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Jean-Sébastien Pentecôte,
Jean-Christophe Poutineau,
Fabien Rondeau

University of Rennes 1 - CREM, UMR CNRS 6211, France

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Trade Integration and Business Cycle Synchronization in the EMU: the Negative Effect of New Trade Flows

J.-S. PENTECOTE[a], J.-C. POUTINEAU[a], F. RONDEAU[a*]

[a]CREM CNRS 6211 - University of Rennes 1

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*Corresponding author: fabien.rondeau@univ-rennes1.fr, Tel:+33-2-23233366, Fax:+33-2-23233599, 7 place Hoche CS 86514, 35065 Rennes Cedex, France. We would like to thank Nathalie Colombier for helpful assistance. We are also grateful to Angela Cheptea, Valérie Mignon and Daniel Mirza.

Abstract

This paper questions the impact of trade integration on business cycle synchronization in the EMU by distinguishing increase of existing trade flows (the intensive margin) and creation of new trade flows (the extensive margin). Using a DSGE model, we find that synchronization is weakened when new firms are allowed to export in response to productivity gains. Using disaggregated data over 1995–2007 for the 10 founding members of the EMU and consistently with our model, we find that trade intensity has a positive direct effect while new trade flows have a negative effect on business cycle synchronization. Furthermore, new flows play essentially an indirect role by intensifying specialization and explain 60% of the overall effect of trade intensity and specialization on synchronization.

Keywords: Trade Integration, New Trade Flows, Business Cycles, Synchronization, European Monetary Union.

JEL codes: F14; F15; F41; F44

1 Introduction

The effect of trade integration on business cycle synchronization remains a key issue for the member countries of the European Monetary Union (EMU). Indeed, having adopted a single currency these countries can no longer use nominal exchange rate to adjust to asymmetric shocks. Thus, a deeper trade integration, by promoting price convergence, should make the adjustment of the terms of trade irrelevant. On the macroeconomic side, the deepening of goods market integration coming from the trade increase should promote closer synchronization of national business cycles in the EMU and give a rise to a European business cycle.

Although the trade effect of the euro has been widely empirically documented in the literature, it is still uncertain. Summarizing the evidence since the influential study of Frankel and Rose (1998), Rose and Stanley (2005) conclude to a positive effect of the European single currency on trade accross the Member States so that their business cycles have become more synchronized. This latter finding seems rather optimistic with regard to the more skeptical evidence provided by Berger and Nitch (2008) and by Havránek (2010).

These contrasting findings illustrate the debate regarding the interplay between trade integration and business cycle synchronization. Authors such as Baxter and Kouparitsas (2003, 2005), Fonseca et al. (2010) and Dées and Zorell (2012) provide empirical evidence on the strong and positive effect of trade intensity on business cycle synchronization. This effect may interact with other factors such as product diversification or the convergence in macroeconomic policies according to Inklaar et al. (2008). Moreover, Abbott et al. (2008) find that the dependence of business cycle on trade intensity is both timely and geographically dependent, being negative in some cases.

Our paper questions the impact of trade integration on business cycle synchronization in the EMU, by distinguishing the trade increase that comes from either the existing or the new trade flows, that is gains at the intensive or at the extensive margin respectively. This latter dimension is important for issues related to the member countries of the EMU. As already noticed by Flam and Nordström (2006), the switch to the single currency has increased the number of traded goods in the euro area. This result is in line with Harris et al. (2012) who underline the reciprocal and the mixed transitory/permanent nature of trade flows around the world.

On the theoretical front, as discussed by Bergin and Lin (2009, 2012), currency unions may well boost the extensive margin of bilateral trade flows, both in absolute and relative terms. Currency unification induces a reduction in transaction costs - and thereby in trade barriers - between its members. In addition, there is an incentive for firms to invest so as to enter a new export market because monetary unions historically last longer than currency pegs. Improved risk sharing from a deeper financial integration may also lead firms to concentrate on specific production activities, thus inducing foreign trade between countries as they become more specialized (Kalemli–Ozcan et al., 2003, 2005).

To account for the effect of the nature of trade increase on business cycle synchronization, our paper adopts a disaggregated view on bilateral trade flows. Drawing on the CEPII–BACI database, we consider 5,000 bilateral trade flows between the 10 founding countries of the EMU over the 1995–2007 period. We thus document around 4.7 millions potential trade relationships. Table 1 reveals that only half of all the recorded bilateral trade flows within the euro area falls into the traded / non traded goods dichotomy (respectively 18% and 32%). Transitory trade flows thus represent 50% of bilateral trade relations during this 13–year period, averaging 24,000 new transactions each year.

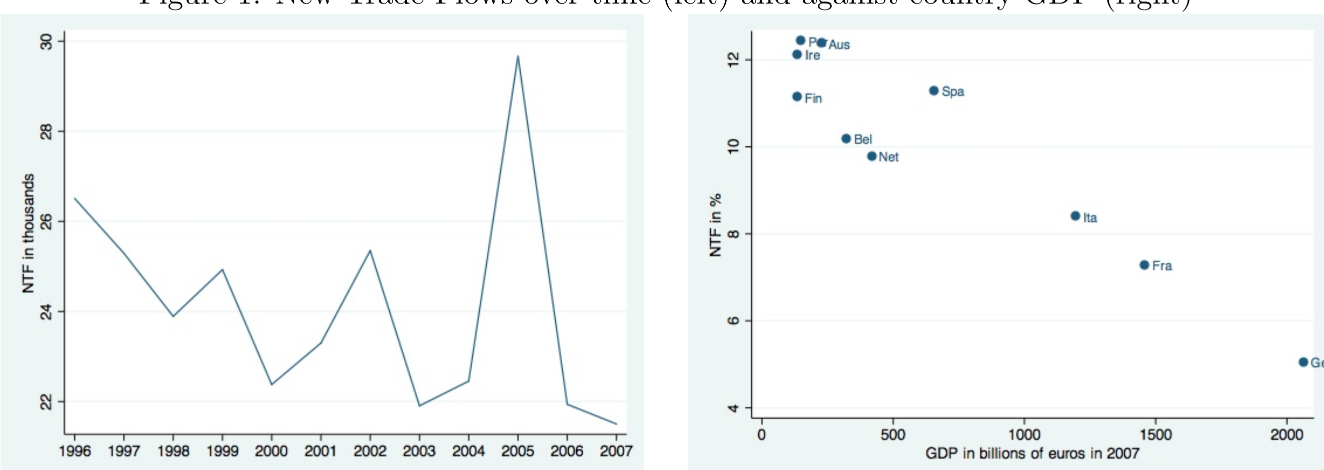
The bilateral nature of trade flows is important to account for. Indeed, as noticed in figure 1, the share of new trade flows is variable over time and across countries. This finding is in line with the recent evidence provided by Harris et al. (2012) and Abbott et al. (2008) at the world

Table 1: Bilateral Trade Flows among the 10-founders of EMU between 1995 and 2007.

Occurences (years)	Number of flows	Frequency (%)
0 - No Trade	857,649	18
1-12 - New Trade	2,354,170	50
13 - Permanent Trade	1,501,409	32
Total	4,713,228	100.00

and at the European levels respectively. New flows seem to follow a decreasing trend from 1995 to 2007 (left). Furthermore, smaller countries are characterized by a higher increase of trade flows (Portugal 12.43%, Austria 12.37% and Ireland 12.12%) while, it represents much less for larger countries such as Germany (5.04%) or France (7.28%).

Figure 1: New Trade Flows over time (left) and against country GDP (right)



Notes: *Bel* for Belgium-Luxemburg, *Fra* for France, *Ger* for Germany, *Ire* for Ireland, *Ita* for Italy, *Por* for Portugal, *Spa* for Spain, *Net* for The Netherlands, *Fin* for Finland and *Aus* for Austria.

To our knowledge the effect of the transitory nature of bilateral trade flows on bilateral business cycle correlation has not yet been studied in the literature although it may shed light to the debate on the interplay between trade and business cycle synchronization. Indeed, coherence estimates reported in table 2 reveal the close association between bilateral trade and the coupling of business cycles despite strong disparities across the euro countries.

Table 2: Average Coherences between New Trade Flows and Business Cycles Correlations for country i (in column) against the rest of EMU

Country	Bel.	Fra	Ger	Ire	Ita	Por	Spa	Net	Fin	Aus	Average
Coherences	0.67	0.66	0.72	0.72	0.57	0.67	0.72	0.66	0.78	0.71	0.69

Notes: Coherences go from 0 (no correlations) to 1 (perfect correlations). The 5% critical level is 0.51.

The aim of this paper is to understand how the distinction between the extensive and intensive margin of trade may account for the mixed evidence on the link between trade integration and business cycle synchronization.

First, we introduce an illustrative dynamic stochastic general equilibrium model following the recent literature on the extensive margin of international trade (Bilbiie et al., 2012; Corsetti et al., 2013). We find that the response of the cyclical component of output to a positive specific productivity shock depends on the variation in the terms of trade. Domestic and foreign outputs tend to move together when trade develops only at the intensive margins. By contrast, the ability of firms to react to shocks by producing and exporting new goods dampens the fluctuations in the terms of trade. The business cycle component in the domestic country becomes less synchronized with regard to its foreign counterpart.

Second, we assess the empirical relevance of the negative contribution of the extensive margin of trade on business cycle synchronization on the 10 founding countries of the EMU over the 1995–2007 period. We adapt the simultaneous equation framework initially developed by Imbs (2004, 2010) and extended by Abbott et al. (2008) to a panel data model. In contrast with the existing literature, we consider new trade flows as a separate driver of business cycle synchronization in association with trade intensity and trade structure. Specialization and new trade flows affect negatively business cycle synchronization whereas trade intensity has a positive influence. Two-thirds of the contribution of new trade flows is channeled through specialization. More importantly, our empirical findings show that new trade flows act mainly as a propagation mechanism: more than 60% of the overall effect of trade intensity and specialization on synchronization is transmitted by new trade flows.

The paper is organized as follows. Section 2 presents the theoretical analysis. Section 3 presents the empirical results. Section 4 concludes.

2 A model of international trade and business cycle fluctuations with heterogeneous firms

The model describes a two country world with flexible prices. Each country is populated by homogeneous households and heterogeneous firms. Each individual firm is specialized in the production of a given variety of goods that is imperfectly substitutable in the consumers' bundle. Firms belong to the traded or the non traded sector depending on their productivity level. To simplify matters, the capital stock of domestic firms is entirely owned by the residents and the current account is always in equilibrium. Assuming that the structure of countries is symmetric, we present in details the domestic country. Foreign variables are indicated by an asterisk as exponent.

2.1 Households

The number of households is normalized to 1. The consumer i in the domestic country maximizes,

$$\underset{c_t(i),l_t(i),b_{t+1}(i)}{Max} E_t \sum_{j=0}^{\infty} \beta^j \left[\ln c_{t+j}(i) - \Xi \frac{l_{t+j}(i)^{1+\kappa}}{1+\kappa} \right], \tag{1}$$

by choosing $c_t(i)$ (consumption), $l_t(i)$ (labour supply) and $b_{t+1+j}(i)$ (the real amount of private bonds held at the end of period t), subject to the budget constraint,

$$E_t\beta^j[w_{t+j}l_{t+j}(i) + b_{t+j}(i) - c_{t+j}(i) - (1 + r_{t+j})^{-1}b_{t+1+j}(i)] = 0, \quad (2)$$

where w_t is the real wage and r_{t+j} is the real rate of interest between periods $(t+j)$ and $(t+j+1)$. The first order conditions give an Euler bond equation and a labour supply curve,

$$\begin{aligned} c_t^{-1}(i) &= \beta(1 + r_t)E_t c_{t+1}^{-1}(i), \\ \Xi(l_t(i))^{\kappa} &= c_t^{-1}(i)w_t. \end{aligned}$$

In period t the consumer allocates total consumption $c_t(i)$ between (tradable and non tradable) home goods and (imported) foreign goods. The consumption and consumption price indexes are defined according to the CES aggregators,

$$c_t(i) = \left(\int_0^{n_{D,t}} c_{D,t}(\omega,i)^{\frac{\theta-1}{\theta}}d\omega + \int_0^{n_{X,t}} c_{X,t}(\omega,i)^{\frac{\theta-1}{\theta}}d\omega + \int_0^{n^*_{X,t}} c_{M,t}(\omega,i)^{\frac{\theta-1}{\theta}}d\omega\right)^{\frac{\theta}{\theta-1}} \quad (3)$$

$$P_{c,t} = \left(\int_0^{n_{D,t}} p_{D,t}(\omega)^{1-\theta}d\omega + \int_0^{n_{X,t}} p_{X,t}(\omega)^{1-\theta}d\omega + \int_0^{n^*_{X,t}} p_{M,t}(\omega)^{1-\theta}d\omega\right)^{\frac{1}{1-\theta}} \quad (4)$$

where θ is the elasticity of substitution across goods; variables $c_{D,t}(\omega,i), c_{X,t}(\omega,i), c_{M,t}(\omega,i)$ represent the individual demand of domestic non traded goods, domestic traded goods and imports; variables $p_{D,t}(\omega), p_{X,t}(\omega), p_{M,t}(\omega)$ are the associated nominal prices. Variables $n_{D,t}$ and $n_{X,t}$ are respectively the number of domestic tradable and non tradable goods, and $n^*_{X,t}$ is the number of imported goods. Let $\rho_{j,t}(\omega) = \frac{p_{D,t}(\omega)}{P_{c,t}}$ be the real price of good ω in the segment $j = \{D, X, M\}$ of the domestic market. We can then write the demand for a representative good as, $c_{j,t}(\omega,i) = \rho_{j,t}(\omega)^{-\theta}c_t(i)$.

2.2 Firms

The total number of firms operating in each economy is normalized to 1. Each firm produces a specific good ω. The corresponding production function of the representative firm is, $y_t(\omega) =$

$z(\omega)A_t\ell_t^d(\omega)$. Following the literature, firm heterogeneity comes from a specific shock $z(\omega)$ as a deviation from total factor productivity in the economy, A_t. Firms' productivity $z(\omega)$ is drawn from a Pareto distribution with lower bound $z_{\min}$, and shape parameter $k > (\theta - 1)$. A_t is homogeneous to all firms and evolves according to: $\log A_t = \rho \log A_{t-1} + \xi_{A,t}$, where $\xi_{A,t}$ is a white noise process. Each firm maximizes its profit function,

$$\pi_t(\omega) = \rho_t(\omega)y_t^d(\omega) - \frac{w_t}{z(\omega)A_t}y_{D,t}^d(\omega), \tag{5}$$

by choosing the optimal selling price according to,

$$\rho_t(\omega) = \frac{\theta}{\theta - 1}\frac{w_t}{z(\omega)A_t}. \tag{6}$$

The level of profit depends on the segment of the goods market on which the firm operates. On the non–traded segment, it faces the demand curve, $y_t^d(\omega) = \rho_{D,t}^{-\theta}(\omega)c_t$, with $c_t = \int_0^1 c_t(i)di$, so that the profit function is, $\pi_{D,t}(\omega) = \frac{1}{\theta}\rho_{D,t}^{1-\theta}(\omega)c_t$. To become an exporter, the representative firm has to pay an entry cost to get access to the foreign market. That cost of entry is paid in terms of real wage as it is equal to $f_e\frac{w_t}{A_t}$, where f_e is a scale parameter. Furthermore, foreign trade is costly as consumers have to pay an iceberg shipping cost τ to have access to foreign traded goods. Thus, if the representative firm serves the traded segment of the goods market, it faces the demand for goods, $y_t^d(\omega) = \rho_{X,t}^{-\theta}(\omega)c_t + \rho_{M,t}^{*-\theta}(\omega)c_t^*$. The real price of imports is, $\rho_{M,t}^* = (1+\tau)q_t^{-1}\rho_{X,t}$, where q_t is the real exchange rate as the relative price of the foreign consumption price index in terms of the domestic price index. Since the demand addressed to the domestic firm on the traded goods segment is $y_t^d(\omega) = \rho_{X,t}^{-\theta}(\omega)[c_t + q_t^{\theta}(1+\tau)^{-\theta}c_t^*]$, its profit function writes, $\pi_{X,t}(\omega) = \frac{1}{\theta}\rho_{X,t}^{1-\theta}(\omega)[c_t + q_t^{\theta}(1+\tau)^{-\theta}c_t^*] - f_e\frac{w_t}{A_t}$.

The distribution of firms between the two sectors depends on a cut–off point z_X. It defines the minimal value of the specific productivity needed to be able to export (*ie*, to incur the entry cost that must be paid to stay on the traded segment). Domestic firms with $z(\omega)$ lower than z_X

produce non traded goods, while the others deliver goods in both countries. The cut–off point between the two sectors is determined by the last firm that enters the traded segment. The trigger point is determined by $\pi_{D,t}(\omega, z_X) = \pi_{X,t}(\omega, z_X)$, with $\rho_{D,t}(\omega, z_X) = \rho_{X,t}(\omega, z_X)$. Intuitively, the marginal gain of exporting must compensate for the marginal cost of entering the foreign segment of the goods market. It is defined according to,

$$z_X = \frac{f_e}{(\theta - 1)} \left(\frac{\theta(1+\tau)}{q_t} \frac{w_t}{A_t} \right)^{\frac{\theta}{\theta-1}} c_t^{*1-\theta}. \tag{7}$$

In period t, $n_{D,t}$ firms operate in the non traded goods sector while $n_{X,t}$ firms belong to the traded sector. The relative weight of the exporting firms is determined by $n_{X,t} = 1 - G(z_X)$. Given the Pareto distribution, this leads to $n_{X,t} = z_{\min}^k z_{X,t}^{-k}$ and $n_{D,t} = 1 - z_{\min}^k z_{X,t}^{-k}$. The average productivity level of each sector, $\tilde{z}_{D,t}, \tilde{z}_{X,t}$ is then given by $\tilde{z}_{X,t} = \nabla^{\frac{1}{\theta-1}} z_{X,t}$, and $\tilde{z}_{D,t} = \nabla^{\frac{1}{\theta-1}} \left(\frac{z_{\min} - z_{\min}^k z_{X,t}^{1-k}}{1 - z_{\min}^k z_{X,t}^{-k}} \right)$, where $\nabla = \left(\frac{k}{k-(\theta-1)} \right)$. Finally, the average level of activity in each sector is $\tilde{y}_{X,t} = \tilde{\rho}_{X,t}^{-\sigma}[c_t + q_t^{\theta}(1+\tau)^{-\theta} c_t^*]$ and $\tilde{y}_{D,t} = \tilde{\rho}_{D,t}^{-\sigma} c_t$, where, $\tilde{\rho}_{X,t} = \frac{\theta}{\theta-1} \frac{w_t}{\tilde{z}_{X,t} A_t}$, $\tilde{\rho}_{D,t} = \frac{\theta}{\theta-1} \frac{w_t}{\tilde{z}_{D,t} A_t}$.

2.3 Aggregation and general equilibrium

In this fully symmetric case, the aggregate level of output is defined according to,

$$\begin{aligned} y_t &= \tilde{\rho}_t \tilde{y}_t = \int_0^1 \rho_t(\omega) y_t(\omega) d\omega = n_{D,t} \tilde{\rho}_{D,t} \tilde{y}_{D,t} + n_{X,t} \tilde{\rho}_{X,t} \tilde{y}_{X,t}, \\ y_t^* &= \tilde{\rho}_t^* \tilde{y}_t^* = \int_0^1 \rho_t^*(\omega) y_t^*(\omega) d\omega = n_{D,t}^* \tilde{\rho}_{D,t}^* \tilde{y}_{D,t}^* + n_{X,t}^* \tilde{\rho}_{X,t}^* \tilde{y}_{X,t}^*, \end{aligned} \tag{8}$$

and consumption price indexes according to,

$$\begin{aligned} 1 &= n_{D,t} \tilde{\rho}_{D,t}^{1-\theta} + n_{X,t} \tilde{\rho}_{X,t}^{1-\theta} + n_{x,t}^* \tilde{\rho}_{M,t}^{1-\theta}, \\ 1 &= n_{D,t}^* \tilde{\rho}_{D,t}^{*1-\theta} + n_{X,t}^* \tilde{\rho}_{X,t}^{*1-\theta} + n_{x,t} \tilde{\rho}_{M,t}^{*1-\theta}. \end{aligned} \tag{9}$$

In this setting, a competitive equilibrium is defined as a sequence of quantities $\{Q_t\}_{t=0}^{\infty} = \{c_t, c_t, y_t, y_t^*, l_t, l_t^*, n_{X,t}, n_{X,t}^*, n_{D,t}, n_{D,t}^*, \tilde{y}_{X,t}, \tilde{y}_{X,t}^*, \tilde{y}_{D,t}, \tilde{y}_{D,t}^*\}_{t=0}^{\infty}$, and a sequence of real prices $\{P_t\}_{t=0}^{\infty} = \{r_t, r_t^*, w_t, w_t^*, \tilde{\rho}_{X,t}, \tilde{\rho}_{X,t}^*, \tilde{\rho}_{D,t}, \tilde{\rho}_{D,t}^*.q_t\}_{t=0}^{\infty}$ such that, for any sequence of shocks

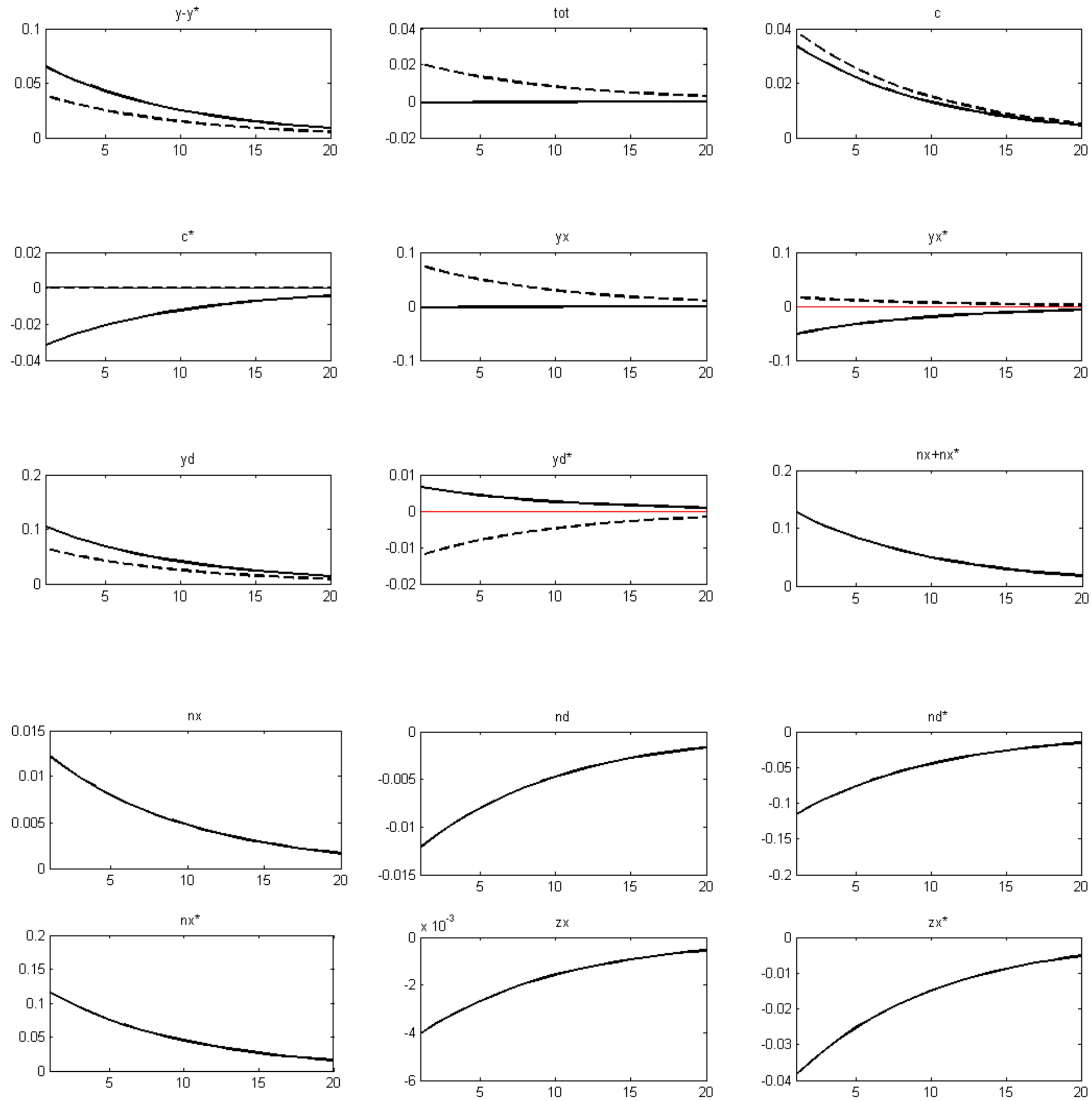
$\{S_t\}_{t=0}^{\infty} = \{A_t, A_t^*\}_{t=0}^{\infty}$, the sequence $\{Q_t\}_{t=0}^{\infty}$ meets the first–order conditions for households and firms. It also guarantees labour market clearing ($\int_0^1 l_t(j)dj = \int_0^1 l_t(\omega)d\omega$ and $\int_0^1 l_t^*(j)dj = \int_0^1 l_t^*(\omega)d\omega$), goods market equilibrium ($\int_0^1 c_t(j)dj = \int_0^1 \rho_t(\omega)y_t(\omega)d\omega$ and $\int_0^1 c_t^*(j)dj = \int_0^1 \rho_t^*(\omega)y_t^*(\omega)d\omega$), and a balanced current account ($q_t n_{X,t}\tilde{\rho}_{X,t}^{1-\theta}c_t^* = n_{X,t}^*\tilde{\rho}_{X,t}^{*1-\theta}c_t$).

2.4 Trade and Business Cycles Synchronization

We now illustrate how the nature of international trade flows affects the synchronization of activity by analysing the transmission of an asymmetric 1% increase in domestic productivity. The Impulse Response Functions (IRFs) are computed assigning benchmark values for the parameters of the model. Here $\kappa = 5$ is the inverse of the intertemporal elasticity of substitution of labour supply. It lies in the range presented by Canzoneri et al. (2007). The elasticity of substitution in aggregate consumption is equal to $\theta = 3.7$ as proposed by Bilbiie et al. (2012). The shape of the Pareto distribution k must exceed $(\theta - 1)$ leading us to set $k = 3$. The iceberg cost represents 30% of the value of the traded goods so that $\tau = 0.3$. Finally, we assume $\Xi = 1$, $f_e = 1$, and $\rho = 0.9$.

The results of the simulation for this baseline calibration of the model are reported in the figure 2 below. We contrast the IRF of an asymmetric 1% increase in domestic aggregate productivity in two situations. The plain curves represent the adjustment of the variables when the number of traded varieties evolves. The dotted curves describe the adjustment of the world economy when the number of traded varieties is fixed. As shown in the first graph of figure 2, new trade flows contribute negatively to business cycle synchronization. This increases output dispersion by one half on impact in comparison with the fixed variety version of the model. When trade adjusts at the intensive margin only (dotted lines), a positive productivity shock in the domestic economy increases income and thus aggregate consumption. Following the surge in supply, home goods prices must fall thereby deteriorating the terms of trade by around 0.02%. The surge in

Figure 2: IRF to a 1% domestic productivity shock



aggregate consumption in the domestic economy falls on foreign exports and conversely a part of the additional domestic exports must be bought by foreigners. Thus the relative price of foreign tradables in terms of domestic ones must increase. After an asymmetric productivity shock, the deterioration of the terms of trade implies an international transfer that favors the synchronization of income growth rates.

By contrast, terms of trade movements are severely dampened when trade adjustment operates at both intensive and extensive margins (plain lines in figure 2) as noted by Corsetti et al. (2013). Since the number of firms operating in each sector is endogenous, the supply of foreign exports is now modified. Indeed, the increase in domestic consumption favours the demand for foreign exports. This lowers the cut-off point $z^*_{X,t}$ and makes the entry of foreign firms on the tradable segment more profitable. Thus the number of foreign traded goods increases much more than the reduction in individual supply of foreign firms that operate on this market segment. As a consequence, there is a net increase in the supply of foreign goods. On impact, we even notice a small improvement in the terms of trade due to the strong reaction of the foreign supply of tradables. As noted in the graphs, this implies a greater divergence of income growth rates.

Ignoring firm entry, the adjustment of trade between countries relies only on the variations in relative prices. This correction mechanism disappears when trade growth operates at the extensive margin. Thus, endogenous firm entry allows for diverging paths across business cycles. As underlined by the graphs of figure 2, most of the extensive margin of trade comes from the foreign country (around 90%). Indeed, as the supply of foreign goods increases since it is directly affected by the increase in domestic aggregate consumption. In the meanwhile the increase in the number of traded varieties in the domestic economy is very low (it represents almost 10% of the increase in the number of foreign traded varieties).

The cut off point in the domestic economy is affected by two opposite effects. On the one hand, productivity gains tie the cut-off point down to stimulate the entry of domestic firms into the export sector. On the other hand, a depressed foreign demand for domestic products due to the decrease in the foreign aggregate consumption raises the value of the cut off point, which makes firm entry on the traded sector less profitable. Thus, the distribution of firms across sectors remains almost unchanged in the domestic country. Basically, the productivity shock moves the individual supply of domestic non–traded goods upward. Finally, there is a rise in the domestic consumption in terms of both domestic non traded and foreign traded goods. New trade flows reduce the need for their relative price to adjust compared with what happens in the baseline case.

In table 3, we compare the model with a fixed number of Existing Trade Flows only (ETF model) with a model incorporating New Trade Flows (NTF model). We evaluate how results from the benchmark case (first row) vary with deeper good market integration (rows 2 and 3), a reduction in the elasticity of substitution (rows 4 and 5), less firm heterogeneity (rows 6 and 7), or more asymmetric productivity shocks (rows 8 and 9).

Table 3: Correlations between NTF and Business Cycle Synchronization

	Existing Trade Flows		New Trade Flows			
Calibration	$\sigma_{(y-y^*)}$	σ_{tot}	$\sigma_{(y-y^*)}$	σ_{tot}	$\sigma_{(n_X+n_X^*)}$	$\rho_{(y-y^*),(n_X+n_X^*)}$
Benchmark	2.17	1.17	3.70	0.05	6.48	0.128
$\tau = 0.2$	2.17	1.17	3.67	0.03	6.56	0.127
$\tau = 0.1$	2.17	1.17	3.62	0.01	6.66	0.126
$\theta = 3.2$	2.16	1.35	2.58	0.08	6.03	0.094
$\theta = 2.7$	2.14	1.58	2.12	0.01	5.15	0.085
$k = 4$	2.17	1.17	2.99	0.25	8.19	0.095
$k = 5$	2.17	1.17	2.72	0.31	9.71	0.082
$\sigma_A^* = 0.6$	2.02	1.09	3.45	0.05	6.15	0.274
$\sigma_A^* = 0.5$	1.89	1.02	3.22	0.04	5.86	0.432

Notes: σ_x is the standard deviation of x, $\rho_{x,y}$ is the coefficient of correlation between x and y.

In the benchmark calibration, the extensive margin of trade weakens the synchronization of business cycles with regards to the ETF model. It also reduces the volatility of the terms of trade. As explained above, the foreign economy reacts by offering more traded varieties following productivity gains by domestic firms. Fluctuations in the terms of trade are thus dampened. The standard deviation of the total number of traded varieties is roughly twice that of business cycle divergence. In this case, the correlation between the degree of business cycle divergence and the increase in the traded varieties is equal to 0.13. Greater trade integration can come from a reduction in the value of the iceberg shipping cost τ. Firms benefit from a lower value of the cut off points z_x and z_x^*, letting the volatility of the ETF model unchanged. By contrast, there is a rising number of traded varieties in the NTF case at the expense of a dampened response of the terms of trade. Cutting transportation costs by half reduces the home bias in consumption which, in turn, promotes business cycle synchronization as $\sigma_{(y-y^*)}$ goes from 3.67 to 3.62.

A lower elasticity of substitution (θ) requires a rise in relative prices (σ_{tot}) in the ETF case whereas the terms of trade play a limited role in the NTF case. In the latter situation, the bulk of adjustment passes through a reduction in the number of traded varieties ($\sigma_{(n_X+n_X^*)}$) that fosters business cycles convergence. However, $\rho_{(y-y^*),(n_X+n_X^*)}$ is still positive meaning that new trade flows are negatively linked to business cycle synchronization.

Less firms heterogeneity – that is a higher value of the shape parameter k – leads to new trade flows. Productivity gains have a greater impact on the number of traded goods because firms are more concentrated around the cut off points z_x and z_x^*. Shocks are more symmetric among countries, allowing for more synchronized business cycles. Finally more homogeneous goods lead relative prices to play a greater role in the adjustment process and output to deviate less across countries.

Finally, smaller foreign supply shocks (σ_A^* goes down) lowers the average volatility of aggregates in the world economy. Instead, it magnifies the correlation between the divergence of business cycles and the number of traded varieties. The reduced synchronization of business cycles comes from new trade flows as countries become more homogeneous.

3 New Trade as an Amplifier to Business Cycle Decoupling within EMU

We use disaggregated data over the period 1995–2007 for the 10 founding countries of the EMU to evaluate the empirical relevance of the negative contribution of new trade flows on business cycle synchronization. The aim of our econometric analysis is twofold: first, we evaluate the possibility of either direct and/or indirect impacts of new trade flows on business cycle synchronization and second, we check for the robustness of the existing results, once new trade flows are taken into account.

3.1 Econometric methodology

Since the seminal analysis of Frankel and Rose (1998), many refinements have been proposed in the econometric methodology to asses the effect of trade integration on business cycle synchronization. Here we adopt the empirical strategy initially developed by Imbs (2004) and extended to panel data analysis by Abbott et al. (2008). A panel data model with 3SLS estimators fits well to the question at hand. First, it corrects for the possible endogeneity of trade variables. Second, business cycle correlation may be influenced by unobservable country–pair effects. These individual effects may have been important over the period, as these countries have adopted structural reforms to foster nominal convergence given the launching of the euro.

For each country pair (i,j), we estimate the full system,

$$SYN_{ij,t} = \alpha_0 + \alpha_1 TRI_{ij,t} + \alpha_2 NTF_{ij,t} + \alpha_3 SPE_{ij,t} + \alpha_4 Z1_{ij,t} + \alpha_5 G1_{ij,t} + \epsilon_{1ij,t}, \tag{10}$$

$$TRI_{ij,t} = \beta_0 + \beta_1 SPE_{ij,t} + \beta_2 NTF_{ij,t} + \beta_3 Z2_{ij,t} + \beta_4 G2_{ij,t} + \epsilon_{2ij,t}, \tag{11}$$

$$NTF_{ij,t} = \phi_0 + \phi_1 TRI_{ij,t} + \phi_2 SPE_{ij,t} + \phi_3 Z3_{ij,t} + \phi_4 G3_{ij,t} + \epsilon_{3ij,t}, \tag{12}$$

$$SPE_{ij,t} = \gamma_0 + \gamma_1 TRI_{ij,t} + \gamma_2 NTF_{ij,t} + \gamma_3 Z4_{ij,t} + \gamma_4 G4_{ij,t} + \epsilon_{4ij,t}. \tag{13}$$

Equation (10) describes the determinants of business cycle synchronization between the country pair i and j in year t ($SYN_{ij,t}$). We distinguish the traditional direct effects of trade intensity ($TRI_{ij,t}$) and specialization ($SPE_{ij,t}$) from the direct effect of new exports ($NTF_{ij,t}$). Equation (11) relates trade intensity ($TRI_{ij,t}$) to specialization ($SPE_{ij,t}$) and new trade flows ($NTF_{ij,t}$). Equation (12) is new to the existing literature as it relates new trade flows ($NTF_{ij,t}$) to trade intensity ($TRI_{ij,t}$) and specialization ($SPE_{ij,t}$). Equation (13) explains specialization ($SPE_{ij,t}$) by trade intensity ($TRI_{ij,t}$) and new trade flows ($NTF_{ij,t}$).

Turning now to the variables, we define New Trade Flows between countries i and j in period t ($NTF_{ij,t}$) as the ratio between the value of new export flows from country i to country j in period t ($X^n_{ij,t} = \sum_k X^n_{ij,k,t}$ where k is the variety index) and the value of total exports from country i to country j in period t ($X_{ij,t}$) , *ie*, $NTF_{ij,t} = \frac{\sum_k X^n_{ij,k,t}}{X_{ij,t}}$. This definition has two advantages compared to the sole number of new traded goods: first it takes into account the heterogeneity of new flows in terms of selling prices; second it provides a definition of new trade flows that can be measured on the same metric as trade intensity. To measure business cycle synchronization we follow Inklaar et al. (2008), and compute the Fisher transform of correlation between countries i and j in period t defined as $SYN_{ij,t} = \frac{1}{2} ln \left(\frac{1+C_{ij,t}}{1-C_{ij,t}} \right)$. Here $C_{ij,t}$ is the pairwise correlation coefficient for countries (i,j) in period t using GDP data from the OECD database[1]. Trade intensity is the ratio of the sum of total exports from country i to country j ($X_{ij,t}$) and imports of country i from country j ($M_{ij,t}$) over country i GDP ($Y_{i,t}$), *ie* $TRI_{ij,t} = \frac{X_{ij,t}+M_{ij,t}}{Y_{i,t}}$. Following Imbs (2004) and Inklaar et al. (2008), specialization is defined as the absolute difference of the GDP share of an industry in two countries, *ie* $Specia_{ij,t} = \sum_s |V_{is} - V_{js}|$. The corresponding data on 27 sectors of goods and services come from the OECD database.

The sets $Z1_{ij,t}, Z2_{ij,t}, Z3_{ij,t}$ and $Z4_{ij,t}$ control for financial integration, similarity of economic

[1] A detailed description of the variables, data and sources is presented in appendix.

policies and the volatility of real exchange rates. We account for the similarity of macroeconomic policies in two ways. We compute yearly averages of the standard deviation of monthly real interest rate differentials ($IFI1_{ij,t}$) using nominal interest rates and consumer price indices. Monetary conditions are captured through three–month interest rates. We use the OECD data.

We consider the absolute difference between the net foreign assets ($NFA_{ij,t}$) of a country-pair as a proxy of bilateral capital restrictions ($IFI2_{ij,t}$) following Imbs (2004) and Inklaar et al. (2008). The NFA annual data series come from the updated database of Lane and Milesi-Feretti (2007). We use absolute differences between the GDP ratios of the cumulated current accounts for each country-pair. We account for financial linkages between country pairs as suggested by Otto et al. (2001). Real equity returns are computed on the basis of monthly nominal stock market indices and consumer price indices ($IFI3_{ij,t}$). We use the Harmonized Consumer Price Index as deflator. Data come from the OECD.

Following Darvas et al. (2005), the adjusted government primary balance (in percent of GDP) measures fiscal policy divergence ($FIS_{ij,t}$). The logarithm of the standard deviation of the difference of real bilateral exchange rates ($RER_{ij,t}$) are taken from the Pacific Retrieval Interface of the British Columbia University.

The sets $G1_{ij,t}, G2_{ij,t}, G3_{ij,t}$ and $G4_{ij,t}$ combine gravity variables. As stressed by Clark and van Wincoop (2001), output correlations among countries (or regions) can also be influenced by distance factors. Dummy variables from the CEPII bilateral distance database are used to control for contiguity (CON_{ij}) and for a common language (LAN_{ij}). Economic distance between pairs of countries ($DIS_{ij,t}$) is proxied by the log of the distance (in kilometers) between their capital cities. Finally, we also control for the effect of size on trade by an additional variable based on per capita output in the two economies (SIZ_{ij}).

3.2 Simultaneous–equations estimates

We report results from a three-stage-least-squares (3SLS) panel estimation of equations (10)-(13) using the Random Effect (RE) estimator[2]. The left–hand side of table 4 reports results from a benchmark model ignoring new trade flows.

We find a robust and positive influence (0.206) of trade intensity on business cycle comovements as previously obtained by Imbs (2004), Baxter and Kouparitsas (2005), Inklaar et al. (2008) and Abbott et al. (2008). Specialization has a negative impact on synchronization (-1.020). This supports previous empirical findings such as Imbs (2004) and Kalemli-Ozcan et al. (2009). Conversely, higher trade intensity decreases the specialization of the trading partners (-0.143). According to the Ricardian approach, specialization increases bilateral trade (0.674). However bilateral trade intensity is primarily influenced by gravity factors: the more distant two euro members are, the less they trade with each other, a common language tends to boost bilateral trade significantly but there is no significant country size effect. Finally, specialization increases when two countries share a common border. Having the same language has no significant effect on production structures.

The right hand–side of table 4 takes into account new trade flows as a specific component of trade integration in Europe. Adding this new variable to the system reduces the impact of trade intensity on business cycle synchronization by more than 40 percent (from 0.206 to 0.111). In the same way, the effect of specialization on business cycle synchronization is also reduced by 40% (from -1.020 to -0.537). Given table 4, the negative contribution of new trade flows on business cycle comovements (-0.042) is significant at the 1% level. Accounting for new trade flows in the 3SLS–RE panel estimation we find that specialization is now positively affected by trade intensity. This result is in line with Krugman's view about the possible negative consequences of

[2]The Hausmann test shows that a random effect representation outperforms the fixed effect alternative.

trade integration. International trade can be viewed as a source of heterogeneity within a currency union. In contrast the impact of specialization on trade intensity remains unchanged. New trade flows have no significant direct impact on trade intensity while trade intensity reduces new trade flows. This feature can be explained as follows: when trade intensity is high, this reduces the possibility of creating new bilateral trade relations.

Table 4: Determinants of synchronization: 3SLS–RE panel results over 1995–2007.

	Benchmark Model			Model with New Trade Flows			
	SYN	TRI	SPE	SYN	TRI	NTF	SPE
TRI	0.206		-0.143	0.111		-9.978	0.538
	(6.25)***		(2.26)**	(2.65)***		(2.08)**	(2.66)***
NTF				-0.042	0.027		0.162
				(3.97)***	(0.53)		(5.57)***
SPE	-1.020	0.674		-0.537	0.727	14.446	
	(5.36)***	(2.38)**		(2.48)**	(2.42)**	(3.80)***	
FISC	-0.007			-0.004			
	(1.86)*			(1.08)			
IFI1	0.011			0.015			
	(3.33)***			(4.01)***			
IFI2	0.077			0.072			
	(5.85)***			(5.30)***			
RER	-0.012	0.014		-0.011	0.014	0.182	
	(5.17)***	(5.81)***		(4.74)***	(4.34)***	(2.58)***	
SIZ		0.137	0.177		0.117	-2.661	0.486
		(2.18)**	(7.15)***		(1.43)	(3.50)***	(6.63)***
DIS		-1.0×10^{-4}	6.9×10^{-6}		-1.3×10^{-4}	5.8×10^{-4}	-2.8×10^{-4}
		(7.09)***	(0.80)		(1.40)	(1.31)	(4.56)***
LAN		0.162	-0.021		0.175	2.642	-0.044
		(6.43)***	(1.90)*		(4.34)***	(2.91)***	(1.37)
CON		0.458	0.176		0.458	4.000	-0.383
		(11.37)***	(4.56)***		(10.63)***	(1.71)*	(3.19)***
IFI3			0.063				0.069
			(7.73)***				(3.48)***
Const.	0.105	-0.119	-0.143	0.096	-0.104	2.681	-0.445
	(9.08)***	(1.79)*	(5.48)***	(8.17)***	(1.20)	(3.36)***	(5.89)***

Sample size is 1080. Absolute value of z statistics in parentheses.
, **, * significant results at 10%, 5% and 1% respectively.*

New trade flows also tend to increase the specialization of countries. This can occur if new exports concern an existing traded sector in which the country is already specialized. Finally specialization has a positive effect on trade intensity, as less diversified countries tend to have a higher bilateral trade. It also promotes new trade flows since, once a country becomes more specialized, it can export more new varieties.

The roles played by financial integration and policy coordination are more cumbersome. As described by the negative influence of the FIS variable in table 4, business cycles tend to be less synchronized in case of diverging fiscal paths between Member States. Accordingly, the lower the volatility of the short–term interest rate differential ($IFI1$) is, the higher is the correlation between business cycles. These findings constrast with the absence of a policy coordination effect on the comovements in the European cycles as documented in Clark and van Wincoop (2001). As they argue, this lack of evidence may come from the ambiguous role of national policies that can either boost or dampen cyclical fluctuations in output.

Financial integration has a significantly positive influence on the coupling of business cycles in the euro area. Smaller deviations in net foreign assets relative to GDP ($IFI2$) or less volatile real bilateral exchange rates (RER) strengthen the comovements of national GDPs. This channel has been neglected by Frankel and Rose (1998) and Kose et al. (2003). For Dées and Zorell (2012), it is difficult to isolate the role of bilateral capital flows on business cycles correlation. In contrast with these authors, we rely on and Milesi-Ferretti's computations of net foreign assets and make no distinction between equities, foreign direct investment, and bonds. This feature may explain the departure of our results from these previous findings.

As reported in table 4, the impact of new trade flows on business cycle synchronization is significant but weak with regard to trade intensity and specialization. However this direct effect offers only a partial view of the impact of new trade flows on business cycle comovements, given the interplay of trade variables. Following Imbs (2004) and Dées and Zorell (2012), we compute the overall effect of trade intensity, new trade flows and specialization on business cycle synchronization.

3.3 Direct and indirect effects of new trade flows

Table 5 decomposes the overall effect of each of these variables. Disentangling the nature of the indirect effects, one shall note that new trade flows act mainly as a propagation mechanism whereas it plays a minor role as an impulse variable. As an amplifying factor it works through both trade intensity and specialization. Remarkably, the overall effect of new trade flows depends on the indirect impact through the specialization channel ($\alpha_3\gamma_2 = -0.087$) that is twice the value of its direct effect on business cycle synchronization ($\alpha_2 = -0.042$).

Table 5: Decomposition of the effects on business cycles comovements.

	Overall	Direct	Indirect	Propagation through		
				TRI	SPE	NTF
	Benchmark system					
TRI		α_1			$\alpha_3\gamma_1$	
	0.352^{***}	0.206^{***}	0.146^{**}		0.146^{**}	
SPE		α_3		$\alpha_1\beta_1$		
	-0.881^{***}	-1.020^{***}	0.139^{**}	0.139^{**}		
	System with new trade flows					
TRI		α_1			$\alpha_3\gamma_1$	$\alpha_2\phi_1$
	0.821^{***}	0.111^{***}	0.710^{***}		0.289^{*}	0.421^{*}
SPE		α_3		$\alpha_1\beta_1$		$\alpha_2\phi_2$
	-1.067^{***}	-0.537^{***}	-0.529^{***}	0.080^{*}		-0.610^{***}
		α_2		$\alpha_1\beta_2$	$\alpha_3\gamma_2$	
NTF	-0.126^{***}	-0.042^{***}	-0.084^{**}	0.003	-0.087^{**}	

*, **, *** *significant results at 10%, 5% and 1% respectively.*

The key role of new trade flows as an amplifying channel can easily be observed by contrasting the two estimated models. First, ignoring new trade flows as in the benchmark case, the overall effect of trade intensity (0.352) is mainly explained by the direct impact ($\alpha_1 = 0.206$) already noted in table 4. The indirect effect ($\alpha_3\gamma_1 = 0.146$) is positive as trade intensity reduces specialization that itself affects negatively business cycle synchronization.

The model that takes into account new trade flows gives a new picture for the relative strength of direct and indirect channels. The net increase in the overall effect is now explained by the indirect channels. The direct impact of trade intensity now represents 20% of the total effect ($\alpha_1 = 0.111$) while its indirect impact is more than six times higher (that is 40% through specialization and 60% through new trade flows). This feature also characterises the impact of specialization on business cycle synchronization. In the benchmark model, the negative effect of specialization on business cycle comovements ($\alpha_3 = -1.020$) is partially dampened by the indirect positive effect of specialization on trade intensity ($\alpha_1\beta_1 = 0.139$). In the competing model, the overall negative effect of specialization on business cycle synchronization is strengthened through the indirect channel of new trade flows. As noted previously for trade intensity, the direct effect is divided by two ($\alpha_3 = -0.537$) to equate the size of the indirect effect, which is mostly explained by the new trade flows channel ($\alpha_2\phi_2 = -0.610$).

4 Conclusion

This paper has investigated the impact of trade integration on business cycle synchronization for the founding countries of the EMU. We have first built an illustrative DSGE model highlighting the role of the terms of trade in the coupling of business cycles across countries. Synchronization is weakened when new firms export as a response to productivity gains. Then, we have extended the standard approaches promoted by Imbs (2004), Inklaar et al. (2008) and Abbott et al. (2008) to take the trade effect of the euro on the extensive margin of international trade into account.

Using a panel data approach and tackling the endogeneity issue we have found that trade intensity has still a direct positive effect. This contrasts with the negative impact of new trade flows and specialization on business cycle comovements. However the direct effect of new trade flows is quite weak. Furthermore, we have decomposed the overall impact of each trade variable on business cycle synchronization. This delivers a new picture of the role of new trade flows on business cycle comovements as this variable acts mainly as a propagation mechanism. This indirect channel represents at least as much as the respective direct impact of trade intensity and specialization on business cycle synchronization.

Two main implications should be drawn from this paper. First, it underlines the role of indirect channels to assess the overall impact of trade intensity and specialization on business cycle synchronization. This pattern, already noted by Imbs (2004) and Dées and Zorell (2012) for financial factors, also operates through the increase in the number of traded varieties. Second our results show that the composition of trade between the intensive and extensive margins (here measured by new trade flows) also matters for the cohesion of business cycles within a currency area. From this perspective, new trade flows like specialization dampen output comovements. By so a key component of the trade effect of the euro has clearly played against the synchronization of the European business cycles.

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Appendix

Variables	Description	Measure	Data Source
SYN	Business cycle synchronization index	$SYN_{ij,t} = \frac{1}{2} ln\left(\frac{(1+C_{ij,t})}{(1-C_{ij,t})}\right)$ $C_{ij,t}$ is the pairwise correlation coefficient between HP–filtered GPD series	OECD
TRI	Bilateral Trade Intensity	$TRI_{ij,t} = \frac{X_{ij,t}+M_{ij,t}}{Y_{i,t}}$ with X, M exports and imports and Y the GDP.	OECD
NTF	Bilateral share of New Trade Flows	$NTF_{ij,t} = \frac{\sum_k X^n_{ij,k,t}}{\sum_k X_{ij,k,t}}$ with $X^n_{ij,t}$ value of new exports at the period t	CEPII, BACI
SPE	Sectoral specialization	$SPE = \sum_s \lvert V_{is} - V_{js} \rvert$ V_{is} as the GDP share of industry s in country i.	OECD
FIS	Divergence of cyclically adjusted fiscal positions	$FIS = \lvert Budg_{it} - Budg_{jt} \rvert$ $Budg$: net fiscal lend/borrowing as % of potential GDP.	OECD
IFI1	Volatility of the spread of 3–month interest rates	$IFI1_{ij,t} = ln\left(\sigma\left(r_{i,t} - r_{j,t}\right)\right)$	OECD
IFI2	Divergence between net foreign assets	$IFI2_{ij,t} = \left\lvert \frac{NFA_{i,t}}{GDP_{i,t}} - \frac{NFA_{j,t}}{GDP_{j,t}} \right\rvert$	Lane & Milesi-Feretti's (2007) database
IFI3	Volatility of real equity returns	$IFI3_{ij,t} = ln\left(\sigma\left(R_{i,t} - R_{j,t}\right)\right)$ with R the real rate of return the stock market index.	OECD
RER	Volatility of the real bilateral exchange rate	$RER_{ij,t} = ln\left(\sigma\left(e_{ij,t}\right)\right)$ with $e_{i,t}$ the US dollar rate for the domestic currency.	British Columbia University
SIZ	Product of GDPs (in logs)	$SIZ = ln(Y_{i,t} \times Y_{j,t})$	CEPII
DIS	Log of distance (in Km) between capital cities		CEPII
LAN	Dummy for common language		CEPII
CON	Dummy for common border		CEPII