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HOW DO FISCAL CONSOLIDATION AND FISCAL STIMULI IMPACT ON THE SYNCHRONIZATION OF BUSINESS CYCLES?

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ABSTRACT

Using quarterly data for a panel of advanced economies, we show that synchronized fiscal consolidation (stimulus) programmes in different countries make their business cycles more closely linked. We also find: (i) some evidence of decoupling when an inflation targeting regime is unilaterally adopted; (ii) an increase in business cycle synchronization when countries fix their exchange rates and become members of a monetary union; (iii) a positive effect of bilateral trade on the synchronization of business cycles. Global factors, such as a rise in global risk aversion and uncertainty and a reversal of nonstandard expansionary monetary policy, can also reduce the degree of co-movement of business cycles across countries. From a policy perspective, our work shows that an inflation targeting regime coupled with simultaneous fiscal consolidations can lead to more business cycle synchronization.

Keywords: fiscal consolidation, fiscal stimulus, business cycle synchronization

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1. INTRODUCTION

Following the global crisis of 2008–09, many governments in developed countries put in place fiscal stimuli measures aimed at promoting the recovery from a protracted housing bust (Castro, 2010; Agnello and Schuknecht, 2011; Agnello and Sousa, 2013a; Agnello *et al.*, 2015). The subsequent concerns about long-term sustainability and spikes in government bond yields ultimately translated into the sovereign debt crisis. In this context, fiscal consolidation programmes were designed and restrictive fiscal packages were implemented.

In Europe, the conduct of fiscal policy has been guided by the assumption that fiscal consolidation is a necessary condition for sustainable growth over the medium to long-term. In other countries – namely, the United Kingdom and the United States –, governments have recognized

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that there is a (negative) trade-off between fiscal austerity and economic growth, at least, in the short-term. For instance, Agnello *et al.* (2013) show that government spending cuts can bring public debt back to a sustainable path, but fiscal discipline also plays a key role as it helps shorten the duration of fiscal consolidations. Mallick and Granville (2005) also find that poverty reduction can only be temporarily achieved via fiscal adjustments.

Countries under financial stress and struggling to restore their public finances via consolidation measures appear to have no alternative but to pay the price of creating a recessionary environment (at least, in the short term). On the other hand, countries that managed to avoid fiscal austerity seem to be weathering better in terms of economic performance. This raises a number of questions on the impact of fiscal adjustments on business cycle synchronization. Specifically, do fiscal consolidation programmes lead to decoupling? What are the effects of fiscal stimulus episodes on the synchronization of business cycles? Are fiscal adjustments implemented by a single country more likely to result in de-synchronized business cycles (i.e., to reduce the correlation of the cyclical component of economic activity across countries) than programmes that are simultaneously adopted by different countries?

Experience says that economies can be subject to shocks that are asymmetric: for instance, the macroeconomic impact of large depreciations is different from small depreciations; and large wage adjustments can affect real economic activity more substantially than small movements. Moreover, it is also well-known that the impact of common shocks can be asymmetric: for example, positive commodity price shocks can favour large net commodity exporters at the expense of large net commodity importers.

Under these conditions, if asymmetries are partially offset by fiscal adjustments, then fiscal consolidation/stimuli measures can lead to a higher degree of co-movement of business cycles across countries. In contrast, if fiscal policy is pro-cyclical (Gavin and Perotti, 1997; Lane, 2003) and changes in the institutional or the political background make sizeable fiscal adjustments unavoidable in a given country, then consolidation/stimulus programmes can be associated with a fall in the correlation of the cyclical component of real output between any pair of countries.

Thus, the relationship between fiscal adjustments and business cycle synchronization cannot be determined *ex-ante*. In the current work, we explore empirically this link with a suitable econometric framework.

We start by considering the identification of fiscal consolidation programmes of Devries *et al.* (2011), who rely on a narrative approach. Using quarterly data for a panel of industrialized countries, we show that fiscal consolidations implemented by a single country (i.e., unilateral fiscal consolidation programmes) do not significantly impact on business cycle synchronization or can even reduce it. In contrast, fiscal consolidation measures that are adopted by both countries (i.e., synchronized fiscal consolidation programmes) make their business cycles behave more closely.

Then, we use the statistical approach of Alesina and Ardagna (2010) to identify fiscal stimulus episodes. We find similar evidence of a positive and significant impact on business cycle synchronization from the bilateral implementation of fiscal stimuli. However, unilateral fiscal stimulus programmes do not tend to exert such effect.

Further, the results provide some evidence of decoupling when an inflation targeting regime is adopted unilaterally, but business cycle synchronization improves when both countries move towards this monetary policy regime. In addition, there is an increase in business cycle synchronization when both countries fix their exchange rates and when countries become members of a monetary union. Finally, we uncover a positive effect of bilateral trade on business cycle synchronization.

The main policy implication of our work is that a synchronization of fiscal consolidation measures coupled with an inflation targeting regime can induce stronger co-movement of

business cycles across countries. The reason is that when monetary policy is conducted with the goal of achieving price stability over the medium to long-term, central banks respond to foreign output shocks by stabilizing prices and allowing domestic output to adjust. Thus, business cycle synchronization tends to rise. If governments also react to foreign output shocks by implementing fiscal consolidation measures that overlap in time across countries, this will further increase the co-movement of their business cycles.

The paper is organised as follows. Section II reviews the related literature. Section III describes the econometric methodology and presents the data. Section IV provides the empirical results. Section V concludes.

II. LITERATURE REVIEW

Our analysis is related to various other studies on the determinants of business cycle synchronization. In particular, Artis and Zhang (1997, 1999) and Artis (2004) detect an 'European business cycle' since the early eighties. Devereux and Engel (2001, 2003) find that floating exchange rates protect the domestic economy from foreign monetary shocks (the so-called 'insulation' effect). Baxter and Kouparitsas (2005) conclude that the degree of bilateral trade between a pair of countries has a robust effect on business cycle synchronization. Kose *et al.* (2003, 2012) and Imbs (2006) emphasize that countries with closer financial ties tend to have more synchronized business cycles. Darvas and Szapáry (2000) do not find a significant impact of the exchange rate regime on capital flows across countries. Darvas *et al.* (2005) highlight that the business cycles of countries with similar government budget positions move more closely. Thus, fiscal divergence i.e., deviations from a fiscally responsible behaviour, creates idiosyncratic shocks and is associated with lower business cycles synchronization.

Darvas and Szapáry (2008) examine business cycle synchronization in the new EU members of Central and Eastern Europe and the euro zone countries. They show that, despite the dramatic improvement in the correlation of the cyclical components of GDP, industrial production and exports among the new EU members, the degree of synchronization of private consumption with the euro zone countries remained low. Artis (2008) shows that as the process of international trade deepens, regional business cycle affiliations are superseded by wider business cycle clubs. Araújo and Oliveira Martins (2009a, 2009b) show that the deep fall in economic activity during the so-called 'Great Recession' largely reflected the 'Great Synchronization' of trade flow declines across countries.

More recently, Flood and Rose (2010) argue that business cycles in countries targeting inflation are only slightly synchronized with foreign ones. Artis *et al.* (2011) study the behaviour of the international business cycle across advanced and emerging market economies and find evidence of a secular increase in international business cycle synchronization within a group of European and a group of English-speaking economies.

We contribute to this literature by assessing the impact of fiscal adjustments on business cycle synchronization, an issue that, to the best of our knowledge, has not been investigated thoroughly yet. Arghyrou (2000) finds that the accession to the European Monetary Union (EMU) has led to important changes in the trade patterns, even though it did not seem to have a significant effect on prices (Arghyrou, 2007). Fatás and Mihov (2003) show that fiscal policy discretion leads to macroeconomic instability. Arghyrou and Luintel (2007) develop a new empirical approach and find that the Maastricht criteria had a positive effect on the government's intertemporal budget constraint of a series of EMU countries. Along the same lines, Afonso *et al.* (2011) provide a new methodology to investigate long-term fiscal developments, which accounts for the persistence, the cyclicality and the discretion of fiscal adjustments. Castro (2011) highlights the importance

of fiscal rules for the economic growth of the European Union. Afonso and Jalles (2012) use different analytical approaches and a policy-action framework to assess the success of fiscal consolidations, and emphasize the importance of the cyclically adjusted primary balance and the duration of the programmes. Agnello and Sousa (2013b) show that fiscal prudence is key for economic prosperity and Agnello and Sousa (2014) find that political instability is associated with more discretion in fiscal policy.

III. EMPIRICAL METHODOLOGY

In order to explore the empirical relationship between business cycle synchronization and fiscal adjustments, we estimate the following model using a pooled Ordinary-Least Squares (OLS) estimator:

$$\rho_{ij,t}^{cycle} = \beta_1 IT(1)_{ij,t} + \beta_2 IT(2)_{ij,t} + \gamma_1 Fix(1)_{ij,t} + \gamma_2 Fix(2)_{ij,t} + \lambda_1 MU(1)_{ij,t} + \lambda_2 MU(2)_{ij,t} + \left\{\kappa_1 Cons(1)_{ij,t}\right\}_{\tau=m} + \left\{\kappa_2 Cons(2)_{ij,t}\right\}_{\tau=m} + \mathrm{X}_{ij,t} + \varepsilon_{ij,t} \quad (1)$$

where $\rho_{ij,t}^{cycle}$ is the sample correlation coefficient (Pearson's coefficient) between real output in country i and real output in j over 5-year non-overlapping windows.

Since we are interested in the business cycle deviations from the trend, we consider two alternative techniques for de-trending real output (GDP), namely: (i) the Baxter-King band-pass filter; and (ii) the fourth difference, i.e., the annual growth rate implied by the quarterly data. Data on the seasonally adjusted GDP are obtained from the International Financial Statistics (IFS) and the World Economic Outlook (WEO) of the International Monetary Fund (IMF) and the Organization for Economic Co-Operation and Development (OECD).

Flood and Rose (2010) show that inflation targeting has a positive (albeit small) impact on business cycle synchronization. Thus, we test whether the advent of inflation targeting (IT) provides some sort of insulation from external shocks. In this context, *IT(1)* and *IT(2)* are dummy variables that take the value of one if one or both countries are inflation targeters and zero, otherwise. Information about inflation targeting regimes is based on the identification put forward by Mishkin (2008).

Mundell (1968) shows that under a fixed exchange rate regime, monetary shocks increase the synchronization of business cycles across countries, but the effect of real shocks cannot be determined a priori. In the case of a flexible exchange rate, real shocks have a positive impact on business cycle synchronization, but monetary shocks have an ambiguous effect. To assess the impact of fixed exchange rate regimes on business cycle synchronization, we add *Fix(1)* and *Fix(2)* to the set of explanatory variables. These are dummy variables that take the value of one if one or both countries have a fixed exchange rate regime and zero, otherwise.

Similarly, we check whether membership of a currency union affects the degree of synchronization of business cycles. Thus, we consider *MU(1)* and *MU(2)* among the set of regressors. These are dummy variables that take the value of one if one or both countries are members of a monetary union.

Both fixed exchange rate regimes and monetary unions are measured in accordance with the work of Reinhart and Rogoff (2004). It should be noted that *Fix(2)* and *MU(2)* are equal to one if *both* countries have a fixed exchange rate vis-à-vis each other and if both countries are in the same currency union, respectively. This implies that, for countries that are in a currency union but do not share a common currency, *MU(2)* takes the value of zero. Flood and Rose (2010) show that countries fixing exchange rates against each other have more synchronized business cycles and the same applies in the case of monetary unions, albeit to a smaller extent.

In addition, we include *Cons(1)* and *Cons(2)* in the set of explanatory variables. These are also dummy variables that take the value of one if one (unilateral adjustment) or both countries (synchronized adjustment) have implemented a fiscal consolidation programme for *m* consecutive years within the 5-year non-overlapping window. We expect synchronized fiscal consolidations to have a positive impact on the co-movement of business cycles across countries, as 'coordinated'/'simultaneous' fiscal adjustments tend to generate effects on economic growth of the same direction. Thus, they are likely to increase business cycle synchronization. In contrast, the impact of unilateral fiscal consolidation episodes is undetermined.

Finally, $X_{ij,t}$ is a vector of control variables, which includes: 1) the degree of bilateral trade between countries *i* and *j*; 2) the log distance between countries *i* and *j*; 3) the Chicago Board Options Exchange (CBOE) Volatility Index (VIX); and 4) the U.S. term spread.

According to Baxter and Kouparitsas (2005), the degree of bilateral trade between a pair of countries is an important determinant of business cycle synchronization, with effects that are above and beyond those of the impact of the monetary regime. Thus, we consider their measure of bilateral trade among the set of control variables. In particular, we compute the sum of all four bilateral trade flows (i.e., exports from country *i* to country *j*, imports into country *j* from country *i*, exports from country *j* to country *i*, and imports into country *i* from country *j*), divided by the multilateral sums (i.e., country *i*'s exports, country *j*'s exports, country *i*'s imports and country *j*'s imports). Data on exports and exports is sourced from the IMF's Direction of Trade dataset.

Along the same lines, we follow Baxter and Kouparitsas (2005) and Flood and Rose (2010) and include the natural logarithm of the distance between a pair of countries in the vector of control variables. Countries· locations in latitude and longitude are sourced from the CIA's World Factbook location. We expect distance to be negatively correlated with the degree of business cycle synchronization.

The VIX is typically considered a proxy for risk aversion and uncertainty and a good way to track the dynamics of the integration of countries in the world economy due to, for instance, the co-movement implied by the global financial cycle (Rey, 2015). An increase in risk aversion and uncertainty should be associated with growth decoupling across countries.

As for the U.S. term spread, it captures expectations about future growth, as well as the recent unconventional monetary policies that have been put in place in recent times. We expect a tightening of (nonstandard) monetary policies to have a negative effect on business cycle synchronization.

We also account for the effects of fiscal stimuli on business cycle synchronization. To that end, the dummy variables *Cons(1)* and *Cons(2)* are replaced with the dummy variables *Stim*(1) and *Stim*(2), which take the value of one if one or both countries have adopted fiscal stimuli packages for *m* consecutive years within the 5-year non-overlapping window.

Fiscal consolidation (stimulus) episodes are identified using data for government spending and government revenue from the OECD's Economic Outlook. As in the case of fiscal consolidations, synchronized fiscal stimuli should lead to more co-movement of business cycles, but the effect of unilateral fiscal stimuli episodes should be ambiguous.

Therefore, we run the following panel-data regression using a pooled Ordinary-Least Squares (OLS) estimator:

$$\rho_{ij,t}^{cycle} = \beta_1 IT(1)_{ij,t} + \beta_2 IT(2)_{ij,t} + \gamma_1 Fix(1)_{ij,t} + \gamma_2 Fix(2)_{ij,t} + \lambda_1 MU(1)_{ij,t} + \lambda_2 MU(2)_{ij,t} + \left\{\kappa_1 Stim(1)_{ij,t}\right\}_{\tau=m} + \left\{\kappa_2 Stim(2)_{ij,t}\right\}_{\tau=m} + \mathrm{X}_{ij,t} + \varepsilon_{ij,t} \quad (2)$$

We identify fiscal consolidation episodes using a narrative approach based on the work of Devries *et al.* (2011). As emphasized by these authors, the standard statistical approach, which

TABLE 1
Summary statistics

	# Observ.	Mean	St. Dev.	Minimum	Maximum
BK $\rho_{ij,t}^{cycle}$	950	0.2756	0.4885	−0.9665	0.9864
Growth $\rho_{ij,t}^{cycle}$	960	0.3224	0.3464	−0.6834	0.9605
IT(1)	1140	0.3482	0.4766	0	1
IT(2)	1140	0.0684	0.2526	0	1
Fix(1)	1140	0.3088	0.4622	0	1
Fix(2)	1140	0.0605	0.2386	0	1
MU(1)	1140	0.2702	0.4442	0	1
MU(2)	1140	0.0965	0.2954	0	1
Cons(1)	1140	0.1193	0.3243	0	1
Cons(2)	1140	0.1246	0.3304	0	1
Stim(1)	1140	0.4930	0.5002	0	1
Stim(2)	1140	0.0974	0.2966	0	1
Bilateral trade	1064	0.0076	0.0120	0.0001	0.1109
Distance	1140	7.5906	1.1570	4.9216	9.4169
VIX	950	19.2924	5.9092	11.0349	29.3189
US Term Spread	950	1.6121	1.1580	−0.3989	2.7871

builds on variation in the cyclically-adjusted primary budget balance (CAPB), suffers from three major limitations. First, the procedure to adjust the budget balance for the effect of the business cycle is subject to uncertainty. Second, the measurement error of the CAPB may be correlated with economic developments. Finally, the statistical approach omits periods of fiscal consolidation that were followed by negative shocks and offsetting discretionary fiscal policies.

Thus, Devries *et al.* (2011) analyse policy measures that are motivated by deficit reduction by examining accounts and records of what governments were planning to do at the time of publications (such as the IMF Recent Economic Developments reports, the IMF Staff Reports, or the OECD Economic Surveys). In this context, the narrative approach eliminates the endogeneity of the response of fiscal policy to the economy.

Yet, one disadvantage of the database compiled by Devries *et al.* (2011) is that it does not distinguish between episodes of fiscal consolidation and of fiscal stimulus respectively. For this reason, we identify fiscal stimulus programmes using a statistical approach based on the work of Alesina and Ardagna (2010), and thus correct the primary surplus for year-to-year changes in the unemployment rate. More specifically, a fiscal stimulus episode corresponds to a year in which the cyclically-adjusted primary balance deteriorates by at least 1.5 percent of GDP.

Table 1 provides a summary of the descriptive statistics of the variables. The correlation between the two dependent variables is large (0.7221) and significant at the 1 percent level. This implies that our measure of business cycle synchronization is not sensitive to the de-trending process. In the case of the dummy variables, their means are typically larger for 'unilateral' events than for 'bilateral' events that apply to each pair of countries. Among other control variables, the dispersion of distance and VIX is particularly high.

In Table 2, we provide the list of episodes of fiscal consolidation identified using the narrative approach of Devries *et al.* (2011) and the list of episodes of fiscal stimulus identified using the statistical approach of Alesina and Ardagna (2010). Given that the two types of episodes are identified using different approaches, there is some degree of overlapping between fiscal

TABLE 2
Fiscal consolidation and fiscal stimulus episodes

	Fiscal consolidation (Devries et al., 2011)	*Fiscal stimulus (Alesina and Ardagna, 2010)*
Australia	1985–1988, 1994–1999	1990–1991
Austria	1980–1981, 1984, 1996–1997, 2001–2002	1975, 2004
Belgium	1982–1985, 1987, 1990, 1992–1994, 1996–1997	1975, 1981, 2005
Canada	1984–1997	1975, 1982, 1991, 2001
Denmark	1983–1985, 1995	1974–1975, 1980–1982
Finland	1992–1997	1978, 1982–1983,1987,1990–1992, 2001, 2003
France	1979, 1987, 1989, 1991–1992, 1995–1997, 1999–2000	1975, 1981, 1992–1993, 2002
Germany	1982–1984, 1991–1995, 1997–2000, 2003–2004, 2006–2007	1995, 2001
Greece	–	1981, 1985, 1989, 1995, 2001
Ireland	1982–1988, 2009	1974–1975, 1978, 2001, 2007
Italy	1991–1998, 2004–2007	1972, 1975, 1981, 2001
Japan	1979–1983, 1997–1998, 2003–2007	1975, 1993, 1998, 2005, 2007
Netherlands	1981–1988, 1991–1993, 2004–2005	1975, 1980, 1995, 2001–2002
Norway	–	1974, 1976–1977, 1986–1987, 1991, 1998, 2002, 2007
New Zealand	–	1988
Portugal	1983, 2000, 2002–2003, 2005–2007	1978, 1985, 1993, 2005
Spain	1983–1984, 1989–1990, 1992–1997	1981–1982, 1993
Sweden	1984, 1993–1998	1974, 1977, 1979–1980, 1991–1992, 2001–2002
UK	1979–1982, 1994–1999	1971–1973, 1990–1992, 2001–2003
USA	1978, 1980–1981, 1985–1986, 1988, 1990–1998	2002

consolidations and fiscal stimuli even though it is very small. Additionally, it can be seen that there is also some synchronization between the two types of episodes across countries.

IV. EMPIRICAL RESULTS

IV.1 Fiscal consolidation programmes

We start our investigation of the impact of fiscal adjustments on business cycle synchronization by considering fiscal consolidation episodes that last *exactly* 1 year, 2 years, 3 years and 4 years over the 5-year window period under analysis.[1] For each experiment, we provide two sets of results: (i) one for the model without global factors (i.e., the VIX and the U.S. term spread); and (ii) another one where we add the global factors. Tables 3 and 4 summarize the

[1]Given the very small number of fiscal consolidation programmes that last *exactly* 5 years, we do not report the corresponding results.

TABLE 3

Fiscal consolidation and business cycle synchronization – Baxter-King de-trending

	Duration (in years) of fiscal consolidation episodes within 5-year window periods											
	1 year			*2 years*			*3 years*			*4 years*		
IT(1)	−0.0495	−0.0472	−0.0531	−0.0416	−0.0329	−0.0429	−0.0516	−0.0496	−0.0544	−0.0487	−0.0456	−0.0499
	(0.0355)	(0.0377)	(0.0384)	(0.0355)	(0.0381)	(0.0384)	(0.0363)	(0.0383)	(0.0388)	(0.0356)	(0.0378)	(0.0384)
IT(2)	0.1780**	0.1942**	0.1833**	0.1886**	0.2163***	0.1950**	0.1574**	0.1683**	0.1605**	0.1771**	0.1870**	0.1788**
	(0.0764)	(0.0774)	(0.0759)	(0.0775)	(0.0788)	(0.0774)	(0.0779)	(0.0797)	(0.0783)	(0.0777)	(0.0794)	(0.0778)
Fix(1)	0.0427	0.0612	0.0649	0.0433	0.0683	0.0747	0.0445	0.0625	0.0649	0.0483	0.0688	0.0715
	(0.0400)	(0.0457)	(0.0458)	(0.0402)	(0.0458)	(0.0459)	(0.0398)	(0.0457)	(0.0459)	(0.0398)	(0.0457)	(0.0459)
Fix(2)	0.2612***	0.2650***	0.2625***	0.2612***	0.2596***	0.2561***	0.2509***	0.2555***	0.2533***	0.2593***	0.2646***	0.2628***
	(0.0713)	(0.0737)	(0.0731)	(0.0708)	(0.0726)	(0.0717)	(0.0709)	(0.0730)	(0.0726)	(0.0707)	(0.0728)	(0.0725)
MU(1)	0.1850***	0.2492***	0.2191***	0.1835***	0.2834***	0.2247***	0.2058***	0.2518***	0.2325***	0.1963***	0.2457***	0.2223***
	(0.0473)	(0.0882)	(0.0588)	(0.0491)	(0.0875)	(0.0591)	(0.0481)	(0.0887)	(0.0596)	(0.0483)	(0.0898)	(0.0601)
MU(2)	0.2228***	0.2488***	0.2459***	0.2337***	0.2612***	0.2551***	0.2211***	0.2433***	0.2410***	0.2265***	0.2503***	0.2481***
	(0.0537)	(0.0565)	(0.0563)	(0.0546)	(0.0578)	(0.0573)	(0.0543)	(0.0569)	(0.0567)	(0.0542)	(0.0569)	(0.0567)
Cons(1)	−0.0466	−0.0822	−0.0811	0.0625	0.0898*	0.0846*	0.0128	0.0085	0.0095	0.0646	0.0644	0.0627
	(0.0454)	(0.0524)	(0.0525)	(0.0413)	(0.0462)	(0.0458)	(0.0389)	(0.0461)	(0.0465)	(0.0486)	(0.0508)	(0.0508)
Cons(2)	0.0868**	0.0870*	0.0855*	0.0765	0.1046	0.0908	0.1513**	0.1454*	0.1438*	0.1666	0.1770	0.1731
	(0.0429)	(0.0451)	(0.0452)	(0.0593)	(0.0641)	(0.0640)	(0.0730)	(0.0773)	(0.0773)	(0.1080)	(0.1098)	(0.1107)
Bilateral trade	4.7532***	4.4269***	4.4159***	4.8122***	4.5981***	4.5987***	4.6347***	4.3788***	4.3708***	4.8221***	4.6454***	4.6354***
	(1.3016)	(1.6146)	(1.6195)	(1.3014)	(1.5952)	(1.6076)	(1.3027)	(1.6150)	(1.6171)	(1.3245)	(1.6473)	(1.6497)
Distance	−0.0595***	−0.0461**	−0.0459**	−0.0627***	−0.0507**	−0.0499**	−0.0612***	−0.0474**	−0.0471**	−0.0579***	−0.0431**	−0.0430**
	(0.0171)	(0.0202)	(0.0203)	(0.0170)	(0.0201)	(0.0202)	(0.0169)	(0.0200)	(0.0201)	(0.0169)	(0.0202)	(0.0202)
VIX		−0.0054			−0.0097			−0.0039			−0.0040	
		(0.0075)			(0.0076)			(0.0075)			(0.0075)	
US Term Spread			−0.0229			−0.0347			−0.0198			−0.0161
			(0.0342)			(0.0345)			(0.0347)			(0.0347)
Constant	0.6114***	0.6024***	0.5419***	0.6220***	0.6888***	0.5671***	0.6215***	0.5788***	0.5404***	0.5928***	0.5394**	0.4931***
	(0.1434)	(0.2122)	(0.1740)	(0.1407)	(0.2117)	(0.1727)	(0.1397)	(0.2108)	(0.1718)	(0.1409)	(0.2143)	(0.1748)
Observations	874	703	703	874	703	703	874	703	703	874	703	703
R-squared	0.1370	0.1437	0.1436	0.1356	0.1428	0.1421	0.1351	0.1390	0.1391	0.1348	0.1393	0.1392

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 4

Fiscal consolidation and business cycle synchronization – Growth de-trending

	Duration (in years) of fiscal consolidation episodes within 5-year window periods											
	1 year			*2 years*			*3 years*			*4 years*		
IT(1)	0.0821***	0.0807***	0.0666**	0.0889***	0.0935***	0.0766***	0.0828***	0.0810***	0.0681**	0.0842***	0.0838***	0.0711***
	(0.0257)	(0.0271)	(0.0273)	(0.0257)	(0.0271)	(0.0271)	(0.0263)	(0.0275)	(0.0276)	(0.0259)	(0.0273)	(0.0274)
IT(2)	0.1037**	0.1274***	0.1081**	0.1132**	0.1463***	0.1198***	0.0867*	0.1141**	0.0974**	0.1026**	0.1226***	0.1056**
	(0.0440)	(0.0420)	(0.0424)	(0.0453)	(0.0434)	(0.0439)	(0.0457)	(0.0448)	(0.0449)	(0.0448)	(0.0436)	(0.0440)
Fix(1)	0.0219	0.0282	0.0338	0.0229	0.0359	0.0432	0.0252	0.0307	0.0355	0.0286	0.0362	0.0407
	(0.0276)	(0.0313)	(0.0308)	(0.0275)	(0.0312)	(0.0308)	(0.0273)	(0.0312)	(0.0307)	(0.0273)	(0.0313)	(0.0309)
Fix(2)	0.1535***	0.1721***	0.1650***	0.1529***	0.1667***	0.1587***	0.1446***	0.1645***	0.1578***	0.1518***	0.1709***	0.1638***
	(0.0510)	(0.0526)	(0.0502)	(0.0495)	(0.0504)	(0.0478)	(0.0504)	(0.0515)	(0.0492)	(0.0501)	(0.0514)	(0.0492)
MU(1)	0.0223	0.1117**	0.0714*	0.0206	0.1312***	0.0748*	0.0377	0.1185***	0.0834**	0.0289	0.1112**	0.0751*
	(0.0348)	(0.0436)	(0.0385)	(0.0354)	(0.0440)	(0.0387)	(0.0354)	(0.0446)	(0.0392)	(0.0351)	(0.0441)	(0.0389)
MU(2)	0.0408	0.0781	0.0716	0.0492	0.0880*	0.0791	0.0401	0.0739	0.0685	0.0423	0.0782	0.0723
	(0.0487)	(0.0500)	(0.0500)	(0.0491)	(0.0504)	(0.0504)	(0.0496)	(0.0507)	(0.0508)	(0.0493)	(0.0505)	(0.0506)
Cons(1)	−0.0626*	−0.0872**	−0.0839**	0.0535*	0.0795**	0.0773**	0.0141	−0.0133	−0.0098	0.0794**	0.0813**	0.0739**
	(0.0334)	(0.0382)	(0.0380)	(0.0289)	(0.0323)	(0.0322)	(0.0271)	(0.0309)	(0.0310)	(0.0313)	(0.0326)	(0.0333)
Cons(2)	0.0804**	0.0893**	0.0866**	0.0972**	0.1192***	0.1023**	0.1127**	0.0835	0.0754	0.1371**	0.1452**	0.1239*
	(0.0342)	(0.0357)	(0.0358)	(0.0404)	(0.0418)	(0.0429)	(0.0504)	(0.0510)	(0.0507)	(0.0632)	(0.0626)	(0.0635)
Bilateral trade	4.5059***	4.0280***	4.0082***	4.5100***	4.0962***	4.1250***	4.4641***	4.2359***	4.2026***	4.5562***	4.2440***	4.2241***
	(0.9009)	(1.1168)	(1.1347)	(0.8825)	(1.0857)	(1.1173)	(0.8946)	(1.1324)	(1.1451)	(0.9067)	(1.1445)	(1.1582)
Distance	−0.0481***	−0.0250*	−0.0242*	−0.0508***	−0.0296**	−0.0283**	−0.0487***	−0.0249*	−0.0242*	−0.0460***	−0.0220*	−0.0217*
	(0.0113)	(0.0128)	(0.0129)	(0.0113)	(0.0127)	(0.0129)	(0.0112)	(0.0129)	(0.0129)	(0.0113)	(0.0130)	(0.0131)
VIX		−0.0101***			−0.0128***			−0.0092***			−0.0092***	
		(0.0035)			(0.0035)			(0.0034)			(0.0034)	
US Term Spread			−0.0615***			−0.0702***			−0.0598***			−0.0571***
			(0.0173)			(0.0177)			(0.0173)			(0.0172)
Constant	0.5932***	0.6066***	0.5292***	0.5981***	0.6654***	0.5499***	0.5913***	0.5874***	0.5238***	0.5662***	0.5513***	0.4871***
	(0.0931)	(0.1266)	(0.1118)	(0.0914)	(0.1261)	(0.1115)	(0.0906)	(0.1274)	(0.1115)	(0.0919)	(0.1294)	(0.1139)
Observations	884	713	713	884	713	713	884	713	713	884	713	713
R-squared	0.1194	0.1128	0.1176	0.1165	0.1099	0.1139	0.1120	0.0977	0.1030	0.1147	0.1030	0.1072

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

empirical findings using a measure of business cycle synchronization based on the Baxter-King de-trending and growth de-trending, respectively.

Given that the focus of our paper is on the relationship between fiscal adjustments and business cycle synchronization, we pay particular attention to the dummy variables, *Cons(1)* and *Cons(2)*, which capture the implementation of unilateral and synchronized fiscal consolidations, respectively. Concerning unilateral fiscal consolidation episodes, overall the results do not point to a significant impact on business cycle synchronization. The effect can even be negative for short fiscal consolidation episodes, i.e., fiscal adjustments lasting 1 year. By contrast, when both countries implement fiscal consolidation measures (i.e., in the case of synchronized fiscal consolidations), the empirical findings suggest stronger business cycle synchronization. Indeed, the estimated coefficient for *Cons(2)* is statistically significant and large, especially for episodes lasting 2 or more years.

Turning to the effects of inflation targeting on business cycle synchronization, we find little support for weakly synchronized business cycles resulting from only one country adopting inflation targeting (*IT(1)*), but most estimates associated with the case in which both countries adopt inflation targeting (*IT(2)*) are statistically significant. Thus, the advent of inflation targeting has moved business cycles more closely across countries (Flood and Rose, 2010).

With regard to the exchange rate regime, the empirical findings clearly show that countries that fix exchange rates against each other (*Fix(2)*) have more synchronized business cycles. By contrast, when only one country (for each pair of countries considered) adopts a fixed exchange rate (*Fix(1)*), we do not find a significant effect on business cycle synchronization. This is consistent with the findings of Agnello and Sousa (2014), who show that countries with a less flexible exchange rate system are more insured against the uncertainty about the conduct of fiscal policy.

As for the effect of membership of a monetary union, the results are in accordance with the economic theory suggesting that a common monetary policy is associated with an increase in the degree of synchronization of business cycles. Interestingly, while both *MU(1)* and *MU(2)* are statistically significant when we use the Baxter-King de-trending technique, the coefficients associated with the latter are typically larger i.e., business cycle synchronization is stronger when both countries are members of a monetary union.

Finally, when looking at the other control variables, we find that bilateral trade makes business cycles significantly more synchronized, while an increase in the distance among countries reduces business cycle synchronization. Additionally, global monetary and financial conditions play an important role, but the effect is only statistically significant in the case of the growth de-trending framework: (i) a rise in global risk aversion and uncertainty leads to a decoupling of business cycles across countries; and (ii) a reversal of nonstandard expansionary monetary policies in the United States (by means of an increase in the term spread) can make business cycles around the world less synchronized.

All in all, these results have an important policy implication: synchronized fiscal consolidation measures coupled with the bilateral adoption of an inflation targeting regime can lead to stronger business cycle synchronization across countries. In fact, by allowing output to adjust to external shocks (thus smoothing price developments), domestic monetary authorities 'allow' output changes to be more correlated. And, if fiscal adjustments are also aligned, then the correlation of business cycles will be amplified. In contrast, unilateral fiscal adjustments and unilateral moves towards inflation targeting regimes can lead to some decoupling of growth.

A potential limitation of the previous estimates is the fact that only fiscal consolidation programmes with an *exact* duration in years are considered. For instance, within the 5-year window periods examined, the percentage of unilateral fiscal consolidation episodes that lasted exactly 1 and 3 years was 14.33 percent and 23.29 percent. respectively; for synchronized

fiscal consolidation episodes the corresponding percentages are 12.46 percent and 3.42 percent respectively. Therefore, we also take a more flexible approach considering fiscal consolidation programmes that last *at least* a specific number of years (i.e., 1 year, 2 years, 3 years and 4) over the 5-year window periods.

The results of this alternative procedure are summarized in Tables 5 and 6, again using both the Baxter-King and growth de-trending methods respectively to measure business cycle synchronization. Over the 5-year window periods considered, 78.55 percent (25.09 percent) of unilateral (synchronized) fiscal consolidation episodes lasted at least 1 year and 51.74 percent (6.05 percent) had a length of at least 3 years.

Fiscal consolidation programmes seem to have a positive effect on the synchronization of business cycles, especially when adopted by both countries. This impact is stronger when a low threshold is set for the minimum duration of the fiscal consolidation episode (say, at least 1 year or at least 2 years). Put differently, the higher the likelihood of a fiscal consolidation programme being implemented, the more synchronized the business cycles between two countries will be.

We also find: (i) some evidence of decoupling when an inflation targeting regime is adopted unilaterally even though the effect is not consistent across the two de-trending techniques; (ii) an increase in business cycle synchronization when both countries fix the exchange rates vis-à-vis each other; and (iii) a rise in the synchronization of business cycles when countries are members of a monetary union.

As before, there is a positive effect of bilateral trade on business cycle synchronization, but the log distance, the global uncertainty and the U.S. term spread are negatively associated with the sample correlation coefficient (Pearson's coefficient) between real output in country *i* and real output in *j* over 5-year non-overlapping windows.

IV.2 Fiscal stimulus programmes

We now examine the effects of fiscal stimulus programmes on business cycle synchronization. We consider unilateral adjustment episodes (*Stim(1)*) that last *exactly* 1 year, 2 years, 3 years and 4 years[2] and synchronized adjustment episodes (*Stim(2)*) that last *exactly* 1 year and 2 years (i.e., the maximum duration of such type of synchronized events) over the 5-year window period. In our sample, the percentage of unilateral fiscal stimuli episodes lasting exactly 1 or 3 year is 53.39 percent and 4.63 percent respectively. The likelihood of synchronized fiscal stimulus episodes is much lower: the percentage of those lasting exactly 1 year and 2 years was 9.74 percent and 0.35 percent respectively.

We estimate our baseline model (III) with and without global factors (i.e., the VIX index and the U.S. term spread); Tables 7 and 8 summarize the main results using the two measures of business cycle synchronization. As in the case of fiscal consolidation programmes, the empirical findings suggest that unilateral fiscal stimulus episodes (*Stim(1)*) of short duration have a weakly significant impact on business cycle synchronization and lead to some decoupling, but no statistically significant effect is uncovered for longer programmes. As for fiscal stimulus packages adopted by both countries, the results show that they increase significantly the synchronization of business cycles, especially in the case of programmes that last 1 year.

Moreover, we find that when one country adopts inflation targeting (*IT(1)*), there is somewhat a fall in business cycle synchronization in the case of the Baxter-King de-trending and a rise in the co-movement of business cycles for the growth de-trending technique. By contrast, when both countries do so (*IT(2)*), the results support the existence of a consistently positive and significant impact on business cycle synchronization. Further, it appears that while the adoption of a fixed exchange rate by a single country (*Fix(1)*) does not affect the synchronization of

[2]There is no record of fiscal stimuli programmes with a 5-year length.

TABLE 5

Fiscal consolidation and business cycle synchronization – Baxter-King de-trending (minimum duration)

	Minimum duration (in years) of fiscal consolidation episodes within 5-year window periods											
	At least 1 year			*At least 2 years*			*At least 3 years*			*At least 4 years*		
IT(1)	−0.0722**	−0.0652*	−0.0678*	−0.0680*	−0.0624	−0.0652*	−0.0658*	−0.0638	−0.0655*	−0.0633*	−0.0598	−0.0618
	(0.0359)	(0.0379)	(0.0383)	(0.0360)	(0.0381)	(0.0384)	(0.0371)	(0.0391)	(0.0394)	(0.0376)	(0.0392)	(0.0393)
IT(2)	0.1494*	0.1623**	0.1479*	0.1669**	0.1838**	0.1697**	0.1560**	0.1624**	0.1566**	0.1831**	0.1908**	0.1849**
	(0.0763)	(0.0783)	(0.0769)	(0.0762)	(0.0773)	(0.0763)	(0.0778)	(0.0801)	(0.0783)	(0.0778)	(0.0797)	(0.0782)
Fix(1)	0.0281	0.0597	0.0661	0.0259	0.0584	0.0645	0.0358	0.0567	0.0587	0.0385	0.0607	0.0630
	(0.0405)	(0.0458)	(0.0459)	(0.0403)	(0.0455)	(0.0456)	(0.0398)	(0.0455)	(0.0456)	(0.0399)	(0.0456)	(0.0457)
Fix(2)	0.2663***	0.2696***	0.2703***	0.2580***	0.2584***	0.2589***	0.2511***	0.2577***	0.2577***	0.2540***	0.2603***	0.2603***
	(0.0707)	(0.0728)	(0.0727)	(0.0706)	(0.0727)	(0.0725)	(0.0713)	(0.0733)	(0.0732)	(0.0714)	(0.0735)	(0.0735)
MU(1)	0.1775***	0.2564***	0.1948***	0.1993***	0.2800***	0.2215***	0.2164***	0.2514***	0.2312***	0.2120***	0.2509***	0.2287***
	(0.0467)	(0.0869)	(0.0586)	(0.0473)	(0.0877)	(0.0587)	(0.0484)	(0.0890)	(0.0595)	(0.0481)	(0.0894)	(0.0595)
MU(2)	0.2135***	0.2412***	0.2393***	0.2215***	0.2508***	0.2486***	0.2160***	0.2403***	0.2392***	0.2178***	0.2416***	0.2405***
	(0.0531)	(0.0557)	(0.0555)	(0.0533)	(0.0560)	(0.0558)	(0.0541)	(0.0565)	(0.0564)	(0.0541)	(0.0566)	(0.0565)
Cons(1)	0.0756*	0.1109*	0.1077*	0.0925**	0.1273***	0.1251***	0.0497	0.0565	0.0568	0.0671*	0.0724*	0.0736*
	(0.0450)	(0.0593)	(0.0597)	(0.0361)	(0.0429)	(0.0431)	(0.0335)	(0.0386)	(0.0388)	(0.0370)	(0.0402)	(0.0411)
Cons(2)	0.1046***	0.1138***	0.1133***	0.0744	0.0779	0.0775	0.0964	0.0945	0.0970	0.0027	0.0049	0.0066
	(0.0371)	(0.0399)	(0.0401)	(0.0469)	(0.0499)	(0.0504)	(0.0620)	(0.0650)	(0.0661)	(0.0901)	(0.0915)	(0.0925)
Bilateral trade	3.8448***	3.5549**	3.5180**	3.8941***	3.5743**	3.5430**	4.3131***	4.0439**	4.0179**	4.7218***	4.5006***	4.4779***
	(1.2933)	(1.6060)	(1.6027)	(1.3274)	(1.6464)	(1.6425)	(1.3330)	(1.6608)	(1.6643)	(1.3229)	(1.6537)	(1.6561)
Distance	−0.0607***	−0.0445**	−0.0449**	−0.0669***	−0.0521***	−0.0523***	−0.0616***	−0.0465**	−0.0466**	−0.0590***	−0.0444**	−0.0444**
	(0.0165)	(0.0195)	(0.0196)	(0.0167)	(0.0197)	(0.0198)	(0.0168)	(0.0199)	(0.0200)	(0.0169)	(0.0201)	(0.0201)
VIX		−0.0066			−0.0064			−0.0024			−0.0027	
		(0.0074)			(0.0075)			(0.0077)			(0.0077)	
US Term Spread			−0.0004			−0.0021			−0.0025			−0.0028
			(0.0343)			(0.0347)			(0.0359)			(0.0367)
Constant	0.5585***	0.5010**	0.3787**	0.6180***	0.5749***	0.4574***	0.6099***	0.5197**	0.4782***	0.5968***	0.5148**	0.4685***
	(0.1412)	(0.2126)	(0.1807)	(0.1389)	(0.2084)	(0.1720)	(0.1394)	(0.2152)	(0.1744)	(0.1407)	(0.2182)	(0.1775)
Observations	874	703	703	874	703	703	874	703	703	874	703	703
R-squared	0.1456	0.1545	0.1535	0.1433	0.1532	0.1523	0.1370	0.1416	0.1415	0.1353	0.1400	0.1398

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 6

Fiscal consolidation and business cycle synchronization – Growth de-trending (minimum duration)

	Minimum duration (in years) of fiscal consolidation episodes within 5-year window periods											
	At least 1 year			*At least 2 years*			*At least 3 years*			*At least 4 years*		
IT(1)	0.0605**	0.0652**	0.0531**	0.0636**	0.0682**	0.0575**	0.0664**	0.0687**	0.0599**	0.0634**	0.0649**	0.0570**
	(0.0253)	(0.0266)	(0.0268)	(0.0255)	(0.0267)	(0.0269)	(0.0263)	(0.0276)	(0.0276)	(0.0259)	(0.0270)	(0.0271)
IT(2)	0.0722*	0.0968**	0.0762*	0.0904**	0.1157***	0.0962**	0.0856*	0.1055**	0.0933**	0.1094**	0.1275***	0.1121**
	(0.0432)	(0.0416)	(0.0423)	(0.0440)	(0.0426)	(0.0433)	(0.0449)	(0.0444)	(0.0447)	(0.0445)	(0.0441)	(0.0442)
Fix(1)	0.0072	0.0258	0.0336	0.0033	0.0262	0.0335	0.0141	0.0241	0.0297	0.0156	0.0258	0.0316
	(0.0277)	(0.0313)	(0.0308)	(0.0277)	(0.0308)	(0.0305)	(0.0275)	(0.0311)	(0.0308)	(0.0273)	(0.0310)	(0.0307)
Fix(2)	0.1582***	0.1757***	0.1683***	0.1514***	0.1656***	0.1597***	0.1426***	0.1637***	0.1583***	0.1462***	0.1665***	0.1607***
	(0.0492)	(0.0505)	(0.0487)	(0.0492)	(0.0504)	(0.0485)	(0.0503)	(0.0514)	(0.0494)	(0.0502)	(0.0513)	(0.0496)
MU(1)	0.0146	0.1255***	0.0659*	0.0324	0.1342***	0.0811**	0.0487	0.1190***	0.0854**	0.0504	0.1260***	0.0891**
	(0.0340)	(0.0434)	(0.0378)	(0.0345)	(0.0448)	(0.0385)	(0.0354)	(0.0450)	(0.0391)	(0.0348)	(0.0440)	(0.0385)
MU(2)	0.0269	0.0677	0.0617	0.0348	0.0763	0.0699	0.0325	0.0706	0.0665	0.0307	0.0674	0.0636
	(0.0476)	(0.0485)	(0.0486)	(0.0491)	(0.0503)	(0.0503)	(0.0497)	(0.0509)	(0.0509)	(0.0493)	(0.0504)	(0.0505)
Cons(1)	0.0874***	0.1012**	0.0838**	0.1091***	0.1255***	0.1155***	0.0727***	0.0651**	0.0565**	0.0923***	0.0952***	0.0836***
	(0.0315)	(0.0406)	(0.0403)	(0.0258)	(0.0300)	(0.0300)	(0.0239)	(0.0271)	(0.0275)	(0.0256)	(0.0268)	(0.0278)
Cons(2)	0.0978***	0.1106***	0.1018***	0.0681**	0.0679**	0.0575*	0.0592	0.0489	0.0385	−0.0199	−0.0201	−0.0304
	(0.0262)	(0.0273)	(0.0276)	(0.0312)	(0.0322)	(0.0326)	(0.0415)	(0.0416)	(0.0417)	(0.0571)	(0.0570)	(0.0572)
Bilateral trade	3.6406***	3.2431***	3.3676***	3.5738***	3.2354***	3.3620***	3.9669***	3.7665***	3.8346***	4.4126***	4.1041***	4.1312***
	(0.8856)	(1.0941)	(1.1107)	(0.9043)	(1.1182)	(1.1296)	(0.9267)	(1.1557)	(1.1634)	(0.9181)	(1.1559)	(1.1563)
Distance	−0.0486***	−0.0234*	−0.0230*	−0.0555***	−0.0306**	−0.0295**	−0.0503***	−0.0253**	−0.0246*	−0.0468***	−0.0228*	−0.0226*
	(0.0110)	(0.0125)	(0.0126)	(0.0110)	(0.0124)	(0.0126)	(0.0112)	(0.0128)	(0.0129)	(0.0113)	(0.0129)	(0.0130)
VIX		−0.0118***			−0.0104***			−0.0079**			−0.0080**	
		(0.0034)			(0.0035)			(0.0035)			(0.0034)	
US Term Spread			−0.0532***			−0.0489***			−0.0495***			−0.0470***
			(0.0171)			(0.0175)			(0.0182)			(0.0178)
Constant	0.5243***	0.5240***	0.4143***	0.5881***	0.5650***	0.4601***	0.5813***	0.5356***	0.4801***	0.5656***	0.5228***	0.4632***
	(0.0931)	(0.1304)	(0.1194)	(0.0900)	(0.1258)	(0.1119)	(0.0905)	(0.1299)	(0.1130)	(0.0916)	(0.1284)	(0.1135)
Observations	884	713	713	884	713	713	884	713	713	884	713	713
R-squared	0.1367	0.1311	0.1295	0.1364	0.1292	0.1284	0.1212	0.1053	0.1080	0.1204	0.1097	0.1115

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 7

Fiscal stimuli and business cycle synchronization – Baxter-King de-trending

	Duration (in years) of fiscal stimuli episodes within 5-year window periods											
	1 year			*2 years*			*3 years*			*4 years*		
IT(1)	−0.0593*	−0.0668*	−0.0719*	−0.0359	−0.0317	−0.0384	−0.0422	−0.0413	−0.0475	−0.0432	−0.0425	−0.0495
	(0.0359)	(0.0385)	(0.0389)	(0.0354)	(0.0378)	(0.0384)	(0.0357)	(0.0380)	(0.0385)	(0.0355)	(0.0377)	(0.0383)
IT(2)	0.1703**	0.1788**	0.1668**	0.1745**	0.1885**	0.1756**	0.1816**	0.1925**	0.1831**	0.1817**	0.1936**	0.1843**
	(0.0755)	(0.0764)	(0.0747)	(0.0753)	(0.0762)	(0.0747)	(0.0776)	(0.0789)	(0.0775)	(0.0776)	(0.0790)	(0.0775)
Fix(1)	0.0563	0.0697	0.0740	0.0433	0.0702	0.0744	0.0489	0.0645	0.0678	0.0509	0.0639	0.0665
	(0.0398)	(0.0457)	(0.0458)	(0.0399)	(0.0456)	(0.0458)	(0.0400)	(0.0458)	(0.0460)	(0.0400)	(0.0458)	(0.0460)
Fix(2)	0.2564***	0.2636***	0.2607***	0.2744***	0.2862***	0.2834***	0.2527***	0.2579***	0.2541***	0.2554***	0.2592***	0.2561***
	(0.0696)	(0.0711)	(0.0707)	(0.0682)	(0.0697)	(0.0689)	(0.0711)	(0.0732)	(0.0726)	(0.0709)	(0.0730)	(0.0723)
MU(1)	0.1868***	0.2439***	0.2065***	0.1801***	0.2477***	0.2109***	0.2020***	0.2561***	0.2348***	0.2019***	0.2551***	0.2355***
	(0.0468)	(0.0860)	(0.0579)	(0.0468)	(0.0863)	(0.0583)	(0.0478)	(0.0890)	(0.0602)	(0.0477)	(0.0890)	(0.0594)
MU(2)	0.2125***	0.2242***	0.2221***	0.2058***	0.2270***	0.2240***	0.2279***	0.2486***	0.2458***	0.2288***	0.2477***	0.2445***
	(0.0545)	(0.0573)	(0.0572)	(0.0534)	(0.0558)	(0.0556)	(0.0543)	(0.0569)	(0.0568)	(0.0543)	(0.0569)	(0.0567)
Stim(1)	0.0295	0.0614	0.0552	−0.1461***	−0.2074***	−0.2040***	0.0579	0.0080	0.0292	0.1993	0.3360	0.3660
	(0.0327)	(0.0376)	(0.0374)	(0.0426)	(0.0483)	(0.0482)	(0.0802)	(0.1052)	(0.1067)	(0.1229)	(0.2217)	(0.2262)
Stim(2)	0.1366**	0.1658***	0.1677***	0.3356	0.3311	0.3579	–	–	–	–	–	–
	(0.0538)	(0.0591)	(0.0591)	(0.3468)	(0.3409)	(0.3407)	–	–	–	–	–	–
Bilateral trade	5.1638***	5.0482***	5.0062***	4.5139***	4.5594***	4.5442***	5.0209***	4.7714***	4.7781***	5.0163***	4.7970***	4.7947***
	(1.3046)	(1.6120)	(1.6151)	(1.2997)	(1.6083)	(1.6120)	(1.3040)	(1.6166)	(1.6225)	(1.3050)	(1.6174)	(1.6249)
Distance	−0.0519***	−0.0370*	−0.0370*	−0.0673***	−0.0496**	−0.0493**	−0.0588***	−0.0458**	−0.0453**	−0.0582***	−0.0462**	−0.0459**
	(0.0171)	(0.0202)	(0.0202)	(0.0168)	(0.0198)	(0.0199)	(0.0170)	(0.0201)	(0.0202)	(0.0170)	(0.0201)	(0.0202)
VIX		−0.0061			−0.0064			−0.0051			−0.0049	
		(0.0073)			(0.0073)			(0.0075)			(0.0075)	
US Term Spread			−0.0214			−0.0254			−0.0282			−0.0288
			(0.0336)			(0.0336)			(0.0348)			(0.0344)
Constant	0.5282***	0.5088**	0.4354**	0.7033***	0.6813***	0.6059***	0.6001***	0.5889***	0.5420***	0.5959***	0.5877***	0.5488***
	(0.1443)	(0.2113)	(0.1759)	(0.1405)	(0.2069)	(0.1718)	(0.1412)	(0.2118)	(0.1723)	(0.1411)	(0.2109)	(0.1722)
Observations	874	703	703	874	703	703	874	703	703	874	703	703
R-squared	0.1395	0.1490	0.1486	0.1471	0.1628	0.1626	0.1327	0.1359	0.1361	0.1338	0.1371	0.1375

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 8

Fiscal stimuli and business cycle synchronization – Growth de-trending

	Duration (in years) of fiscal stimuli episodes within 5-year window periods											
	1 year			*2 years*			*3 years*			*4 years*		
IT(1)	0.0813***	0.0725***	0.0604**	0.0910***	0.0922***	0.0776***	0.0887***	0.0863***	0.0732***	0.0879***	0.0866***	0.0722***
	(0.0260)	(0.0274)	(0.0273)	(0.0260)	(0.0276)	(0.0276)	(0.0260)	(0.0273)	(0.0274)	(0.0259)	(0.0273)	(0.0274)
IT(2)	0.1002**	0.1168***	0.0991**	0.1040**	0.1236***	0.1053**	0.1049**	0.1250***	0.1082**	0.1039**	0.1249***	0.1072**
	(0.0445)	(0.0424)	(0.0428)	(0.0454)	(0.0436)	(0.0438)	(0.0454)	(0.0440)	(0.0442)	(0.0454)	(0.0440)	(0.0442)
Fix(1)	0.0315	0.0345	0.0399	0.0252	0.0317	0.0362	0.0280	0.0316	0.0371	0.0266	0.0317	0.0366
	(0.0273)	(0.0311)	(0.0306)	(0.0274)	(0.0313)	(0.0307)	(0.0274)	(0.0312)	(0.0308)	(0.0274)	(0.0313)	(0.0308)
Fix(2)	0.1483***	0.1698***	0.1615***	0.1512***	0.1744***	0.1670***	0.1467***	0.1653***	0.1569***	0.1470***	0.1651***	0.1584***
	(0.0499)	(0.0512)	(0.0489)	(0.0501)	(0.0515)	(0.0489)	(0.0503)	(0.0515)	(0.0492)	(0.0502)	(0.0514)	(0.0490)
MU(1)	0.0275	0.1076**	0.0680*	0.0324	0.1158***	0.0804**	0.0343	0.1166***	0.0841**	0.0323	0.1167***	0.0810**
	(0.0350)	(0.0441)	(0.0391)	(0.0349)	(0.0441)	(0.0387)	(0.0351)	(0.0446)	(0.0391)	(0.0350)	(0.0445)	(0.0391)
MU(2)	0.0388	0.0648	0.0608	0.0427	0.0711	0.0656	0.0442	0.0775	0.0721	0.0431	0.0777	0.0714
	(0.0502)	(0.0518)	(0.0517)	(0.0498)	(0.0510)	(0.0511)	(0.0495)	(0.0507)	(0.0508)	(0.0495)	(0.0507)	(0.0508)
Stim(1)	0.0128	0.0459*	0.0326	−0.0085	−0.0543	−0.0488	0.0218	−0.0054	0.0404	−0.0590	−0.0359	0.0275
	(0.0229)	(0.0256)	(0.0254)	(0.0307)	(0.0347)	(0.0347)	(0.0606)	(0.0844)	(0.0853)	(0.1075)	(0.1803)	(0.1872)
Stim(2)	0.0600	0.0729	0.0761*	0.3500	0.3337	0.3940	–	–	–	–	–	–
	(0.0409)	(0.0457)	(0.0462)	(0.2805)	(0.2719)	(0.2709)	–	–	–	–	–	–
Bilateral trade	4.8233***	4.5517***	4.4809***	4.7287***	4.3430***	4.3046***	4.7592***	4.3723***	4.3582***	4.7319***	4.3727***	4.3382***
	(0.8870)	(1.0926)	(1.1166)	(0.9024)	(1.1254)	(1.1439)	(0.8968)	(1.1222)	(1.1372)	(0.8982)	(1.1235)	(1.1402)
Distance	−0.0440***	−0.0204	−0.0199	−0.0481***	−0.0262**	−0.0253*	−0.0470***	−0.0246*	−0.0235*	−0.0476***	−0.0245*	−0.0238*
	(0.0115)	(0.0129)	(0.0130)	(0.0114)	(0.0130)	(0.0131)	(0.0113)	(0.0129)	(0.0130)	(0.0113)	(0.0129)	(0.0130)
VIX		−0.0100***			−0.0099***			−0.0096***			−0.0096***	
		(0.0033)			(0.0034)			(0.0034)			(0.0034)	
US Term Spread			−0.0600***			−0.0667***			−0.0644***			−0.0625***
			(0.0170)			(0.0172)			(0.0173)			(0.0174)
Constant	0.5467***	0.5440***	0.4718***	0.5891***	0.6169***	0.5502***	0.5782***	0.5911***	0.5226***	0.5863***	0.5900***	0.5245***
	(0.0937)	(0.1275)	(0.1130)	(0.0934)	(0.1283)	(0.1138)	(0.0916)	(0.1273)	(0.1120)	(0.0916)	(0.1281)	(0.1119)
Observations	884	713	713	884	713	713	884	713	713	884	713	713
R-squared	0.1115	0.1033	0.1075	0.1131	0.1038	0.1110	0.1087	0.0950	0.1015	0.1089	0.0950	0.1010

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 9

Fiscal stimuli and business cycle synchronization – Baxter-King de-trending (minimum duration)

	Minimum duration (in years) of fiscal stimuli episodes within 5-year window periods											
	At least 1 year			*At least 2 years*			*At least 3 years*			*At least 4 years*		
IT(1)	−0.0447	−0.0387	−0.0458	−0.0403	−0.0353	−0.0407	−0.0411	−0.0409	−0.0474	−0.0432	−0.0425	−0.0495
	(0.0355)	(0.0380)	(0.0387)	(0.0355)	(0.0380)	(0.0386)	(0.0356)	(0.0379)	(0.0384)	(0.0355)	(0.0377)	(0.0383)
IT(2)	0.1755**	0.1865**	0.1778**	0.1729**	0.1872**	0.1707**	0.1830**	0.1927**	0.1840**	0.1817**	0.1936**	0.1843**
	(0.0753)	(0.0769)	(0.0746)	(0.0760)	(0.0763)	(0.0752)	(0.0776)	(0.0790)	(0.0774)	(0.0776)	(0.0790)	(0.0775)
Fix(1)	0.0495	0.0694	0.0716	0.0393	0.0647	0.0712	0.0510	0.0650	0.0679	0.0509	0.0639	0.0665
	(0.0397)	(0.0454)	(0.0455)	(0.0399)	(0.0457)	(0.0458)	(0.0400)	(0.0458)	(0.0460)	(0.0400)	(0.0458)	(0.0460)
Fix(2)	0.2567***	0.2615***	0.2579***	0.2720***	0.2892***	0.2874***	0.2524***	0.2573***	0.2533***	0.2554***	0.2592***	0.2561***
	(0.0699)	(0.0719)	(0.0712)	(0.0687)	(0.0697)	(0.0693)	(0.0711)	(0.0731)	(0.0725)	(0.0709)	(0.0730)	(0.0723)
MU(1)	0.1856***	0.2354***	0.2208***	0.1787***	0.2548***	0.1940***	0.2049***	0.2551***	0.2381***	0.2019***	0.2551***	0.2355***
	(0.0467)	(0.0869)	(0.0579)	(0.0472)	(0.0866)	(0.0589)	(0.0478)	(0.0890)	(0.0602)	(0.0477)	(0.0890)	(0.0594)
MU(2)	0.2176***	0.2380***	0.2347***	0.2085***	0.2275***	0.2252***	0.2296***	0.2488***	0.2459***	0.2288***	0.2477***	0.2445***
	(0.0541)	(0.0571)	(0.0569)	(0.0538)	(0.0559)	(0.0557)	(0.0544)	(0.0569)	(0.0568)	(0.0543)	(0.0569)	(0.0567)
Stim(1)	−0.0682*	−0.0972**	−0.0978**	−0.1030***	−0.1846***	−0.1774***	0.0878	0.0302	0.0529	0.1993	0.3360	0.3660
	(0.0373)	(0.0411)	(0.0412)	(0.0394)	(0.0459)	(0.0462)	(0.0707)	(0.1009)	(0.1026)	(0.1229)	(0.2217)	(0.2262)
Stim(2)	0.1664***	0.2087***	0.2118***	0.4037	0.4553	0.4715	–	–	–	–	–	–
	(0.0542)	(0.0593)	(0.0593)	(0.3356)	(0.3246)	(0.3246)	–	–	–	–	–	–
Bilateral trade	4.6363***	4.3698***	4.3678***	4.5614***	4.4615***	4.4313***	5.0594***	4.7875***	4.8014***	5.0163***	4.7970***	4.7947***
	(1.3493)	(1.6794)	(1.6890)	(1.3110)	(1.6247)	(1.6209)	(1.3022)	(1.6147)	(1.6221)	(1.3050)	(1.6174)	(1.6249)
Distance	−0.0566***	−0.0432**	−0.0426**	−0.0671***	−0.0503**	−0.0504**	−0.0579***	−0.0457**	−0.0451**	−0.0582***	−0.0462**	−0.0459**
	(0.0173)	(0.0201)	(0.0202)	(0.0169)	(0.0197)	(0.0198)	(0.0170)	(0.0201)	(0.0202)	(0.0170)	(0.0201)	(0.0202)
VIX		−0.0045			−0.0079			−0.0048			−0.0049	
		(0.0073)			(0.0073)			(0.0075)			(0.0075)	
US Term Spread			−0.0311			−0.0137			−0.0302			−0.0288
			(0.0336)			(0.0339)			(0.0349)			(0.0344)
Constant	0.6269***	0.6115***	0.5829***	0.7021***	0.7261***	0.5980***	0.5886***	0.5818***	0.5431***	0.5959***	0.5877***	0.5488***
	(0.1505)	(0.2157)	(0.1770)	(0.1420)	(0.2070)	(0.1712)	(0.1418)	(0.2118)	(0.1724)	(0.1411)	(0.2109)	(0.1722)
Observations	874	703	703	874	703	703	874	703	703	874	703	703
R-squared	0.1434	0.1544	0.1550	0.1416	0.1600	0.1588	0.1338	0.1360	0.1365	0.1338	0.1371	0.1375

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 10

Fiscal stimuli and business cycle synchronization – Growth de-trending (minimum duration)

	Minimum duration (in years) of fiscal stimuli episodes within 5-year window periods											
	At least 1 year			*At least 2 years*			*At least 3 years*			*At least 4 years*		
IT(1)	0.0813***	0.0782***	0.0641**	0.0908***	0.0914***	0.0767***	0.0883***	0.0863***	0.0731***	0.0879***	0.0866***	0.0722***
	(0.0263)	(0.0281)	(0.0280)	(0.0259)	(0.0275)	(0.0275)	(0.0260)	(0.0273)	(0.0274)	(0.0259)	(0.0273)	(0.0274)
IT(2)	0.1009**	0.1200***	0.1027**	0.1034**	0.1226***	0.1042**	0.1045**	0.1249***	0.1084**	0.1039**	0.1249***	0.1072**
	(0.0443)	(0.0427)	(0.0427)	(0.0454)	(0.0436)	(0.0439)	(0.0454)	(0.0440)	(0.0442)	(0.0454)	(0.0440)	(0.0442)
Fix(1)	0.0321	0.0343	0.0391	0.0246	0.0305	0.0354	0.0278	0.0315	0.0370	0.0266	0.0317	0.0366
	(0.0273)	(0.0311)	(0.0306)	(0.0274)	(0.0313)	(0.0307)	(0.0275)	(0.0312)	(0.0308)	(0.0274)	(0.0313)	(0.0308)
Fix(2)	0.1473***	0.1651***	0.1583***	0.1518***	0.1768***	0.1677***	0.1472***	0.1654***	0.1571***	0.1470***	0.1651***	0.1584***
	(0.0497)	(0.0508)	(0.0485)	(0.0502)	(0.0515)	(0.0489)	(0.0502)	(0.0514)	(0.0491)	(0.0502)	(0.0514)	(0.0490)
MU(1)	0.0287	0.1067**	0.0734*	0.0313	0.1155***	0.0773**	0.0336	0.1166***	0.0844**	0.0323	0.1167***	0.0810**
	(0.0350)	(0.0440)	(0.0393)	(0.0350)	(0.0441)	(0.0384)	(0.0351)	(0.0446)	(0.0391)	(0.0350)	(0.0445)	(0.0391)
MU(2)	0.0409	0.0720	0.0658	0.0418	0.0701	0.0660	0.0439	0.0775	0.0720	0.0431	0.0777	0.0714
	(0.0502)	(0.0515)	(0.0517)	(0.0498)	(0.0509)	(0.0510)	(0.0495)	(0.0507)	(0.0508)	(0.0495)	(0.0507)	(0.0508)
Stim(1)	0.0069	0.0037	0.0019	−0.0113	−0.0582*	−0.0421	0.0064	−0.0075	0.0400	−0.0590	−0.0359	0.0275
	(0.0260)	(0.0280)	(0.0281)	(0.0278)	(0.0327)	(0.0325)	(0.0541)	(0.0801)	(0.0810)	(0.1075)	(0.1803)	(0.1872)
Stim(2)	0.0748*	0.0937**	0.0989**	0.3578	0.3735	0.4213	–	–	–	–	–	–
	(0.0417)	(0.0463)	(0.0468)	(0.2814)	(0.2697)	(0.2691)	–	–	–	–	–	–
Bilateral trade	4.8473***	4.4436***	4.3913***	4.7096***	4.2924***	4.2848***	4.7491***	4.3700***	4.3613***	4.7319***	4.3727***	4.3382***
	(0.8835)	(1.1098)	(1.1312)	(0.9016)	(1.1285)	(1.1435)	(0.8967)	(1.1225)	(1.1374)	(0.8982)	(1.1235)	(1.1402)
Distance	−0.0429***	−0.0208	−0.0199	−0.0485***	−0.0266**	−0.0255*	−0.0471***	−0.0246*	−0.0235*	−0.0476***	−0.0245*	−0.0238*
	(0.0116)	(0.0130)	(0.0130)	(0.0114)	(0.0129)	(0.0130)	(0.0113)	(0.0129)	(0.0130)	(0.0113)	(0.0129)	(0.0130)
VIX		−0.0092***			−0.0103***			−0.0096***			−0.0096***	
		(0.0033)			(0.0033)			(0.0034)			(0.0034)	
US Term Spread			−0.0629***			−0.0646***			−0.0645***			−0.0625***
			(0.0171)			(0.0169)			(0.0173)			(0.0174)
Constant	0.5367***	0.5460***	0.4875***	0.5938***	0.6325***	0.5491***	0.5805***	0.5916***	0.5232***	0.5863***	0.5900***	0.5245***
	(0.0979)	(0.1287)	(0.1158)	(0.0936)	(0.1273)	(0.1129)	(0.0917)	(0.1273)	(0.1121)	(0.0916)	(0.1281)	(0.1119)
Observations	884	713	713	884	713	713	884	713	713	884	713	713
R-squared	0.1129	0.1018	0.1085	0.1132	0.1048	0.1105	0.1086	0.0950	0.1015	0.1089	0.0950	0.1010

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

business cycles, they become more synchronized when both countries fix their exchange rates (*Fix(2)*).

Regarding the effects of membership of a monetary union, both *MU(1)* and *MU(2)* are found to be statistically significant and positively related with business cycle synchronization in the Baxter-King de-trending framework, with the effects being particularly large when both countries are members.

The results also confirm the role played by bilateral trade in increasing the correlation of the cyclical component of economic activity across countries, and geographical distance which appears to reduce it. In this context, Agnello and Sousa (2013b) also show that higher public deficit volatility is magnified in countries with a high degree of openness. In the case of global factors, they enter the regressions with a negative coefficient, but the effects are only significant in the case of the growth de-trending technique.

Summing up, fiscal stimuli and inflation targeting regimes adopted unilaterally can cause some lack of synchronization of business cycles across countries. However, expansionary fiscal policies and moves towards a conduct of monetary based on the goal of achieving a target inflation, when implemented bilaterally, can induce stronger co-movement of the cyclical component of real GDP. The rationale for this finding relies on the increase of the correlation of output variations across countries when discretionary fiscal policies are synchronized (thus, their impact on output) and monetary policy sets a target for inflation (therefore, allowing output to adjust to shocks).

Finally, we assess the effect of fiscal stimulus programmes on business cycle synchronization using a more flexible approach that considers adjustment programmes with a minimum duration of 1 year and 2 years: 77.03 percent (10.09 percent) of unilateral (synchronized) fiscal stimulus episodes lasted at least 1 year and 26.51 percent (0.35 percent) had a length of at least 2 years over the 5-year window periods under consideration.

Tables 9 and 10 report the main findings based on the two measures of synchronization. As before, the impact of fiscal stimuli episodes on business cycle synchronization is statistically significant and positive only when both countries implement such type of adjustments (*Cons(2)*) and, especially for fiscal stimulus programmes lasting at least 1 years. As for fiscal unilateral fiscal stimuli programmes, we find some evidence of business cycle decoupling.

In addition, the results suggest that: (i) inflation targeting significantly affects the synchronization of business cycles; (ii) a significant and positive impact of the exchange rate regime on business cycle synchronization occurs when both countries fix their exchange rates; (iii) entry into a monetary union also leads to an increase in the synchronization of business cycles; (iv) bilateral trade increases the correlation of the cyclical component of economic activity across countries; and (v) longer distance across countries, as well as higher global uncertainty and tighter monetary conditions in the United States, are associated with lower business cycle synchronization.

V. CONCLUSIONS

In this paper, we analyse the empirical relationship between fiscal adjustments and business cycle synchronization. Using quarterly data for a panel of industrialized countries, we find that fiscal adjustments that are unilaterally implemented can lead to some business cycle decoupling. By contrast, fiscal consolidation (stimulus) measures that are adopted by countries at the same time (i.e., synchronized fiscal consolidation/stimulus programmes) lead to a closer co-movement of business cycles. We estimate that episodes of synchronized fiscal consolidation (stimulus) increase the correlation coefficient of the business cycle across countries by between 0.06 and 0.15 (0.08 and 0.21).

Our empirical findings also suggest that the adoption of an inflation targeting regime has increased business cycle synchronization. Similarly, fixing the exchange rate or membership of a monetary union leads to bigger co-movement of business cycles.

Finally, we show that while bilateral trade has a positive effect on business cycle synchronization, the distance between countries, global risk aversion and uncertainty and a reversal from nonstandard expansionary monetary policy conditions can cause a significant fall in the co-movement of the cyclical component of economic activity between countries.

From a policy perspective, our work shows that synchronous fiscal adjustment measures can result in more business cycle synchronization. Thus, if the domestic sovereignty on the monetary front is complemented with an inflation targeting regime and simultaneous consolidations of the fiscal stance, countries will achieve more co-movement of their business cycles. More specifically, when the main goal of the monetary authority is to guarantee medium to long-term price stability, foreign output shocks lead to end up leading to changes in domestic output, thus stronger business cycle synchronization, as central banks stabilize prices. If, in addition, fiscal authorities respond to foreign output shocks by adopting synchronous adjustments of their fiscal stance, the positive effect on business cycle synchronization will be amplified.

The present paper also opens new avenues for further research. In particular, it would be interesting to exploit the effects of crisis episodes on business cycle synchronization. More specifically, an assessment of the likely impact of systemic crises and non-systemic crises on the co-movement of business cycles across countries can provide insightful implications for the conduct of monetary and fiscal policies in the context of global financial turmoils. Additionally, a promising direction to investigate consists on analysing the monetary spillovers between advanced economies and emerging markets, especially in the context of a normalisation of policy conditions after a prolonged period of historically low interest rates. We plan to pursue these lines of research in the future.

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