The Euro Effects on Intra-EU Trade Flows and Balance: Evidence from the Cross Sectionally Dependent Panel Gravity Models*

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Abstract

?? Recently, there has been an intense policy debate on the Euro effects on trade flows. The investigation of unobserved multilateral resistance terms in conjunction with omitted trade determinants has also assumed a prominent role in the literature. Following recent developments in panel data studies, we propose the cross-sectionally dependent panel gravity models. The desirable feature of this approach is to control for time-varying multilateral resistance, trade costs and globalisation trends through the use of both observed and unobserved factors, which are allowed to be cross-sectionally correlated. This approach also enables us to consistently estimate the impacts of (potentially endogenous) bilateral trade barriers. Applying the proposed approach to the dataset over 1960-2008 for 91 country-pairs of 14 EU countries, we find that the Euro impact on trade amounts to 3-4%, far less than those reported by earlier studies. Furthermore, the Euro is found to promote EU integration by eliminating exchange rate-related uncertainties. An obvious policy implication is that countries considering to join the Euro would benefit from the ongoing process of integration, but should also be wary of regarding promises of an imminent acceleration of intra-EU trade.

JEL Classification: C33, F14.

Key Words: Heterogeneous Gravity Panel Data Models, Cross-section Dependence, Multilateral Resistance, The Euro Effects on Trade Flows, Balances and the EU Integration.

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1 Introduction

{*YC will redraft??*} With the formation of the euro in 1999, the literature on the common currency effects on trade has been rapidly growing. By eliminating exchange rate volatility and reducing the trade costs, a currency union is expected to boost trades among member countries. An important policy issue is what are the right magnitude and the nature of the Euro's trade impact, both of which are not only important for member countries but also for EU members that have not joined yet. See Baldwin (2006) for an extensive survey.

However, most of earlier studies implicitly made a strong assumption that bilateral trade flows are independent of the rest of the trading world. Anderson and van Wincoop (2003) highlighted an importance of controlling for the regional interaction structure in estimating gravity models, and propose to include multilateral resistance terms that capture the fact that bilateral trade flows depend on bilateral barriers as well as trade barriers across all trading partners. Baldwin (2006) also stressed that many of omitted pair-specific variables clearly reflect time-varying factors such as multilateral trade costs.

To address such an important issue of how best to simultaneously model (unobserved and time-varying) multilateral resistance and bilateral heterogeneity, we follow two alternative methodologies: the factor-based approach proposed by Serlenga and Shin (2007, hereafter SS) and the spatial-based techniques advanced by Behrens, Ertur and Kock (2012, hereafter BEK). The spatial dependence may arise due to the so-called third country or neighbour effects. BEK propose the modified spatial technique and derived the spatial weight matrix directly from the structural gravity model. By capturing multilateral resistance through the spatial dependence, they showed that the Canada-US border effects are significantly lower than paradoxically large estimates reported by McCallum (1995). On the other hand, SS developed the cross-sectionally correlated panel gravity model by taking account into an issue of cross-section dependence explicitly through the use of observed and unobserved factors, which is designed to simultaneously control for time-varying multilateral resistance, trade costs and globalisation trends. SS then proposed to combine the PCCE estimator proposed by Pesaran (2006) with the instrument variables estimator advanced by Hausman and Taylor (1981) in order to consistently estimate the impacts of both time-varying and time-invariant regressors.[1] **{Maybe MSSa here}**

Chudik *et al.* (2011) show that the factor-based models exhibit the strong form of cross section dependence (hereafter, CSD) whilst the spatial-based models can accommodate only weak CSD. Notice, however, that the factor-based procedure can be extended to cope with the weak spatial effects. This can be achieved by applying the spatial model to the (de-factored) residuals. Bailey *et al.* (2013) develop estimation methods that can distinguish the relationship between spatial units that is purely spatial from that which is due to the effect of common factors, and propose the multi-step procedure. Recently, Kapetanios

[1] Bertoli and Fernández-Huertas Moraga (2013) propose an empirical framework in which the common factor setup can be derived from the theoretical gravity model, thus justifying the link between factors with heterogeneous loadings and multilateral resistance terms. In this context, they apply the CCE estimator proposed by Pesaran (2006) to the gravity model of migration flows using high-frequency data during the Spanish immigration boom between 1997 and 2009, and document evidence that controlling for multilateral resistance to migration tend to produce much larger policy effects. These studies also demonstrate that ignoring the multilateral resistance generates biased estimates of the determinants of migration.

et al. (2014) proposed a novel nonlinear panel data model which can generate strong and/or weak CSD endogenously. In particular, this approach allows for considerable flexibility in terms of the genesis of the herding or clustering type behavior. In this regard MSS propose the novel framework for accommodating both weak and strong CSD in modelling technical efficiency by combining an endogenous threshold regime selection mechanism advanced by Kapetanios *et al.* (2014) and the exogenously driven factor-based approach. In this paper we follow this research trend and develop the unified framework for modelling multilateral resistance and bilateral heterogeneity by accommodating both weak and strong CSD in the error components.

The recent European sovereign-debt crises have exacerbated the difference between core and peripheral economies in the EU. Especially, peripheral countries suffer from the high level of current account deficits and government debts. Such negative economic outlooks ignite intense political debates to questioning the existence of the Euro or the exit of weakest countries (*The Economist*, 25 May 2010). Standard Eurobarometer (2013) shows that the public opinion loses its confidence in the EU as an institution, especially in Southern countries. These trends are clearly reflected in the latest European election outcomes in May 2014 as we have seen the rise of Euro-scepticisms with Anti-European parties gaining 100 seats out of 751 seats (*The Economist*, 31 May 2014). **{Recent Greek Poll??}**

It can be argued that the creation of EMU and the subsequent introduction of the euro may correspond to the start of deterioration of current accounts for Southern countries (*e.g.* Jaumotte and Sodsriwiboon, 2010). On the real economy side, however, the EU integration, in general, and the euro, in particular, have clearly boosted the total intra-trade flows as documented by numerous empirical studies. **{summary findings??}** The EU has also made substantial efforts for sustaining laggard and peripheral countries through Structural and Cohesion Policy and Common Agricultural Policy. Moreover, trade liberalisation and currency union may provide an incentive for small and medium firms of peripheral countries with lower productivity to enter international markets by lowering export costs and trade barriers (e.g. the new good hypothesis in Baldwin (2006)).

{dasi} It is, therefore, important to carefully analyse (i) what are the right magnitude of the euro effect on the total intra-EU trade flows; whether the introduction of the euro has exerted the different impacts on the regional trade flows in core and peripheral countries and (ii) whether the euro contributes to the deterioration of the current account of peripheral countries, and in particular through which channels. (iv) impacts on the EU integration process;??

V: Many theoretical studies have highlighted the importance of analysing current accounts dynamics in an intertemporal approach. Among the others, Obstfeld and Rogoff (1995) show how present imbalances might be the outcome of intertemporal saving and investment decisions of forward-looking households and firms. In integrated financial and real market, countries with lower per- capita income attract investments from more developed countries, because of higher expected productivity of capital. This also implies higher levels of consumption and lower level of savings and, as a consequence, a temporary worsening of the current accounts which is sustainable, given

the higher rate of returns of the investments. Therefore, in this setting, a temporary imbalance is evidence of an ongoing convergence process among countries with different levels of development, provided that the gap will be filled by future growth.[2]

Blanchard (2007) remarks that in the presence no distortion and fully rational agents, imbalances might be overlooked. However, if distortions in goods, labour or financial markets are detected, policy interventions aimed at reducing imbalances are desirable.

There are several reasons why we should be concerned with trade/ current account imbalances in the peculiar case of European integration process.

First of all, the monetary union imposes fixed nominal exchange rates to the state members, so that adjustment of imbalances are only possible through real prices. Therefore, the worsening of the balances of the peripheral countries after the euro inception, can be a seen as a symptom of rigidities in the labour and productive structure.

Second, the integration process brought about the elimination of currency risk and the convergence in regulatory settings and thus favoured capital flows from core countries to peripheral countries (see Lane and Milesi-Ferretti, 2007 and Chen et al., 2013). However, mispricing of the risks and overestimation of expected returns may have caused capital inflows to foster imbalances.

This might be especially true in the peripheral countries, where capital inflows fueled the housing-sector boom. This generated capital gains and inflated incomes and, in turn, aggregate demand and price levels, with a positive effect on import and a negative effect on the competitiveness of export sector.

Finally, external imbalances can be harmful in case there is an aggregate liquidity shock which suddenly stops capital flows to finance the deficit. The reversal can cause high losses in terms of output and employment, because the required adjustment can only be attained through wages (see Lane, 2012 on the recent crisis).

For these reasons, it is important to assess the size and the causes of current account/trade imbalances, especially in the particular case of an integrated area such the European Union.

However, such an important issue has been neglected in the empirical literature. This is a rather surprising omission given that there is a huge literature studying the euro impacts on trade or export flows. **{maybe a few theoretical studies or indirect studies?? double-check the literature??}** Up to our knowledge there is only one empirical study conducted by Berger and Nitsch (2010), who attempt to estimate the impacts of the euro on trade balance. **(more details or results??)V: The authors find that the countries belonging to the EMU have a higher and more persistent trade imbalance with respect to the other European countries.**

However, their approach is inappropriate to unravel such an issue exactly as the dependent variable is constructed as an absolute value of the difference between export and import instead of the signed difference, in which case any

[2]Gourinchas and Rey (2007) empirically find that present imbalances should correspond either to future trade surpluses or future movements in the net foreign asset portfolio in order for the intertemporal budget constraint to hold.

meaningful economic interpretation cannot be drawn in terms of the balance of payments.

{**dasi**} In this paper, therefore, we focus narrowly on uncovering an unambiguous effect of the Euro on trade balances. This requires us to formulate the correct gravity regression specifications for trade imbalances by carefully dividing the group of countries of interest and selecting the smaller bilateral pairs. In this regard, we are able to address the high profile political issue such as "does the euro help to aggravate the terms of trade of the South (Peripheral) relative to the North (Core)?" Furthermore, we also develop the framework under which we can evaluate the effects of the euro on the regional total trade flows by augmenting the gravity equations with the regional and interaction dummies in order to examine that the euro boosts the within core trades more substantially than other types such as the within peripheral or the between trades, and *vice versa*.

{*edit??*} In this paper we apply the proposed cross-sectionally dependent panel gravity model to the dataset over the period 1960-2008 (49 years) for 91 country-pairs of 14 EU member countries. We analyse the effect of the euro both on trade flows and trade imbalances. Our main empirical findings are summarized as follows: Firstly, once we control for time-varying multilateral resistance terms and trade costs appropriately through cross-sectionally correlated unobserved factors, we find that the Euro impact on trade amounts to 7-11% only. Importantly, this magnitude is consistent with broad evidence compiled by Baldwin (2006) and more recent studies that attempt to address an importance of taking into account time-varying multilateral resistance and/or omitted trade determinants at least partially (e.g. Bun and Klaassen, 2007; Berger and Nitsch, 2008). When considering regional dummies we find that the introduction of a common currency area has boosted the trades more among the Southern countries than among the Northern counterparts. This relatively surprising evidence might provide a further support for the thesis that the potential trade-creating effects of the Euro should be viewed in the proper historical and multilateral perspective rather than focusing simply on the formation of a monetary union as an isolated event, e.g. Berger and Nitsch (2008), and Lee (2012).

Turning to the impacts of bilateral resistance terms, we find that the impacts of both distance and common language on trade are significantly negative and positive whereas the border impact is no longer significant. Further investigation of time-varying coefficients on these variables reveals that border and language effects started to decline more sharply just after 1999. The implication of these findings is that the Euro helps to reduce trade effects of bilateral resistance and thus promote integration among the Euro countries by eliminating exchange rate-related uncertainties and transaction costs. On the other hand, distance impacts have been rather stable, showing no pattern of downward trending. This generally supports broad empirical evidence that the notion of the death of distance is difficult to identify in current trade data (Disdier and Head, 2008; Jacks, 2009).

V: Finally, we find that the euro has a negative impact on the trade balance of peripheral countries and, conversely, a positive impact on the trade balance of core countries. However, the effect on the trade balance is modest, compared to the steep decline of current account which peripheral countries experienced.

The accumulation of deficits can be explained by the documented increase in capital inflows, which have financed the non-tradable sector, giving rise to increased demand for imports and competitiveness losses for the trading sector. Moreover, the worsening of trade balance during the European integration process is an evidence of the absence of real adjustment mechanisms which calls for structural policy interventions aimed at correcting rigidities in the labour and productive structure as well as allocation problems in the financial sector, together with close monitoring of imbalances.

The paper is organised as follows: Section 2 reviews the literature on the Euro's Trade Effects. Section 3 describes the cross-sectionally dependent panel gravity models and proposes the estimation methodologies. Section 4 provides main empirical findings. Section 5 concludes.

2 Overview on the Euro's Trade Effects

There has been an intense policy debate on the Euro effects on trade flows between Euro and non-Euro nations.[3] Baldwin (2006) offers an extensive survey, covering the infamous Rose (2000)'s huge trading effect over 200% [4] as well as recent studies reporting the relatively smaller effects. It is widely acknowledged that the Rose's estimate of the currency union effect on trade is severely (upward) biased. In particular, his estimates are heavily inflated by the presence of small (e.g. Panama) or very small (e.g. Kiribati, Greenland, Mayotte) countries (Frankel, 2008). An important issue is why a currency union raises trades so much. In 2003 the UK Treasury made a bold prediction that the pro-trade effect of using the Euro on UK would be over 40%.[5] One suspects that these results be seriously interpreted to mean that trade among its members would have collapsed in the late 1990s without the Euro (Santos Silva and Tenreyro, 2010). Thus, it is unclear whether one can uncover similar findings for the European monetary union involving the substantially large economies such as Germany and France.

The gravity model popularised by Rose (2000) attempts to provide the main link between trade flows and trade barriers, though his original approach has attracted the number of strong criticisms. The main critiques are classified as follows: inverse causality or endogeneity; missing or omitted variables; and incorrect model specification (nonlinearity or threshold effects). Now, the general consensus is that the currency union effect seems to be far less than those reported earlier by Rose and others, once all these methodological issues are appropriately accommodated.

[3]Currently, the euro area contains 17 EU member states. In 1999 eleven countries adopted the euro as a common currency while Greece entered in 2001. Slovenia joined in 2007, Cyprus and Malta in 2008, Slovakia in 2009 and Estonia in 2011. Denmark and the United Kingdom have 'opt-outs' from joining laid down in Protocols annexed to the Treaty whereas Sweden has not yet qualified to be part of the euro area.

[4]Rose (2000) estimates a gravity equation using data for 186 countries from 1970 to 1990 and finds that countries in a currency union trade three times as much.

[5]Micco et al. (2003) provide the first evaluation of the Euro effect, finding that the common currency boosts trade among Euro members by 4% in the short-run and 16% in the long-run. The subsequent stduies by de Nardis and Vicarelli (2003), Flam and Nordström (2006), Berger and Nitsch (2008), and de Nardis et al. (2008), show that the range of the estimated Euro effects is still very wide from 2% to more than 70%.

Frankel (2005) claims that there are other third factors, such as common language, colonial history, and political/institutional link, that may influence both currency choice and trade link. In this regard, high correlations reported in earlier studies may be spurious as an artifact of reverse causality. A related issue is how the currency union is formed. Countries who decide to join a currency union are self-selected on the basis of distinctive features shared by countries that have been EU members during the pre-Euro period. Hence, countries are likely to foster integration by enhancing standards of harmonization and reducing regulatory barriers. To address this issue, a number of studies have employed different techniques such as Heckman selection and instrumental variables, though they still obtained the substantial Euro effects on trade, e.g. Persson (2001) and Alesina et al. (2002).[6]

A more important issue is omitted variables bias. Omitted pro-bilateral trade variables are likely to be correlated with the currency union dummy, as the formation of currency unions is not random, but rather driven by some factors which are likely to be omitted from the gravity regression. The implication is that the Euro effect will capture general economic integration among the member states, not merely the currency effect. Several studies tried to reduce the endogenous effect of currency unions by introducing country-pair and year fixed effects in the gravity regression, see Micco et al. (2003), Flam and Nordström (2006) and Berger and Nitsch (2008).

Anderson and van Wincoop (2003) propose the 'micro foundation' of the gravity equation by introducing the multilateral resistance terms, which are relative trade barriers - the bilateral barrier relative to average trade barriers that both countries face with all their trading partners. Hence, the standard gravity model is seriously lacking if multilateral resistance terms and/or trade costs are ignored or seriously misspecified.[7] Furthermore, Baldwin (2006) stresses an importance of taking into account time-varying multilateral resistance terms, and criticises the conventional fixed effect estimation because many of omitted pair-specific variables clearly reflect time-varying factors such as multilateral trade costs. The use of time-invariant effects only may still leave a time-series trace in the residual, which is likely to be correlated with the currency union dummy (*e.g.* Baldwin and Taglioni, 2006).

A number of studies have attempted to capture such time-varying effects. Bun and Klaassen (2007) claim that upward trends in omitted trade determinants may cause the estimated Euro effect to be substantially upward-biased, and these biases tend to be magnified as the sample period enlarges. In order to deal with the heterogeneous effects of time varying omitted components across country-pairs, they introduce a time trend with heterogeneous coefficients, and find that the Euro effect on trade falls dramatically from 51% to 3% for the dataset over the period, 1967-2002. Moreover, Berger and Nitsch (2008) find no impact of the Euro on trade when including a linear trend in the gravity regression for the data over the period, 1948-2003, and conclude that the Euro-

[6]The Heckman approach produces estimates in the order of 50 %. Surprisingly, however, the instrumental variable approach generates huge estimates of the currency effects, sometimes even larger than the Rose effect.

[7]The empirical gravity literature has simply added the so-called remoteness variable, which is defined as a weighted average distance from all trading partners with the weights being based on the size of the trading partners, *e.g.* Frankel and Wei (1998) and Melitz (2007), though such atheoretical remoteness indices fail to capture any of the relative trade barriers in a coherent manner.

12 countries have already been integrated strongly even before the Euro was created.

In sum, a large number of existing studies have established an importance of appropriately taking into account unobserved and time-varying multilateral resistance and bilateral heterogeneity, simultaneously. This immediately raises another important issue of cross-section dependence among trade flows, which has been neglected in the aforementioned studies. Only recently, Herwartz and Weber (2010) propose to capture multilateral resistance terms and omitted trade costs via unobserved time-varying country-pair specific random walk factors, and develop the Kalman-filter extension of the gravity model. They find that aggregate trade (export) within the Euro area increases between 2000 and 2002 by 15 to 25 percent compared with trade with non-members. Camaero et al. (2012) suggest to estimate a gravity equation by a panel-based cointegration approach that allows for cross-section dependence through the common factors. Applying the continuously updated estimator of Bai et al. (2009) to the bilateral dataset for 26 OECD countries over the period 1967-2008, they find that the Euro appears to generate somewhat lower trade effects than suggested by previous studies.[8] {*more??*}

Alternatively, Behrens et al. (2012) derive a quantity-based structural gravity equation system in which both trade flows and error terms are allowed to be cross-sectionally correlated, and propose the modified spatial techniques by adopting a broader definition of the spatial weight matrix, called the interaction matrix, which can be derived directly from a theoretical model. By controlling for cross-sectional interdependence and thus directly capturing multilateral resistance, they find that the measured Canada–US border effects are significantly lower than paradoxically large estimates reported by McCallum (1995).[9]

Taken together, all of the above discussions may suggest that an Euro effect on trade is expected to be smaller than previously thought once multilateral resistance term is well-captured through appropriately modelling cross-sectional correlation of trade flows. In retrospect, Serlenga and Shin (2007, henceforth SS) is the first paper to propose the cross-sectionally dependent panel gravity model by explicitly incorporating both observed and unobserved factors which are designed to control for time-varying multilateral resistance, trade costs and globalisation trends, simultaneously. In order to consistently estimate the parameters on both time-varying and time-invariant regressors, SS propose to combine the consistent estimator proposed by Pesaran (2006) with the instrument variables estimators advanced by Hausman and Taylor (1981).[10] By applying

[8]The approach by Camaero et al. (2012) can be regarded as an extension of Bun and Klaasen (2007), who estimate the long-run cointegrating relationship without controlling for cross-section dependence. Interestingly, however, the euro impact is estimated at about 16%, substantially higher than 3% estimated by Bun and Klaasen (2007).

[9]Behrens et al. (2012) also argue that their approach - unconstrained linearized gravity equation with cross-sectionally correlated trade flows - is better suited than the two-stage gravity equation system with nonlinear constraints in unobservable price indices advanced by Anderson and von Wincoop (2003).

[10]Bertoli and Fernández-Huertas Moraga (2013) propose an empirical framework in which the common factor setup can be derived from the theoretical gravity model, thus justifying the link between factors with heterogeneous loadings and multilateral resistance terms. In this context, they apply the CCE estimator proposed by Pesaran (2006) to the gravity model of migration flows using high-frequency data during the Spanish immigration boom between 1997 and 2009, and document evidence that controlling for multilateral resistance to migration tend to produce much larger policy effects. These studies also demonstrate that ignoring the

the proposed approach to the dataset for 91 country-pairs of 14 EU countries over the period 1960-2001, SS find that the introduction of a common currency does not exert any significant effect on intra-EU trade, though their sample covers only three years' data after the introduction of the Euro in 1999.

Given the availability of a longer sample, we wish to redress this important issue by extending the cross-sectionally dependent panel gravity model and addressing all of the issues related to unobserved and time-varying multilateral resistance and bilateral heterogeneity as surveyed above.

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{*Need more editing, also check any important paper to miss?*}

The recent European sovereign-debt crises have exacerbated the difference between core and peripheral economies in the EU. Especially, peripheral countries suffer from the high level of current account deficits and government debts. Such negative economic outlooks ignite intense political debates to questioning the existence of the Euro or the exit of weakest countries. Standard Eurobarometer (2013) shows that the public opinion loses its confidence in the EU as an institution, especially in Southern countries. These trends are clearly reflected in the latest European election outcomes in May 2014 as we have seen the rise of Euro-scepticisms with Anti-European parties gaining 100 seats out of 751 seats (*The Economist*, 31 May 2014). **{Recent Greek Poll??}**

Current account imbalances are the outcome of cross-country differences in saving patterns, investment patterns and the degree of risk of assets. These differences are sometimes leading to good or bad imbalances (Blanchard and Milesi-Ferretti, 2009 and Lane 2012). When large deficit countries grow much slowly than surplus countries, consumption growth in the former necessarily rises faster than income growth, a process that is very likely to end in crisis unless the debtor's income growth catches up. Indeed, this trend underlies the sovereign debt crisis within the euro zone (Giavazzi and Spaventa, 2010). Holinski et al. (2012) document that the current account of the euro area has been roughly balanced over the period 1992-2007. On the contrary, the increasing current account surpluses in North are due to upward trends in the trade surplus and its net factor income receipts whereas the increasing current account deficits in South are driven mainly by the decline in transfers and the increase in net factor payments. As about two-thirds of the current account deficit is due to its net factor income payments, it is not the trade balance dynamics that cause the massive current account deficits in South but rather the loss of transfer receipts and the increased net factor payments.[11] **{V: I would put this results as the evidence that for the CA the effect of EU is even worse rather than the trade balance is not relevant}** They then conclude that systematic monitoring of external imbalances and implementing better coordinated policies to prevent the emergence of unsustainably large imbalances is advisable.

multilateral resistance generates biased estimates of the determinants of migration.

[11] See also Jaumotte and Sodsriwiboon (2010) for similar descriptive evidence, showing that of the 10% average decline in the current account, the trade balance contributed 2.8%, net income contributed 3.6%, and net transfers 3.6%. **{different definition of CB??} {different groups: South=GIPS in Holinski et al. (2012) and South=Cyprus, Greece, Italy, Malta, Portugal, Slovenia, and Spain in Jaumotte and Sodsriwiboon (2010) and different periods: 1999-2007 (average, I suppose) in Holinski et al. (2012) and 2008 in Jaumotte and Sodsriwiboon (2010).}**

A few empirical studies mostly searching for determinants of current account balances... Many studies have explored the determinants of current account balances in Europe... this is from Niemen (2014) and I will simlify further...}

{V: In early contributions, current account deficit in poor countries and surplus in rich countries has been interpreted as the result of economic and financial integration, which allowed capital flows from the rich countries to finance investment in the poor countries.}

By using a simple intertemporal model, Blanchard and Giavazzi (2002) show that for a converging country the recommended level of current account deficit increases with the expected output growth (relative to others) and with the elasticity of substitution between domestic and foreign goods.**{V: This is because poorer countries' growth potential attracts foreign capital which finance current account deficits. Economic integration facilitates poorer countries' borrowing, hence causes the worsening of the current account.}** Indeed, the authors provide evidence that for the euro area, the relation between the current account balance and income per capita was much stronger during the 1994–2000 period than during the 1985–1993 period. Furthermore, they observe that the correlation between savings and investments, the Feldstein-Horioka puzzle, largely disappear with the increased integration. Schmitz and von Hagen (2011) test whether the net capital flows follow differences in per capita income among the EU-15 countries by employing trade balances against euro area and the rest of the world over the period 1981-2005. They find that the net capital flows follow differences in per capita income and that this elasticity increased following the inception of the euro, and conclude that the widening of current account balances within the euro area should be considered a sign of the proper functioning of the euro area rather than a sign of improper macroeconomic adjustment. Niemen (2014) augmented the previous studies by including a larger set of theoretically plausible explanatory variables derived from the standard current account literature, and find out that the main results by Schmitz and von Hagen (2011) largely disappear, namely the introduction of the euro has not increased the elasticity of trade flows to per capita income among EU-15 countries over the period from 1984 to 2011. In addition, Niemen (2014) demonstrates that there is significant heterogeneity among the usual determinants of trade balances whether those contribute to intra balances or extra balances.

{Already Jones (2003) in the early stage of the monetary union warned against the potential danger of peripheral countries excessive accumulation of deficits. In a later paper, Giavazzi and Spaventa (2010) argue that foreign borrowing is not necessarily devoted to the production of tradable goods. If a country is borrowing to finance the production of non-tradables, it might be unsuccessful in generating the required trade surpluses in future. ***V:I moved this part from a footnote to the introduction of studies concerning "bad" imbalances.*****}**

{V: In a descriptive analysis, Holinski et al. (2012) interpret worsening net factor income as evidence that peripheral countries are borrowing from core countries in order to maintain its positive net imports and to finance its past debt service.
quotation from the paper:**}**

"In summary, the increasing current account surpluses in North over the

period are due to upward trends in the trade surplus and its net factor income receipts. The increasing current account deficits in South are driven mainly by the decline in transfers and the increase in net factor payments. The trade balance dynamics play a marginal role in South. Put differently, South has entered a vicious circle: Lower transfers did not lead to structural adjustment of the trade balance. Instead, South has been borrowing to allow it to maintain its positive net imports and finance its debt service. However, the borrowing only further increases the net foreign debt and subsequent interest payments, predictably leading to an unsustainable net foreign debt position in the future." **{V: They show that inflow of capital has not generated an increase in private investment, rather it financed higher consumption. The lack of gains in productivity and per-capita income sheds doubts on the convergence of peripheral countries and on the sustainability of the imbalances.}**

"In summary, we conclude that the evidence in favor of structural economic convergence is weak as yet. In accordance with theory, capital has flowed from high-income North to low-income South between 1992 and 2007, even accelerating after the introduction of the euro in 1999. Also, real exchange rates in South have appreciated because of higher inflation rates, which is consistent with theory. Unfortunately, the cumulative inflow of capitalØ²oughly equal to 50 percent of SouthÓ³ GDPØ¯ver the period 1999-2007 has not yet resulted in measurable gains of productivity and per capita income. increase in private investment in South has remained limited despite the massive inflow of capital. Lower savings and higher consumption play an equally large role. In our view, the overall picture casts serious doubt on the hypothesis of automatic convergence in the euro area."

Moreover, Shambaugh (2012) argues that the monetary union has caused a loss of competitiveness of the high-inflation peripheral countries with respect to low-inflation core countries, because of the increase in the relative prices of peripheral countries with respect to core countries. The capital inflow, by increasing internal prices, worsened even more the competitiveness of peripheral countries.

Jaumotte and Sodsriwiboon (2010): Dependent variable: current account vs all countries (intra+extra) over GDP. They use country (not pair) level data - source IMF-IFS; (i) financial liberalization weakened the current account balance, mostly by depressing saving rates;20 (ii) the impact of EMU on current accounts was positive for NEA, and negative but insignificant for SEA; and (iii) in contrast to EMU, euro adoption lowered current accounts substantially in both subregions by raising investment. How can these effects be explained??

On the one hand, EMU appears to have improved current accounts in the Northern countries by a sizeable amount (about 3 percentage points), while no significant effect is found for Southern countries. On the other hand, euro adoption tended to lower current accounts in both subregions, also by a sizeable amount (an additional 4 percentage points relative to the EMU effect). **{V: However, since they use current account against the rest of the world, their approach does not clarify which is the direction of flows between north and south}**

{V:*I moved this part upper*} Berger and Nitsch (2014) used bilateral trade data on 18 European countries from 1948 to 2008. They observed that, as

a result of introduction of the euro, the trade imbalances among the euro area members widened and became more persistent. **More.... {V: They analyze bilateral trade balances of 18 European countries and they find that the countries belonging to the EMU have on average 1.8- 3% higher imbalance, defined as absolute difference between export and import for each countries pair. Moreover, the imbalances are 25% more persistent for EMU countries, with respect to the other European countries.}**

Chen, Milesi-Ferretti, and Tressel (2013) make an important observation by saying that the explanations for euro area current account imbalances highlighted above, namely, the catching-up process and diverging competitiveness, rely on intra-euro area factors. However, the euro area as a whole is an open economy; therefore, trade and financial linkages between the euro area and the rest of the world are also important. They detect the following pattern: debtor countries, namely, Greece, Ireland, Italy, Portugal, and Spain, experienced real appreciation, but this largely resulted from the strengthening of the euro. Greece, Portugal and Spain had a trade deficit not only against the eurozone but also against the rest of the world. The investors outside the euro area primarily invested in core euro area countries such as Germany and France, whereas private capital flows from the core countries financed the deficits in the GIIPS countries. Consequently, they put forth a hypothesis that external shocks might have had an asymmetric impact on the export performance of Germany and GIIPS countries. They find evidence that there were differences on how the rise of China, higher oil prices, and the integration of Central and Eastern European countries affected the trade performance of GIIPS countries compared to Germany.

Criticism against the existing methodologies: we use the Prais-Winsten estimation with panel-corrected standard errors, which allows residuals to be contemporaneously correlated across panels.

Schmitz and von Hagen (2011) used the Prais-Winsten estimator with panel-corrected standard errors. We do not include period dummies in our model because these cannot be identified when we are including Oil...

During the period of 1999–2011, Greece (161% of GDP), Portugal (120% of GDP), and Spain (66% of GDP) were the Southern euro area countries that accumulated the largest trade deficits, whereas the Netherlands (62% of GDP), Germany (58% of GDP), and Finland (33% of GDP) were the Northern euro area countries that accumulated the largest trade surpluses.

Schmitz and von Hagen (2011) provide evidence that the elasticity of trade flows to per capita incomes within the euro area for member countries increased as a result of the euro. When we augment their model using standard variables from the current account literature, we find out that this result largely disappears...

Then criticism against their approach and methodology, esp. in terms of the euro effect... importantly suffering from an identification issue and no account of pervasive CSD... hence those results may be suggestive but potentially misleading... This provides our second motivation and contributions...

I also add the few of our previous discussions...

Then discuss the paper Current accounts and financial flows in the euro area by Alexandr Hobza, Stefan Zeugner: **{I would put this results as the evidence that for the CA the effect of EU is even worse rather than the trade balance is not relevant}**

We construct a new database of bilateral financial flows among euro area countries and their major world partners and explore the role of financial links in the accumulation and then adjustment of current account imbalances in the euro area. The data show that the geography of financial flows can differ quite markedly from trade flow patterns and suggest that the nexus between surpluses in the core with deficits in the periphery went along financial rather than trade interlinkages.

At the same time, the euro area as a whole, despite its economic weight and intensive participation in cross-border trade and finance, had a broadly balanced current account. This implies that the deficits were almost exclusively financed from the surpluses in other euro area countries...

We also analyze the relative role of bilateral financial and trade flows in shaping the pattern of intraeuro area imbalances.

We argue that financial flows have been key in driving the specific pattern of intra-euro area imbalances, overriding the traditional role of trade flows in determining external balances of countries. Bilateral net trade does not provide a good indication of net bilateral financial flows.

In the euro area, the surplus countries financed the periphery by more than their bilateral trade balances, and effectively intermediated flows coming from the rest of the world. Using spatial econometric analysis, we then assess the relative importance of financial spillovers and interlinkages between surplus and deficit countries.We find that financial interlinkages are significant and negative: a country is more likely to run a deficit if its major financial partners run surpluses, and vice versa. In contrast, trade spillovers tend to have a different pattern and countries are more likely to run a current account surplus if their trade partners run a surplus. These findings are highly relevant for empirical analyzes of cross-border spillovers. Weights based on trade flows are usually used in this type of analysis as a measure of interlinkages. However, this may not be fully appropriate

read 4.4. Trade, financial flows and current accounts

Fig. 10 decomposes the total financial account balance and the trade balance as % of GDP into bilateral balances with the euro area (horizontal axis) and the rest of the world (vertical axis) for a number of countries in the period before the crisis

For a broad sample of 40 countries over 2001-12, bilateral trade and financial balances are not statistically associated: the correlation coefficient between the geographical components of these balances (expressed as % of GDP) is close to zero (0.002). The same applies just for the EU (0.013)... In the absence of similarity between the bilateral trade and financial flows, it is the latter that appear to be more aligned with the pattern of current account balances in the euro area.

Table 1

Spatial correlation along financial and trade linkages.

Table 1 presents the results for a broad sample of 37 countries over the period 1999e2010 which show that there is a positive and strongly significant correlation between current account balances and both trade and financial flows. This would imply that countries are more likely to run a current account surplus if their trade or financial partners run a surplus, and vice versa for deficits. However, the spatial correlation coefficient becomes insignificant for trade linkages when the residuals for a current account regression are used. This finding indicates that any positive spatial correlation of unadjusted current account balances along trade links is mainly reflecting secular trends in the underlying current account determinants. In contrast, the spatial correlation of current account residuals is significantly negative along financial links. This implies that on top of the effects of current account determinants captured in the underlying regression, the variation in current account balances is also influenced by spillovers along financial links. The negative coefficient means that a country is more likely to run a deficit if its financial partners run a surplus, and vice versa. This result holds both for the whole sample as well as the sub-sample of euro area countries.

{YC: Vanessa and Camilla?} move some discussions in section 4.2 and combine here to complete a sort of literature review??

3 Cross Sectionally Correlated Panel Gravity Models

An Euro effect on trade flows and trade balances should be carefully examined under the appropriate econometric framework that is expected to deal with time-varying and cross-sectionally correlated multilateral resistance and bilateral heterogeneity in a robust manner.[12] In what follows, we describe two alternative approaches, the spatial-based techniques developed by Behrens, Ertur and Kock (2012, hereafter BEK) and the factor-based approach proposed by Serlenga and Shin (2013, hereafter SS). Then, following recent research trends (Bailey *et al.* 2013; Mastromarco *et al.*, 2014), we propose the unified framework for accommodating both weak and strong CSD in the panel gravity models.

Consider the factor-based panel data model:

$$y_{it} = \beta' \mathbf{x}_{it} + \gamma' \mathbf{z}_i + \pi_i' \mathbf{s}_t + \varepsilon_{it},\ i = 1, ..., N,\ t = 1, ..., T, \tag{1}$$

$$\varepsilon_{it} = \alpha_i + \varphi_i' \theta_t + v_{it}, \tag{2}$$

where $\mathbf{x}_{it} = (x_{1,it}, ..., x_{k,it})'$ is a $k \times 1$ vector of variables that vary across individuals and over time periods, $\mathbf{s}_t = (s_{1,t}, ..., s_{s,t})'$ is an $s \times 1$ vector of observed factors, $\mathbf{z}_i = (z_{1,i}, ..., z_{g,i})'$ is a $g \times 1$ vector of individual-specific variables, $\beta = (\beta_1, ..., \beta_k)'$, $\gamma = (\gamma_1, ..., \gamma_g)'$ and $\pi_i = (\pi_{1,i}, ..., \pi_{s,i})'$ are the associated

[12] The multilateral resistance function and trade costs are not only difficult to measure, but also vary over time. A number of *ad hoc* approaches have been proposed. Simply, fixed time dummies or time trends are added as a proxy, *e.g.* Bun and Klaassen (2007) and Berger and Nitsch (2008). Alternatively, regional remoteness indices are considered (*e.g.* Melitz and Ghironi, 2007).

column vectors of parameters, α_i is an individual effect that might be correlated with regressors, $\mathbf{x}_{it}$ and $\mathbf{z}_i$, θ_t is the $c \times 1$ vector of unobserved common factors with the heterogeneous loading vector, $\varphi_i = (\varphi_{1,i}, ..., \varphi_{c,i})'$, and v_{it} is a zero mean idiosyncratic disturbance with constant variance. Chudik *et al.* (2011) show that these factor models exhibit the strong form of cross section dependence (hereafter, CSD).

To avoid the potential biases associated with the cross-sectionally dependent factor structure, (1), we consider the use of the two leading approaches developed by Pesaran (2006) and Bai (2009). Hence, we consider the following cross-sectionally augmented regression of (2):

$$y_{it} = \beta' \mathbf{x}_{it} + \gamma' \mathbf{z}_i + \lambda_i' \mathbf{f}_t + \tilde{\alpha}_i + \tilde{v}_{it},\ i = 1, ..., N,\ t = 1, ..., T, \tag{3}$$

where $\mathbf{f}_t$ is the $\ell \times 1$ vector of augmented factors with $\ell = s + 1 + k$ and $\lambda_i = (\lambda_{1,i}, ..., \lambda_{\ell,i})'$, $\bar{y}_t = N^{-1} \sum_{t=1}^{T} i = 1^N y_{it}$, $\bar{\mathbf{x}}_t = N^{-1} \sum_{t=1}^{T} i = 1^N \mathbf{x}_{it}$, $\lambda_i' = (\pi_i' - (\varphi_i / \bar{\varphi})\, \bar{\pi}', (\varphi_i / \bar{\varphi}), -(\varphi_i / \bar{\varphi})\, \beta')'$ with $\bar{\varphi} = N^{-1} \sum_{t=1}^{T} i = 1^N \varphi_i$ and $\bar{\pi} = N^{-1} \sum_{t=1}^{T} i = 1^N \pi_i$, $\tilde{\alpha}_i = \alpha_i - (\varphi_i / \bar{\varphi})\, \bar{\alpha} - (\varphi_i / \bar{\varphi})\, \gamma' \bar{\mathbf{z}}$ with $\bar{\alpha} = N^{-1} \sum_{t=1}^{T} i = 1^N \alpha_i$ and $\bar{\mathbf{z}} = N^{-1} \sum_{t=1}^{T} i = 1^N \mathbf{z}_i$, and $\tilde{v}_{it} = v_{it} - (\varphi_i / \bar{\varphi})\, \bar{v}_t$ with $\bar{v}_t = N^{-1} \sum_{t=1}^{T} i = 1^N v_{it}$. Using (3), we can estimate β consistently by the Pesaran's Pooled Common Correlated Effects (PCCE) estimator or the Bai's (2009) interactive principal component (IPC) estimator as follows:

$$\hat{\boldsymbol{\beta}}_{CSD} = \left(\sum_{t=1}^{T} \sum_{i=1}^{N} \mathbf{x}_i' \mathbf{M}_T \mathbf{x}_i \right)^{-1} \left(\sum_{t=1}^{T} \sum_{i=1}^{N} \mathbf{x}_i' \mathbf{M}_T \mathbf{y}_i \right),\ \hat{\boldsymbol{\beta}}_{CSD} = \hat{\boldsymbol{\beta}}_{CSD\,PCCE} \text{ or } \hat{\beta}_{IPC} \tag{4}$$

where $\mathbf{y}_i = (y_{i1}, ..., y_{iT})'$, $\mathbf{x}_i = (\mathbf{x}_{i1}, ..., \mathbf{x}_{iT})'$, $\mathbf{M}_T = \mathbf{I}_T - \mathbf{H}_T \left(\mathbf{H}_T' \mathbf{H}_T \right)^{-1} \mathbf{H}_T'$, $\mathbf{H}_T = (\mathbf{1}_T, \mathbf{f})$, $\mathbf{1}_T = (1, ..., 1)'$ and $\mathbf{f} = (\mathbf{f}_1', ..., \mathbf{f}_T')'$. Notice that $\mathbf{f}_t = (\mathbf{s}_t', \bar{y}_t, \bar{\mathbf{x}}_t')'$ for PCCE and $\mathbf{f}_t = \left(\mathbf{s}_t', \hat{\theta}_t' \right)'$ for IPC.

Alternatively, the CSD among trade flows can be investigated through employing the spatial techniques. This approach assumes that the structure of CSD is related to the location and the distance on the basis of a pre-specified weight matrix. Hence, CSD is represented mainly by means of a spatial process, which explicitly relates each unit to its neighbours. The most popular approaches are the Spatial Autoregressive (SAR), the Spatial Moving Average (SMA), and the Spatial Error Component (SEC) specifications. The spatial panel data model is estimated using the maximum likelihood (ML) or the generalized method of moments (GMM) techniques (*e.g.*, Elhorst, 2011). We follow BEK and consider a spatial panel data gravity (SARAR) model, which combines a spatial lagged variable and a spatial autoregressive error term:

$$y_{it} = \rho y_{it}^* + \beta' \mathbf{x}_{it} + \gamma' \mathbf{z}_i + \tilde{\alpha}_i + v_{it},\ i = 1, ..., N,\ t = 1, ..., T, \tag{5}$$

$$v_{it} = \lambda v_{it}^* + u_{it} \tag{6}$$

where $y_{it}^* = \sum_{j \neq i}^{N} w_{ij} y_{jt}$ is the spatial lagged variable, and $v_{it}^* = \sum_{j \neq i}^{N} w_{ij} v_{jt}$ is the spatial autoregressive error term, w_{ij}'s are the spatial weight with the row-sum normalisation, $\sum_i w_{ij} = 1$, and u_{it} is a zero mean idiosyncratic disturbance with constant variance. This approach is especially designed to deal

with weak CSD across variables and errors. ρ is the spatial lag coefficient and λ is the spatial error component coefficient. These coefficients capture the spatial spillover effects and measure the influence of the weighted average of neighboring observations. Chudik *et al.* (2011) show that a particular form of a weak cross dependent process arises when pairwise correlations take non-zero values only across finite units that do not spread widely as the sample size rises.[13]

Notice that the factor-based procedure can be extended to cope with the weak spatial effects (*e.g.*, Holly *et al.*, 2010). This can be achieved by applying the spatial model to the (de-factored) residuals, because the spatial dependence is dominated by the common factor error structure. Bailey *et al.* (2013) develop methods that can distinguish the relationship between spatial units that is purely spatial from that which is due to the effect of common factors, and propose the multi-step estimation and testing procedure. They find that this approach can successfully uncover genuine spatial correlations in the study of US house prices. Recently, Kapetanios *et al.* (2014) propose an alternative nonlinear panel data model which can generate strong and/or weak CSD endogenously. This approach allows for considerable flexibility in terms of the genesis of the herding or clustering type behavior.

Following these research trends, MSS propose the novel framework for accommodating both weak and strong CSD in modelling technical efficiency in stochastic frontier panels by combining the exogenously driven factor-based approach and an endogenous threshold regime selection mechanism simultaneously. We now consider the following unified modelling approach:

$$y_{it} = \beta' \mathbf{x}_{it} + \gamma' \mathbf{z}_i + \pi_i' \mathbf{s}_t + \varepsilon_{it},\ i = 1, ..., N,\ t = 1, ..., T, \tag{7}$$

$$\varepsilon_{it} = u_{it} + v_{it}, \tag{8}$$

$$u_{it} = \alpha_i + \rho \tilde{u}_{it}(r) + \varphi_i' \theta_t, \tag{9}$$

$$\tilde{u}_{it}(r) = \frac{1}{m_{it}} \sum_{j=1}^{N} I\left(|u_{it-1} - u_{jt-1}| \geq r\right) u_{jt-1}, \tag{10}$$

where $\tilde{u}_{it}(r)$ represents a spatial or cluster effect, r is the threshold parameter (determined endogenously) and v_{it} is an idiosyncratic disturbance. MSS develop the consistent estimation techniques, which involve the iterative estimations of (7) and (9) until convergence. The resulting CSD-consistent estimators are denoted respectively as the PCCE-KMS and the IPC-KMS estimator.

The proposed specifications can be expected to deal with complex interdependence across all trading partners in a flexible manner. In particular, the term, $\tilde{u}_{it}(r)$ in (9) is defined as the cross-sectional local average of the unobserved trade barrier among 'distant' trading partners, and thus it may be thought of capturing the multilateral resistance term via the spatial spillover effects. For example, as discussed by Behrens *et al.* (2012), if the trade barriers between country k and country j (k different from i and j) are reduced, then the trade flows between country j and country k increase while the trade flows

[13] In particular, Pesaran and Tosetti (2011) show that spatial processes can be represented by a process with an infinite number of weak factors and no idiosyncratic error terms.

between country i and j decrease. In this regard, we expect the sign of ρ to be negative because 'multilateral resistance' drives the trade flows towards alternative destinations. Determining how countries relate to each other requires us to select a suitable metric for dealing with any kind of interactions in any network structure on the basis of a dissimilarity (or similarity) measure. Our approach is expected to select this metric in an appropriate manner. We allow the trading partners to cluster and these clusters to evolve over time. The distinguishing feature of our approach lies in the use of both weak and strong CSD components through $\tilde{u}_{it}(r)$ and θ_t in modelling multilateral resistance and bilateral heterogeneity in a robust manner.

The panel gravity specification includes both time-varying and time-invariant regressors. This raises the issue that both PCCE and IPC estimators are unable to estimate the coefficients, γ on time-invariant variables because they are the extended fixed effect estimators. In this regard, SS combine the PCCE estimation with the instrumental variables estimation proposed by Hausman and Taylor (1981, HT), and develop the PCCE-HT estimator. Baltagi (2010) further proposes the PCCE-AM estimator by employing the additional instrument variables proposed by Amemiya and MaCurdy (1986, AM). We can also develop the corresponding counterparts, using the Bai's IPC estimator, which we denote by IPC-HT and IPC-AM estimators, respectively.

Conformable with HT, we now decompose $\mathbf{x}_{it} = (\mathbf{x}'_{1it}, \mathbf{x}'_{2it})'$ and $\mathbf{z}_i = (\mathbf{z}'_{1i}, \mathbf{z}'_{2i})'$ in (7), where $\mathbf{x}_{1it}$, $\mathbf{x}_{2it}$ are $k_1 \times 1$ and $k_2 \times 1$ vectors, and $\mathbf{z}_{1i}$, $\mathbf{z}_{2i}$ are $g_1 \times 1$ and $g_2 \times 1$ vectors with $k_1 \geq g_2$. Under the standard assumptions that $\mathbf{x}_{1it}$ and $\mathbf{z}_{1i}$ are uncorrelated with α_i, but $\mathbf{x}_{2it}$ and $\mathbf{z}_{2i}$ are correlated with α_i, we can estimate γ consistently using instrumental variables in the following regression:

$$d_{it} = \gamma'_1 \mathbf{z}_{1i} + \gamma'_2 \mathbf{z}_{2i} + \alpha^*_i + u^*_{it} = \mu + \gamma' \mathbf{z}_i + \varepsilon^*_{it},\ i = 1, ..., N,\ t = 1, ..., T, \quad (11)$$

where $d_{it} = y_{it} - \boldsymbol{\beta}'_{CSD} \mathbf{x}_{it} - \lambda'_i \mathbf{f}_t$, $\mu = E(\alpha^*_i)$ and $\varepsilon^*_{it} = (\alpha^*_i - \mu) + u^*_{it}$ is a zero mean process by construction. In matrix notation we have:

$$\mathbf{d} = \mu \mathbf{1}_{NT} + \mathbf{Z}_1 \gamma_1 + \mathbf{Z}_2 \gamma_2 + \varepsilon^*, \quad (12)$$

where $\mathbf{d} = (\mathbf{d}'_1, ..., \mathbf{d}'_N)'$, $\mathbf{d}_i = (d_{i1}, ..., d_{iT})'$, $\mathbf{Z}_j = \left(\left(\mathbf{z}'_{j1} \otimes \mathbf{1}_T \right)', ..., \left(\mathbf{z}'_{jN} \otimes \mathbf{1}_T \right)' \right)'$, $j = 1, 2$, $\mathbf{1}_{NT} = (\mathbf{1}'_T, ..., \mathbf{1}'_T)'$, $\mathbf{1}_T = (1, ..., 1)'$, and $\varepsilon^* = \left(\varepsilon^{*\prime}_1, ..., \varepsilon^{*\prime}_N \right)'$ with $\varepsilon^*_i = (\varepsilon^*_{i1}, ..., \varepsilon^*_{iT})'$. Replacing $\mathbf{d}$ by its consistent estimate, $\hat{\mathbf{d}} = \left\{ \hat{d}_{it}, i = 1, ..., N,\ t = 1, ..., T, \right\}$, where $\hat{d}_{it} = y_{it} - \hat{\boldsymbol{\beta}}'_{CSD} \mathbf{x}_{it} - \hat{\lambda}'_i \mathbf{f}_t$ with $\hat{\lambda}_i$ the OLS estimator of λ_i consistently estimated from the regression of $\left(y_{it} - \hat{\beta}'_{CSD} \mathbf{x}_{it} \right)$ on $(1, \mathbf{f}_t)$ for $i = 1, ..., N$, we have:

$$\hat{\mathbf{d}} = \mu \mathbf{1}_{NT} + \mathbf{Z}_1 \gamma_1 + \mathbf{Z}_2 \gamma_2 + \varepsilon^+ = \mathbf{C} \delta + \varepsilon^+, \quad (13)$$

where $\varepsilon^+ = \varepsilon^* + \left(\hat{\mathbf{d}} - \mathbf{d} \right)$, $\mathbf{C} = (\mathbf{1}_{NT}, \mathbf{Z}_1, \mathbf{Z}_2)$ and $\delta = (\mu, \gamma'_1, \gamma'_2)'$.

To deal with nonzero correlation between $\mathbf{Z}_2$ and α, we need to find the $NT \times (1 + g_1 + h)$ matrix of instrument variables:

$$\mathbf{W} = [\mathbf{1}_{NT}, \mathbf{Z}_1, \mathbf{W}_2],$$

where $\mathbf{W}_2$ is an $NT \times h$ matrix of instrument variables for $\mathbf{Z}_2$ with $h \geq g_2$ for identification. First, we consider the $NT \times (k_1 + \ell)$ HT instrument matrix given by

$$\mathbf{W}_2^{HT} = \left[\mathbf{P}\mathbf{X}_1, \mathbf{P}\hat{\xi}_1, \mathbf{P}\hat{\xi}_2, ..., \mathbf{P}\hat{\xi}_\ell\right]$$

where $\mathbf{P} = \mathbf{D}(\mathbf{D}'\mathbf{D})^{-1}\mathbf{D}'$ is the $NT \times NT$ idempotent matrix with $\mathbf{D} = \mathbf{I}_N \otimes \mathbf{1}_T$, $\mathbf{I}_N$ an $N \times N$ identity matrix, and $\hat{\xi}_j = \left(\hat{\lambda}_{j,1}\mathbf{f}_j', \hat{\lambda}_{j,2}\mathbf{f}_j', ..., \hat{\lambda}_{j,N}\mathbf{f}_j'\right)'$, $j = 1, ..., \ell$, where $\mathbf{f}_j = (f_{j,1}, ..., f_{j,T})'$. Next, we derive the $NT \times (k_1 + \ell + Tk_1 + T\ell)$ AM instrument matrix by

$$\mathbf{W}_2^{AM} = \left[\mathbf{W}_2^{HT}, (\mathbf{Q}\mathbf{X}_1)^*, \left(\mathbf{Q}\hat{\xi}_1\right)^*, \left(\mathbf{Q}\hat{\xi}_2\right)^*, ..., \left(\mathbf{Q}\hat{\xi}_\ell\right)^*\right] \tag{14}$$

where $\mathbf{Q} = \mathbf{I}_{NT} - \mathbf{P}$ and $(\mathbf{Q}\mathbf{X}_1)^* = (\mathbf{Q}\mathbf{X}_{11}, \mathbf{Q}\mathbf{X}_{12}, ..., \mathbf{Q}\mathbf{X}_{1T})$ is the $NT \times k_1 T$ matrix with $\mathbf{Q}\mathbf{X}_{1t} = (\mathbf{Q}\mathbf{X}_{11t}, ..., \mathbf{Q}\mathbf{X}_{1kt})'$.[14]

To derive the consistent estimator of δ, we premultiply $\mathbf{W}'$ by (13)

$$\mathbf{W}'\hat{\mathbf{d}} = \mathbf{W}'\mathbf{C}\delta + \mathbf{W}'\varepsilon^+. \tag{15}$$

Therefore, the GLS estimator of δ is obtained by

$$\hat{\delta}_{GLS} = \left[\mathbf{C}'\mathbf{W}\mathbf{V}^{-1}\mathbf{W}'\mathbf{C}\right]^{-1}\mathbf{C}'\mathbf{W}\mathbf{V}^{-1}\mathbf{W}'\hat{\mathbf{d}}, \tag{16}$$

where $\mathbf{V} = Var\left(\mathbf{W}'\varepsilon^+\right)$. To obtain the feasible GLS estimator we replace $\mathbf{V}$ by its consistent estimator. In practice, estimates of δ and $\mathbf{V}$ can be obtained iteratively until convergence, see also SS for further details.

Notice that the HT-IV estimator employs only the individual mean of $\mathbf{X}_1$ to be uncorrelated with the effects, α_i^* whereas the AM-IV estimator exploits such moment conditions to be held at every time period. Hence, the validity of the AM instruments requires a stronger exogeneity assumption for $\mathbf{X}_1$, under which the AM-IV estimator is more efficient than HT-IV. The validity of the AM instruments can be easily tested via the Hausman statistics testing for the difference between HT-IV and AM-IV estimators as follows:

$$H_{AM} = \left(\hat{\delta}_{AM} - \hat{\delta}_{HT}\right)'\left[Var\left(\hat{\delta}_{HT}\right) - Var\left(\hat{\delta}_{AM}\right)\right]^{-1}\left(\hat{\delta}_{AM} - \hat{\delta}_{HT}\right)$$

which follows the asymptotic χ_g^2 distribution with the degree of freedom g being the number of coefficients tested.

4 Empirical Applications

We extend the dataset analysed by Serlenga and Shin (2007) to cover the longer period 1960-2008 (49 years) for 91 country-pairs amongst 14 EU member countries (Austria, Belgium-Luxemburg, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United

[14] Notice that the rank of $(\mathbf{Q}\mathbf{X}_1)^*$ is $(T-1)k_1$, because only $(T-1)$ deviations from means are (linearly) independent. Similarly for $\left(\mathbf{Q}\hat{\xi}_1\right)^*$, ..., $\left(\mathbf{Q}\hat{\xi}_\ell\right)^*$.

Kingdom).[15] Our sample period consists of several important economic integrations, such as the Custom Union in 1958, the European Monetary System in 1979 and the Single Market in 1993, all of which can be regarded as promoting intra-EU trades (Eurostat, 2008).[16]

Focusing on the EU trade patterns since the Euro, we find it interesting to observe from Eurostat (2003) that the EU trade fell by only 0.7% per annum during 2000-2003, even though the global trades sharply contracted following the world-wide recession in 2001 and 2002 (trade flows of US, Japan and Canada, recorded an annual reduction of around 6.7%). The EU trades grew strongly during 2003-2007, thanks to upswing in the world trade taking place after 2003 and the accession of 12 new member states in 2004 and 2007. In particular, the intra-EU trade increased by almost 40% during 2003-2004, mainly due to the 25% real appreciation of the Euro against the US dollar (Eurostat, 2003). The Euro area (intra and extra) trade in goods grew significantly over the last decade - increased to 32% of Euro area GDP in 2008 from 26 % in 1999 (Unctad, 2012). Furthermore, trade growth was faster than real GDP growth, leading to an increasing openness ratio of the Euro area (as measured by the sum of imports and exports as a share of GDP in real terms), which reached 82% in 2008 as compared to 64% in 1999 (World Bank, 2012). These tight trade linkages can be explained partially by both single market and single currency (ECB Bulletin, 2010).

Table 1, panel A and B, presents key summary figures of EU trade shares and growths.[17] First, the intra-EU trade has been a considerable part of the total trade in EU. Its share reached and has stayed over 60% since 1990s. Second, the US is still the leading trade partner of the EU, though its leading role has recently been challenged by China and Russia, as the US share of extra-EU trade decreased significantly from 21.9% in 2000 to 15.1% in 2008. Third, the trade still grows faster than real GDP in 2000s. Finally, the share of exports is slightly higher than that of imports.

In a regional perspective, the average growths of intra-EU exports and imports registered different patterns: for the peripheral countries, the intra-EU export grew faster than the import till the 90's while the export and import patterns in core countries are **twisted??** As a consequence the trade balance of the periphery ameliorated until 1990, but it started to worsen afterwards, though peripheral countries have always registered trade deficits over the sample period. This is clearly visible from Figure 1 which displays an inverse-U shape of the peripheral countries' trade balance. This time-varying pattern is generally consistent with the hypothesis that the fixed exchange rate regime (*e.g.* the Bretton Woods era and the EMU) is associated with the larger trade imbalances. Furthermore, we find from Figure **??** that their trade deficits are more pronounced against EMU core countries than non-EMU countries, suggesting that the peripheral countries might have suffered more from the loss of competitiveness after the introduction of the euro.

[15] Denmark, Sweden and The UK constitute a meaningful control group since these non-member countries, as part of the EU, experienced similar history and faced similar legislation and regulation to euro-area countries.

[16] To mitigate the potentially negative impacts of the ongoing global financial crisis on our analysis, however, we exclude the data after 2008. Both imports and exports in the Euro area fell by around one-fifth in 2009 (Statistical Yearbook, 2010).

[17] This is the updated table as reported in Serlenga and Shin (2007).

Table 1 and Figure 1 about here

The creation of EMU and the subsequent introduction of the euro may correspond to the start of deterioration of current accounts for the South (*e.g.* Jaumotte and Sodsriwiboon, 2010). To further examine this issue we collect the aggregate current account and trade balances of peripheral and core EU countries against the rest of the world,[18] we plot these balances together in Figure 3. We observe the following stylised facts: First, trade balances of the periphery tracked its current account balances very closely until the late 90's. Second, since the launch of the euro, current account balances of the periphery became more worsened than its trade balances. Notice that such downward trends of trade and current account balances of the peripheral countries coincide with the deterioration of their net foreign asset position (see Figure 1 in Chen et al., 2013). Finally, from 2006, the South trade deficits stayed flat while the current account deficits kept increasing, rendering their gap wider. This pattern is generally consistent with Holinski et al. (2012) who document that it is not the trade balance dynamics that cause the massive current account deficits in South but rather the loss of transfer receipts and the increased net factor payments.

{yc: ok but can you add more in relation to our literature review and empirical findings here?}

4.1 The effect of the Euro on bilateral trade flows

Given that the Euro effect should be analysed as an ongoing process, we will examine the Euro's trading effect more precisely by applying the cross-sectionally dependent panel data methodology developed in Section 3 to the dataset with the longer sample period.[19] When estimating the panel data gravity model, we consider three cases. In the first case, we consider the model without unobserved time-varying factors in (7) in which case $\varepsilon_{it} = \alpha_i + v_{it}$, and we thus consider the FE estimation.[20] Next, we consider the model which explicitly incorporates unobserved time-varying factors in (7) with $\varepsilon_{it} = \alpha_i + \varphi_i'\theta_t + v_{it}$. In this case we employ two alternative consistent estimators, the PCCE and the IPC estimators. Finally, we apply the proposed model given by (7)-(9), which

[18] The data on bilateral current accounts are not available. In any case, intra-EU trade balance pattern closely follows that of trade balance against the rest of the world (Figure **??**).Thus, we expect that this approximate analysis will provide qualitatively similar evidence.

[19] The dependent variable is the logarithm of real total trade. The regressors are the logarithm of total GDP ($TGDP$) which proxies for trade partners' mass; similarity in size (SIM) and difference in relative factor endowment (RLF) which are introduced following recent advancements of New Trade Theory; the logarithm of real exchange rate (RER) proxying for relative price effects; a dummy for European Community membership (CEE) and a dummy for European Monetary Union (EMU); time-invariant bilateral resistance terms such as a dummy for common language (LAN), a dummy for common border (BOR), and the logarithm of geographical distance (DIS). See the Data Appendix in SS for details of the data construction.

[20] The fixed effects (FE) model takes into account the bilateral trade heterogeneity only and the FE estimation results are likely to be biased in the presence of CSD. So these results are presented mainly for comparison with existing studies. We have also estimated the conventional two-way fixed effects model with $\varepsilon_{it} = \alpha_i + \theta_t + v_{it}$. We find that these estimation results (available upon request) are mostly misleading. As highlighted by SS, this is mainly due to its failure to accommodate (heterogeneous) cross-section dependence.

is designed to control for both weak and strong CSD in modelling time-varying unobserved multilateral trade barriers in a robust manner. Here we apply the PCCE-KMS and IPC-KMS estimators.

Table 2 presents the estimation and test results for the bilateral trade flows. To investigate whether our sample of the EU countries is subject to the CSD issue, we apply the CD diagnostic test advanced by Pesaran (2013) and select the final preferred model specifications. As expected, we find from Table 2 that the FE estimation results suffer from strong evidence of CSD. Surprisingly, the CD tests applied to the defactored residuals obtained from the PCCE and IPC estimation, also reject the null hypothesis of no weak CSD convincingly in both models.[21] Finally, we find that the CD test fails to reject the null of no weak CSD for both PCCE-KMS and IPC-KMS estimators. These diagnostic results suggest that our proposed procedure is able to successfully deal with both strong and weak CSD in the dataset, as this combines both exogenous and endogenous CSD elements explicitly.

Given the CD test results, we focus on the estimation results obtained from the PCCE-KMS and IPC-KMS estimators. In the former case we consider $\mathbf{f}_t = \left\{t, RERT_t, \overline{TGDP}_t, \overline{SIM}_t, \overline{RLF}_t, \overline{CEE}_t\right\}'$ in (3), where the bar over variables indicates their cross-sectional average, t is the linear trend and $RERT_t$ is an observed factor defined as the (logarithm of) real exchange rates that would capture relative price effects between the European currencies and the US dollar. To derive IPC estimators, we first extract six common PC factors using the Bai and Ng (2002) procedure, and use them as $\mathbf{f}_t$ in (3) together with t and $RERT_t$.[22] Furthermore, in order to consistently estimate the impacts of individual-specific variables jointly under the maintained assumption that LAN is the only time invariant variable correlated with individual effects, we use the instrument variables, $HT = \left\{IV, \hat{\xi}_{it}\right\}$, where $IV = \{RER_{it}, RLF_{it}\}$, $\hat{\xi}_{it} = \hat{\lambda}_i f_t$, and $\hat{\lambda}_i$ are estimated loadings. We also consider an additional instrument set denoted AM performing the AM transformation to the HT set. [23]

Both PCCE-KMS and IPC-KMS estimation results are mostly statistically significant and consistent with our *a priori* expectations. The impact of $TGDP$ (the sum of home and foreign country GDPs) on trade is positive. Similarity in size (SIM) boosts trade flows. The impact of relative difference in factor endowments between trading partners (RLF) is very small and insignificant, which is a plausible finding given that the impact of RLF on total trade flows (the sum of inter- and intra-industry trades) might not be unambiguous.[24] Combined

[21] See also BHP and MSS for similar findings.

[22] After estimating a number of specifications augmented with several combinations of factors, we have selected the final specification on the basis of overall statistical significance and empirical coherence. See also BEK for similar analysis.

[23] AM-IV sets can be created by performing the similar AM transformation as described in footnote 19. Hence, we can construct up to $T(k_1 + \ell)$ additional instruments, where $\ell = 5$ in CEEP and $\ell = 6$ in PC. Again, due to low cross-variations of $(\mathbf{QX}_1)^*$ and $\left(\mathbf{Q}\hat{\xi}\right)^*$, we only consider subsets of $T(k_1 + \ell)$ to avoid collinearity. Beginning with the first T years we include as many instruments as possible. The final selection is made on the basis of the Sargan test results. Further, we do not consider the alternative set of instruments $(\mathbf{QX}_2)^*$ proposed by BMS because the dummies CEE and EMU in $\mathbf{X}_2 = (TGDP, SIM, CEE, EMU)$ do not vary across country-pairs over a number of years (EMU is 0 before than 1999 and CEE is always 1 after 1995), leading to perfect multicollinearity.

[24] This is because the larger difference may result in the higher (lower) volume of inter- (intra-) industry trade.

together, these results may suggest that the intra-industry trade has become the main part of the intra-EU trade.[25] Thirdly, as expected , a depreciation of the home currency (increase in RER) leads to a modest increase in trade flows, which is consistent with the fact that the export component of the total trade is slightly higher than the import component (see Table 1). Fourthly and importantly, the impacts of EMU and CEE are significant, but they become substantially smaller than the FE estimation counterparts which do not accommodate the presence of CSD. The Euro impact drops sharply from 0.212 to 0.108 and 0.070 for the PCCE-KMS and IPC-KMS estimators. This range is consistent with a broad evidence compiled by Baldwin (2006) and recent studies reviewed in Section 2. Similarly, the impacts of CEE are estimated at 0.369 (PCCE-KMS estimator) and 0.068 (IPC-KMS estimator), which are significantly lower than the FE estimate (0.591).

Furthermore, the PCCE-KMS and the IPC-KMS estimators produce the estimates of the threshold parameter, r and the spatial autoregressive parameter, ρ in (9) using the iterative estimation algorithm as described in MSS. The threshold coefficient ($r = 1.594$) is close to the standard deviation of unconditional distribution of the trade flows of 1.9, suggesting that the trading partners group, $\tilde{u}_{it}(r)$, selected endogenously, consists of rather distant countries. Consistent with our *prior*, the spillover coefficient, ρ, is significantly negative, implying the strong negative spillover effects of multilateral resistance trade barriers. This finding might provide a support for the hypothesis that multilateral resistance (negative spillover) is more likely to be induced by trade flows-related distance rather than the geographical distance (*e.g.* Behrens et al., 2012; Bertoli and Moraga, 2013).

Finally, turning to the impacts of time-invariant regressors and focussing on more efficient AM-IV estimates as confirmed by the Hausman test results, we find that distance and common language dummies exert significantly negative and positive impacts on trade whereas the border impact is insignificant. In light of our *a priori* expectations and survey evidence reviewed in Section 2, we therefore conclude that all these estimation results are mostly sensible by explicitly taking into account both weak and strong CSD.

Table 2 about here

The euro's effect on regional trade flows We now estimate the augmented gravity specification in (27) with three regional dummies interacted with the EMU dummy. Interestingly, from Panel A of Table 3, we find that the euro effect on bilateral trade flows is much stronger when both countries belong to the South, suggesting that the euro has boosted trades among the South twice more than trades among the Northern counterparts. This evidence might provide a further support for the thesis that the trade increase within the Euro area reflects a continuation of a the long-run historical trend, probably linked to the broader set of EU's economic integration policies and institutional changes,[26]

[25] The share of the intra-trade has increased from 37.2% in 1960 to around 60% from 1990 onwards (see Table 1).

[26] The European Economic Community members attempted to limit currency volatility after the collapse of the Bretton Woods system in 1971. The so-called "snake in the tunnel" was the first example of European monetary cooperation, aiming at limiting fluctuations between different European currencies. The tunnel consisted of bands of 2.25% up and down, inside

e.g. Berger and Nitsch (2008) and Lee (2012). Indeed, most countries of the North had been more integrated well before the introduction of the euro, as confirmed by the results in Panel B displaying that trade flows are, on average, higher among the North than in the South. In fact, when the euro was planned in the 1990s, many German politicians wanted a currency zone comprising only Germany, the Benelux countries and France. Hence, it is likely that the effect of the euro may have been well-anticipated in the North relative to the South, leading to a lower effect of the eur on trades among the North.

Table 3 about here

The effect of the Euro on the EU integration In what follows we investigate an important issue related to the time-varying trade effects of bilateral resistance terms. Surprisingly, most existing studies neglect an important issue of assessing the effect of currency union on trade through bilateral resistance channels. In this regard we propose to test the validity of the following hypothesis: if the Euro had a positive effect on internal European trade (by reducing overall trade costs), this might have caused a decrease in trade impacts of bilateral trade barriers, especially the border effects (e.g. Cafiso, 2010). This will provide an alternative way to testing the Euro effect on trade integration. Consequently, we will check whether the trend line of coefficients of bilateral resistance proxies are more downward-sloping after 1999 than before 1999, in which case we deduce a positive effect of the Euro in terms of European Integration. To address this issue we re-estimate the model, (13), by the cross-section regressions for each time period such that we can estimate the time-varying coefficients of γ. Notice that this estimation can be easily conducted within our framework after consistently estimating $\hat{d}_{it}$ in (13) by either PCCE or PC estimation.

Figure 5 displays the time-varying estimation results obtained by AM-IV where we employ k_1 instruments at each time period (see footnote 23). The effects of border and language are decreasing over the observed period and, approximately after the introduction of the euro (vertical line in the figure), they show a rather stable pattern. Both both the effects of border and language are declining after 1970, this stresses that the process of integration among the European countries has helped to reduce both border-linked trade costs and cultural differences. This downward trend may reflect the progressive lessening of restrictions on labor mobility within EU that encouraged migration and thus reduced the relative importance of cultural and linguistic trade barriers.[27] In fact, net migration (immigrants minus emigrants) in the EU registers an increasing trend after 1990, probably capturing the effect of the Maastricht Treaty in 1993 (World Bank, 2012).[28] After 1999, the patterns are stable showing a rather complete integration process which highlight the importance of common

which currencies were allowed to trade. The system started in April 1972 with 9 members (Belgium, France, Italy, Luxembourg, the Netherlands, West Germany, the UK and Ireland). The UK left the tunnel in June of the same year, Italy in January 1973 and France in 1974 (it later rejoined and left again in 1976).

[27]Immigrants promote trade with their country of origin, e.g. Rauch and Trindade (2002).

[28]The Treaty of Maastricht in 1993 introduced the concept of citizenship of the European Union which confers every Union citizen a fundamental and personal right to move and reside freely without reference to an economic activity.

currency in the ongoing integration process.[29]

Turning to the distance effects on trade, we find that its impacts have been slightly increasing over the full sample period.[30] This is generally consistent with findings in the meta-study of a large number of estimated distance effects conducted by Disdier and Head (2008), who document that the trade elasticity with respect to distance does not decline over time, but rather increases. This may confirm that the notion of the death of distance has been difficult to identify in present-day trade data (Jacks, 2009).

Finally, it is also important to observe that the effects of the NN and SS dummies follow an opposite pattern. The effect of the NN dummy is always higher than the effect of the SS dummy reflecting higher trade volumes among northern partners. However, Figure 4 shows that, as the EU integration intensifies, those impacts monotonically decrease and the gap between NN and SS narrows. Interestingly, the effect of NN and SS slowly convergences after the introduction of the euro showing signs of further regional integration. These results might be linked to our trade balance results and show that, the deterioration of the current account balance, registered to all Euro area periphery countries, is not really due to the real part of trade (that indeed converges after euro introduction) but to the capital flows.

Overall, we might conclude that the introduction of the Euro helps to reduce trade effects of bilateral trade barriers and promote more integration among the EU countries by eliminating exchange rate-related uncertainties and transaction costs.

Figure 5 about here

[29] Egger and Lassmann (2012) provides a meta-analysis based on 701 language effects collected from 81 academic articles. On average, a common language increases trade flows by 44%.

[30] The coefficient on ditance is taken in absolute terms.

4.2 The effect of the Euro on bilateral trade balances

{edit} C: The estimation results for the coefficients of the export and the import are in line with theoretical predictions, except for the *rer* coefficient, which is negative in the export regression and positive in import regression. The coefficients for the PCCE and IPC are smaller in magnitude with respect to the FE coefficients, confirming the role of cross- section dependence and heterogeneous trends. Moreover, CD test fails to reject the null of no weak CSD , therefore, we estimate PCCE-KMS and PC-KMS specifications which allows us to control for weak CSD. The spillover effect of multilateral resistance (identified with ρ) is negative and significant, both in the export and in the import regression, as expected.
As a consequence, the impact of the euro on the trade balance of the South is negative and, conversely, the impact of the euro on the trade balance of the North is positive. The introduction of the euro leads to a worsening of the terms of trade of southern countries with respect of the northern countries, i.e. from the South perspective, the effect of the euro on the import is larger than the effect of the euro on the exports, the opposite is true for the northern countries by construction. Also, it appears that the effect of the introduction of a common currency is larger than that of the creation of the trade union. Furthermore, we can notice that the impact of the monetary union on the Southern export is negative and significant in most of the specifications. This suggests that the common currency caused a competitiveness loss of the southern countries exporters.

In the literature there are two main explanations for the persistence of current account deficits among EU periphery members: (i) declining export performance due to deterioration of real exchange rate, i.e., competitiveness and (ii) credit expansion driven by cheap capital flow, as well as fiscal excess.

The literature on competitiveness argument emphasizes that the CA imbalances depends on a structural imbalance between export-led countries with current account surpluses (Austria, Belgium, Finland, Germany, the Netherlands, and to a lesser extent France) and domestic demand-led countries with current account deficits (Italy, Spain, Greece, Portugal, and occasionally Ireland) (Belke and Dreger 2011; Bibow 2012; Obstfeld and Rogoff 2009; Shambaugh et al. 2012). With the currency union, competitiveness, measured by a country's real exchange rate, became function only of inflation among EU members trading in the same currency. Hence, with the introduction of EURO, Core European countries, which kept their inflation rates low, realize a competitive (in terms of real exchange rate) advantage which leads to trade surpluses and current account surpluses. Conversely, periphery EU members, with high inflation rates, lost competitiveness and increase their {V: trade and} CA deficits. In order to finance these deficits, these countries needed to externally borrow through the capital account which largely stemmed from Northern lending (Gros, 2012). Such external borrowing could either occur via private banking channels (which largely explains crisis exposure in fiscally prudent Ireland and Spain) or through public borrowing channels (Italy and Greece). Current account deficits are not a problem if they are able to generate future current account surpluses through enhancing productivity in the export sector and, thereby boosting long-term productivity. However, in the Eurozone periphery, external borrowing was largely channeled into nontradable sectors (construction in Ireland and Spain, and the

public sector in Greece) that are unable to generate future current account surpluses. The persistence of these current account deficits in the euro periphery, financed by external lending within Europe, leads markets to doubt total solvency within these member states, exposing them to speculative crisis in 2008. This loss-of-competitiveness argument explains rising financial and trade imbalances between the EMU's creditor and debtor countries as the causal factor via the current account.

A second explanation, however, found within the broader international political economy and financial liberalization literature, argues the opposite. The loss of competitiveness was a consequence of credit expansion. The absence of integrated financial markets and banking union across Europe, leads to unsustainable imbalances between the North and Periphery started in the capital account, which led to the divergences in the current account (Burda 2013; Jones 2014a, 2014b; Lane 2012). This literature suggests that, the source of rising economic imbalances between countries in the EMU's core and its periphery stems from the influence of the monetary union on nominal interest rates, which expanded the availability of cheap credit for both the private and public sector. It is the capital rather than the current account that we should examine if we want to explain the divergent exposure to speculative market pressure during the Eurozone crisis. Capital flows and trade flows are determined simultaneously in world markets. There is always an identity between a current account deficit and a capital import, and a current account surplus and a capital export, except minor currency movements. In the recent years, current account deficits of peripheral countries of euro area have reached unprecedented levels, never seen among euro area countries. By interpreting current account balances as the counterparts to international flow, Schmidt and Hagen (2011) show that capital flows in Europe follow differences in capital endowments of European countries and that EMU has significantly increase the tendency of net capital to go from relatively rich to relatively poor countries within the euro area. However, the current account imbalances in peripheral countries after the euro's inception, is caused mainly by non-tradable sector, primarily construction. Increase in financial integration in the euro area favours inflows of foreign capital to the non-tradable sectors of periphery countries and boost demand for imports and increases in prices of primarily non-tradable goods and services (Galier and Vicard, 2014). Indeed, the European crisis has highlighted the role of intra-European payments imbalances for the survival of the EMU. Payment imbalances between the core and the peripheral countries have contributed to the accumulation of large stock of foreign debt, while flows of foreign capital have ceased to finance productive investment, which might have contributed to debt repayment, financing instead consumption and an inflated housing bubble (Hughes Hallett and Marinez Oliva, 2013). Very different are the policy implications of the two different views of rising CA imbalances between core and periphery EU members. In the policy debate, a lot of emphasis is placed on the role of price competitiveness in the process of current account rebalancing within the monetary union. It is concluded that the countries in the periphery need to restore competitiveness by bringing inflation and unit labour cost growth below the euro area average. This is often seen as a long and painful process, which could even drive individual member states towards deflation. The focus on competitiveness therefore usually leads to a plea for structural reforms on product and labour markets, that would speed up the adjustment of relative

prices. However, most of the euro area countries with current account deficits have already achieved balanced current accounts or – in the case of Ireland – even a current account surplus. This is despite the fact that the adjustment of relative prices has only been slow and partial, at least until recently. Real effective exchange rates have not returned to the levels at the start of EMU, and losses in price competitiveness have therefore not been fully restored yet.

Our TB results support this evidence and shows that the effect of EURO on trade competitiveness deterioration of periphery countries has been low. We find small negative impact of EURO on exports of peripheral EU members, only 13% decrease on exports. This finding, read together with the positive effect of EURO on total trade of peripheral EU members, seems to suggest that the introduction of euro has intensified the economic integration between core and peripheral EMU countries, with a larger effect on total trade of peripheral countries and a slight deterioration of their competitiveness.

Nevertheless, the introduction of euro, with lower interest rate, has allowed peripheral countries to run bigger deficits and inflate their economies. Moreover, as Hale and Obstfeld (2014) state, the introduction of euro determines for Core Emu countries an increase of borrowing from outside EMU as well as a rise of lending to the EMU periphery both through debt markets and through bank lending. This also confirms the theoretical hypothesis of Aguiar, Amador, Farhi and Copinath (2014) who show that, an increase in inflation credibility after joining the euro, for countries with a history of high inflation (as Greece and Italy), leads to sharp reduction in inflation together with a prolonged build up of sovereign debt due to raising the maximum borrowing limit of the country and reducing any incentive to save. Hence, a switch from low to high inflation credibility can turn government from savers to borrowers. Peripheral countries in euro area gain the higher inflation commitment of a monetary union but end up with a sovereign borrowing boom. As is well known, increasing current account deficit of these heavily borrowing countries is accompanied by a marked suppression in their government bond spreads relative to the Core countries. The big public debt and current account deficit of peripheral euro countries reflect an accumulation of problems mainly due to market rigidities and imperfections. The introduction of euro has facilitated and financed the accumulation of these imbalances. In fact, not only, after the euro, peripheral countries borrow more, but core countries expand their lending to facilitate peripheral deficits, thereby increasing their financial fragility.

Our results call for more emphasis on credit growth and macro prudential policy, in addition to the current attention for competitiveness and structural reforms as policy advices.

{V:Retrospectively, the integration process and the formation of a currency union has focused on a limited set of criteria (price stability, public deficits and public debt), disregarding other relevant indicators of structural imbalances, such as saving-investment balance, productivity and costs indicators, competitiveness indicators etc.
From December 2011, the European Commission has put in place the Macroeconomic Imbalance Procedure (MIP), as part of the "six-pack" regulations. Based on a set of indicators and critical thresholds (which consider current account imbalances and other structural in-

dicators)[31], the MIP aims at identifying a set of countries which deem attention and need preventive and corrective actions. The Commission and the Council adopt and enforce - through sanctions for non-compliance - recommendations in case the country experiences excessive imbalances.
Applying this early warning system to potential new members of the European Union and Monetary Union could prevent accumulation of imbalances subsequent to their eventual joining of the Union. }

{V: We saw that imbalances are symptoms of underlying distortions, both in the real and in the financial markets. Therefore, increased financial market integration should be supported by interventions on domestic markets of peripheral countries aimed at eliminating factors which distort private savings and facilitate excessive expansion of private credit and misallocation of financial resources to non-productive sectors. On the other hand, it is important to avoid agents' excessive exposure to risk, with appropriate macro-prudential supervision of financial institutions.}

{Moreover, policy maker should foster competitiveness with trade specialization and efficiency gains in both tradable and non-tradable sectors.}

Table 4 about here

[31]For further details see `http://ec.europa.eu/economy_finance/economic_governance/macroeconomic_imbalance_procedure/mip_scoreboard/index_en.htm`

5 Conclusions

{*Edit ??*} The investigation of unobserved multilateral resistance terms in conjunction with omitted trade determinants has recently assumed a prominent role in the literature on the Euro's trade effects (Baldwin, 2006). In this paper we follow recent developments in panel data studies (Ahn et al., 2001, Pesaran, 2006; Bai, 2009), and extend the cross-sectionally dependent panel gravity models advanced by Serlenga and Shin (2007). The desirable feature of this approach is to control for time-varying multilateral resistance, trade costs and globalisation trends explicitly through the use of both observed and unobserved factors, which are modelled as (strong) cross-sectionally correlated. Furthermore, this approach allows us to consistently estimate the impacts of (potentially endogenous) bilateral trade barriers such as the border and the common language dummies through combining the PCEE and IPC estimators with the HT and AM IV estimators.

Applying the proposed cross-sectionally dependent panel gravity model to the dataset over the period 1960-2008 (49 years) for 91 country-pairs amongst 14 EU member countries, we obtain stylised findings as follows: Firstly, as expected, the sum of home and foreign country GDPs significantly boosts trade while a depreciation of the home currency increases trade flows. Secondly, the impact of difference in relative factor endowments is no longer significant whilst the effect of similarity turns out to be substantially larger. This suggests that similarity (in terms of countries' GDP rather than relative factor endowments) helps to ease the integration process by capturing trade ties across countries. Thirdly, the impacts of both distance and common language on trade are significantly negative and positive, attesting the validity of these proxies to capture bilateral trade barriers, though the border impact is no longer significant. Finally and importantly, the Euro's trade effect amounts to 3-4% only, even after controlling for trade diversion effects. We also find that the custom union effect is substantially reduced to 10% from 31% (without accommodating cross-section dependence). These small effects of both currency and custom unions provide a support for the thesis that the trade increase within the Euro area may reflect a continuation of a long-run historical trend, probably linked to the broader set of EU's economic integration policies and institutional changes, e.g. Berger and Nitsch (2008), and Lee (2012). While the advent of the Euro might be a necessary condition for the European integration process to continue beyond the single market agenda in the early 1990s, the Euro's repercussions on trade are difficult to understand without taking proper account of the process of the underlying European institutions. An obvious policy implication is that countries considering joining the Euro would benefit from the ongoing process of integration, but should also be wary of regarding promises of an imminent acceleration of intra-area trade.

6 Appendix: The Panel Gravity Model Specifications

In our empirical application we consider the following gravity model specification:

$$y_{it} = \boldsymbol{\beta}_1' \mathbf{x}_{1,it} + \boldsymbol{\beta}_2' \mathbf{x}_{2,it} + \boldsymbol{\gamma}_1' \mathbf{z}_{1,i} + \boldsymbol{\gamma}_2' \mathbf{z}_{2,i} + \pi_i' \mathbf{s}_t + \varepsilon_{it}, \tag{17}$$

where y_{it} is the bilateral total trade flows (the sum of bilateral export and import flows) or the bilateral trade balances (the difference between bilateral export and import flows), $\mathbf{x}_{1it}$, $\mathbf{x}_{2it}$ are $k_1 \times 1$ and $k_2 \times 1$ vectors of time-varying regressors, $\mathbf{z}_{1i}$, $\mathbf{z}_{2i}$ are $g_1 \times 1$ and $g_2 \times 1$ vectors of time invariant regressors, $\mathbf{s}_t$ is an $s \times 1$ vector of observed factors, and ε_{it} is the cross-sectionally correlated error components given by (8)-(10). Conformable with HT, we maintain the standard assumptions that $\mathbf{x}_{1it}$ and $\mathbf{z}_{1i}$ are uncorrelated with α_i, $\mathbf{x}_{2it}$ and $\mathbf{z}_{2i}$ are correlated with α_i, and $k_1 \geq g_2$.

In order to uncover an unambiguous effect of the Euro on bilateral trade flows and trade balances, we should develop the appropriate gravity regression specifications respectively for trade flows and trade balances. For the bilateral total trade flows SS estimate the gravity mode in (17),[32] and employ only the half of the total pairs ($91 = (14 \times 13)/2$) due to the symmetry of the bilateral total trade flows. In next subsections we first establish that the SS approach is indeed a valid approach for investigating an unambiguous effect of the Euro on bilateral trade flows. We then develop the appropriate specifications for measuring the regional impacts of the euro on trade flows and trade balances. For regional trade flows we can augment the gravity equations with the regional dummies interacted with the euro dummy. For the regional trade balance, however, we should select the smaller unique subset of pairs to avoid the fundamental identification failure.

Once we resolve such important specification and identification issues in relation to the euro's impact on trade flows and balances, the implementation of our proposed CSD panel gravity model, described in Section 2, is straightforward. Given that there is no study addressing this high profile issue in a very satisfactory manner, we believe that our proposed approach can shed further lights on the empirical literature on the trade or current account balances.

6.1 For the bilateral total trade flows

Suppose that we run the gravity regression for the bilateral export and import flows, denoted y_{it}^{EX} and y_{it}^{IM}, respectively, using the total $N(N-1)$ pairs out of N countries. For convenience we consider the following simpler version of (17) with the common time-varying regressors:

$$y_{it}^{EX} = \boldsymbol{\beta}^{EX\prime}\mathbf{x}_{it} + \varepsilon_{it}^{EX},\ i = 1, ..., N(N-1),\ t = 1, ..., T, \tag{18}$$

$$y_{it}^{IM} = \boldsymbol{\beta}^{IM\prime}\mathbf{x}_{it} + \varepsilon_{it}^{IM},\ i = 1, ..., N(N-1),\ t = 1, ..., T. \tag{19}$$

We will show that (18) and (19) are observationally equivalent such that both estimation results are equivalent.

To show this equivalence, we decompose N countries into two groups, A and B. We then construct the matrices of the bilateral export and import flows with

[32] SS prefer to use the double index specification over the 'triple-way model' popularised by Matyas (1997) where time, exporter and importer effects are specified as fixed and unobservable. As demonstrated by Baltagi et al. (2003) and Egger and Pfaffermayr (2003), if the triple index specification is extended to include bilateral trade interaction effects, then it is identical to the double index specification with time and bilateral effects only. Furthermore, if we are interested mainly in uncovering the effects of the common currency on trades, the double index specification should be more appropriate.

zero diagonals as

$$EX = \left[\begin{array}{cc} EX_{A\to B} & EX_{B\to A} \end{array} \right]' \text{ and } IM = \left[\begin{array}{cc} IM_{A\leftarrow B} & IM_{B\leftarrow A} \end{array} \right]'$$

where $EX_{A\to B} = IM_{B\leftarrow A}$ and $EX_{B\to A} = IM_{A\leftarrow B}$ by construction.

We first run the export and import gravity regressions from A's perspective as follows:

$$EX_{A\to B} = X\beta_A^{EX} + \varepsilon_A^{EX}, \tag{20}$$

$$IM_{A\leftarrow B} = X\beta_A^{IM} + \varepsilon_A^{IM}. \tag{21}$$

Here we obtain the regression coefficients by

$$\hat{\beta}_A^{EX} = (X'X)^{-1} X'EX_{A\to B} \text{ and } \hat{\beta}_A^{IM} = (X'X)^{-1} X'IM_{A\leftarrow B}.$$

Similarly, we run the export and import regressions for the group B:

$$EX_{B\to A} = X\beta_B^{EX} + \varepsilon_B^{EX} \tag{22}$$

$$IM_{B\leftarrow A} = X\beta_B^{IM} + \varepsilon_B^{IM} \tag{23}$$

and obtain:

$$\hat{\beta}_B^{EX} = (X'X)^{-1} X'EX_{B\to A} \text{ and } \hat{\beta}_B^{IM} = (X'X)^{-1} X'IM_{B\leftarrow A}.$$

Then, it is easily seen that

$$\hat{\beta}_A^{EX} = \hat{\beta}_B^{IM} \text{ and } \hat{\beta}_B^{EX} = \hat{\beta}_A^{IM} \tag{24}$$

because $EX_{A\to B} = IM_{B\leftarrow A}$ and $EX_{B\to A} = IM_{A\leftarrow B}$.

Next, we run the following gravity regressions using the total $N(N-1)$ pairs:

$$EX = X\beta^{EX} + \varepsilon^{EX} \tag{25}$$

$$IM = X\beta^{IM} + \varepsilon^{IM}. \tag{26}$$

Then, it follows that

$$\hat{\beta}^{EX} = (X'X)^{-1} X'EX = \frac{1}{2}\left(\hat{\beta}_A^{EX} + \hat{\beta}_B^{EX}\right),$$

and similarly,

$$\hat{\beta}^{IM} = (X'X)^{-1} X'IM = \frac{1}{2}\left(\hat{\beta}_A^{IM} + \hat{\beta}_B^{IM}\right).$$

Using (24), it is easily seen that $\hat{\beta}^{EX} = \hat{\beta}^{IM}$, which confirms that the estimation results for (18) and (19) are equivalent when the total pairs are employed.

This analysis demonstrates that we are estimating the hybrid average impact of X on bilateral export and import flows, due to the equivalence in (24),[33]

[33]Notice that the number of studies use export flows as a dependent variable and run the gravity regression for all of bilateral pairs, *e.g.* Feenstra *et al.* (2001), Egger (2004), and Carrère (2006).

whenever we use the export flows specification, (18) or the import flows specification, (19) Therefore, the more valid approach is to estimate the gravity specification in (17) for bilateral total trade flows using the half of the total pairs.

Next, we wish to evaluate the euro effects on the regional total trade flows, separately. To this end we construct three regional dummies, denoted NN (1 when both countries belong to the North, and 0 otherwise), NS (1 when one country belongs to the North and another belongs to the South or *vice versa,* and 0 otherwise) and SS (1 when both countries belong to the South, and 0 otherwise). To decompose the total effects of the euro into the three regional (namely, the within-North, the within-South and the between North-South) effects, we then construct three interaction dummies, denoted by $euro_{NN} = euro \times NN$, $euro_{NS} = euro \times NS$, and $euro_{SS} = euro \times SS$, respectively. Thus, we augment the gravity specification in (17) as follows:

$$y_{it} = \boldsymbol{\beta}'\mathbf{x}_{it} + \boldsymbol{\beta}_w'\mathbf{w}_{it} + \boldsymbol{\gamma}'\mathbf{z}_i + \boldsymbol{\gamma}_d'\mathbf{d}_i + \varepsilon_{it},\ i = 1, ..., N\left(N-1\right)/2, \tag{27}$$

where $\mathbf{w}_{it} = (euro_{NN}, euro_{NS}, euro_{SS})'$ and $\mathbf{d}_i = (NN, SS)'$. The specification, (27) also enables us to estimate the average time-invariant regional trade effects by the coefficients on NN and SS.

Since the dummies are mutually exclusive, it is easily seen that the euro dummy is the sum of three interactions:

$$euro_{it} = euro_{it} \times NN_i + euro_{it} \times SS_i + euro_{it} \times NS_i.$$

Hence, the total impact coefficient of the euro is equal to the weighted average of the impact coefficients of the regional interaction dummies as follows:

$$\beta_{euro} = \left(\frac{1}{N_{SS}} \times \beta_{euroSS} + \frac{1}{N_{NS}} \times \beta_{euroNS} + \frac{1}{N_{NN}} \times \beta_{euroNN}\right)$$

where the weights are determined by the frequency of each groups.

Similarly, we construct three regional dummies interacted with CEE (a dummy for European Community membership), namely, $CEE_{NN} = CEE \times NN$, $CEE_{NS} = CEE \times NS$, and $CEE_{SS} = CEE \times SS$, and decompose the total effects of the trade union into the three regional effects.

6.2 For the bilateral trade balances

We turn to measuring the euro effects on regional trade balances. For convenience we consider the same groups, A and B. For group A (see (20) and (21)), it is straightforward to derive the impacts on the total trade flows (β_A^T) and the trade imbalances (β_A^{TB}) from the regressions of $(EX_{A\to B} + IM_{A\to B})$ and $(EX_{A\to B} - IM_{A\to B})$ on the common regressors, X, respectively:

$$\hat{\beta}_A^T = \left(X'X\right)^{-1}X'(EX_{A\to B} + IM_{A\to B}) = \hat{\beta}_A^{EX} + \hat{\beta}_A^{IM}, \tag{28}$$

$$\hat{\beta}_A^{TB} = \left(X'X\right)^{-1}X'(EX_{A\to B} - IM_{A\to B}) = \hat{\beta}_A^{EX} - \hat{\beta}_A^{IM}. \tag{29}$$

Suppose that $\beta_A^{TB} > 0$, implying that the impact on export flows is stronger than the impact on import flows for the group A. We thus set the null hypothesis of no trade imbalance for group A as

$$H_0^A : \beta_A^{TB} = 0. \tag{30}$$

Similarly, we can derive: $\hat{\beta}_B^{TB} = \hat{\beta}_B^{EX} - \hat{\beta}_B^{IM}$, and set the null of no trade imbalance for the group B as

$$H_0^B : \beta_B^{TB} = 0.$$

Then, it is easily seen that

$$\beta_{TB}^B = \beta_B^{EX} - \beta_B^{IM} = \beta_A^{IM} - \beta_A^{EX} = -\beta_A^{TB}. \tag{31}$$

When using the total pairs to estimate the impact of the Euro on the trade imbalance, it is easily seen that $\hat{\beta}^{EX} = \hat{\beta}^{IM}$, and thus $\hat{\beta}^{TB} = 0$ by construction, so that the regional trade balance effects of the euro cannot be identified. Notice that this caveat equally applies to the methodologies employed by most existing studies, e.g., *Berger and Nitsh (2014) and ??.*

However, the current approach suffers from the fundamental identification failure: even though we employ the half of the total pairs, we always end up with the same result in (31) irrespective of the different group classification selected. To demonstrate this we consider the 4 country example with Germany, France, Italy and Spain. First, we group the countries into A = {Germany, France} and B = {Italy, Spain}, and consider the lower triangular part of the bilateral export flows matrix:

$$\begin{bmatrix} 0 & & & \\ EX_{G\to F} & 0 & & \\ EX_{G\to I} & EX_{F\to I} & 0 & \\ EX_{G\to S} & EX_{F\to S} & EX_{I\to S} & 0 \end{bmatrix} \tag{32}$$

Next, we group the countries into C = {Germany, Italy} and D = {France, Spain}, and consider the lower triangular counterpart given by

$$\begin{bmatrix} 0 & & & \\ EX_{G\to I} & 0 & & \\ EX_{G\to F} & EX_{I\to F} & 0 & \\ EX_{G\to S} & EX_{I\to S} & EX_{F\to S} & 0 \end{bmatrix} \tag{33}$$

If we select all six export flows in the gravity regression, six export flows selected for group A are equivalent to those for group C. Therefore, the result in (31) cannot identify whether it represents the first or the second group classification.[34]

We now provide the simple and novel technique for identifying the euro's impact on the (regional) trade balances. To achieve this goal, we should select the unique smaller group of sub-pairs. We now select the sub-block of four export flows, namely, $\begin{bmatrix} EX_{G\to I} & EX_{F\to I} \\ EX_{G\to S} & EX_{F\to S} \end{bmatrix}$ in (32) and $\begin{bmatrix} EX_{G\to F} & EX_{I\to F} \\ EX_{G\to S} & EX_{I\to S} \end{bmatrix}$ in (33). Clearly, the first block consists of the export flows from group A to group B and the second contains the export flows from group C to group D.

In the empirical application we consider the divide between the North (Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, the Netherlands, Sweden and the UK) and the South (Greece, Ireland, Italy, Portugal and

[34]It is also clear that the use of regional interaction dummies employed in the regional total trade flows specification cannot be applied for the trade balance.

Spain).[35] We then estimate the trade balance gravity regression, (29) for the North using $9 \times 5 = 45$ sub-pairs selected. This identification scheme enables us to estimate the gravity specification for bilateral export flows from the North to the South. Similarly for bilateral import flows of the North from the South. Thus, we are able to provide an unequivocal interpretation of the euros' impact on the trade imbalances of the North against the South. Obviously, we will get the mirror image for the South. Therefore, our proposed approach is expected to represent a significant improvement over the current empirical literature on the trade or current account imbalances, which fails to provide any clear-cut conclusion in terms of directional regional imbalances, *e.g. Berger and Nitsch (2014) and ??* Furthermore, our approach can be easily implemented in any pairwise studies by selecting the appropriate group of sub-pairs.

[35] Our choice of including the Irish economy in the South is mainly guided by its experience during the European integration and recent financial crises as they are the five largest net debtors' in the eurozone.

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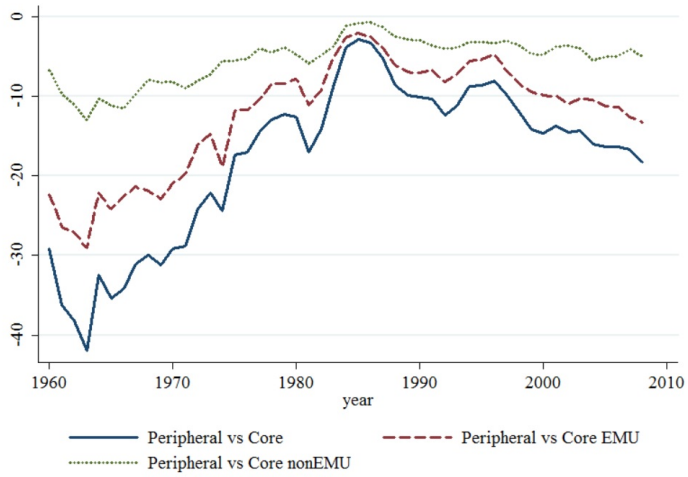
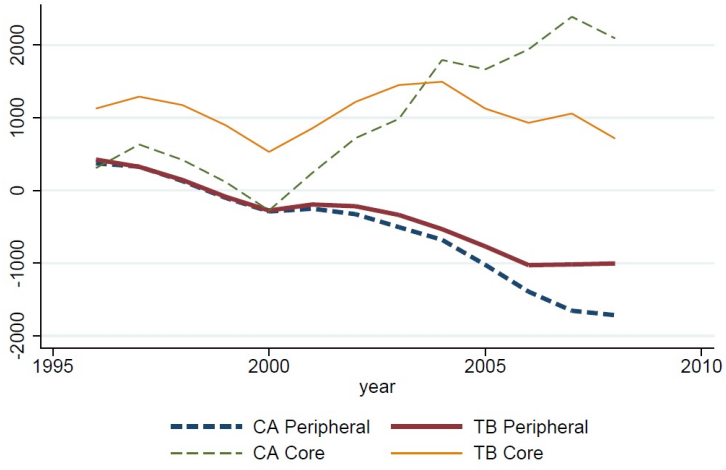
Figure 1: Aggregate trade balance of peripheral countries vs core countries



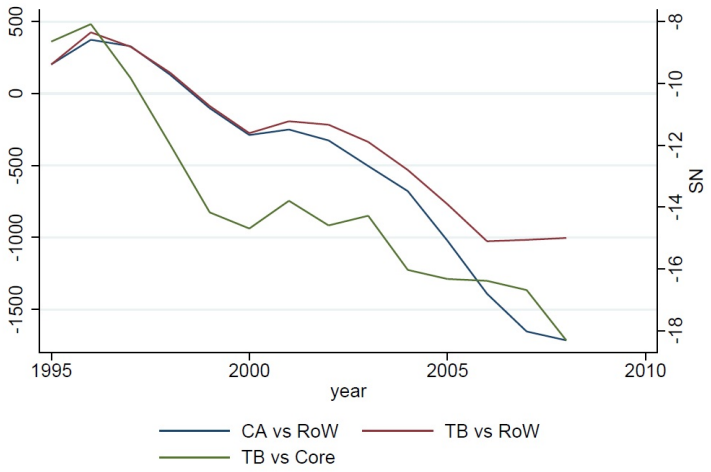
Notes: The figure shows the plot of the aggregate trade balance of peripheral European countries against core European countries, and its decomposition in trade balance against core European countries belonging to EMU and against core European countries not belonging to EMU. For each year, the aggregate trade balance is is the unweighted sum of individual peripheral countries trade balance. *Source:* OECD - Monthly Statistics of International Trade.

Figure 2: Current Account and Trade Balance



Notes: The figure reports core and peripheral countries's aggregate current account and trade balance against the rest of the world. For each year, the variables are the unweighted average over individual countries. *Source:* OECD - Main Economic Indicators

Figure 3: Peripheral Trade Balance vs Rest of the World and vs Core



Notes: The figure reports peripheral countries's aggregate trade balance, computed as difference between the logarithms of real export and the logarithms of real import and aggregate current account and trade balance against the rest of the world (real values). For each year, the variables are the unweighted average over individual peripheral countries. *Source:* OECD - Main Economic Indicators

Figure 4: Time-varying estimation of NN and SS dummies

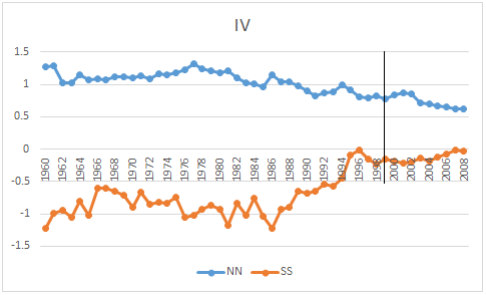
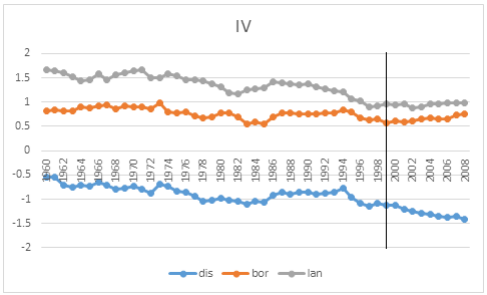


Figure 5: Time-varying estimation of the trade effects of bilateral trade barriers



Notes: This figure shows the time-varying estimation of the trade effects of bilateral trade barriers using the AM set of instruments (see footnotes 19). The time-varying coefficients are obtained in two steps: first, we estimate model (1)-(2) by CCEP including heterogeneous trends as in Table 2 and then estimate (13) by cross-section AM regressions for each time period.

Table 1: Descriptive Statistics

Panel A	1960[1]	1970[2]	1980[3]	1990[4]	2000[5]	2008[6]
Share of US on Extra-EU trade	16.5	26.3	33.8	19	21.9	15.1
Share of Intra-EU on EU trade	37.2	49.8	50.5	59.7	61.7	61
Share of Export on Intra-EU trade	52.4	51.6	51.1	49.7	51.2	50.1
Panel B		60/70	70/80	80/90	90/00	00/08
Average Growth of GDP		5.2	3.4	2.4	2.7	2.2
Average Growth of Intra-EU trade		9.8	7.3	8.2	4.3	6.2
Average Growth of Total EU trade		10.3	20.1	7.2	3.9	8.1
Average Growth of Bilateral Exch. Rate		0.12	7.9	-1.4	-3.7	-2.3
Panel C - Peripheral and Core Countries						
Peripheral Countries	1960	1970	1980	1990	2000	2008
Average GDP per capita	8.3	8.8	9.2	9.4	9.7	9.8
Average Intra-EU Trade Balance	-0.45	-0.45	-0.19	-0.16	-0.23	-0.28
		60/70	70/80	80/90	90/00	00/08
Average Growth of GDP per capita		5.5	3.3	2.3	2.8	1.7
Average Growth of Intra-EU Export		11.1	10.5	10.3	4.7	5.7
Average Growth of Intra-EU Import		11.2	8.0	9.9	5.4	6.4
Average Growth of Intra-EU Trade		11.2	8.0	10.5	5.1	6.2
Core Countries	1960	1970	1980	1990	2000	2008
Average GDP per capita	9.2	9.6	9.8	10.1	10.3	10.4
Average Intra-EU Trade Balance	0.25	0.25	0.11	0.09	0.13	0.16
		60/70	70/80	80/90	90/00	00/08
Average Growth of GDP per capita		3.9	2.5	2.2	2.0	1.6
Average Growth of Intra-EU Export		9.3	6.5	7.0	3.8	6.2
Average Growth of Intra-EU Import		9.3	7.9	7.2	3.4	5.9
Average Growth of Intra-EU Trade		9.0	6.9	7.0	3.9	6.2
Peripheral and Core Exchanges		60/70	70/80	80/90	90/00	00/08
Peripheral - Peripheral Trade Growth		12.1	10.6	12.5	6.9	7.8
Peripheral - Core Trade Growth		10.5	7.5	9.1	5.0	5.6
Core - Core Trade Growth		8.2	6.1	5.8	3.4	6.5
Peripheral→Core Export		10.8	10.1	9.3	3.8	5.1
Peripheral←Core Import		10.8	6.4	8.8	4.8	6.1

Notes: Panel A: 1 refers to EU6 (Belgium, France, Germany, Italy, Luxemburg, Netherlands) from 1960 to 1969; 2 refers to EU6 from 1970 to 1973 and EU9 (EU6 plus Denmark, Ireland and UK) from 1973 to 1979; 3 refers to EU9 in 1980, EU10 (EU9 plus Greece) from 1981 to 1985, and EU12 (EU10 plus Portugal and Spain) from 1986 to 1989; 4 refers to EU12 from 1990 to 1994 and EU15 (EU12 plus Austria, Finland and Sweden) from 1995 to 1999; 5 refers to EU15 from 2000 to 2001; 6 refers to EU15 from 2001 to 2004 and EU25 (EU15 plus Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) and EU27 (EU25 plus Romania and Bulgaria) from 2007 to 2008, respectively. Sources: Statistical Yearbook, Eurostat (1997) and Trade Policy Review of the European Union: A Report by the Secretariat of the WTO, WTO (2002), Unctatd (2012), World Bank (2012).
Panel C: Entries are group/decade averages of the respective measures. 7 Includes both Peripheral-Core and Core-Peripheral exchanges.

Table 2: The panel gravity model estimation results for bilateral trade flows

	FE	PCCE	PCCE-KMS	HT	AM	IPC	IPC-KMS	HT	AM
gdp	2.089***	1.824***	1.868***			1.636***	1.612***		
	[0.011]	[0.043]	[0.143]			[0.053]	[0.066]		
sim	0.412***	0.192	0.228			0.371***	0.371***		
	[0.121]	[0.130]	[0.211]			[0.144]	[0.128]		
rlf	0.078***	0.011	0.009			-0.006	-0.008*		
	[0.026]	[0.022]	[0.011]			[0.006]	[0.005]		
rer	-0.028**	0.133***	0.146***			0.100***	0.091**		
	[0.014]	[0.018]	[0.042]			[0.040]	[0.040]		
cee	0.591***	0.355***	0.369***			0.097***	0.0675***		
	[0.014]	[0.011]	[0.029]			[0.017]	[0.017]		
emu	0.212***	0.112***	0.108***			0.071***	0.070***		
	[0.015]	[0.011]	[0.031]			[0.023]	[0.018]		
		OLS				OLS			
con		1.674		0.017	1.542	11.917***		8.221***	11.528***
		[1.897]		[2.174]	[1.846]	[2.013]		[2.488]	[1.716]
dis		-1.483***		-1.258***	-1.468***	-1.707***		-1.206***	-1.654***
		[0.261]		[0.296]	[0.252]	[0.277]		[0.341]	[0.235]
bor		0.238		-0.66	0.18	0.406		-1.595	0.196
		[0.532]		[0.855]	[0.423]	[0.564]		[1.496]	[0.307]
lan		1.512***		4.081**	1.677***	1.217**		6.946**	1.820***
		[0.641]		[2.087]	[0.725]	[0.680]		[3.359]	[0.468]
r			1.594				1.594		
ρ			-0.8715***				-0.525***		
CD	92.85	8.28	2.28			12.25	2.50		
	(0.000)	(0.000)	(0.131)			(0.000)	(0.114)		
Sargan				$\chi^2_6 = 9.2680.1$	$\chi^2_{56} = 9.2647.7$			$\chi^2_6 = 10.61$	$\chi^2_{57} = 45.04$
				(0.159)	(0.774)			(0.225)	(0.874)
Hausman					$\chi^2_3 = 2.19$				$\chi^2_3 = 3.921$
					(0.700)				(0.417)

Notes:The dependent variable is the sum of logarithms of bilateral real export and of real import flows. We estimate the gravity regression using 91 pairs over the period 1960-2008. The fixed effects (FE) estimation results are obtained from the panel data gravity model without unobserved time-varying factors in (7) with $\varepsilon_{it} = \alpha_i + v_{it}$. The PCCE (Pesaran, 2006) and the IPC (Bai, 2009) estimators are obtained from the panel data gravity model with unobserved time-varying factors in (7) with $\varepsilon_{it} = \alpha_i + \varphi_i'\theta_t + v_{it}$. See also (4). To approximate unobserved factors, θ_t, we employ: $\mathbf{f}_t = \left\{RERT_t, \overline{TGDP}_t, \overline{SIM}_t, \overline{RLF}_t, \overline{CEE}_t\right\}$ for PCCE and $\mathbf{f}_t = \{PC_1, PC_2, PC_3, PC_4, PC_5, PC_6, RERT_t\}$, where the bar over variables indicate their cross-section averages, and $PC_1, ..., PC_6$ are the six principal component factors extracted by the Bai and Ng (2002) procedure. The PCCE-KMS and IPC-KMS estimators are obtained from the unified model given by (7)-(10). To derive the HT and AM estimates we use the following set of instruments, $IV = \{RER_{it}, RLF_{it}\}$. Figures in [] indicate the standard errors. ***, ** and * denote 1, 5, and 10 percent level of significance, respectively. CD stands for the diagnostic test statistic for the null hypothesis of no CSD advanced by Pesaran (2013). Sargan denotes the Sargan statistic testing for the validity of over-identifying restrictions. Hausman is the Hausman statistic testing for the legitimacy of the AM estimator against the HT estimator. The corresponding p-values are provided in parenthesis.

Table 3: The panel gravity model estimation results for bilateral trade flows with regional and interaction dummies

				Panel A				
	FE	PCCE	PCCE-KMS		IPC	IPC-KMS		
ceeNN	0.35***	0.277***	0.297***		0.163***	0.133***		
	[0.037]	[0.003]	[0.005]		[0.021]	[0.003]		
ceeNS	0.646***	0.438***	0.439***		0.024	0.005		
	[0.038]	[0.005]	[0.007]		[0.023]	[0.004]		
ceeSS	1.585***	0.391***	0.429***		0.062	-0.006		
	[0.082]	[0.019]	[0.027]		[0.059]	[0.010]		
euroNN	0.165***	0.089***	0.091***		0.088***	0.089***		
	[0.051]	[0.004]	[0.005]		[0.03]	[0.003]		
euroNS	0.114***	0.107***	0.106***		0.044	0.043		
	[0.047]	[0.005]	[0.007]		[0.027]	[0.004]		
euroSS	0.482***	0.209***	0.165***		0.192***	0.174***		
	[0.102]	[0.014]	[0.019]		[0.063]	[0.009]		
				Panel B				
		OLS		HT	AM	OLS		HT	AM
con		6.309		5.392**	5.392**	6.252**		8.301***	9.155***
		[4.273]		[2.653]	[2.653]	[2.467]		[2.506]	[2.041]
dis		-0.988*		-0.853**	-0.853**	-0.979**		-1.219***	-1.350***
		[0.564]		[0.354]	[0.354]	[0.328]		[0.333]	[0.270]
bor		0.411		-0.842	-0.842	0.321		-0.730	0.513
		[0.961]		[0.907]	[0.907]	[0.562]		[1.128]	[0.493]
NN		1.131*		0.892**	0.892**	1.114***		0.168	0.407
		[0.625]		[0.322]	[0.322]	[0.286]		[0.361]	[0.303]
NS		-0.966		-0.822	-0.822	-0.956***		-0.648	-0.789**
		[0.962]		[0.528]	[0.528]	[0.439]		[0.516]	[0.419]
lan		1.625		4.879**	4.879**	1.858*		4.907**	1.681***
		[1.103]		[2.056]	[2.056]	[1.049]		[2.484]	[0.832]
r			1.594				1.594		
rho			-0.898***				-0.499***		
CD			2.291				2.521		
			(0.131)				(0.112)		
Sargan				$\chi^2_6 = 2.71$	$\chi^2_{40} = 7.88$			$\chi^2_8 = 13.70$	$\chi^2_{48} = 47.1$
				(0.910)	(0.999)			(0.101)	(0.510)
Hausman					$\chi^2_5 = 0.665$				$\chi^2_5 = 0.709$
					(0.955)				(0.999)

Notes: The dependent variable is the sum of logarithms of bilateral real export and of real import flows. Three regional dummies are denoted by NN (1 when both countries belong to the North, and 0 otherwise), NS (1 when one country belongs to the North and another belongs to the South or *vice versa,* and 0 otherwise) and SS (1 when both countries belong to the South, and 0 otherwise). We then construct three euro interaction dummies by NNemu = NN×emu, NSemu = NS×emu and SSemu = SS×emu and the cee interaction dummies by NNcee = NN×cee, NScee = NS×cee and SScee = SS×cee. All the estimation results are obtained from the augmented gravity specification in (27). See also notes to Table 2.

Table 4: The panel gravity model estimation results for bilateral export flows of the South to the North

	FE	PCCE	PCCE-KMS	HT	AM	IPC	IPC-KMS	HT	AM
gdp	1.278***	1.162***	1.241***			0.846***	0.911***		
	[0.023]	[0.040]	[0.136]			[0.061]	[0.057]		
sim	0.447***	0.371***	0.265			-0.032	-0.034		
	[0.116]	[0.129]	[0.211]			[0.163]	[0.157]		
rlf	0.013	0.055**	0.049**			0.011	0.015		
	[0.028]	[0.028]	[0.022]			[0.017]	[0.015]		
rer	-0.115***	0.314***	-0.305***			-0.367***	-0.367***		
	[0.025]	[0.024]	[0.058]			[0.040]	[0.045]		
cee	0.281***	0.134***	0.136***			0.098***	0.0947***		
	[0.031]	[0.006]	[0.022]			[0.023]	[0.020]		
emu	-0.133***	0.015*	0.021			-0.085***	-0.010***		
	[0.034]	[0.010]	[0.024]			[0.030]	[0.025]		
		OLS				OLS			
con		-4.955*		-10.834***	-5.132**	5.885***		4.852**	5.478***
		[2.783]		[4.629]	[2.666]	[2.503]		[2.679]	[2.152]
dis		-0.763**		0.027	-0.742**	-0.802***		-0.663**	-0.748***
		[0.374]		[0.619]	[0.359]	[0.336]		[0.364]	[0.294]
bor		-0.486		-1.970*	-0.567*	0.171		-0.089	0.069
		[0.562]		[1.369]	[0.358]	[0.506]		[0.396]	[0.215]
lan		1.947*		2.389***	3.332***	0.650		2.111	1.225**
		[1.042]		[6.938]	[0.678]	[0.937]		[2.142]	[0.710]
CD			3.15				1.87		
			(0.076)				(0.172)		
ρ			-0.302***				-0.624***		
r			0.72				0.72		
Sargan				$\chi^2_6 = 3.75$	$\chi^2_{33} = 28.93$			$\chi^2_8 = 10.71$	$\chi^2_{21} = 21.54$
				(0.710)	(0.670)			(0.219)	(0.426)
Hausman					$\chi^2_5 = 8.79$				$\chi^2_5 = 0.153$
					(0.067)				(0.997)

Notes: The dependent variable is the logarithm of bilateral real export flows of the South to the North. We divide between the North (Austria, Belgium-Luxembourg, Denmark, Finland, France, Germany, the Netherlands, Sweden and the UK) and the South (Greece, Ireland, Italy, Portugal and Spain). We estimate the gravity regression for the South using $5 \times 9 = 45$ sub-pairs selected over the period 1960-2008. See also notes to Table 2.

Table 5: The panel gravity model estimation results for bilateral import flows of the South from the North

	FE	PCCE	PCCE-KMS	HT	AM	IPC	IPC-KMS	HT	AM
gdp	1.011***	1.229***	1.160***			0.964***	1.028***		
	[0.016]	[0.056]	[0.113]			[0.056]	[0.053]		
sim	-0.862***	0.106	0.089			0.335**	0.296***		
	[0.081]	[0.112]	[0.179]			[0.148]	[0.116]		
rlf	0.018	-0.027	-0.025			-0.010	-0.006		
	[0.020]	[0.037]	[0.021]			[0.015]	[0.012]		
rer	-0.0370***	-0.076***	0.088**			0.286***	0.276***		
	[0.018]	[0.028]	[0.052]			[0.037]	[0.042]		
cee	0.349***	0.252***	0.257***			0.211***	0.206***		
	[0.022]	[0.007]	[0.0226]			[0.021]	[0.020]		
emu	0.244***	0.214***	0.209***			0.065***	0.053***		
	[0.024]	[0.015]	[0.023]			[0.027]	[0.021]		
		OLS				OLS			
con		-9.434***		-12.695***	-10.112***	6.679***		6.042***	6.411***
		[2.405]		[2.853]	[1.847]	[2.053]		[1.509]	[1.060]
dis		-0.339		0.099	-0.248	-0.910***		-0.824***	-0.874***
		[0.323]		[0.379]	[0.254]	[0.276]		[0.203]	[0.143]
bor		-0.496		-1.319*	-0.665*	-0.158		-0.319	-0.226**
		[0.486]		[0.839]	[0.368]	[0.415]		[0.302]	[0.144]
lan		2.385***		6.997*	3.332***	1.980***		2.881**	2.359***
		[0.901]		[3.998]	[0.985]	[0.769]		[1.548]	[0.477]
CD			2.38				2.03		
			(0.123)				(0.154)		
ρ			-0.891***				-0.789***		
r			0.72				0.72		
Sargan				$\chi^2_7 = 7.73$	$\chi^2_{41} = 33.44$			$\chi^2_8 = 16.67$	$\chi^2_{21} = 23.48$
				(0.357)	(0.793)			(0.034)	(0.319)
Hausman					$\chi^2_5 = 0.71$				$\chi^2_5 = 0.059$
					(0.950)				(0.999)

Notes: The dependent variable is the logarithm of bilateral real import flows of the South from the North. See also notes to Tables 2 and 4.

Table 6: The estimated effects of CCE and EMU on the trade balance of the South against the North

	FE	PCCE	PCCE-KMS	IPC	IPC-KMS
			Effect of Cee on trade balance		
$\hat{\beta}^{x}_{1,cee}$	0.281	0.134	0.136	0.098	0.095
$\hat{\beta}^{m}_{1,cee}$	0.349	0.252	0.257	0.211	0.206
$\hat{\beta}^{b}_{1,cee}$	-0.068	-0.117	-0.121	-0.113	-0.112
s.e.	[0.032]	[0.007]	[0.027]	[0.024]	[0.022]
			Effect of Euro on trade balance		
$\hat{\beta}^{x}_{1,euro}$	-0.133	0.015	0.021	-0.085	-0.100
$\hat{\beta}^{m}_{1,euro}$	0.244	0.214	0.209	0.065	0.053
$\hat{\beta}^{b}_{1,euro}$	-0.377	-0.199	-0.188	-0.150	-0.152
s.e.	[0.035]	[0.010]	[0.028]	[0.031]	[0.028]

Notes:The dependent variable is the logarithm of bilateral trade balances of the South against the North. See also notes to Tables 2, 4 and 5.