ranged between \$ -257 billions and \$ -625 billions. In this respect, these forecasts resemble forecasts of, for example, exchange rates.³ To the best of our knowledge, the heterogeneity of these key macroeconomic variables has not yet been documented in the literature. Given the substantial cross-sectional heterogeneity of private sector forecasts, the following sections examine in more detail whether herding or anti-herding behavior of individual forecasters with respect to forecasts published by the IMF or the OECD can explain this heterogeneity.

4.3 A Test for Herding and Anti-Herding

The large sample of private sector forecasters participating in the Consensus Economics forecast poll raises the question whether an individual forecaster is influenced by the forecasts published by the IMF or the OECD.⁴ Bernhardt et al. (2006) suggest an empirical test for herding and anti-herding that can

³Cross-sectional heterogeneity of forecasts of exchange rates has been widely documented in the recent literature (see, e.g. Benassy-Quere et al., 2003).

⁴Our analysis concerns the cross-sectional herding or anti-herding of forecasters. In empirical literature, researchers have used the term "herding" to characterize the time-series properties of forecasts (Lakonishok et al., 1992). Our use of the term herding, thus, should not be confused with the terminology used by other researchers who have used the term herding to describe, for example, destabilizing trend-extrapolative forecasts in a time-series contexts.

be applied to this question. It involves studying the relationship between individual forecasts, the forecasts published by international organizations, and the actual values.

With new information arriving, every forecaster combines all available information to update and form a posterior distribution over the future actual value. The mean of this distribution is the forecaster's best estimate and represents his unbiased forecast. Herding occurs, when forecasters, being aware of the IMF (OECD) forecast, place their forecast closer to the IMF (OECD) forecast than they would have done otherwise. In this case, forecasters bias their forecast away from their best estimate towards the forecasts published by international organization. Likewise, anti-herding occurs when forecasters bias their forecasts further away from the IMF (OECD) forecast than they would have done otherwise.

If a private sector forecaster issues his best estimate, he submits an unbiased forecast. In this case, he is not influenced by the forecasts published by the IMF or the OECD. Since the IMF (OECD) releases its forecasts in spring and fall (summer and winter), we use, as the relevant comparison, the private sector forecasts compiled directly after the releases of the World Economic Outlook (Economic Outlook). This guarantees that the forecasts published by the international organization were already available to private sector forecasters and, at the same time, were not outdated.

If a private sector forecaster i does not herd and, hence, issues at time t an unbiased forecast (i.e., his best estimate) of a variable v for the period $t + k$, the probability that his forecast $E_{i,t}[v_{t+k}]$ exceeds (falls short of) the actual value, v_{t+k} , is equal to 0.5, both unconditional, and conditional on

anything in the information set available to the forecaster, including the organizational forecast $E_t^{Org}[v_{t+k}]$.

Against this background, a herding or anti-herding behavior of forecasts, as proposed by Bernhardt et al. (2006), can be developed as follows: Under the null hypothesis of no herding and no anti-herding, the conditional probability, P , that a forecast of a specific economic variable overshoots (undershoots) the realized value is 0.5, regardless of the forecasts published by the IMF or the OECD respectively. Accordingly, the conditional probability of overshooting the realized value given that the forecast is higher than the IMF or the OECD forecast is

$$(4.1) \quad P(v_{t+k} < E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] > E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) = 0.5.$$

Likewise the conditional probability of undershooting the realized value given that the forecast is smaller than the organizational forecast is

$$(4.2) \quad P(v_{t+k} > E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] < E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) = 0.5.$$

The two conditional probabilities, thus, also average 0.5. This is not the case under the alternative hypothesis of herding or anti-herding. If a forecaster herds, biasing the forecast towards the organizational forecast, the forecast will be located between the unbiased private forecast and the forecast of the respective international organization. As a consequence, if the forecast exceeds the IMF or the OECD forecast, the conditional probability of overshooting the realized value is smaller than 0.5. Similarly, if the forecast falls short of the IMF or the OECD forecast, the conditional probability of undershooting is also smaller than 0.5. This means

$$(4.3) \quad P(v_{t+k} < E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] > E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) < 0.5.$$

$$(4.4) \quad P(v_{t+k} > E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] < E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) < 0.5.$$

If forecasters herd, the average of the two conditional probabilities is smaller than 0.5. If forecasters anti-herd, in contrast, the average of the two conditional probabilities is larger than 0.5. In this case the forecast overshoots the unbiased private forecast in the direction away from the forecast published by the IMF or the OECD. This means

$$(4.5) \quad P(v_{t+k} < E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] > E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) > 0.5.$$

$$(4.6) \quad P(v_{t+k} > E_{i,t}[v_{t+k}] \mid E_{i,t}[v_{t+k}] < E_t^{Org}[v_{t+k}], v_{t+k} \neq E_{i,t}[v_{t+k}]) > 0.5.$$

The test statistic S is defined as the average of the sample estimates of the conditional probabilities used in Equations (4.3) – (4.6). Bernhardt et al. (2006) show that the test statistic, S , has an asymptotic normal distribution and is robust to various problems arising in the case of, e.g. correlated forecast errors, market-wide shocks, and optimism or pessimism among forecasters. It is the averaging that makes the test robust under the null hypothesis. For example, "bubble-like" swings in the economy like the dot-com bubble of 2000 or the financial turbulence of 2008-2009 may give rise to a preponderance of unexpected market-wide shocks. Such shocks raise (lower) the probability that the subsequently actual value exceeds (falls short of) forecasts, given any conditioning information, but leave the average of the conditional probabilities unaffected under the null hypothesis. Market-wide shocks and the resulting positive cross-correlation of forecast errors do not bias the mean of the S statistic, but only increase its variance below the one obtained in the case of zero cross-correlation of forecast errors. In other words, the test statistic S is conservative because positive unexpected shocks make it more difficult to reject the null hypothesis of unbiasedness when we should do so (Type II error). Finally, it is relevant for our analysis to note that outliers and large disruptive events like the financial crisis 2008-2009 should have a minor effect on the conditional

probabilities (i.e., empirical frequencies of events). The test statistic S is robust to such events.

4.4 Empirical Results

Tables 4.1 and 4.2 summarize the results of the (anti-) herding test for more than 30,000 current-year forecasts for the IMF panel (Panel *A*) and the OECD panel (Panel *B*). Our results indicate that private sector forecasts show an anti-herding behavior in 23 (18) out of 28 cases for the IMF (OECD) as the S statistic significantly exceeds the value of 0.5 in most cases. Hence, anti-herding is the predominant strategy and more pronounced for IMF forecasts than for OECD forecasts. For the IMF, the overall coefficient for the G7 is estimated as 0.60 indicating that the probability of undershooting (overshooting) the actual value given that the private sector forecast falls short of (exceeds) the IMF forecast is 60 percent. The estimated coefficient of 0.57 for the OECD is lower but nevertheless indicates strong anti-herding behavior of private sector forecasters.

Tables 4.1 and 4.2 (fifth row) show that an anti-herding strategy of private sector forecasters is significantly predominant in each G7 country. It is interesting to note that in case of France, Italy, and the US forecasters significantly anti-herd from the IMF for all variables under consideration. Likewise, UK forecasters strongly follow an anti-herding strategy with respect to OECD forecasts.

Table 4.1: (Anti-)Herdning-Test for the Current-Year IMF Forecasts (Panel A)

	Canada	France	Germany	Italy	Japan	UK	US	G7
Growth	0.53 (0.02) [0.14]	0.63* (0.02) [0.00]	0.52 (0.02) [0.24]	0.62* (0.02) [0.00]	0.59* (0.02) [0.00]	0.57* (0.02) [0.00]	0.65* (0.02) [0.00]	0.58* (0.01) [0.00]
Inflation	0.67* (0.02) [0.00]	0.57* (0.02) [0.00]	0.74* (0.02) [0.00]	0.62* (0.02) [0.00]	0.60* (0.02) [0.00]	0.67* (0.02) [0.00]	0.65* (0.02) [0.00]	0.65* (0.01) [0.00]
Fiscal	0.68* (0.04) [0.00]	0.57+ (0.03) [0.02]	0.61* (0.03) [0.00]	0.75* (0.04) [0.00]	0.48 (0.08) [0.84]	0.50 (0.03) [0.89]	0.66+ (0.09) [0.08]	0.61* (0.01) [0.00]
Current account	0.59* (0.02) [0.00]	0.57* (0.02) [0.00]	0.56* (0.02) [0.00]	0.60* (0.02) [0.00]	0.68* (0.02) [0.00]	0.52 (0.01) [0.13]	0.57* (0.02) [0.00]	0.58* (0.01) [0.00]
Total	0.61* (0.01) [0.00]	0.58* (0.01) [0.00]	0.58* (0.01) [0.00]	0.62* (0.01) [0.00]	0.64* (0.01) [0.00]	0.58* (0.01) [0.00]	0.61* (0.01) [0.00]	0.60* (0.00) [0.00]
Observations	1,843	2,095	3,311	1,652	2,241	3,545	3,049	17,736

Note: The test statistic S is defined as the average of the sample estimates of the conditional probabilities given in Equations (4.3) to (4.6). If forecasters neither herd nor anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution. Standard errors are given in parentheses and p-values are given in brackets. * (+) indicates significance at a 1 (10) percent significance level.

Table 4.2: (Anti-)Herdning-Test for the Current-Year OECD Forecasts (Panel B)

	Canada	France	Germany	Italy	Japan	UK	US	G7
Growth	0.51 (0.02) [0.67]	0.55 ⁺ (0.02) [0.01]	0.54 ⁺ (0.01) [0.01]	0.51 (0.02) [0.58]	0.55 ⁺ (0.02) [0.02]	0.61* (0.02) [0.00]	0.54 ⁺ (0.02) [0.03]	0.55* (0.01) [0.00]
Inflation	0.54 (0.03) [0.19]	0.36* (0.03) [0.00]	0.58* (0.02) [0.00]	0.70* (0.03) [0.00]	0.53 (0.03) [0.33]	0.76* (0.03) [0.00]	0.51 (0.02) [0.71]	0.57* (0.01) [0.00]
Fiscal	0.57 ⁺ (0.04) [0.07]	0.68* (0.03) [0.00]	0.65* (0.02) [0.00]	0.67* (0.03) [0.00]	0.49 (0.06) [0.86]	0.57* (0.02) [0.00]	0.57 ⁺ (0.04) [0.05]	0.63* (0.01) [0.00]
Current account	0.47 (0.02) [0.18]	0.52 (0.02) [0.39]	0.43* (0.01) [0.00]	0.58* (0.02) [0.00]	0.78* (0.02) [0.00]	0.60* (0.02) [0.00]	0.59* (0.02) [0.00]	0.56* (0.01) [0.00]
Total	0.54* (0.01) [0.00]	0.55* (0.01) [0.00]	0.53* (0.01) [0.00]	0.60* (0.01) [0.00]	0.61* (0.01) [0.00]	0.63* (0.01) [0.00]	0.55* (0.01) [0.00]	0.57* (0.00) [0.00]
Observations	1,581	1,824	3,786	1,380	1,796	2,771	2,521	15,659

Note: The test statistic S is defined as the average of the sample estimates of the conditional probabilities given in Equations (4.3) to (4.6). If forecasters neither herd nor anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution. Standard errors are given in parentheses and p-values are given in brackets. * (+) indicates significance at a 1 (10) percent significance level.

The results also indicate that forecasters in a particular country anti-herd more from the IMF than the OECD. This is captured by the magnitude of the S statistic which is significantly higher for the IMF than for the OECD for any country except the UK. From a cross-country perspective, Tables 4.1 and 4.2 (last column) show that an anti-herding behavior is prevalent for all variables regardless of the international organization. With the exception of the fiscal balance variable forecasters again anti-herd more predominantly from the IMF than the OECD. Especially in the case of inflation, forecasters irrespectively of their origin, follow a strong anti-herding behavior against the IMF. With respect to OECD forecasts it is interesting to note that a herding behavior is prevalent in case of France (inflation) and Germany (current account) as the coefficients are significantly lower than 0.5.

Tables 4.3 and 4.4 report the test statistic for the next-year forecasts. Again, the anti-herding behavior is stronger for IMF forecasts (0.59) than for OECD forecasts (0.58). While the forecasters in most countries again significantly anti-herd from forecasts published by international organizations, the results for Italy do not support the view of a strategic behavior of forecasters. In the case of the next-year forecasts for Italy, forecasters seem to be influenced only by the IMF's forecast of the growth rate (0.56) and the inflation rate (0.54). By contrast, in the case of France forecasters seem to follow an anti-herding behavior with respect to all variables under consideration regardless of the international organization.

Table 4.3: (Anti-)Herdung-Test for Next Year IMF Forecasts

	Canada	France	Germany	Italy	Japan	UK	US	G7
Growth	0.53 (0.02) [0.22]	0.62* (0.02) [0.00]	0.44* (0.02) [0.00]	0.56+ (0.02) [0.02]	0.68* (0.02) [0.00]	0.65* (0.02) [0.00]	0.55* (0.02) [0.00]	0.56* (0.01) [0.00]
Inflation	0.69* (0.02) [0.00]	0.58* (0.02) [0.00]	0.63* (0.02) [0.00]	0.54+ (0.02) [0.08]	0.55+ (0.02) [0.03]	0.55* (0.02) [0.00]	0.71* (0.02) [0.00]	0.60* (0.01) [0.00]
Fiscal	0.65* (0.05) [0.00]	0.66* (0.03) [0.00]	0.53 (0.03) [0.31]	0.50 (0.04) [0.91]	0.45 (0.09) [0.59]	0.53 (0.03) [0.40]	0.58+ (0.05) [0.09]	0.56* (0.01) [0.00]
Current account	0.69* (0.02) [0.00]	0.67* (0.02) [0.00]	0.60* (0.02) [0.00]	0.50 (0.02) [0.95]	0.70* (0.02) [0.00]	0.68* (0.01) [0.00]	0.53+ (0.02) [0.06]	0.63* (0.01) [0.00]
Total	0.64* (0.01) [0.00]	0.62* (0.01) [0.00]	0.53* (0.01) [0.00]	0.49 (0.01) [0.32]	0.65* (0.01) [0.00]	0.63* (0.01) [0.00]	0.59* (0.01) [0.00]	0.59* (0.00) [0.00]
Observations	1,860	2,076	3,246	1,581	1,914	3,499	2,958	17,134

Note: The test statistic S is defined as the average of the sample estimates of the conditional probabilities given in Equations (4.3) to (4.6). If forecasters neither herd nor anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution. Standard errors are given in parentheses and p-values are given in brackets. * (+) indicates significance at a 1 (10) percent significance level.

Table 4.4: (Anti-)Herding-Test for Next Year OECD Forecasts

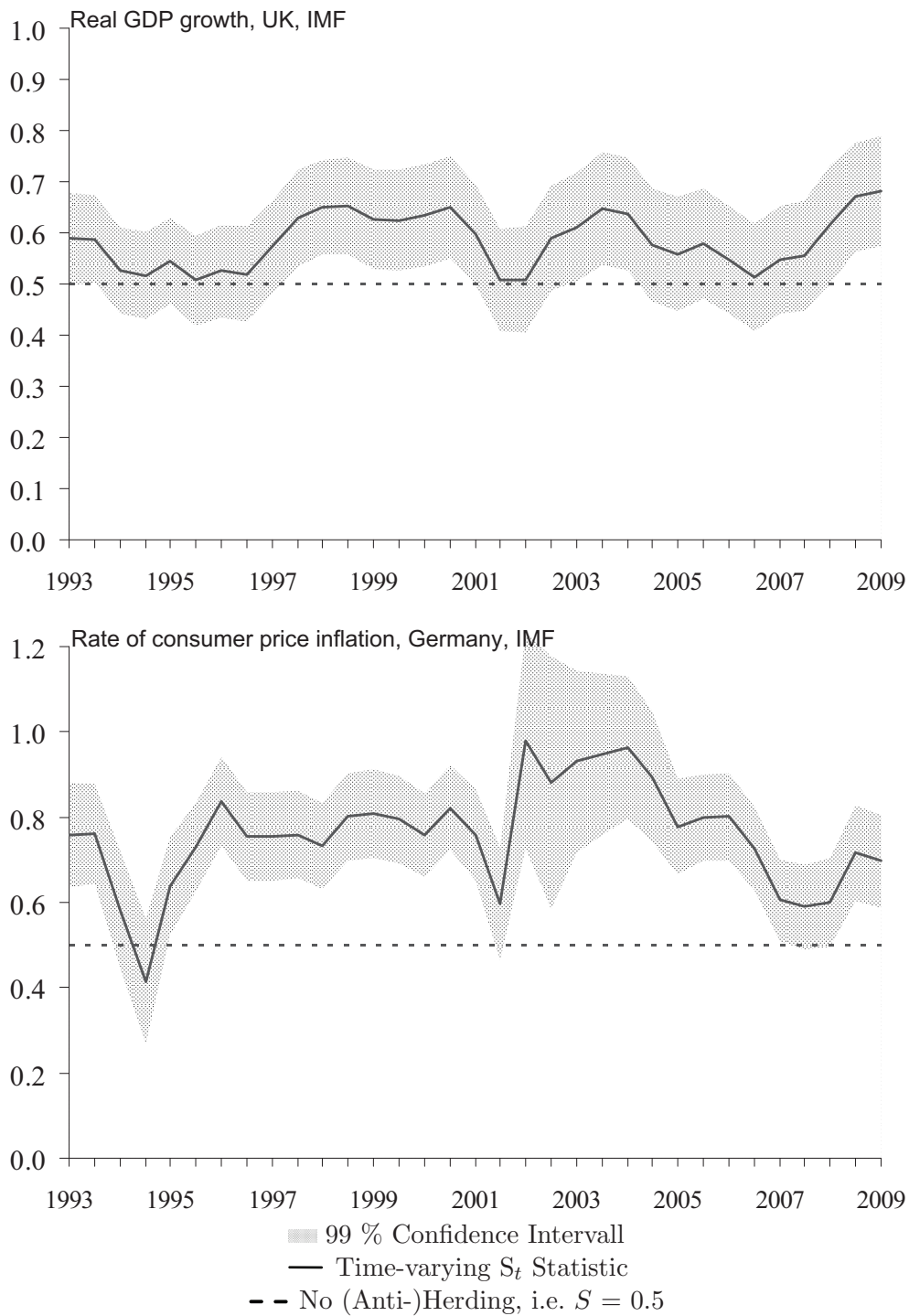
	Canada	France	Germany	Italy	Japan	UK	US	G7
Growth	0.53 (0.02) [0.26]	0.59* (0.02) [0.00]	0.53 ⁺ (0.02) [0.07]	0.53 (0.02) [0.20]	0.62* (0.02) [0.00]	0.63* (0.02) [0.00]	0.49 (0.02) [0.66]	0.55* (0.01) [0.00]
Inflation	0.66* (0.03) [0.00]	0.70* (0.03) [0.00]	0.56 ⁺ (0.03) [0.02]	0.50 (0.03) [0.90]	0.61* (0.03) [0.00]	0.65* (0.04) [0.00]	0.59* (0.03) [0.00]	0.61* (0.01) [0.00]
Fiscal	0.71* (0.04) [0.00]	0.63* (0.03) [0.00]	0.61* (0.02) [0.00]	0.47 (0.03) [0.37]	0.47 (0.06) [0.56]	0.50 (0.02) [1.00]	0.46 (0.03) [0.22]	0.57* (0.01) [0.00]
Current account	0.57* (0.02) [0.00]	0.62* (0.02) [0.00]	0.54 ⁺ (0.02) [0.02]	0.53 (0.02) [0.24]	0.76* (0.03) [0.00]	0.68* (0.02) [0.00]	0.62* (0.02) [0.00]	0.62* (0.01) [0.00]
Total	0.58* (0.01) [0.00]	0.60* (0.01) [0.00]	0.53* (0.01) [0.00]	0.52 (0.01) [0.20]	0.64* (0.01) [0.00]	0.64* (0.01) [0.00]	0.55* (0.01) [0.00]	0.58* (0.00) [0.00]
Observations	1,549	1,833	3,561	1,375	1,572	2,742	2,495	15,127

Note: The test statistic S is defined as the average of the sample estimates of the conditional probabilities given in Equations (4.3) to (4.6). If forecasters neither herd nor anti-herd (null hypothesis), the test statistic assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution. Standard errors are given in parentheses and p-values are given in brackets. * (+) indicates significance at a 1 (10) percent significance level.

From a cross-country perspective, the anti-herding behavior is again more pronounced for IMF inflation forecasts than for other variables. The only incidence of a herding behavior we find for the German growth rate forecasts of the IMF.

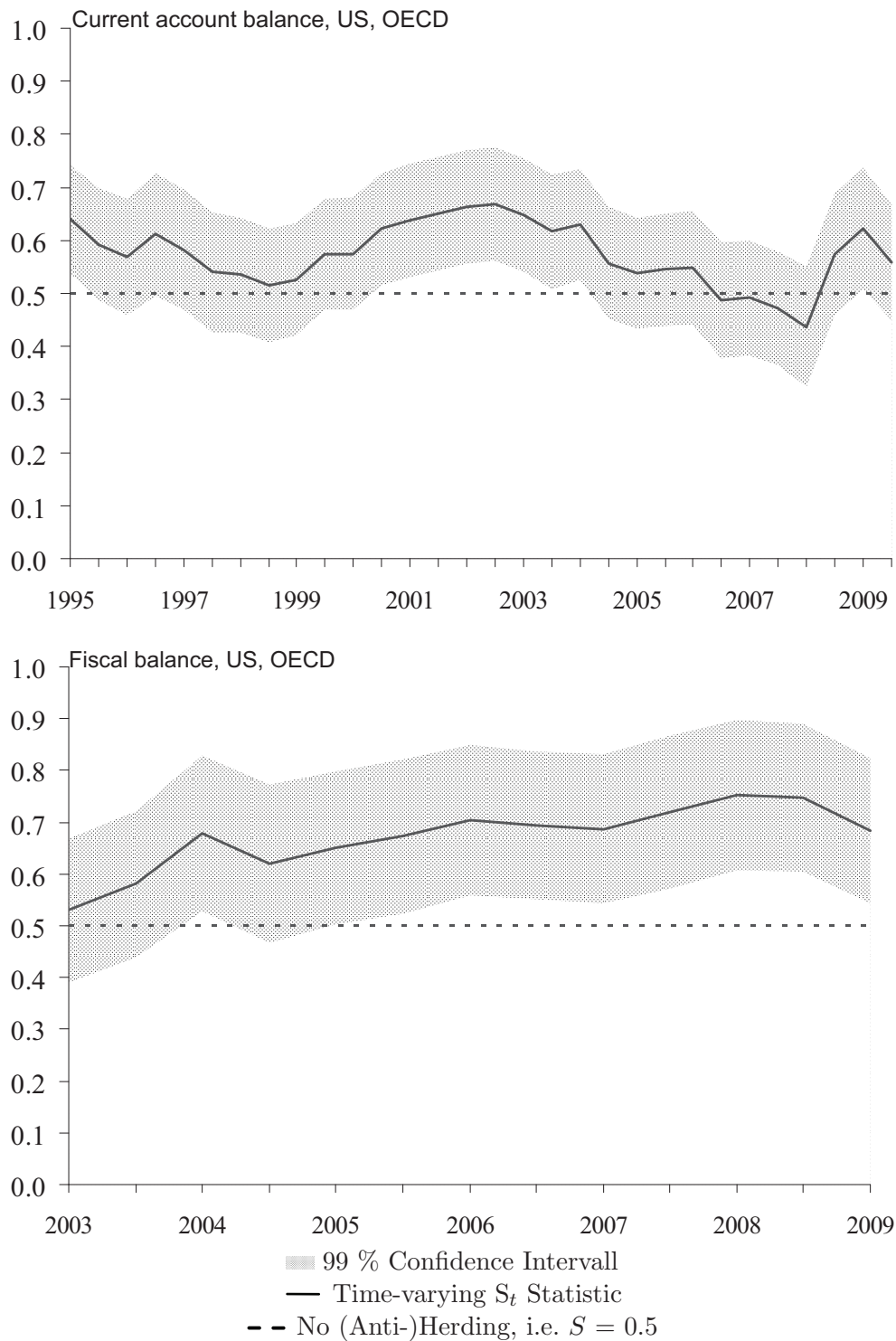
Since the sample period varies across the variables and among the international organizations, the anti-herding behavior might be associated with specific periods. To analyze the robustness of our results, we analyze the temporal stability by means of rolling-window estimates of the test statistic S . Starting with an estimation window of four years, we constantly forward the estimation window by one observation and drop (add) one observation at the beginning (at the end) of the time series. We continue this process of dropping and adding observations until we reach the end of the sample period. Figures 4.3 and 4.4 show the results for some selected cases. Throughout the sample period the time-varying test statistic almost always significantly exceeds its unbiased forecast value of 0.5. This supports that anti-herding is not subject to a specific period and reflects the robustness of our results.

Figure 4.3: Time Variance of the Strategic Behavior 1



Note: This figure shows the time-varying S_t statistic. In the case of no herding or anti-herding the test statistic S assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

Figure 4.4: Time Variance of the Strategic Behavior 2



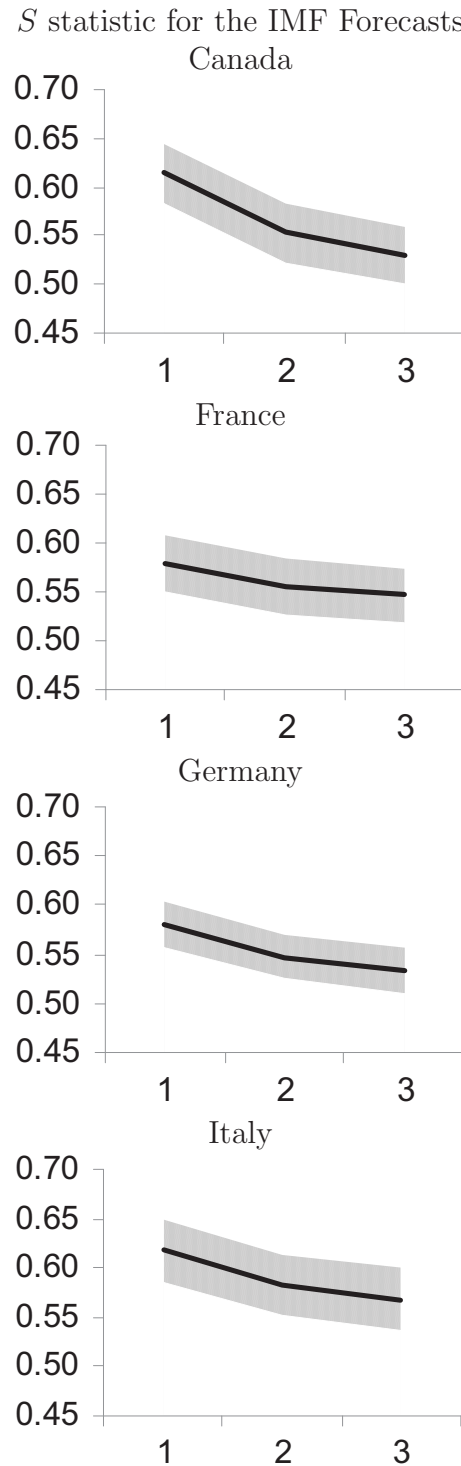
Note: This figure shows the time-varying S_t statistic. In the case of no herding or anti-herding the test statistic S assumes the value $S = 0.5$. If forecasters herd, the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

4.5 Sustainability of Herding and Anti-Herding

In this section we shed light on the question how long forecasts of international organizations affect private sector forecasts. To this end, we increase the time lag between the release of IMF and OECD forecasts from two weeks up to three months. We expect that the effect of forecasts of international organizations on private sector forecasts diminishes the larger the time lag is. Technically, we replace the subsequently released private sector forecast $E_{i,t}[v_{t+k}]$ ($t = 1$) in Equations (4.3) to (4.6) by the forecasts that are submitted two and three months after the release of the IMF and OECD forecast ($t = 2, 3$).

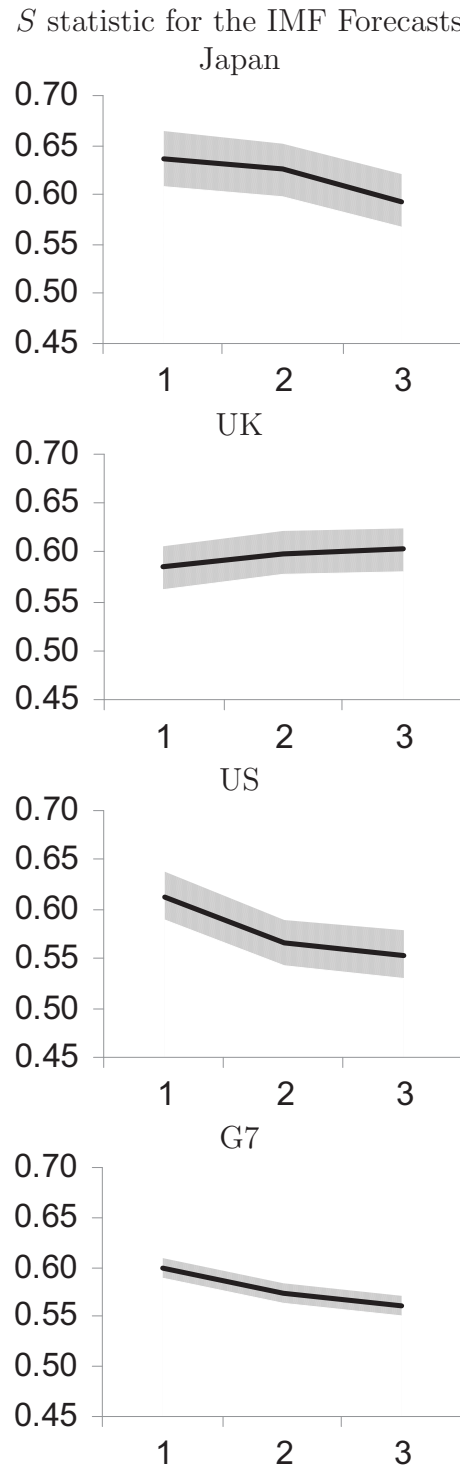
Figures 4.5 - 4.8 show the S statistic for the IMF (Panel A1 and A2) and OECD (Panel B1 and B2) forecasts as a function of the time lag ($t = 1, 2, 3$) between the forecasts of the international organization and those of the private sector. In most cases, forecasts of international organizations become stale over time as the herding coefficient converges towards 0.5. Apparently, forecasts of international organizations have the strongest effect on private sector forecasters right after their release. For instance, the overall coefficient for the IMF is 0.60 for the first month ($t = 1$) and decreases to 0.57 and 0.56 for the second and the third months ($t = 2$ and $t = 3$), respectively. In some incidences, the anti-herding effect vanishes. With respect to the OECD, US private sector forecasts exhibit a value of 0.55 and decreases to 0.52 and 0.51 while the latter is not different from 0.50. Hence, the strategic behavior of private sector forecasters with respect to the forecasts of international organizations lasts roughly three months.

Figure 4.5: Sustainability of the Strategic Behavior A1



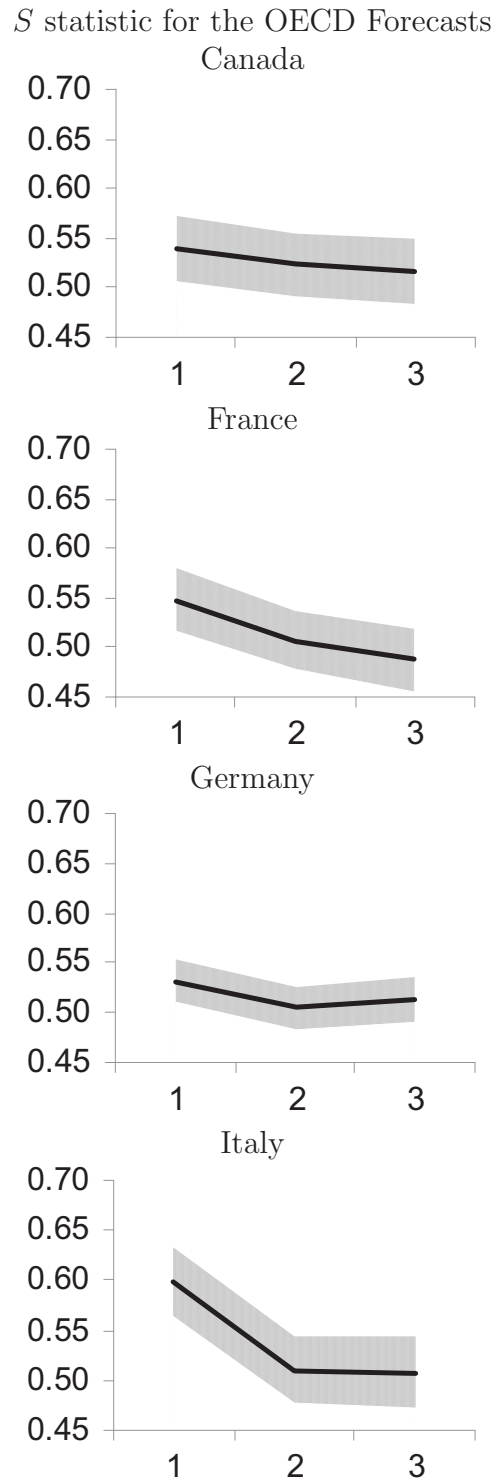
Notes: This figure shows the current-year S_t statistic for $t = 1, 2$, and 3 . In the case of no herding or anti-herding, the test statistic S assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

Figure 4.6: Sustainability of the Strategic Behavior A2



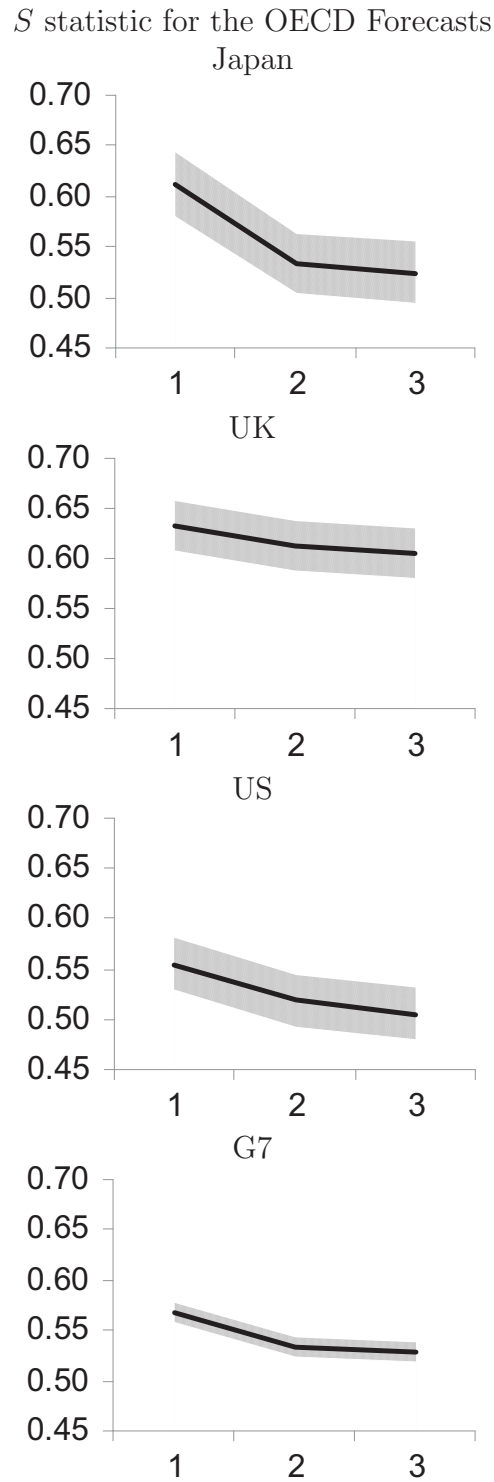
Note: This figure shows the current-year S_t statistic for $t = 1, 2,$ and 3 . In the case of no herding or anti-herding, the test statistic S assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

Figure 4.7: Sustainability of the Strategic Behavior B1



Note: This figure shows the current-year S_t statistic for $t = 1, 2,$ and 3 . In the case of no herding or anti-herding, the test statistic S assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

Figure 4.8: Sustainability of the Strategic Behavior B2



Note: This figure shows the current-year S_t statistic for $t = 1, 2,$ and 3 . In the case of no herding or anti-herding, the test statistic S assumes the value $S = 0.5$. If forecasters herd the test statistic assumes a value $S < 0.5$. If forecasters anti-herd the test statistic assumes a value $S > 0.5$. The test statistic S has an asymptotic normal distribution.

4.6 Conclusions

We use data from the Consensus Economics forecast poll to analyze whether individual private sector forecasters are influenced by forecasts published by international organizations, such as the IMF and the OECD. Given the significant cross-sectional heterogeneity of forecasts, our analysis of more than 60,000 individual forecasts of the four key macroeconomic variables for the G7 countries provides interesting insights on how private sector forecasters form their expectations.

Our main results can be summarized as follows: First, private sector forecasters are influenced by forecasts published by international organizations. Second, private sector forecasters follow an anti-herding strategy with respect to IMF forecasts and OECD forecasts. The anti-herding strategy is, however, more pronounced for IMF forecasts than for OECD forecasts. This result is robust over time and to variations in the forecast horizon and the countries examined. Third, the strategic behavior of private sector forecasters diminishes as the time lag between the organizational forecasts and the private sector forecasts increases. One conceivable reason why private sector forecasters deliberately place their forecasts further away from the forecasts published by international organizations would be that forecasters are not primarily interested in unbiased and accurate forecasts but take also publicity issues into account. The success of forecasters, as viewed by forecasters themselves, depends on their loss function and not necessarily on the forecast accuracy (Laster et al., 1999). Thus, anti-herding can be a rational strategy, as some forecasters might submit extreme forecasts and put more weight on publicity than on accuracy. Ottaviani and Sørensen (2006) argue that in a forecasting contest forecasters differentiate

their predictions from those of competitors. The reason is that a forecaster gains from moving away from his best estimate, since, in this case, the number of forecasters that correctly guess the respective value is lower.

Our results do not only provide insights into how forecasters form their expectations, but have also important macroeconomic implications. Since international organizations influence the private sector's perception by their forecasts, the IMF and the OECD can act stabilizing by communicating sound forecasts. Whether such a forecasting behavior of international organizations is actually in place is left to future research.

Chapter 5

Conclusion and Policy Implications

This thesis investigates the key determinants of Germany's exports on the one hand and the formation process of private sector forecasts on the other. The main results of the thesis can be summarized as follows:

First, the estimation results of the vector error correction model indicate that world demand, price competitiveness, energy prices and the fragmentation of production processes are the main factors explaining Germany's merchandise exports. While world demand and price competitiveness have traditionally been crucial determinants of exports, new factors emerged which became important over time. The estimation results suggest that German companies have optimized their value chain of production in such a way as to make use of comparative advantages of different locations. This enabled them to improve their productivity and, thereby, increase their export volumes. The empirical results support the view that if countries in the supply chain specialize in the part or component in which they have a comparative advantage, the fragmentation of production processes across the world creates enormous economic benefits (Baldwin and Taglioni, 2011).

Similarly, the German export sector benefited from rising energy prices. At first glance, this result might be counterintuitive, as rising energy prices are usually attributed to higher production costs, especially in the manufacturing sector. However, if one takes into account the rising global demand for energy-efficient technologies because of energy resources becoming scarce, the positive demand effect can overcompensate the negative supply effect in those countries that have a comparative advantage in these products. While the estimation results suggest that the oil price and the fragmentation of production processes are crucial factors in explaining German exports, there is no conclusive evidence of exports being determined by quality differentials.

Second, the estimation results regarding the properties of individual current account forecasts provide interesting insights into how private sector forecasters form their expectations. To analyze the performance of private sector forecasts, survey data from the Consensus Economics Forecast Poll is used. In comparison to other survey data, this poll has the advantage that the name of the forecasting institution is published along with the individual forecasts. Thus, an evaluation of the accuracy of a particular institution's forecast is relatively easy to conduct, which may impinge back on the reputation of the institution with respect to its forecasting activities (Keane and Runkle, 1990). The estimation results indicate that individual current account forecasts do not satisfy traditional unbiasedness and orthogonality criteria for forecast rationality. Besides, an anti-herding behavior can be observed among forecasters. This result is robust with respect to different time horizons and countries examined. Moreover, the cross-sectional heterogeneity of forecasts with regard to anti-herding is associated with cross-sectional heterogeneity in forecast accuracy. In other terms, there is some evidence indicating that forecasters who tend to herd towards the

consensus forecast provide more accurate current account projections than their colleagues who follow an anti-herding strategy. Further analyses are conducted on individual private sector forecasts in order to shed light on whether individual forecasters are influenced by forecasts published by the IMF and the OECD. The results point towards an anti-herding strategy of private sector forecasters with respect to IMF and OECD forecasts. However, the strategic behavior of private sector forecasters diminishes as the time lag between the organizational forecasts and the private sector forecasts increases. One reason why private sector forecasters follow an anti-herding behavior would be that forecasters are not primarily interested in unbiased and accurate forecasts but take also publicity issues into account. The success of forecasters, as viewed by forecasters themselves, depends on their loss function and not necessarily on the forecast accuracy (Laster et al., 1999). Thus, anti-herding can be a rational strategy, as some forecasters might submit extreme forecasts and put more weight on publicity than on accuracy.

This thesis is addressed to researchers and policymakers alike. While the results of the thesis might be useful for researchers trying to model international trade, policymakers should be aware of the results when deciding on the future course of action. Policymakers, for instance, consider current account forecasts of the private sector in their economic analyses, as these contain important information on the market perception with respect to the external developments of a country. However, our results demonstrate that economic agents who use private sector forecasts should be aware of the issues concerning rationality, heterogeneity, herding and accuracy of forecasts.

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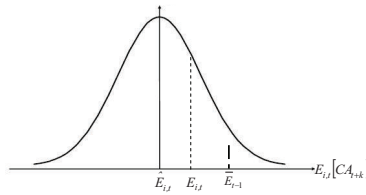
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Appendix A: Illustration of the Herding Test

Forecasters herd if they issue forecasts that are biased in the direction of the consensus forecast ($\bar{E}_{t-1}[CA_{t+k}]$). Accordingly, the eventually published forecast ($E_{i,t}[CA_{t+k}]$), is larger (Case I) (smaller (Case II)) than the private forecast ($\hat{E}_{t-1}[CA_{t+k}]$). As a result, the probability that the biased public forecast falls short of the subsequently actual current account value (CA_{t+k}) should be smaller than 0.5 (Case I). Similarly, if the biased published forecast is larger than the consensus forecast, the probability that the published biased forecast exceeds the subsequently actual current account should also be smaller than 0.5 (Case II).

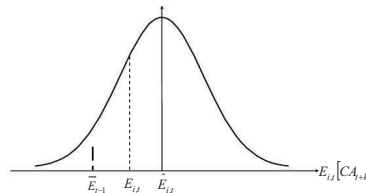
Figure 5.1: Illustration of the Herding Test

Case I



$$(5.1) \quad P(CA_{t+k} > E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] < \bar{E}_{t-1}[CA_{t+k}]) < 0.5$$

Case II



$$(5.2) \quad P(CA_{t+k} < E_{i,t}[CA_{t+k}] \mid E_{i,t}[CA_{t+k}] > \bar{E}_{t-1}[CA_{t+k}]) < 0.5$$