

# External asymmetries in the Euro area and the role of foreign direct investment

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## Abstract

Soon after the introduction of the common currency, a divide emerged between two groups in the Euro area: one comprised of the North-European countries achieving external surpluses and the other of the South-European countries with large external deficits. This paper shows that different patterns of Foreign Direct Investment (FDI) inflows across the Euro area countries contributed to this divergence. Our theoretical framework shows that if the economy is relatively capital-intensive in the production of traded (non-traded) output, FDI will be channeled in greater proportions to the traded (non-traded) sector, thus improving (deteriorating) the trade balance. Focusing on ten Euro area countries over the period 1980-2009, we establish a positive (negative) long-run effect of FDI inflows on the trade balance in the North (South). In the North the positive effect stems from the traded-sector FDI inflows that were significantly higher in comparison to the South, both before and after the EMU. In contrast, in the South the increased FDI inflows in the post-EMU era were dominated by investments in the non-traded sector. When industry-level data are employed, a positive (negative) long-run effect of manufacturing (non-manufacturing) FDI inflows on the trade balance in the North (South) is further established.

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**Keywords:** Euro area, trade balance, Foreign Direct Investment (FDI)

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## **1. Introduction**

Though overshadowed by the ongoing debt crisis, a deeply worrying development in the Euro area since the establishment of the common currency was the continuing divergence of trade balances and current accounts among member states. The issue was never formally considered as an explicit target in the Treaties for setting-up the EMU, perhaps because it was difficult to imagine that external imbalances would diverge so dramatically afterwards. The EMU project was in fact based on the optimistic assumption that - as a result of the monetary unification - increased factor mobility would foster growth and competitiveness across countries, enough to redress any serious imbalances emerging in their current accounts. The problem was addressed in an alarming tone by the European Commission (2009) only after the global crisis in 2008 demonstrated that countries with sizeable current account deficits are more vulnerable to credit and liquidity pressures.

Other studies went further to show that external imbalances may well have been among the reasons that Euro area countries were entangled in their current malaise. In this context, Shelburne (2008) warned that the tightening of global credit may turn a problem of illiquidity into one of insolvency. Krugman (2011) suggested that the crisis in the southern European countries had little to do with fiscal imbalances but mainly with the sudden stoppage of capital inflows required to finance their huge external deficits. Other studies clearly established that EMU countries with large external deficits experienced the highest sovereign spreads (see, e.g., Attinasi et al. (2009), Barrios et al. (2009)). Das et al. (2010) examined in detail the discrepancies between core and peripheral countries in the Euro area and found that structural differences had led to such productivity gaps that made the integration process questionable in the medium run. In a similar tone, Sinn (2012) found that the current account imbalances in the Euro area are so enormous that pose a threat similar to that experienced during the late phase of the Bretton Woods system.

Therefore, a crucial issue is what exactly has caused so large divergences in the external balances of the member-states. In the first years of the EMU, the dominant view was that the external deficits have been a demand-driven phenomenon which was expected to dissipate as soon as integration advances (see Gruber and Kamin (2009)). Blanchard and Giavazzi (2002) argued that increased mobility in capital markets was likely to result in large current account deficits in the short-run. However, they disregarded any explosive pattern in the medium-run and argued that countries such as Portugal and Greece need not to take any measures to reduce their deficits. It was only after external imbalances were aggravated that alternative and more convincing explanations were sought. In this vein, Arghyrou and Chortareas (2008)

suggested that “*other factors beyond income growth may explain the current account positions of Greece, Italy, Portugal and Spain*” and provided evidence that the deviation in competitiveness among the member states was a decisive factor.

The present paper seeks to examine - in theory and empirically - the implications of another factor that has not thus far attracted much attention; namely the different patterns of FDI inflows across Euro area countries. Although relatively small in size if compared to other macroeconomic effects, FDI inflows play a crucial role in shaping the technology advantage and overall capital productivity in the destination country.<sup>1</sup> Hence, if the size and/or the composition of FDI inflows is found to differ across Euro area countries, this might have been a crucial factor in reinforcing productivity gaps and causing further divergence in the external accounts.

All countries but Greece have received higher FDI inflows in the post-EMU era, confirming the expectation that capital flows would be encouraged under EMU (see e.g., Barrell and Pain (1997,1998)). However, country patterns seem to have been sharp different in both the size and composition of FDI inflows. As described in the next section, two groups can be distinguished among the early members of the Euro area, according to whether their external balances have been improved or deteriorated after EMU relative to their pre-EMU levels. As they happen to be geographically grouped as well, these two inner groups are loosely classified as ‘North’ and ‘South’ respectively. Using this convenient taxonomy, it seems that after the introduction of the Euro the North has attracted more FDI inflows in comparison to the South, whereas both before and after this transition it also attracted a higher amount of manufacturing (traded-sector) FDI. In stark contrast, the increased FDI inflows in the South in the post-EMU era were dominated by investments in the non-traded sector. This divergence in the pattern of FDI inflows can be of particular importance, since externalities associated with FDI inflows might differ markedly between the manufacturing and the non-manufacturing sectors (see, e.g., UNCTAD (2001)).<sup>2</sup>

Despite the recent literature on the rising asymmetries within the Euro area, this is the first time – to our best knowledge – that the effect of aggregate and industry-level FDI inflows is quantified as a critical factor for the observed external imbalances. The theoretical analysis is based on a two-sector dynamic model with traded and non-traded goods as developed by Engel and Kletzer (1989), Brock and Turnovsky (1994), and Turnovsky (1996).

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<sup>1</sup>For a survey on the effect of FDI on the host country’s activities, see Lipsey (2002) and Gorg and Greenway (2004).

<sup>2</sup>We discuss the literature of sectoral FDI inflows in the next section where we present evidence for the pattern of FDI inflows within the Euro area.

Two types of economies are considered, according to whether they are relatively capital-intensive in the traded or non-traded sector respectively. We prove that if a country is FDI-intensive in the traded (non-traded) sector, an increase in FDI inflows will increase traded (non-traded) output and improve (deteriorate) the trade balance. Thus, if the economy is relatively capital-intensive in the production of traded (non-traded) output, FDI will be channeled in greater proportions to the traded (non-traded) sector expanding relatively more traded (non-traded) output, and, thus, improving the trade balance. Though our model draws on the existing literature, it employs an alternative formulation on capital installation costs that leads to unique equilibrium and avoids the indeterminacy of other sectoral models.

To test the theoretical predictions of the model, we focus our attention on the two groups of the Euro-area over the period 1980-2009. Our results indicate a positive long-run effect of FDI inflows on the trade balance in the North, while the opposite effect is observed in the South. Consistent with our theory, in the North the positive effect stems from the manufacturing FDI inflows that were higher in comparison to the South, both before and after the introduction of the Euro. In contrast, the negative long-run effect found in the South over the period 1980-2009, seems to be driven by the post-EMU era where FDI inflows increased but were dominated by investments in the non-traded sector. In particular, when industry-level data are employed, a negative long-run effect of non-manufacturing (non-traded) FDI inflows on the trade balance in the South is established. In contrast, in the North both the manufacturing and non-manufacturing FDI inflows appear to improve the external balance.

The rest of the paper is organized as follows. Section 2 discusses the data and presents basic statistics on the evolution of external accounts and FDI inflows within the Euro area. Section 3 presents the theoretical analysis and demonstrates key implications. Section 4 describes the empirical strategy in detail and reports preliminary statistical tests, whereas Section 5 contains the main econometric results. Finally, Section 6 offers some concluding remarks.

## **2. External asymmetries and investment patterns in the Euro area**

In this section we present some evidence for the pattern of external balances and FDI inflows within the Euro area over the last 30 years. Our sample spans over the period 1980-2009 and includes ten Euro area countries, namely Austria, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. Countries that joined the common currency after its launch are excluded so as to avoid mixing the post-EMU period with their own transition

toward it.<sup>3</sup> Moreover, Belgium and Luxemburg are excluded for two reasons. First, separate data for each country exist only after 2002. Second, Belgium and (even more so) Luxemburg have received extremely large amount of FDI inflows, part of which were subsequently channeled to other Euro area countries.

The variables of interest are the net FDI inflows (*FDI*) and the net trade in goods and services (*trade balance*), both scaled by GDP and expressed as percentages.<sup>4</sup> Both variables are obtained from the IMF's database of International Financial Statistics (*IFS*). Explicit definitions, descriptive statistics and sources of the variables employed are provided in Appendix B. Table 1 reports the average *trade balance* for each country of our sample for two sub-periods; namely the pre-EMU period (1980-1998) and the post-EMU period (1999-2009). As can be seen, two groups of the Euro area countries can be considered according to whether their balances have been improved or deteriorated in the post-EMU period.<sup>5</sup> The group characterized as the North includes Austria, Finland, Germany, Ireland and the Netherlands, and exhibits an average improvement of the *trade balance* in the post-EMU period of about 4.37% of GDP. In contrast, the group termed as the South includes France, Greece, Italy, Portugal and Spain, and shows an average deterioration of the *trade balance* of about 0.95% of GDP. It is worth noting that a similar pattern emerges for the current account balances, which improve in the North (with the exception of Ireland) and deteriorate in the South.

**[Table 1 and Figure 1 here]**

Two warnings should be noted about the categorization of the Euro area counties into the two groups. First, the division is adopted only for studying the interactions between external balances and FDI flows, and by no means should it be taken to imply a deep-down division on other fronts of economic activities. For example, after EMU, Greece experienced a real-estate boom weaker than that of Finland, whereas France proved to be a lot more resilient than Ireland after the global crisis in 2008. Second, pooling countries together ignores differences within the group which might be important in other aspects of policy analysis. For example, France and Italy experienced only a mild deterioration in trade balance, while Spain

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<sup>3</sup> Following a decision by the European Council in June 2000, Greece entered EMU in January 2001, two years after its launch but still well ahead of its physical circulation in 1.1.2002.

<sup>4</sup> It is worth noting that the main variable of interest is the *trade balance* and not the current account balance, since the latter includes net factor income from investments which potentially can overshadow the impact of FDI inflows on the real economy.

<sup>5</sup> The fact that Portugal's *trade balance* improved in the post-EMU period is mainly attributed to the fact that, during 1982 and 1983, the trade deficit was above 20% of GDP. If we exclude these observations, the *trade balance* of Portugal deteriorates by 1% of GDP in the post-EMU period.

and Greece saw their external deficits widening beyond control. The small sample, however, does not allow a more detailed pooling.

With these caveats in mind, we now turn our attention in the examination of the FDI inflows, before and after the introduction of the Euro, which are found to display the following features. First, as can be seen in Figure 2, the volume of FDI inflows in the post-EMU period differs significantly between the two groups. Although in the pre-EMU period, both groups were receiving a similar amount of net FDI inflows, the pattern changed abruptly afterwards. Table 2 depicts a substantial increase of FDI inflows in the North of about 4% of GDP during the post-Emu period, while the respective increase in the South is found to be much lower at 1.18% of GDP.

**[Figure 2 and Table 2 here]**

Second, and more importantly, the composition of FDI inflows differs significantly between the two groups. To get an idea for the investment patterns at the industry level, we construct the variables *FDI Manufacturing* and *FDI Real Estate*, both scaled by GDP and expressed as percentages.<sup>6</sup> Both variables are obtained from the OECD Statistics database (online version). In Figure 3 we see that the North has attracted significantly more FDI inflows in the manufacturing sector, both before and after the introduction of the Euro. In contrast, the FDI inflows in the South, especially during the post-EMU period, were dominated by investment in real estate activities.<sup>7</sup> In addition, evidence in Figure 4 suggests that the variable *FDI manufacturing (FDI real estate)* is positively (negatively) correlated with the *trade balance*.<sup>8</sup> This is in accordance with the well-known fact that investing in the manufacturing sector is more likely to improve productivity and raise exports. In that context, vast empirical evidence indicates the positive effect of FDI inflows that are concentrated in the manufacturing sector on productivity and exports (see, e.g., Aitken et al. (1997), Aitken and Harrison (1999), Dimelis and Louri (2002), Chuang and Hsu (2004) and Greenway et al. (2004)). Moreover, Coeurdacier et al. (2009) found a positive effect of the European integration on cross-border mergers and acquisitions in the manufacturing sector, which subsequently played a crucial role in advancing productivity. Regarding the widely discussed ‘Irish model’, Ruane and

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<sup>6</sup> It is worth noting that the variable *FDI Real Estate* includes investment in equipment and other productive investment in the tourism sector. However, due to lack of disaggregated data, we collect them with the real estate.

<sup>7</sup> Due to missing data, in order to employ an equal number of observations for the variables *FDI Manufacturing* and *FDI Real Estate* we had to limit the sample to the years 1991-2009.

<sup>8</sup> It is worth noting that in order to avoid, to the extent possible, small-size distortions, we include in the calculations countries for which at least 10 observations are available.

Gorg (1999) showed that the economy was completely transformed precisely as a result of the massive flow of foreign affiliates in the manufacturing sector. In contrast, investment in real estate augments the demand for imports and is more likely to deteriorate the trade balance. An example in case is Spain, where investments in real estate activities increased sharply in the post-EMU era, representing around 40% of total FDI inflows. Rodriguez and Bustillo (2008) showed that these inflows significantly contributed to the housing bubble and the rising Spanish current account deficit. A similar pattern was observed in other South-European countries, as noted by Xiao et al. (2008).

[Figures 3 and 4 here]

The preliminary evidence presented above indicates that another factor that may have played a role in shaping productivity, and consequently the external position of the economy, is stemming from the different patterns of FDI towards the two groups of the Eurozone.

### 3. A two-sector framework

#### 3.1. The two-sector model

A two-sector small open economy is considered here. One sector produces internationally traded goods ( $Y_T$ ) and is subsequently referred to as the *traded* sector. The other produces non-traded goods ( $Y_N$ ) and is referred to as the *non-traded* sector. The international price of traded goods is taken as unity, and the relative price of non-traded goods is denoted by ( $p$ ), as in Turnovsky (1996). The economy is inhabited by a single infinitely lived representative agent who provides labour inelastically and accumulates two types of capital, traded ( $K$ ) and non-traded ( $H$ ). With continuous-time representation, a dot to indicate time derivatives and subscripts T and N for the traded and non-traded sectors respectively, production functions and accumulation dynamics are given as follows:

$$\text{Traded sector output:} \quad Y_T = A K_T^\alpha H_T^\alpha \quad (1a)$$

$$\text{Non-traded output:} \quad Y_N = B K_N^\beta H_N^\beta \quad (1b)$$

$$\text{Total output:} \quad Y = Y_T + Y_N \quad (2a)$$

$$\text{Total consumption:} \quad C = C_T + C_N \quad (2b)$$

$$\text{Net exports:} \quad X = Y_T - C_T - I \quad (3a)$$

$$\text{Current account:} \quad \dot{B} = X - Y_T - C_T \quad (3b)$$

$$\text{Traded capital stock:} \quad K = K_T + K_N \quad (4a)$$

$$\text{Capital accumulation:} \quad \dot{K} = -\delta K + I = -\delta K + Y_T - C_T - X \quad (4b)$$

$$\text{Non-traded capital stock:} \quad H = H_T + H_N \quad (5a)$$

$$\text{Capital accumulation:} \quad \dot{H} = I_H - \varepsilon H \quad (5b)$$

$$\text{Installation costs:} \quad \psi(I) \equiv \sigma I^2 \quad (6)$$

The first two equations (1a, 1b) are homogeneous Cobb-Douglas production functions for the traded and non-traded sector, with constant returns to scale, traded-capital intensities  $0 < \alpha, \beta < 1$ , and exogenous technologies  $A, B > 0$ , respectively. For simplicity, there is no role for government, and labour is fixed in each sector and thus not included as a separate factor of production. However, such extensions can be included as in Brock (1988) without fundamentally affecting any of the conclusions. Equations (2a) and (2b) denote the decomposition of output and consumption, respectively. Equation (3a) denotes net exports of internationally traded goods, whereas (3b) the dynamics of bonds ( $B$ ) held abroad at an exogenous world interest rate ( $r$ ).

Equations (4a, 4b) express the decomposition and accumulation of the traded capital stock, whereas (5a, 5b) show those for the non-traded capital, with  $\delta$  and  $\varepsilon$  denoting the respective depreciation rates. Savings in each sector are assumed to be invested in the same type of capital stock, and this may lead to rental prices of each factor ( $R_K, R_H$ ) to differ. However, perfect mobility is assumed for each type of capital between traded and non-traded sectors, so that marginal revenues are equalized as analyzed in Appendix A.

In the above model, FDI is represented by the exogenous variable ( $I$ ), whereas function (6) represents the cost of installation that is assumed to incur only in terms of non-traded capital, as suggested by Brock (1988). This is in agreement with the fact that the real-estate boom and the sharp rise in housing prices over the last decade have adversely affected investment in the traded sector. No installation costs are assumed for non-traded investment.

### 3.2 Solving the model

Despite the complications arising from the large number of variables and dynamic equations, sectoral outputs are neatly derived as in Turnovsky (1996) to be:



$$Y = \alpha K^{\alpha} L^{1-\alpha} \quad (7a)$$

$$Y = \alpha K^{\alpha} L^{1-\alpha} \quad (7b)$$

Based on these expressions, it is easy to examine how output composition is affected by changes in the traded or non-traded capital stock. If  $\alpha > \beta$ , the traded sector is more intensive in traded capital, and an increase in the latter shifts production in favor of traded goods. If  $\alpha < \beta$ , the non-traded sector is relatively more intensive in internationally traded capital stock and an increase in FDI augments non-traded output. This is the well-known ‘Rybczynski effect’ according to which an increase in a factor of production shifts the composition of output in favor of the sector that is relatively intensive in that factor (see Rybczynski (1955)). Appealing to this effect, we categorize the Euro area economies according to the relative intensity of traded capital as explained below:

Typically one expects the traded sector to be capital-intensive (i.e.  $\alpha > \beta$ ), but in practice certain conditions such as congestion in the production of traded goods might lead to situations in which  $\alpha < \beta$ . According to Barro and Sala-i-Martin (1995), if non-traded capital is a scarce factor (such as industrial land) it may be quickly congested by the installation of manufacturing capital. To reflect congestion effects, production function (1a) is reformulated as:

$$Y = \alpha K^{\alpha} L^{1-\alpha} \quad (8)$$

where  $x$  is a congestion parameter. When this is strong enough so that  $x > \omega - \beta$ , we get  $\alpha = \omega - x < \beta$ . Such differentiation might exist among the Euro area countries due – for example - to the different extent and depth of structural reforms and regulations that affect capital productivity and FDI patterns. By comparing the quality of the regulatory environment as measured by the Worldwide Governance Indicators of the World Bank as a proxy for the facilitation of FDI installation in the traded sector, such a duality is clearly emerging between the two groups. As shown in Figure 5, the southern countries demonstrate an inferior quality regulation relative to the northern members.

[Figure 5 here]

Distinguishing according to whether  $\alpha > \beta$  or  $\alpha < \beta$ , the model is then solved to maximize a discounted utility function with a weighted average of traded and non-traded goods. Investment is finally derived as a function of the price of non-traded goods ( $p$ ) and the price of installed traded capital ( $Q$ ). To examine the changes incurred in investment behavior in the post-EMU era, the implementation of EMU is modeled here as a permanent reduction in real interest rates ( $r$ ).<sup>9</sup> As described in Appendix A, the transition to a new equilibrium is fundamentally different across economies that are intensive in traded or non-traded capital, and it is precisely this mechanism that differentiates the response of external balances in the two Euro area groups.

### 3.3. Stylized facts

A number of stylized facts regarding the effects of FDI on relative prices, asset prices, and the external balance are derived as follows:

**Proposition 1:** A permanent change in interest rate causes non-traded sector prices ( $p$ ) to diverge between countries that are FDI-intensive in the traded or in the non-traded sector respectively, thus causing a productivity gap between the two groups. Moreover, prices are gradually adjusted in the former group and more quickly in the latter.

*Proof:* The transition paths of relative prices after a permanent reduction in the real interest rate are derived in Appendix A and depicted in Figures 6a and 6b for the two types of economies. In the North, the price of traded capital ( $Q$ ) immediately ‘jumps’ to a higher level, whence it further rises to the new equilibrium ( $E_1$ ). The price of non-traded goods ( $p$ ) is only gradually falling without an initial jump. A different pattern emerges in the South, where both prices of traded and non-traded capital rise and immediately adjust to the new equilibrium ( $E_2$ ).

**[Figure 6a, 6b here]**

This asymmetry has two implications: First, a productivity gap in favour of the North emerges by the accumulated inflation differentials, as shown in Figure 7a. Second, the speed of price adjustment is higher in the South and only gradual in the North.

*Evidence:* Actual inflation rates in the two groups are displayed in Figure 7b. In the beginning of EMU they were at similar levels, but subsequently diverged sharply. In the

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<sup>9</sup> This is an assumption valid until 2008, as the relaxation of monetary policy in the aftermath of the global recession has temporarily resulted in negative real interest rates.

southern countries, inflation during 2002-2007 exceeded that of the northern ones by one percentage point on average, thus undercutting competitiveness and deteriorating trade balances in the countries involved. Regarding the speed of adjustment, it is evident that the rise of inflation in the southern group was imminent, while the deceleration of prices in the northern countries took place more gradually.

[Figure 7a, 7b here]

**Proposition 2:** In the face of a permanent reduction in the interest rate, asset prices of installed traded capital stock rise in both types of economies.

*Proof:* As shown in Figure 6a, for the first type of the economy, asset prices initially peak and then converge gradually to a new steady state. For an economy with  $\alpha < \beta$ , Figure 6b shows that asset prices move immediately to the new equilibrium without further rise. Total change is likely to be lower in the latter case.

*Evidence:* Asset prices are approximated by the quarterly Stock Exchange indices of the Euro area countries. For comparison they are normalized at the same base in the first month of 1998, one year before the start of the EMU. Figure 8 shows that, in the first years after the introduction of the Euro, asset prices have risen in both groups, confirming the Proposition. Though both declined in the aftermath of the *dot.com* bubble, the northern index remained consistently higher than that of the South.

[Figure 8 here]

**Proposition 3:** Total FDI flows are expected to be higher in an economy in which the traded-sector is relatively more intensive in traded capital.

*Proof:* Dividing the optimal investment rules as in (A6) for the North and South groups respectively, we obtain the ratio:

$$\frac{I_N^N}{I_N^S} = \frac{\sigma_N \beta_N}{\sigma_S \beta_S} \frac{1 + \beta_N}{1 + \beta_S} \frac{1 + \beta_S}{1 + \beta_N} \frac{1 + \beta_N}{1 + \beta_S} \quad (9)$$

To facilitate comparisons, superscripts N and S are used to indicate the two groups.

*Evidence:* All terms in the r.h.s. exceed unity – the first because installation of FDI is more costly in the South (i.e. a higher  $\sigma$ ) due to less efficient market regulation as discussed earlier and shown in Figure 5. The second term exceeds unity by virtue of Proposition 1 and

the third according to Proposition 2. Total FDI inflows were indeed higher in the northern group, as shown in Figure 2.

**Proposition 4:** After a permanent fall in real interest rates, the proportion of productive foreign investment to the total stock of FDI rises in economies with  $\alpha > \beta$ , while it shrinks in economies with  $\alpha < \beta$ .

*Proof:* A detailed proof is given in Appendix A.

*Evidence:* Figure 3 shows that manufacturing FDI is higher in the North before 1999, and then increased even further by 0.21% of GDP per annum on average during the post-EMU period. In contrast, in the South the already low amount of manufacturing FDI fell even further by 0.05% of GDP after the introduction of the Euro. As FDI inflows in the South were routed mainly to the non-traded sector, this reduction results in the proportion of productive investment falling significantly.

**Proposition 5:** If the traded (non-traded) sector is relatively intensive in traded capital, then FDI inflows are positively (negatively) correlated with trade balances.

*Proof:* Since foreign investment is treated as a rise in the stock of traded capital, the following implications for the two cases are immediately derived by recalling (7a, 7b):

(i) If the economy is relatively capital-intensive in the production of traded output, FDI will be directed in greater proportions to the traded sector. In this case, traded output expands relatively more than non-traded, thus improving the trade balance.

(ii) If the economy is relatively capital-intensive in the non-traded sector, then most of the internationally traded FDI will be attracted by the non-traded sector, and production will shift towards non-traded goods. As a result, the trade balance deteriorates, as shown in Figure 9.

*Evidence:* Figure 1 provides clear evidence of the divergence between the two groups.

#### **4. Econometric analysis**

In this section we examine empirically the effect of FDI inflows on the trade balance for the two groups of the Euro area over the period 1980-2009. The empirical approaches applied to estimate the external account determinants have differed substantially across studies (see, e.g., Chinn and Prasad (2003), Arghyrou and Chortareas (2008) and Schmitz and Von Hagen (2011)). Judging from the large selection of methods, particular caution seems to be warranted in specifying an appropriate model. Hence, before proceeding to the estimation, a

variety of specification tests is essential to be performed as proposed by modern econometric analysis.

#### 4.1. Cointegration

Previous to the cointegration analysis, the Carrion-i-Silvestre *et al.* (2005) panel stationarity test pointed at the non-stationarity of the variables *FDI* and *trade balance*.<sup>10</sup> Our next step involves testing for the existence of a long-run relationship using quarterly data from 1980:Q1 to 2009:Q4. We apply the Kao's (1999) panel cointegration test, which is in the same spirit of the Engle and Granger (1987) residual-based test and imposes homogeneity of the panel units. Based on the results in Table 3, the null hypothesis of no cointegration is rejected for both country groups. Therefore, we have strong indications that the variables *trade balance* and *FDI* are cointegrated.

[Table 3 here]

As already mentioned in Section 2, the construction of the two country groups should not be taken as a deep-down division on all fronts of economic activities. It must be further stressed that pooling countries together ignores the possibility that the empirical findings obtained for each group can be driven by one or two countries rather than applying to the group as a whole. Moreover, since structural breaks are statistically identified for some countries, we undertake country-by-country cointegrating analysis by implementing the Gregory and Hansen (1996) residual-based test. The test assumes the null hypothesis of no cointegration against the alternative hypothesis of cointegration with one structural break. In particular, Gregory and Hansen (1996) proposed three model specifications of structural change: (i) level shift; (ii) level shift with trend; (iii) regime shift, where intercept and slope coefficients change. The test for each model specification is computed based on a modified version of the cointegration test of Engle and Granger (1987), as well as the modified  $Z_a$  and  $Z_t$  tests of Phillips and Ouliaris (1990). In our study, breaks for the three model specifications are chosen based on the  $Z_t$  test statistic because it is the best in terms of size and power as suggested by Gregory and Hansen (1996).

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<sup>10</sup> The Carrion-i-Silvestre *et al.* (2005) test is a generalization of Hadri's (2000) panel stationarity test, which in addition allows each panel unit to have a different number of breaks based on the method proposed by Bai and Perron (1998). Our findings hold whether or not we allow for the presence of structural breaks, and whether or not we assume homogeneity or heterogeneity in the long-run variance. These results have been omitted but are available from the authors upon request.

Results are reported in Table 4. For the models with a level shift and a regime shift the null hypothesis of no cointegration is rejected at the 5% level or below for all countries but Germany.<sup>11</sup> Only if a trend is included in the level shift, the hypothesis of no cointegration is rejected for all countries of our sample. Upon closer examination of the variables *FDI* and *trade balance* for the case of Germany, it seems that *FDI* peaked in 2000 and levelled afterwards, while the *trade balance* started improving with a lag and not simultaneously with investment flows. Trade surpluses started to systematically accumulate only after 2002 when a plan of fiscal consolidation was put in motion in conjunction with a reform program aiming at boosting productivity and suppressing real wages. These policies, branded as ‘Agenda 2010’, seem to have sped up the effect of FDI on trade balance; for a discussion see Rattner (2011) and Bernanke (2015) among many others. The systematic improvement is captured by a trend shift, and this is the reason that a long lasting relationship between *trade balance* and *FDI* is established in this case.<sup>12</sup>

**[Table 4 here]**

Overall, we find strong evidence that the variables *trade balance* and *FDI* are cointegrated even in the presence of a structural change. Furthermore, as expected, the majority of the identified break points are located in years very close to the introduction of the euro in 1999.

#### 4.2. Model specification

Since we find strong evidence of cointegration, we proceed to estimate the long-run relationship between the variables *trade balance* and *FDI* using the Pooled Mean Group (PMG) estimator as proposed by Pesaran et al. (1999). Our approach can be summarized as a panel error-correction model, where short- and long-run effects are estimated jointly from a general autoregressive distributed-lag (ARDL) model. Short-run coefficients, the speed of adjustment and error variances are allowed to vary across countries, while the long-run coefficients are constrained to be the same.

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<sup>11</sup> As can be seen in Table 4, Greece is not included in the estimations since we cannot perform the cointegration test due to a gap in the data in year 1998. Regarding the case of Germany, it is worth noting that in the next section where we apply panel cointegration techniques, our results remain unaffected when Germany is dropped from the estimations.

<sup>12</sup> It is worth noting that when a trend is added in the model with the regime shift, once again, we reject the null of no cointegration for the case of Germany.

A fairly general dynamic specification is represented by an auto-regressive distributed lag model  $ARDL(p_i, q_i)$  of order  $p_i$  and  $q_i$  that takes the form<sup>13</sup>:

$$TRADE_{it} = \sum_{j=1}^{p_i} \lambda_{ij} TRADE_{it-j} + \sum_{j=0}^{q_i} \delta_{ij} FDI_{it-j} + \mu_i + \varepsilon_{it} \quad (10)$$

Reparametrising and stacking time series observations, the PMG specification is rewritten in error-correction form as:

$$\Delta TRADE_{it} = \phi_i (TRADE_{it-1} + \frac{\beta_i}{\phi_i} FDI_{it}) + \sum_{j=1}^{p_i-1} \lambda_{ij}^* \Delta TRADE_{it-j} + \sum_{j=0}^{q_i} \delta_{ij}^* \Delta FDI_{it-j} + \mu_i + \varepsilon_{it} \quad (11)$$

where it is set:

$$\phi_i = -(1 - \sum_{j=1}^{p_i} \lambda_{ij}), \beta_i = \sum_{j=0}^{q_i} \delta_{ij}, \lambda_{ij}^* = -\sum_{k=j+1}^{p_i} \lambda_{ik}, \delta_{ij}^* = -\sum_{k=j+1}^{q_i} \delta_{ik}$$

For a long-run relationship to exist,  $\phi_i$  has to be significantly different from zero. Additionally, when the  $ARDL(p_i, q_i)$  is stable,  $\phi_i$  is expected to be negative and less than one in absolute value. The long-run relationship is defined by:

$$TRADE = -\frac{\beta_i}{\phi_i} FDI_{it} + \eta_{it} \quad (12)$$

where  $\eta_{it}$  is a stationary process. In the steady state, *trade balance* and *FDI* are tied together with a long-run coefficient of  $\Theta_i = -\beta_i / \phi_i$ . Moreover, the parameter  $\delta_{ij}^*$  is the short-run coefficient relating *FDI* inflows to the *trade balance*.

The PMG estimator is an intermediate solution between the Dynamic Fixed Effects estimator (DFE) and the Mean Group estimator (MG). The DFE model assumes slope homogeneity and intercept heterogeneity, while the MG estimator of Peasran and Smith (1995) averages heterogeneous slopes and intercepts across panel units. One advantage of the PMG estimator over the DFE estimator is that it allows for the short-run dynamics to differ across countries. Moreover, the PMG estimator has the advantage over the MG estimator in

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<sup>13</sup> Notation of variables and parameters in the econometric specifications should not be confused with those used in the theoretical model of Section 3.

that it performs well even when the number of cross sections is small. Hsiao et al. (1998) showed that, if at least one dimension of the panel is small, the MG - although consistent - is not a good estimator. Furthermore, being an unweighted average, the MG estimator, unlike the PMG estimator, is very sensitive to the inclusion of outliers in small samples. This can be problematic, since the variable *FDI* in many instances, and especially during the post-EMU era, takes extreme values.

An additional advantage of the ARDL model is that it yields consistent estimates of the long-run parameters, regardless of whether the underlying regressors are stationary, non-stationary or mutually cointegrated (see Pesaran and Shin (1999)). In other words, this procedure allows inferences to be made in the absence of any a priori information about the order of integration of the series under investigation. This property of the ARDL model can be extremely useful in our case for two reasons. First, given the low power of the panel unit root tests, it is difficult to draw safe inferences for the statistical properties of our data. Second, in the next section, we intend to apply alternative empirical specifications in order to make safe inferences about the *trade balance-FDI* nexus. More specifically, although in our main specification we employ quarterly data, we start the empirical analysis using annual data since information about industry-level FDI inflows are not available on a higher frequency.<sup>14</sup> Moreover, we check the robustness of our results applying an extended set of control variables in equation (11). Finally, we split the sample into the sub-periods 1980-1998 and 1999-2009 in order to identify if the different investment patterns between the two groups of countries after the introduction of the euro are reflected in the parameter estimates.

## 5. Estimation results

We start our analysis by estimating equation (11), for northern and southern European countries in Tables 5 and 6, respectively, using annual data that refer to the period of 1980-2009. Considering the gains in consistency and efficiency, we emphasize the results obtained with the PMG estimator. However, to facilitate comparison, we start our regression analysis with the DFE and the MG estimators. When the emphasis is given in the long-run parameters, as in our case, the lag order of the ARDL model can be selected using some consistent information criteria on a country-by-country basis (see Loayza and Ranciere (2006)). Hence, for the PMG and the MG estimators we choose the lag length for each individual country in

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<sup>14</sup> It is worth noting that when we repeat the specification tests conducted in Table 3 using annual data, results (available upon request) are qualitatively similar to those obtained with quarterly data. We do not re-run the Gregory and Hansen (1996) cointegration test using annual data since the time span does not provide a reasonable number of observations for cointegration analysis to be meaningful at the country level.



the panel by means of the Akaike information criterion (AIC). It is worth noting that in order to avoid computational difficulties and preserve degrees of freedom, while allowing for reasonably rich dynamics, we impose a maximum lag length of 2.<sup>15</sup> For the DFE method, which imposes the same lag structure on all countries across the panel, we set the number of lags equal to 2. For brevity, given that our attention is concentrated on the long-run effect of FDI inflows, we report only the estimates of the long-run parameters in Tables 5 and 6.<sup>16</sup>

For the existence of a long-run relationship (dynamic stability), the coefficient of the error-correction term should be negative and within the unit circle. As can be seen in Tables 5 and 6, the error correction term in all regressions is significantly negative and falls within the dynamically stable range, indicating the presence of a long-run relationship. However, it is apparent that the speed estimates are found to be higher (in absolute terms) in the southern group than in the northern one. The finding is very robust and applies across all full-period estimations based on either annual or quarterly data; there is only an exception with the PMG specification for the pre-EMU period 1980-1998. The difference in the speed of adjustment is fully in line with Proposition 1 in Section 3, according to which prices respond to shocks much quicker when the economy is characterized by relative investment intensity in the non-traded sector.

Regarding the long-run coefficient of the variable *FDI*, consistent with our theoretical predictions, results in columns (1) to (3) of Table 5 (6) indicate a positive (negative) effect on the *trade balance* in northern (southern) European countries.<sup>17</sup> To test the assumption of the long-run homogeneity restriction- and hence the suitability of the PMG estimator- we employ a standard Hausman-type statistic. According to the Hausman test, when comparing the MG and PMG estimates in columns (2) and (3) of Tables 5 and 6, the null hypothesis of long-run homogeneity of coefficients cannot be rejected.<sup>18</sup>

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<sup>15</sup> Alternatively, we impose a uniform two-lag structure for all countries and variables entering the model, in order to mitigate concerns about reverse causality running from the dependent variable (*trade balance*) to the independent variable (*FDI*) (see, e.g., Catao and Solomou (2005), and Catao and Terrones (2005)). Results (available upon request) remain very similar to those depicted in Tables 5 and 6.

<sup>16</sup> The full set of results is available upon request.

<sup>17</sup> We get some indications that FDI inflows deteriorate the trade balance in the short-run in northern European countries. One explanation might be that FDI inflows in northern European countries, which are concentrated to a great extent in the productive sector, required imported inputs and products from the home country, as suggested by Head and Ries (2001). These imported intermediate and capital goods may deteriorate trade balance at destination in the short-run, and improve the host country's trade balance in the long-run (see Fontagne (1999)).

<sup>18</sup> The Hausman test statistic is 0.96 (2.63), with a p-value of 0.33 (0.15), for the case of northern (southern) European countries. It is worth noting that for the rest of the specifications the joint Hausman test statistic is indeterminate as the difference between the variance-covariance matrices of the MG and PMG estimators is not positive definite. However, in some cases that we derive estimates for the individual Hausman test statistic, results for the main variable of interest, namely *FDI*, do not reject the homogeneity restriction. Moreover, it should be noted that some standard tests on the functional form are performed, indicating that the models are correctly specified. Results are available upon request.

### [Tables 5 and 6 here]

As a next step, we attempt to disentangle the effect of FDI inflows at the industry level on trade balance. For this reason, we employ in our analysis the variables *FDI manufacturing* and *FDI non-manufacturing* for investments that occurred in the manufacturing and the non-manufacturing sectors, respectively. Unfortunately, data availability did not allow us to extend a similar empirical analysis in the real-estate sector. The results of this specification can be found in column (4) of Tables 5 and 6. As can be seen, the long-run coefficient of the variable *FDI manufacturing* is positively and significantly related to the *trade balance* in the case of the North. Interestingly enough, for the South the effect is statistically insignificant. This result can be attributed to the fact that southern European countries have attracted a small amount of FDI inflows in the manufacturing sector, during both the pre- and post-EMU eras, leading to a neutral long-run effect on trade balances.

Regarding the long-run coefficient of the variable *FDI non-manufacturing*, results reveal a positive (negative) effect on the *trade balance* in northern (southern) European countries. This suggests the existence of synergies between manufacturing and non-manufacturing FDI in the North, which is clearly absent in the case of the South. This result is consistent with the well-documented evidence in the literature according to which increased foreign entry in the service sector (e.g., energy, telecommunications and transport) can display substantial positive effects in the productivity of the manufacturing sector (see, e.g., Arnold et al. (2011, 2015) and Fernandes and Paunov (2012)). In other words, a substantial part of investment in the non-traded sector in the northern group was in effect complementary to the traded sector, thus exerting a positive effect on productivity and leading to improvements of the trade balance in the long-run. On the contrary, the non-manufacturing sector in the South was dominated by investments in real-estate activities causing the trade balance to deteriorate. These results are in line with those obtained for the variable *FDI*. Consistent with our theory, the variable *FDI* depicts that northern (southern) European countries have attracted more FDI inflows in the traded (non-traded) sector causing an increase in their traded (non-traded) outputs and in turn an improvement (deterioration) of their trade balances in the long-run.

Moving one step forward, we introduce in our basic specification in equation (11) two additional control variables that are considered as important determinants of the trade balance.<sup>19</sup> In particular, we add the real effective exchange rate index (*REER*), as

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<sup>19</sup> It is worth noting that due to lack of degrees of freedom, we cannot add control variables in the specification of column (4).

international competitiveness is expected to be an important determinant of the diverging external accounts between the two groups of countries (see, e.g., Pain and van Welsum (2003), Lee and Chinn (2006) and Arghyrou and Chortareas (2008)).<sup>20</sup> In addition, the real annual percentage change of GDP (*growth*) is added in the specification to account for the fact that increased economic activity is likely to lead to a deterioration of the external balance (see, e.g., Gandolfo (2004) and Abel and Bernanke (2005)). Both variables are obtained from the *IFS* database. As can be seen in column (5) of Tables 5 and 6, the long-run coefficients of both variables are negative and statistically significant, which is in accordance with our theoretical priors. Although the variable *REER* is affected by changes in productivity caused by the FDI inflows, relative prices are neither solely nor immediately determined by this factor. In fact, it seems that variables *FDI* and *REER* act complementarily in our estimated equation. In particular, the significance of the variable *FDI* remains unaffected in both country groups.

As a next step we attempt to expand the set of control variables used in equation (11) even further. In order to deal with the degrees of freedom problem that arises from the inclusion of additional control variables we are constrained to move to a specification with quarterly data.<sup>21</sup> Regarding the additional control variables, we first inquire the possibility that our results for the *FDI* variable are affected by the reduction in real interest rates that occurred in the post-EMU period and led to an expansion in credit finance. This credit expansion can be a significant determinant of the *trade balance*, especially in southern European countries. To construct the series of real interest rate variable (*RIR*) data are obtained from the *IFS* database.<sup>22</sup> A similar argument can be made for fiscal policy. In particular, southern European countries expanded their public spending in the post-EMU period, on average, at a higher rate in comparison to northern European countries. This factor could have contributed further to the divergence of trade balances between the two country groups. For this reason, we add in the specification government consumption spending

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<sup>20</sup> An increase in *REER* index for each country indicates deterioration of competitiveness and vice versa.

<sup>21</sup> When we apply quarterly data in the specification of column (5), qualitative results (available upon request) for both country groups remain unaffected.

<sup>22</sup> We preferred the long-term interest rate instead of the short-run interest rate for two reasons. First, because the quarterly data of the latter variable have many gaps within years, a factor that creates computational difficulties in the maximization algorithm. Second, for some countries of our sample the quarterly data of the variable short-run interest rate has only been back dated until 1995, which makes difficult the computation of the results when we split our sample into two sub-periods, 1980-1998 and 1999-2009. However, it is worth noting that when we employ the real short-term interest rates in the estimations, although our sample is significantly reduced, our results for the variable *FDI* remain unaffected.

(*government consumption*) as a percentage of GDP, as obtained from the OECD Statistics database (online version).<sup>23</sup>

Hence, in columns (6) to (8) of Tables 5 and 6 we rerun equation (11) employing quarterly data for the full set of control variables. To facilitate comparison we employ the DFE and the MG estimators along with the PMG estimator. As can be seen in Table 5, once again results indicate a positive effect of the variable *FDI* on *trade balance*. For the southern European countries, we observe in column (8) of Table 6 that according to the PMG estimator, the variable *FDI* is negative and statistically significant. The coefficient obtained with the MG estimator in column (7) is larger in absolute value but less precisely estimated. Given that the PMG and the MG estimates are fairly close, considering the consistency and efficiency of the PMG estimator, we conclude - once again - that the FDI inflows in southern European countries have caused a deterioration of the trade balance in the long-run.<sup>24</sup> Concerning the magnitude of the long-run effect of the variable *FDI*, an increase of 1% in the share of FDI inflows over GDP is expected to improve (deteriorate) the trade balance in the North (South) by +0.093% (-0.203%). Given that the average trade balance in the North (South) is +4% (-3.41%), it is clear that FDI inflows is an important determinant of the diverging external accounts.

In column (9) of Table 5 (6) we rerun the specification of column (8) after restricting only the long-run coefficients of the variables *FDI* and *REER* (*FDI*, *REER* and *RIR*) to be common across countries. This is because in columns (7) and (8) the MG and PMG estimates deviate quite significantly for the rest of the controls, indicating that the MG estimator is more suitable to capture their long-run dynamics.<sup>25</sup> As can be seen in column (9) of Table 5(6), the positive (negative) long-run effect of the variable *FDI* remains unaffected. Although the magnitude of the long-run effect of FDI deteriorate in both groups, it still is qualitatively sizeable- namely 0.059% in the North and -0.168% in the South. Moreover, the long-run coefficient of the variable *REER* is negative and statistically significant for both groups. Furthermore, the long-run coefficients of the variables *growth* and *RIR* are correctly signed in

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<sup>23</sup> Due to the transition from the System of National Accounts 1968 (SNA68) to the System of National Accounts 1993 (SNA93), which introduced new concepts and methodology for the estimation of public capital stock, data for total public spending on an annual basis has only been back-dated until 1995 for the majority of the countries in our sample. Moreover, data availability for total public spending on a quarterly basis is even more limited. It is worth noting that for observations where variables total government expenditures and *government consumption* overlap, correlation reaches 80%, whereas after 1999 is close to 85%, ensuring that the development of the public sector in European countries is captured efficiently.

<sup>24</sup> Although we cannot derive the individual Hausman test, the small difference between the MG and PMG estimates is a clear indication towards the direction of accepting long-run homogeneity of coefficients. Safe inferences from comparing PMG and DFE estimates is hard to draw but, nevertheless, it is worth recalling that the short-run homogeneity imposed by the latter method can lead to less precise identification of the long-run parameters.

<sup>25</sup> Unfortunately, we cannot derive the individual Hausman tests for each variable in this specification.

both groups but statistically significant only for the ‘South’. Finally, the variable *government consumption* is correctly signed but statistically insignificant.

The final step in our empirical analysis is to check the *trade balance-FDI* nexus in the pre-EMU and the post-EMU eras, by splitting the sample into the 1980-1998 and the 1999-2009 sub-periods. For results to be consistent with those in column (9) of Table 5 (6), long-run homogeneity is imposed only for the variables *FDI* and *REER* (*FDI*, *REER* and *RIR*).<sup>26</sup> As can be seen in columns (10) and (11) of Table 5, the long-run coefficient of the variable *FDI* is positive and statistically significant in both the pre-EMU and the post-EMU eras. The consistent positive effect obtained in both sub-periods stems from the fact that northern European countries attracted a significant amount of manufacturing FDI inflows both before and after EMU (see Figure 3). The fact that the coefficient obtained in the pre-EMU era is higher can be attributed to the significant increase of FDI inflows in the post-EMU era. With respect to southern European countries, in Table 6, we observe that the long-run coefficient of variable *FDI* is negative and statistically significant only in the post-EMU era. Given that the post-EMU increase in FDI inflows towards southern European countries was dominated by investments in the non-traded sector, this finding is in agreement with the predictions of the theoretical model in Section 3. Concerning the rest of the control variables, the most consistent effect is observed for the variable *government consumption*, which seems to cause deterioration in the trade balance in both groups during the post-EMU era.

To sum up, the results in all specifications of Table 5 indicate that FDI inflows have caused an improvement of the trade balance in northern European countries. Regarding the South, results in Table 6 reveal a negative effect of the variable *FDI* on *trade balance*, which, however, seems to be driven by the post-EMU era. Hence, in addition to other important factors that contributed to the divergence of external accounts between the two groups, the role of FDI inflows should not be overlooked. According to our estimates, an increase by 1% on average in the FDI inflows in the post-EMU era caused a divergence in the trade balance of the two groups by 0.17% of GDP; see column (11) of Tables 5 and 6. Of course, the magnitude of this effect is significantly higher if we take into account the real changes of FDI inflows in the post-EMU era, and the fact that external accounts deviated even during the pre-EMU era because the North attracted a higher amount of manufacturing FDI.

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<sup>26</sup> It is worth noting, however, that when we impose long-run homogeneity for the whole set of control variables, our results for the variable *FDI* (available upon request) remain unaffected.

## 6. Conclusions

Although after the introduction of the Euro almost all member-states have attracted substantial FDI inflows, their size and composition seems to differentiate significantly between the country groups of the North and the South. This paper suggests that different patterns of FDI inflows across Euro area countries, have contributed in the productivity gaps and the observed trade imbalances among the member states of the Euro area.

First, we develop a theoretical framework predicting that if the traded (non-traded) sector is relatively intensive in traded capital, then FDI inflows are positively (negatively) correlated with trade balances. More specifically, if the economy is relatively capital-intensive in the production of traded (non-traded) output, FDI will be channelled in greater proportions to the traded (non-traded) sector expanding relatively more traded (non-traded) output thus improving the trade balance. Our empirical results for a sample of ten Euro area countries over the period 1980-2009 support the theoretical predictions. More specifically, a positive long-run effect of FDI inflows on trade balance is depicted for the North, while the opposite holds for the South. The positive effect in the North stems from the fact that it attracted a significant amount of manufacturing FDI inflows both before and after the EMU era. In contrast, the South has attracted FDI inflows that - in comparison to the North - were fewer and mostly in the non-traded sector. When industry-level data are employed, a negative long-run effect of non-manufacturing (non-traded) FDI inflows on the trade balance in the South is established. In contrast, in the North both the manufacturing and non-manufacturing FDI inflows appear to improve the external balance. This suggests the existence of synergies between manufacturing and non-manufacturing FDI in the North, which is clearly absent in the case of the South.

Backed by strong empirical results, we contend that disparities in external accounts and productivity gaps seem, overall, to be closely related to the differences in the investment pattern observed between the two groups of the Euro area. This can provide a useful lesson in order to avoid the repetition of major external imbalances in the future. Another lesson concerns new or perspective member states in that they should not be solely interested in attracting FDI inflows, but they should also care about their type and quality so as to maximize value added and improve competitiveness.

Future research can expand the present analysis in two ways: first, by including the nine most recent members of the Euro area, and, second, by applying the two-sector framework on countries outside the Euro area that are characterized by different patterns of external balances. The obvious example is to compare a group of surplus economies, such as the

Nordic group of Norway, Sweden and Denmark, with an economy with external deficits, such as the UK, and test if differences can be explained by the patterns of FDI.

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## Appendix A: Solving the two-sector model

The rates of returns are obtained as in Turnovsky (1996), as follows:

$$R_K = \frac{\partial \alpha_L Z_K}{\partial K} \quad (A1a)$$

$$R_H = \frac{\partial \alpha_L Z_H}{\partial H} \quad (A1b)$$

where  $Z_K$  and  $Z_H$  are expressions of model parameters:

$$Z_K = \frac{1}{\beta} \left[ \frac{\beta \alpha_L}{\alpha_H} \frac{1}{\beta} \frac{\partial \alpha_L Z_K}{\partial K} \right] \quad (A2a)$$

$$Z_H = \frac{1}{\beta} \left[ \frac{\beta \alpha_L}{\alpha_H} \frac{1}{\beta} \frac{\partial \alpha_L Z_H}{\partial H} \right] \quad (A2b)$$

### Optimization

The representative agent chooses the set  $\{C_T, C_N, I\}$  at each time  $t$  to maximize the intertemporal utility function:

$$U = \int_0^{\infty} e^{-\rho t} \left[ \theta C_T + (1-\theta) C_N \right]^\gamma dt \quad (A3)$$

where  $\rho$  is the rate of time preferences,  $\gamma$  is the CRRA coefficient and  $\theta$  the composition of consumption between traded and non-traded goods. The discounted Hamiltonian is given by:

$$H = \int_0^{\infty} e^{-\rho t} \left[ \theta C_T + (1-\theta) C_N \right]^\gamma dt - \lambda \left[ \frac{dK}{dt} - \frac{dH}{dt} - I \right] - p \left[ \frac{dQ}{dt} - \frac{dP}{dt} - I \right] \quad (A4)$$

In the above expression,  $\lambda$  is the shadow price of external assets,  $Q$  is the asset price of installed traded capital and  $p$  the relative price of non-traded goods, all expressed in terms of foreign asset prices. Given the shares of consumption in (12), the consumer price index is equal to  $\theta + (1-\theta)p$ , and the economy-wide inflation rate is given by:

$$\pi = (1-\theta) \frac{\dot{p}}{p} \quad (A5)$$

Differentiating (A4) w.r.t.  $\{I\}$  we obtain:

$$\frac{\partial H}{\partial I} = 0$$

Recalling (6), the optimal new investment in traded capital stock is given by:

$$I = \frac{1}{2\varphi} (Q - 1) \quad (A6)$$

### Dynamics

To obtain the dynamics of adjustment, the equations for the three state variables in (9) are:

$$\dot{p} = \frac{1}{\beta} (p - 1) \quad (A7)$$

$$\dot{Q} = \frac{1}{\alpha} (Q - 1) \quad (A8a)$$

$$\dot{r} = \frac{1}{\gamma} (r - 1) \quad (A8b)$$

Equations (A8a and b) can be used to determine the dynamics of adjustment to equilibrium for the steady-state values of asset prices and the relative price of non-traded goods. We distinguish the following two cases:

(i) *Traded sector relatively intensive in FDI* ( $\alpha > \beta$ ): The equilibrium loci for the prices of traded capital and non-traded goods ( $Q^*, p^*$ ) are depicted in Figure 6a. Since  $p^*$  is independent of  $Q^*$ , its locus is a vertical line, while the asset price locus is a downward slopping curve. The unique equilibrium is given by  $E_0$ , and the dynamics of adjustment imply a saddle-path  $S_0S_0$ . If there is a permanent fall in the world real interest rate ( $r$ ), the first locus remains the same, while the asset price locus moves upwards. Adjustment takes place by the asset price jumping onto the new saddle-path  $S_1S_1$ , leading to a new equilibrium  $E_1$  with a higher asset price ( $Q > Q_0$ ). The price of the non-traded goods is gradually reaching a lower equilibrium ( $p_1 < p_0$ ). Calculation of equilibrium values from (A8a, b) is straightforward.

(ii) *Non-traded sector relatively intensive in FDI* ( $\alpha < \beta$ ): The equilibrium loci for the prices of traded capital and non-traded goods ( $Q^*, p^*$ ) are now depicted in Figure 6b. The  $p^*$  locus is again a vertical line, but now the asset price locus is an upward slopping curve, as implied by (A8a) and moves leftwards with a rise in interest rates. The equilibrium is unique and given by  $E_0$ , but the system is not saddle-path stable anymore, as is clearly shown by the dynamics of adjustment.

Thus, when there is a permanent rise in interest rate  $I$ , both the asset price and the non-traded price have to jump on the new equilibrium  $E_2$  and take higher values:

~~$Q > Q$~~

#### Proof of Proposition 4

Setting the degrees of composition as  ~~$\frac{H}{K} = \frac{H}{K}$~~ , production functions (1a) and (1b) are rewritten as

$$Y = A \tau^{\alpha} (H/K)^{1-\alpha} \quad (A9a)$$

~~$$Y = A \tau^{\alpha} (H/K)^{1-\alpha}$$~~

$$Y = A \tau^{\alpha} (H/K)^{1-\alpha} \quad (A9b)$$

From (7a) and (7b), we obtain two expressions for the ratio  $H/K$ , and equating them we get

$$\frac{1-\tau}{1-\alpha} = \frac{1-\beta}{1-\alpha} \quad (A10)$$

From (A1a, b) and (A2a, b) we obtain

$$\frac{\tau H}{K} = \left[ \frac{1-\tau}{1-\alpha} \right]^{\frac{1}{1-\alpha}} \frac{1}{\beta} \quad (A11)$$

Combining (A10) and (A11), the fraction of FDI allocated in the traded sector is given as a function of  $K$  and  $p$  by the expression:

$$\frac{H}{K} = \xi \frac{1-\beta}{\alpha \beta} \frac{1}{p} \quad (A12)$$

Where  $\xi = [(1-\alpha)A]^{\frac{1}{1-\alpha}} \frac{1}{Z_H^{\frac{1}{1-\alpha}}} \beta(1-\alpha)/\alpha$

Differentiating w.r.t.  $K$  and  $p$ , the total shift in fraction ( $\tau$ ) is obtained as:

$$\frac{d\tau}{d\tau} = \frac{\partial \tau}{\partial p} + \frac{\partial \tau}{\partial K} \quad (A13)$$

Partial differentials are given by

$$\frac{\partial \tau}{\partial p} = \xi \frac{1-\beta}{\alpha \beta} \frac{1}{p^2} \quad (A14a)$$

$$\frac{\partial \tau}{\partial K} = \xi \frac{1-\beta}{\alpha \beta} \frac{1}{p} \quad (A14b)$$

The sign of (A14b) is ambivalent, and two cases are distinguished:

(i). For a ‘northern-type’ economy with  $\alpha > \beta$ , we have  $\partial\tau/\partial K > 0$ , and for  $dp < 0$ , we clearly get  $d\tau > 0$ . Thus, a permanent fall in interest rates leads to the economy becoming *more* intensive in traded capital.

(ii). For a southern-type economy with  $\alpha < \beta$ , we have  $\partial\tau/\partial K < 0$ , and for  $dp > 0$ , it clearly follows that  $d\tau < 0$ . Thus, a permanent fall in interest rates leads to the economy becoming *less* intensive in traded capital.

## Appendix B. Data sources and descriptive statistics

Variable	Description	Frequency	Obs.	Mean	Std. dev.	Source
<b>Asset prices</b>	Index of European Stock Markets (1989:Q1=1)	quarterly	385	1.184	0.562	<i>Eurostock</i>
<b>Current account</b>	Current account balance as a share of GDP (%)	annual	299	-0.927	4.715	International Financial Statistics ( <i>IFS</i> )
<b>FDI</b>	Net (new investment inflows less disinvestment) Foreign direct investment inflows as a share of GDP (%)	annual	299	2.121	3.881	<i>IFS</i>
<b>FDI</b>	Net (new investment inflows less disinvestment) Foreign direct investment inflows as a share of GDP (%)	quarterly	1048	2.266	6.006	<i>IFS</i>
<b>FDI manufacturing</b>	Net Foreign direct investment inflows in the manufacturing sector as a share of GDP (%)	annual	220	0.511	1.123	OECD Statistics
<b>FDI non-manufacturing</b>	Net Foreign direct investment inflows in the non- manufacturing sector as a share of GDP (%)	annual	220	1.479	2.559	OECD Statistics
<b>FDI real estate</b>	Net Foreign direct investment inflows in real estate, renting and business activities, in construction activities and in hotel and restaurants as a share of GDP (%)	annual	141	0.827	1.448	OECD Statistics
<b>government consumption</b>	Government Consumption as a share of GDP (%)	quarterly	1320	19.353	2.582	OECD Statistics
<b>growth</b>	Real growth rate of output (%)	annual	300	2.428	2.633	<i>IFS</i>
<b>growth</b>	Real growth rate of output (%)	quarterly	1081	2.729	2.711	<i>IFS</i>
<b>Inflation rate</b>	Average annual percentage change of consumer price index	quarterly	1272	5.046	5.438	<i>IFS</i>
<b>REER</b>	Real effective exchange rates index	annual	300	97.329	10.431	<i>IFS</i>
<b>REER</b>	Real effective exchange rates index	quarterly	1200	97.329	10.517	<i>IFS</i>
<b>Regulatory quality</b>	Index of the quality of regulatory environment (min=0, max=2)	annual	100	1.324	0.356	World Bank, World Governance Indicators
<b>RIR</b>	Nominal long term interest rate minus the contemporaneous rate of inflation	quarterly	1199	3.564	2.679	<i>IFS</i>
<b>trade balance</b>	Net trade in goods and services as a share of GDP (%)	annual	299	0.307	6.066	<i>IFS</i>
<b>trade balance</b>	Net trade in goods and services as a share of GDP (%)	quarterly	1048	0.706	6.030	<i>IFS</i>

## Appendix C: Tables

**Table 1.** Trade balances in the Euro area as % of GDP, average annual figures

COUNTRY	1980-1998	1999-2009	CHANGE
Austria	-0.115	3.119	3.234
Finland	2.380	6.976	4.596
Germany	1.895	4.191	2.296
Ireland	3.751	12.966	9.215
Netherlands	4.069	6.601	2.532
<b>North (average)</b>	<b>2.396</b>	<b>6.771</b>	<b>4.375</b>
France	0.919	0.097	-0.822
Greece	-6.688	-8.258	-1.57
Italy	0.927	0.412	-0.515
Portugal	-9.725	-8.756	0.969
Spain	-0.869	-3.683	-2.814
<b>South (average)</b>	<b>-3.087</b>	<b>-4.037</b>	<b>-0.950</b>

Source: IFS

**Table 2.** FDI inflows in the Euro area as % of GDP

COUNTRY	1980-1998	1999-2009	CHANGE
Austria	0.644	5.644	5.000
Finland	0.976	3.125	2.149
Germany	0.255	2.459	2.204
Ireland	2.062	7.82	5.758
Netherlands	2.407	7.176	4.769
<b>North (average)</b>	<b>1.268</b>	<b>5.244</b>	<b>3.976</b>
France	0.969	2.994	2.025
Greece	1.074	0.844	-0.230
Italy	0.307	1.228	0.921
Portugal	1.609	2.766	1.157
Spain	1.615	3.634	2.019
<b>South (average)</b>	<b>1.115</b>	<b>2.293</b>	<b>1.178</b>

Source: IFS



**Table 3.** Results of Kao's (1999) residual cointegration test ( $H_0$  : no cointegration)

	North		South	
	Test statistic	p-value	Test statistic	p-value
<i>ADF</i>	-1.788**	0.037	-1.848**	0.032

**Notes:** Automatic selection of lags based on Akaike information criterion with a max of 2 lags. \*\*\* denotes significance at 1% level, \*\* denotes significance at 5% level and \* denotes significance at 10% level.

**Table 4.** Cointegration tests for Trade Balance and FDI ( $H_0$  : no cointegration)

COUNTRY	Model 1: Level shift		Model 2: level shift with trend		Model 3: Regime Shift	
	$Z_t$	Break Date	$Z_t$	Break Date	$Z_t$	Break Date
Austria	-12.25***	2001q2	-12.98***	1993q2	-12.23***	2001q2
Finland	-5.17**	1996q3	-6.13**	1996q4	-5.19**	1996q3
Germany	-3.50	2002q4	-7.14***	1990q3	-3.59	2002q4
Ireland	-5.23**	2000q1	-5.71**	1999q4	-5.20**	2000q1
Netherlands	-7.10***	2003q1	-7.97***	2004q3	-7.11***	2003q2
France	-4.84**	2000q1	-5.46*	2000q3	-4.90***	2000q2
Italy	7.11***	1992q4	7.11***	1992q4	7.11***	1992q4
Portugal	-6.09***	1994q2	-6.31***	1994q2	-6.91***	1996q1
Spain	-5.93***	2004q1	-6.02***	2003q2	-5.93***	2004q1

**Notes:** The method is according to Gregory and Hansen (1996). Critical values for the  $Z_t$  test for Model 1 at 1%, 5% and 10% are -5.13, -4.61 and -4.34, respectively; for Model 2 are -5.45, -4.99 and -4.72, respectively; for Model 3 are -5.47, -4.95 and -4.68, respectively. \*\*\* denotes significance at 1% level, \*\* denotes significance at 5% level and \* denotes significance at 10% level. Automatic selection of lags based on Akaike information criterion with a max of 2 lags.

**Table 5.** Dynamic panel estimates of Trade Balance determinants in northern European countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Annual data					Quarterly data					
Sample Period	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 1998	1999- 2009
Estimator	DFE	MG	PMG	PMG	PMG	DFE	MG	PMG	PMG	PMG	PMG
<i>Long-run coefficients</i>											
FDI	0.437*** (5.234)	0.633** (2.527)	0.400*** (4.666)	-	0.485*** (6.578)	0.119*** (5.456)	0.059*** (5.515)	0.093*** (2.620)	0.059** (2.540)	0.112* (1.726)	0.021** (1.977)
FDI manufacturing	-	-	-	2.099** (2.282)	-	-	-	-	-	-	-
FDI non-manufacturing	-	-	-	1.124** (2.490)	-	-	-	-	-	-	-
REER	-	-	-	-	-0.159*** (-3.386)	-0.123*** (-4.009)	-0.101 (-1.157)	-0.080 (1.402)	-0.086* (1.659)	-0.080** (-2.500)	0.143*** (5.252)
growth	-	-	-	-	-0.250** (-2.017)	-0.259 (-1.391)	-0.337 (-1.315)	-0.013 (-0.105)	-0.306 (-1.188)	0.262 (0.926)	-0.428 (-1.144)
RIR	-	-	-	-	-	-0.531** (-2.215)	-0.049 (-0.159)	-0.601*** (-3.563)	-0.238 (-0.836)	-0.193 (-0.739)	0.070 (0.374)
government consumption	-	-	-	-	-	0.775** (2.114)	-1.319 (-1.264)	1.193*** (3.195)	-0.923 (-0.840)	0.376 (0.401)	-2.542** (-2.013)
Speed of adjustment	-0.213*** (-6.302)	-0.287*** (-4.548)	-0.255** (-3.523)	-0.116** (-2.426)	-0.254*** (-2.969)	-0.278*** (-3.651)	-0.439*** (-4.951)	-0.288*** (-3.258)	-0.387*** (-3.687)	-0.675*** (-5.272)	-0.655*** (-3.207)
No. of obs.	140	145	145	90	145	438	443	443	443	220	215
Log likelihood	-248.97	-211.058	-215.733	-123.147	-198.771	-896.04	-811.4666	-834.040	-819.1367	-371.903	-424.268

**Notes:** DFE stands for the Dynamic Fixed Effects Estimator; MG for the Mean Group estimator and PMG for the Pooled Mean Group Estimator. Short-run coefficients not reported for economy of space. t-statistics are presented in parentheses. For the DFE estimator the t-statistics are calculated using heteroskedasticity consistent standard errors. For the MG and PMG estimators lags are selected based on the Akaike information criterion with a maximum lag length of 2. For the DFE estimator, which imposes a uniform lag structure across all counties in the panel, we set the lag length equal to 2. \*\*\* denotes significance at 1% level, \*\* denotes significance at 5% level and \* denotes significance at 10% level.

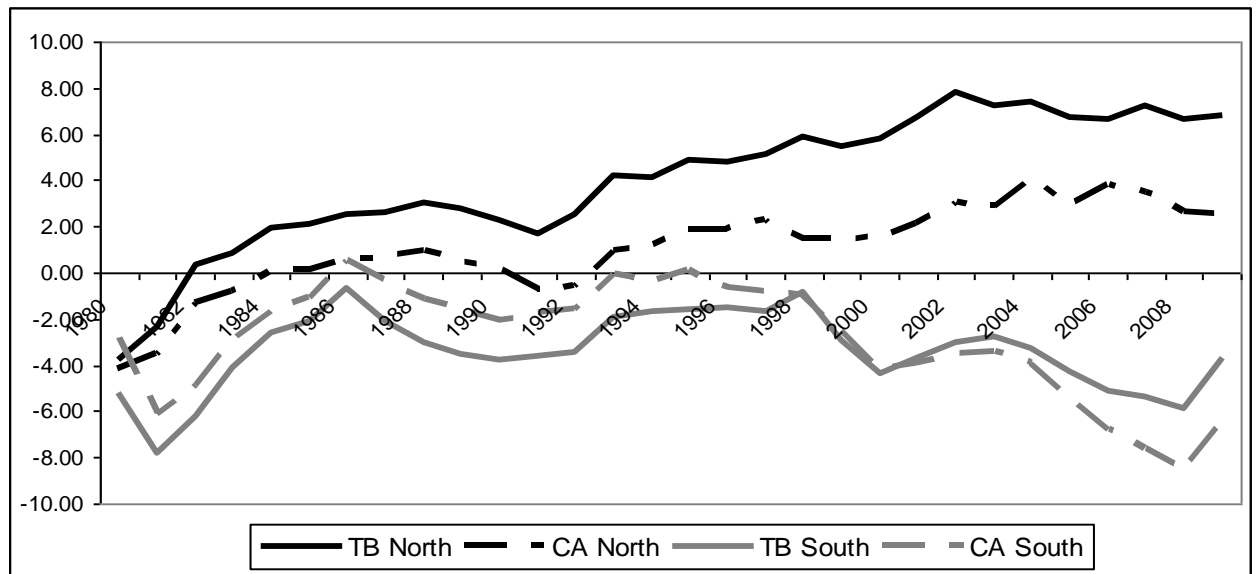
**Table 6.** Dynamic panel estimates of Trade Balance determinants in southern European countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	<b>Annual data</b>					<b>Quarterly data</b>					
Sample Period	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 2009	1980- 1998	1999- 2009
Estimator	DFE	MG	PMG	PMG	PMG	DFE	MG	PMG	PMG	PMG	PMG
<i>Long-run coefficients</i>											
FDI	-0.745*** (-5.100)	-1.591** (-2.505)	-0.643** (-2.593)	-	-1.014*** (-3.569)	-0.118 (0.516)	-0.252 (-1.197)	-0.203** (-2.109)	-0.168* (-1.765)	0.064 (0.119)	-0.152** (-2.188)
FDI manufacturing	-	-	-	0.290 (0.379)	-	-	-	-	-	-	-
FDI non-manufacturing	-	-	-	-0.608*** (-4.769)	-	-	-	-	-	-	-
REER	-	-	-	-	-0.096*** (-3.879)	-0.183*** (-5.447)	-0.197** (-2.292)	-0.183*** (-6.367)	-0.179*** (-5.967)	-0.179*** (-4.866)	-0.074** (-2.551)
Growth	-	-	-	-	-0.419** (-3.656)	-0.236 (-1.409)	-0.727*** (-3.154)	-0.195** (-2.280)	-0.561*** (-3.005)	-0.231 (-0.762)	-0.306 (-0.717)
RIR	-	-	-	-	-	0.528*** (3.224)	0.715*** (4.677)	0.449*** (6.122)	0.472*** (6.366)	0.196 (1.488)	0.078 (0.647)
government consumption	-	-	-	-	-	0.611*** (4.608)	-0.473 (-0.546)	0.198 (1.031)	-0.251 (-0.455)	0.920*** (3.533)	-1.262*** (3.006)
Speed of adjustment	-0.434*** (-7.635)	-0.353*** (-3.419)	-0.366*** (-3.953)	-0.507** (-2.492)	-0.424*** (-2.774)	-0.459*** (-2.691)	-0.616** (-2.455)	-0.567** (-2.488)	-0.611** (-2.378)	-0.381*** (-3.197)	-0.917*** (-4.056)
No. of obs.	139	144	144	109	142	498	503	503	503	296	203
Log likelihood	-212.630	-193.670	-196.030	-144.874	-185.933	-1126.190	-888.018	-905.418	-896.527	-528.127	-299.839

Notes: see Table 7

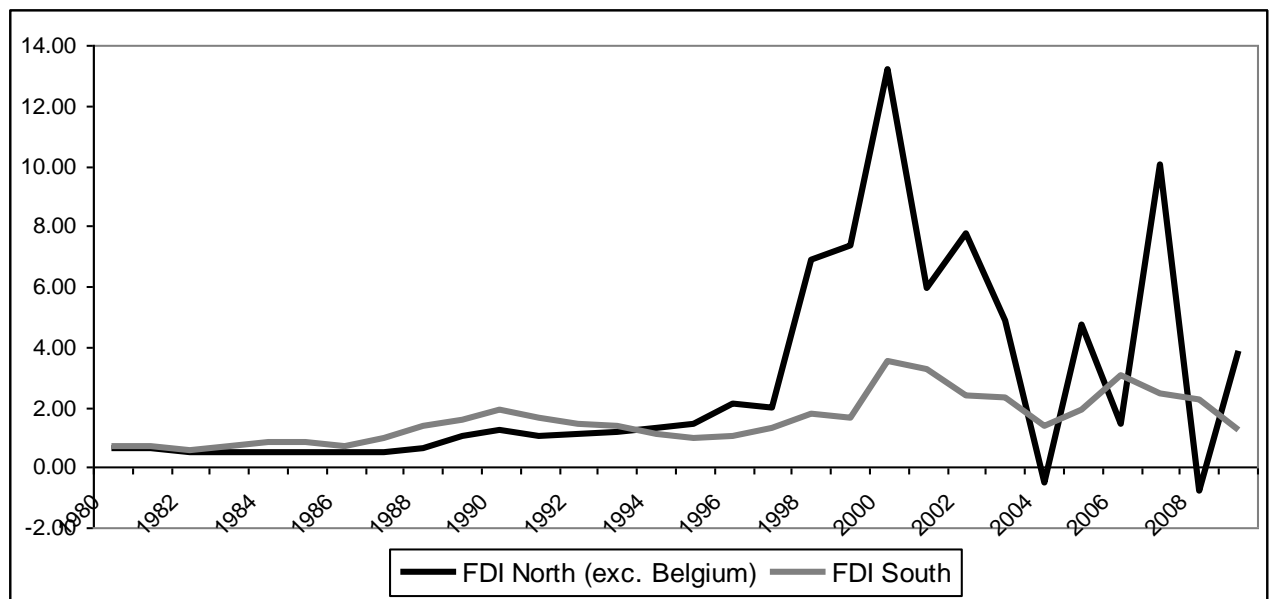
## Appendix D: Figures

**Figure 1.** Trade balances (TB) and current accounts (CA) (% of GDP)



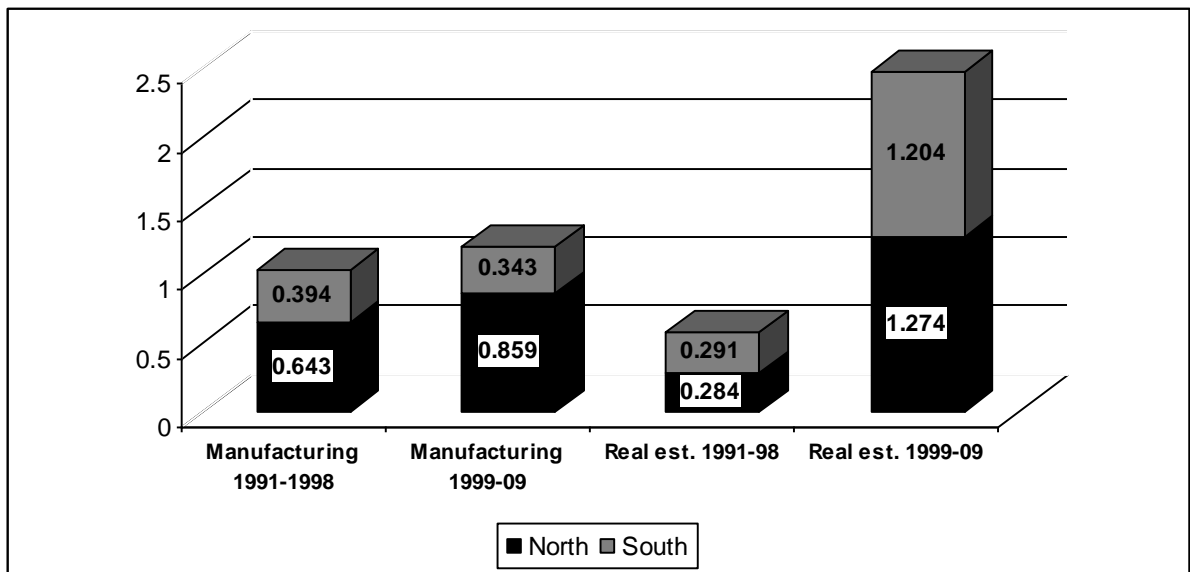
Source: IFS

**Figure 2.** FDI inflows (% of GDP)



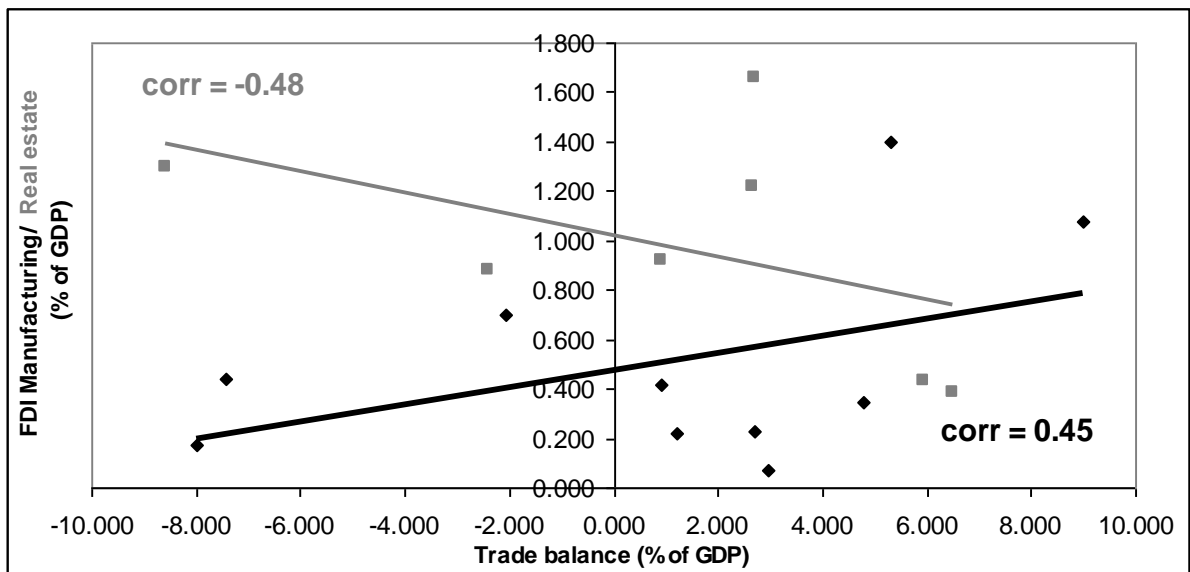
Source: IFS

**Figure 3.** Sectoral FDI inflows in the two groups of the Euro area (% of GDP)



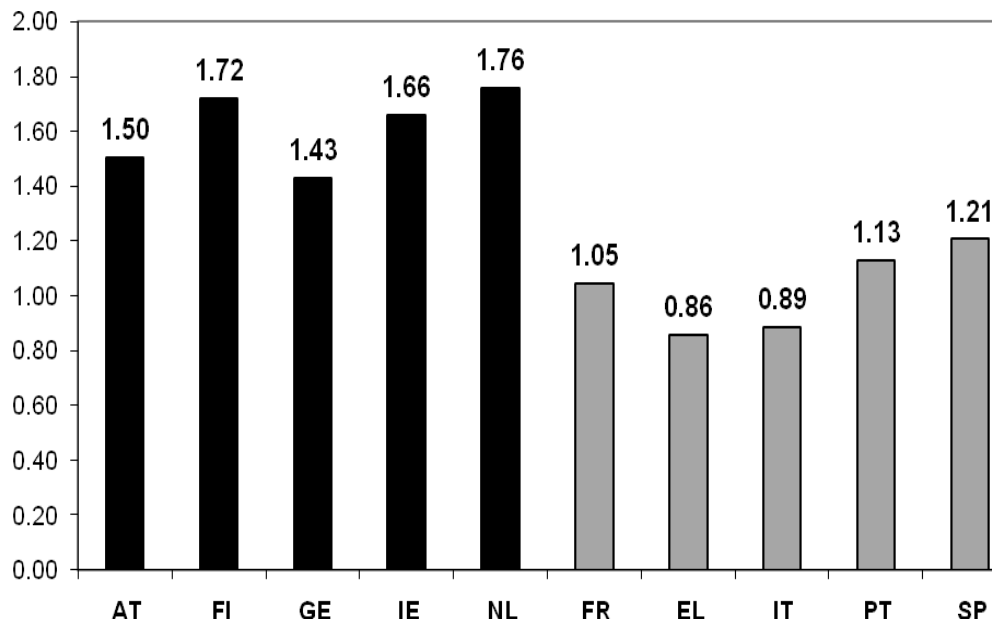
Source: OECD

**Figure 4.** Correlation between FDI inflows and Trade Balances



Source: OECD and IFS

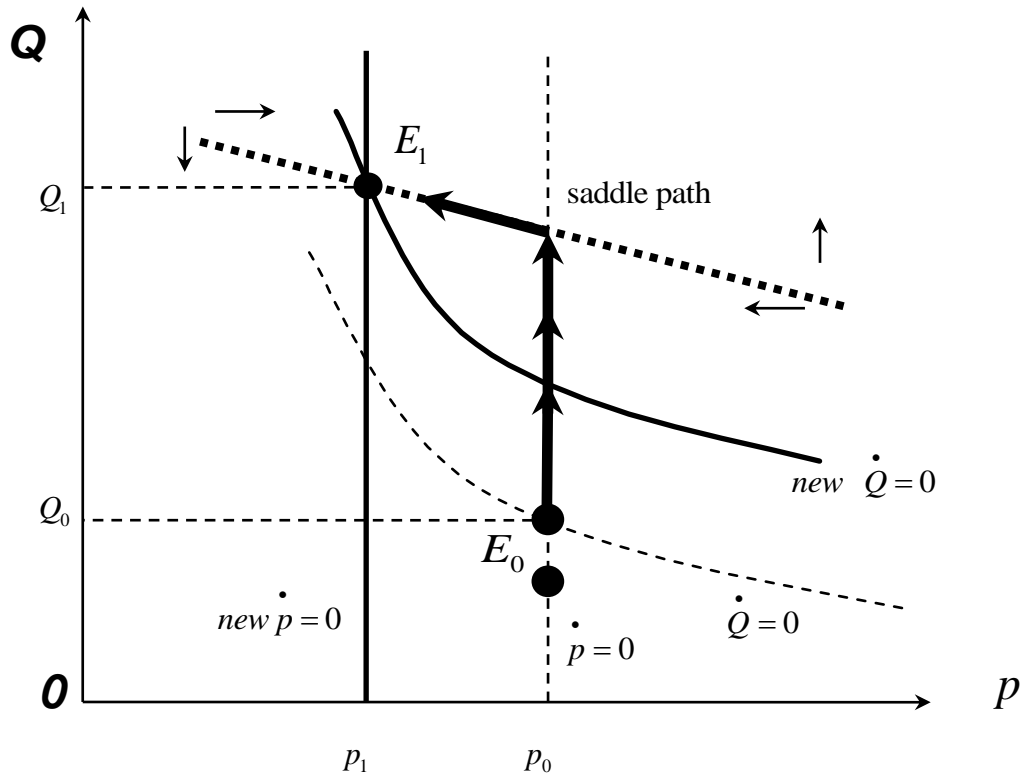
**Figure 5.** Regulatory quality



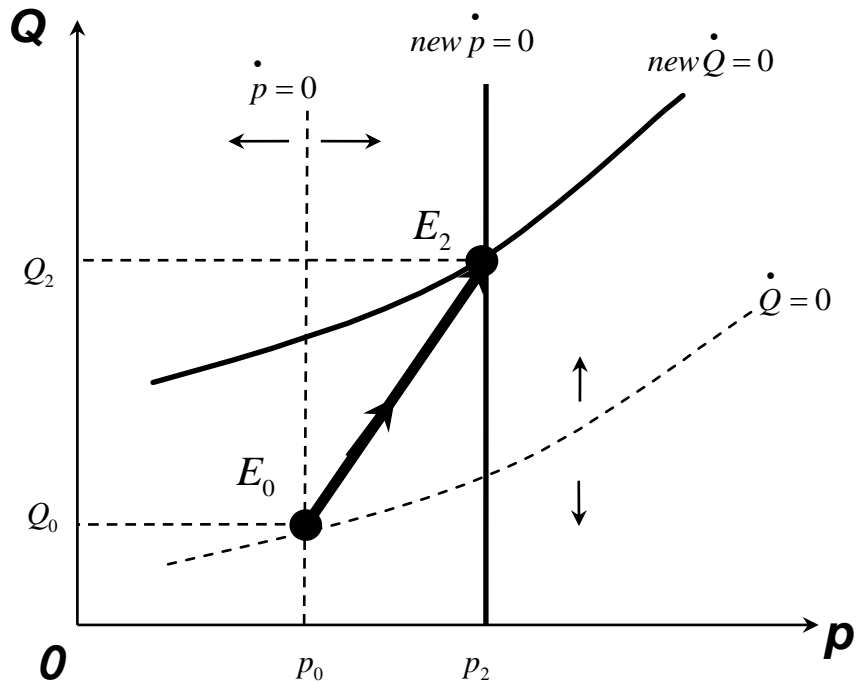
**Source:** World Bank, World Governance Indicators.

**Notes:** This indicator is measured in units ranging from 0 to 2, with higher values corresponding to better regulation outcomes. We use data from 1996 to 2008; periods 1997, 1999 and 2001 are not available. If congestion factor ( $x$ ) is proxied by the proportional deviation from the upper bound, the capital intensities are derived as in (8). For example if France has  $\omega=0.80$  and  $x=(2-1.1)/2=0.475$ , then  $\alpha=\omega-x=0.325$  and  $\beta=1-\omega+x=0.675$ , and the economy is categorized as relatively capital-intensive in the non-traded sector.

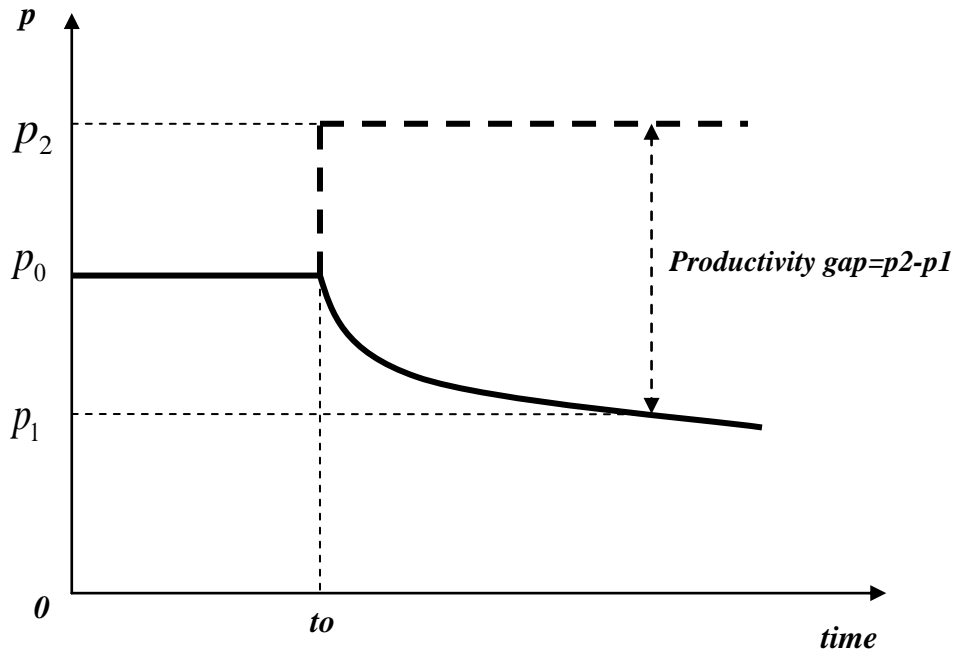
**Figure 6a:** Adjustment of asset prices after a permanent fall in interest rates  
(Case I: FDI intensive in the Traded sector)



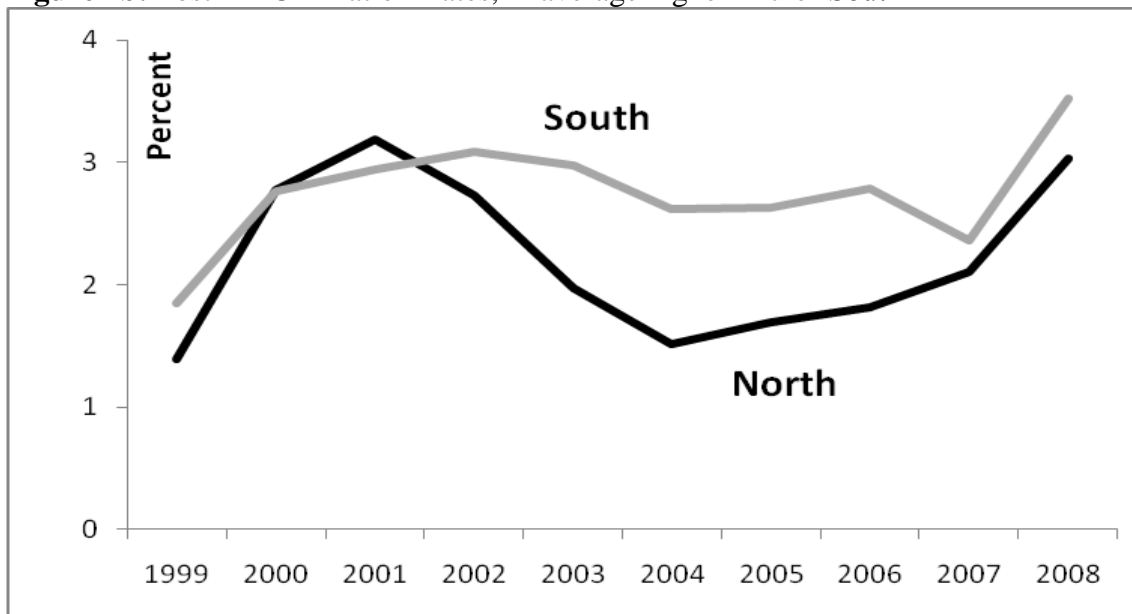
**Figure 6b:** Adjustment of asset prices after a permanent fall in interest rates  
(Case II: FDI intensive in the Non-traded sector)



**Figure 7a.** Price level adjustment after a permanent fall in interest rates. Solid (dotted) line indicates Traded (Non-traded) sector Intensive in FDI



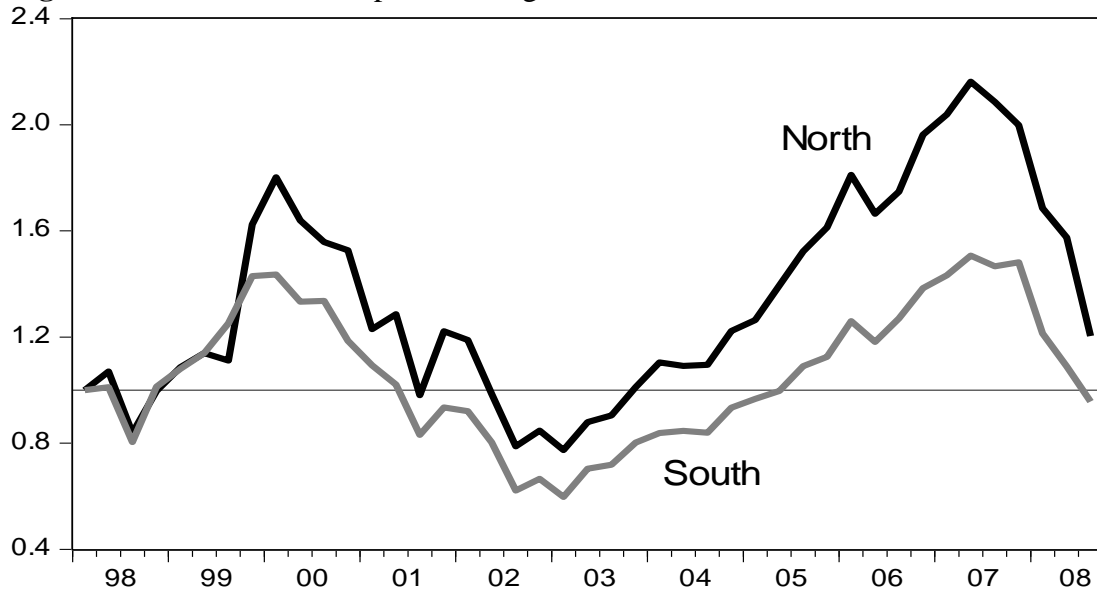
**Figure 7b:** Post-EMU Inflation Rates, in average higher in the 'South'



Source: Source: IFS



**Figure 8.** After EMU, asset prices stronger in the North.



**Source:** Eurostock, quarterly data. Unweighted country averages. Each index normalised 1998:01=1.

**Figure 9.** External balance adjustment after a permanent fall in interest rates. Solid (dotted) line indicates that Traded (Non-traded) sector is intensive in FDI

