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**Research Report**

## Determinants of the Trade Balance in Industrialized Countries

FIW-Research Reports, No. 013

**Provided in Cooperation with:**

FIW - Research Centre International Economics, Vienna

*Suggested Citation:* Falk, Martin (2008) : Determinants of the Trade Balance in Industrialized Countries, FIW-Research Reports, No. 013, FIW - Research Centre International Economics, Vienna

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FIW Research Report N° 013 / Foreign Direct Investment  
June 2008

## Determinants of the Trade Balance in Industrialized Countries

Falk, M.

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### Abstract

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This paper investigates the determinants of the trade balance using panel data for 32 industrialized and emerging economies for the period 1990–2007. The results based on fixed effects models and linear mixed models allowing for random slope coefficients, show that the trade balance as a percentage of GDP is significantly positively related to real foreign GDP per capita of the trading partners. Real domestic GDP per capita has a negative effect on the trade balance. A real depreciation of the real exchange rate index leads to an improvement of the trade balance. However, in countries with a negative trade balance and/or a large positive net foreign direct investment position the trade balance is much less sensitive to movements in the real effective exchange rate index.

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The FIW Research Reports show the results of the three thematic work packages 'Export of Services', 'Foreign Direct Investment' and 'Competitiveness', that were commissioned by the Austrian Federal Ministry of Economics and Labour (BMWA) within the framework of the 'Research Centre International Economics' in November 2006.

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WIRTSCHAFTSFORSCHUNG**

**Determinants of the Trade Balance  
in Industrialized Countries**

**Martin Falk**

Projektkoordination: Yvonne Wolfmayr, Irene Langer

**April 2008**

# **Determinants of the Trade Balance in Industrialized Countries**

**Martin Falk**

Studie im Rahmen des Leitprojekts "Forschungsschwerpunkt Internationale Wirtschaft (FIW)" des Österreichischen Instituts für Wirtschaftsforschung im Auftrag des Bundesministeriums für Wirtschaft und Arbeit

Arbeitspaket N°2 Direktinvestitionen: Modul 1, Teilmodul 1.2

Begutachtung: Werner Hölzl

Projektkoordination: Yvonne Wolfmayr, Irene Langer

April 2008

# **Determinants of the Trade Balance in Industrialized Countries**

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# Determinants of the Trade Balance in Industrialized Countries

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## Das Wichtigste in Kürze

Die Handelsbilanz in den Industrieländern hat sich in den letzten 15 Jahren sehr unterschiedlich entwickelt. Während einige EU-Länder wachsende Handelsbilanzüberschüsse erzielt haben (Norwegen, Österreich, Schweiz, Deutschland und die Niederlande), hat sich die Handelsbilanz in anderen Industriestaaten deutlich verschlechtert (Australien, Spanien, Italien, Vereinigtes Königreich und die Vereinigten Staaten). Die neuen EU-Mitgliedstaaten weisen wiederum anhaltende Handelsbilanzdefizite auf, welche ein Spiegelbild der hohen Nettoauslandsinvestitionen sind.

Die unterschiedliche Entwicklung der Leistungsbilanz wirft die Frage nach den grundlegenden Bestimmungsfaktoren der Handelsbilanz auf. Dazu zählen der Außenwert der Währung (realer effektiver Wechselkursindex), das inländische BIP, das handelsgewichtete ausländische BIP und das Budgetdefizit. Dabei wird häufig der Außenwert der Währung als ein Maß für die preisliche Wettbewerbsfähigkeit herangezogen. Zur Beantwortung dieser Frage wurde eine empirische Analyse der Determinanten der Handelsbilanz auf Basis von 32 Industrieländern für den Zeitraum 1990–2007 durchgeführt. Eine Besonderheit dieser Arbeit ist, dass Modelle mit variablen Koeffizienten verwendet werden, welche eine Abschätzung der Variabilität der Effekte zwischen Ländern möglich machen.

Die Analyse kommt zum Ergebnis, dass die Handelsbilanz positiv vom ausländischen realen BIP pro Kopf und negativ vom inländischen realen BIP pro Kopf abhängt. Eine Verbesserung der preislichen Wettbewerbsfähigkeit (gemessen an der Veränderung des realen Wechselkursindex definiert als um die Lohnstückkostenrelation zwischen Inland und Ausland bereinigter Wechselkursindex) hat einen positiven Einfluss auf die Handelsbilanz. Das Budgetdefizit hat einen positiven Einfluss, welcher allerdings nicht robust ist und stark zwischen den Ländern schwankt. Zudem zeigt die empirische Analyse, dass die Effekte stark zwischen Ländern variieren. Für Österreich haben die preisliche Wettbewerbsfähigkeit und das ausländische reale BIP pro Kopf einen im Ländervergleich überdurchschnittlich hohen Effekt auf die Handelsbilanz. Da sich die preisliche Wettbewerbsposition Österreichs (zusammen mit Japan, Deutschland, Finnland, der Schweiz und Korea) seit Mitte der 90er Jahre erheblich verbessert hat, ist ein Großteil des Anstiegs der Handelsbilanz auf diesen Faktor zurückzuführen. Dagegen hat sich das für Österreich relevante handelsgewichtete ausländische reale BIP pro Kopf im Ländervergleich nicht überdurchschnittlich entwickelt. Dies wiederum ist vor allem auf das schwache Pro-Kopf-Wachstum der wichtigsten Handelspartner Österreichs (Deutschland, Italien, Schweiz) zurückzuführen. Somit hat die Handelsbilanz Österreichs vom Zuwachs des ausländischen Wirtschaftswachstums nur unterproportional profitiert.





## **Abstract**

This paper investigates the determinants of the trade balance using panel data for 32 industrialized and emerging economies for the period 1990–2007. The results based on fixed effects models and linear mixed models allowing for random slope coefficients, show that the trade balance as a percentage of GDP is significantly positively related to real foreign GDP per capita of the trading partners. Real domestic GDP per capita has a negative effect on the trade balance. A real depreciation of the real exchange rate index leads to an improvement of the trade balance. However, in countries with a negative trade balance and/or a large positive net foreign direct investment position the trade balance is much less sensitive to movements in the real effective exchange rate index.

JEL Classification: F10, F31

Keywords: trade balance, real effective exchange rate index, fiscal balance, panel data methods.



## 1. Introduction<sup>1)</sup>

Some industrialized countries such as USA, Greece, Portugal, Spain, United Kingdom and Australia show large and persistent trade deficits. Large trade deficits can also be observed in the Central and Eastern European countries. In contrast, some Western European countries such as Germany, Austria, Finland, Netherlands, Switzerland, Sweden and Ireland have accumulated large trade surpluses measured as a fraction of GDP.

Given the difference in the trade balance across countries and time, it is essential to ask what are the main factors influencing the trade balance and whether there are differences in the effects across countries. Many empirical analyses have examined the determinants of the trade balance. Some examine the bilateral trade balance while other focus on the aggregate trade balance (see for a survey Bahmani–Oskooee and Ratha, 2004). Despite the large number of studies there is still no consensus on the size of the effects.

The aim of this paper is to re–examine the determinants of the trade balance (measured as trade balance as a fraction of GDP). One novelty of the paper is that we consider the cross–country heterogeneity of the factors influencing the trade balance. It is expected that the effects differ between countries maintaining a positive net FDI position and/or a negative trade balance and those recording a negative FDI position and/or a positive trade balance. Since the trade balance and the net international investment position (which the FDI balance is part of) are connected by the accounting identity, it is not surprising that in the CEE countries the trade deficits generally correspond with large net FDI inflows. In contrast, the majority of countries with a large trade surplus also maintains a negative direct investment position (inward FDI stock is lower than the outward FDI stock). We also provide evidence for the relationship between the fiscal balance measured by the primary balance as a percentage of GDP and the trade balance. In the US there is an ongoing discussion on the possible contribution of the government budget deficit to the trade deficit. To analyze the major factors behind the trade balance, we estimate a static panel data model with country effects. In particular, we use the fixed effects model as well as fixed effects models with country interaction terms. In addition, we use linear mixed models in which the slopes for the relationship we are interested in are allowed to vary across countries. To our knowledge, random coefficients models have not

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<sup>1)</sup> I would like to thank Mariya Hake for proof-reading.

been widely applied for the aggregate trade balance equation. The study is based on a panel of 32 industrialized and emerging economies for the period of 1990–2007.

The structure of this paper is the following. Section 2 introduces the empirical model and the hypotheses. Section 3 presents the data used, while the empirical results are discussed in section 4. Some concluding remarks are provided in section 5.

## 2. Empirical model

The trade balance equation can be derived from the theoretical model introduced by Goldstein and Khan (1985). The outcome of the reduced form model predicts that the trade balance depends negatively on domestic income and positively on foreign income. A depreciation of the real exchange rate improves the trade balance in the long-run. The trade balance equation can be specified as:

$$TBGDP_{it} = \alpha_i + \alpha_1 \ln REER_{it} + \alpha_2 \ln Y_{it}^* + \alpha_3 \ln Y_{it} + \alpha_4 PRIMBALGDP_{it} + \varepsilon_{it},$$

where  $i=1, \dots, N$ ,  $t=1990-2007$  and  $\ln$  denotes the natural logarithm.  $TBGDP$  is the trade balance measured as the difference between the value of country's exports and imports and as a percentage of nominal GDP. Alternatively, one can use the logarithm of the ratio of exports to imports as the dependent variable (Rose and Yellen, 1989).  $REER$  denotes the real effective exchange rate index measured as annual averages, where the  $REER$  is defined as  $EP/P^*$ , with  $E$  the nominal effective exchange rate index and  $P^*$  and  $P$  are the foreign and domestic unit labour costs, respectively. In our case, an increase in  $REER$  refers to a real appreciation.  $Y^*$  is weighted average real GDP per capita of the 40 major trading partners and  $Y$  is real domestic GDP per capita and  $PRIMBALGDP_{it}$  is the primary balance as a percentage of GDP.  $\varepsilon_{it}$  is the usual error term and assumed to be identically and independently distributed with a zero mean and constant variance, i.e.  $\varepsilon_{it} \sim IID(0, \sigma^2)$ . Country effects,  $\alpha_i$ , account for country specific factors such as the size of the country.

Previous empirical and theoretical work suggests that the trade balance is influenced by a number of important factors. In the following, we advance a number of hypotheses concerning the relationship between the trade balance and the possible factors influencing the balance of trade, which we will proceed to evaluate in the following empirical work.

### Real effective exchange rate index (REER) effects

The REER based on unit labor costs is a measure of the domestic production costs in relation to that of the trading partners. In our case, a decline in the REER reflects the reduction in the cost of producing domestic goods and an increase in export competitiveness. A number of studies have examined the relationship between the real effective exchange rate index and the trade balance using either aggregate or

bilateral trade data. Studies based on aggregate data usually find that devaluations improve the trade balance in the long-run (see Arize, 1994; Bahmani-Oskooee, 1985; Bahmani-Oskooee, 1991; Himarios, 1985, 1989; Miles, 1979; Shirvani and Wilbratte, 1997 for cross-country studies; Bahmani-Oskooee and Ratha, 2004 for a survey). However, for the Central and Eastern European countries Bahmani-Oskooee and Kutan (2008) do not find a long-run impact of the real effective exchange rate index on the trade balance. We expect that a real depreciation improves the trade balance in the long-run and vice versa at least on average, but there is large extent of cross-country heterogeneity.

### **Real domestic and foreign income**

We expect domestic income to be negatively related to the trade balance since imports are positively related to domestic income. Foreign income and the trade balance are expected to be positively related because a rise in foreign income stimulates exports.

### **Effects of the government budget balance**

There is a discussion in the literature that the increase in the trade deficit and the rise of the government budget are related to each other (see Bachmann 1992; Mohammadi and Skaggs, 1996; Darrat, 1988). In the US the coexistence of both budget deficit and trade deficit is known as the twin deficit. Empirical studies on the relationship between the trade deficit and the budget deficit do not give a clear picture on the effects. Evidence based on time series data for the US suggests that the effect of the budget balance on the trade balance is modest (Mohammadi and Skaggs, 1996). However, Darrat (1988) finds causal evidence between the trade deficit and the budget deficit.

In order to test whether the variables in the regression are non-stationary we apply unit-root tests. Unreported results indicate that the trade balance, the real effective exchange rate index and the relative income are stationary. However, for some countries we can not test for non-stationarity due to the small number of time series observations. Therefore, we assume that all variables are stationary. Note also that the power of unit-root tests is quite weak in small samples.

An interesting question is whether the determinants of the trade balance differ between countries, for instance between countries that maintain a positive net FDI position (inward FDI stock exceeds the outward FDI stock) and countries with a negative net FDI position (i.e. inward FDI stock is lower than the

outward FDI stock). In order to investigate whether the fundamental determinants of the trade balance are different for countries with a positive net FDI position, we introduce country interaction terms in the fixed effects model:

$$TBGDP_{it} = \alpha_i + \alpha_1 \ln REER_{it} + \alpha_2 \ln Y_{it}^* + \alpha_3 \ln Y_{it} + \alpha_4 PRIMBALGDP_{it} + \beta_1 \ln REER_{it} \times DNFDI + \beta_2 \ln Y_{it}^* \times DNFDI + \beta_3 \ln Y_{it} \times DNFDI + \beta_4 PRIMBALGDP_{it} \times DNFDI + \varepsilon_{it}$$

where *DNFDI* is a dummy variable equal to one when the country persistently maintains a positive net FDI position and zero otherwise.

Another more general approach to account for the cross-country heterogeneity in trade balance effects is the linear mixed model (see Verbeke and Molenberghs, 2000; Skrondal and Rabe-Hesketh, 2008). The mixed models differ from the random coefficients model developed by Swamy (1970) since coefficients can be treated as either fixed or random. The linear mixed can be written as follows (t is suppressed for convenience):

$$TBGDP_i = X_i \beta + Z_i u_i + \varepsilon_i,$$

with  $i = 1, \dots, N$  countries,  $\varepsilon_i$  denotes the random error term that is independent and normally distributed,  $X_i$  is a matrix containing the explanatory variables,  $\beta$  is the vector of coefficients that are treated as fixed,  $Z_i$  denotes other explanatory variables and  $u_i$  denotes the country specific coefficients (i.e. random-intercept and random-slope). The random effects and the residual component are assumed to be independent. The vector of coefficients of the random effects is assumed to follow the normal distribution with mean vector 0 and the constant variance and covariance. In our application we estimate four different specifications of the linear mixed model where in each specification the intercept and one slope are treated as random whereas the others are treated as fixed. The mixed model allows us to predict the country-specific coefficients.





### 3. Data and descriptive statistics

The main data source is the OECD National Accounts and the OECD Economic Outlook database as well as the Eurostat Newcronos database. The OECD data can be downloaded from <http://www.sourceoecd.org>. The real effective exchange rate indices are taken from Eurostat's Newcronos database and are calculated by the ECB. They are based on the nominal effective exchange rate indices calculated as the geometric weighted averages of bilateral exchange rates against the currencies of the 36 major trading partners. The real effective exchange rate index is then deflated by the difference in domestic and foreign unit labor costs in the total economy. Domestic GDP per capita is measured as the GDP in constant purchasing power parities per capita and is drawn from the OECD Economic Outlook database and the Newcronos database for the New EU Member States. Real foreign GDP per capita is calculated as the weighted average of domestic real GDP per capita of 40 trading partners, where the weights are defined as the share of country's exports going to the other countries. Note that we use fixed weights measured as averages over the period 1990–2007. Real GDP per capita for following trading partners is taken from the World bank World Development Indicators: Brazil, Chinese Taipei, India, Indonesia, Malaysia, Saudi Arabia, Thailand, China, Croatia, Hong Kong, Russia, Singapore and Ukraine. The primary balance is obtained from the Newcronos database and the OECD National Accounts.

Table 1 contains descriptive statistics. Across all years and countries, the trade balance as percentage of GDP is 0.2 on average. However, there are large variations across countries. The sample mean of the government budget balance is also 0.2. Real domestic GDP per capita varies more heavily across countries and time than real foreign GDP per capita.

*Table 1: Summary statistics*

	Mean	Median	Std. Dev.	Min	Max
Trade balance as percent of GDP	0.2	0.2	6.0	-20.2	18.2
Real foreign GDP per capita (2000=100)	97.4	96.5	11.7	73.5	129.9
Real domestic GDP per capita (2000=100)	98.0	97.3	15.1	54.0	161.6
Real effective exchange rate index (2000=100)	105.8	104.6	15.2	56.7	162.6
Primary balance as percent of GDP	0.2	0.4	3.2	-21.1	7.9

Notes: Pooled data across countries and time. The countries are Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom and the United States. - Source: OECD, Eurostat, own calculations.

Table 2 shows the evolution of all variables over time for two sub samples, i.e. countries that maintain a positive FDI position and countries with a negative or zero FDI position. The group of countries with a large positive net FDI position and/or are negative trade balance includes Australia, Belgium, Bulgaria, Czech Republic, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, New Zealand, Poland, Portugal, Romania, Slovakia and Slovenia. Note that the net direct international investment position is about 34 percent of the GDP in the sample of countries where the inward FDI stock exceeds the outward FDI stock. In the remaining countries, the net FDI position is negative of about 14 percent of GDP. We observe strong difference in means of the variables across the two sub samples. For countries with a strong positive FDI position, we observe a permanent trade deficit, zero or negative government balance, higher growth of real GDP per capita, and an appreciation of the REER. For the remaining countries we find a persistent trade surplus, little change in the REER over time and a lower growth rate of GDP per capita.

To get some insight into the relationship between the trade balance and the possible factors, we provide a scatter plot and spearman rank correlation coefficients based on long differences data (see Figure 1 to Figure 4 in the Appendix). We find that the change in real effective exchange rate index is negatively related to the change in the trade balance, whereas there is a positive relationship between the primary balance as a fraction of GDP and the trade balance. However, both coefficients are only significant at the 10 percent. The growth rates of both foreign GDP per capita and domestic GDP per capita do not seem to be correlated with the change in the trade balance.

Table 2: Summary statistics, evolution over time

	Trade balance as percent of GDP	Real foreign GDP per capita	Real domestic GDP per capita	REER	Primary balance as percent of GDP	Net FDI stock as percent of GDP
<i>Total sample</i>						
1990	-0.2	81.3	80.7	111.9	0.7	3.0
1991	0.2	81.7	81.1	110.9	-0.3	3.3
1992	0.6	83.1	81.2	105.7	-1.4	3.7
1993	1.2	83.4	81.5	103.0	-2.5	4.5
1994	1.2	85.7	84.1	101.6	-1.2	4.4
1995	0.6	87.5	85.9	101.0	-0.9	4.0
1996	-0.3	89.2	88.2	103.6	0.2	4.5
1997	-0.1	91.9	91.2	103.3	0.8	4.2
1998	-0.4	93.9	93.4	102.6	1.1	6.4
1999	-0.2	96.4	96.3	101.1	1.2	6.4
2000	0.2	100.0	100.0	100.0	2.0	7.1
2001	0.3	101.2	102.2	101.3	1.1	6.4
2002	0.4	102.5	104.8	103.7	0.1	8.7
2003	0.0	104.2	107.2	106.7	-0.3	10.4
2004	-0.1	107.4	111.1	109.2	0.2	11.4
2005	-0.4	111.6	115.6	112.0	0.5	8.9
2006	-1.0	116.7	121.4	114.1	1.0	9.8
2007	1.9	120.9	121.7	116.1	1.2	
<i>Countries with a permanent positive net FDI position</i>						
1990	-2.1	81.6	77.5	109.5	0.9	17.5
1991	-1.5	82.3	78.3	106.5	0.6	19.8
1992	-0.4	84.4	78.7	98.4	-0.4	15.3
1993	-0.8	84.5	79.8	99.1	-2.3	19.1
1994	-0.4	86.5	82.7	95.9	-0.4	18.5
1995	-1.7	88.0	84.4	93.0	-0.7	13.7
1996	-3.5	89.5	87.3	97.8	0.1	15.5
1997	-3.5	92.0	90.6	101.1	0.0	17.0
1998	-3.9	94.0	93.2	103.1	0.6	20.3
1999	-3.5	96.4	96.1	100.6	0.3	22.0
2000	-3.1	100.0	100.0	100.0	0.2	26.2
2001	-2.9	101.4	103.4	102.5	-0.1	25.8
2002	-2.9	102.9	107.6	105.5	-0.6	30.3
2003	-3.3	104.7	111.4	109.2	-0.1	32.3
2004	-3.8	108.0	116.8	113.0	0.1	33.5
2005	-3.8	112.3	121.9	117.9	0.0	30.6
2006	-5.0	117.6	128.6	121.3	0.3	34.0
2007	0.0	121.5	125.9	130.2	0.0	
<i>Countries with a negative or zero net FDI position</i>						
1990	0.5	81.2	81.9	112.9	0.6	-2.4
1991	0.8	81.4	82.2	112.5	-0.6	-2.8
1992	1.2	82.4	82.6	109.9	-1.9	-2.8
1993	2.3	82.8	82.5	105.2	-2.5	-3.8
1994	2.3	85.2	85.0	105.5	-1.7	-4.4
1995	2.7	87.1	87.2	108.6	-1.1	-4.6
1996	2.8	89.0	89.1	109.0	0.3	-5.2
1997	3.1	91.8	91.7	105.4	1.5	-7.0
1998	3.2	93.7	93.6	102.0	1.6	-7.4
1999	3.2	96.4	96.4	101.6	2.1	-9.1
2000	3.5	100.0	100.0	100.0	3.7	-12.0
2001	3.6	100.9	101.1	100.1	2.2	-13.0
2002	3.7	102.1	102.0	101.9	0.7	-12.9
2003	3.3	103.7	102.9	104.2	-0.5	-11.5
2004	3.5	106.8	105.4	105.5	0.3	-10.7
2005	3.1	110.8	109.2	106.1	1.0	-12.7
2006	3.0	115.8	114.2	106.9	1.7	-14.4
2007	3.1	120.5	119.0	107.3	1.9	

Notes: see Table 1.



## 4. Results

The results for the fixed effects model are reported in Table 3. Specification (1) presents the results of the fixed effects model for the total sample. Since the trade balance is typically negative for countries maintaining a positive net FDI position, we provide additional fixed effects results with interaction terms between each variable and a dummy variable that is equal to one if the inward FDI stock is larger than the outward FDI stock on average (see specification 2). The fixed effects model uses 520 observations on 32 industrialized and emerging economies for the period 1990–2007.

*Table 3: Results of the fixed effects model for the determinants of the trade balance*

	Specification without interaction terms (1)		Specification with interaction terms (2)	
	Coeff.	t	Coeff.	t
ln REER	-0.054 ***	-4.46	-0.083 ***	-4.57
ln REER x dummy variable for countries with a positive net FDI position			0.059 **	2.37
ln real foreign GDP per capita	0.062 **	2.32	0.102 ***	3.38
ln real foreign GDP per capita x dummy variable for countries with a positive net FDI position			-0.091 *	-1.71
ln real domestic GDP per capita	-0.029	-1.10	-0.082 **	-2.47
ln real domestic GDP per capita x dummy variable for countries with a positive net FDI position			0.076	1.53
Primary balance as percent of GDP	0.169 ***	3.47	0.260 ***	4.54
Primary balance as percent of GDP x dummy variable for countries with a positive net FDI position			-0.002 *	-1.73
Constant	0.005 ***	3.76	0.004 ***	3.11
Wald test ln real foreign GDP = ln real domestic GDP = 0 (p-value)	0.00			
R <sup>2</sup> within	0.11		0.13	
# of observations	528		528	
# of countries	32		32	

Notes: The dependent variable is the trade balance as a percentage of GDP. \*\*\*, \*\* and \* denote significance at the 1 percent, 5 percent and 10 percent level. t-values are based on standard errors that adjusted for clustering at the country level in order to allow for any arbitrary autocorrelation of the errors in each country.

Since all of the right-hand variables are transformed into logarithms, the coefficients can be interpreted as semi-elasticities, except for the coefficient on the primary balance. As expected, the real effective exchange rate index has a significantly negative effect on the trade balance. The semi-elasticity is  $-0.054$  implying that a real appreciation of the REER of 10 percent deteriorates the trade balance as percentage of GDP by 0.54 percentage points. Real foreign GDP per capita has a positive impact on the trade balance with a semi-elasticity of 0.062. For real domestic GDP per capita we find a negative coefficient of  $-0.029$ . However, the coefficient is not significantly different from zero. It is obvious that domestic and foreign income are highly correlated which may lead to multicollinearity problems in estimating the coefficients.

Therefore, we implement Wald tests of joint significance. Indeed, the Wald tests indicate that both foreign and domestic GDP are jointly significant at the 1 percent level. Furthermore, government budget balance measured as the primary balance as percentage of GDP has a positive and significant impact on the trade balance indicating that a reduction of the budget deficit improves the trade balance.

Specification 2 shows the results for the fixed effects model with interaction terms of all variables with a dummy variable for countries that maintain a positive FDI position. The *t*-statistics reported on the variables and the country interaction terms test whether the coefficient is significantly different from the overall coefficient. We find that the trade balance effects are significantly different for the countries that have a positive FDI position. The country interaction term for the real effective exchange rate index is positive and significant, indicating that in countries with a positive net FDI position the trade balance is less price sensitive. The country interaction term for the real effective exchange rate index is positive and significant indicating that the trade balance is less sensitive to changes in foreign income.

Table 4 reports the results of the linear mixed model estimated by maximum likelihood. We provide four different specifications where in each specification the intercept and one explanatory variable are treated as random, whereas the other variables are treated as fixed. The likelihood ratio test to test the null hypothesis of identical slope-coefficients across countries can be clearly rejected in all cases. Again, we find that the trade balance is significantly positively related to foreign income and negatively to both domestic income and the real effective exchange rate index. However, government budget balance no longer has a significant effect using the mixed model. Table 5 in the Appendix presents the individual country predictions of the key parameters. The results indicate that there is a substantial variation in the predicted coefficients across countries. To give a general picture, we calculate the means for the different groups of countries. Again we find that the effects of the REER in absolute terms are lower in the New EU Member States as well as in countries with a positive net FDI position. Regarding foreign GDP all countries have the expected sign except Bulgaria, Latvia and the United States. Domestic GDP shows also the expected negative sign except for Ireland, Norway and the Czech Republic. The results for the primary balance are not clear-cut. In 22 out of 32 countries we find a positive relationship between the government budget balance and the trade balance indicating that reducing government deficits improve the trade balance. However in 10 out of 32 we find a negative relationship.

*Table 4: Results of the linear mixed models*

	ln REER random		ln foreign GDP random		ln domestic GDP random		primary balance random	
	Coeff.	t	Coeff.	t	Coeff.	t	Coeff.	t
ln REER	0.048 **	2.24	0.165 ***	3.73	0.168 ***	6.10	0.071 ***	3.23
ln foreign GDP	-0.034 **	-1.97	-0.117 ***	-4.65	-0.137 ***	-4.04	-0.039 **	-2.19
ln domestic GDP	-0.057 **	-2.21	-0.072 ***	-7.22	-0.061 ***	-6.30	-0.053 ***	-5.49
primary balance	0.143 ***	3.29	0.080 *	1.95	0.140 ***	3.36	0.094	1.21
Constant	0.000	0.00	0.002	0.19	0.002	0.16	0.000	0.02
LR test vs linear regression (p-value)	0.00		0.00		0.00		0.00	
# of observations	528		528		528		528	
# of countries	32		32		32		32	

Notes: \*\*\*, \*\* and \* denote significance at 1 percent, 5 percent and 10 percent level. Random-intercept and random-slope (coefficient) model, correlated random effects.





## **5. Conclusions**

This paper investigate empirically the key factors influencing the aggregate balance of trade using data for 32 industrialized and emerging economies for the period 1990–2007. In particular, we analyze the impact of the real effective exchange rate index, real foreign and domestic GDP per capita and the government budget balance on the trade balance. This paper contributes to the previous literature in several ways. First, the country coverage is broader than those used in previous literature. Second, we investigate the cross–country heterogeneity in the factors influencing the trade balance. The empirical results based on the fixed effects model and the mixed model show that the real effective exchange rate index, foreign and domestic income have the expected sign and constitute important factors in explaining the aggregate trade balance. On average, a 10 percent real appreciation of the real effective exchange rate index reduces the trade balance by 0.5 percentage points. Evidence for the impact of the government budget balance is mixed. The results of the fixed effects model suggest a positive and significant relationship between the government budget balance and the trade balance. However, the effect is no longer significant based on the mixed model.

The main finding of the paper is that the effects differ significantly between countries with a positive FDI position and that of a negative or zero FDI position. For countries that have a positive net FDI position (often in combination with a negative trade balance) we find that the trade balance is less sensitive to movements of the real effective exchange rate index.



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## 7. Appendix

Figure 1: Correlation coefficients between the trade balance and the real effective exchange rate index and the primary balance variables (based on long differences)

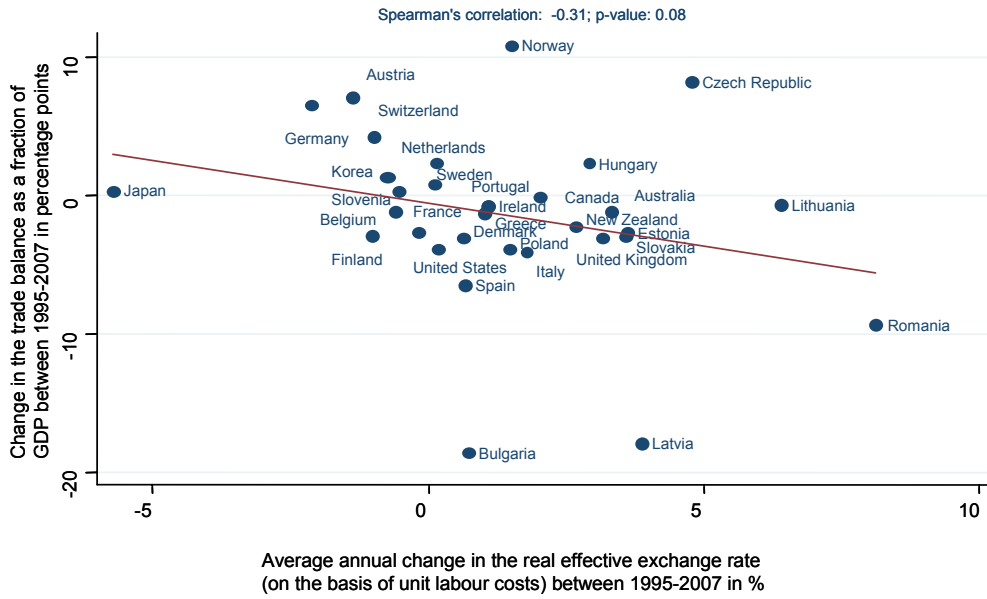


Figure 2: Correlation coefficients between the trade balance and the primary balance variables (based on long differences)

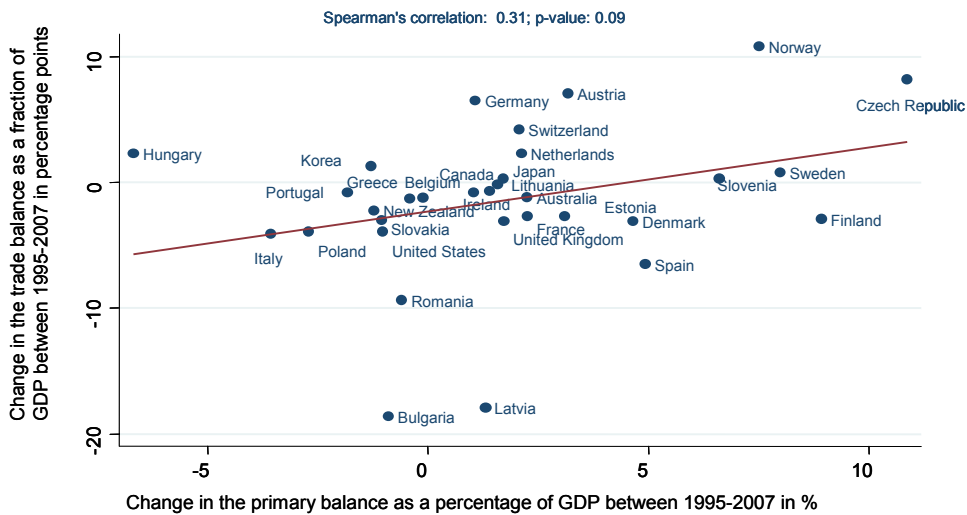


Figure 3: Correlation coefficients between the trade balance and the foreign GDP per capita (based on long differences)

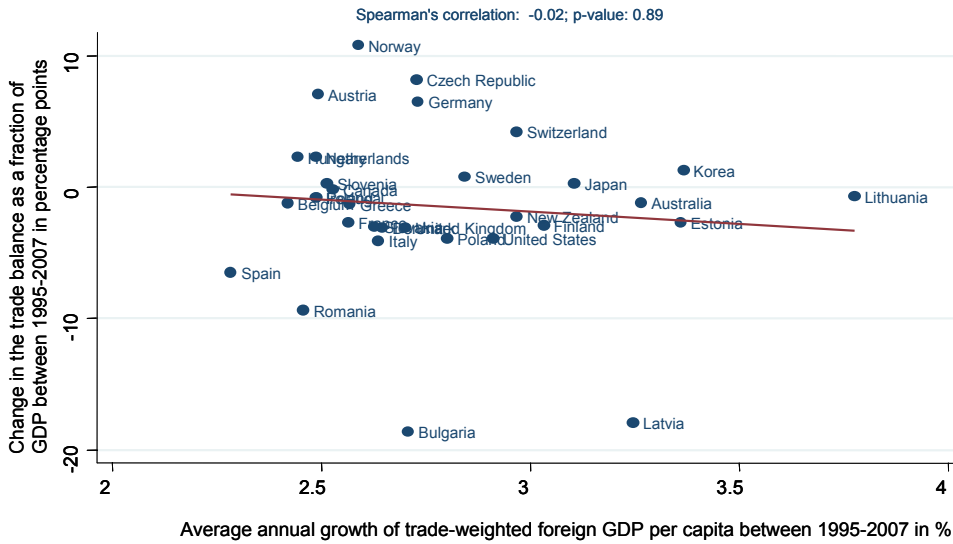
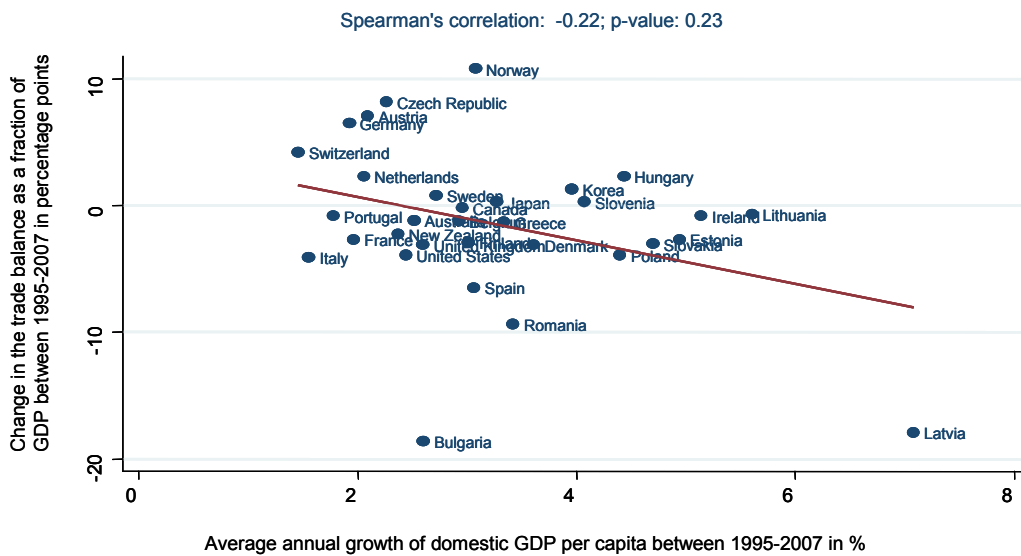


Figure 4: Correlation coefficients between the trade balance and domestic GDP per capita (based on long differences)



*Table 5: Results of the mixed models: best linear country specific predictions of the effects*

	ln REER	ln real foreign GDP	ln real domestic GDP	Primary balance as percent of GDP
Australia	-0.024	0.09	-0.22	-0.167
Austria	-0.208	0.27	-0.02	0.276
Belgium	0.025	0.14	-0.14	0.122
Bulgaria	-0.069	-0.41	-0.46	0.160
Canada	-0.079	0.21	-0.08	0.231
Czech Republic	0.032	0.38	0.05	0.100
Denmark	-0.149	0.10	-0.19	-0.154
Estonia	-0.005	0.26	-0.07	-0.120
Finland	-0.179	0.15	-0.13	0.199
France	-0.057	0.06	-0.24	-0.004
Germany	-0.142	0.22	-0.05	-0.022
Greece	0.108	0.25	-0.06	0.323
Hungary	0.027	0.38	-0.01	0.044
Ireland	-0.220	0.47	0.02	-0.223
Italy	-0.062	0.00	-0.33	0.261
Japan	0.008	0.02	-0.25	0.182
Korea	-0.199	0.23	-0.08	-0.130
Latvia	-0.232	-0.08	-0.24	-0.069
Lithuania	0.044	0.32	-0.03	0.233
Netherlands	0.096	0.22	-0.07	0.021
New Zealand	-0.102	0.07	-0.23	-0.058
Norway	0.280	0.48	0.09	0.904
Poland	-0.136	0.18	-0.13	0.128
Portugal	-0.040	0.11	-0.19	0.150
Romania	-0.051	0.17	-0.17	0.143
Slovakia	-0.005	0.28	-0.07	0.280
Slovenia	-0.023	0.21	-0.09	0.112
Spain	-0.131	0.01	-0.24	-0.360
Sweden	-0.164	0.21	-0.09	0.133
Switzerland	0.016	0.15	-0.16	0.071
United Kingdom	-0.104	0.10	-0.19	0.036
United States	-0.091	-0.01	-0.29	0.206
Total sample means	-0.057	0.165	-0.137	0.094
Countries with a negative trade balance and/or positive net FDI position, means	-0.042	0.177	-0.129	0.072
Remaining countries, means	-0.073	0.153	-0.145	0.116
New EU Member States, means	-0.031	0.169	-0.122	0.098

Notes: The coefficients are the best linear unbiased predictions of the random slopes.