

Financial Integration and Business Cycle Synchronization*

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Abstract

We analyze the effect of financial integration on the degree of business cycle synchronization, utilizing a confidential dataset on banks' international bilateral exposure over the past three decades in a panel of twenty developed countries. Financial integration is associated with less synchronized output cycles, in line with the standard theories of output fluctuations. We construct a measure of "predicted integration" using exogenous variation in legislative-regulatory financial harmonization policies and use this measure to identify the causal effect of financial integration on business cycle synchronization. Our results contrast with those of the cross-sectional studies that show an increase in the degree of business cycles synchronization as a result of financial integration. We reconcile the different results by showing that the cross-sectional estimates suffer from omitted-variable bias.

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1 Introduction

In the midst of the biggest economic turmoil since the great depression, many argue that financial linkages has been a catalyst for the transmission of the 2007–2008 crisis from the U.S. to the rest of the world. Unfortunately, even before this crisis, we did not have a good understanding of how financial integration contributes to the spread of country-specific shocks given the conflicting results from the theoretical and empirical literature. Over the past decades cross-border financial integration has increased significantly (e.g. Lane and Milesi-Ferretti (2004, 2007)), while at the same time international business cycles have become more alike as shown in Figures 1 and 2.¹ Does this mean financial integration leads to more synchronized business cycles? While a mechanical interpretation of this co-evolution of cross-country correlations and cross-border financial linkages will imply so, we show systematic robust evidence that this is not the case. Our empirical results are consistent with the standard international real business cycle models that suggest that output growth rates between financially integrated economies should diverge.

We identify the one-way effect of financial integration on international output co-movement utilizing a unique, confidential, and so far unexploited dataset from the Bank of International Settlements (BIS) that reports bilateral cross-country bank assets and liabilities (stocks and flows) over the period 1978–2007 for twenty developed countries. The rich panel structure and our focus on a homogeneous group of advanced economies over a period of unprecedented stability and no major financial turmoil, allows us to account for many of the theoretical and econometric challenges that such an exercise entails. We document that conditional on global common factors and country-pair time-invariant characteristics, an increase in the level of financial integration is followed by less synchronized, more divergent, output patterns. This result is supportive to the main prediction of international business cycle theories that in the absence of major financial shocks, financial integration should magnify the effect of total-factor-productivity shocks and make output patterns to diverge. In contrast to previous cross-country studies that due to data limitations relied on cross-sectional approaches, the considerable time-variation of our data enables us to exploit the within country-pair variation and account for all time-invariant country-pair factors, that may affect both business cycle co-movement and financial integration. This approach gives confidence that the negative correlation between integration and business cycle synchronization is not spuriously

¹See among others, Kose, Otrok, and Prasad (2008), Otto, Voss, and Willard (2001), and Rose (2009). 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. Doyle and Faust (2005), employing a structural break analysis, find no change in the co-movement for the G7 countries since 1980s.

driven.

As implied by the theory, if the effect of financial integration on synchronization is causal, then it becomes relevant for the policy analysis. We take a heroic step and estimate instrumental variables specifications for the effect of integration on fluctuations in bilateral country-pair fixed-effect models. We construct a measure of “predicted integration”, using exogenous variation in the transposition dates of the legislative harmonization policies in financial services and show that this predicted integration by financial laws causes less synchronized output cycles.

Why are the results from the theory and empirical literature conflicting? In the canonical two-country general equilibrium model of Backus, Kehoe, and Kydland (1992) with complete financial markets, the country hit by a positive productivity shock experiences an increase in the marginal product of capital and labor, workers substitute leisure for labor, and the country receives capital on net—a mechanism that leads to negative output correlations between the two countries (see also Heathcote and Perri (2004a) for a multi-country model). Obstfeld (1994) formalizes another mechanism that also yields a negative effect of financial integration and business cycle synchronization. In his model financial integration shifts investment towards risky projects, enabling countries to specialize according to their comparative advantage, which in turn implies that output growth among financially integrated countries should be negatively correlated.² There might also be the case, where the negative association between financial integration and business cycle synchronization is explained by reverse causality. Financial linkages among dissimilar economies might be higher, because international diversification benefits become larger when shocks (and thus returns) are less correlated across countries. For example, in the Heathcote and Perri (2004b) model less correlated cycles lead to an increase in the equilibrium level of financial integration, which in turn further reduces the correlation of the business cycles.

The empirical literature, however, fails to find this theoretically predicted negative association between financial integration and business cycle synchronization. If anything, cross-country studies find a significant positive correlation between financial integration and GDP co-movement (Imbs (2006); Otto, Voss and Willard (2001); Kose, Prasad, and Terrones (2004)).³ Likewise Morgan,

²Kalemli-Ozcan, Sørensen, and Yosha (2003) using regional and country level data show that financial integration causes higher industrial specialization. Imbs (2004) and Kalemli-Ozcan, Sørensen, and Yosha (2001) further show that higher industrial specialization in turn leads to less synchronized cycles.

³Imbs (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) find 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. The only

Rime, and Strahan (2004) document that banking integration in the U.S. in the 1970s and the 1980s was followed by an increased co-movement of state's output cycle (and a lower volatility).

To rationalize these empirical findings, the literature has proceeded in several directions. One avenue is to introduce some sort of financial friction that works on top of (and eventually dominates) the standard TFP shocks (e.g. Calvo and Mendoza (2001); Perri and Quadrini (2009); Mendoza and Quadrini (2009)). Negative shocks to bank capital or frictions to financial intermediation arising from asymmetric information and moral hazard can generate contagion and thus make business cycles among integrated economies more similar. This is because in response to a negative financial shock foreign investors will withdraw capital from other markets. Corporate finance theories focusing specifically on banking integration also yield an ambiguous sign on the correlation coefficient between integration and synchronization. Morgan, Rime, and Strahan (2004) extend the banking model of Holmstrom and Tirole (1997) to a multi-economy setting and show that the impact of banking integration on output co-movement depends on whether bank supply (financial) or bank demand/collateral (TFP) shocks dominate.⁴ On the one hand a negative productivity shock will lead to capital withdrawals and thus output differences among financially integrated economies will get amplified. On the other hand, if there is negative shock to bank capital in one country, then banks reduce their lending in other economies and inter-connected economies experience an increase the co-movement of output. The net effect depends on which shock dominates.

From these arguments, it is clear that an empirical paper on this question faces serious challenges. If we want to test the prediction of the standard international real business cycle model on the negative association between financial integration and output co-movement in response to TFP shocks, we need to:

1. Separate TFP from financial shocks.
2. Isolate country-specific shock from common-global shocks.
3. Control for differences in the pattern of international trade and industrial specialization and also other factors that affect output synchronization and financial integration.
4. Account for reverse causation.

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.

⁴In addition the Holmstrom and Tirole (1997) and the Morgan *et al.* (2004) models suggest that the impact of financial integration on output volatility and output co-movement depends also on the form it takes, i.e. equity or debt.

Our main contribution in this paper is to explicitly deal with each of the four issues and identify the one-way effect of financial integration on output co-movement. For the first issue we will focus on a sample of countries/years without major financial shocks. Alternatively one can examine the international transmission following a well-specified credit crunch episode as the current crisis.⁵ Due to limited degrees of freedom most of the previous cross-sectional studies on the determinants of business cycle synchronization pool developed, emerging market and under-developed countries into the estimation (an exception is Inklaar, Jong-A-Pin, and de Haan (2008)). Yet there are major differences in the sources of business cycle fluctuations among these groups of countries. While emerging and under-developed countries experienced many major financial crises over the past three decades, until 2007–2008 industrial countries had witnessed an unparalleled period of stability without major financial shocks. Thus, although the BIS dataset includes data on developing and poor countries we limit our analysis to a group of relatively homogenous advanced economies in a period where financial shocks were not a major source of output fluctuations. Our focus on the rich OECD economies also minimizes concerns arising from unobserved heterogeneity. This is important because the parallel work on trade and output synchronization shows that the effect of trade integration on business cycle patterns can be quite different across the developed and the developing world.⁶

Second, our panel dataset enables us to control for global shocks. This is essential since the cross-country output response to common shocks is going to be similar. Besides accounting for common shocks, the considerable time dimension of the data allows us to control for other global policy factors and trends that have affected both financial integration and output synchronization. Financial globalization goes hand-in-hand with trade integration, where the latter can lead to increased output co-movement. In addition, monetary policy has increasingly been coordinated at a global level which can also affect integration and synchronization. For example, Rose (2009) and Flood and Rose (2009) show 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. In the same vein, Inklaar, Jong-A-Pin, and de Haan (2008) find that fiscal policy convergence has also an effect on the synchronicity of output growth in the OECD economies.

⁵We are tackling this issue in our companion paper. Also, Rose and Spiegel (2009) examine the impact of financial linkages on the spread of the recent financial meltdown, while Van Rijckeghem and Weder (2003) examine how the Mexican and the East Asian crises spread through financial centers.

⁶On the differential effect of international linkages on output comovement, see for example Kraay and Ventura (2000, 2007) and Calderon, Chong, and Stein (2007).

Third, the rich panel structure allows us to control for unobservable and hard-to-account-for time-invariant country-pair factors, such as distance, sociopolitical ties and differences in 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); Ekinçi, Kalemli-Ozcan and Sørensen (2008); Giannetti and Yafeh (2008); Mian (2006)). In addition by shaping preferences, trust and cultural norms might directly affect business cycle patterns (e.g. Stockman and Tesar (1995)).⁷ Thus accounting for such factors is key to identify the one-way relationship between financial integration and business cycle co-movement. The inclusion of country-pair fixed-effects also help us accounting for differences in international specialization and (that are relatively stable over time); yet we also explicitly control for time-varying differences in sectoral production and international trade.

Last but not least, while there has been no paper to our knowledge that estimates bilateral time-varying instrumental-variable (IV) specifications for financial (or trade) integration, we estimate such models in an effort to account for reverse causation. Building on our parallel work on the effects of the European Union (EU) and the associated financial sector reforms on banking integration (Kalemli-Ozcan, Papaioannou, and Peydró (2009)), we use as an excludable instrument a bilateral time-varying index that measures the degree of legislative-regulatory harmonization policies in financial services among EU countries. This identification strategy is theoretically appealing as it links reforms in financial intermediation with outcomes in the same sector and in turn to output synchronization. The exogeneity assumption for instrument validity is plausible, because policy changes are unilateral (at the country-level), while the outcome we study (integration) is bilateral. Moreover the exclusivity assumption is also reasonable as harmonization policies in financial services should primarily affect business cycle patterns through financial integration. In line with the evidence of the law and finance literature (e.g. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998); La Porta, Lopez-de-Silanes, and Shleifer (2008)) that however mainly focuses on country-level data patterns, there is a strong positive relationship between implemented legislative harmonization policies in financial services and bilateral banking integration, conditional on the monetary unification. 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.

We also employ an alternative identification strategy that links the flexibility of the exchange

⁷The previous studies use data on cross-sectional bilateral flows from the IMF CPIS surveys (available at most for a few years, and ends up being pooled) and instrument these flows by factors such as distance and legal structure. These variables may not be excludable from the second stage regression given the above cited papers.

rate regime with financial integration in the first-stage and integration with synchronization in the second-stage. These country-pair panel 2SLS estimates also reveal 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 (and thus the exclusivity assumption might be violated), we do not find such an effect in our data. Most importantly, 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 financial legislation reforms and the nature of exchange rate arrangements 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:

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

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 .⁸ $BANKINT_{i,j,t-1}$ is a measure of cross-border banking integration between countries i and j in the previous year ($t - 1$).⁹ 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 shocks and other common factors that affect both business cycle patterns and banking integration. The country-pair effects account for hard-to-measure factors such as 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.

⁸Using PPP adjusted GDP p.c. yields almost identical results.

⁹We have also estimated this specification using contemporaneous values of financial/banking integration finding similar results.

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 – 2007.¹⁰ These countries are: Australia, Austria, Belgium, Canada, Switzerland, 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.¹¹ 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.¹² 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.¹³ 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

¹⁰We prefer to use annual data given the noisy nature of quarterly data. Our panel has $1/2N * (N - 1) * T$, 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.

¹¹Our 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.

¹²Assets 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.

¹³For 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.

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.¹⁴

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 the average of (the logs of) gross bilateral flows of assets and liabilities as a share of the population of the two countries.¹⁵ 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 .

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

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

¹⁴Note 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).

¹⁵We 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 output growth and, therefore, allows us to identify the impact of banking integration on the covariation of output growth.¹⁶ 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 on country fixed-effects and year fixed-effects.

$$\ln Y_{i,t} - \ln Y_{i,t-1} = \gamma_i + \phi_t + v_{i,t} \quad \forall i, j \quad (3)$$

The residuals ($v_{i,t}$ 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 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.

$$FLUCT_{i,t} \equiv |v_{i,t}| \quad \text{and} \quad FLUCT_{j,t} \equiv |v_{j,t}| \quad (4)$$

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:

$$SYNCH2_{i,j,t} \equiv -|v_{i,t} - v_{j,t}| \quad (5)$$

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.

¹⁶See Doyle and Faust (2005) who underline the importance of a synchronization measure that does not include volatility. Another benefit of this measure compared to standard correlation measures, is that our dependent variable is not bounded between -1 and 1 and thus the error of the specification is well-behaved (e.g. Inklaar, Jong-A-Pin, and de Haan (2008)).

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:

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

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 ($SYNCH2$) in synchronization 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 2007.¹⁷ 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

¹⁷These 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)) .

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 0.6.¹⁸

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" estimator removes the time dimension 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.¹⁹ 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 specification. The panel fixed-effect models therefore imply that a higher level of international banking integration is associated with less -

¹⁸For completeness 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.

¹⁹Due 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.

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.²⁰ The 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.²¹

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

²⁰Although 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 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.

²¹The 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 = $\frac{\beta}{1-\rho_1-\rho_2}$.

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 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.²² It is important to account for differences in bilateral trade when working 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.²³ 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

²²We also augmented the empirical model with trade and specialization one at a time, obtaining similar results.

²³Note 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.

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.²⁴

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 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.²⁵ 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).²⁶

²⁴Note that given the limited time-variation in trade and specialization differences, these variables now become insignificant correlates of business cycle synchronization.

²⁵For 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).

²⁶We thank Gian-Maria Milesi-Ferretti for pointing this possibility.

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 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).²⁷ 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 causal interpretation of our results by using two different instrumental variables approaches.

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 Directives of the Financial Services Action Plan (FSAP), a major policy initiative that aimed to remove regulatory and legislative barriers across European countries in financial sector. 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.²⁸ 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

²⁷For 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.

²⁸The remaining 6 Directives of the FSAP 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).

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. $HARM_{i,j,t} \equiv \ln(LEX_{i,t}) + \ln(LEX_{j,t})$).²⁹

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 became more financially integrated through international banking activities.³⁰ 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, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998); La Porta, Lopez-de-Silanes, and Shleifer (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.³¹ 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 (positive) estimate on $HARM_{i,j,t}$. This suggests that conditional on country-pair factors and global trends, harmonization policies in financial services have lowered

²⁹Imbs (2006) and Kalemli-Ozcan, Sorensen and Yosha (2001) employ a similar bilateral instrumentation strategy using, however, cross-sectional data. Specifically these studies use the sum of the La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998) measures of investor protection of the two countries as an instrument for bilateral financial integration.

³⁰The first stage estimates differ in the case of dynamic panel estimation since we have slightly different samples.

³¹Kalemli-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 that 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.

the synchronicity of output growth.

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 (in Tables 2 and 3). 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 (2004, 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).³² 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.

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 emerging economies 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

³²These results are not shown for brevity. In Table 8 and Section 3.3 we perform a formal test of the "exclusivity" assumption.

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 ($ERSUM = \ln(ER_{i,t}) + \ln(ER_{j,t})$).³³

Table 6 reports 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 integration channels. A potential other channel of influence of the exchange rate regime on synchronization is through goods trade. While there weak evidence linking exchange rate regime flexibility and trade, Klein and Shambaugh (2006) document a significant effect. Yet, it is 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, once we control for country-pair fixed-effects and global trends.

Yet clearly one could rule out that the effect of the exchange rate regime on synchronization works (partially at least) through trade. 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. Exchange rate flexibility is

³³This transformation does not change our results. Taking logs gives us a better first-stage fit.

a highly significant (at the 1% level) correlate of financial integration, even when we control for trade and specialization. The F -score of the excluded instrument is in the range of 18 – 31, much higher than the critical values tabulated by Stock and Yogo (2002) that alert for weak instrument biases. The second-stage coefficient on banking integration continues to be negative and significant at the 1% level. Not only does the coefficient on banking integration retains its significance when we control for trade and specialization, but the specifications clearly show that trade is an insignificant correlate of GDP synchronization. In contrast specialization enters with a significant estimate (at the 10%) suggesting that a higher degree of production similarities is associated with more similar output patterns.

To investigate whether the exchange rate regime has a direct impact on output synchronization we estimated LS specifications with both *BANKINT* and *ERSUM* on the RHS. The results (not reported for brevity) show that once we control for banking integration, the coefficient on the 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

The 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. Both instruments enter with significant point 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. 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

The recent credit crunch in the U.S. and the global transmission of the crisis have raised the interest of the policy makers on how financial globalization affects the propagation of country-specific shocks. Theoretical studies and empirical literature have produced conflicting results on the effect of financial integration on output synchronization. As we show in this paper, this is because identifying the one way effect of financial integration on cross-border output patterns entails addressing many challenges.

First, one needs to isolate productivity from credit shocks. Although previous empirical studies have neglected this issue, it is vital to distinguish the underlying source of fluctuations, because theory makes sharply different predictions on the role of financial integration in the propagation of productivity compared to financial shocks. Second empirical work needs to account for global factors, as according to the theory financial integration magnifies idiosyncratic, country-specific shocks. Common sources of fluctuations have similar effects on output dynamics. Third, one also has to control for the other factors that affect both business cycle co-movement and financial integration. Fourth, one has to account for endogeneity arising from reverse causation; international capital asset pricing models suggest that it is differences on output fluctuations and returns that make financial integration rise, rather than the other way around.

In this paper we try to address all these challenging issues, exploiting a unique 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. We limit our attention to the pre-crisis period 1978–2007 in the group of advanced economies, to avoid mixing productivity with financial shocks. The 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 that previous research identifies as key correlates of both synchronization and integration. In addition, we control for global shocks, arising from 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 a 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. 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. 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 account for reverse causality we also estimate bilateral panel instrumental variable specifications that link legislative harmonization policies in financial services with banking integration and output synchronization. The first-stage specifications indicate a significant and strong correlation between banking integration among countries that harmonize legislation in financial services. The second-stage estimates show that the component of bilateral financial integration explained by the legislative reforms in financial services is negatively associated with business cycle synchronization. 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. Our empirical approach and results suggest that policy suggestions based on simple time-series or cross-sectional correlations can be quite misleading. As data will start becoming available, future research should analyze the effect of financial globalization on the propagation of the recent financial crisis.

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. $SYNCH2_{i,j,t} \equiv -|v_{i,t} - v_{j,t}|$. *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, Chong, and Stein (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. $SPEC_{i,j,t} \equiv \sum_{n=1}^N |s_{i,t}^n - s_{j,t}^n|$. 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).*

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Figure 1: Banking Integration over Time

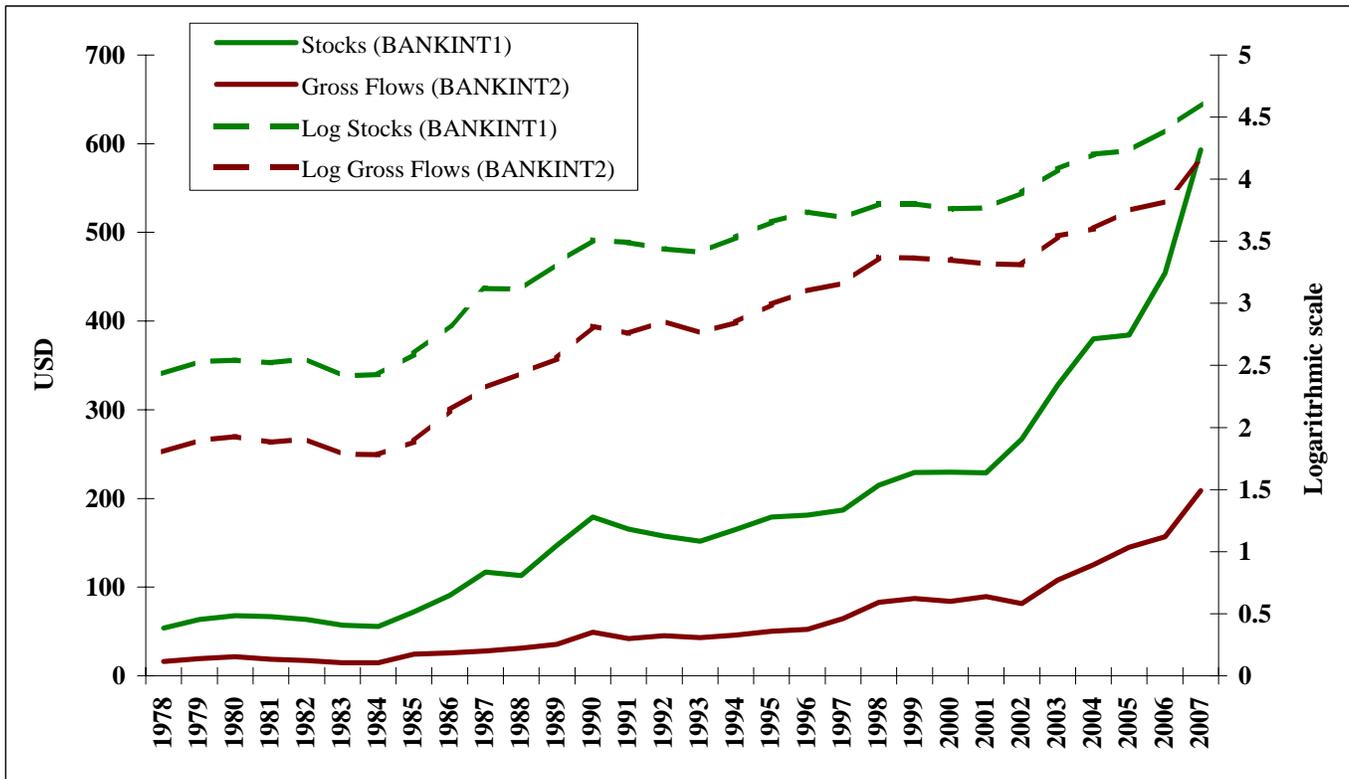


Figure 1 plots the evolution of the two banking integration measures, expressed in levels (solid lines) and in logs (dashed lines). *BANKINT1* denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population. *BANKINT2* denotes the average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

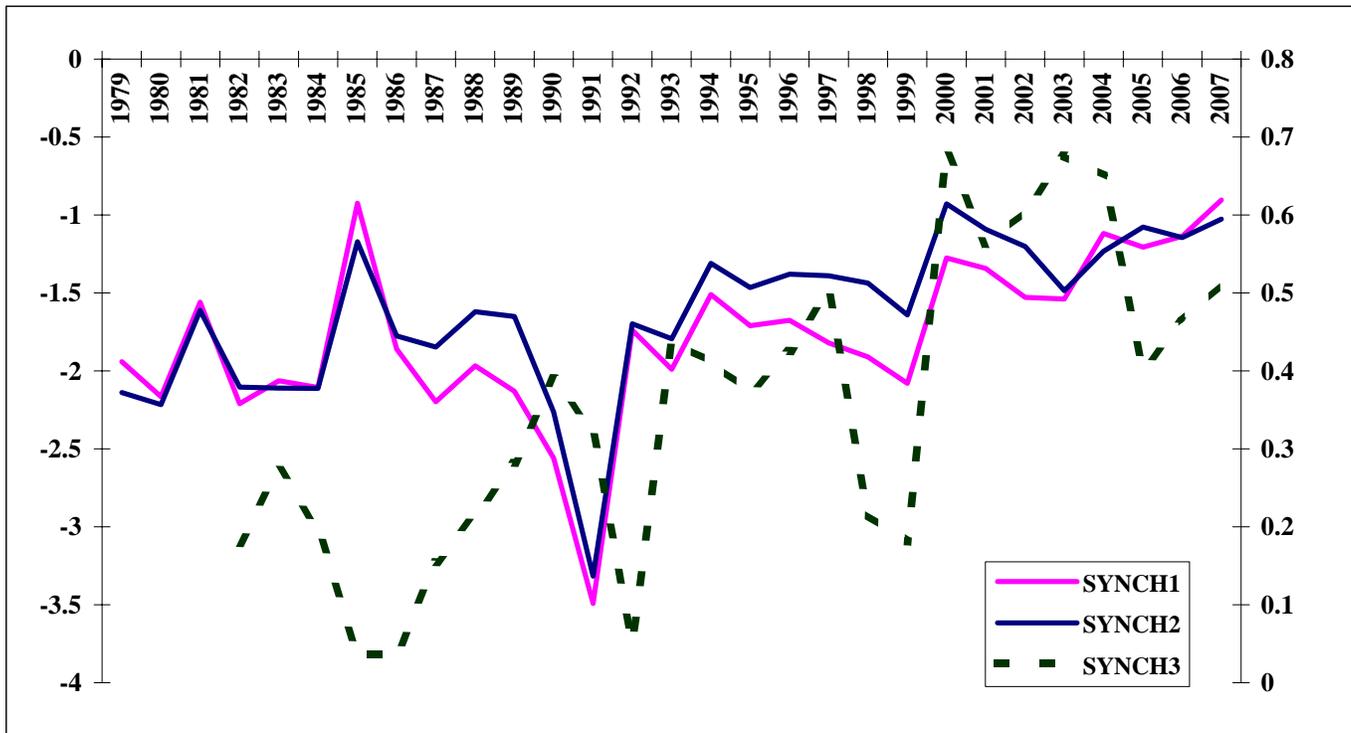


Figure 2 plots the evolution of the average value of each of the three synchronization measures employed in the empirical analysis across the 1978-2007 period. For each year the average is estimated across 190 country pairs (our sample spans 20 countries). *SYNCH1* is the negative value of the absolute 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 for the three synchronization measures for each of the twenty countries in our sample.

Table 1: Descriptive Statistics

	<i>Obs.</i>	<i>mean</i>	<i>st. dev.</i>	<i>min</i>	<i>p25</i>	<i>p50</i>	<i>p75</i>	<i>max</i>
<i>SYNCH1</i>	5376	-1.76	1.60	-13.95	-2.44	-1.31	-0.62	0.00
<i>SYNCH2</i>	5376	-1.61	1.45	-12.55	-2.19	-1.23	-0.55	0.00
<i>BII</i>	5376	195.54	507.25	0.00	9.52	41.95	155.70	9110.02
<i>BI2</i>	5376	63.99	151.05	0.04	4.87	18.37	62.62	4065.77
<i>ERFSUM</i>	5376	14.152	6.265	2.000	12.000	15.000	19.000	28
<i>FSAPSUM</i>	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*. *BII* 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			
	<i>BANKINT1</i>		<i>BANKINT2</i>		<i>BANKINT1</i>		<i>BANKINT2</i>	
Integraton Measure:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Integration (<i>BANKINT</i>)	0.066 (0.022) 2.96	-0.186 (0.039) -4.82	0.066 (0.029) 2.23	-0.157 (0.040) -3.94	0.078 (0.017) 4.58	-0.068 (0.029) -2.38	0.087 (0.023) 3.80	-0.082 (0.032) -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 <i>SYNCH1</i>		Synchrononization Measure 2 <i>SYNCH2</i>	
	<i>BANKINT1</i>	<i>BANKINT2</i>	<i>BANKINT1</i>	<i>BANKINT2</i>
Integration Measure:	(1)	(2)	(3)	(4)
Lag (1) Synchronization (<i>SYNCH</i>)	0.209 (0.021) <i>10.01</i>	0.211 (0.021) <i>10.06</i>	0.198 (0.019) <i>10.39</i>	0.197 (0.019) <i>10.4</i>
Lag (2) Synchronization (<i>SYNCH</i>)	0.078 (0.018) <i>4.33</i>	0.080 (0.018) <i>4.36</i>	-0.032 (0.013) <i>-2.46</i>	-0.032 (0.013) <i>-2.53</i>
Lag (1) Banking Integration (<i>BANKINT</i>)	-0.108 (0.029) <i>-3.67</i>	-0.098 (0.031) <i>-3.12</i>	-0.063 (0.028) <i>-2.29</i>	-0.074 (0.030) <i>-2.46</i>
Long-run effect - Banking Integration <i>F</i> -score <i>p</i> -value	-0.152 13.04 <i>0.000</i>	-0.138 9.37 <i>0.000</i>	-0.076 5.29 <i>0.023</i>	-0.089 5.98 <i>0.015</i>
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 <i>SYNCH3</i>				Synchrononization Measure 3 <i>SYNCH3</i>			
	<i>BANKINT1</i>		<i>BANKINT2</i>		<i>BANKINT1</i>		<i>BANKINT2</i>	
Integration Measure:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Integration (<i>BANKINT</i>)	0.031 (0.008) 3.98	-0.054 (0.020) -2.68	0.043 (0.010) 4.19	-0.039 (0.023) -1.70	0.025 (0.010) 2.55	-0.113 (0.029) -3.91	0.038 (0.012) 3.11	-0.104 (0.032) -3.2
Trade (<i>TRADE</i>)					5.015 (1.208) 4.15	-1.355 (1.405) -0.96	4.738 (1.191) 3.98	-1.329 (1.463) -0.91
Specialization (<i>SPEC</i>)					-0.042 (0.019) -2.22	-0.024 (0.029) -0.83	-0.045 (0.019) -2.36	-0.015 (0.029) -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**

Integration Measure:	Static Panel Estimates				Dynamic Panel Estimates			
	<i>BANKINT1</i>		<i>BANKINT2</i>		<i>BANKINT1</i>		<i>BANKINT2</i>	
Dependent Variable:	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Panel A: 2SLS Estimates: Dependent Variable is Synchronization

Banking Integration (<i>BANKINT</i>)	-0.263 (0.160)	-0.371 (0.151)	-0.263 (0.155)	-0.370 (0.142)	-0.229 (0.134)	-0.370 (0.134)	-0.238 (0.132)	-0.382 (0.129)
	<i>-1.64</i>	<i>-2.46</i>	<i>-1.69</i>	<i>-2.60</i>	<i>-1.71</i>	<i>-2.76</i>	<i>-1.80</i>	<i>-2.96</i>

Panel B: 1st Stage Estimates and Diagnostics: Dependent Variable is Banking Integration

Financial Sector Harmonization (<i>HARM</i>)	0.225 (0.049)	0.225 (0.049)	0.222 (0.042)	0.222 (0.042)	0.223 (0.048)	0.225 (0.048)	0.215 (0.041)	0.216 (0.041)
	<i>4.56</i>	<i>4.56</i>	<i>5.31</i>	<i>5.31</i>	<i>4.60</i>	<i>4.67</i>	<i>5.24</i>	<i>5.28</i>
<i>F</i> -score	20.77	20.77	28.15	28.15	21.17	21.77	27.46	27.88
<i>p</i> -value	<i>0.00</i>							
Year FE	Yes							
Country-pair FE	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 indicators are instrumented with a bilateral time-varying measure of harmonization 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**

Integration Measure:	Static Panel Estimates				Dynamic Panel Estimates			
	<i>BANKINT1</i>		<i>BANKINT2</i>		<i>BANKINT1</i>		<i>BANKINT2</i>	
Dependent Variable:	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>	<i>SYNCH1</i>	<i>SYNCH2</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Panel A: 2SLS Estimates: Dependent Variable is Synchronization

Banking Integration (<i>BANKINT</i>)	-0.248 (0.150)	-0.259 (0.149)	-0.264 (0.164)	-0.281 (0.158)	-0.310 (0.125)	-0.273 (0.118)	-0.339 (0.132)	-0.297 (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 (<i>ERSUM</i>)	(0.053)	(0.053)	(0.042)	(0.042)	(0.054)	(0.056)	(0.043)	(0.044)
	-4.31	-4.31	-4.88	-4.88	-5.01	-4.97	-5.62	-5.61
<i>F</i> -score	18.54	18.54	23.79	23.79	25.06	24.69	31.55	31.52
<i>p</i> -value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Year FE	Yes							
Country-pair FE	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 indicators 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:	<i>BANKINT1</i>		<i>BANKINT2</i>	
Dependent Variable:	<u><i>SYNCH3</i></u>	<u><i>SYNCH3</i></u>	<u><i>SYNCH3</i></u>	<u><i>SYNCH3</i></u>
	(1)	(2)	(3)	(4)

Panel A: 2SLS Estimates: Dependent Variable is Synchronization

Banking Integration (<i>BANKINT</i>)	-0.227 (0.074) -3.06	-0.383 (0.154) -2.49	-0.250 (0.081) -3.09	-0.382 (0.140) -2.72
Trade (<i>TRADE</i>)		0.167 (1.755) 0.10		0.473 (1.723) 0.27
Specialization (<i>SPEC</i>)		-0.091 (0.049) -1.88		-0.066 (0.041) -1.60

Panel B: 1st Stage Estimates and Diagnostics

Exchange Rate Regime Flexibility (<i>ERSUM</i>)	-0.283 (0.064) -4.42	-0.201 (0.069) -2.92	-0.258 (0.050) -5.16	-0.201 (0.051) -3.95
Trade (<i>TRADE</i>)		3.4967 (2.9100) 1.20		4.3302 (2.1053) 2.06
Specialization (<i>SPEC</i>)		-0.2285 (0.0527) -4.34		-0.1637 (0.0376) -4.35
<i>F</i> -score	18.55	8.50	26.67	15.63
<i>p</i> -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

Table 7-Notes

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 indicators are instrumented with a bilateral time-varying measure of the flexibility of the exchange rate regime.

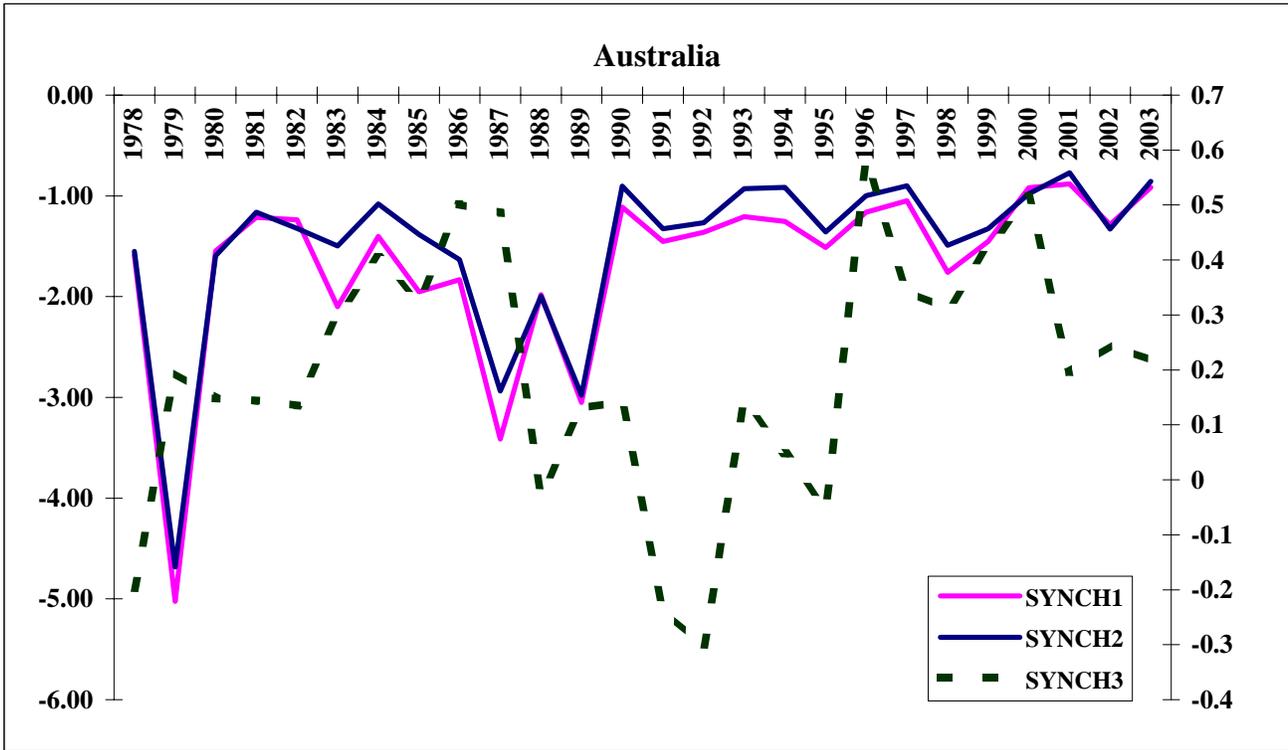
Table 8-Notes

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 .

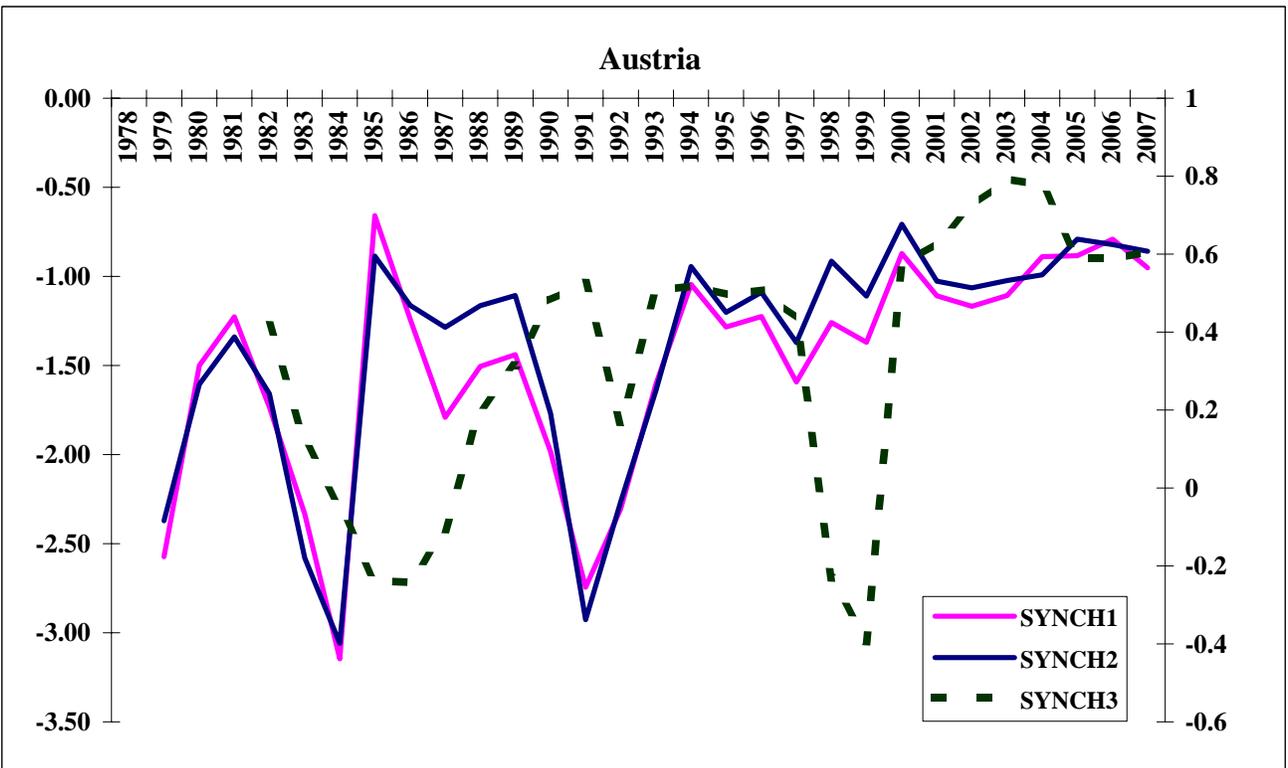
BANKINT1 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t . *BANKINT2* denotes the one year lagged value of the average of the logs of bilateral gross flows in assets and liabilities normalized by the sum of the two countries' population in year t . The two banking integration indicators 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 harmonization 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

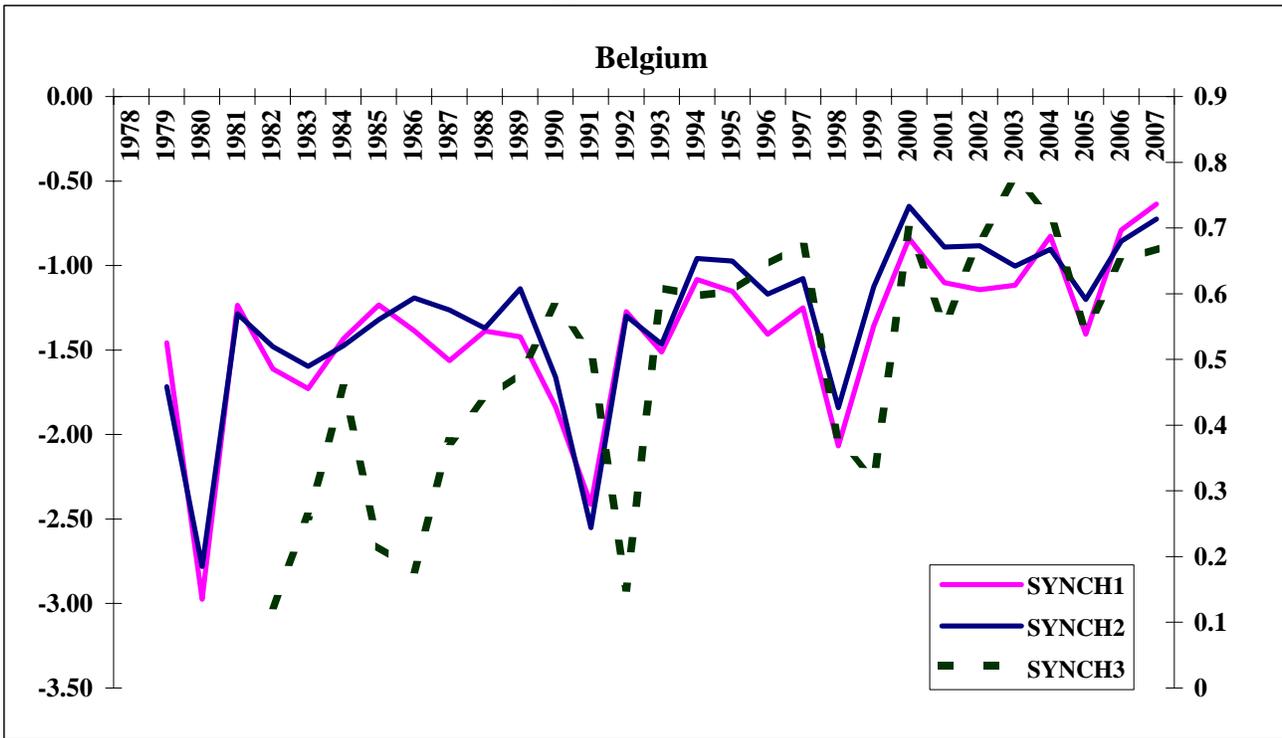


Appendix Figure 1.2

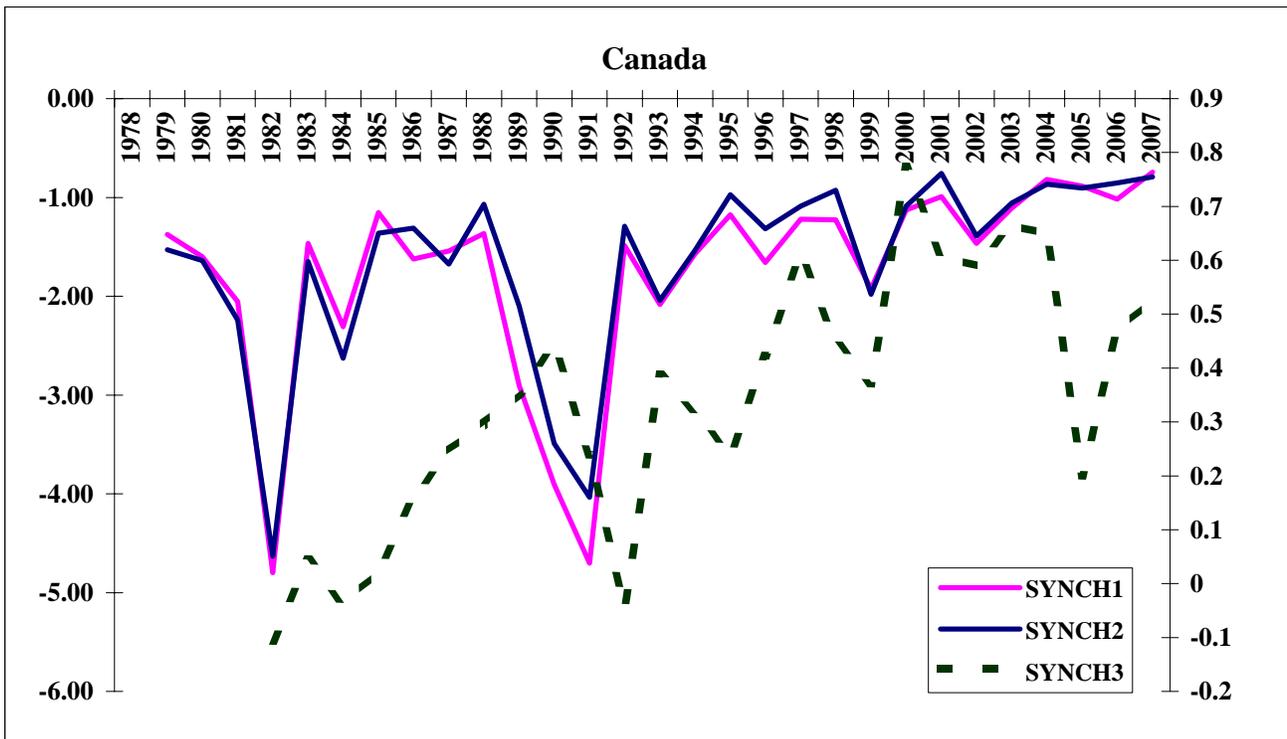


Supplementary Appendix

Appendix Figure 1.3

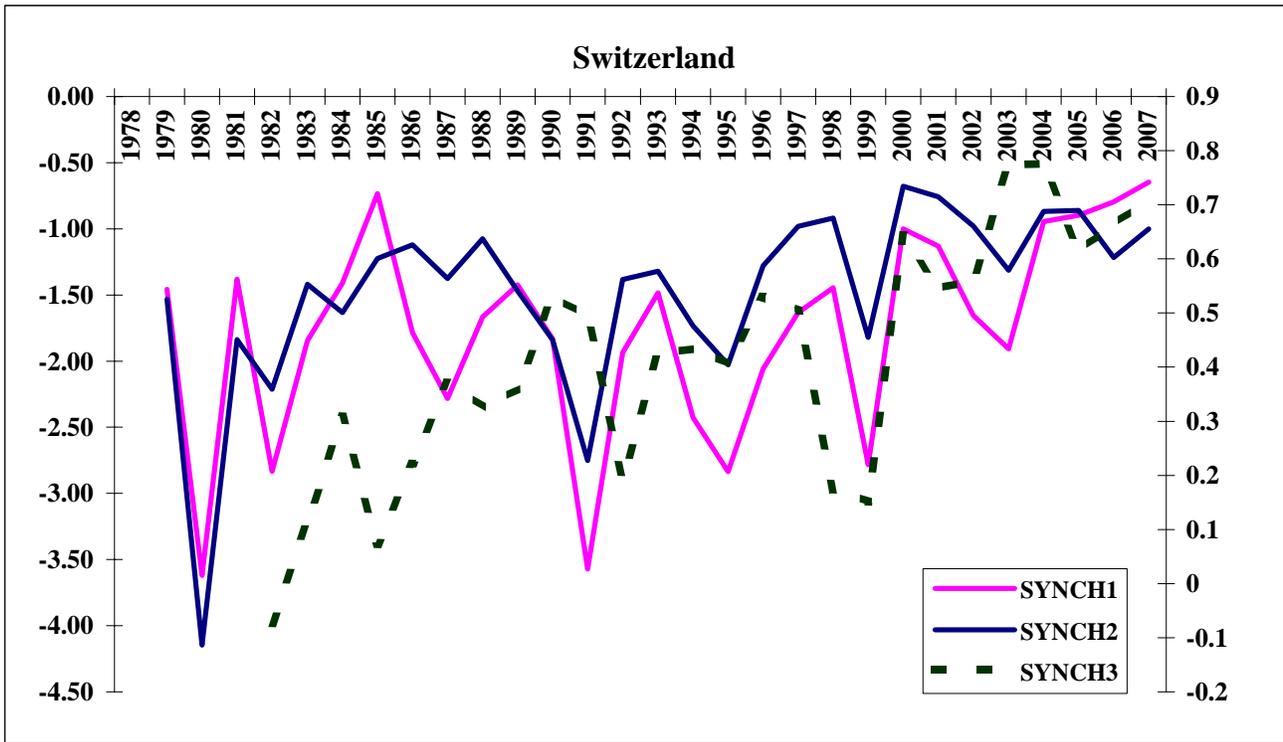


Appendix Figure 1.4

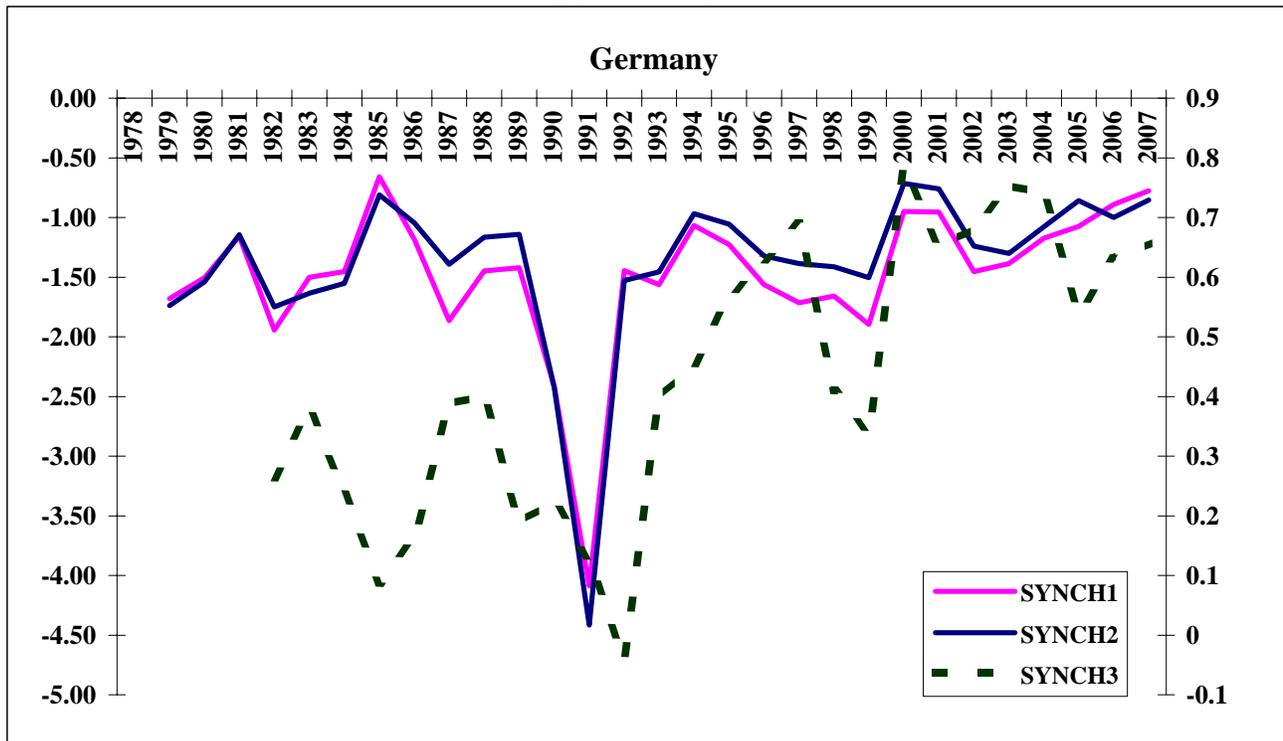


Supplementary Appendix

Appendix Figure 1.5

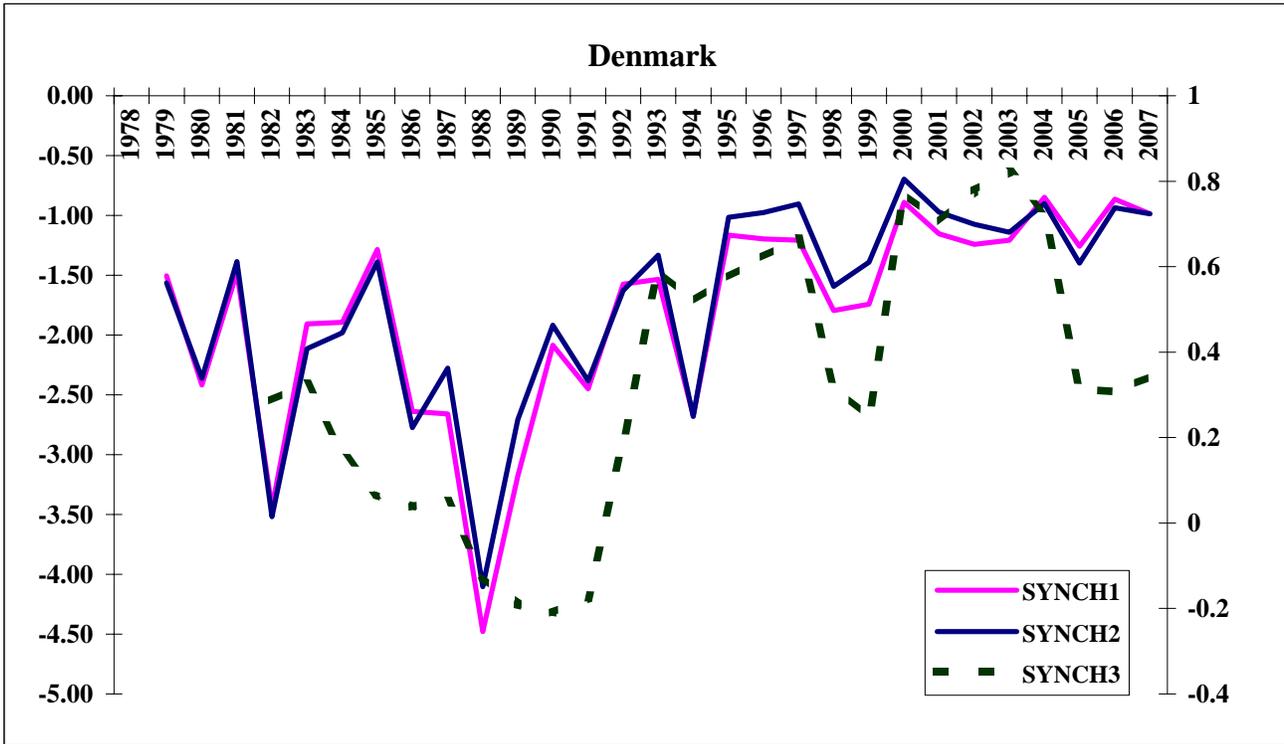


Appendix Figure 1.6

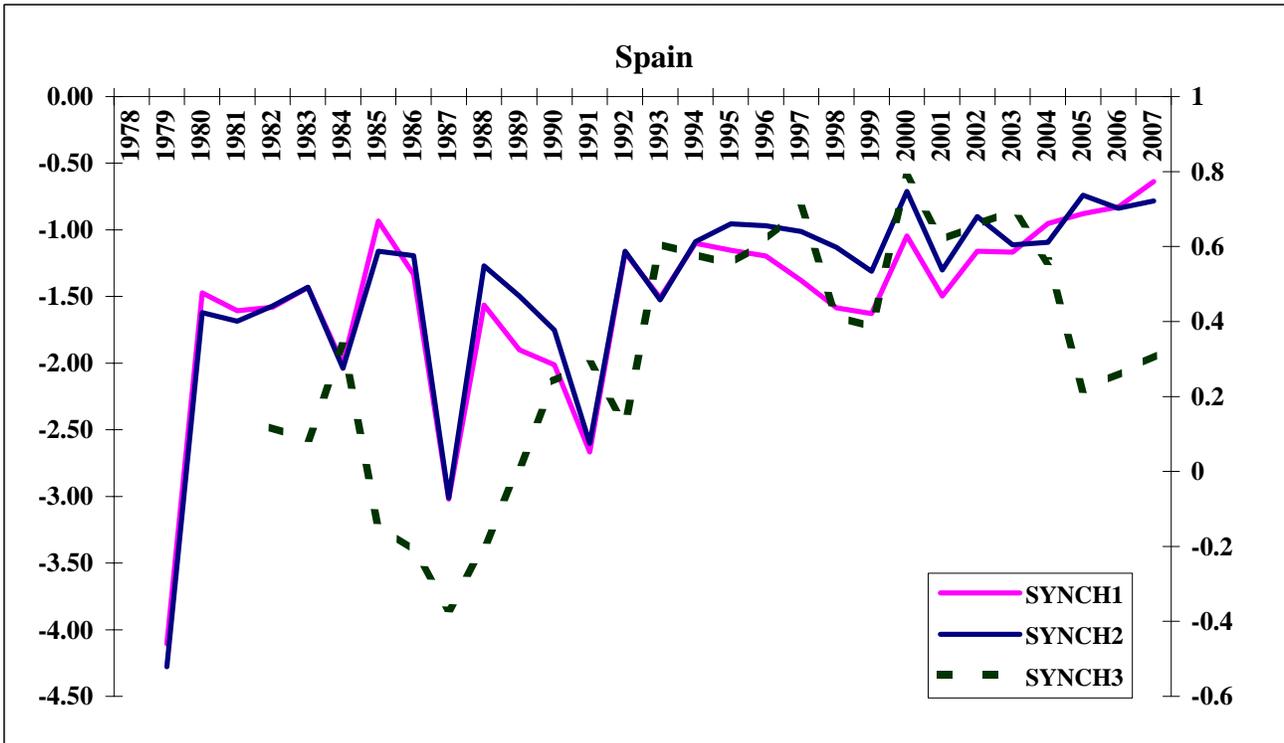


Supplementary Appendix

Appendix Figure 1.7

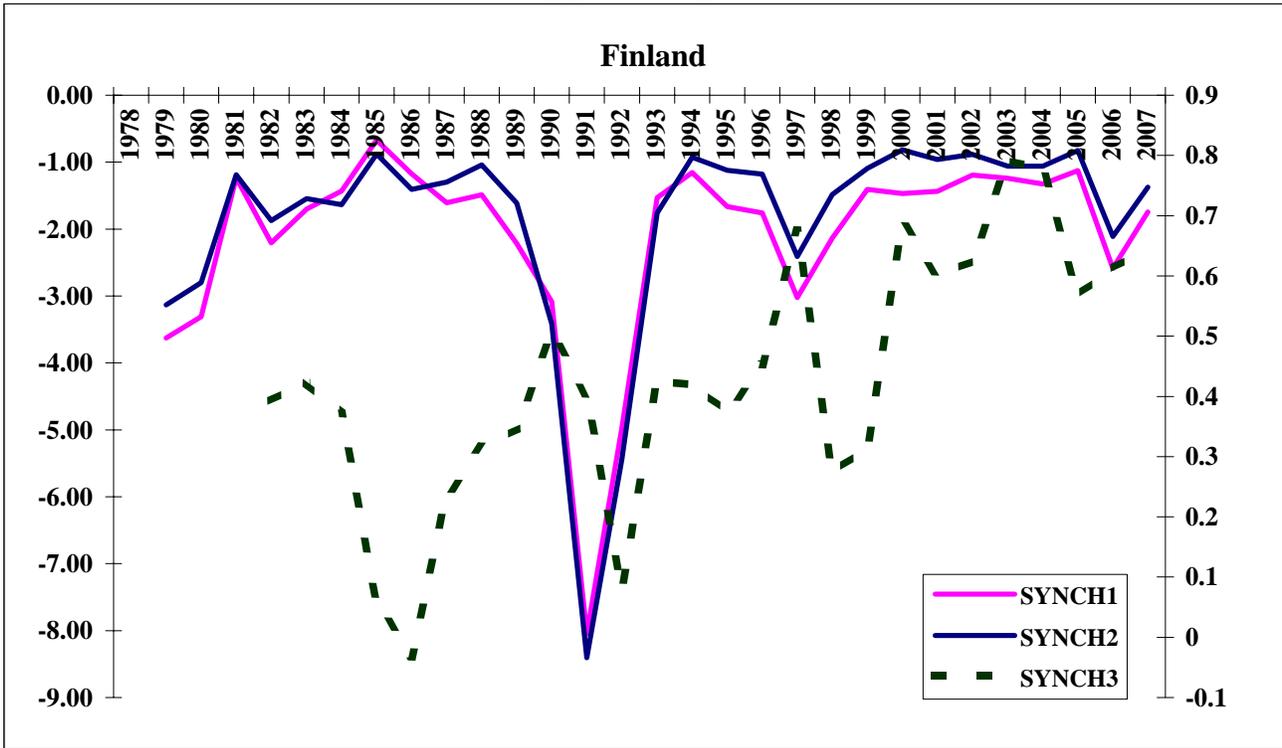


Appendix Figure 1.8

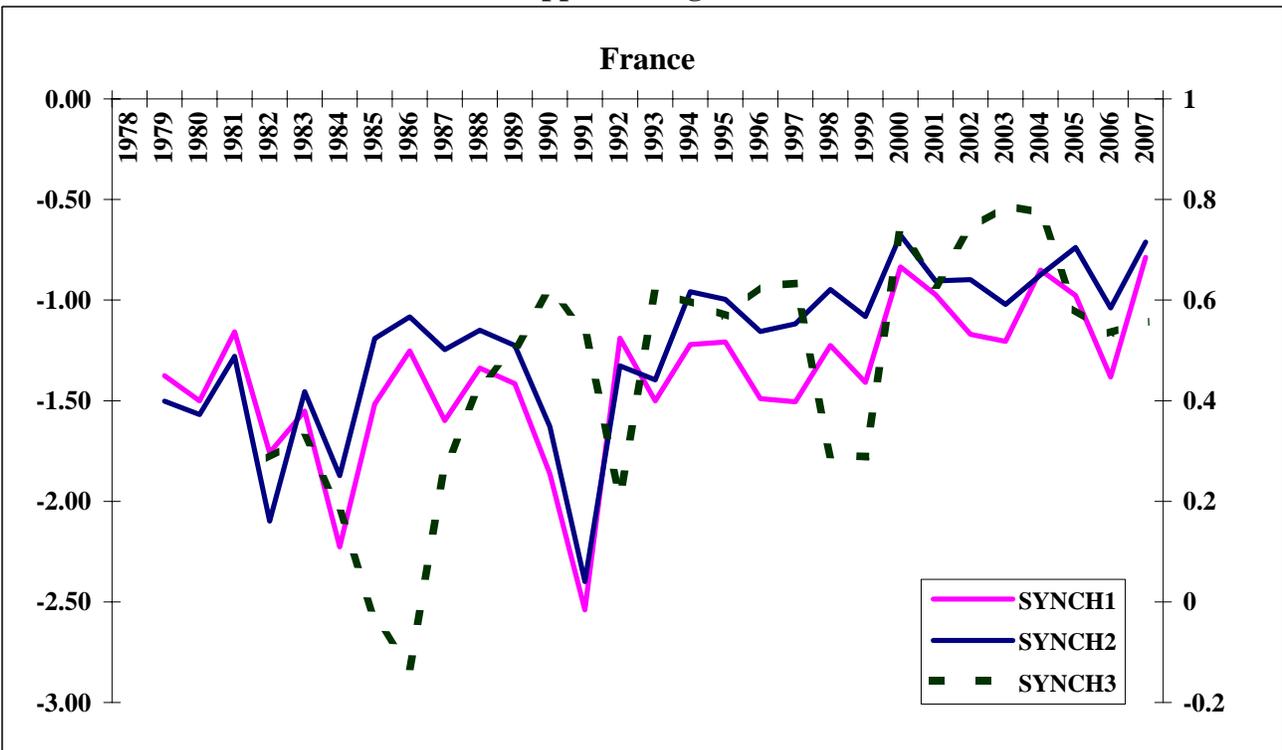


Supplementary Appendix

Appendix Figure 1.9

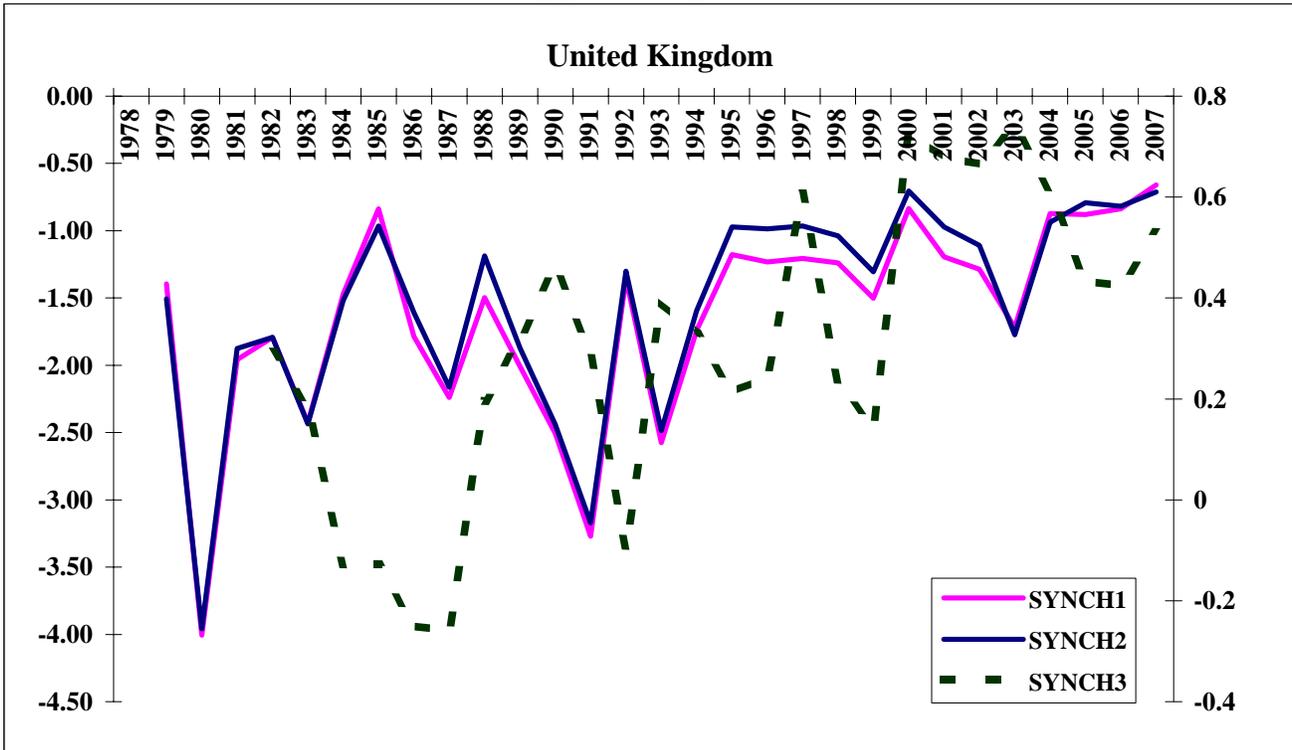


Appendix Figure 1.10

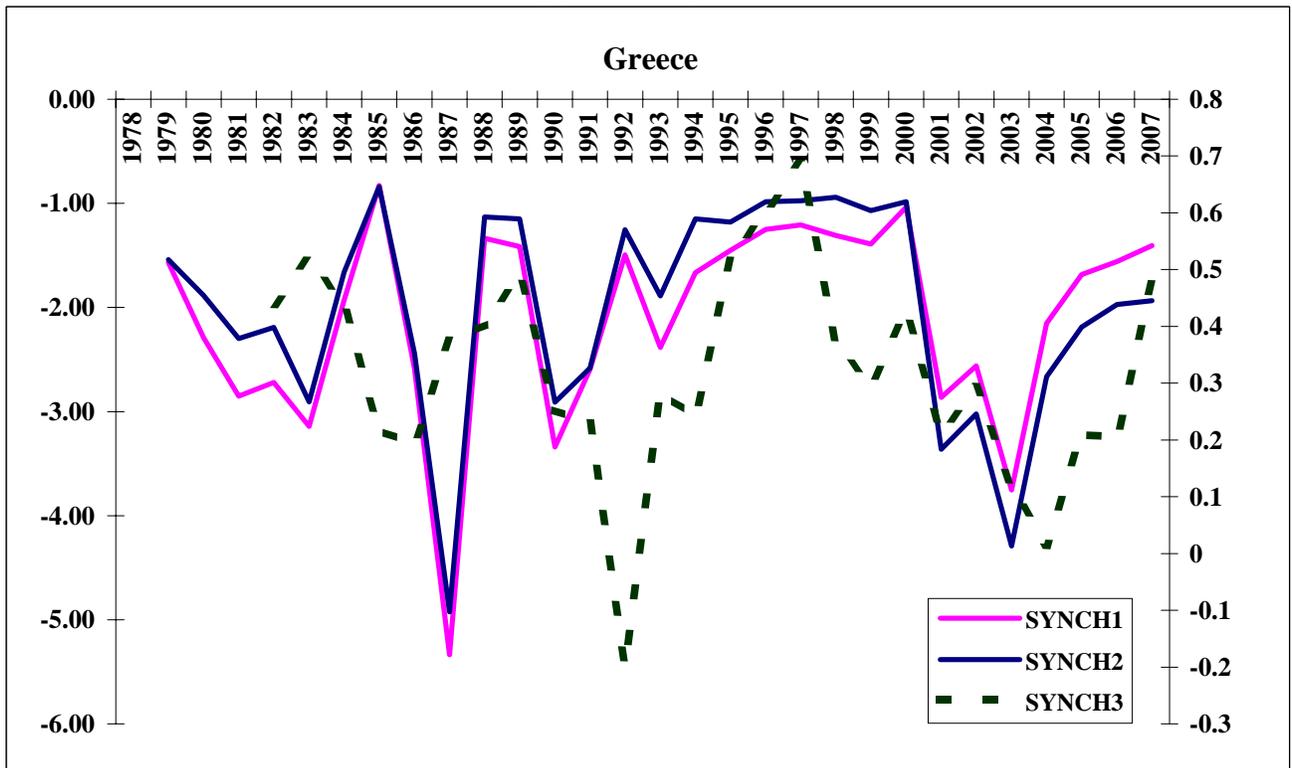


Supplementary Appendix

Appendix Figure 1.11

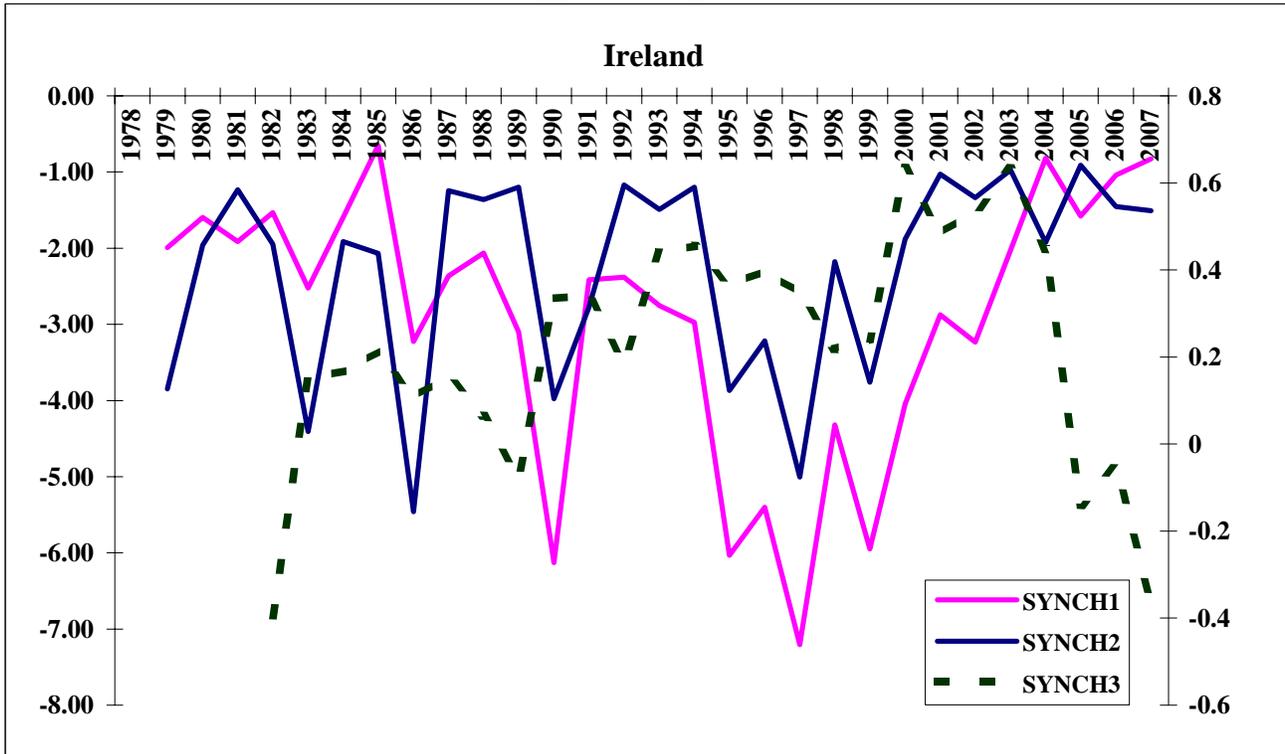


Appendix Figure 1.12

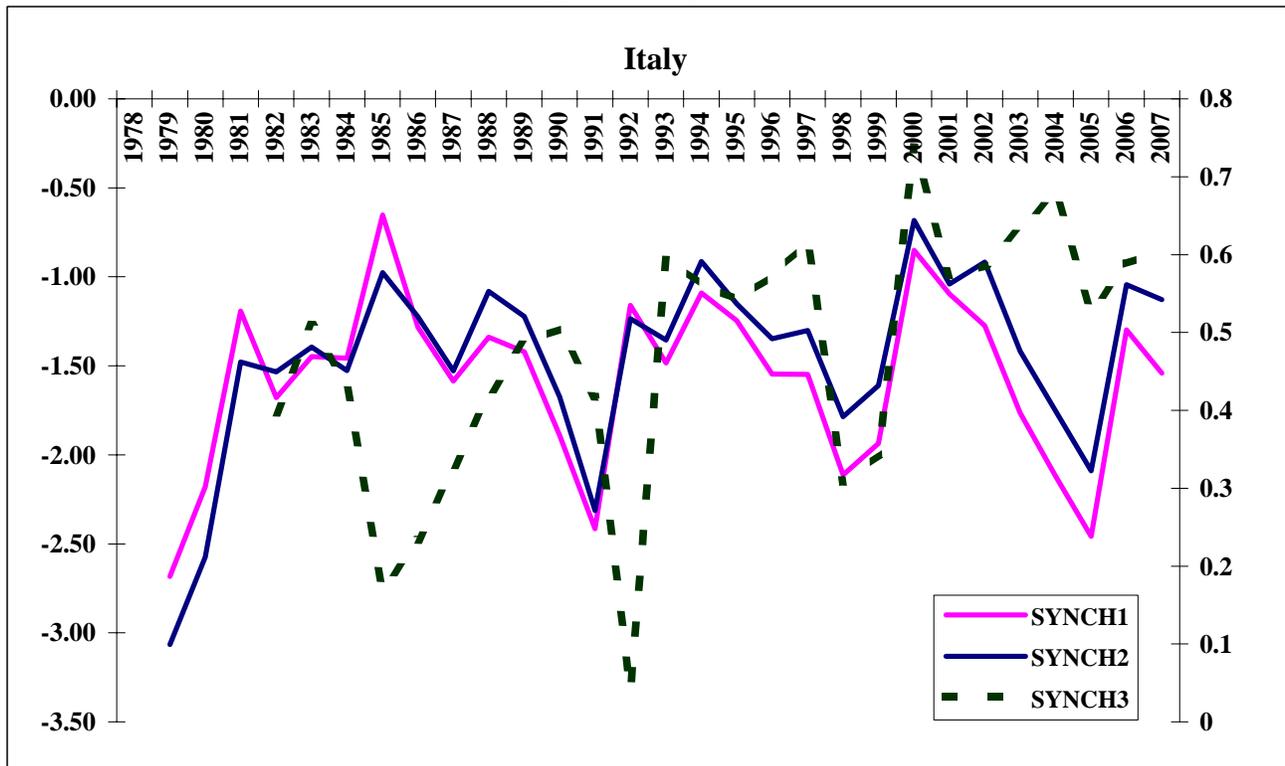


Supplementary Appendix

Appendix Figure 1.13

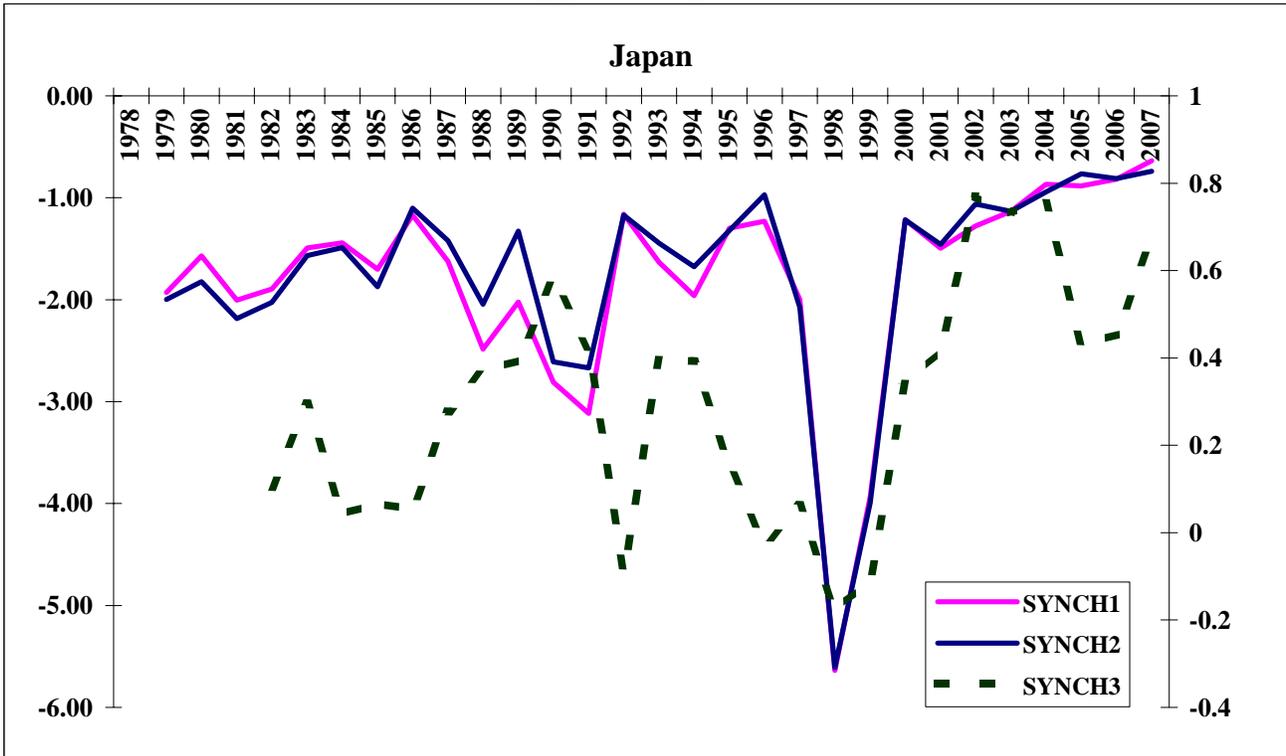


Appendix Figure 1.14

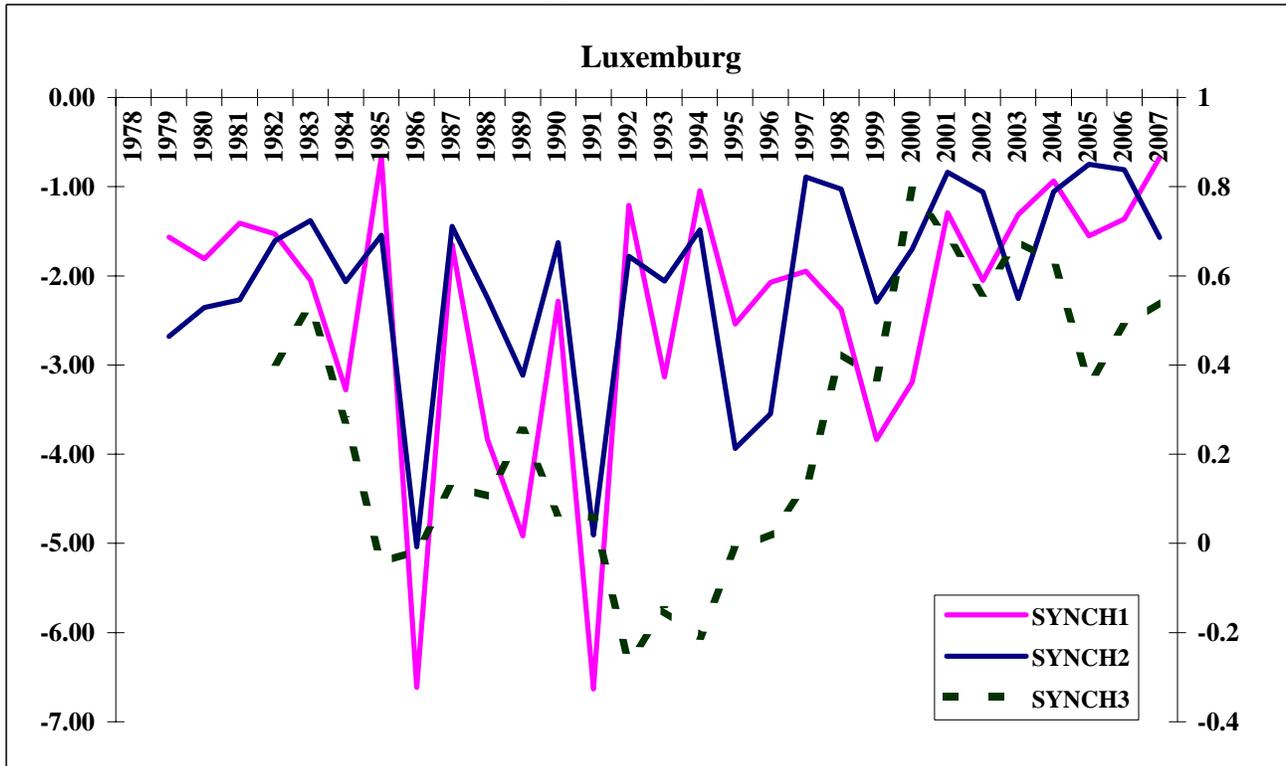


Supplementary Appendix

Appendix Figure 1.15

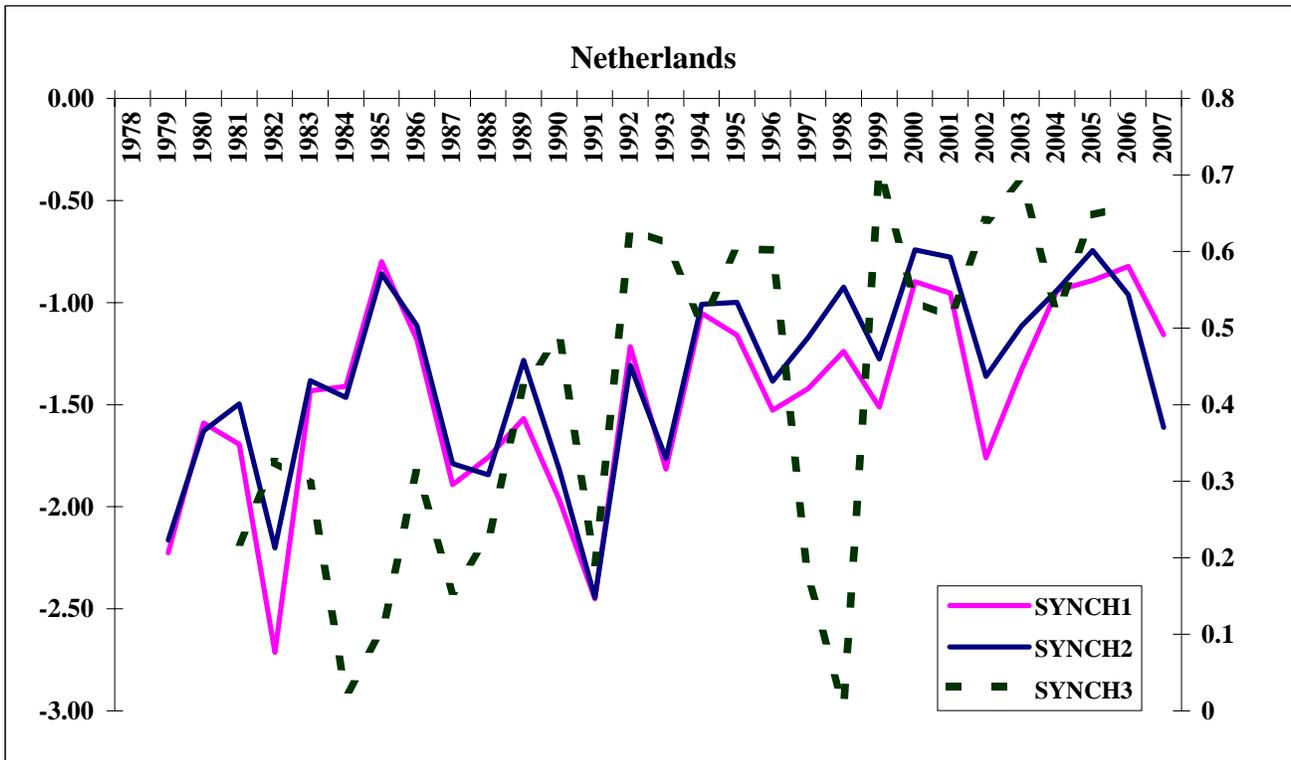


Appendix Figure 1.16

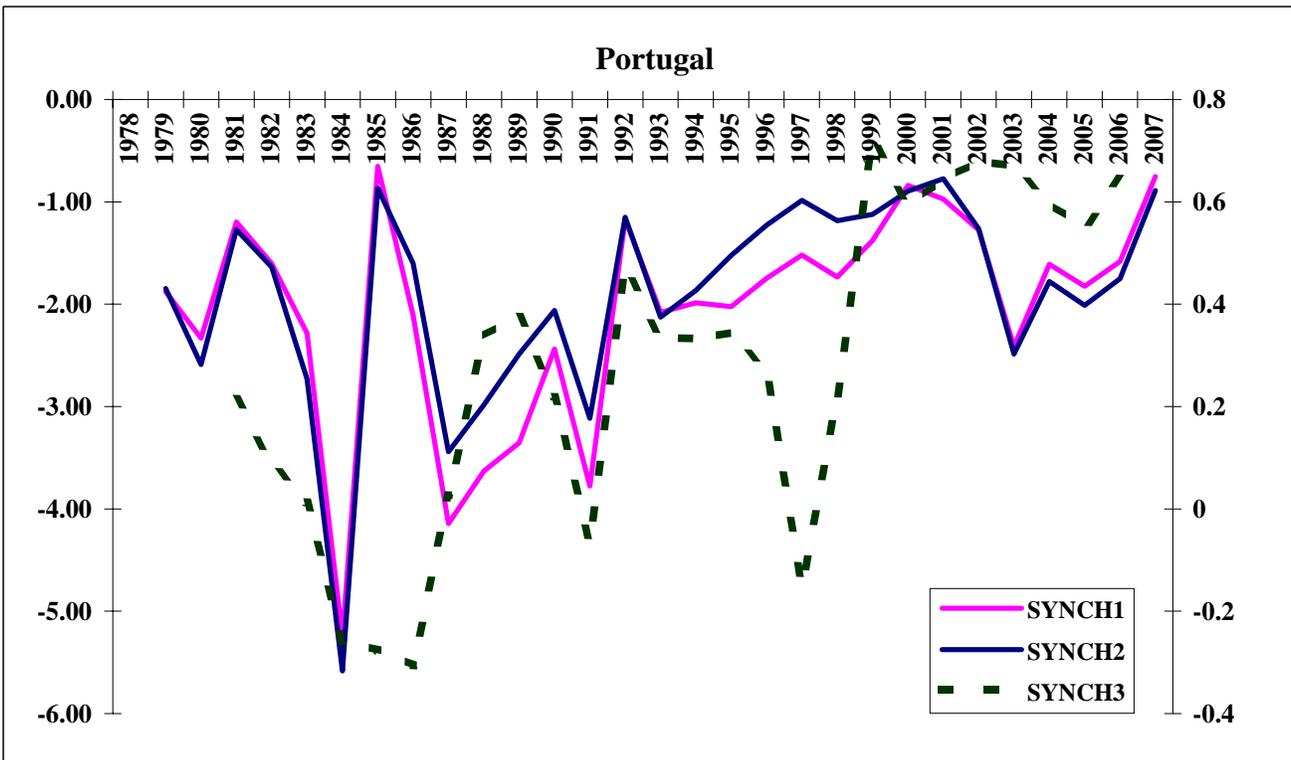


Supplementary Appendix

Appendix Figure 1.17

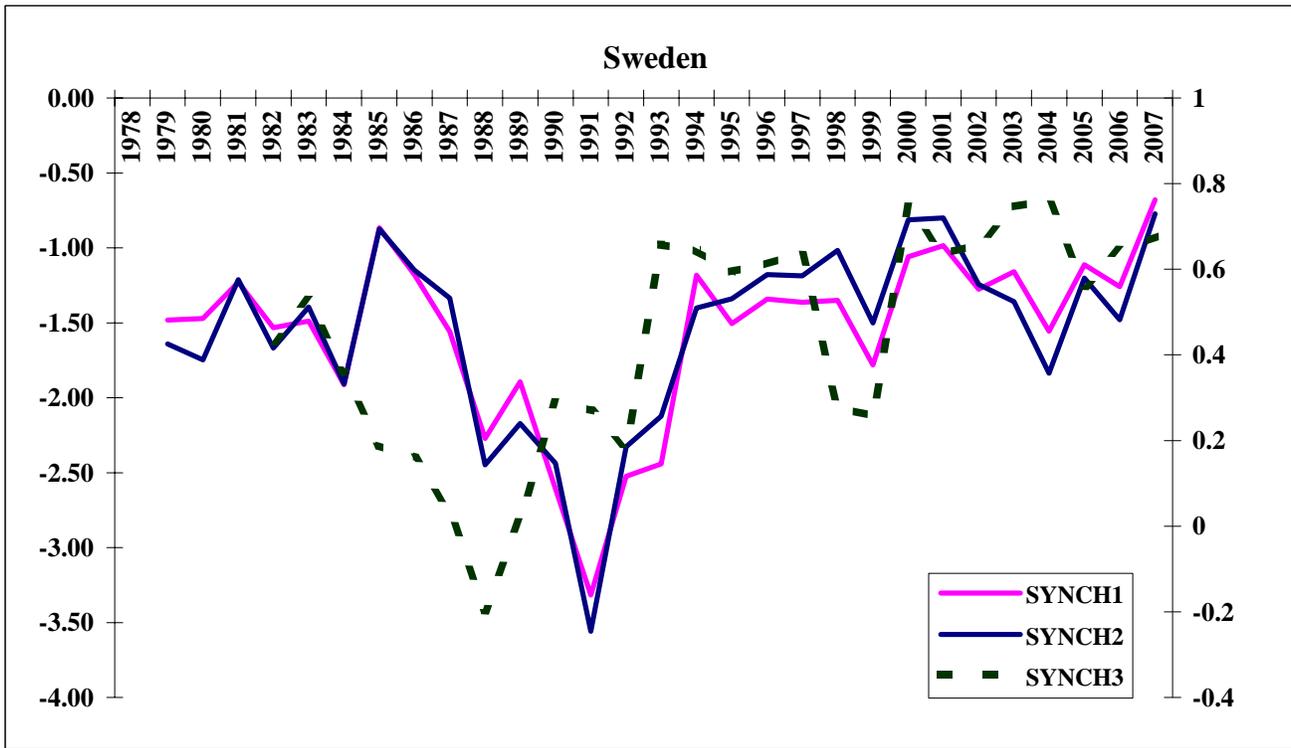


Appendix Figure 1.18

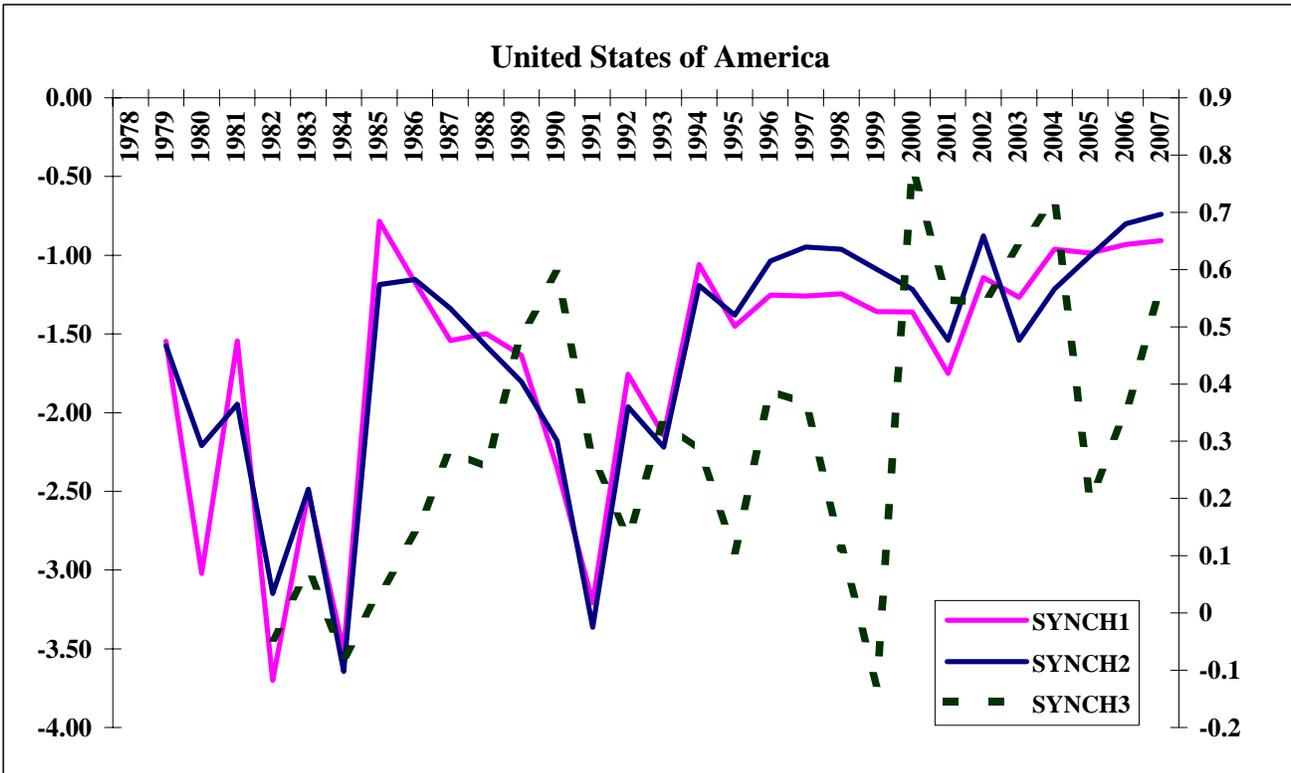


Supplementary Appendix

Appendix Figure 1.19

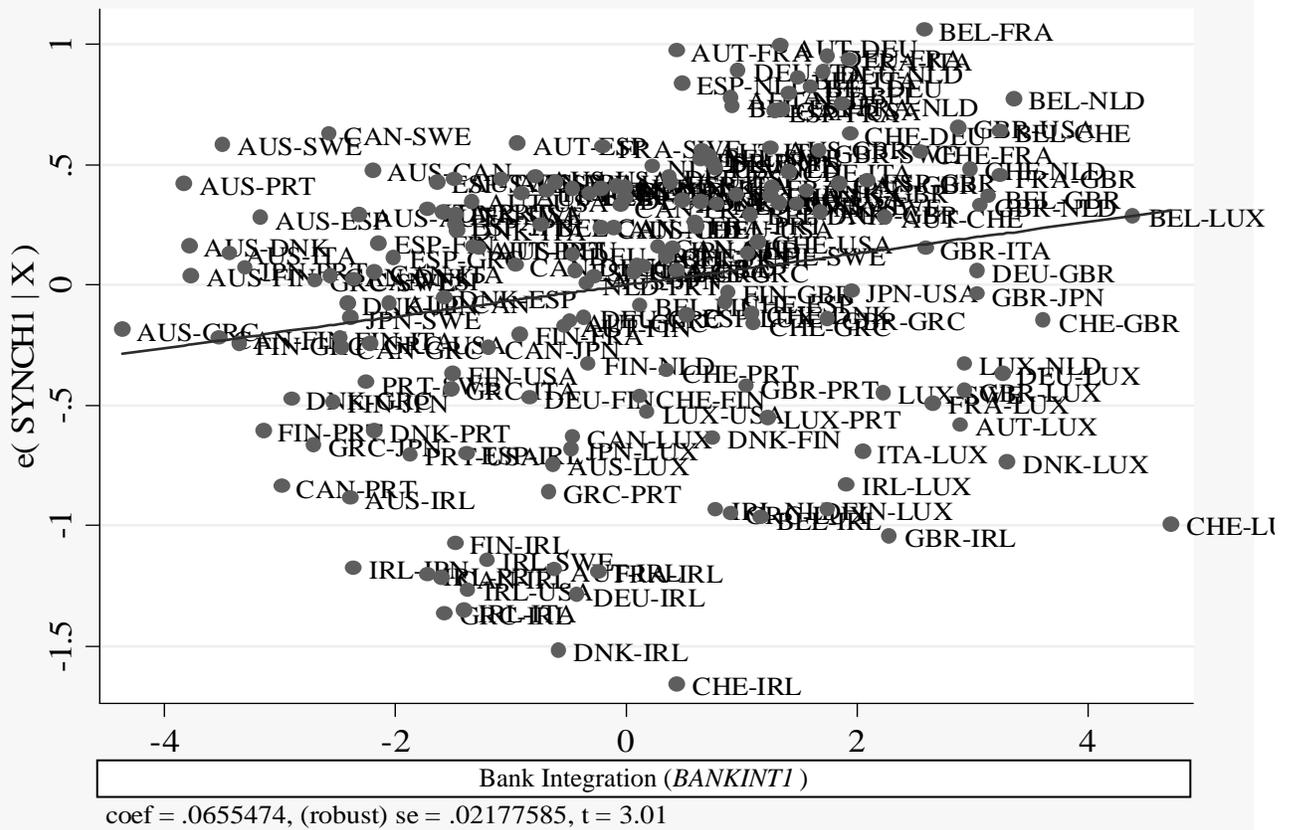


Appendix Figure 1.20



Supplementary Appendix

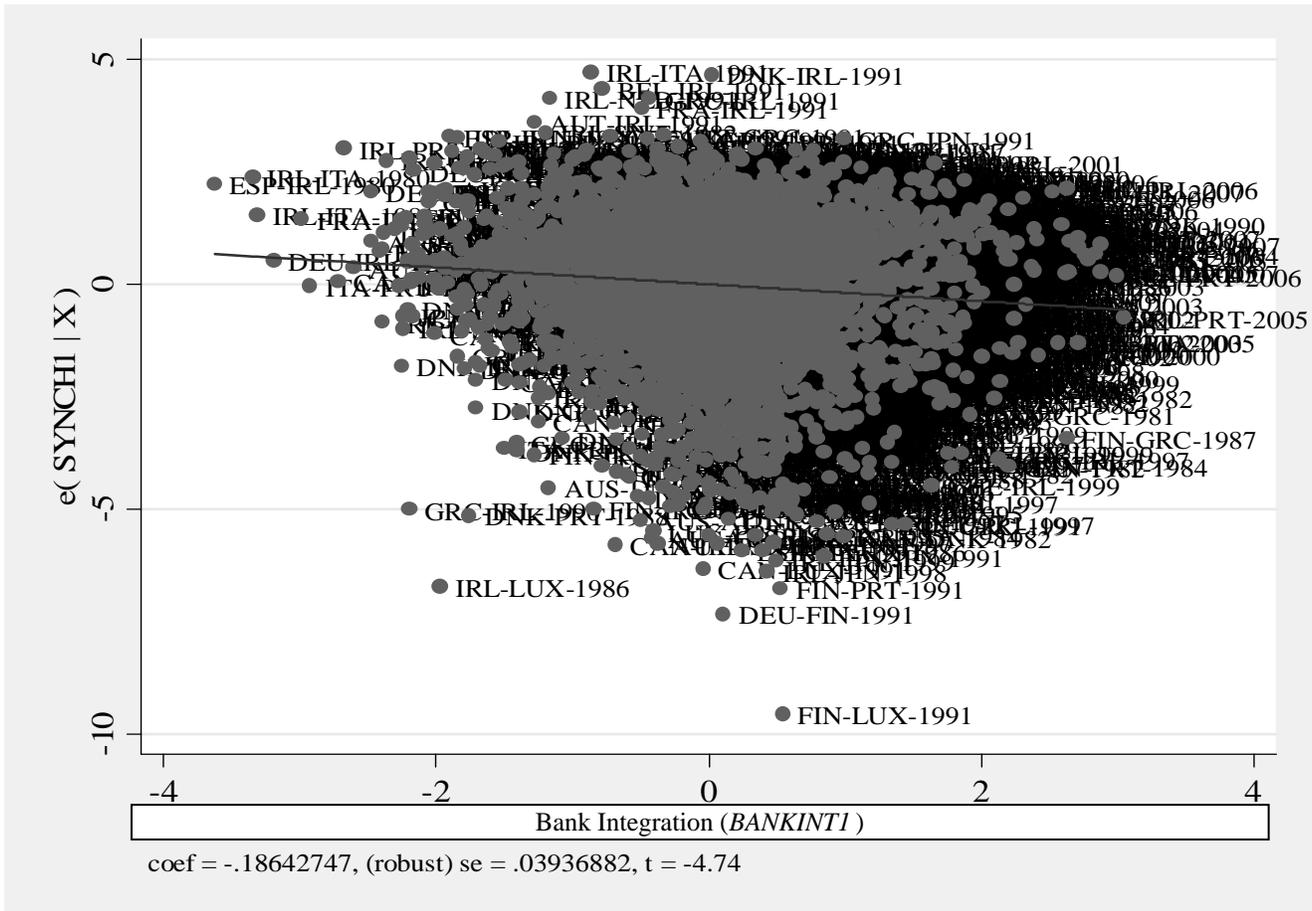
Appendix Figure 2 - Scatter Plot for Benchmark Cross-Sectional ("between") Specification



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 ($SYNCHI$). 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 ($BANKINTI$).

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 ($SYNCHI$). 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 ($BANKINTI$).