FINANCIAL INTEGRATION, MACROECONOMIC VOLATILITY AND RISK SHARING –
THE ROLE OF THE MONETARY UNION¹

BY SEBÑEM KALEMLI-OZCAN, UNIVERSITY OF HOUSTON AND NBER
SIMONE MANGANELLI, ECB
ELIAS PAPAIOANNOU, DARTMOUTH COLLEGE AND CEPR
JOSÉ LUIS PEYDRÓ, ECB

ABSTRACT

This paper is composed of two parts. We first review the literature on the effects of the euro on financial integration. We discuss the measurement of financial integration and describe the main legislative and regulatory harmonization policies that the EU member states have implemented in financial markets. We then review empirical results showing a positive impact of these policies and of the single currency on financial integration. Second, we present new empirical evidence of the impact of cross-border financial integration on macroeconomic volatility and cross-country risk sharing for 20 industrialized countries (including EU-15) over 1978-2007. We find that higher cross-border banking integration leads to lower consumption volatility and higher output volatility. These results imply that banking integration spurs risk sharing. The quantification of the amount of consumption and income smoothing reveals an economically significant positive effect of integration on risk sharing. Our results, therefore, suggest that the increased financial integration has fostered ex-post the optimality of the currency union.

¹ Essential parts of this paper were prepared while Sebnem Kalemli-Ozcan was visiting the European Central Bank as 2008 Duisenberg Fellow. She thanks the economists at the bank for providing a stimulating research environment. We thank Dimitrios Rakitizis for excellent research assistance, and Marco Lo Duca, Vladimir Lazarov, and Bernadette Lauro for help in obtaining part of the data used in this paper. Fabio Fiorello from the European Commission and Ana Margarida Monteiro from the Legal Department of the ECB helped us gather the data related to the implementation of EU Financial Acts. Ana Margarida Monteiro also provided us with very useful suggestions and feedback related to the EU Acts. We also thank Ignazio Angeloni, Luca Dedola, Charles Engel, Domenico Giannone, Philipp Hartmann, Michele Lenza, Roberto de Santis, Patrick Sandars, Bent Sorensen, Marc Spiegel, and Frank Smets, and especially the discussants Marco Pagano and Axel Weber, for helpful comments and suggestions.
Financial systems play a key role in the functioning of modern economies. Capital markets, by efficiently allocating resources across space and time, are instrumental in ensuring long-term non-inflationary growth. In addition, financial integration may be welfare enhancing by enabling agents to smooth consumption and share idiosyncratic risk. From a central banking perspective, financial systems represent the primary channel through which monetary policy is conducted. A stable, integrated and efficient financial system enhances the smooth and effective transmission of monetary policy throughout the economy.

Barriers and obstacles to financial integration prevent the allocation of capital to the most valuable projects at the lowest possible cost. European capital markets had been shaped by decades of national policies and cultural norms. Although the various stages of the Economic and Monetary Union (EMU) project eliminated many obstacles and barriers, numerous domestic conventions and practices remained, mainly because strong network externalities made it costly for market participants to abandon them. Thus, while the introduction of the single currency has spurred financial integration across euro area member states, existing barriers implied an important loss of efficiency. As a consequence, promoting integration of European financial markets has been one of the priorities of European policy makers.

This paper is composed of two parts. First, we review the literature on the impact of the single currency on various forms of financial integration. Although the introduction of the euro has arguably been the single most important force behind the evolution of European financial markets over the past two decades, it has been preceded and followed by a series of policy initiatives aimed at creating a level playing field across the euro area. Most previous work do not distinguish the impact of monetary union from the accompanying policy reforms. We argue that, the importance of these reforms in the process of financial integration should not be understated: they are continuously shaping the legislative architecture and technical infrastructure on which financial markets operate. For these reasons, we discuss the main legislative actions taken at the European level, as well as the ongoing efforts aimed at integrating the infrastructure of the different market segments. Then, we review results from Kalemli-Ozcan, Papaioannou, and Peydró (2008b), who analyze the effect of the euro and the most important legislative and harmonization policies in the European financial sector – the Financial Sector Action Plan (FSAP) – on banking integration.

Second, we present new empirical evidence regarding the impact of financial integration on macroeconomic volatility and risk sharing. Our key innovation compared to previous research is distinguishing between external assets and cross-border liabilities. Using banking integration data for 20 industrial countries over the past 30 years, we find that a higher degree of external asset holdings is associated with a lower level of consumption volatility. We also find that a higher level of external bank liabilities tends to increase output fluctuations. Jointly these results suggest that banking integration may facilitate risk sharing. These results are supportive for the models in the spirit of Obstfeld (1994), who emphasize the welfare enhancing aspects of financial globalization. Yet our
results differ from previous empirical studies, which fail to detect a significant effect of financial integration on macroeconomic volatility (e.g. Kose et al. 2006). We, also, following Demyanyk et al. (2008), quantify the degree of international diversification as a result of banking integration by estimating formal risk-sharing specifications. We find that the average consumption risk sharing among the 20 developed countries is 38%. This means that 38% of the country-specific risk is diversified away, on average, through cross-border bank investment and lending. In addition, we find that a country that doubles the holdings of its external assets (relative to population) is able to diversify away an additional 17%. External bank liabilities seem to have a dis-smoothing effect, but the estimated coefficient is not significant. We also estimate income (GNI) risk-sharing regressions. We estimate that the average income risk sharing over the last two decades has increased from zero to 12%. More importantly, a country that increases the holdings of external liabilities (relative to population) by 100% achieves 18% of additional income smoothing. To our knowledge these results are the first to reveal an economically significant positive effect of cross-border banking integration on risk sharing. The only other study that we are aware of is Demyanyk et al. (2008), who also investigated the effect of bank integration on risk sharing for Europe. Demyanyk et al. (2008), however, do not find a significant effect of banking integration on consumption risk sharing. Most likely this difference is due to our sample, which covers a larger number of countries and years.

Our findings have important implications for policy makers in the euro area. Asymmetric shocks in a currency union generate output and inflation differentials. The impact of such shocks can be considerably reduced if financial markets enable cross-country risk sharing. To the extent that risk-sharing allows for the hedging of consumption, it represents a key counteracting mechanism against output shocks among members of a currency union. This mechanism reduces the need for policy intervention in dealing with such asymmetries. Our results, therefore, suggest that the increased cross-border banking integration has improved ex-post the optimality of the currency union by improving consumption risk sharing.

The paper proceeds as follows. Section 1 reviews the vast and growing literature on the effect of the single currency on various forms of financial integration. We then describe the main regulatory and legislative policies that the EU member states have (are) implemented (implementing). We conclude this review part by summarizing the findings from Kalemli-Ozcan, Papaioannou, and Peydró (2008b), who isolate the effect of monetary union from that of the parallel financial sector reforms that took place under the Financial Service Action Plan (FSAP) on cross-border financial integration. Section 2 investigates the “real” effects of banking integration. We start by examining the impact of cross-border banking integration on GDP and consumption volatility. Besides using an aggregate index of banking integration that blends foreign assets and liabilities, we also distinguish between the two. We then quantify the degree of risk sharing that is explained by banking integration. Section 3 concludes.
There is a vast and growing literature on measuring financial integration (e.g. Adam et al. (2002)). The literature tends to measure integration both from the “price” side and also from the “quantity” side. Most studies consider the financial markets to be integrated if all agents face the same set of rules, are treated equally and have equal access to financial products (e.g. Baele et al. (2004)). If these conditions are satisfied, any price difference between identical assets will be immediately arbitraged away. Given the variety of assets traded, the measurement of financial integration with “price-based” indicators is not straightforward. Hence the literature also looks at the volume of cross-border transactions in the various market segments.

By opening access to foreign markets, financial integration offers agents a wider range of financing sources and investment opportunities, and permits the creation of deeper and more liquid markets. This allows more information to be pooled and processed more effectively, and economies of scale to be exploited. Financial integration also increases competition, thereby putting pressure on the cost of production for financial services, and increases financial development.

Although increased financial integration and development are usually associated with better economic performance, the implications for financial stability are more ambiguous. A higher degree of financial integration and development can have a positive impact on financial stability, to the extent that both facilitate risk sharing among agents. On the other hand, as the recent turmoil clearly demonstrates, some new (ill-designed or badly implemented) financial instruments may magnify problems arising from asymmetric information, distort incentives and offer opportunities for extreme risk taking. As pointed out among others by Rajan (2006) and Ferguson et al. (2007), financial integration will improve stability most of the times, but may make rare and extreme events more severe.

A key summary statistic to gauge the development of a financial system is the capital market size. Chart 1 reports the total size of capital markets, which aggregates the size of stock, bond and loan markets as a share of GDP. The Chart shows that the size of capital markets it has been growing steadily over the past fifteen years for all developed economies. Papaioannou and Portes (2009) provide formal econometric evidence that the euro has accelerated the growth of financial development among euro area member countries. Establishing larger and more liquid capital markets is key to financial development, which in turn has a positive effect on investment and total-factor-productivity (see Levine (2005) and Papaioannou (2007) for reviews).

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2 One important caveat is the following: the data behind the indicators discussed in this survey stop in mid 2008. Therefore, they do not cover the very recent developments. Preliminary evidence from ECB (2009) shows signs of divergence on price-based indicators (for instance in the cross-country dispersion of money market lending rates). From a financial integration perspective, it is important to understand how much of this divergence reflects differences in credit risk among banks, or alternatively higher market segmentation.
The growing size of the euro area financial system shown in Chart 1, hides uneven developments of its individual segments. In the rest of this section we will review the literature that examines the impact of the single currency on the most important market segments, namely the money, bond, equity and banking market. Following the literature on financial integration, we will distinguish between price-based measures (based on asset pricing models) and quantity-based measures (based on cross-border asset allocations) (Obstfeld and Taylor (2004)).

**MONEY MARKETS**

The euro area money market covers interbank short-term lending and borrowing and deposit taking. The most important segment is the (unsecured and secured repo) markets. The unsecured deposit market is where credit institutions exchange short-term liquidity without posing collateral as guarantee. In the repo market, participants obtain liquidity against collateral, with the agreement to reverse the transaction at some pre-specified future date and price. The derivatives market includes interest rate futures, options and swaps, and has become increasingly important in recent years. The short-term securities market consists of commercial paper issued by corporations and certificates of deposit issued by banks with less than one year maturity.

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3 For early surveys see Adam et al. (2002), Hartmann et al. (2003) and Baele et al. (2004). Recently, the European Commission and the ECB have been publishing comprehensive reports on financial integration (see EC (2008) and ECB (2008)).

4 See ECB (2008d) for a review of the recent developments in money markets.
Hartmann et al. (2003), Gaspar et al. (2001) and Perez-Quiros and Mendizabal (2006) analyze the evolution and integration of these markets in the early years of EMU. Financial integration in money markets is typically measured by the dispersion of average daily interest rates prevailing in each euro area country. Since transactions in these markets are characterized by similar cash flows and, given the very short term maturity contained very little credit risk (until the start of the turmoil), the law of one price suggests that in perfectly integrated markets any dispersion should converge to zero. The available evidence suggests that both the unsecured and secured segments of money markets have reached a high degree of integration (see Chart 2). The cross-sectional standard deviation of

**Chart 2 Cross-country standard deviation of unsecured interbank and repo rates across euro area countries**

Note: Each indicator is constructed as the unweighted standard deviation of average daily interest rates (in basis points) prevailing in each euro area country. The bottom figure reports the indicators since the introduction of the euro.
the overnight lending rates across euro area countries fell sharply to almost zero following the introduction of the euro. Spreads between the policy rate and the inter-bank rates have been also small and have remained stable until the summer of 2007, the start of the financial turmoil. Similar results hold for the 1-month and 12-month EURIBOR and EUREPO rates.

Following the collapse of Bear Stearns and Lehman Brothers even very short term interbank loans are perceived as risky. This in part explains the higher dispersion of money market rates observed over the last year, which must not necessarily be associated with an increased market segmentation. In the presence of asymmetric information – for instance with high uncertainty about the number of risky borrowers in the interbank market – the interest rate rises and safer borrowers may choose to drop out of the market. As counterparty risks increase even further, banks may prefer not to lend to other banks, thus reducing liquidity and increasing volatility in the interbank market (Heider, Hoerova and Holthausen (2008)).

Sources: ECB, Euroclear, Banque De France, Dealogic and FED.
Note: The height of the bar for Europe is the sum of Euro Commercial Paper (ECP), and the commercial paper outstanding in the Belgian, German, Dutch, Spanish and French markets. Certificates of deposits and Asset Backed commercial paper are excluded. The blue area indicates the fraction of commercial paper that has the STEP, Short-Term European Paper, label. Since issuance in the ECP market is mainly undertaken by residents in the euro area and UK, the amounts outstanding of European commercial paper have been expressed in percentage of the sum of the Euro area and UK GDP.

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5 For systemic risk in banking see de Bandt, Hartmann, and Peydró (2009), and for interbank contagion see Iyer and Peydró (forthcoming).
6 Cassola, Lo Duca and Holthausen (2008) show that cross-border trades declined significantly after the start of the turmoil. At the same time the price for cross-border transactions has been significantly lower than that for domestic trades. According to the authors, these facts are consistent with a two-tier system of the money market: cross-border interbank trades are conducted by banks with a relatively high credit standing, while the other banks are mainly trading in domestic markets where interest rates are higher because the average credit risk is perceived to be higher.
The market for short-term securities, on the other hand, has shown little signs of integration, mainly because of differences in market practices and standards. Since commercial paper contracts vary across countries due to differences in legal systems and regulatory requirements, the market for short-term paper in Europe has remained largely of domestic nature. Since June 2006, the STEP initiative (Short-Term European Paper) aims at fostering the integration of this market by promoting convergence of market standards.

Chart 3 illustrates the progress achieved so far. In 2007 more than half of the outstanding commercial paper in euros had been assigned the STEP label. As more issuers use a common STEP label, obstacles to cross-border transactions represented by different domestic practices are progressively eliminated. The commercial paper market has therefore the potential to become a truly integrated euro area market, whose dimension is comparable to that of the US.

**BOND MARKETS**

With the introduction of the euro and the removal of exchange rate risk, yields in the bond market have converged in all euro area member countries, and spreads tend to be increasingly driven by common factors. The extant literature and available indicators show that the euro had a substantial impact in these markets. Unlike for money markets, whose rates are directly comparable, naïve comparisons of bond yield differentials may give a misleading indication of the state of integration of bond markets. Besides exchange rate risk, bond returns differentials reflect differences in perceived credit risk, stemming for example from fiscal policies, a history of default, and current account positions. As such, bond spreads reflect the proper functioning of market discipline, rather than lack of integration. Most price-based measures of integration in bond markets are based on the intuition that in integrated markets bond yields should react to common, rather than local, factors. We review the evidence for government and corporate bond markets separately.

**Government Bond Markets** Examining the effect of monetary integration on government bonds is quite important, as even a small reduction of spreads may entail significant savings for the tax payer. A reduction in the cost of borrowing may free resources to invest in public works and social welfare programs. After the impressive convergence in the run up to EMU spreads have narrowed significantly in the initial post-euro period, although differences have not disappeared completely. Yet since the start of the financial market turmoil in summer 2007, spreads have increased significantly, specifically among countries with huge levels of debt, budget and trade deficits.

Although part of the remaining spread reflects cross-country differences in debt levels and budget deficits/surpluses, a common finding of the literature that clearly points to a higher degree of integration is that following the advent of the euro spreads tend to move together (see Pagano and Von Thadden (2004) for an early review of the literature). The empirical literature tries to identify

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7 The London based Euro Commercial Paper (ECP) market is the only market where the short term paper is traded on a cross border basis.
which common factors explain spread co-movement. Codogno et al. (2003) find that yield differentials between government bonds can be explained by variations in international risk factors, such as risk aversion proxied by the spread between the U.S. corporate and government bonds. The results are obtained with simple regressions, where spreads are regressed against countries’ deviation of debt-to-GDP ratios with respect to Germany and their proxy for the international risk premium. Using alternative econometric techniques Geyer et al. (2004) and Bernoth et al. (2004) reach similar conclusions. Manganelli and Wolswijk (2008) show that the spreads of euro area government bonds are tightly related to the level of short-term interest rates set by the Eurosystem, which in turn may be related to time-varying risk aversion: an increase in interest

Source: Datastream.
Note: Spreads are expressed in basis points. The small figure reports the behaviour of spreads since the introduction of the euro.
rates is associated to a widening of spreads and conversely lower interest rates induce a reduction in spreads. Their finding is also consistent with an emerging line of empirical research, showing how tight monetary policy decreases the willingness of investors to bear risks.\textsuperscript{8} Liquidity appears to be an important factor (e.g., Gomez-Puig (2006); Jankowitsch et al. (2006); Favero et al. (2007)). The general finding of this body of work is that the benchmark property appears to command a liquidity premium, although there may be relevant non-linear interactions between liquidity and credit risk.

\textit{Corporate Bond Market} The introduction of the euro has been one of the driving forces behind the strong development of the euro area corporate bond market. Pagano and von Thadden (2004) provide a broad overview of the major structural developments. On the supply side, the introduction of the euro has offered companies the opportunity to access a larger pool of investors and diversify their liabilities away from traditional loans. Rajan and Zingales (2003), using panel data on domestic outstanding corporate debt in several countries till the early years of the single currency (2001, 2002), document that EMU had a positive and statistically significant effect on the amount of net debt issues.

Similarly, the market for corporate euro bond underwriting, after the introduction of the euro became a much more contestable business. Santos and Tsatsaronis (2003) show that the arrival of the euro had an important negative impact on the underwriting fees of international corporate bonds issued in the new currency. Biais et al. (2006) document how euro area corporate bonds have narrower bid-ask spreads than comparable bonds denominated in other currencies. According to the study this spread reduction is largely the outcome of the large pool of institutional investors, which was made possible by the integration of the European corporate bond market after the introduction of the euro. On the demand side, there has been a strong increase in the geographical diversification of euro area bond portfolios.

Chart 5 shows that the trend towards internationalization is ongoing. The Chart plots cross-border holdings among euro area member states of long-term debt securities. Overall, euro area residents have strongly increased their cross-border holdings of debt securities since the end of the 1990s, from about 10% to almost 60%. Given the very low starting point in 1997, this indicator suggests that investors have substantially diversified their portfolios across the euro area. One obtains similar results by looking at cross-border holdings of financial institutions. Cross-border holdings of long-term debt securities have continued to increase over the past ten years from about 15% in 1999 to about 40% in 2007 (see ECB 2008). The visual impression of Chart 5 is confirmed by formal econometric studies. Lane (2006) and Cœurdacier and Martin (2007) regress the amount of cross-border bond holdings on an EMU dummy, controlling for several bilateral characteristics, among which EU membership and bilateral trade. They find that the introduction of the euro had a substantial impact on the amount of cross-border bond investments.

\textsuperscript{8} See, for instance, Rajan (2006), Bernanke and Kuttner (2005) and Jimenez et al. (2008).
Researchers studying price-based measures also find a significant impact of the euro on integration in the corporate bond market. Baele et al. (2004) test whether risk-adjusted yields have a systematic country component. In an integrated market, the proportion of the total yield spread variance that is explained by country effects should be close to zero. The respective indicator shows that the euro area corporate bond market is quite integrated. Country effects explain only a very small proportion of the cross-sectional variance of corporate bond yield spreads (see ECB (2008)).

**EQUITY MARKETS**

Equity markets in Europe have developed substantially over the past two decades, in the midst of a wave of consolidation of stock exchanges. A higher volume of transactions lowers intermediation fees and increases market efficiency (see ECB (2007a)). Through network externalities and economies of scale the consolidation of stock exchanges can further spur integration. Market consolidation occurred initially at the national level. Consolidation continued then at the regional level (Euronext and OMX), and more recently outside the euro area (with the NYSE-Euronext and LSE-Borsa Italiana mergers). Schmiedel and Schönberger (2005) report that securities exchanges (including stocks and derivatives) in the 12 euro area countries have decreased from 30 in 1999 to 22 in 2005.

It is much harder to assess the degree of integration of equity markets relative to money and bond markets, as equity returns are not directly comparable. In principle, in a perfectly integrated market only common risk factors are priced, while diversifiable country risks command no risk premia. In practice,
it is difficult to disentangle the impact on equity returns of changing economic fundamentals from changes in the pricing mechanism (see Adjaouté and Danthine (2004) for an in-depth discussion). A simple, direct attempt to quantify the impact of integration in equity markets is to look at the dynamics of investors’ portfolios. In a truly integrated market, investors should not prefer national over foreign equities. Evidence of decreased home bias can therefore be consistent with the disappearance of psychological or physical barriers to cross border investments.

The available quantity-based measures indicate a rising degree of integration in equity markets. De Santis and Gerard (2006) investigate the determinants of international portfolio reallocation for 30 large economies between 1997 and 2001. They find an overall decrease in home bias that is more pronounced for euro area member states. Lane and Milesi-Ferretti (2007) and Cœurdacier and Martin (2007) reach similar results. Chart 6 shows that euro area residents increased their holdings of equity issued in another euro area country between 1997 and 2004. Over this period, the share of intra-euro area cross-border holdings of equity securities doubled to 28%, while the share of euro area equity assets held outside the euro area is much lower and increased only slightly.

Another strand of the literature studies integration in equity markets by looking at asset returns. A first group of papers uses asset pricing models, while a second group looks at changes in comovements at country and sectoral level. Hardouvelis et al. (2006) use a conditional asset pricing model where the risk premium of the stock market is decomposed into a euro area wide and country specific risk factors. The relative importance of these two factors is measured.
by a time-varying parameter that reflects the (conditional) level of integration of each market. The empirical findings show that the degree of integration has gradually increased to the point where individual euro area country stock markets appear to be fully integrated into the EU market. In a similar fashion, Cappiello, Lo Duca and Maddaloni (2008) use an intertemporal CAPM to study the dynamics of equity risk premia for the five largest euro area economies. They also find that euro area equity markets are well integrated. Fratzscher (2002), Baele et al. (2004) and Fratzscher and Stracca (2009) assess to what extent local equity returns react to news. The estimates are interpreted as a measure of the intensity with which euro area and world factors are transmitted to local equity markets. They find that greater economic and financial integration leads to a higher degree of co-movement across countries and therefore to an increase in sensitivities to euro area factors.

Asset pricing models depend on the particular methodology and empirical specification of the risk factors. Furthermore, any test of market integration based on an asset pricing model is at the same time a test of the asset pricing model itself. To address these limitations, the literature has developed measures of integration based on less-restrictive (“model free”) approaches. Following Heston and Rouwenhorst (1994) a common approach is to analyze the relative importance of country and industry factors in driving returns. The idea of this body of work is that in segmented financial markets the benefits of cross-country diversification should be relatively higher than those of cross-sector diversification. An interesting finding of this line of research is that the dominance of country factors has decreased substantially and at certain points in time it has been overcome by industry factors in the euro area.

**Banking Markets**

Banking markets encompass interbank (or wholesale) activities, capital market-related activities and retail banking activities. Since we have already analyzed interbank and capital market related activities, we focus here on the retail segment. As banking is a multi-product business and banking services are quite heterogeneous it is hard to precisely assess the degree of integration. Retail customers typically buy packages of financial services that differ from bank to bank, let alone from country to country. Furthermore, because of limited access to “hard information” (such as publicly accessible account statements or an observed repayment track record), banks’ loans to small customers have to rely on “soft information”, such as personal interaction with the customer and knowledge of the local customs.

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9 Ayuso and Blanco (2001) follow the approach proposed by Chen and Knez (1995). Although their application is limited to US, German and Spanish stock markets, their results point to an already substantial degree of integration during the nineties.


A simple way to describe the progress of integration in the banking market is to examine whether barriers to entry have been progressively removed. In principle, the absence of barriers to entry and the threat of new entries should deter incumbents from charging prices in excess of their marginal costs. In practice, such an ideal condition is rarely met. Several studies show that even in the U.S. the distance between borrower and lender is a highly significant determinant of lending conditions (e.g. Petersen and Rajan (2002)). Degryse and Ongena (2005) using a data set containing more than 17,000 firm loans of a large Belgian bank find that rates decrease in the distance between the firm and the lender. Similarly, loan rates increase in the distance between the firm and competing banks. Degryse and Ongena (2004) provide an extensive overview of empirical and theoretical literature suggesting that market segmentation may persist in retail banking for some time.

Notwithstanding these caveats, quantitative measures of integration in the retail bank market can be obtained directly by looking at the dispersion of interest rates on loans and deposits from banks to non-financial corporations and households. Euro area cross-country dispersion of bank interest rates has remained relatively high (at least when compared to the government bond market and interest rates on debt securities more generally, see ECB (2008)).

12 An alternative way to gauge directly the degree of integration in banking market is to compare cross-country efficiency of European banks, as suggested for instance by Bos and Schmiedel (2007).
Quantity-based indicators of banking integration are based on measures of cross-border activities. Chart 7 reports the geographical holdings of securities issued by euro area financial institutions and held by other financial institutions resident in other euro area countries or in the rest of the European Union. The indicator shows substantial progress in the degree of euro area diversification. Other indicators, such as loans to other financial and non-financial institutions also reveal the existence of an increasing trend of cross-border activity (see ECB (2008)). The econometric analysis of Perez, Salas-Fumas and Saurina (2005) shows that this integration process has been boosted by the introduction of the euro.

The intrinsic nature of the banking system – characterized by strong information asymmetries – suggests that bank mergers and acquisitions (M&A) may be the best strategy to enter another market and provide truly pan-European cross-border services. Cross-border M&A in banking were low compared to related activities in the manufacturing sector. This reflected the existence of barriers, not only of geographical but also of regulatory and legal nature (see ECB (2007b), Berger (2007), Altunbas and Marqués-Ibáñez (2008)). The introduction of the euro has spurred cross-border bank M&A. Chart 8 reports average cross-border M&A activities of euro area banks, broken down by the geographical location of the deals. We notice that there has been a substantial reduction in the proportion of domestic deals which has been substituted by intra-euro area cross-border M&A activity. The extent to which banks are owned by foreign institutional investors appears to be an important determinant of cross-border M&A activity.
(ECB (2008e)). If foreign institutional ownership and cross-border M&A help to reduce home bias and encourage foreign portfolio investments, they may represent important channels to foster financial integration.

2.1 POLICY INITIATIVES COMPLEMENTING MONETARY UNION

The degree of financial integration varies considerably across the various market segments. The more uniform the characteristics of the asset the more integrated that market. The unsecured money market, where banks lend to each other on such a very short term that the credit risk was essentially null (until the start of the turmoil), appeared to be the most integrated. Bond markets, where cash flows are directly comparable and credit risk can be reasonably estimated, also appear quite integrated. Equity and banking markets appear to be the least integrated.

Lack of integration reflects the existence of barriers to cross-border activities. We can classify the obstacles to financial integration in three main categories:

1. Cultural/informational
2. Regulatory/legal
3. Technical/infrastructure

CULTURAL/INFORMATIONAL
Recent work shows that there are non-negligible psychological and cultural barriers to financial integration (see for a review Guiso et al. (2006)). For example cultural differences and mistrust explains a significant portion of bilateral financial (and trade) flows (see Kalemli-Ozcan et al. (2008) and Guiso et al. (2008) for evidence). Giannetti and Yafeh (2008) show that cultural similarities correlate significantly with rates and the loan structure in the international syndicated bank loan market. Besides cultural and psychological reasons, information frictions seem to have a significant effect on financial integration. Research by Portes and Rey (2005) shows that variables reflecting information asymmetries among countries (such as telephone costs, trading time, foreign newspaper circulation) correlate significantly with cross-border equity flows. Subsequent work on other forms of financial integration reaches similar results (e.g. Aviat and Cœurdacier (2006); Papaioannou (2009)). Quite importantly in all studies, distance is negatively correlated with financial integration even if one accounts for cultural, regulatory, or informational differences. EU integration policies mainly focus on removing regulatory-legal barriers and building the necessary infrastructure for cheap and fast trading and settlement procedures. These measures can also serve to ease the informational frictions. We henceforth focus our analysis on these barriers.

REGULATORY/LEGAL OBSTACLES
A precondition for financial integration is the removal of any legislative or regulatory differences discriminating agents on the basis of their location. Many of the efforts at the European level have been directed at the removal of barriers to cross-border activities.
The legal and regulatory environment of the European banking industry has been radically changed over the past three decades (see Dermine (2003, 2006)). The transformation started in 1977, with the First Banking Directive establishing the principle of home country control: supervision of financial institutions operating in two or more member countries was shifted to the home country of the parent institution. It was followed in 1988 by the Second Banking Directive, under which all credit institutions authorized in a EU country were able to establish branches or supply cross-border financial services in other EU countries without further authorization (“single banking license”). In parallel with these EU-wide policies member states adopted additional policies that aimed at further strengthening the banking system (e.g. privatization policies).

After the introduction of the single currency, the European Commission launched in 1999 the Financial Services Action Plan (FSAP). The FSAP included a set of initiatives aiming at increasing financial integration along three strategic objectives (see Hartmann et al. 2003 for details):

- A single EU market for wholesale financial services,
- Open and secure retail markets,
- State of the art prudential rules and supervision.

While the FSAP constituted a major overhaul of the EU legislation for the entire financial sector, most of the initiatives related to securities markets. Major measures in this respect included, for example, the Markets in Financial Instruments Directive (MiFID), the Transparency Directive, the Market Abuse Directive, and the Prospectus Directive. Building on the achievements under the FSAP, the Commission adopted in December 2005 a White Paper on EU financial services policy for the years 2005-2010. The White Paper aimed at ensuring the effective and consistent implementation of the FSAP measures and at consolidating and simplifying the existing EU legislation.

Several EU initiatives have recently been adopted in the areas of banking regulation and supervision removing existing obstacles to cross-border banking. As already discussed in the banking section, cross-border banking groups are central for the integration process, as they enhance competition across jurisdictions. Against this background, the removal of policy-related obstacles to cross-border banking has become a policy priority in recent years. Partly as a result of a survey of the European Commission on barriers to cross-border banking consolidation, three main obstacles have been identified:

- Prudential – Differences in supervisory approval process and prudential rules.
- Legal – Incompatibilities in national company laws and insufficient legal harmonization.
- Fiscal – Differences in tax treatment of operations related to cross-border banks’ M&A activities.
The European Commission has adopted several directives to address some of these issues. For instance, legal obstacles to cross-border M&A operations arising from differences in national company laws have been addressed to some extent with the Directive on take-over bids, adopted under the FSAP, and with the more recent Directive on cross-border mergers. Similarly, a Directive adopted in 2007 clarifies the procedural rules and the evaluation criteria for the prudential assessment of acquisitions and increases of holdings in the financial sector (see ECB (2007b) for details). In Section 2 we investigate the effect of these policies on cross-border banking integration finding that the implementation of these policies did have a positive impact.

TECHNICAL OBSTACLES

Technical market infrastructures are also key for financial integration. Impediments to securities trading across national borders inhibit arbitrage forces and induce violations of the law of one price. European policy makers and the Eurosystem in particular have devoted great efforts to the establishment of a common infrastructure.

TARGET and TARGET2

There is unanimous agreement that the high degree of integration of the large value payment systems (mostly used for interbank payment transactions) has been instrumental to the integration of money markets and wholesale banking activities. Before 1999, the system was highly fragmented, with only domestic platforms operating in legacy currencies. Payments across national borders within the EU were typically made via correspondent banking, at higher costs and delays compared to national transactions.

The effective conduct of the single monetary policy required the elimination of any difference between intra euro-area and within country payments. With the introduction of TARGET (Trans-European Automated Real-time Gross settlement Express Transfer system) payments between credit institutions within the euro-area take place in real-time and at a harmonized transaction fee. At the same time the number of payment systems was reduced from seventeen to six in 1999.14

TARGET was based on the principle of minimum harmonization, linking the national settlement systems of the 15 EU Member States and the ECB payments...
mechanism into a single platform. In response to the growing demand from financial institutions, the Eurosystem launched TARGET2 on 19 November 2007, which is no longer based on a decentralized architecture of “system of systems”, but on a single shared platform. TARGET2 has replaced the TARGET system in full since 19 May 2008.\textsuperscript{15} TARGET2 is expected to further enhance the integration of wholesale payments by providing its participants with:

- a single pricing structure for both domestic and cross-border transactions,

- a harmonized set of cash settlement services in central bank money for ancillary systems,

- a single technical communication interface for multi-country users, to process the information from branches in different countries.

The centralization of payment business is expected to allow users to exploit benefits from economies of scale and efficiency gains in speed and quality.

*TARGET2-Securities* The integration of the infrastructure-underlying bond and equity markets is much less advanced, partly reflecting the greater complexities of these markets. Each country has developed its own system based on different practices, as well as different legal, regulatory and fiscal regimes. The resulting fragmentation implies higher post-trading costs for EU cross-border securities transactions and constitutes a significant barrier to a truly integrated European financial market. These problems have been under the radar screen of EU policy makers for quite some time, and a number of actions have already been taken, such as:

- Harmonization of market practices, law, regulation and taxation to remove the so-called “Giovannini barriers”.\textsuperscript{16}

- The development of a “Code of Conduct for clearing and settlement” to stimulate fair and open competition among all exchanges, central counterparties and central securities depositories.

- The development of standards for the securities settlement systems aimed at promoting convergence towards the highest standards of safety and efficiency.

To fully exploit the benefit of scale and competition from a truly pan-European securities market, the Eurosystem is working at the establishment of TARGET2-

\textsuperscript{15} We refer to ECB (2008c) for comprehensive information about the main recent developments.

\textsuperscript{16} The Giovannini Group identified a set of barriers to cross-border clearing and settlement, stemming from differences in market practices, legal, regulatory and fiscal provisions. For details, see http://ec.europa.eu/economy_finance/eu經濟 situación/integrating_markets300_en.htm. See Giovannini (2008) for an extensive overview of clearing and settlement systems in Europe.
Securities (T2S), a borderless and neutral platform for securities settlement. The resulting system endeavors making cross border settlement as cheap and efficient as domestic settlement. At the same time, it will allow market participants to pool their liquidity and collateral, reducing costs. The use of a common settlement platform should increase transparency and facilitate investors’ decision to hold securities in the issuing depository, in an investor depository or in a custodian bank. Once implemented, investors should be able to choose the provider on the basis of costs and services offered, rather than the location of the security. This, in turn, will reduce custodian services fees, which currently represent a significant fraction of the costs for end-users.

SEPA: Single Euro Payments Area The integration of retail banking markets has been hampered by, among other things, the high level of fragmentation of the retail payments infrastructure.

Prices for cross-border credit transfers were higher and the execution time substantially longer than for domestic transfers. Despite some initiatives by the banking industry, progress was slow and the pricing structure remained highly heterogeneous. The processing of credit transfers, direct debits and payment cards remained fragmented reflecting the underlying payment infrastructures.

European Parliament and the Council adopted a Regulation in December 2001, which enforced an equal pricing of cross-border and national euro payments for consumers. This was followed in early 2002 by the launch of the Single Euro Payments Area (SEPA) initiative for the banking industry. In SEPA all euro payments will be treated as domestic payments and remaining distinctions between national and cross-border payments will disappear. By creating a truly integrated infrastructure, SEPA should foster the integration and improve the efficiency of the euro area retail banking markets (see ECB (2007c) for details).

STEP: Short-Term European Paper To promote integration in the short-term debt securities (i.e. commercial papers and certificates of deposit) the ECB called for market participants to improve the functioning of this market. In response, the Financial Market Association (ACI) launched the Short-Term European Paper (STEP) initiative to foster the integration of the European market segments for short-term securities. The STEP initiative aimed at (i) identifying a set of common market standards and practices suitable to promote market integration and (ii) fostering the voluntary compliance of market participants by granting a common label to compliant issuance programmes.

The project has been implemented in two main phases. The first phase – concluded in June 2006 with the STEP Market Convention – focused on identifying and codifying adequate market standards. The second phase aimed to raise public awareness of the initiative and the benefits of compliance.

17 The T2S project was officially launched by the Governing Council of the ECB on 17 July 2008. See http://www.ecb.int/paym/t2s/html/index.en.html for more details.
18 Although the Eurosystem was not the main driver of SEPA, it had a catalyst role in fostering agreement and convergence towards common standards among market participants.
awareness. The campaign contributed to the rapid acceptance and the increasing relevance of the STEP market (see Chart 3).

2.2 THE EFFECTS OF THE EURO AND EU-WIDE POLICIES ON FINANCIAL INTEGRATION

A fast growing body of research analyzes the effect of the euro on various forms of financial integration. For example Lane (2006), Courdacier and Martin (2007), and De Santis and Gerard (2006) use bilateral cross-sectional bond and equity holding data (from IMF’s Coordinated Portfolio Investment Survey) in advanced economies to examine the effect of the euro on cross-border bond and equity holdings. Likewise, Papageorgiou (2005), Petroulas (2007), and Flam and Nordstrom (2006) quantify the impact of the single currency on bilateral FDI flows. Bobba et al. (2008) document an increased role of the euro in international debt issuance, while Spiegel (2009) shows a sizable positive impact of the single currency on cross-border banking activities. While estimates differ across studies, the overall evidence shows that the euro has spurred financial integration in equity and bond markets among member states. For example in the context of banking integration Spiegel (2009) finds that cross-border bank lending more than doubled after the introduction of the euro in Portugal and Greece.

Yet little attention has been given to isolating the effects of harmonization policies from monetary union and other parallel developments. In this section we summarize the empirical strategy and results from Kalemli-Ozcan, Papaioannou and Peydró (2008b), who as far as we are aware, is the only study that disentangles the monetary union effect on financial integration from legislative harmonization policies in the financial sector.

Kalemli-Ozcan, Papaioannou and Peydró (2008b) exploit a confidential data-set from the Bank of International Settlements (International Locational Banking Statistics Database) which contains information on bilateral bank holdings and flows among developed countries. This dataset reports asset and liability holdings of banks located in the main industrial countries and some financial centers in roughly 150 countries since 1977. The analysis is carried over a group of 20 advanced economies over the 1977-2007 period. To assess the effect of legislative-regulatory harmonization policies the authors use information from the European Commission on the implementation of the 21 Directives of the FSAP. To measure the impact of the single currency on exchange rate volatility, the authors use the Reinhart and Rogoff (2004) classification.

19 Like SEPA, STEP is a market led initiative. The ECB played a key catalyst role by providing assistance in the formulation and promotion of the project (see ECB 2008b for further details).
20 This work follows an earlier literature on the effects of free-trade-agreements and currency unions on international trade (e.g. Rose (2000); Micco et al. (2003); Flam and Nordstrom (2006); see Baldwin (2006) for a review).
21 The Commission has created league tables to put pressure on the countries to quickly adopt the directives. The data is available at: http://ec.europa.eu/internal_market/finances/index_en.htm. They also analyzed the other Directives that entered after 2003 finding similar results.
In contrast to previous work that mainly used cross-sectional approaches, their three dimensional panel structure allows them to control for year fixed effects and country-pair fixed-effects. Year fixed-effects account for global trends on banking integration. This is important as, for example, cross-border bank flows have increased considerably among the past twenty years (e.g. Lane and Milesi-Ferretti (2007)). Country-pair fixed-effects enables them to control for all sources of (to a first-approximation) time-invariant bilateral characteristics that affect financial integration. Country-pair fixed-effects control for distance, adjacency, and other (gravity-like) factors that correlate with banking integration (e.g. Portes and Rey (2005); Aviat and Cœurdacier (2006); Papaioannou (2009)). In addition, country-pair fixed-effects control for other unobserved or hard-to-account-for factors, such as cultural proximity, political ties, legal system similarities, etc. that affect financial and international banking in particular linkages (Guiso et al. (2009); Giannetti and Yafeh (2008)).

Kalemli-Ozcan, Papaioannou and Peydró (2008b) first estimate difference-in-difference specification where euro area member countries constitute the “treatment” group, while the three EU and the five non-EU countries serve as the “control” group. The estimates suggest that cross-border banking activities between euro area countries increased by 40% – 45%, compared to the general evolution of international financial integration in the control group of countries. The difference-in-difference specifications further show that it was the adoption of the single currency rather than EU membership that spurred banking integration.

Second, the authors augment the model with the bilateral measure of the rigidity of the exchange rate regime and the index that quantifies the implementation of financial sector reforms in the context of the FSAP. The panel estimates show that international banking activities is significantly higher among pair of countries with a fixed exchange rate regime. Thus a primary reason behind the positive impact of the euro on financial integration was the elimination of exchange rate volatility. Legislative harmonization in financial sector tends also to have a significant effect on cross-border banking integration. Roughly one third of the overall positive impact of the euro in the unconditional estimates is explained by these reforms.

Third, the authors also investigate whether the positive effect of the single currency on financial integration is driven by a similarly positive impact on goods trade. Although trade in goods and assets is positively correlated the estimates imply that monetary unification and financial legislation harmonization are the key drivers of cross-border banking integration.

22 This is because previous work mainly relies on IMF’s CPIS data that started becoming available at 1997. Since the initial surveys covered a small number of countries and the data was questionable, most studies use CPIS data after 2001.
23 This finding is interesting in light of the so-called “fear of floating” literature (e.g. Calvo and Reinhart (2003); Klein and Shambaugh (2007)). Yet while this literature focuses on developing economies, these results reveal a similar pattern across developed countries.
24 See Kalemli-Ozcan, Papaioannou and Peydró (2008b) for the robustness of the results reviewed here and also for further results.
In the second part of the paper, we analyze the “real effects” of financial integration. First, we evaluate the effect of banking integration on macroeconomic volatility. Second, we investigate the effect of banking integration on the amount of consumption and income risk sharing.

In this section we use data from BIS’s Banking Statistics on cross-border bank holdings and flows at the country level over the 1978-2007 period and examine the effect of banking integration on output and consumption growth volatility, and on consumption and income risk sharing. Our sample includes the initial 12 euro area member countries, the three non euro area EU15 countries (namely the UK, Sweden, and Denmark) and five other industrial countries (the US, Japan, Australia, Canada, and Switzerland).

### 3.1 The Effects of Banking Integration on Macroeconomic Volatility

Standard theory predicts that financial integration should lead to lower consumption volatility, as agents will be able to smooth idiosyncratic fluctuations. In contrast income volatility may increase as financial integration may magnify productivity differences. Yet the empirical literature fails to find such effects in the data (see for example Kose et al. 2008). For example cross-country studies find an insignificant effect of international financial integration on output and consumption volatility.\(^{25}\)

#### Empirical Specification

We investigate the question of volatility in a panel framework and run the following regression:

\[
FLUCT_{i,t}^{Y,C} = \alpha_i + \alpha_t + \beta FININT_{i,t-1} + \gamma TRADE_{i,t-1} + X'_{i,t-1} + \delta + \epsilon_{i,t}
\]

where dependent variable \(FLUCT_{i,t}^{Y,C}\) is a proxy of the fluctuations of output (\(Y\)) and consumption (\(C\)) growth for country \(i\) in year \(t\). We construct the two measures using the analogous study of Morgan, Rime, and Strahan (2004), who quantify the effect of banking integration on GSP fluctuations across US states. The index is constructed in two steps. First, we regress real p.c. GDP growth

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\(^{25}\) Besides volatility the literature on the “real” effects of financial integration focuses on the correlation between integration and business cycle synchronization (see for example Flood, et al. (2008)). The standard international real business cycle model implies that a positive productivity shock will yield low cross-country output correlations, as capital will flow to the country where the marginal product of labor is high and workers there will substitute leisure for labor (e.g. Backus, Kehoe, and Kydland (1992), Baxter and Crucini (1995), Heathcote and Perri (2002)). (Kalemli-Ozcan, Reshef, Sorensen, and Yoshia (2008)). Yet Kalemli-Ozcan et al reference after Heatcote and Perri reference cross-sectional cross-country works find that financial integration makes business cycles more rather than less alike (Imbs (2004, 2006); see Rosé (2008) for a review). Yet Kalemli-Ozcan, Papaioannou, and Peydró (2008a), however, utilize a unique panel dataset of bilateral financial flows and show robust evidence that a higher degree of banking integration leads to less synchronized output patterns.
for each country $i$ on country fixed-effects and time fixed-effects. The residuals of these models ($\nu_{i,t}^Y$) reflect how much GDP growth 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 reflects GDP fluctuations with respect to the cross-country and the across-year mean growth

$$FLUCT_{i,t}^Y \equiv |\nu_{i,t}^Y|$$

We do the same for consumption growth ($C$) and we obtain

$$FLUCT_{i,t}^C \equiv |\nu_{i,t}^C|.$$

For robustness, we also estimate the model using non-overlapping windows of five-year averaged data, where we measure volatility with the standard deviation of output and consumption growth over each of the six five-year periods.

Our focus is on the coefficient of country-level financial integration with respect to the rest of the world. We use the publicly available version of BIS’ Locational Banking Statistics database and we construct for robustness three measures of integration: First measure is the growth of total bank external assets and liabilities in country $i$, in year $t$. Following Morgan et al. (2004) we also distinguish between assets and liabilities. This is important as international finance theories suggest that they can have different effects on business cycle patterns. Hence our second measure is the growth of bank external liabilities in country $i$ in year $t$; and last but not least we use the growth of bank external assets in country $i$ in year $t$, as our third measure.

Given the emphasis of previous work on international trade and production similarities as determinants of volatility, we also construct proxy measures of trade and specialization patterns. Following Frankel and Rose (1998), we measure $TRADE_{i,t}$ with the log of real (deflated with US price deflator) exports and imports as a share of GDP. For specialization we follow Kalemli-Ozcan, Sorensen, and Yosha (2003) and Imbs (2006), among others, and measure differences in the production structure (specialization) with the following index:

$$SPEC_{i,t} = \sum_{n=1}^{N} \left( s_{i,t}^n - \frac{1}{J-1} \sum_{j=1}^{J} \sum_{n} s_{j,t}^n \right)^2,$$

where $s_{i,t}^n$ denote the GDP share of manufacturing industry $n$ in year $t$ in country $i$ (data are retrieved from UNIDO). $SPEC_{i,t}$ therefore measures the distance between the vector of sector shares in country $i$, and the vector of average sector shares in the other countries, where the total number of countries $J = 20$. Thus, a higher number in $SPEC_{i,t}$ indicates that the country has less similar production structures to the other 19 countries.

Table 1 reports summary statistics for the country level variables.
### Table 1 Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Obs.</th>
<th>Mean</th>
<th>St. dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
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<td>1.00</td>
<td>0.00</td>
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<td>FLUCT Cons</td>
<td>575</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
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<td>BI Assets</td>
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<td>175.00</td>
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<td>298.00</td>
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<td>BI Total</td>
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<td>12.00</td>
<td>14.00</td>
<td>-27.00</td>
<td>218.00</td>
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</table>

Notes: FLUCT GDP and FLUCT Cons is the volatility of real p.c GDP growth and consumption growth respectively. Volatility is calculated as the absolute residual of these respective growth rates after accounting for country fixed-effects and year fixed-effects. FLUCT measures are reported as percent. BI Assets the growth of external bank assets adjusted for valuation effects and exchange rate movements at the country level. BI Liabilities is the growth of external bank liabilities is adjusted for same effects at the country level. BI Total is the growth of sum of external assets and liabilities, also adjusted for the valuation effects. The growth rates are calculated as change in stocks of assets from \( t-1 \) to \( t \) (or liabilities or total) divided by stocks of assets (or liabilities or total) in \( t-1 \). They reported as percent.

### Table 2 Fluctuations of GDP growth

<table>
<thead>
<tr>
<th></th>
<th>Btwn (1)</th>
<th>Wthn (2)</th>
<th>Btwn (3)</th>
<th>Wthn (4)</th>
<th>Btwn (5)</th>
<th>Wthn (6)</th>
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<td>BI total</td>
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<td>0.01</td>
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<td>-0.37</td>
<td>-1.36</td>
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</tr>
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<td>Specialization</td>
<td>0.32</td>
<td>-0.14</td>
<td>0.30</td>
<td>-0.14</td>
<td>1.98</td>
<td>-0.92</td>
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</tr>
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<td>No</td>
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<td>No</td>
<td>Yes</td>
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<tr>
<td>( R^2 )</td>
<td>0.41</td>
<td>0.25</td>
<td>0.43</td>
<td>0.25</td>
<td>0.54</td>
<td>0.32</td>
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<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Notes: t-statistics are reported underneath the estimated coefficients. Fluctuations of GDP growth is a volatility measure and calculated as the absolute residual of growth rates after accounting for country fixed-effects and year fixed-effects. BI Assets the growth of external bank assets adjusted for valuation effects and exchange rate movements at the country level. BI Liabilities is the growth of external bank liabilities is adjusted for same effects at the country level. BI Total is the growth of sum of external assets and liabilities, also adjusted for the valuation effects. The growth rates are calculated as change in stocks of assets from \( t-1 \) to \( t \) (or liabilities or total) divided by stocks of assets (or liabilities or total) in \( t-1 \). Trade is the logarithm of exports plus imports as a share of GDP. Specialization is an index that reflects the dis-similarities in industrial production between the two countries.
We now examine the effect of aggregate (country-level) financial (banking integration) on business cycle volatility. We first examine the effect of financial integration on output fluctuations. Second, we study the effect of integration on consumption fluctuations.

**OUTPUT FLUCTUATIONS**

Tables 2 and 3 report the estimates on the effect of financial integration on GDP volatility. In Table 2 we employ annual data using as the dependent variable the fluctuation index $FLUCT^Y_{i,t}$ of Morgan et al. (2004). Table 3 reports otherwise identical specifications but now the dependent variable is the standard deviation of real GDP p.c. growth over each of the six non-overlapping 5-year periods. For comparability with previous work, besides the panel fixed-effect estimates, we also report the “between” results. We report unconditional correlation coefficients and models that also control for trade and specialization.

The coefficient on the financial (banking) integration measure is positive and significant in the cross-sectional models in columns (1) and (5). This shows that a higher degree of external assets and liabilities is associated with more volatile GDP growth. Yet this correlation could be driven by numerous country-factors.

### Table 3 Fluctuations of GDP growth: 5 year of panel

<table>
<thead>
<tr>
<th></th>
<th>Btwn (1)</th>
<th>Wthn (2)</th>
<th>Btwn (3)</th>
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<th>Wthn (6)</th>
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<tbody>
<tr>
<td>BI total</td>
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<td>0.00</td>
<td>0.04</td>
<td>0.01</td>
<td>2.76</td>
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<td>-0.02</td>
<td>0.03</td>
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<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>2.27</td>
<td>0.68</td>
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<td>Specialization</td>
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<td>-0.00</td>
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<td>$R^2$</td>
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<td>20</td>
<td>20</td>
<td>20</td>
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</tr>
</tbody>
</table>

Notes: t-statistics are reported underneath the estimated coefficients. Fluctuations of GDP growth is a volatility measure and calculated as the standard deviation over a 5-year window of growth rates. BI Assets the growth of external bank assets adjusted for valuation effects and exchange rate movements at the country level. BI Liabilities is the growth of external effects bank liabilities is adjusted for same effects at the country level. BI Total is the growth of sum of external assets and liabilities, also adjusted for the valuation effects. The growth rates are calculated as the change in stocks of assets from $t-1$ to $t$ (or liabilities or total) divided by stocks of assets (or liabilities or total) in $t-1$. Trade is the logarithm of exports plus imports as a share of GDP. Specialization is an index that reflects the dis-similarities in industrial production between the two countries.
In columns (2) and (6) we add a vector of country fixed-effects and period fixed-effects to account for time-invariant country characteristics and global trends. The estimate drops considerably both in the annual and the five-year averaged models and is statistically insignificant. This result is in line with previous work that using broader measures of financial openness and larger samples also show weak correlations between financial integration and macroeconomic volatility.

Theory, however, suggests that external assets and liabilities can have differential effects on macroeconomic performance. A high degree of external assets may lower volatility through international diversification (e.g. Obstfeld (1994)); yet large amounts of external liabilities can magnify fluctuations as foreign investors might leave the country in recession times (e.g. Kaminsky, Reinhart and Vegh (2004)). In models (3), (4), (7), and (8) we thus split the composite measure of financial integration into an assets and liabilities based measure. The “within” estimates clearly show that the two types of financial openness have opposing effects. The coefficient on external liabilities is positive and significant in all model permutations. This suggests that countries that experience a fast
accumulation of foreign external liabilities tend to have more volatile GDP fluctuations. In contrast, the estimate on the growth of external foreign assets is negative and insignificant at standard confidence levels.

**CONSUMPTION FLUCTUATIONS**

Theoretical work emphasizes the welfare effects of financial openness. The standard argument is that through international diversification, financial integration enhances welfare by lowering consumption fluctuations. In Tables 4 and 5 we thus report analogous to the GDP fluctuations estimates, quantifying the effect of banking integration on consumption volatility. Table 4 reports results in the annual dataset using the Morgan et al. (2004) index of consumption fluctuations ($FLUCT^C_{i,t}$) and Table 5 gives analogous estimates using the standard deviation of real consumption growth over 6 non-overlapping five year periods.

---

### Table 5 Fluctuations of consumption growth: 5 year panel

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<thead>
<tr>
<th></th>
<th>Btwn (1)</th>
<th>Wthn (2)</th>
<th>Btwn (3)</th>
<th>Wthn (4)</th>
<th>Btwn (5)</th>
<th>Wthn (6)</th>
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<tr>
<td>BI total</td>
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<td>0.02</td>
<td>0.01</td>
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<td>-1.12</td>
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<td></td>
<td>1.57</td>
<td>-1.24</td>
<td>0.72</td>
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<td>-2.69</td>
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<td></td>
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<td>0.13</td>
<td>1.57</td>
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<td>BI liabilities</td>
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<td></td>
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<td>0.00</td>
<td>-0.01</td>
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<td>Yes</td>
<td>No</td>
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<td>Country FE</td>
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<td>Yes</td>
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<td>Yes</td>
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<td>$R^2$</td>
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<td>0.13</td>
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<td>0.13</td>
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<td>20</td>
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</tr>
</tbody>
</table>

Notes: Fluctuations of GDP growth is a volatility measure and calculated as the standard deviation over a 5-year window of growth rates. BI Assets the growth of external bank assets adjusted for valuation effects and exchange rate movements at the country level. BI Liabilities is the growth of external bank liabilities adjusted for same effects at the country level. BI Total is the growth of sum of external assets and liabilities, also adjusted for the valuation effects. The growth rates are calculated as change in stocks of assets from $t-1$ to $t$ (or liabilities or total) divided by stocks of assets (or liabilities or total) in $t-1$. Trade is the logarithm of exports plus imports as a share of GDP. Specialization is an index that reflects the dis-similarities in industrial production between the two countries. See table 1 for detailed description of variables.

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26 This result is consistent with Kalemli-Ozcan, Sorensen, and Volosovcyh (2009), who shows a positive effect of foreign ownership on regional level volatility within Europe.
In line with the previous evidence on output volatility there seems to be no effect of financial integration on consumption fluctuations, when we use the composite measure of banking integration that blends assets and liabilities. When we split the results between external asset growth and liability growth, we still do not find significant results in the cross-sectional models. However, once we exploit the time variation, controlling for country fixed-effects, we find that a higher degree of external bank asset growth reduces consumption volatility. This applies both when we use the annual fluctuation index (in Table 4) and when we use the standard deviation of real consumption growth (in Table 5) in the LHS of the specification. This new result offers direct support to theories in international finance that international investment enables agents to smooth consumption and diversify idiosyncratic country-specific risk. In the next section we quantify the effects of banking integration on risk sharing.

3.2 BANKING INTEGRATION AND RISK SHARING

If consumption growth rates in all countries are identical, then there is perfect risk sharing. As shown by Arrow and Debreu this is an equilibrium outcome assuming consumers have identical CRRA utility functions and access to a complete set of Arrow-Debreu securities.\(^{27}\) The empirical implication is that consumption in each country is a constant share of aggregate consumption. Starting with Mace (1991) the literature generally tests whether or not the growth rates are identical, where a rejection implies no perfect risk sharing.\(^{28}\)

The literature constructed standard measures of the degree of consumption risk sharing among groups of countries as follows. Denote country \(i\)’s year \(t\) (per capita real, government plus private) final consumption, \(C_{it}\), and denote aggregate consumption in year \(t\), \(C_t\). Similarly, denote country \(i\)’s year \(t\) (real per capita) output, \(GDP_{it}\), and aggregate output in year \(t\), \(GDP_t\). This measure build on the observation that the correlation of country-specific consumption, with country-specific output shocks is zero under perfect risk sharing. One must consider country-specific growth rates, because aggregate shocks cannot be eliminated by the sharing of risk, and the aggregate component is, therefore, deducted from the individual countries’ growth rates.

\[
\Delta \log C_{it} - \Delta \log C_t = \mu_i + \kappa (\Delta \log GDP_{it} - \Delta \log GDP_t) + \epsilon_{it} \tag{2}
\]

In the above panel specification, suggested by Asdrubali, Sorensen, and Yosha (1996), \(1 - \kappa\) is the measure of average amount of risk sharing over the period.\(^{29}\) \(\kappa\) measures the average co-movement of the countries idiosyncratic consumption

\[27\] See Obstfeld and Rogoff (1996).
\[28\] Mace (1991) uses individual level data and Obstfeld (1994) uses country level data to test the same prediction.
\[29\] Note that the above equation is equivalent to using a time fixed effect to remove the aggregate shock as shown by Ravallion and Chaudhuri, (1997). So we can also run,

\[
\Delta \log C_{it} = \mu_i + \lambda_t + \kappa \Delta \log GDP_{it} + \epsilon_{it} \tag{3}
\]
growth with their idiosyncratic GDP growth. The inclusion of country fixed
effects is equivalent to subtracting the country average over the period for each
variable and running the regression with no constant. Hence, since the country
averages over time are removed, risk sharing over longer horizons will not be
captured here. This regression with country fixed effects will only capture risk
sharing at the business cycle frequency, which is our aim here.

Our purpose is to evaluate how much risk sharing is driven by banking integration.
Following Melitz and Zumer (1999), Sorensen et al. (2007), and most importantly
Demyanyk et al. (2008), we modify the basic regression as follows:

$$\Delta \log C_{it} - \Delta \log C_t = \mu_i + \kappa t + (\Delta \log GDP_{it} - \Delta \log GDP_t) + \epsilon_t$$  \hspace{1cm} (4)

where

$$\kappa_t = \kappa_0 + \kappa_1(t - \bar{t}) + \kappa_2 (BANKINT_{it-1} - BANKINT_{t-1})$$  \hspace{1cm} (5)

$t$ is the middle year of the sample period, and $BANKINT_{t-1}$ is the (un-weighted)
average across countries of $BANKINT_{it-1}$ at time $t-1$. Demeaning the interaction
terms is equivalent to removing permanent differences between countries
in banking integration and hence the regressions captures the effect of time
variation in banking integration on risk sharing.

The estimated value of $1 - \kappa_0$ corresponds to the average amount of consumption
risk sharing over time and within the group of countries. $1 - \kappa_0 - \kappa_1(t - \bar{t}) - \kappa_2$
$(BANKINT_{it-1} - BANKINT_{t-1})$ then measures the amount of risk sharing obtained
in period $t$ by country $i$ with bank integration level $BANKINT_{it-1}$. We include
a time trend in order to guard against the upward trending bank integration
measures spuriously capturing trend changes in risk sharing that may be caused
by other developments in international markets. The parameter $-\kappa_1$ captures the
average year-by-year increase in risk sharing. Hence here the amount of risk
sharing is allowed to change over time with the trend and with bank integration.
The parameter $-\kappa_2$ measures how much higher than average banking integration
lowers the co-movement and hence increases the risk sharing.

One can think of other interaction effects. At the same time, the choice of the
interaction effect should not violate the fact that risk sharing is about buffering
shocks via large gross holdings of assets within a group of countries such as
OECD or EU. Hence, primarily, one should account for this direct effect. For
example, the euro is not suitable to use as an interaction effect, since as we have
shown in section 2.1, the euro has spurred banking integration in the euro area.
This implies the effect of the euro on risk sharing works via financial integration.
In addition, the euro might be capturing issues such as trade increases, decreases
in transaction costs, all of which may or may not have an indirect effect on risk
sharing through financial integration. Hence, given the fact that we have a good
proxy for financial integration itself, there is no reason for us to consider the euro
as a proxy for integration as done in some previous works.
Since external assets and liabilities might have asymmetric effects on risk sharing, we specify the risk sharing equation as follows:

\[
\kappa_{it} = \kappa_0 + \kappa_1(t - \bar{t}) + \kappa_2(BANKINT_{it-1}^{Assets} - BANKINT_{t-1}^{Assets}) \\
+ \kappa_3(BANKINT_{it-1}^{Liab} - BANKINT_{t-1}^{Liab})
\]  

Table 6 reports the estimated coefficients. On average consumption risk sharing is 38% (= 1 – 0.62) across the 20 countries over 1978-2007. This number is similar to what has been found in other studies (see Demyanyk et al. (2008)). The effect of banking integration is also economically and statistically significant. The interpretation of these coefficients in the interaction term of idiosyncratic growth with the banking integration measures (\(\kappa_2\) and \(\kappa_3\)) are as follows: A country that increases the holdings of external assets (relative to population) by 100% achieves 17% of additional consumption smoothing, i.e. an additional 17% of the idiosyncratic shocks to GDP will be smoothed out. The liabilities seem to have a dis-smoothing effect but the coefficient is not significant at the standard levels.

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Column (2) drops Luxembourg. This country is an outlier and, hence, this is a necessary robustness test. The average level of risk sharing (\(\kappa_0\)) and the risk sharing through assets (\(\kappa_2\)) slightly decrease, but the results remain qualitatively similar. The dis-smoothing role of liabilities is now significant at 10%. One should note that asset and liability banking integration measures are highly correlated and, hence, dropping observations will lead to an increase in the signal-to-noise ratio. Nevertheless, it is important to show the results with and without Luxembourg. In both cases we confirm the presence of significant amounts of risk sharing on average and through foreign bank assets. Finally, in column (3) we look at household consumption. The results are similar. The coefficients are slightly lower, possibly due to the smoothing role of governments. Overall our
results indicate much higher levels of risk sharing across our sample in the last 30 years, compared to what has been found in the literature. The main reason for this is likely the fact that we have longer time series, which increase the precision of our estimates.

Finally, as shown in the last column, we estimate a similar regression on income (instead of consumption) data.30 We find that income risk sharing has increased over the years. Specifically, the average income risk sharing over the last two decades has increased and must be fluctuated around 12%. More importantly, a country that increases the holdings of external liabilities (relative to population) by 100% achieves 18% of additional income (GNI) smoothing. If we estimate income risk sharing only for the EU sample, we find 15% additional income smoothing. These results lead us to conclude that banking integration, facilitated both by the harmonization policies and the single currency, has improved ex-post the optimality of the currency union by improving risk sharing.

4 CONCLUSIONS

The introduction of the euro and the implementation of financial harmonization policies have transformed European capital markets. Transaction costs in equity and corporate bond markets have fallen considerably, whereas spreads in the government bond markets have narrowed and tend to move together. While retail banking activities remain fragmented, the interbank markets have shown considerable integration. The degree of integration differs across market segments, but nevertheless the overall evidence suggests that the euro has accelerated financial integration during the 10 years since its introduction. In addition the recent episodes of strong financial problems of European countries outside the euro area, especially in the smaller countries, suggest that being a member of the euro during a crisis may protect against extreme volatility as compared to not being a member of the euro area.

This paper comprised two parts. In the first part, we reviewed the vast and growing literature on the effects of the European monetary union on money, bond and equity markets, and on the banking sector. We then discussed the key financial policy initiatives that accompanied and strengthened the monetary union. We also reviewed empirical evidence from Kalemli-Ozcan, Papaioannou and Peydró (2008b) that shows that these policies (in particular, the FSAP) and also the single currency increased cross-border banking integration.

In the second part, we presented empirical evidence regarding the impact of financial integration on macroeconomic volatility and risk sharing.31 Using banking integration data in a sample of 20 industrial countries over the past 30 years, we find that a higher degree of external asset holdings is associated with a lower level of consumption volatility. We also find that a higher level of

30 We thank our discussant Axel Weber to suggest this exercise.
31 For the results on the other effects of financial integration, see Kalemli-Ozcan, Papaioannou, and Peydró (2008a).
cross-border bank liabilities tends to increase output fluctuations. Jointly these results suggest that banking integration may facilitate risk-sharing. We find that a country that increases the holdings of external assets (relative to population) by 100% achieves 17% of additional consumption smoothing, i.e. an additional 17% of the idiosyncratic shocks to GDP will be smoothed out. We also estimate income (GNI) risk-sharing regressions. A country that increases the holdings of external liabilities (relative to population) by 100% achieves 18% of additional income smoothing.

Our findings have important policy implications. Asymmetric shocks in a currency union generate output and inflation differentials. The impact of such shocks is considerably reduced if risk sharing is significant. To the extent that risk-sharing allows hedging of consumption, it represents a key counteracting mechanism against asymmetric output shocks among members of a currency union. This mechanism reduces the need for policy intervention in dealing with such asymmetries. Our results, therefore, suggest that the increased cross-border banking integration due to the harmonization policies and the single currency has improved ex-post the optimality of the currency union by improving consumption and income risk sharing. The right criterion for an optimum currency area, then, is not the output fluctuations asymmetry but rather consumption fluctuations asymmetry given the fact that risk sharing via financial integration will imply a reduction in the latter, but not necessarily in the former.

REFERENCES


