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FINANCIAL INTEGRATION AND BUSINESS CYCLE SYNCHRONIZATION

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ABSTRACT

Standard theory predicts that financial integration leads to a lower degree of business cycle synchronization. Surprisingly, cross-country studies find the opposite. Our contribution is to document the theoretically predicted negative effect of financial integration on business cycle synchronization as a robust regularity. We use a confidential dataset on banks' international bilateral exposure over the past three decades in a panel of twenty developed countries. The rich panel structure allows us to control for time-invariant country-pair factors and global trends that affect both financial integration and business cycle patterns. In contrast to previous empirical work we find that a higher degree of financial integration is associated with less synchronized output cycles. We also employ two distinct instrumental variable approaches to identify the one-way effect of integration on synchronization. These specifications reveal that the component of banking integration predicted by legislative-regulatory harmonization policies and the nature of the bilateral exchange rate regime has a negative effect on output synchronization.

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1 Introduction

Standard theoretical models predict that financial integration should lead to a lower degree of business cycle synchronization. In the canonical two-country general equilibrium model with complete financial markets, the country hit by a positive productivity shock experiences an increase in the marginal product of capital and labor, and receives capital on net—a mechanism that leads to negative output correlations between the two countries (e.g. Backus, Kehoe, and Kydland (1992) and Baxter and Crucini (1995)). Obstfeld (1994) formalizes another mechanism that also implies a positive link between financial integration and business cycle patterns. In his model financial integration shifts investment towards risky projects, enabling countries to specialize according to their comparative advantage, which implies that output growth among integrated countries should be negatively correlated.[1] There might also be the case, where causality runs the other way since diversification benefits become larger with less correlated shocks across countries. Heathcote and Perri (2004) develop a model, where less correlated cycles can lead to an increase in the equilibrium level of financial integration. In their set-up, a higher level of financial integration further reduces the correlation of the business cycles.

Yet, surprisingly, the empirical literature fails to find the theoretically predicted negative association between financial integration and business cycle synchronization in the data. If anything, cross-country studies find a significant positive correlation between financial integration and GDP co-movement.[2] The cross-state analysis of Morgan, Strahan, and Rime (2004) in the United States also reveals a positive association between banking integration and state cycles. While researchers tend to reconcile this positive association between synchronization and integration with various market imperfections such as information frictions, contagion, liquidity constraints and moral hazard (e.g. Calvo and Mendoza (2001); Morgan, Rime, and Strahan (2004)), it is not entirely clear why different cross-country studies all find exactly the opposite prediction of the standard models.

[1] Kalemli-Ozcan, Sorensen, and Yosha (2003) using regional and country level data show that financial integration causes higher industrial specialization. Imbs (2004) and Kalemli-Ozcan, Sorensen, and Yosha (2001) further show that higher industrial specialization in turn leads to less synchronized cycles.

[2] Imbs (2004, 2006) uses bilateral data on financial holdings constructed by the IMF on a large cross-section of countries and shows a significant positive correlation between bilateral financial linkages and output synchronization. Similarly Otto, Voss and Willard (2001) show that OECD countries with strong FDI linkages have more similar cycles. Using cross-country data over the period 1960–1999, Kose, Prasad, and Terrones (2004) document that financially open countries without capital account restrictions have more synchronized business cycles with world output. Davis (2008) also finds a positive correlation between integration and business cycle co-movement in a larger sample of countries. The only study to our knowledge that documents a negative association between financial integration and synchronization is Garcia-Herrero and Ruiz (2008). These authors use capital account data for Spain and document a lower GDP synchronization of Spain with countries that Spain has strong financial linkages.

In this paper we show that the positive association between financial integration and business cycle synchronization found in the cross-country studies is mainly due to not accounting for the effects of country-pair factors and global shocks. These variables are—to a large extent—latent and can drive both integration and synchronization between pair of countries, leading to a positive correlation between the two. To be able to control for these factors, one needs to use data on time-varying cross-border financial holdings between pairs of countries. Previous work has relied either on cross-sectional bilateral flows from the IMF surveys or from the OECD on cross-border investment, which was available at most for a few years, and ends up being pooled in most of the studies. In this paper, we examine the link between financial integration and business cycle synchronization utilizing confidential data from the Bank of International Settlements' (BIS) Locational Banking Statistics Database. This database reports bilateral cross-country bank assets and liabilities (stocks and flows) over the past three decades for a group of twenty developed countries.

Our data set gives us three main advantages over the previous work and helps us to draw inference with stronger identification. First, the rich panel structure allows us to control both for unobservable and hard-to-account-for time-invariant country-pair factors, such as distance, sociopolitical ties and cultural norms. Recent research shows that informational frictions, cultural linkages and bilateral trust—to the extent that they can be measured—have strong effects on financial integration (e.g. Portes and Rey (2005); Guiso, Sapienza, and Zingales (2009); Ekinci, Kalemli-Ozcan and Sørensen (2008); Giannetti and Yafeh (2008); Mian (2006), and Lane and Milesi-Ferretti (2004)). In addition by shaping preferences, trust and cultural norms directly affect business cycle patterns (e.g. Stockman and Tesar (1995)).

Second, the considerable time dimension of the data allows us to control for global shocks over an extended period. Over the past decades cross-border financial integration has increased significantly (e.g. Lane and Milesi-Ferretti (2007)). At the same time business cycles in industrial countries have become more alike (e.g. Kose *et al.* (2008); Otto, Voss, and Willard (2001); Rose (2009)).[3] (Figures 1 and 2 document these two phenomena in our data.) A mechanical interpretation based on the cross-country correlations is then that financial integration has contributed to the increased correlation of countries' output cycles. Yet, financial globalization goes hand-in-hand with trade integration, where the latter can lead to increased synchronization of business cycles.[4] In addition,

[3]In contrast to these recent studies, Heatcote and Perri (2003) document a decline in the U.S.-rest of the world output correlations after 1986, where "rest of the world" is defined as Europe, Japan, and Canada.

[4]The relationship between integration and business cycle synchronization dates back to the study of Mundell (1961) on the desirability of the optimal currency area. The main argument is that countries will be more willing to give up their autonomous monetary policy if their business cycles are more correlated with each other. Frankel and

monetary policy has increasingly been coordinated at a global level which can also affect both integration and synchronization. For example, Rose (2009) shows that inflation targeting countries tend to have a higher degree of business cycle synchronization, while Rose and Engel (2002) present cross-sectional evidence of a higher degree of synchronization among countries that share a common currency.

Third, by focusing on a homogeneous group of twenty developed countries we substantially reduce concerns of parameter heterogeneity. Due to limited degrees of freedom, cross-sectional studies pool developed, emerging market and under-developed countries into the estimation. However, theory and evidence so far suggest that the effect of integration on business cycle patterns can be quite different across the developed and the developing world (e.g. Kraay and Ventura (2000, 2007); Calderon *et al.* (2007); Kose *et al.* (2008); Rose (2009)).

We start our analysis by showing that in the cross-section a higher degree of financial integration is associated with more synchronized output cycles. This result matches the previous findings (e.g. Imbs (2004, 2006)). Yet, once we control for country-pair time-invariant characteristics by including country-pair fixed effects and global shocks by including time fixed effects, we find that a higher degree of financial integration is associated with more divergent, *less* synchronized, output cycles. We obtain similar results when we group the data at a longer frequency by splitting the sample into six non-overlapping 5-year periods. Controlling for bilateral goods trade and industrial specialization patterns does not alter the results either. Dynamic panel estimates that account for inertia in bilateral business cycle synchronization also yield a large negative effect of banking integration on output co-movement. Our results indicate an economically significant effect: a 10% increase in bilateral integration is associated with 1.9% (one standard deviation) fall in GDP growth co-movement.

Rose (1998) point out that even if countries with asynchronous business cycles form a currency union, then the union may become endogenously optimal if trade increases output co-movement through demand spillovers. Theoretically however the impact of trade on output patterns can go either way. If lower barriers to trade induce countries to specialize then output fluctuations will become less, not more, symmetric as argued by Krugman (1991). On the other hand, if most trade stays within sectors (intra-industry trade) in spite of specialization at the sectoral level then the cycle will become more synchronized. Starting with Frankel and Rose (1998) many studies, such as, Clark and van Wincoop (2001), Otto, Voss, and Willard (2001), Baxter and Kouparitsas (2005), and Calderon, Chong and Stein (2007) show that trade integration leads to more correlated business cycles. See Rose (2008) for a review of the literature. At the theoretical side, Kose and Yi (2006) show that one can match the cross-sectional finding by introducing vertical integration and by increasing the correlation of TFP shocks. Consistent with this finding, some recent empirical studies show that intra-industry trade accounts for most of the effect. See also Fidrmuc (2004), Koo and Gruben (2006), Gruben, Koo and Millis (2002), Shin and Wang (2004), and Di Giovanni and Levchenko (2008). It is important to notice that due to lack of bilateral data on asset holdings, an omitted variable in the early studies on the effect of trade on output co-movement is financial integration.

As argued above the finding of a negative association between integration and synchronization can be due to reverse causation. While there has been no paper to our knowledge that estimates bilateral time-varying instrumental-variable (IV) specifications for financial (or even trade) integration, we estimate such models in an effort to identify the one way effect of financial integration on output co-movement.

Specifically we employ two distinct identification (instrumental variable) strategies. First, building on our parallel work on the effects of the Economic and Monetary Unification (EMU) of the European Union (EU) and the associated financial sector reforms on banking integration (Kalemli-Ozcan, Papaioannou, and Peydró (2009)), we use as an instrument a bilateral time-varying index that measures the degree of legislative-regulatory harmonization policies in financial services among EU countries. There is a strong positive relationship between implemented legislative harmonization policies in financial services and bilateral banking integration. This result complements the findings of the law and finance literature (La Porta *et al.* (1997, 1998, 2008)) by showing that cross-country legal harmonization is associated with an increased degree of bilateral financial integration. The positive effect of legislative harmonization policies on integration works on top of the positive effect of monetary unification. Most importantly for our focus, the second stage estimates reveal that the component of banking integration predicted by legislative harmonization policies in the financial sector makes business cycles less alike.

Second, using data from Reinhart and Rogoff (2004) and Ilzetzki, Reinhart, and Rogoff (2008) we construct a time-varying instrument that reflects the bilateral flexibility of the exchange rate regime. The first-stage regression indicates that financial integration is significantly higher among pairs of countries with fixed-exchange rates. This result complements previous work documenting a similar pattern among emerging and under-developed economies (e.g. Calvo and Reinhart (2002) and Gelos and Wei (2005)). The second-stage estimates show that the component of banking integration predicted by the nature of the exchange rate regime is negatively associated with GDP fluctuations. While the exchange rate regime may affect business cycles through trade, we do not find such an effect in the data. In addition, using both instruments, where the over-identifying restriction is not rejected, also implies that higher financial integration yields lower output correlations.

The paper is structured as follows. In the next section we present our econometric methodology and data. Section 3 presents our benchmark results on the effect of financial integration on business cycle synchronization. Section 4 presents the IV estimates that link exchange rate arrangements and financial legislation reforms with banking integration in the first-stage and banking integration

with output synchronization in the second stage. Section 5 concludes.

2 Econometric Methodology and Data

We exploit a unique panel dataset of bilateral financial linkages among 20 industrial countries in the period $1978 - 2007$ and estimate variants of the following specification:

$$SYNCH_{i,j,t} = \alpha_{i,j} + \alpha_t + \beta BANKINT_{i,j,t-1} + \gamma TRADE_{i,j,t-1} + \mathbf{X}'_{i,j,t-1}\delta + \varepsilon_{i,j,t} \qquad (1)$$

Using real per capita GDP data from World Bank's World Development Indicator's Database (WB WDI), we construct time-varying measures of business cycle synchronization ($SYNCH_{i,j,t}$) between countries i and j in year t.[5] $BANKINT_{i,j,t-1}$ is a measure of cross-border banking integration between countries i and j in the previous year $(t-1)$. The specification also includes year (α_t) and country pair fixed-effects ($\alpha_{i,j}$). The year fixed-effects account for the effect of global trends on business cycle patterns and banking integration. The country-pair effects account for hard-to-measure factors such as legal system similarities, cultural ties, informational frictions, political coordination and other time-invariant unobservable factors, all of which have been shown to have an effect on both financial integration and business cycle patterns.

2.1 Financial Integration Measures

We construct time-varying bilateral financial (banking) integration measures using data from the BIS International Locational Banking Statistics Database. This database reports asset and liability holdings of banks located in roughly 40 (mainly industrial) countries ("the *reporting area*") in more than 150 countries (the "*vis-a-vis area*") at a quarterly frequency since the end of 1977. Yet, half of these countries started reporting only recently (mostly after 2000) or are "off-shore" financial centers. Thus, our panel dataset consists of annual bilateral data from 20 rich economies over the period 1978–2007.[6] These countries are: Australia, Austria, Belgium, Canada, Switzer-

[5] Using PPP adjusted GDP p.c. yields almost identical results.

[6] We prefer to use annual data given the noisy nature of quarterly data. Our panel has $N * (N-1) * T$, i.e. $20 * 19 * 30 = 5700$ observations. There are, however, some missing observations (gaps), mainly in the initial years. Thus most of our models are estimated in a sample of $5,376$ observations. For robustness we also estimated the specifications in a balanced panel dropping the observations in the late 1970s. The results are similar to the ones reported below and if anything stronger.

land, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Portugal, Sweden, and the United States.

The data is originally collected from domestic monetary authorities and includes all of banks' on-balance sheet exposure as well as some off-balance sheet items (mainly in the custodian business). The data is based on the location of banks and, therefore, also includes lending to subsidiaries and affiliates.[7] Thus it reflects more accurately the international exposure of countries (and banks) than the consolidated statistics database of the BIS that nets out lending and investment to affiliate institutions. The data captures mainly international bank to bank debt, such as inter-banks loans and deposits, credit lines, and trade-related activities. The data also covers bank's investment in equity-like instruments as well as foreign corporate and government bonds.[8] Unfortunately the BIS dataset does not distinguish between inter-bank debt activities and portfolio investment. Thus we can not explore potential differential effects of various types of capital holdings and flows on business cycles synchronization.[9] Going over the documentation (BIS (2003a,b); Wooldridge (2002)) it seems that during the initial years most flows reflect bank-to-bank transactions and credit lines, while FDI and equity flows have become more important after the mid-nineties. International bank M&A activity and direct lending to foreign residents have been limited overall (see Buch and De Long (2004) and Lane (2008)). Thus, the data mainly captures investment in debt related instruments and standard international banking activities. Besides stocks the BIS also reports asset and liability flows in each period.[10]

The BIS data is expressed originally in current USD. We convert the data into constant USD by deflating the series with the US CPI. For robustness we use both stock and gross flow based measures of financial integration. The first measure ($BANKINT1$) is the average value (over four observations for each pair) of (the logs of) real bilateral stocks in asset and liabilities normalized with the sum of the population of the two countries. Analogously, the second measure ($BANKINT2$) is

[7] Our data includes the transactions through financial centers such as the U.K. and Switzerland. As long as business cycle patterns and dynamics of assets and liabilities systematically differ between financial centers versus the other countries, this will create measurement error that will attenuate our estimates.

[8] Assets include mainly deposits and balances placed with non-resident banks, including bank's own related offices abroad. They also include holdings of securities and participations (i.e. permanent holdings of financial interest in other undertakings) in non-resident entities. Data also include trade-related credit, arrears of interest and principal that have not been written down and holdings of banks own issues of international securities. They also cover portfolio and direct investment flows of financial interest in enterprises.

[9] For example, Davis (2008) and Fratzscher and Imbs (2009), among others, show that various types of financial flows can have differential effects on business cycle patterns and risk sharing.

[10] Note that simply taking first differences of assets and liabilities could be misleading in constructing flows, since a devaluation either at the "*source*" or at the "*recipient*" country might cause an increase or decrease in total assets, even if no capital movements have taken place. Since reporting countries report to the BIS the currency in which the assets and liabilities are denominated, the BIS has constructed an estimate of the flows (see BIS 2003a).

the average of (the logs of) gross bilateral flows of assets and liabilities as a share of the population of the two countries).[11] We also experiment with other measures of integration, such as standardizing gross flows and stocks with GDP (and also the unstandardized measures). The results are similar to the ones reported here.

2.2 Business Cycle Synchronization Measures

For robustness and comparability with previous work we experiment with three different measures of business cycle synchronization ($SYNCH_{i,j,t}$).

First, we measure business cycle synchronization with the negative of divergence defined as the absolute value of real GDP p.c. growth differences between country i and j in year t.

$$SYNCH1_{i,,j,t} \equiv -\left|(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})\right| \tag{2}$$

This index, which follows Giannone, Lenza, and Reichlin (2009), is simple and easy-to-grasp. In addition, it is not sensitive to various filtering methods that have been criticized on various grounds (e.g. Dellas and Canova (1992); Canova (1998, 1999)). In contrast to the correlation measures that cross-country studies mainly work with, the index does not (directly at least) reflect the volatility of output growth and, therefore, allows us to identify the impact of banking integration on the covariation of output growth. Isolating the covariance part is particularly desirable, because over the past two decades global volatility of output has fallen considerably in the industrial economies (e.g. Cecchetti, Flores-Lagunes, and Krause (2006)).

Second, we follow Morgan, Rime, and Strahan (2004) and construct $SYNCH2_{i,,j,t}$ as follows. First, we regress real p.c. GDP growth separately for country i and j on country fixed-effects and year fixed-effects.

$$\ln Y_{i,t} - \ln Y_{i,t-1} = \gamma_i + \phi_t + v_{i,t} \;\forall\; i, j \tag{3}$$

The residuals of these models ($v_{i,t}$ and $v_{j,t}$) reflect how much GDP growth p.c. differs in each country and year compared to average growth in this year (across countries) and the average growth

[11] We prefer using the average of the logs of both right hand side and left hand side variables instead of the log of the average (or the sum), since the aggregate GDP cannot, in general, be strictly log-normally distributed if each country's GDP is log-normally distributed. See Baldwin (2006) for a critique of using the log of the average of two countries GDP.

of this country over the estimation period. The absolute value of these residuals ($FLUCT_{i,t}$) reflects GDP fluctuations with respect to the cross-country and the across-year mean growth.

$$FLUCT_{i,t} \equiv |v_{i,t}| \text{ and } FLUCT_{j,t} \equiv |v_{j,t}| \tag{4}$$

We then construct the business cycle synchronization proxy as the negative of the divergence of these residuals taking the absolute difference of residual GDP growth:

$$SYNCH2_{i,j,t} \equiv -|\nu_{i,t} - \nu_{j,t}| \tag{5}$$

Intuitively this index measures how similar GDP growth rates are between two countries in any given year, accounting for the average growth in each country and the average growth in each year.

Third, we follow previous cross-country studies and estimate $SYNCH3_{i,j,t}$ as the 5-year correlation of the cyclical component of output as measured with Baxter and King (1999) Band-Pass filter (2,8) (e.g. Imbs (2006); Baxter and Kouparitsas (2005)). In contrast to previous cross-sectional work, we have six 5-year observations rather than one observation per country-pair estimated over a longer period.

2.3 Control Variables

Given the emphasis of previous work on international trade and specialization patterns as determinants of synchronization, we control for these variables in our estimation. Following the literature, we measure $TRADE_{i,j,t}$ with the log of bilateral real (deflated with US price deflator) exports and imports as a share of the two countries's GDP.

For specialization we follow Krugman (1991), Imbs (2006), and Kalemli-Ozcan, Sørensen, and Yosha (2003), among others, and measure specialization with the following index:

$$SPEC_{i,j,t} \equiv \sum_{n=1}^{N} \left| s_{i,t}^{n} - s_{j,t}^{n} \right|$$

where $s_{i,t}^{n}$ and $s_{j,t}^{n}$ denote the GDP share of manufacturing industry n in year t in country i and j respectively (data are retrieved from UNIDO). Thus, a higher number in $SPEC_{i,j,t}$ indicates that the two countries have less similar production structures in manufacturing.

2.4 Descriptive Statistics

Table 1 gives descriptive statistics for the main variables employed in the empirical analysis. The average divergence in bilateral real p.c. GDP growth rate is 1.76% ($SYNCH1$). Once we control for country and time fixed-effects ($SYNCH2$) the differences are somewhat smaller (mean of 1.6%). Yet both proxy measures of synchronization exhibit significant variation both across country-pairs and over time (the standard deviation is 1.6% and 1.45% respectively).

Figures 1 and 2 give a graphical illustration of the evolution of banking integration and business cycle synchronization over the period we consider in our analysis. Cross-border banking activities have increased considerably over the past three decades. For example, real international bilateral bank holdings (per capita) have increased from an average value (across the 190 country-pairs of our sample) of roughly 70 dollars to almost 600 per person as of the end of 2007.[12] Figure 2 plots our synchronization measures over the last three decades. Growth divergence measures, $SYNCH1$ and $SYNCH2$ are plotted on the left y-axis and the correlation measure, $SYNCH3$, on the right y-axis. Although there is a considerable (and highly desirable from a panel estimation viewpoint) degree of short-term variability, output synchronization has been steadily increasing according to all measures since the mid-1980s. For example the average correlation of the cyclical component of GDP ($SYNCH3$) was around $0.1 - 0.3$ in the 1980s. In the 1990s the correlation increased on average to 0.4, while in the 2000s the correlation reached 0.6. In the Supplementary Appendix we tabulate country-specific figures with the evolution of the three proxy measures of synchronization for each of the twenty countries we consider in the analysis.

3 Benchmark Estimates

3.1 OLS Estimates: Annual Data

Table 2 gives OLS estimates on the effect of banking integration on GDP synchronization. For comparability with previous cross-country work, we start our analysis by estimating cross-sectional models, by pooling the time series observations across the 190 country pairs. The "between"

[12] These numbers are an order of magnitude smaller than the total bilateral equity holdings reported for example in 2007 vintage of the IMF CPIS dataset. Yet in the 1980s and the early 1990s banking activities were a relatively larger component of total capital flows. Our instrumental variable estimates will account for any measurement error in financial integration, as long as bank holdings/flows and other holdings/flows are correlated (previous works document a strong positive correlation between various types of capital flows (e.g. Bekaert and Harvey (2000); Lane and Milesi-Ferretti (2008)) .

estimator removes the time dimmension by averaging the dependent and the explanatory variable across each country-pair. The cross-sectional coefficient on banking integration in columns (1), (3), (5), and (7) is positive and significant at standard confidence levels. This result is in line with Imbs (2004, 2006), who using alternative measures of financial integration in a larger sample of countries in the late 1990s shows that countries with closer financial linkages tend to have more similar output growth patterns. The significant positive correlation between banking integration and output synchronization is also in line with the cross-sectional estimates of Otto, Voss, and Willard (2001), who show a similar positive association between bilateral FDI linkages and output co-movement in the rich OECD economies.

In even-numbered columns we report otherwise identical specifications, but we add country-pair fixed-effects and year fixed-effects. This allows us to examine whether within pairs of countries and conditional on global trends a higher degree of international banking activities is associated with less or more similar GDP fluctuations.[13] The "within" estimates stand in sharp contrast to the cross-sectional coefficients. The estimate on banking integration is statistically significant at the 1% level, but with the opposite sign to the cross-sectional models. The panel fixed-effect models therefore imply that a higher level of international banking integration is associated with less rather than more alike output fluctuations. This result is present with both banking integration measures and both synchronization proxies.

As the two banking integration measures are expressed in logs (as a share of the two countries' population) and the dependent variable is in percentage units, the coefficients in Table 2 measure the effect of a percentage increase in banking integration on output growth similarities. For example, the estimates in models (2) and (4) imply that a 10 percent increase in bilateral bank holdings is associated with $1.6\% - 1.9\%$ (roughly a one standard deviation; see Table 1) fall in GDP growth co-movement, which is an economically significant effect.

In Table 3 we estimate autoregressive specifications, controlling for persistence in business cycle synchronization. We find that GDP fluctuations are not particularly persistent (the first autoregressive coefficient is around 0.20). Yet one might be worried that our previous results are driven by inertia in output patterns. Autoregressive models are also useful to quantify the short and the long-run effect of banking integration on business cycle synchronization.[14] The

[13] Due to serial correlation standard errors in the "within" models are clustered at the country-pair level (Bertrand, Duflo, and Mullainathan (2004)). This method allows for arbitrary heteroskedasticity and autocorrelation across each country pair.

[14] Although the joint presence of the country-pair fixed effects and the lagged dependent variable yields biased estimates, this bias becomes negligible as the time dimension becomes large. Recent Monte Carlo studies show that

coefficient on $BANKINT$ that measures the annual (short-run) effect of banking integration on GDP synchronization is negative and significant at the 1% level. The long-run effect of banking integration is somewhat larger due to the positive serial correlation in the dependent variable. Overall, the dynamic estimates are quite similar to the simple models in Table 2, suggesting a similar magnitude for the effect of integration on synchronization.[15]

3.2 OLS Estimates: Five-year Averaged Data

One may worry that our results based on annual data are driven by noise. Although it is not clear why annual variation can explain the striking difference of the cross-sectional with the panel fixed-effect estimates, we also group the data into six non-overlapping 5-year periods. We use the correlation of the cyclical component of real p.c. GDP between countries i and j as the dependent variable ($SYNCH3$). Recall that while the previously used measures of synchronization reflect the covariance of output growth, the correlation measure we use in the averaged data also reflects the variance and, hence, the volatility of output growth.

Table 4 reports estimates on the effect of banking integration on the correlation of the cyclical component of output. $BANKINT$ enters with a positive and highly significant coefficient in the simple cross-sectional models (columns (1) and (3)). This is in line with our previously reported estimates in Tables 2 where we used alternative measures of GDP covariation and annual observations. In models (2) and (4) we report the "within" estimates. As in the annual frequency results, there is a striking difference between the cross-sectional and the panel estimates. The coefficient on banking integration in the fixed-effect models is negative and significantly lower than zero at standard confidence levels. The panel estimates, therefore, suggest that a higher degree of financial linkages through international banking activities is associated with less synchronized output patterns, as before.

In columns (5)-(8) we examine whether our results reflect differences on trade intensity or industrial specialization.[16] It is important to account for differences in bilateral trade when working

the bias sharply decays when the time horizon exceeds 20 periods. For example, in the (similar to ours) context of growth regressions, Judson and Owen (1999) estimate that the bias on the lagged dependent variable is around 1 to 2 percent of the true coefficient value when T is greater than 20 and less than 1% when the time horizon exceeds 30. More importantly, the bias on the independent variables (in our case banking integration) becomes less than one percent.

[15]The long-run effect of banking integration is given by the ratio of the estimate (β) on $BANKINT_{i,j,t-1}$ to one minus the sum of the (two) auto-regressive coefficients, ρ_j, i.e. Long-run Effect $= \frac{\beta}{1-\rho_1-\rho_2}$.

[16]We also augmented the empirical model with trade and specialization one at a time, obtaining similar results.

with long-term data as trade in goods and financial services tend to move in tandem (see Rose and Spiegel (2004) and Aviat and Coeurdacier (2007) among others). In addition, previous studies show that trade has a significantly positive effect on business cycle synchronization (see Rose (2008) for a review). Likewise accounting for specialization patterns is key as theoretical and empirical works argue that financial integration affects the specialization patterns (e.g. Obstfeld (1994); Kalemli-Ozcan, Sørensen, and Yosha (2001)). We again start by discussing the cross-sectional estimates reported in columns (5) and (7). The "between" coefficient on $BANKINT$ continues to be at least two standard errors above zero in both permutations.[17] As previous literature shows, trade also enters with a positive estimate in the cross-sectional models, suggesting that countries that trade more have more similar output patterns. The coefficient on $SPEC$ is statistically negative implying that countries with dissimilar production structures have less synchronized cycles. The cross-sectional estimates in columns (5) and (7) are quite similar to Kalemli-Ozcan, Sørensen, Yosha (2003), and Imbs (2004), who both using regional and country-level data and more elaborate techniques (IV and SUR) document similar patterns.

Yet, as in the previously (in Tables 2 and 3) reported specifications with annual data, controlling for country-pair fixed-effects and period fixed-effects changes drastically the results. The coefficient on banking integration changes sign implying that conditional on country-pair fixed factors and general time trends a higher degree of financial integration is associated with less synchronized GDP growth patterns, while controlling trade and specialization. The "within" estimate on banking integration is now larger in absolute size, compared to the analogous unconditional specifications in (2) and (4). The conditional estimates in columns (6) and (8) show that our previous estimates are not driven by differences in trade intensity and specialization patterns.[18]

3.3 Robustness

We performed various sensitivity checks to investigate the stability of our estimates. First, we checked whether our results are driven by influential observations. The change in the sign of the coefficient on banking integration in the between and the within estimation is not due to any particular country-year observations (see the partial correlation plots in the Supplementary

[17] Note that while the models in Table 5 are otherwise similar to these in Table 4, the estimates are not directly comparable as we lose roughly 20% of our sample due to data unavailability on the industrial statistics needed to construct $SPEC$. Specifically we lose all observations in the late 1970s as the UNIDO dataset that we use to construct $SPEC$ starts reporting data after 1980.

[18] Note that given the limited time-variation in trade and specialization differences, these variables now become insignificant correlates of business cycle synchronization.

Appendix). Second, we estimated a weighted LS (by population or GDP p.c.) regression in order to guard against the influence of small country pairs, obtaining similar results.[19] Third, we repeat estimation dropping Luxemburg and/or Switzerland. This helps us check whether our estimates are driven by small countries with large banking systems. The estimates (not shown for brevity) are similar to the ones reported here. Forth, we experiment with alternative proxy measures of trade intensity and production similarities, finding similar results (not shown). Fifth, we used unstandardized measures of banking integration as the dependent variable and controlled directly for population and/or GDP. Again the results (not reported) are similar. Sixth, we controlled for GDP differences to account for the possibility that our estimates are driven by countries receiving a lot of foreign bank capital and also converging to a steady state. While in some specifications lagged log GDP entered with a significant (positive) coefficient, the estimates on banking integration retain their economic and statistical significance (results not shown for brevity).[20]

4 Instrumental Variable Estimates

Our results so far show a strong negative effect of banking integration on business cycle synchronization in a panel of countries. Although this result is robust to numerous model permutations and stability tests, one, however, could still argue that our coefficients do not capture the one way *causal* effect of financial integration on synchronization. As we control for country-pair time-invariant factors and global trends omitted variable bias is not a primary concern (although clearly can not be ruled out).[21] A more important worry is reverse causation. This might occur if banking integration is the outcome rather than the cause of business cycle divergence. To partly account for this possibility, so far we have used lagged values of banking integration (and the other controls). Yet, ideally, one would need exogenous variation on bilateral banking integration. While no study to our knowledge has estimated instrumental variable (IV) bilateral time-varying models on either financial or trade integration, in this section we try to further push on the causality interpretation of our results by using two different instrumental variables approaches.

[19] For example we obtain the following coefficients and standard errors for the benchmark specifications in Table 2, columns (1) and (2). For the within regression, the estimate (s.e.) is -0.187 (0.039) and for the between regression, the estimate (s.e.) is 0.069 (0.021).

[20] We thank Gian-Maria Milesi-Ferretti for pointing this possibility.

[21] For example most of the robust correlates of business cycle synchronization identified in the Baxter and Kouparitsas (2005) study are time-invariant or slowly moving over time.

4.1 Financial Sector Legislative-Regulatory Harmonization and Integration

Building on our parallel work on the impact of European financial harmonization policies and the single currency on banking integration (Kalemli-Ozcan, Papaioannou, and Peydró (2009)), we construct a policy instrument for banking integration using data on financial sector harmonization policies across EU15 countries. Using legislative harmonization in financial services as an instrument for bilateral banking integration is conceptually appealing, as we link policy changes in a particular aspect of law (financial intermediation) with outcomes in the same industry. To construct the instrument we use information from the EU Commission on the implementation of the 21 Directives of the Financial Services Action Plan (FSAP), a major policy initiative launched in 1998 that aimed to remove regulatory and legislative barriers across European countries in financial sector.[22] EU Directives are legal acts that do not become immediately enforceable across the EU. Instead, member countries are given some time to adopt, modify and eventually transpose the Directives into domestic law. The time of the transposition may take many years, as EU member states delay the adaptation to protect domestic firms and interest groups and for other policy motives and bureaucratic inefficiencies.

To construct the bilateral harmonization index we proceed as follows: First, we define 21 indicator variables that are equal to one starting at the year of the transposition of each Directive into national law and zero otherwise. Second, we create the country-time varying legislation measure ranging from 0 to 21 by summing the values of these 21 indicator variables ($LEX_{i,t}$). Third, as we need a country-pair time-varying measure of harmonization and regulatory convergence, we take the sum of the log value of the legislation measure for each country in each year (i.e. $HARM_{i,j,t} \equiv \ln(LEX_{i,t}) + \ln(LEX_{j,t})$).[23]

Table 5 reports (static and dynamic) panel (bilateral) fixed-effect IV specifications examining the "within" correlation of the component of banking integration explained by legal-regulatory harmonization on business cycle synchronization. The first stage estimates show that countries that quickly incorporated into domestic law the EU-wide regulatory-legislative harmonization policies

[22] The FSAP was launched at the end of 1998 with the aim to complement monetary unification. The plan included 27 Directives. However, at the official completion at the end of 2003 the EU Commission had passed only 21 of these measures. The remaining 6 Directives passed in the period 2004–2007 and are still being transposed by member countries. We also used an alternative index based on the total number of the 27 Directives. The results are similar (not reported for brevity).

[23] Imbs (2006) and Kalemli-Ozcan, *et al.* (2001) employ a similar bilateral instrumentation strategy using, however, cross-sectional data. Specifically these studies use the sum of the La Porta *et al.* (1997, 1998) measures of investor protection of the two countries as an instrument for bilateral financial integration.

became more financially integrated through international banking activities.[24] This result is interesting in light of the law and finance literature that demonstrates that countries with well defined and protected investor protection rights tend to have more deep and liquid capital markets (see La Porta *et al.* (1997, 1998, 2008)). The first-stage result adds to this body of work by showing that legal convergence is associated with a higher degree of financial links.[25] The first-stage fit is strong. In all model permutations the first-stage F-score is significantly larger than 10, the rule-of-thumb value that alerts for weak instrument problems (Staiger and Stock (1997); Stock and Yogo (2001)). The "reduced-form" regression of banking integration on legislative harmonization (not shown) yields a positive and highly significant estimate on $HARM_{i,j,t}$, implying that conditional on country-pair factors and global trends, such policies have lowered the synchronicity of output growth.

In line with the analogous OLS estimates (in Tables 2 and 3), in all permutations the second-stage coefficient on banking integration is negative. The estimate is in all specifications significant at standard confidence levels. These results offer support to the idea that banking integration leads to more divergent output patterns (rather than the other way around). The 2SLS estimates are larger than the analogous OLS coefficients. This might be due to the fact that 2SLS corrects for the attenuation bias caused by measurement error. Although our banking integration variable captures all cross-border banking activities (and thus classical measurement error should be negligible), it does not include other types of international investment. As the various forms of financial integration are positively correlated (e.g. Lane and Milesi-Ferretti (2007)), the larger in absolute value IV coefficients most likely reflect this particular form of measurement error.

To investigate the "exclusivity" assumption of our identification approach, we regress synchronization on both bilateral banking integration and harmonization with LS and 2SLS (in this case instrumenting integration with our second instrument).[26] The coefficient on the harmonization index is indistinguishable from zero, while banking integration continues to enter with a negative estimate. This hints that financial services harmonization policies do not affect synchronization directly but rather through financial integration.

[24]The first stage estimates differ in the case of dynamic panel estimation since we have slightly different samples.

[25]Kalemli-Ozcan, Papaioannou and Peydró (2009) show that this result is robust to various permutations and the effect of legal-regulatory harmonization on banking integration works on top of monetary unification (see also results below). Note than the first-stage specification includes a "treatment" group of countries (the EU15) that have harmonized their financial legislation (to different degrees) and a "control" group of economies (non EU-15). As we show below (in Table 7) the positive effect of legislative harmonization policies in financial services on banking integration works on top of the positive effect of the euro due to the elimination of exchange rate risk.

[26]These results are not shown for brevity. In Table 8 and Section 3.3 we perform a formal test of the "exclusivity" assumption.

4.2 Bilateral Exchange Rate Regime and Banking Integration

The "fear of floating" literature (Calvo and Reinhart (2002); Rogoff and Reinhart (2004)) shows that developing countries appear unwilling to let their currencies float. A main reason behind this policy is to attract foreign investment. In line with this, Gelos and Wei (2005) find that large equity funds invest significantly more in countries with a fixed-exchange rate regime. Kalemli-Ozcan, Papaioannou and Peydró (2009) show a similar pattern for developed economies. Building on this body of work we employ an alternative identification scheme that links currency flexibility with synchronization through financial linkages. We exploit the recent update of the de-facto exchange rate regime classification of Reinhart and Rogoff (2004) by Ilzetzki, Reinhart, and Rogoff (2008), and use a bilateral index that measures the flexibility of the exchange rate as an instrument for banking integration. The Reinhart and Rogoff fine classification ranges from 1 to 14 where lower values suggest a more rigid regime. For example, euro area countries get a score of 1 after 1999 and a score of 4 in the 1990s (when they were participating in the European Exchange Rate Mechanism). The U.S. gets a score of 12 to 14, while Canada fluctuates around 8. Using this dataset we construct the bilateral index by taking the sum of the log classification of countries i and j in the beginning of each year t ($ERSUM = \ln(ER_{i,t}) + \ln(ER_{j,t})$).[27]

Table 6 reports both the first-stage and the second-stage results. As shown in panel B, there is a strong negative association between bilateral exchange rate flexibility and banking integration. In line with previous works, there is a higher level of cross-border lending between countries with rigid exchange rate regimes. Not only is the coefficient on the nature of the bilateral exchange rate regime significant at standard confidence, but the diagnostics indicate no weak instrument problems. Turning to the second-stage results (reported on Panel A), the coefficient on $BANKINT$ continues to be negative, implying that a higher degree of banking integration is associated with less synchronized output cycles. The second-stage estimates are significant at the 10% level in the static specifications reported in columns (1)-(4). The estimates are significant at the 1% level in the dynamic specifications in columns (5)-(8), where we control for inertia in GDP growth co-movement. Compared to the analogous OLS estimates, the 2SLS coefficients imply an even larger effect of banking integration on business cycle divergence. As before this is most likely due to the fact that our banking integration data only just captures one portion of bilateral financial linkages.

The exclusivity assumption for instrument validity in the IV results in Table 6 is that the nature of the bilateral exchange rate regime does not affect GDP synchronization via other than financial

[27] This transformation does not change our results. Taking logs gives us a better first-stage fit.

integration channels. A potential other channel of influence of the exchange rate regime is trade in goods (evidence on this effect was mixed, but Klein and Shambaugh (2006) document a significant effect). It is highly unlikely that trade impacts business cycle synchronization at the annual frequency. Even at the five-year panel estimates reported in Table 4 trade was an insignificant correlate of GDP co-movement. To formally account for the potential effect of bilateral exchange rate regime on synchronization via trade rather than via financial integration, we estimate panel 2SLS models in the six non-overlapping 5-year windows controlling for trade (as well as differences in industrial structure). Table 7 reports these models together with analogous unconditional specifications. The first-stage fit continues to be strong in spite of the fact that trade and specialization are controlled now also in the first stage. The second-stage coefficient on the two banking integration measures continues to be negative and significant at the 1% level. Not only does the coefficient on banking integration retain its significance when we control for trade and specialization, but the specifications clearly show that trade is an insignificant correlate of GDP synchronization.

As before to test for "exclusivity" and investigate whether the exchange rate regime has a direct impact on output synchronization we estimated specifications with both $BANKINT$ and $ERSUM$ on the RHS, instrumenting integration with our first instrument. The results (not reported for brevity) show that once we control for banking integration, the coefficient on the bilateral nature of the exchange rate regime turns insignificant. In contrast, banking integration continues to enter with a highly significant estimate. This hints that the nature of the currency regime affects business cycle patterns through financial integration.

4.3 Joint IV and Exclusion Restriction Testing

Our two instrumentation strategies offer support to the idea that banking integration leads to more divergent output patterns rather than the other way around. For testing the validity of the instruments we run 2SLS regressions using both the bilateral harmonization index and the measure of the flexibility of the exchange rate regime as instruments for banking integration. Table 8 reports the panel fixed-effects IV specifications. The first stage estimates (reported in Panel B) show that financial integration is higher among pair of countries that peg their currencies and countries with harmonized legislation-regulation in financial services. Note that both instruments enter with significant estimates. This suggests that cross-border banking activities are affected by both monetary arrangements and legal-regulatory harmonization policies. The joint F-score of the excluded variables indicates no weak instrument problems. The second stage estimates (reported

in Panel *A*) are in line with our LS and IV results so far. The 2SLS estimate on banking integration is negative and significant at standard confidence levels in all permutations. This suggests that the predicted part of banking integration by the exchange rate regime and legislative harmonization is a statistically and economically significant correlate of business cycle divergence.

The IV specifications in Table 8 allow us to perform the usual Sargan-Hansen test of over-identifying restrictions. While not perfect, this test enables to formally investigate the exclusivity assumption of the two instruments. Table 8 reports Hansen's J-statistic score and the corresponding p-value of the null hypothesis of instrument validity. We can not reject the null hypothesis of (joint) instrument validity in all models.

5 Conclusion

Standard theory predicts that financial integration and business cycle synchronization should be negatively correlated, regardless of different mechanisms employed in different models. However, the empirical literature so far documents a significant positive association between the two.

In this paper we use a unique confidential dataset of bilateral cross-country observations on banks' international assets and liabilities over the past thirty years for twenty developed countries to examine the link between financial integration and business cycle synchronization. Our rich panel structure allows us to control for unobserved and hard-to-account-for country-pair specific factors, such as geography, information asymmetries, and cultural similarities. In addition, we control for global trends, that capture the increased coordination of monetary policy, the expansion of trade, and other features of globalization. Both country-pair factors and global trends affect financial integration and output synchronization simultaneously, and hence failing to control for these yields an upward biased estimate from the cross-sectional estimation.

Our analysis shows that accounting for such factors is fundamental. While in the cross-section there is a positive association between integration and output co-movement, once we control for country-pair fixed-effects and time fixed effects the theoretically predicted negative association emerges. The within specifications reveal that a higher degree of cross-border financial integration leads to less synchronized, more divergent, output cycles. This result is robust to numerous permutations, such as accounting for inertia, controlling for trade and production similarities, dropping countries with large banking sectors, and much more.

To identify the one-way effect of financial integration on business cycle synchronization we also

estimate instrumental variable specification using two distinct instruments. The first one is an index of legislative-regulatory harmonization policies in financial services and the second one is a measure of the flexibility of bilateral exchange rates. The first-stage specifications indicate a significant and strong correlation between banking integration among countries that either adopt more rigid exchange rate arrangements and/or that harmonize legislation in financial services. The second-stage estimates show that the component of bilateral financial integration explained by the nature of the exchange rate regime and/or legislative reforms in financial services is negatively associated with business cycle synchronization. The IV specifications thus show that the negative effect of financial integration on output co-movement represents in the LS panel estimation represent something deeper than a simple correlation. Jointly the LS and the IV panel estimates offer support to theories predicting that in response to closer financial linkages output cycles become less synchronized.

The recent crisis shows that in an increasingly globalized world an asymmetric idiosyncratic shock, such as the one in the U.S. sub-prime loans market, can spread rapidly given the tight financial links between countries. Our paper documents that this does not necessarily imply increasingly synchronized business cycles across country-pairs given the negative partial impact of those same financial linkages on the output co-movement. Thus, policy makers should not assume that business cycles are going to move together because of increased financial integration while designing the appropriate regulatory and policy framework.

6 Data Appendix

Synchronization Index 1 [$SYNCH1$]: The measure is defined as minus one times the divergence of (logarithmic) real p.c. GDP growth between each pair of countries in each year. $SYNCH1_{i,,j,t} \equiv -[(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})]$. For output ($Y$) we use World Bank's real per capita GDP at constant prices series. This index follows Giannone, Lenza and Reichlin (2008). *Source: World Bank's World Development Indicators Database (2008).*

Synchronization Index 2 [$SYNCH2$]: The measure follows Morgan, Rime, and Strahan (2004) and is constructed in two steps. First, we regress (logarithmic) real p.c. GDP growth separately for each country on country fixed-effects and year fixed-effects, i.e. $\ln Y_{i,t} - \ln Y_{i,t-1} = \gamma_i + \phi_t + v_{i,t} \; \forall \; i, j$. Second, we construct the business cycle synchronization index as the negative of the divergence of the residuals for each country-pair, i.e. $SYNCH2_{i,j,t} \equiv -|\nu_{i,t} - \nu_{j,t}|$. *Source: World Bank's World Development Indicators Database (2008).*

Synchronization Index 3 [$SYNCH3$]: The measure is the correlation of the cyclical component of (logarithmic) real per capita GDP as measured with Baxter and King (1999) Band-Pass filter (2,8). We estimate the correlation using five-years of data. The index follows Baxter and Kouparitsas (2004) and Imbs (2006). *Source: World Bank's World Development Indicators Database (2008).*

Banking Integration 1 [$BANKINT1$]: Banking integration index based on bilateral cross-border holdings (stocks) of banks. Data on bank's cross-border bilateral stocks of assets and liabilities come from the confidential version of BIS's Locational Banking Statistics. For each country-pair and year there are up to four observations. *i*) asset holdings (stocks) of banks located in country i in all sectors of the economy in country j; *ii*) asset holdings (stocks) of banks located in country j in all sectors of the economy in country i; *iii*) liabilities (stocks) of banks located in country i to country j. *iv*) liabilities (stocks) of banks located in country j to country i. The data is originally expressed in current US dollars. First, we deflate the four series with the US deflator. Second, we standardize the series by dividing asset and liabilities with the sum of the two countries population in each year (using data from World Bank's World Development Indicators Database). Third, we take the average of the log value of real bilateral assets and liabilities in each year. For further details, see Section 2.1. *Source: Bank of International Settlements, Locational Banking Statistics (2008).*

Banking Integration 2 [$BANKINT2$]: Banking integration index based on bilateral cross-

border gross flows of banks. Data on bank's cross-border bilateral gross flows of assets and liabilities come from the BIS Locational Banking Statistics. For each country-pair and year there are up to four observations. *i*) asset flows of banks located in country i in all sectors of the economy in country j; *ii*) asset flows of banks located in country j in all sectors of the economy in country i; *iii*) liability flows of banks located in country i to country j. *iv*) liability flows of banks located in country j to country i. The data is originally expressed in current US dollars. First we deflate the four series with the US deflator. Second we take the absolute value of (net) flows. Third, we standardize the series, by dividing asset and liability flows with the sum of the two countries population in each year (using data from World Bank's World Development Indicators Database). Fourth, we take the average of the log value of real bilateral gross flows in assets and liabilities in each year. For details see Section 2.1. *Source: Bank of International Settlements, Locational Banking Statistics (2008). Source: Bank of International Settlements, Locational Banking Statistics (2008); for details on the BIS dataset see Wooldridge (2003) and BIS (2008).*

Trade Integration [$TRADE$]: Index of bilateral trade intensity. The measure is the log of bilateral real (deflated with the US price deflator) exports and imports as a share of two countries's GDP. This measure follows Calderon *et al.* (2007). *Source: IMF's Direction of Trade Database (2008).*

Specialization [$SPEC$]: Index of industrial specialization, based on dissimilarities in production. The measure is the sum of the absolute differences in the share of industrial production for nine manufacturing sectors as a share of the total manufacturing production in each pair of countries in each year, i.e. $SPEC_{i,j,t} \equiv \sum_{n=1}^{N} \left| s_{i,t}^{n} - s_{j,t}^{n} \right|$. The index follows Krugman (1991), Imbs (2006), and Kalemli-Ozcan, Sørensen, and Yosha (2003). *Source: United Nations Industrial Statistics Database (2008).*

Legislative Harmonization in Financial Services [$HARM$]**:** Index of regulatory-legislative harmonization in financial services based on the transposition of the Directives of the Financial Services Action Plan (FSAP). The FSAP was a major policy initiative at the EU-level, launched in 1998 that included 27 EU-wide legislative acts (the Directives). Until the official completion of the plan in the end of 2003, the EU legislative bodies (the Commission and the Council) had initiated 21 of these laws. However, Directives do not become immediately enforceable across the EU. EU member states have considerable discretion in the transposition (adoption) of these acts. We construct the bilateral harmonization index in three steps. First, for each country we define 21 indicator variables that equal one starting at the year of the transposition of each Directive into national law and zero otherwise. Second, we create a country-time varying legislation measure

ranging from 0 to 21 by summing the values of the 21 indicator variables for each country ($LEX_{i,t}$). Third, we take the sum of the log value of the legislation measure for each country in each year (i.e. $HARM_{i,j,t} \equiv \ln(LEX_{i,t}) + \ln(LEX_{j,t})$). The remaining six Directives of the FSAP were passed in the period $2004 - 2007$. We thus also construct an alternative index, based on the transposition of all the 27 Directives of the FSAP. *Source: Kalemli-Ozcan, Papaioannou, and Peydró (2009), based on data from the EU Commission.*

Exchange Rate Flexibility [$ERSUM$]**:** Bilateral index of the flexibility of the exchange rate, based on "fine" regime classification of Reinhart and Rogoff (2004). The country-specific index ranges from 1 to 14 where lower values suggest a more rigid regime. We construct the bilateral index by taking the sum of the log classification of countries i and j in the beginning (January) of each year t ($ERSUM = \ln(ER_{i,t}) + \ln(ER_{j,t})$). *Source: Ilzetzki, Reinhart, and Rogoff (2008) and Reinhart and Rogoff (2004).*

References

Aviat, A. and Coeurdacier N. (2007), "The Geography of Trade in Goods and Asset Holdings", Journal of International Economics, 71(1): 22–51.

Backus, D., Kehoe, P. and Kydland, F. (1992), "International Real Business Cycles," Journal of Political Economy, 100(4): 745–775.

Baldwin, R. A. (2006), "The Euro's Trade Effects" ECB Working Paper Series No. 594.

Bank of International Settlements (2003a), "Guide to International Financial Statistics", BIS Monetary and Economic Department (Basle, Switzerland) Papers No. 14, February.

Bank of International Settlements (2003b), "Guide to International Banking Statistics", BIS Monetary and Economic Department (Basle, Switzerland) Papers No. 16, April.

Baxter, M. and Crucini, M. J. (1995), "Business Cycles and the Asset Structure of Foreign Trade," International Economic Review 36(4): 821–854.

Baxter, M. and King, R. G. (1999), "Measuring Business Cycles: Approximate Band-pass Filters for Economic Time-Series," Review of Economics and Statistics 81(4): 575–593.

Baxter, M. and Kouparitsas, M. (2005), "Determinants of Business Cycle Co-movement: A Robust Analysis," Journal of Monetary Economics 52(1): 113–157.

Bekaert, G. and Harvey, C. (2000), "Capital Flows and the Behavior of Emerging Equity Market Returns," in Capital Flows and the Emerging Economies: Theory, Evidence and Controversies, Editor: Sebastian Edwards, NBER.

Bertrand, M., Duflo, E. and Mullainathan, S. (2004), "How Much Should We Trust Difference in Differences Estimates?," Quarterly Journal of Economics, 119(1): 249–275.

Buch, C. and De Long G. (2004), "Cross-Border Bank Mergers: What Lures the Rare Animal?," Journal of Banking and Finance, 28(9): 2077–2102.

Calderon, C., Chong, A. and Stein, E. (2007), "Trade Intensity and Business Cycle Synchronization: Are Developing Countries Any Different?," Journal of International Economics 71(1): 2–21.

Calvo G. and Mendoza, E. (2000). "Rational Contagion and the Globalization in Securities Markets," Jouranl of International Economics, 51(1): 79–119.

Calvo G. and Reinhart, C. (2002). "Fear Of Floating," Quarterly Journal of Economics, 117(2): 379-408.

Canova, F. (1998), "Detrending and Business Cycles Facts," Journal of Monetary Economics 41(3): 475–512.

Canova, F. (1999), "Does Detrending Matter For the Determination of the Reference Cycle and the Selection of Turning Points?," Economic Journal 109(452): 126–150.

Canova, F. and Dellas, H. (1992), "Trade Interdependence and the International Business Cycle," Journal of International Economics 34(1-2): 23–47.

Cecchetti, S. G., Flores-Lagunes, A. and Krause, S. (2006), "Assessing the Sources of Changes in the Volatility of Real Growth," NBER Working Paper 11946.

Clark, T. E. and van Wincoop, E. (2001), "Borders and Business Cycles," Journal of International Economics, 55(1): 59–85.

Davis S. (2008), "The Effects of Globalization on International Business Cycle Co-movement: Is all Trade and Finance Created Equal?," Mimeo Vanderbilt University.

Di Giovanni, J. and Levchenko, A. (2008), "Putting the Parts Together: Trade, Vertical Linkages, and Business Cycle Comovement," Mimeo International Monetary Fund.

Ekinci M., Kalemli-Ozcan S. and Sorensen B. (2008), "Financial Integration within EU Countries: The Role of Institutions, Confidence and Trust," NBER Working Papers 13440, forthcoming in NBER-ISOM.

Fidrmuc, J. (2004), "The Endogeneity of the Optimum Currency Area Criteria, Intra-industry Trade, and EMU Enlargement," Contemporary Economic Policy, 22(1): 1–12.

Frankel, J. and Rose, A. (1998), "The Endogeneity of the Optimum Currency Area Criterion," Economic Journal, 108(6): 1009–1025.

Garcia Herrero, A. and Ruiz, J. M. (2008), "Do Trade and Financial Links Foster Business Cycle Synchronization in a Small Open Economy," Moneda y Credito, 226(1): 187–226.

Gelos R. and Wei S-J. (2005), "Transparency and International Portfolio Holdings", Journal of Finance, 60(6): 2987–3020.

Giannetti, M. and Yafeh, Y. (2008), "Do Cultural Differences Between Contracting Parties Matter? Evidence from Syndicated Bank Loans," ECGI Finance Working Paper No. 224/2008.

Giannone, D., Lenza M. and Reichlin, L. (2009), "Did the Euro Imply More Correlation of Cycles?," in Alesina, A. and Giavazzi, F. (eds.) Europe and the Euro, NBER Volume, University of Chicago Press, forthcoming.

Gruben, W.C., Koo, J. and Millis, E. (2002), "How Much Does International Trade Affect Business Cycle Synchronization?," Federal Reserve Bank of Dallas Working Paper No 0203.

Guiso L., Sapienza P., and Zingales, L. (2009), "Cultural Biases in Economic Exchange?," Quarterly Journal of Economics, 124(3).

Heathcote J. and Perri, F. (2004), "Financial Globalization and Real Regionalization," Journal of Economic Theory, 119(1): 207–43.

Ilzetzki E., C. M. Reinhart and Rogoff, K. S. (2008), "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" Mimeo.

Imbs, J. (2004), "Trade, Specialization and Synchronisation," Review of Economics and Statistics 86(3): 723–734.

Imbs, J. (2006), "The Real Effects of Financial Integration," Journal of International Economics 68(2): 296–324.

Imbs, J. and Fratzscher, M. (2009), "Risk Sharing, Finance and Institutions in International Portfolios," Journal of Financial Economics, Forthcoming.

Judson R. and Owen, A. (1999), "Estimating Dynamic Panel Data Models: A Guide for Macroeconomists," Economics Letters, 65(1): 9-15.

Kalemli-Ozcan, S., Sorensen, B. E. and Yosha, O. (2001), "Regional Integration, Industrial Specialization and the Asymmetry of Shocks across Regions," Journal of International Economics, 55(1): 107-137.

Kalemli-Ozcan, S., Sorensen, B. E. and Yosha, O. (2003), "Risk Sharing and Industrial Specialization: Regional and International Evidence," American Economic Review, 93(3): 903-918.

Kalemli-Ozcan, S., Papaioannou, E, and Peydr, J-L. (2009), "How does Euro Affect Financial Integration: Currency Risk, Legislation, and Trade," Mimeo University of Houston, Dartmouth College, ECB.

Koo, J. and Gruben, W.C. (2006), "Intra-Industry Trade, Inter-Industry Trade and Business Cycle Synchronization," Mimeo, Federal Reserve Bank of Dallas.

Kose, M. A., Prasad, E. S. and Terrones, M. E. (2004), " Volatility and Co-movement in an Integrated World Economy: An Exploration," in Siebert, H. (ed.) Macroeconomic Policies in the World Economy, pp. 89–122.

Kose, M. A., and Yi, K. M. (2001), "International Trade and Business Cycles: Is Vertical Specialization the Missing Link?," American Economic Review 91(2): 371–375.

Kose, M. A., and Yi, K. M. (2006), "Can the Standard International Business Cycle Model Explain the Relation between Trade and Comovement?," Journal of International Economics, 68(2): pp. 267–295.

Kose, M. A., Otrok C., and Prasad, E. (2008), "Global Business Cycles: Convergence or Decoupling?" IZA Discussion Paper No. 3442.

Kraay, A. and Ventura, J. (2000), "Current Accounts in Debtor and Creditor Countries," Quarterly Journal of Economics, 115(4): 1137–1166.

Kraay, A. and Ventura, J. (2007), "Comparative Advantage And The Cross-Section Of Business Cycles," Journal of the European Economic Association, 5(6): 1300–1333.

Krugman, P. (1991), "Geography and Trade," MIT Press, Cambridge, MA.

Lane, P. and Milesi-Ferretti, G. M. (2004), "Financial Globalization and Exchange Rates" CEPR Discussion Papers 4745.

Lane, P. and Milesi-Ferretti, G. M. (2007), "The External Wealth of Nations Mark II," Journal of International Economics, 73(1): 223-250.

Lane, P. and Milesi-Ferretti, G. M. (2008), "International Investment Patterns," Review of Economics and Statistics, 90(3): 518–537.

La Porta, R., Lopez-de-Silanes, F., and Shleifer, A. (2008), "The Economic Consequences of Legal Origins," Journal of Economic Literature, 46(2): 285–332.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R. (1997), "Legal Determinants of External Finance," Journal of Finance, 52(3): 1131–1150.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R. (1998), "Law and Finance," Journal of Political Economy, 106(6): 1113–1155.

Mian, A. (2006), "Distance Constraints: The Limits of Foreign Lending in Poor Economies," Journal of Finance, 61(6): 1465–1505.

Morgan, D. P., Rime, B. and Strahan, P. E. (2004), "Bank Integration and State Business Cycles," Quarterly Journal of Economics, 119(3): 1555–85.

Mundell, R. (1961), "A Theory of Optimum Currency Areas," American Economic Review, 51(4): 509–517.

Obstfeld, M. (1994), "Risk-Taking, Global Diversification, and Growth," American Economic Review, 84(5): 1310–1329.

Otto, G., Voss, G. and Willard, L. (2001), "Understanding OECD Output Correlations," Reserve Bank of Australia Research Discussion Paper No 2001/05.

Portes, R. and Rey, H. (2005), "The Determinants of Cross-Border Equity Flows," Journal of International Economics, 65(2): 269–296.

Reinhart, C. and Rogoff, K. (2004), "The Modern History of Exchange Rate Arrangements: A Reinterpretation," Quarterly Journal of Economics, 119(1): 1–48.

Rose, A. (2008), "Is EMU Becoming an Optimum Currency Area? The Evidence on Trade and Business Cycle Synchronization, mimeo University of California-Berkeley.

Rose, A. (2009), "Understanding Business Cycle Synchronization: Is Inflation Targeting Paving the Way to Asian Monetary Union?," mimeo University of California-Berkeley.

Rose, A., and Engel C. (2002), "Currency Unions and International Integration," Journal of Money, Credit and Banking, 34(4): 1067–89.

Rose, A., and Spiegel, M. (2004), "A Gravity Model of Sovereign Lending: Trade, Default, and Credit," NBER Working Paper 9285.

Shambaugh J. and Klein, M. (2006), "Fixed Exchange Rates and Trade," Journal of International Economics, 70(2): 359–83.

Shin, K. and Wang, Y. (2004), "Trade Integration and Business Cycle Co-Movements: The Case of Korea with other Asian Countries," Japan and the World Economy, 16(2): 213–230.

Staiger, D. and Stock, J. H (1997), "Instrumental Variables Regression with Weak Instruments," Econometrica, 65(3): 557–86.

Stock, J. H. and Yogo, M. (2001), "Testing for Weak Instruments in Linear IV Regression," mimeo, Harvard University.

Stockman A. and Tesar, L. (1995), "Tastes and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements," American Economic Review, 85(1): 168–85.

Wooldridge, P. D. (2002), "Uses of the BIS Statistics: An Introduction. " BIS (Basle, Switzerland) Quarterly Review, March.

Figure 1: Banking Integration over Time

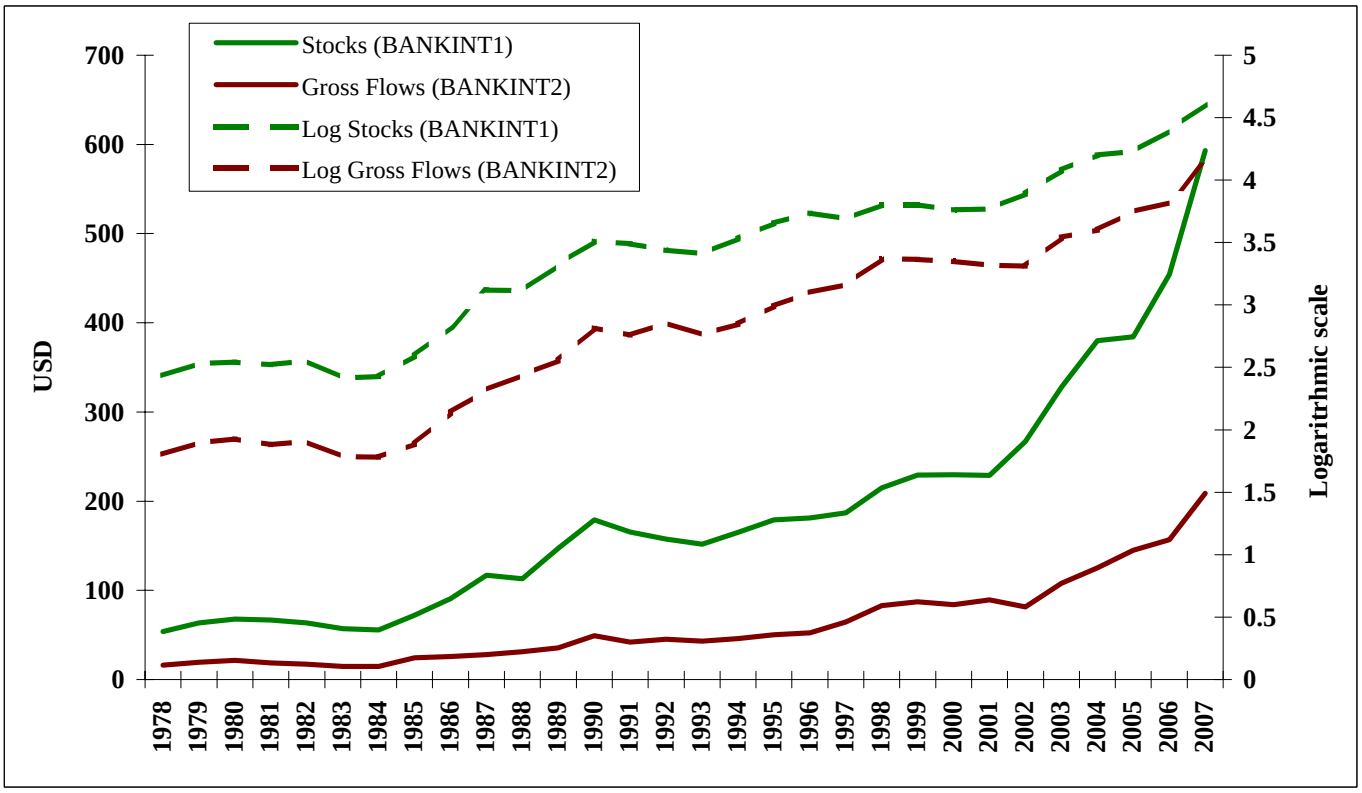


Figure 1 plots the evolution of the two banking integration measures, expressed in levels (solid lines) and in logs (dashed lines). *BANKINT1* denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population. *BANKINT2* denotes the average of the logs of bilateral gross flows of assets and liabilities normalized by the sum of the two countries' population.

Figure 2: GDP Synchronization across Time

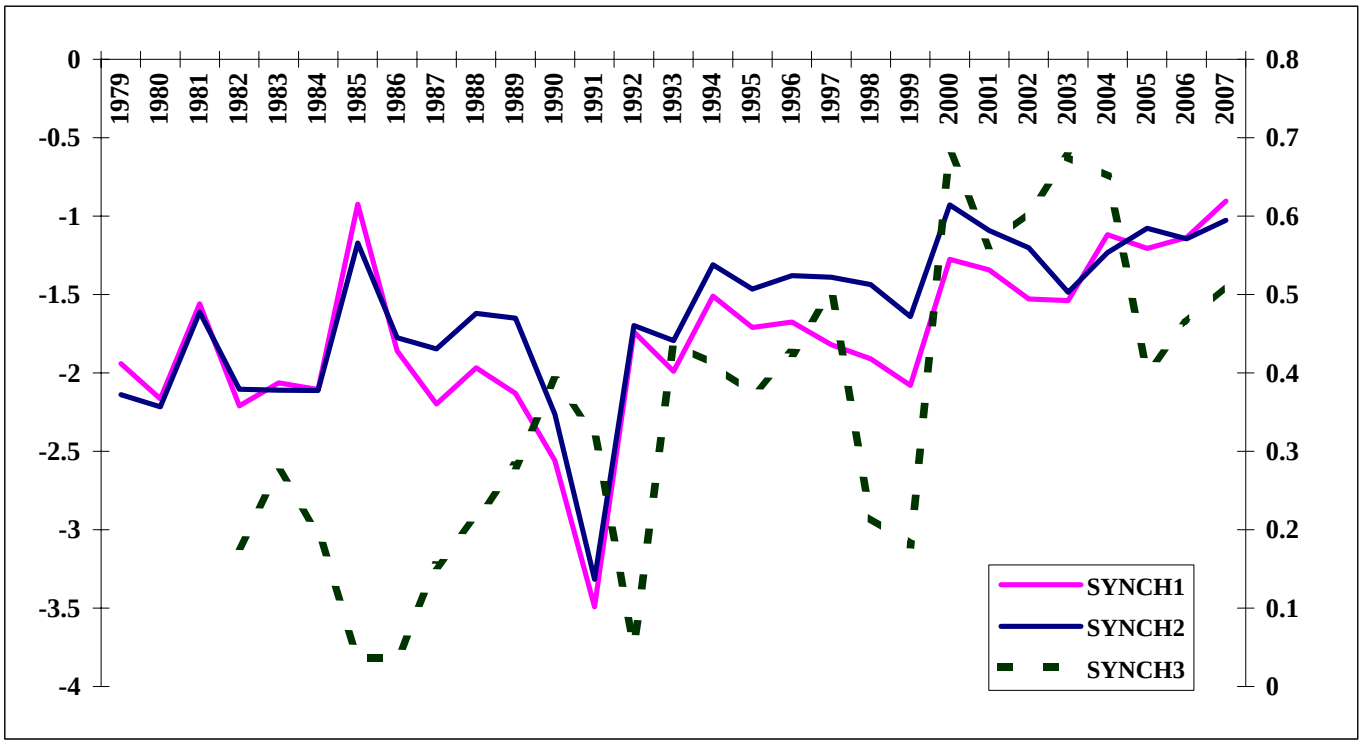


Figure 2 plots the evolution of the average value of each of the three synchronization measures employed in the empirical analysis across the 1978-2007 period. For each year the average is estimated across 190 country pairs (our sample spans 20 countries). *SYNCH1* is the negative value of the absolute difference in real p.c. GDP growth between country i and country j in year t. *SYNCH2* is the negative of the absolute difference of residual real p.c. GDP growth between country i and country j in year t. *SYNCH3* is the correlation of the cyclical component of real p.c. GDP between country i and j in each five-year period (estimated with the Baxter and King Band-Pass filter (2,8)). The correlation is estimated with a five-year rolling window. See the Supplementary Appendix for the evolution fo the three synchronization measures for each of the twenty countries in our sample.

Table 1: Descriptive Statistics

	Obs.	*mean*	*st. dev.*	*min*	*p25*	*p50*	*p75*	*max*
SYNCH1	5376	-1.76	1.60	-13.95	-2.44	-1.31	-0.62	0.00
SYNCH2	5376	-1.61	1.45	-12.55	-2.19	-1.23	-0.55	0.00
BI1	5376	195.54	507.25	0.00	9.52	41.95	155.70	9110.02
BI2	5376	63.99	151.05	0.04	4.87	18.37	62.62	4065.77
ERFSUM	5376	14.152	6.265	2.000	12.000	15.000	19.000	28
FSAPSUM	5376	4.250	10.206	0.000	0.000	0.000	1.000	42

The table reports summary statistics of the main variables used in the empirical analysis. *SYNCH1* is the negative value of the absolute difference in real p.c. GDP growth between country *i* and country *j* in year *t*. *SYNCH2* is the negative of the absolute difference of residual real p.c. GDP growth between country *i* and country *j* in year *t*. *BI1* denotes the average of bilateral stocks of assets and liabilities of countries *i* and *j* normalized by the sum of the two countries' population in year *t*. In the empirical specifications we use the log of this measure (*BANKINT1*). *BI2* denotes the average bilateral gross flows of assets and liabilities of countries *i* and *j* normalized by the sum of the two countries' population in year t. In the empirical specifications we use the log of this measure *(BANKINT2).*

ERSUM denotes the sum of the values of the Reinhart and Rogoff (2004) exchange rate classification of the countries *i* and *j* in the beginning of each year *t*. For each country the Reinhart and Rogoff (fine) grid ranges from 1 to 14 with higher values indicating a more flexible currency arrangement. *FSAPSUM* is a bilateral index that sums the number of EU laws in financial services that member countries have adopted in each year. These laws (Directives) were part of the Financial Services Action Plan (FSAP), initiated by the EU Commission in 1998 to integrate financial services in Europe. The value for each country ranges from 0 to 21, with higher values suggesting a higher degree of harmonization. For details on the construction of all variables see Section 2.2 and the Data Appendix.

Table 2: Banking Integration and Business Cycle (GDP) Synchronization

Dependent Variable:	Synchrononization Measure 1: Absolute differences in GDP growth				Synchrononization Measure 2: Absolute value of residual differences in GDP growth			
Integration Measure:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Integration	0.066	-0.186	0.066	-0.157	0.078	-0.068	0.087	-0.082
(*BANKINT*)	(0.022)	(0.039)	(0.029)	(0.040)	(0.017)	(0.029)	(0.023)	(0.032)
	2.96	*-4.82*	*2.23*	*-3.94*	*4.58*	*-2.38*	*3.80*	*-2.58*
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Country-pair FE	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.044	0.131	0.026	0.128	0.100	0.131	0.071	0.132
Observations	5,376	5,376	5,376	5,376	5,376	5,376	5,376	5,376
Country-pairs	190	190	190	190	190	190	190	190

Odd numbered columns report cross-sectional (between) coefficients. Even numbered columns report panel fixed-effect (within) coefficients. These models include a vector of country-pair fixed-effects and a vector of year fixed-effects. In the panel models standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation. In specifications (1)-(4) the dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t. In specifications (5)-(8) the dependent variable is minus one times the absolute difference of residual real p.c. GDP growth between country i and country j in year t.

BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows of assets and liabilities normalized by the sum of the two countries' population in year t. The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables. The Table also gives the number of country-pairs, the number of observations, the between R-squared (for the cross-sectional models) and the within R-squared (for the panel fixed-effect specifications).

Table 3: Banking Integration and Business Cycle Synchronization (GDP): Dynamic Panel Models

Dependent Variable:	Synchrononization Measure 1 *SYNCH1*		Synchrononization Measure 2 *SYNCH2*	
Integration Measure:	*BANKINT1*	*BANKINT2*	*BANKINT1*	*BANKINT2*
	(1)	(2)	(3)	(4)
Lag (1) Synchronization	0.209	0.211	0.198	0.197
(*SYNCH*)	(0.021)	(0.021)	(0.019)	(0.019)
	10.01	*10.06*	*10.39*	*10.4*
Lag (2) Synchronization	0.078	0.080	-0.032	-0.032
(*SYNCH*)	(0.018)	(0.018)	(0.013)	(0.013)
	4.33	*4.36*	*-2.46*	*-2.53*
Lag (1) Banking Integration	-0.108	-0.098	-0.063	-0.074
(*BANKINT*)	(0.029)	(0.031)	(0.028)	(0.030)
	-3.67	*-3.12*	*-2.29*	*-2.46*
Long-run effect - Banking Integration	-0.152	-0.138	-0.076	-0.089
F-score	13.04	9.37	5.29	5.98
p-value	*0.000*	*0.000*	*0.023*	*0.015*
Year FE	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes
R-squared	0.188	0.187	0.167	0.168
Observations	5,029	5,024	5,029	5,024
Country-pairs	190	190	190	190

The Table reports panel fixed-effect coefficients. All models include a vector of country-pair fixed-effects and a vector of year fixed-effects. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In specifications (1)-(2) the dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t *(SYNCH1)*. In specifications (3)-(4) the dependent variable is minus one times the absolute difference of residual real p.c. GDP growth between country i and country j in year t *(SYNCH2)*. All specifications include two lags of the dependent variable.

BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population in year t. The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables. The Table also gives the long-run coefficient of banking integration and the corresponding F-score and p-value.

Table 4: Banking Integration and Business Cycle (GDP) Synchronization: Six non-overlapping periods of 5-year averaged data

Dependent Variable:	Synchrononization Measure 3 *SYNCH3*				Synchrononization Measure 3 *SYNCH3*			
Integration Measure:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Integration	0.031	-0.054	0.043	-0.039	0.025	-0.113	0.038	-0.104
(*BANKINT*)	(0.008)	(0.020)	(0.010)	(0.023)	(0.010)	(0.029)	(0.012)	(0.032)
	3.98	*-2.68*	*4.19*	*-1.70*	*2.55*	*-3.91*	*3.11*	*-3.2*
Trade					5.015	-1.355	4.738	-1.329
(*TRADE*)					(1.208)	(1.405)	(1.191)	(1.463)
					4.15	*-0.96*	*3.98*	*-0.91*
Specialization					-0.042	-0.024	-0.045	-0.015
(*SPEC*)					(0.019)	(0.029)	(0.019)	(0.029)
					-2.22	*-0.83*	*-2.36*	*-0.53*
Period FE	No	Yes	No	Yes	No	Yes	No	Yes
Country-pair FE	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.078	0.226	0.085	0.222	0.253	0.28	0.266	0.274
Observations	1,118	1,118	1,116	1,116	820	820	818	818
Country-pairs	190	190	171	190	190	190	171	190

Odd numbered columns report cross-sectional (between) coefficients. Even numbered columns report panel fixed-effect coefficients (within). These models include a vector of country-pair fixed-effects and a vector of period fixed-effects. In the panel models standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In all specifications the dependent variable is the correlation of the cyclical component of real p.c. GDP between country *i* and *j* in each five-year period (*SYNCH3*; estimated with the Baxter and King Band-Pass filter (2,8)).

BANKINT1 denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population. *BANKINT2* denotes the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population. *TRADE* denotes the log of real bilateral imports and exports as a share of the two countries' GDP. *SPEC* is an index of specialization that reflects the dis-similarities in industrial production (in manufacturing) between the two countries in each period. All independent variables are averaged over each 5-year period. The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables. The Table also gives the number of country-pairs, the number of observations, the between R-squared (for the cross-sectional models) and the within R-squared (for the panel fixed-effect specifications).

Table 5: Financial Sector Legislation Harmonization, Banking Integration and Business Cycle Synchronization (GDP):
Panel Instrumental Variables (IV) Fixed-Effects Estimates with Annual Data

	Static Panel Estimates				Dynamic Panel Estimates			
Integration Measure:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
Dependent Variable:	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 2SLS Estimates: Dependent Variable is Synchronization								
Banking Integration	-0.263	-0.371	-0.263	-0.370	-0.229	-0.370	-0.238	-0.382
(*BANKINT*)	(0.160)	(0.151)	(0.155)	(0.142)	(0.134)	(0.134)	(0.132)	(0.129)
	-1.64	*-2.46*	*-1.69*	*-2.60*	*-1.71*	*-2.76*	*-1.80*	*-2.96*
Panel B: 1st Stage Estimates and Diagnostics: Dependent Variable is Banking Integration								
Financial Sector	0.225	0.225	0.222	0.222	0.223	0.225	0.215	0.216
Harmonization	(0.049)	(0.049)	(0.042)	(0.042)	(0.048)	(0.048)	(0.041)	(0.041)
(*HARM*)	*4.56*	*4.56*	*5.31*	*5.31*	*4.60*	*4.67*	*5.24*	*5.28*
F -score	20.77	20.77	28.15	28.15	21.17	21.77	27.46	27.88
p -value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5376	5376	5376	5376	5029	5029	5024	5024
Country-pairs	190	190	190	190	190	190	190	190

The Table reports (static and dynamic) panel fixed-effect instrumental variable coefficients. Panel A reports 2nd-Stage estimates. Panel B reports 1st-stage estimates and regression diagnostics. First stage regression includes all the controls from the second stage. All models include a vector of country-pair fixed-effects and a vector of year fixed-effects. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In specifications (1), (3), (5) and (7) the dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t. In specifications (2), (4), (6) and (8) the dependent variable is minus one times the absolute difference of residual real p.c. GDP growth between country i and country j in year t.

BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population in year t. The two banking integration inidcators are instrumented with a bilateral time-varying measure of harmoninzation of legislative and regulatory financial policies (conducted in the context of the Financial Services Action Plan). The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables.

Table 6: Exchange Rate Regime, Banking Integration and Business Cycle Synchronization (GDP): Panel Instrumental Variables (IV) Fixed-Effects Estimates with Annual Data

	Static Panel Estimates				Dynamic Panel Estimates			
Integration Measure:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
Dependent Variable:	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 2SLS Estimates: Dependent Variable is Synchronization								
Banking Integration	-0.248	-0.259	-0.264	-0.281	-0.310	-0.273	-0.339	-0.297
(*BANKINT*)	(0.150)	(0.149)	(0.164)	(0.158)	(0.125)	(0.118)	(0.132)	(0.124)
	-1.65	*-1.74*	*-1.61*	*-1.78*	*-2.48*	*-2.32*	*-2.57*	*-2.39*
Panel B: 1st Stage Estimates and Diagnostics: Dependent Variable is Banking Integration								
Exchange Rate	-0.227	-0.227	-0.203	-0.203	-0.272	-0.276	-0.241	-0.244
Regime Flexibility	(0.053)	(0.053)	(0.042)	(0.042)	(0.054)	(0.056)	(0.043)	(0.044)
(*ERSUM*)	*-4.31*	*-4.31*	*-4.88*	*-4.88*	*-5.01*	*-4.97*	*-5.62*	*-5.61*
F -score	18.54	18.54	23.79	23.79	25.06	24.69	31.55	31.52
p -value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5376	5376	5376	5376	5029	5029	5024	5024
Country-pairs	190	190	190	190	190	190	190	190

The Table reports (static and dynamic) panel fixed-effect instrumental variable coefficients. Panel A reports 2nd-stage estimates. Panel B reports 1st-stage estimates and regression diagnostics. First stage regression includes all controls from the second stage. All models include a vector of country-pair fixed-effects and a vector of year fixed-effects. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In specifications (1), (3), (5) and (7) the dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t. In specifications (2), (4), (6) and (8) the dependent variable is minus one times the absolute difference of residual real p.c. GDP growth between country i and country j in year t.

BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks (holdings) in assets and liabilities normalized by the sum of the two countries' population in year t. *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population in year t. The two banking integration inidcators are instrumented with a bilateral time-varying measure of the flexibility of the exchange rate regime (*ERSUM*). The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables.

Table 7: Exchange Rate Regime, Banking Integration and Business Cycle Synchronization: Panel Instrumental Variables (IV) Fixed-Effects Estimates in 5-year periods

Integration Measure:	*BANKINT1*		*BANKINT2*	
Dependent Variable:	*SYNCH3*	*SYNCH3*	*SYNCH3*	*SYNCH3*
	(1)	(2)	(3)	(4)
Panel A: 2SLS Estimates: Dependent Variable is Synchronization				
Banking Integration (*BANKINT*)	-0.227	-0.383	-0.250	-0.382
	(0.074)	(0.154)	(0.081)	(0.140)
	-3.06	*-2.49*	*-3.09*	*-2.72*
Trade (*TRADE*)		0.167		0.473
		(1.755)		(1.723)
		0.10		*0.27*
Specialization (*SPEC*)		-0.091		-0.066
		(0.049)		(0.041)
		-1.88		*-1.60*
Panel B: 1st Stage Estimates and Diagnostics				
Exchange Rate Regime Flexibility	-0.283	-0.201	-0.258	-0.201
(*ERSUM*)	(0.064)	(0.069)	(0.050)	(0.051)
	-4.42	*-2.92*	*-5.16*	*-3.95*
F-score	18.55	8.50	26.67	15.63
p-value	*0.00*	*0.00*	*0.00*	*0.00*
Period FE	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes
Observations	1118	817	1116	814
Country-pairs	190	187	190	186

Panel A reports 2nd-stage estimates. Panel B reports 1st-stage estimates and regression diagnostics. First stage regression include all controls from the second stage. The dependent variable is the correlation of the cyclical component of real p.c. GDP between country i and j in each five-year period (estimated with the Baxter and King Band-Pass filter (2,8)). The standard errors are adjusted as in the previous tables.

BANKINT1 denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population. *BANKINT2* denotes the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population. *TRADE* denotes the log of real bilateral imports and exports as a share of the two countries' GDP. *SPEC* is an index of specialization that reflects the dis-similarities in industrial production between the two countries in each period. The Data Appendix and Section 3.1. give details on the construction and the sources of all variables. All independent variables are averaged over each 5-year period. The two banking integration inidcators are instrumented with a bilateral time-varying measure of the flexibility of the exchange rate regime.

Table 8: Exchange Rate Regime, Financial Sector Legislation Harmonization, Banking Integration and Business Cycle Synchronization (GDP)
Panel Instrumental Variables (IV) Fixed-Effects Estimates with Annual Data

	Static Panel Estimates				Dynamic Panel Estimates			
Integration Measure:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
Dependent Variable:	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*	*SYNCH1*	*SYNCH2*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: 2SLS Estimates: Dependent Variable is Synchronization								
Banking Integration (*BANKINT*)	-0.2534	-0.3006	-0.2636	-0.3223	-0.2914	-0.2941	-0.309	-0.3218
	(0.1401)	(0.1372)	(0.1439)	(0.1365)	(0.1190)	(0.1137)	(0.1218)	(0.1159)
	-1.81	*-2.19*	*-1.83*	*-2.36*	*-2.45*	*-2.59*	*-2.54*	*-2.78*
Panel B: 1st Stage Estimates and Diagnostics: Dependent Variable is Banking Integration								
Exchange Rate Regime Flexibility (*ERSUM*)	-0.1699	-0.1699	-0.1399	-0.1399	-0.2276	-0.2322	-0.1916	-0.1947
	(0.5587)	(0.5587)	(0.0435)	(0.0435)	(0.0579)	(0.0597)	(0.0453)	(0.0461)
	3.04	*3.04*	*3.21*	*3.21*	*3.93*	*3.89*	*4.23*	*4.22*
Financial Sector Harmonization (*HARM*)	0.1301	0.1301	0.1439	0.1439	0.0980	0.0976	0.1099	0.1093
	(0.0500)	(0.0500)	(0.0424)	(0.0424)	(0.0490)	(0.0490)	(0.0417)	(0.0417)
	2.61	*2.61*	*3.39*	*3.39*	*2.00*	*1.99*	*2.63*	*2.62*
F-score	11.87	11.87	15.64	15.64	14.41	14.06	17.73	17.85
	0.00	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Sargan-Hansen Overidentification	0.013	0.784	0.466	0.001	0.564	0.896	0.851	0.631
	0.91	*0.38*	*0.49*	*0.99*	*0.45*	*0.34*	*0.36*	*0.43*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5376	5376	5376	5376	5029	5029	5024	5024
Country-pairs	190	190	190	190	190	190	190	190

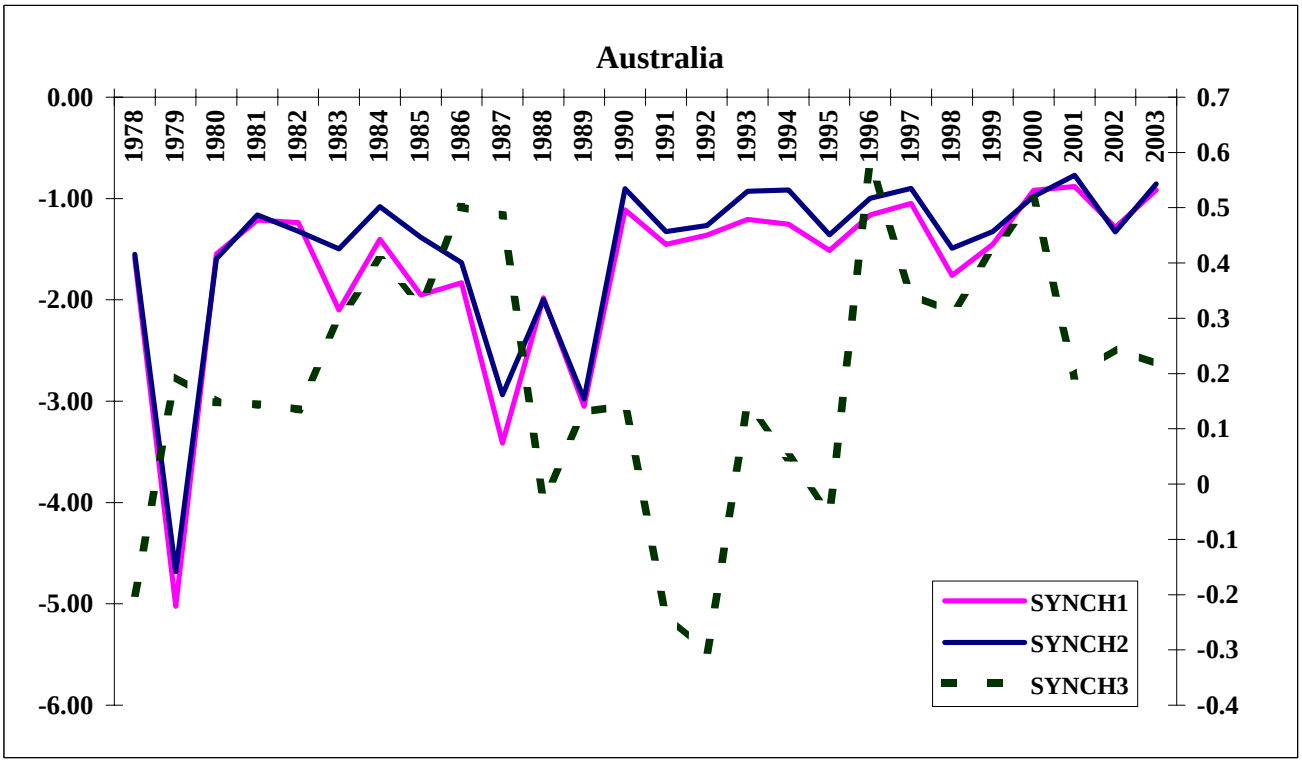
Table 8-Notes

Panel A reports 2nd-stage estimates. Panel B reports 1st-stage estimates and regression diagnostics. First stage regression includes all controls from the second stage. In specifications (1), (3), (5) and (7) the dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t. In specifications (2), (4), (6) and (8) the dependent variable is minus one times the absolute difference of residual real p.c. GDP growth between country i and country j in year t.

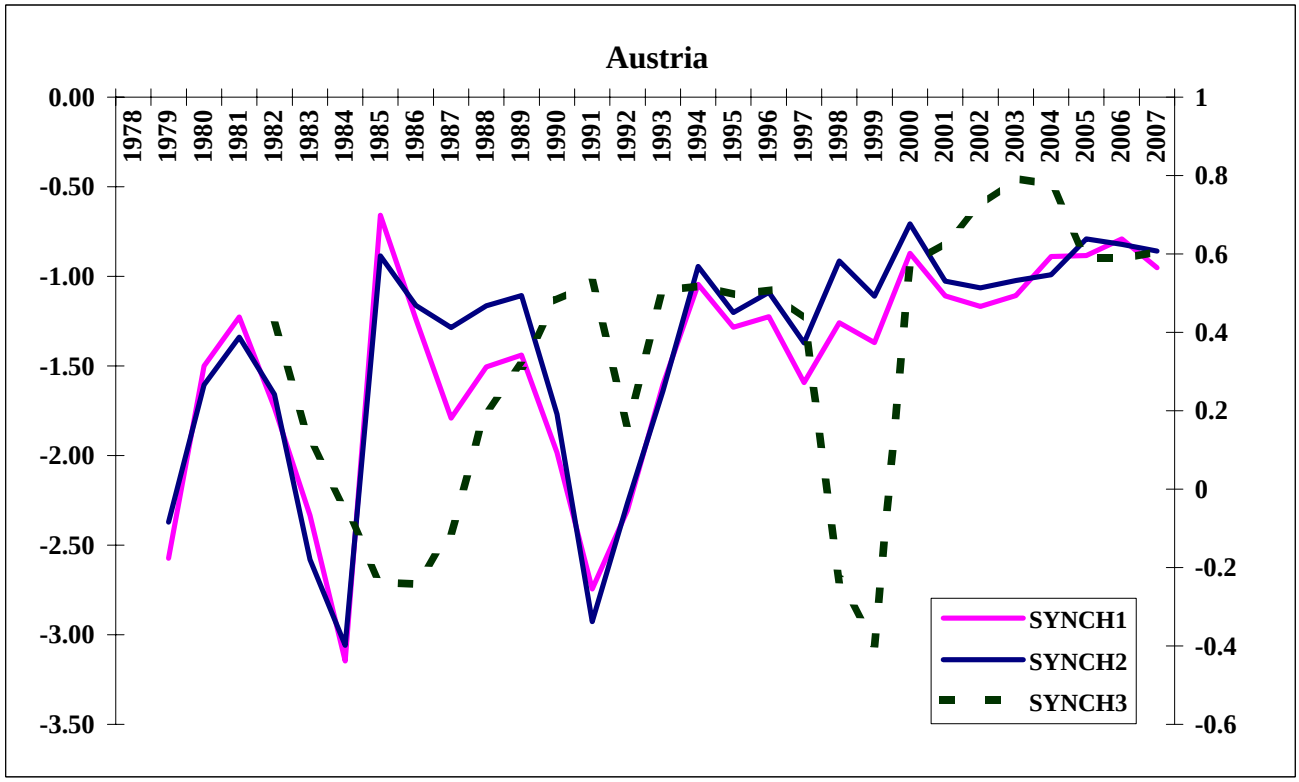
BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks ofassets and liabilities normalized by the sum of the two countries' population in year t. *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population in year t. The two banking integration inidcators are instrumented with the following instruments: (i) bilateral time-varying measure of the flexibility of the exchange rate regime; (ii) a bilateral time-varying measure of harmoninzation of legislative and regulatory financial policies (conducted in the context of the Financial Services Action Plan). The Data Appendix and Section 3.1. gives details on the construction and the sources of all variables. The table also reports the Sargan-Hansen test of over-identifying restrictions. Under the null hypothesis all instruments are valid.

Supplementary Appendix

Appendix Figure 1.1

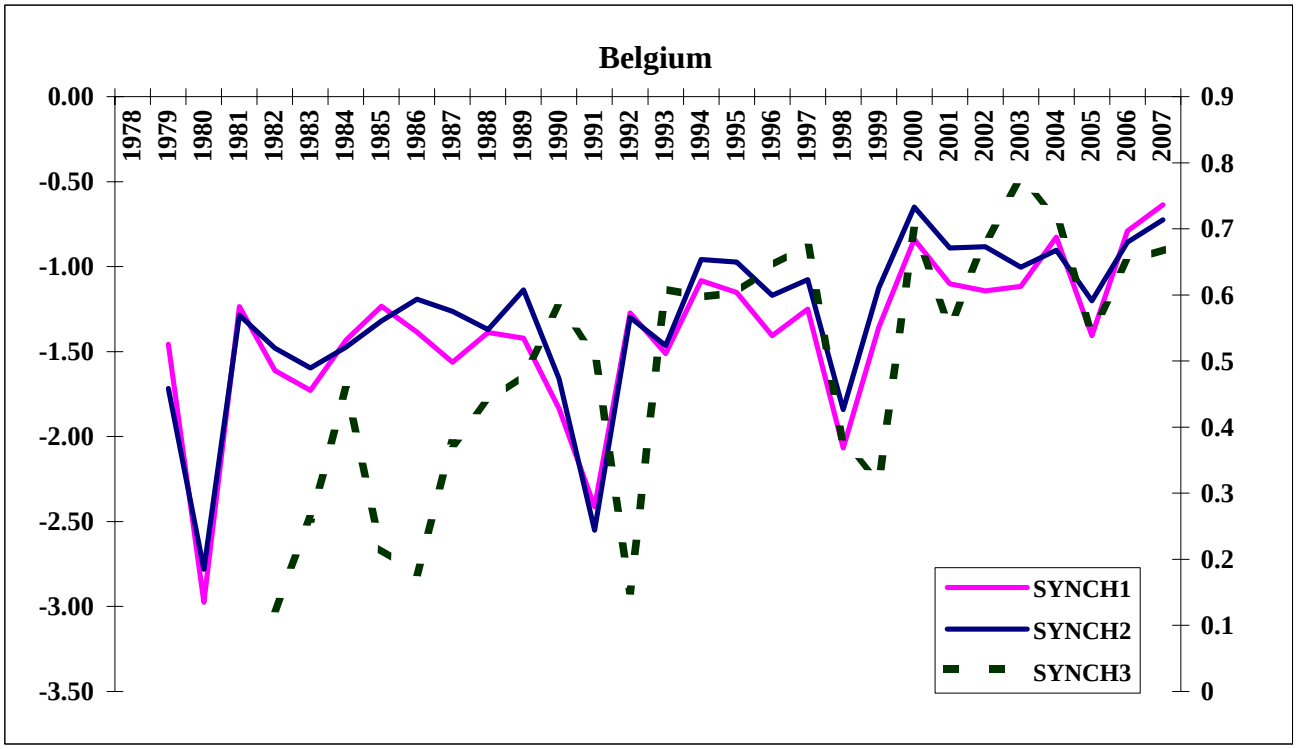


Appendix Figure 1.2

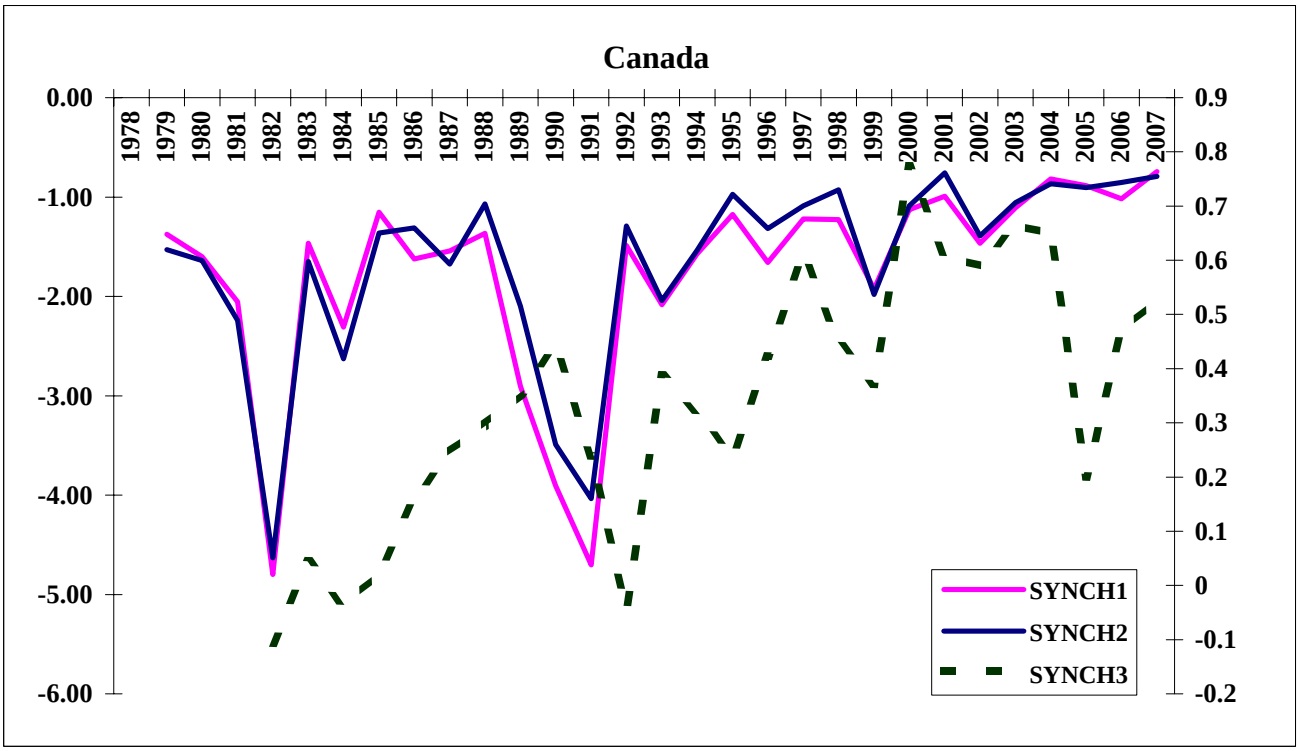


Supplementary Appendix

Appendix Figure 1.3

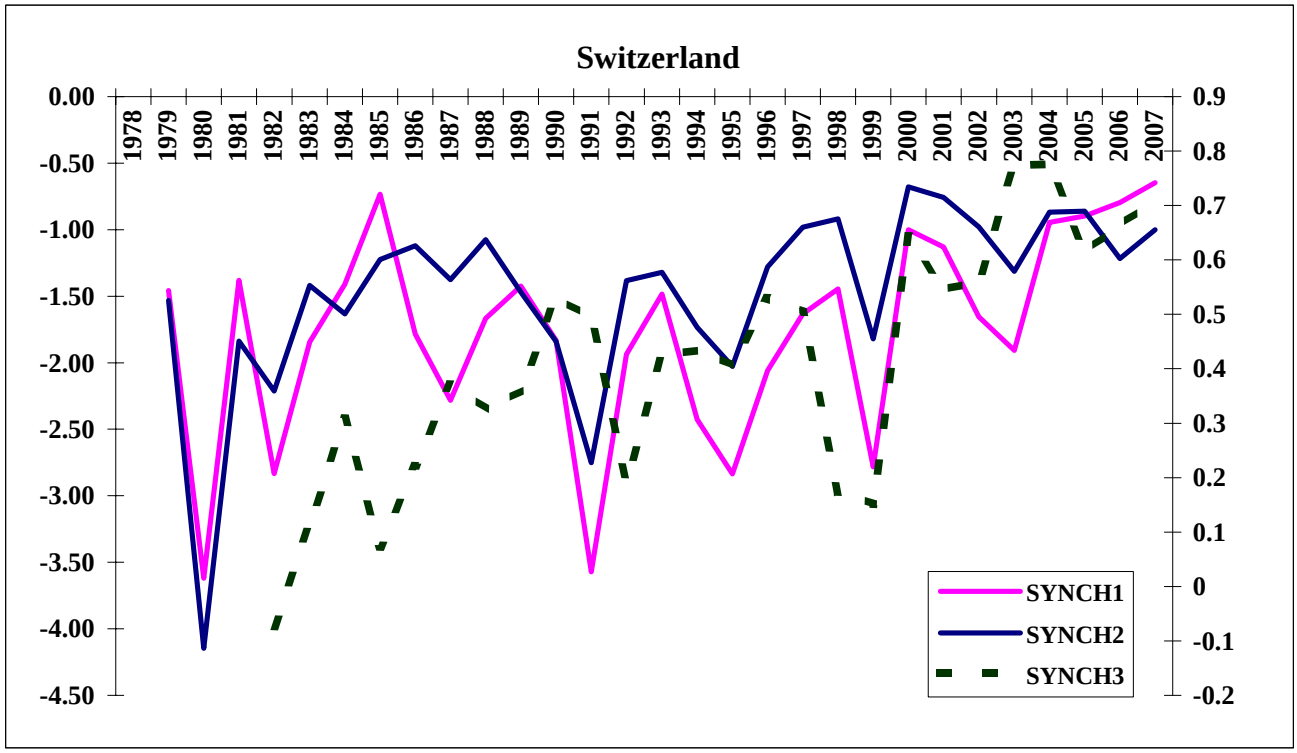


Appendix Figure 1.4

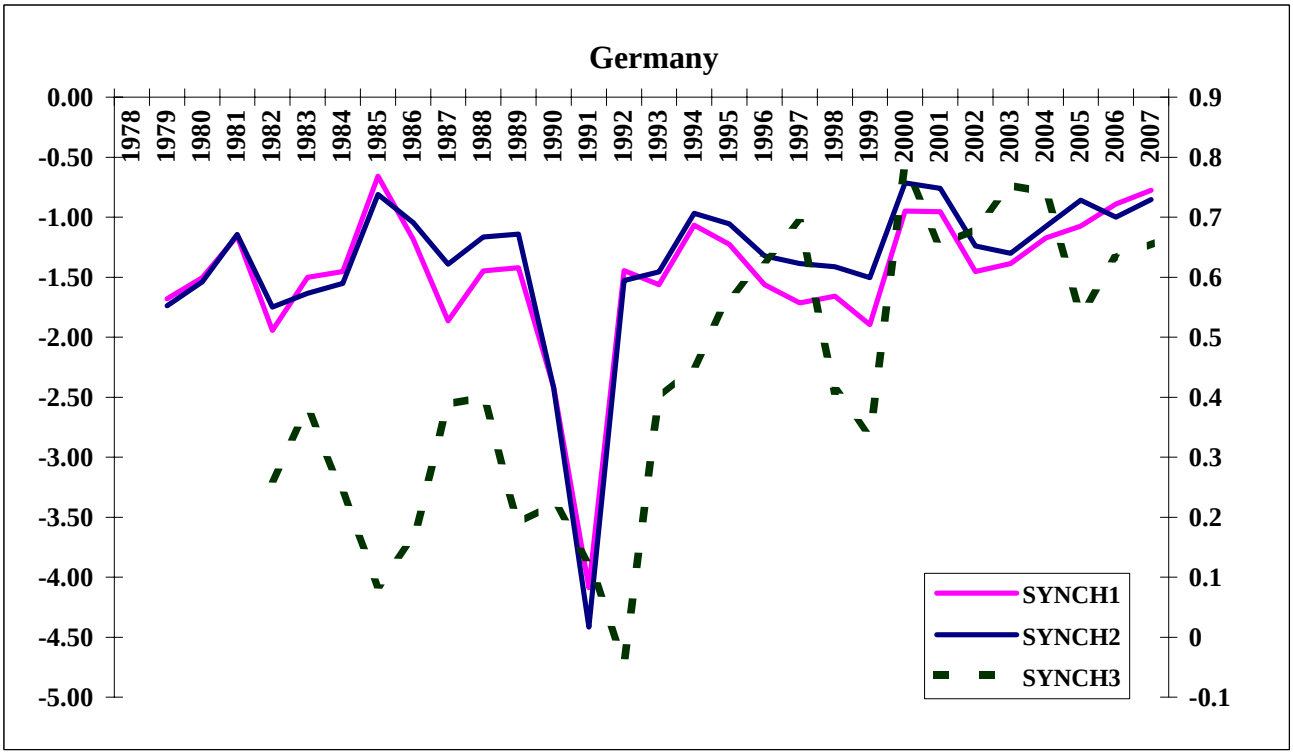


Supplementary Appendix

Appendix Figure 1.5

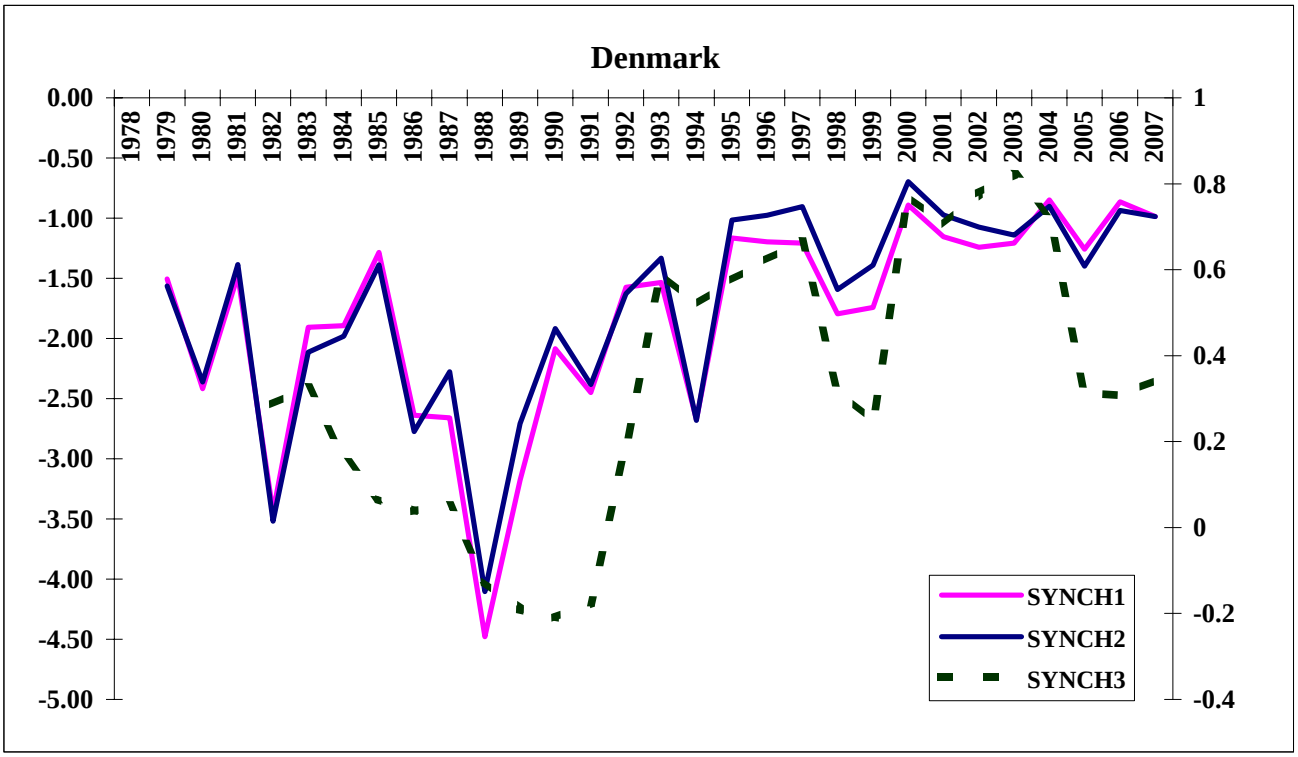


Appendix Figure 1.6

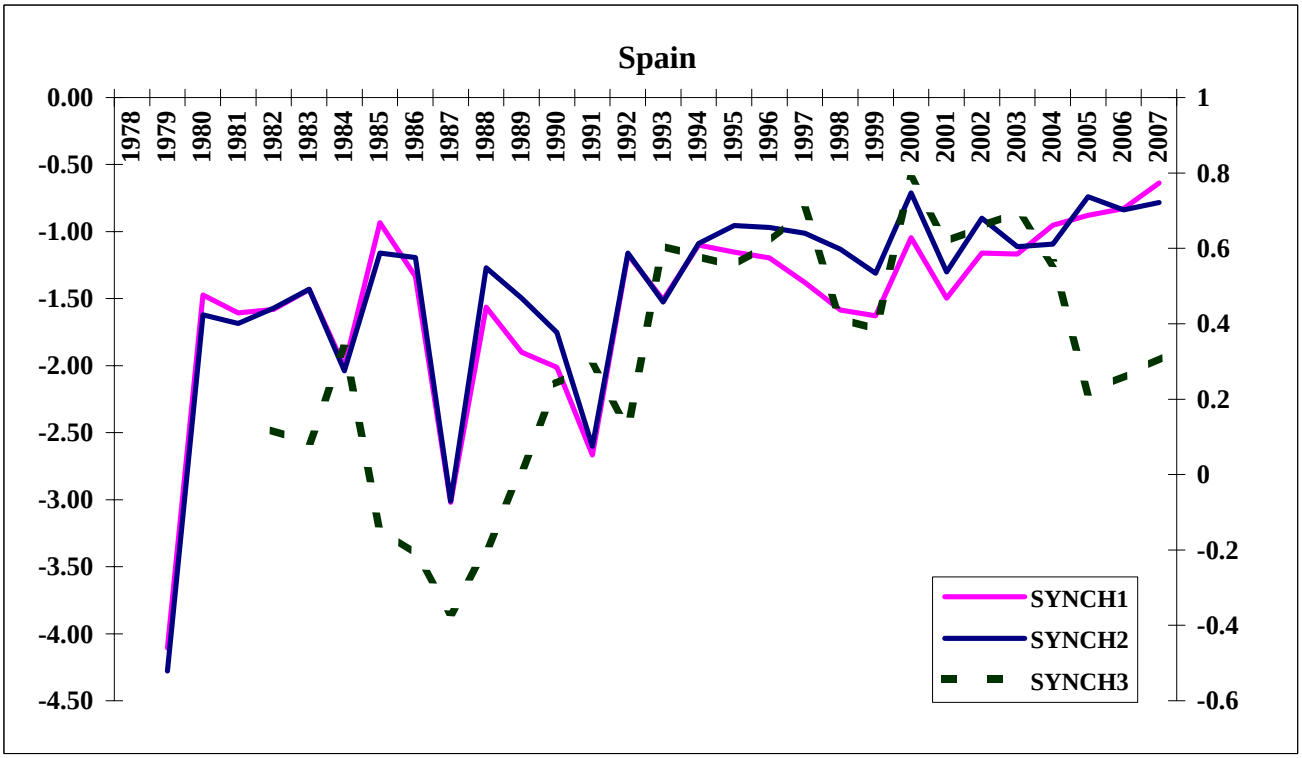


Supplementary Appendix

Appendix Figure 1.7

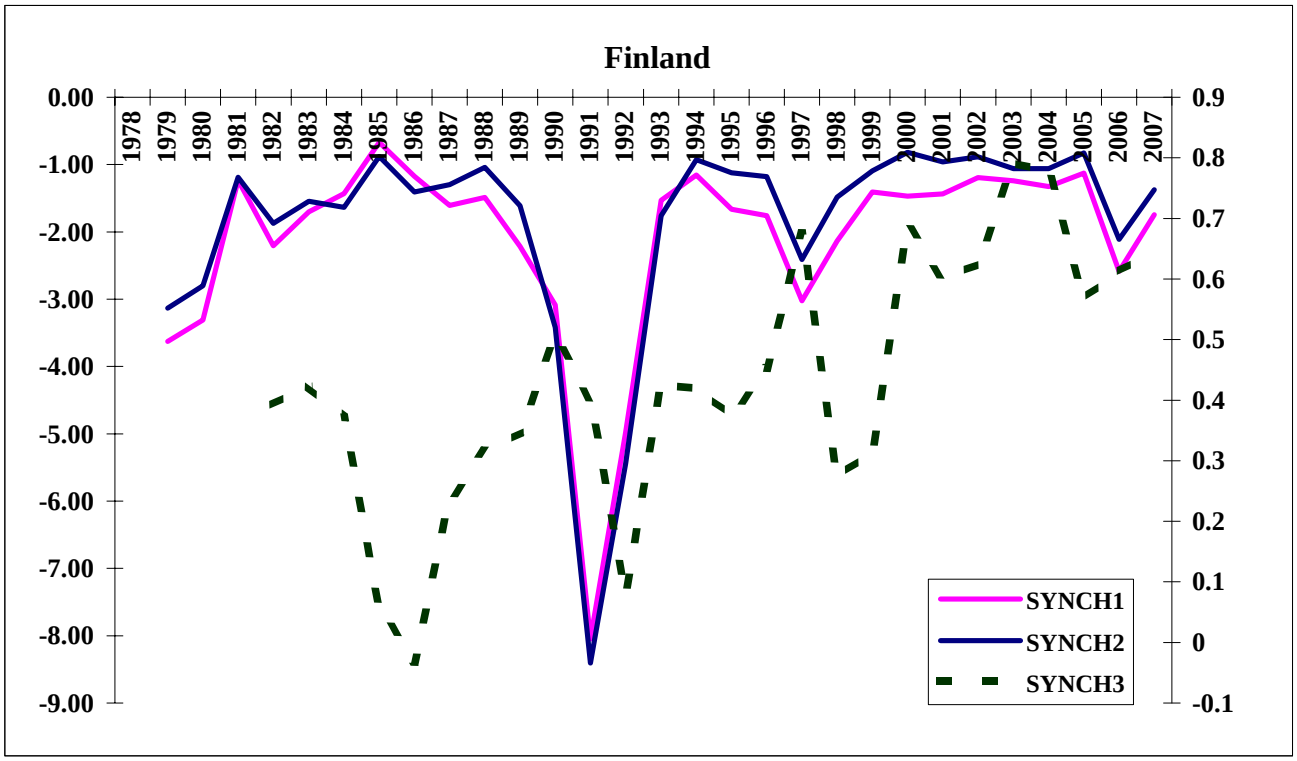


Appendix Figure 1.8

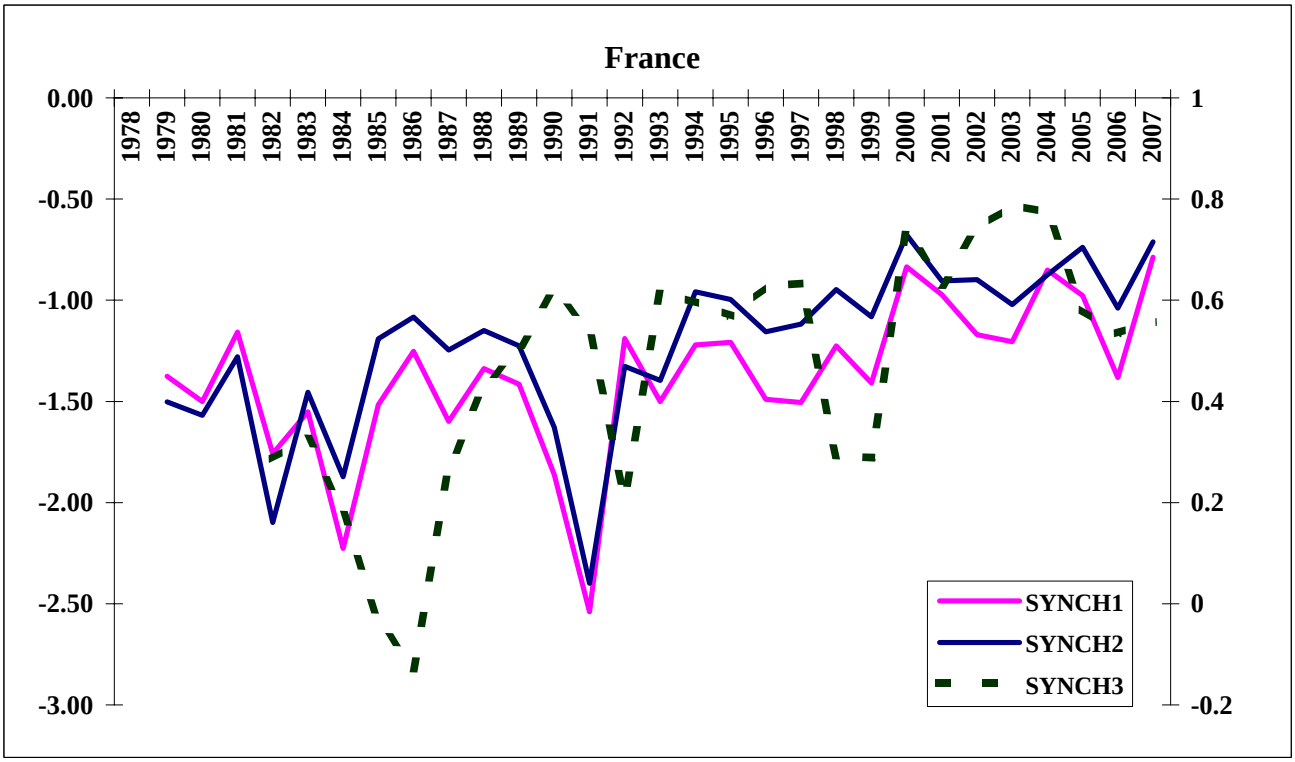


Supplementary Appendix

Appendix Figure 1.9

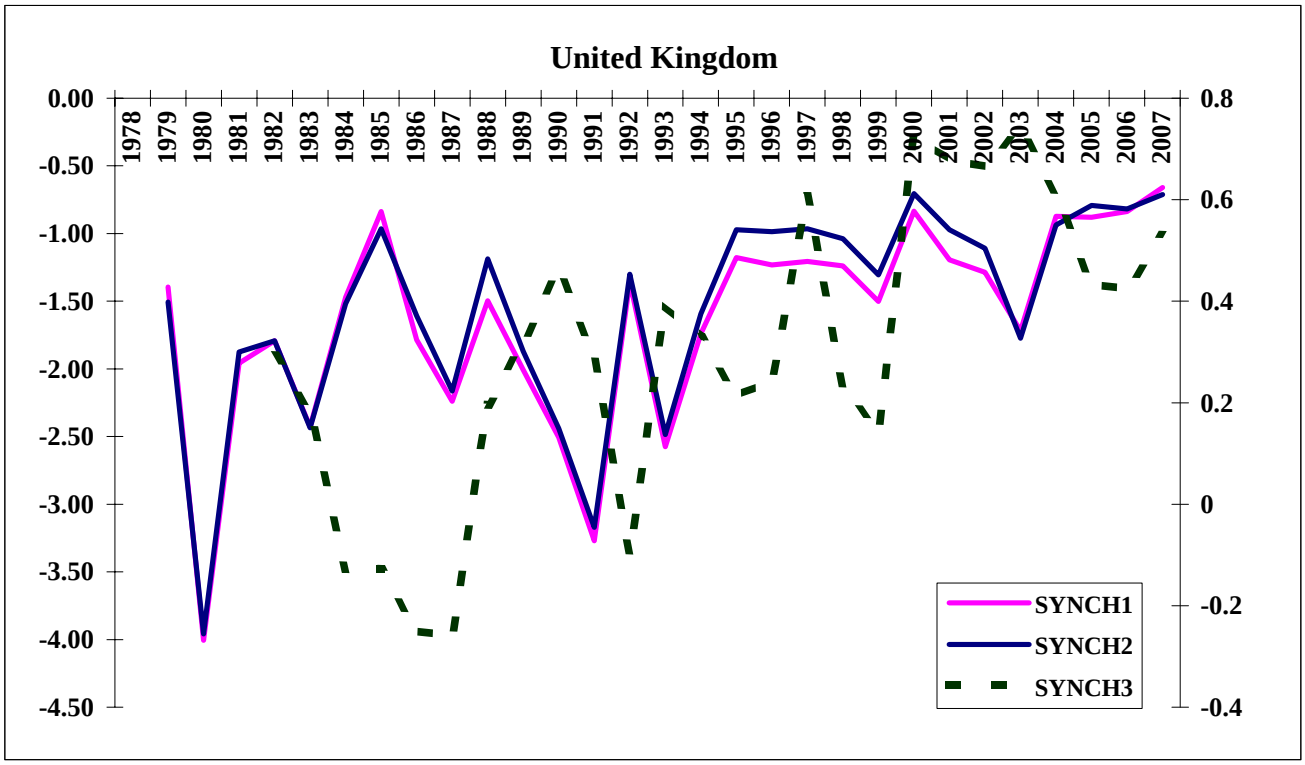


Appendix Figure 1.10

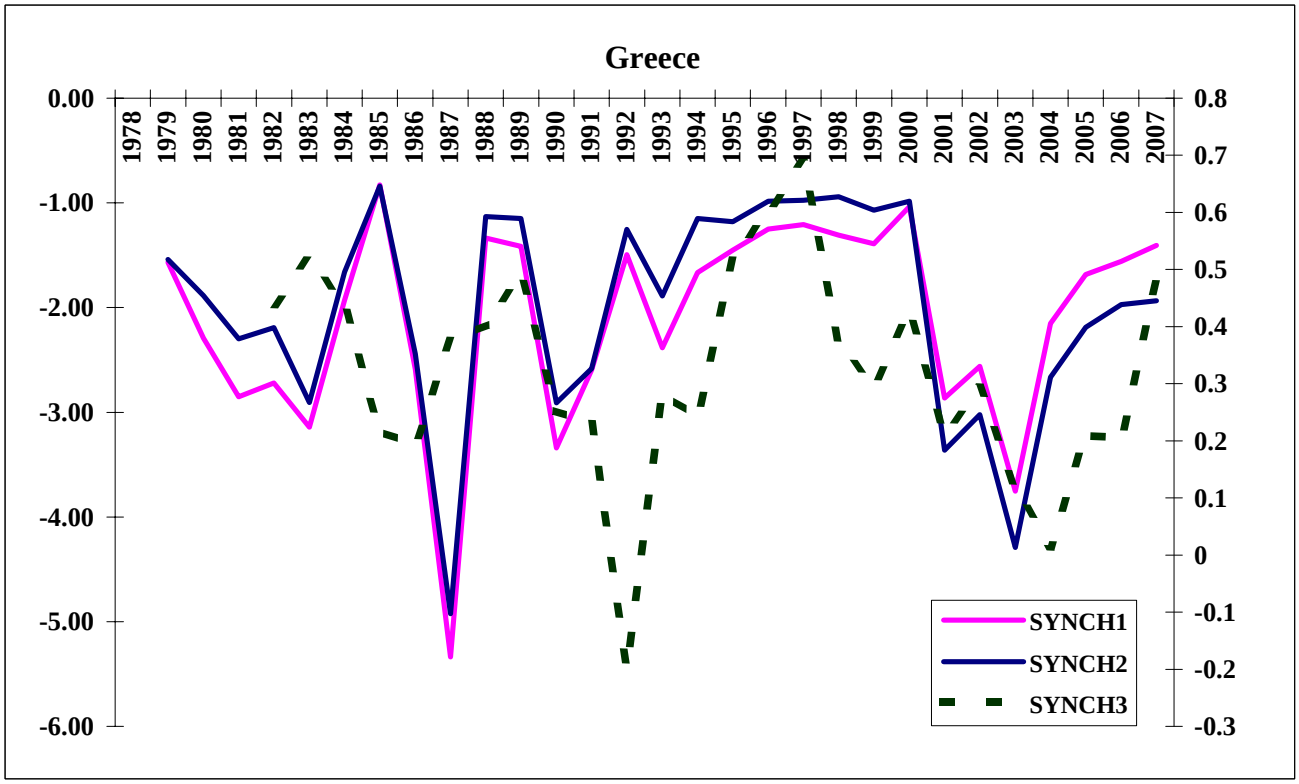


Supplementary Appendix

Appendix Figure 1.11

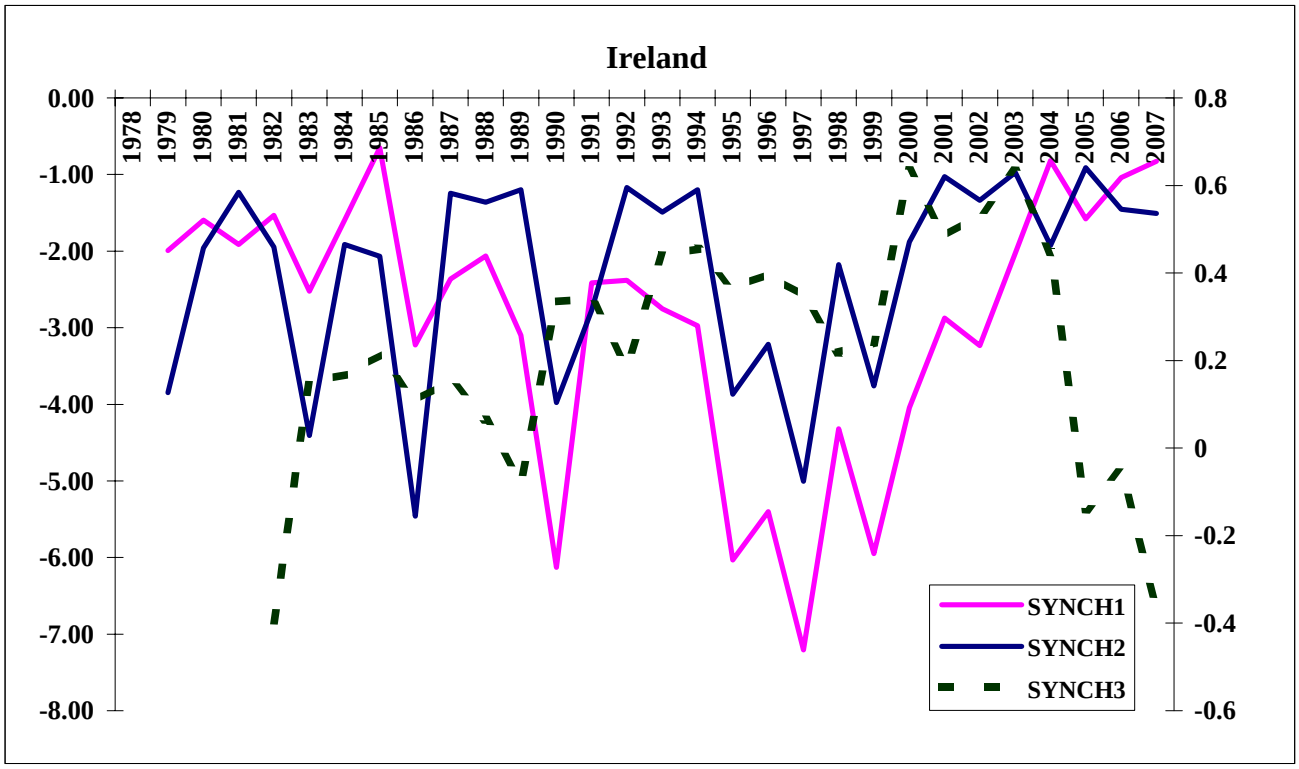


Appendix Figure 1.12

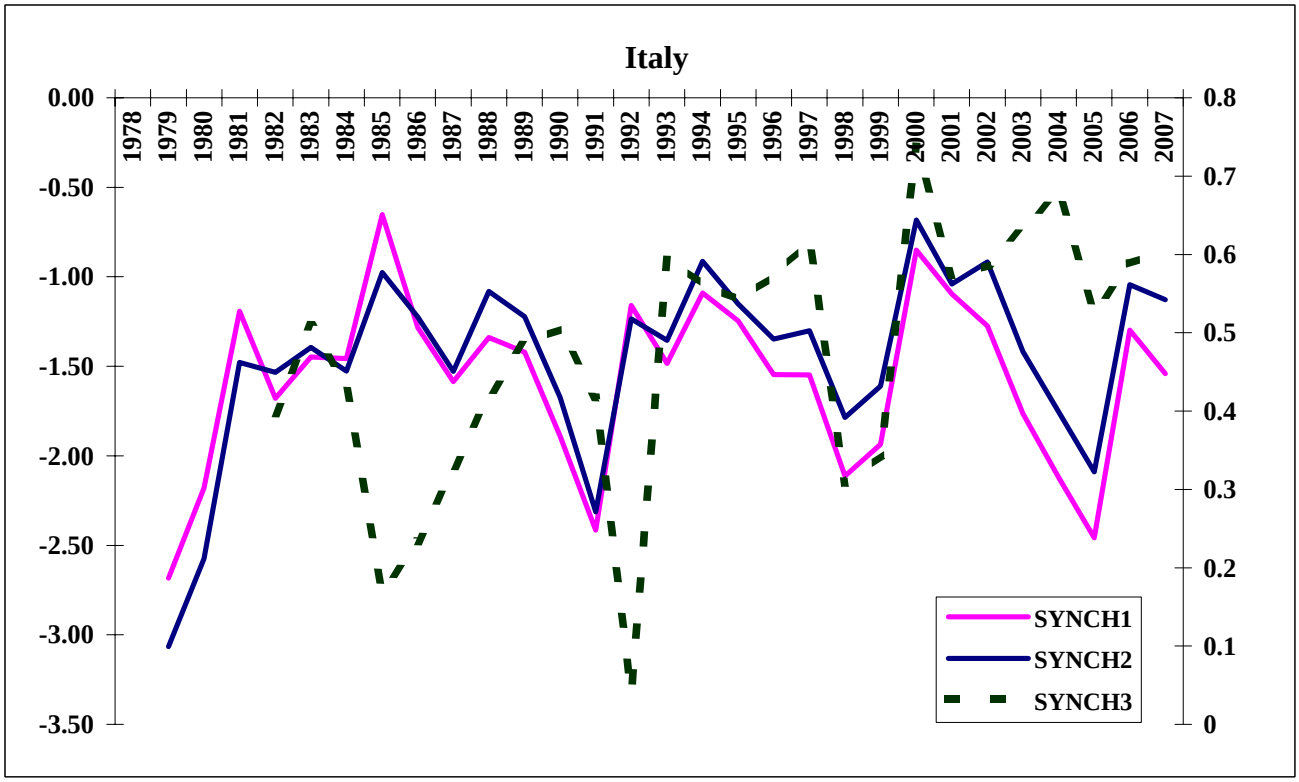


Supplementary Appendix

Appendix Figure 1.13

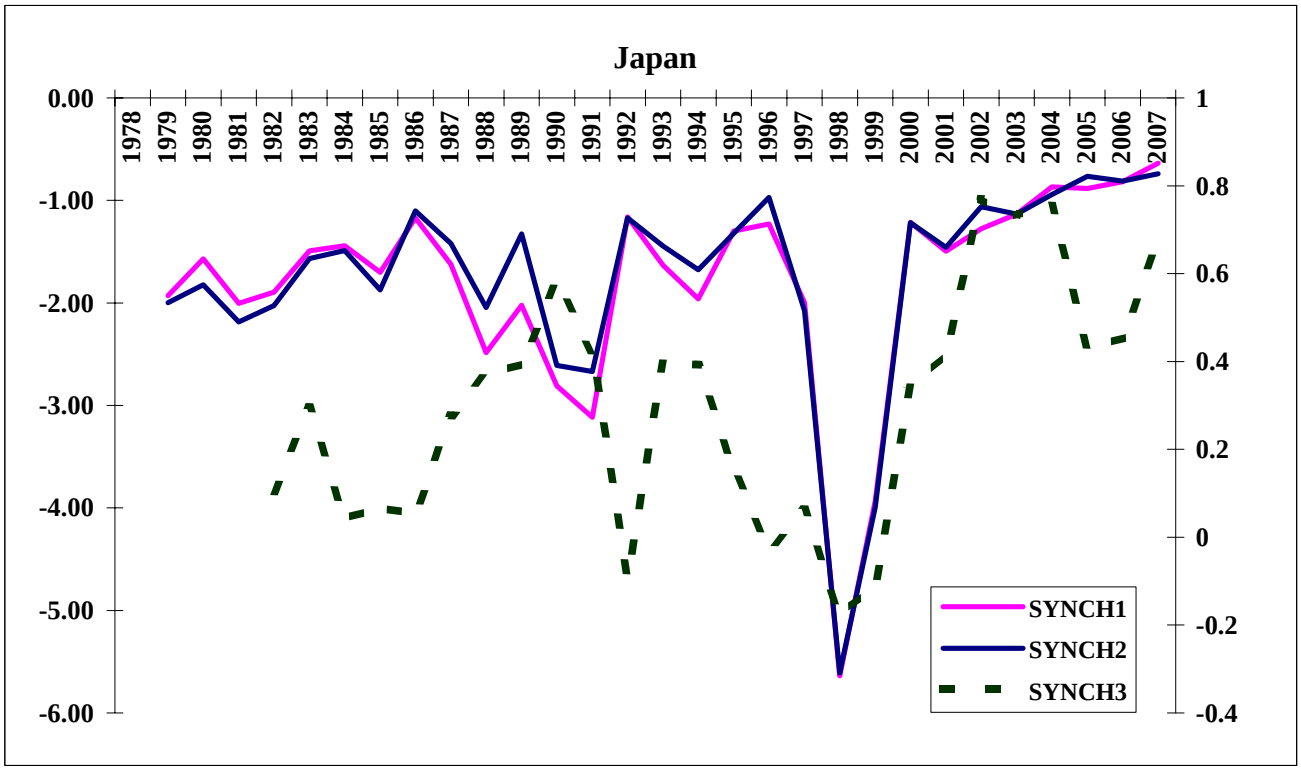


Appendix Figure 1.14

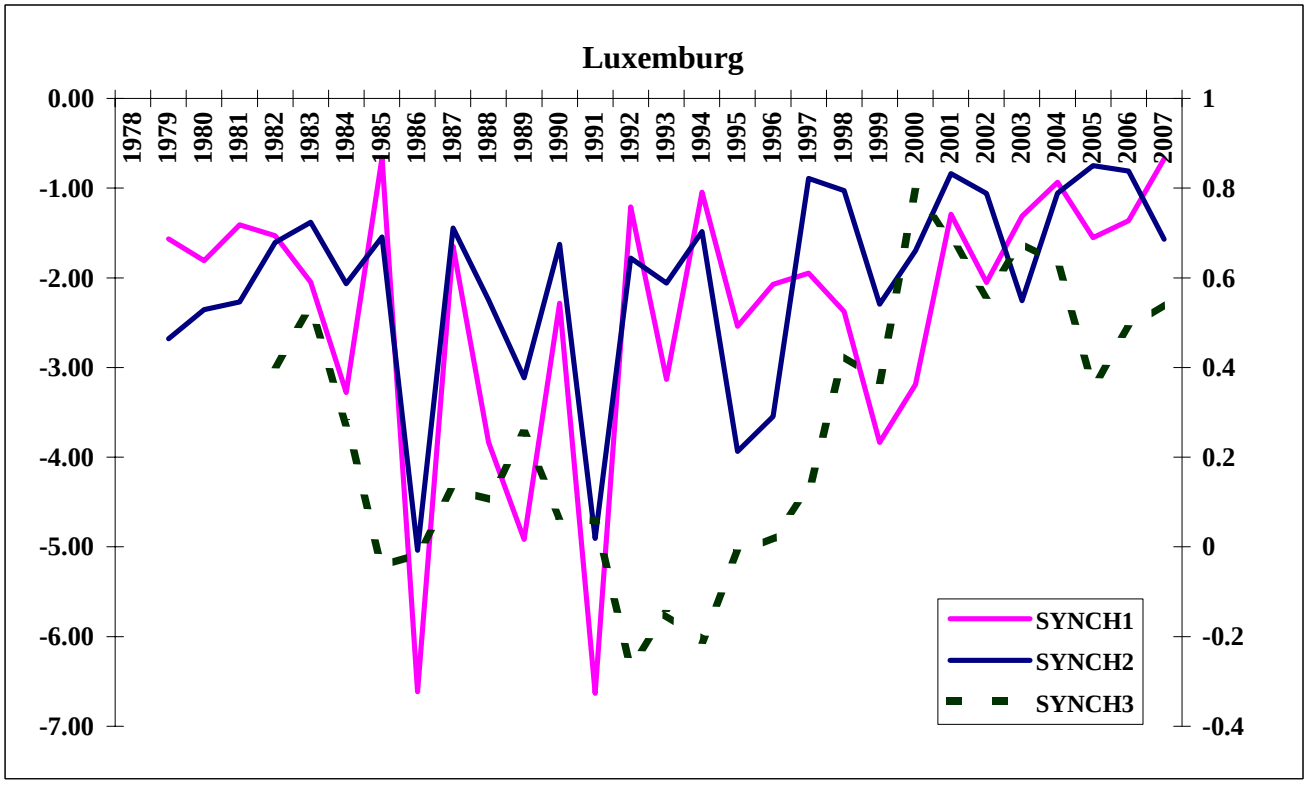


Supplementary Appendix

Appendix Figure 1.15

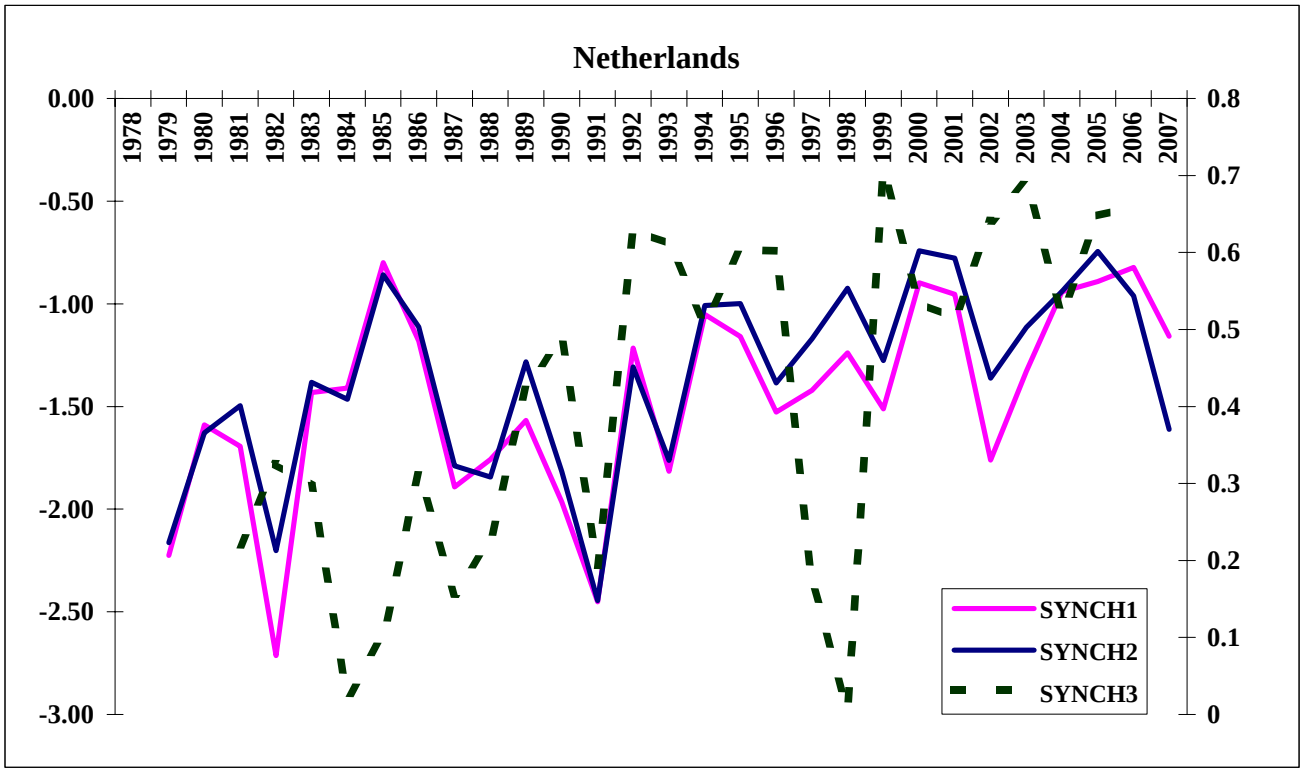


Appendix Figure 1.16

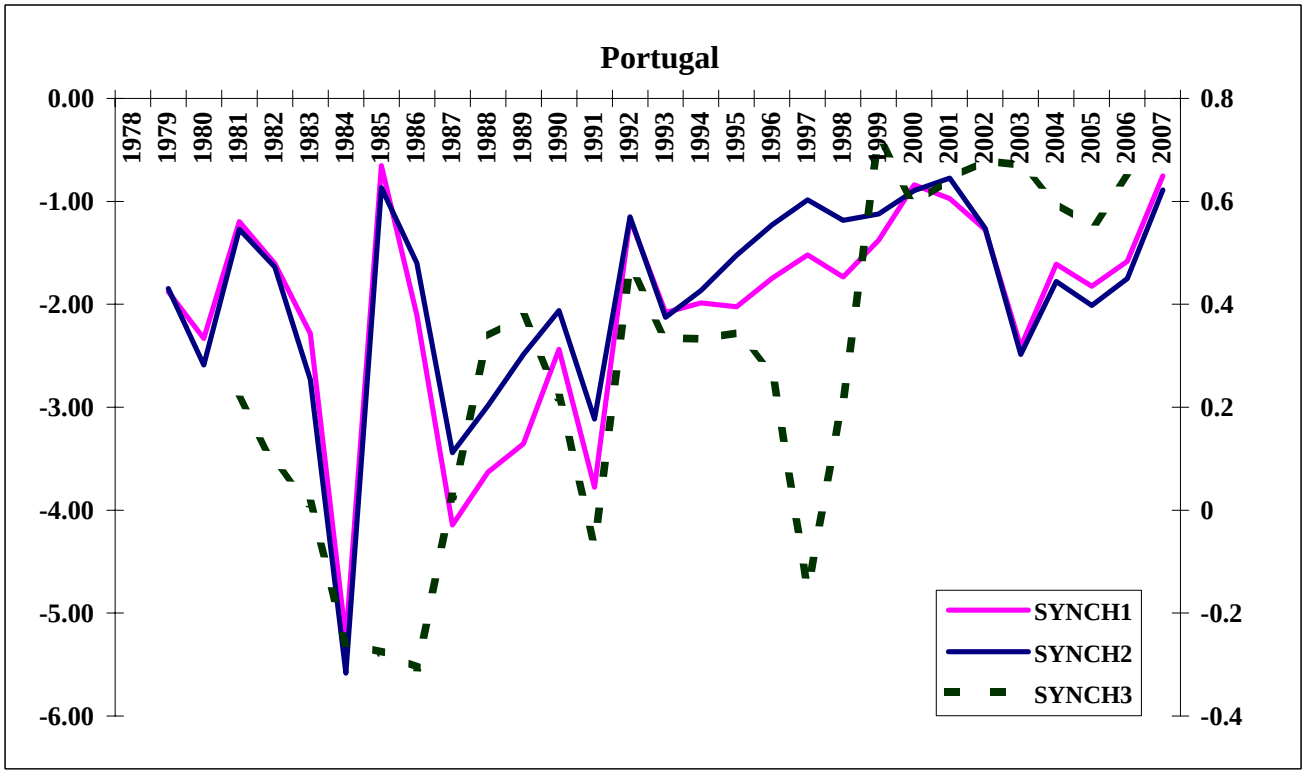


Supplementary Appendix

Appendix Figure 1.17

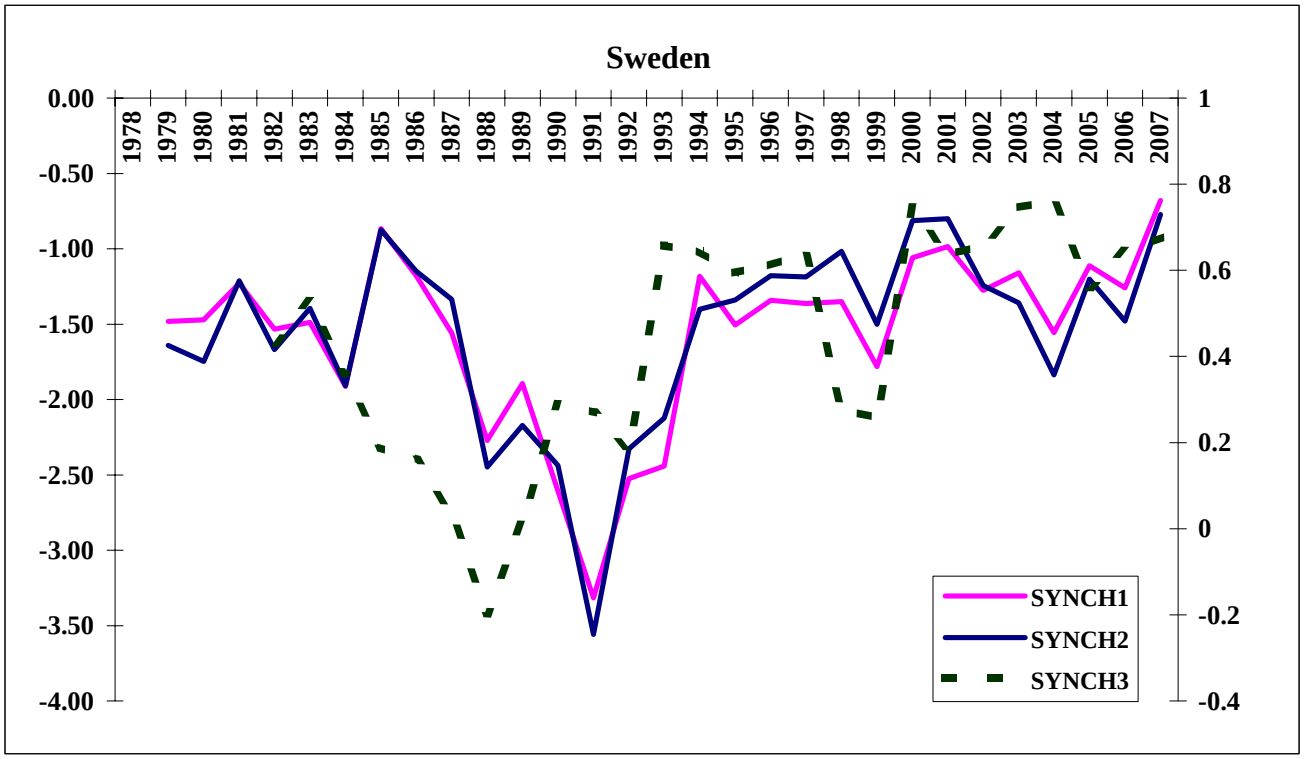


Appendix Figure 1.18

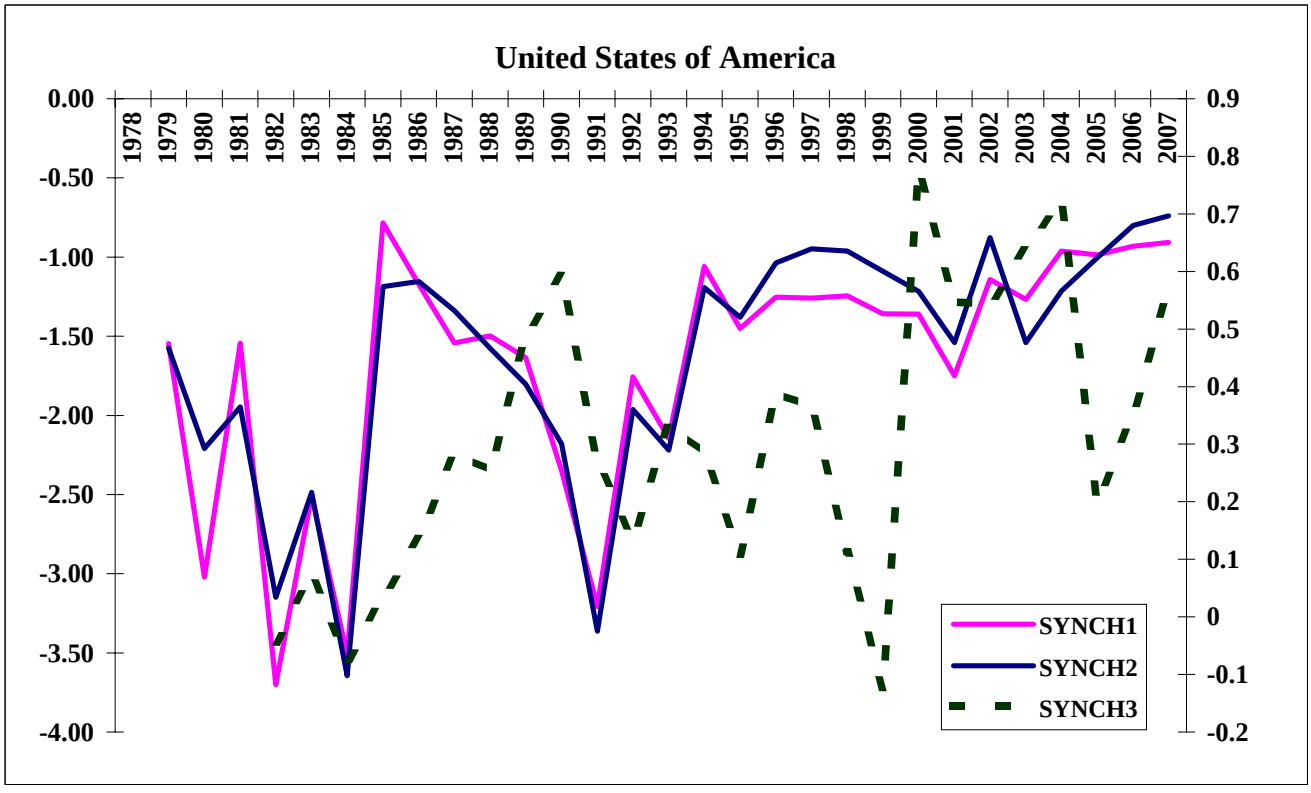


Supplementary Appendix

Appendix Figure 1.19

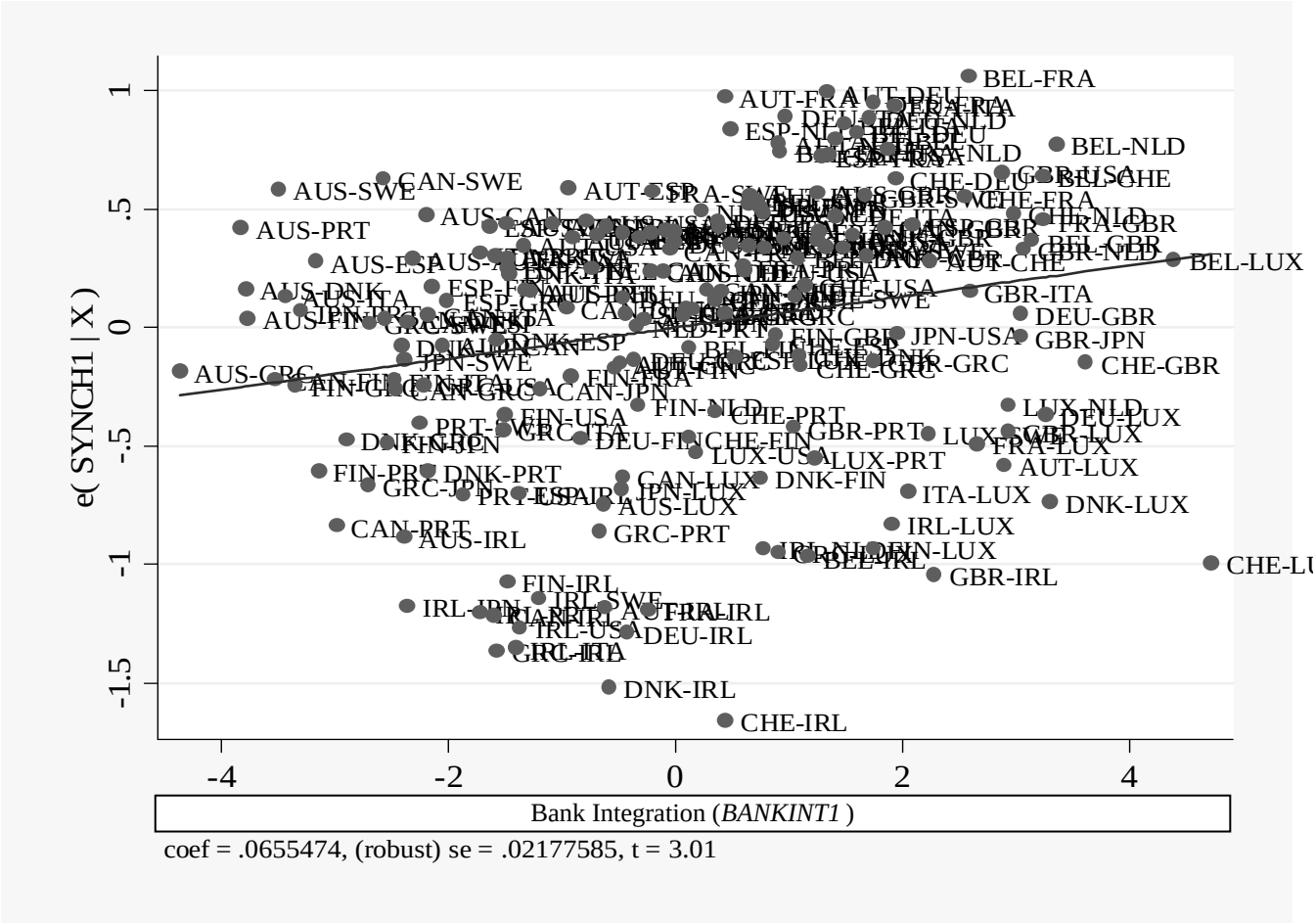


Appendix Figure 1.20



Supplementary Appendix

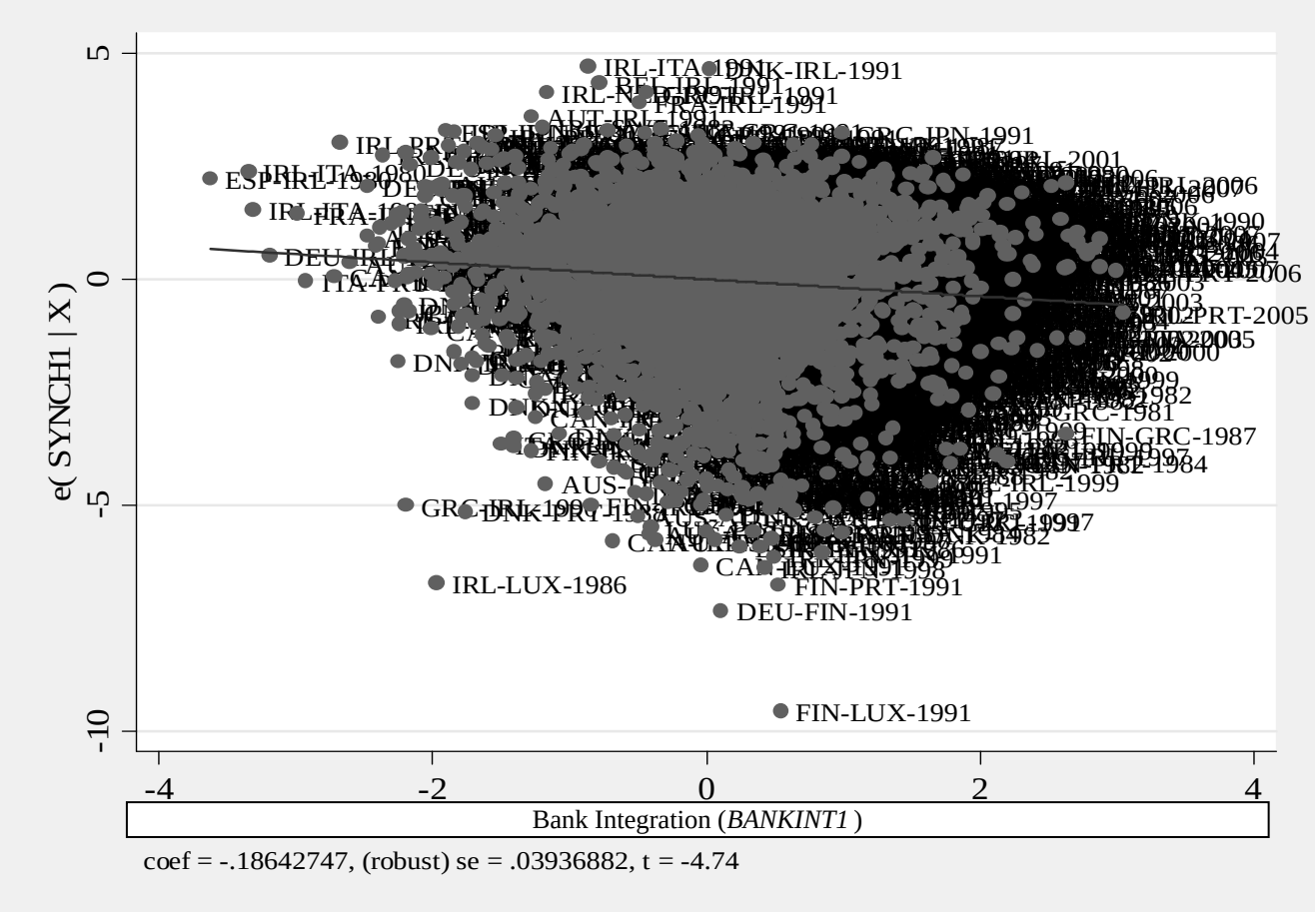
Appendix Figure 2 - Scatter Plot for Benchmark Cross-Sectional ("between") Specification



Supplementary Appendix Figure 2 plots the benchmark cross-sectional specification in column (1) of Table 2. The cross-sectional regression is estimated in a sample of 190 country pairs. The dependent variable is minus one times the absolute difference in real p.c. GDP growth between country *i* and country *j* averaged over the period 1978-2007 (*SYNCH1*). The regressor is the log of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population averaged over the period 1978-2007 (*BANKINT1*).

Supplementary Appendix

Appendix Figure 3 - Scatter Plot for Benchmark Panel ("within") Specification



Supplementary Appendix Figure 2 plots the benchmark panel specification in column (2) of Table 2. The panel regression is estimated in a sample of 190 country pairs over the period 1978-2007. The specification includes a vector of country-pair fixed-effects and a vector of time (year) fixed-effects. The dependent variable is minus one times the absolute difference in real p.c. GDP growth between country i and country j in year t (*SYNCH1*). The regressor is the log of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population averaged in year t (*BANKINT1*).