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Costs and benefits of running an international currency

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Costs and benefits of running an international currency[1]

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Table of Contents

1. Introduction: the framework

1.1 Developments in the international role of the euro

The euro has been in the global markets for ten years now. There can be little doubt that its introduction has been successful. For example, the European Central Bank has managed to keep inflation low, minimizing the fears that it may abandon the strong price stability focus of the Bundesbank. The ECB has also become established as a key stabilizing force in financial markets, in particular, during the ongoing financial turmoil. Most importantly, the euro has quickly established itself as a major international currency. This manifests itself in various forms.

First, many countries have decided to anchor their monetary policy vis-á-vis the single European currency (ECB, 2008). In addition many countries now peg their monies to basket of currencies where the euro has an important share (e.g. Russia). While there is a strong regional pattern in the decisions of countries to anchor their monetary policies to the euro area, an increasing number of countries far away from Europe already do or may include the euro in basket-based peg systems.

Second, the share of the euro in international reserve holdings has substantially surpassed the sum of the legacy currencies and is slowly but steadily increasing (see Papaioannou and Portes, 2008; and Chinn and Frankel, 2008).

Third, an increasing number of corporations and governments issue debt and equity in euros (Bobba *et al.*, 2007). Again, this pattern is not limited to countries geographically close to the euro area countries. For example, an increasing number of US corporations issue international debt in euros.

Fourth, while the dollar is still by far the dominant international currency, the euro is becoming increasingly important as an invoicing and quotation currency in international trade (e.g. Kamps, 2007; Wilander, 2006).

Fifth, the euro has spurred financial integration across Europe and has contributed to the development of pan-European liquid financial markets. Transaction costs in euro-

denominated securities are nowadays minimal, offering consumers a variety of financial instruments to smooth consumption and diversify risk.

Sixth, the euro is playing a rapidly increasing role as an asset currency. The ECB (2008) reports that a growing number of non euro area residents hold euro bank notes. The use of the euro is not limited to its use as parallel cash, but has also increased in banking activities (loans and deposits). Most Balkan countries' banking system transactions are indexed nowadays in euros. This indicates clearly the increasing international role of the euro and has direct welfare consequences as it implies larger gains from seigniorage.

In this report we discuss the potential benefits and costs of the rising international role of the single European country.

1.2. Factors underlying the choice of an international currency

What determines currency internationalization? Why has the dollar been the main international currency during the post war period? Theoretically the literature on the factors underlying the international usage of a currency is built on the trade-off between the benefits arising from network externalities and the associated diversification losses.

The dominance of the dollar is usually explained with theories of network externalities and increasing returns that arise from the use of a single currency (see the theoretical models of Rey (2001), Zhou (1997), and Matsuyama, Kiyotaki, and Matsui (1993)). An economic agent (individual, corporation or government) is more likely to use a particular currency in the goods or asset markets if others are also using this money. Although network externalities give a strong argument favouring the use of a single currency in the international financial system, there is an inherent trade-off between holding assets in just one currency and diversifying risk among other monies. Although the literature has recognized this trade-off, the argument was that market size and liquidity were too low and transaction costs too high in other currencies. While this was indeed the case throughout the postwar period, this is no longer so, as the euro offers a viable alternative to the dollar as an international currency. In addition, the currencies of several other industrial countries

appear nowadays to be quite attractive alternatives, as they offer nice diversification instruments with minimal transaction costs.

The empirical literature has also tried to identify the underlying factors that give rise to an international usage of a currency (*e.g.,* Eichengreen and Mathieson, 2001; Dooley *et al.*, 1989; Chinn and Frankel, 2008). The literature has identified the following key factors.

First is economic strength and market size. Since the end of the Second World War, the US economy has been by far the largest in the world. In addition the U.S. was the main trading partner for most countries, absorbing most of global exports. Now, however, the euro zone is comparable with the American economy in terms of GDP and trade openness. The euro area may soon become even larger, when the non-eurozone EU members join in. During the 1990s the US economy grew faster than the EU countries. In the late nineties growth was similar across the Atlantic (see Figure 1.1). The dot-com crash and the 9/11 crisis had less sharp but more prolonged negative effects on euro-area countries than on the US.[2] Still, the evidence is not clear. For example, GDP per capita has grown just as fast in the euro zone as in the US since 1999 (IMF, *World Economic Outlook* 2008, Table B1).

Many argue that the dynamism and flexibility of the US economy and a supposed ECB 'anti-growth bias' give an edge to the dollar (e.g. Posen, 2007a; Cohen, 2007). But the data do not support the view that ECB monetary policy has been unduly restrictive, with negative consequences for economic growth. On the other hand, the U.S. product, labor, and capital markets are less regulated than those in Europe, and this tends to speed productivity growth by enabling the fast reallocation of resources to firms and sectors that face good prospects (see among others, Caballero et al. (2004); Ciccone and Papaioannou (2007, 2008) and Fisman and Love (2004, 2007)). Yet recent evidence shows that the introduction of the euro has led to an acceleration of reforms in the product markets (Alesina, Ardagna, and Galasso, 2008) and financial sector (e.g. Hartmann, *et al.* 2007). These policies foster macroeconomic flexibility and will most likely have positive medium-term consequences for productivity growth. Indeed the forecasts of the IMF (shown in

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[2] See, for example "Economic Forecast Spring 2008", European Economy 1/2008, Directorate General for Economic and Financial Affairs, European Commission. There is little reliable evidence on total factor productivity growth rates for the euro zone (although the literature on the EU as a whole suggests a productivity slowdown since the mid-1990s, while TFP growth in the US accelerated for several years – Gordon and Dew-Becker, 2008).

Figure 1.1.) suggest that the recovery of the euro area economy from the ongoing financial crisis will be quite similar (albeit somewhat smaller) to the U.S.

Figure 1.1: Evolution and forecasts of real GDP growth

Real p.c. GDP Growth in the Eurozone and the United States

Source: IMF's World Economic Outlook Database
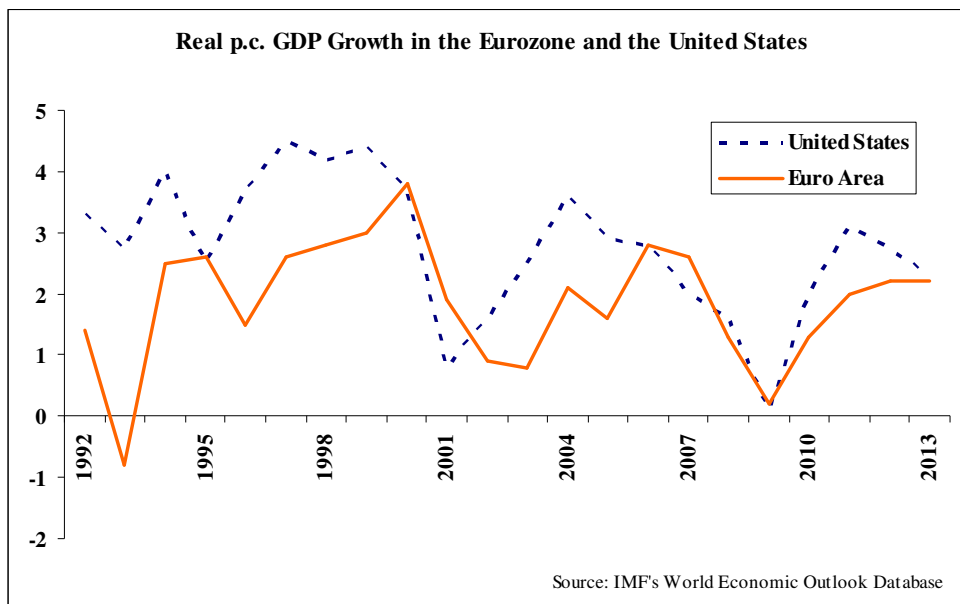
Second, currency internationalization is positively associated with low inflation and exchange rate stability. The ECB has managed to keep inflation quite low and has effectively signaled to the markets that price stability is its primary objective. In addition the exchange-rate volatility of the euro and the dollar against most other currencies is similar (see Sec. 6). Most importantly the negative current account position of the US raises serious concerns of a future dollar depreciation. For example while US current account deficit has long surpassed 5% of GDP, euro area trade has been close to balanced (see Figure 1.2). The IMF forecasts that the devaluation of the dollar will help the US narrow its current account deficit, but the fiscal position of the US is significantly worse than that of the euro area.

Third, broad, deep and efficient financial markets are also key determinants of currency international usage. The integration and development of euro-area financial markets since 1999 has been substantial. For example, bid-ask spreads in euro-denominated bonds and equities are comparable with those of the US. While the US does offer some alternative assets, such as mortgage and asset-backed securities, recent events have reduced their attractiveness, and the euro area now offers a wide variety of financial instruments.

Figure 1.2: Evolution and Forecasts of Current Account Positions

Current Account Balance (as % of GDP) in the Eurozone and the United States

Source: IMF's World Economic Outlook Database
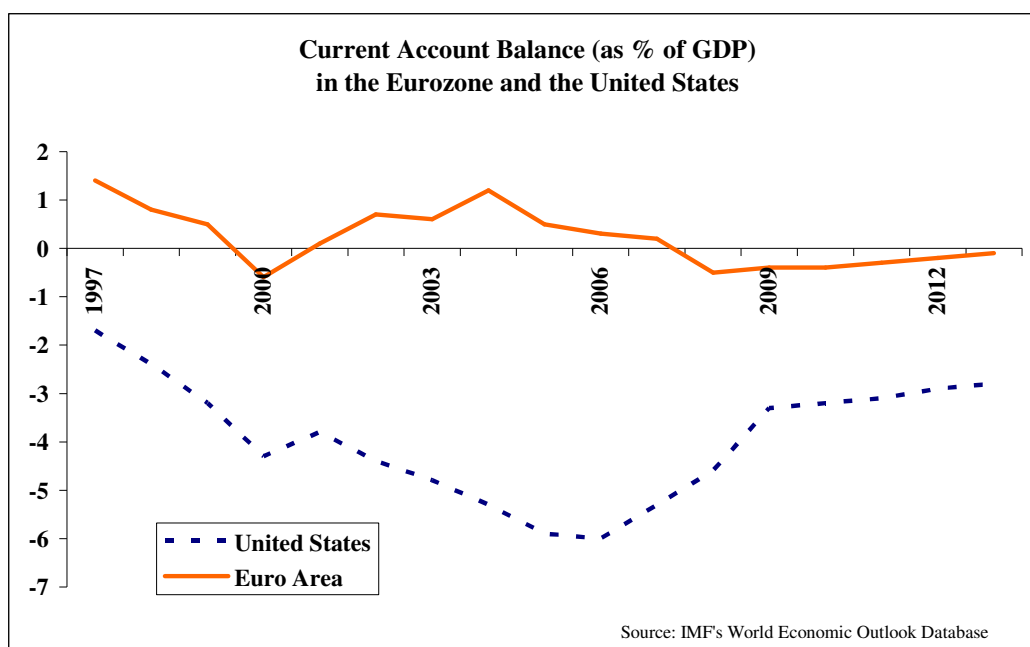
Fourth, although hard to quantify, political power also contributes to currency internationalization. Indeed before the introduction of the euro many were skeptical of its prospects, pointing out the potential political economy conflicts between euro area member states (e.g. Feldstein, 1997, 1999). While in contrast to the U.S., the euro area is still a group of independent nation states, there is only a very small probability that a member state would decide to abandon the euro zone and pursue independent monetary policies (see Eichengreen (2008)). Moreover, euro area countries are politically tied through the

European Union (EU) political and economic institutions. That is unlikely to change in the foreseeable future. In addition many academics, commentators, and politicians argue that US geopolitical strength has declined significantly since the turn of the century.

1.3. Structure of this report

In the next Section we discuss the effect of the euro's internationalization on financial markets. We first present some estimates on the impact of the single currency on private credit. Then we discuss recent work that examines the effect of the euro on financial integration. We relate both of these developments to the internationalization of the euro and draw some conclusions about the benefits. We also discuss the implications of the euro's rising internationalization on the liquidity premium.

In Section 3 we turn to the vehicle currency role of the euro and present some results using new data from the latest BIS Triennial Survey on the foreign exchange market. In Section 4 we turn to the direct benefits of running an international currency. We first offer some estimates on the likely gains from international seigniorage. We then discuss work on the effects of the internationalization of the euro on the terms of trade and invoicing patterns in international trade. In Section 5 we discuss the implications of the international role of the euro for portfolio returns. We consider in detail the "exorbitant privilege" – *i.e.,* the ability of the country having an international currency to run large current account deficits, ultimately financed by the issuance of liabilities held by foreign central banks. Using new data from the ECB, we present estimates on excess returns that European residents earn over other currencies. In Section 6 we discuss the effects of the single currency on exchange rate volatility and relate this to the internationalization of the euro. In Section 7 we summarize recent research on the impact of the euro on global bond and equity portfolios. We also analyze the potential implications of the euro's international status for central banks' reserve holdings. In Section 8 we turn to the effects of the euro on the stability of domestic money demand and the problems posed for monetary policy by the increasing usage of the European currency by non-residents. In Section 9 we consider the implications of the internationalization of the euro for international financial stability. Section 10 summarizes.

2. Internationalization of the euro and financial markets

One of the main arguments for the introduction of the single currency was that *network externalities and increasing returns arising from the internationalization of the euro would lower transaction costs in financial markets* (Portes and Rey, 1998), lower the cost of capital and spur investment and output growth. In addition the increased size of the integrated European capital markets was believed to foster total-factor-productivity and enable better risk sharing among households and investors. Preliminary and mainly anecdotal evidence tend to support this conjecture. For example spreads in the foreign exchange market have fallen to almost negligible levels (Papaioannou, *et al*., 2006), and spreads in the euro-area government bond markets are also very low now (Dunne, *et al.*, 2006). Biais *et al*. (2006) further show that European corporate bonds have gained liquidity since the advent of the euro and spreads in euro assets are tighter than in sterling- and dollar-denominated bonds (see also ECB (2007)). In the same vein Santos and Tsartsaronis (2003) provide early evidence that underwriting fees in the corporate bond market fell considerably since the advent of the euro. Transaction costs in the equity markets have also fallen. The euro has also spurred a consolidation of securities exchanges, which has helped narrow bid-ask spreads (Schmiedel and Schonenberger, 2005). The increased competition in the banking system has also lowered the costs of mortgages and other standardized financial products.[3] Yet the significant decline in transaction costs in financial services in European countries has coincided with a similar decline in most other industrial (and even emerging economies). In addition cross-border capital flows have expanded greatly over the past decade for all industrial countries, not just between the euro area and the rest of the world. Therefore we need empirical evidence to attribute to the internationalization of the single currency a part of the observed drop in transaction costs and the increased financial integration in European markets. That is the focus of this section. We consider in turn the effects of the euro on financial development, the effects of the euro on asset trade, and the liquidity premium one might expect from the internationalization of the currency.

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[3] We have searched for houseold transaction cost data, but unfortunately such data are unavailble for a large number of European countries. The ECB has very recently started to collect data on household finance.

2.1. The effects of the euro on financial development in the euro area

Easier access to finance is associated with significant economic benefits.[4] A vast literature shows that deep and liquid financial markets spur growth through a number of channels. First, across countries financial development and integration is associated with a lower cost of capital and increased capital accumulation (e.g. Beck, Levine, and Loyaza (2000); Henry (2000)). Country case- studies further support the finance-investment link. Cetorelli and Strahan (2006) show that the US banking deregulation was particularly helpful for financially constrained small and medium sized firms. Bertrand *et al.* (2006) find similar results in their analysis of the aftermath of the French banking reforms in the mid 1980s, while Guiso *et al.* (2004) report similar findings of a strong financial efficiency-productivity link across Italian regions. Second, financial development increases total-factor-productivity by improving the efficiency of investment and promoting the fast reallocation of capital to sectors and firms with the most valuable projects (e.g. Rajan and Zingales (1998); Fisman and Love (2004, 2007); Ciccone and Papaioannou (2006)). Third, financial efficiency affects economic performance through a number of other channels. For example evidence suggests that financial integration enhances risk sharing (e.g. Kalemli-Ozcan and Sorensen, 2008), fosters trade (e.g. Manova, 2008), and promotes entrepreneurship (e.g. Klapper, Laeven, and Rajan, 2006).

But what are the determinants of efficient financial intermediation and financial integration? An influential literature emphasizes the importance of investor protection and more broadly legal quality in enabling the development of deep and liquid capital markets (see La Porta *et al*, 1997, 1998, 2008). The Single Market programme and the initial stages of the EMU required legal and financial sector reforms from the member states. In addition the advent of the euro accelerated integration of payment systems and over-the-counter-markets, and to some extent helped member countries to pass legislation protecting shareholders and creditors (for example by enhancing transparency and speeding judicial

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[4] See Levine (2005) for a thorough literature review on finance and growth. Papaioannou (2008) surveys the evidence on financial development and productivity, from a growth accounting viewpoint, placing an emphasis on industrial countries. Hartmann *et al*. (2008) report a variety of financial efficiency indicators among euro area countries and investigate their effect on productivity. Guiso *et al*. (2003) provide an early assessment of EMU on financial development and growth. See also Jappelli and Pagano (2008) for a recent review in the context of the EMU.

process). We therefore examine whether the euro was indeed associated with an increase in the depth of financial markets in euro area countries.

Specification and Data

To quantify the effect of the euro on financial development we estimate variants of the following regression equation:

$$\Delta lnFD_{i,t} = \alpha_i + \alpha_t + \delta EURO_{i,t} + \gamma OTHER_{i,t} + \lambda lnFD_{i,t-1} + \varphi \Delta lnFD_{i,t-1} + \varepsilon_{i,t}$$

The dependent variable is the annual logarithmic growth in financial development (*FD*) in country *i* in year *t*. The specification includes country-fixed effects (α_i) and year fixed-effects (α_t) to control for time-invariant country characteristics (such as culture, legal efficiency, trust, etc.) and global trends (e.g. increased openness to international markets, worldwide interest rates, etc.) respectively. The main variable of interest, *EURO*, is an indicator (dummy) variable that takes the value one in the year that a country adopted the single currency and in all years following the introduction of the euro and zero otherwise. So for all euro area member countries (but Greece) the indicator takes on the value one for the period 1999-2006 (and for Greece in 2001-2006) and zero otherwise. We also control for other time-varying correlates of financial development ($OTHER_{i,t}$). In all specifications we include the lagged (log) level of per capita GDP and the logarithmic GDP growth; we also control for persistence in financial development controlling for the initial (log) level of financial development ($lnFD_{i,t-}$) and lagged financial development growth ($\Delta lnFD_{i,t-1}$).

Our empirical specification is a difference-in-difference model, where euro member countries are the "treated" group, while non-reforming countries serve as the "control" group. Due to the inclusion of country and year fixed-effects the coefficient δ on the *EURO* dummy measures the annual growth effect of euro in euro area member countries compared to the general evolution of financial development growth in all the other countries (the control group).

The various measures of financial development are non-stationary (trending upwards). We therefore estimate the model in first differences, as this transformation makes the variables mean-reverting. We also estimate "error correction" models, including in the set of explanatory variables the lagged log level of financial development and autoregressive

11

terms. Besides accounting for non-stationarity and residual autocorrelation, the dynamic models enable us to quantify the impact of the euro on the long-run level of financial development.

We use three proxy measures of financial development exploiting the recent update of World Bank's Financial Structure Database (Beck, Demirguc-Kunt, and Levine, 2000).[5] Specifically we will use two measures of private credit and a proxy measure of the financial system's liquidity. While these three measures are consequences rather than causes of financial efficiency, most recent work on finance has relied on them to assess the growth effects and the determinants of financial development (see for example the review by Levine (2005) and the recent study of Djankov, Mc Liesh, and Shleifer (2007) on the determinants of financial development).

In Table 2.1 we report estimates using the largest possible sample that spans the period 1961-2006 and covers 158 countries. In models (1)-(2) we measure financial development with the share of liquid liabilities of the financial system as a share of GDP. In columns (3)-(4) we use the share of private credit provided by the banking system as a share of GDP, while in columns (5)-(6) we employ a broader measure of private credit that also includes credit provided by other than banks financial institutions.

In line with previous work (e.g. Djankov, *et al.* (2007)) income and GDP growth enter with positive and significant estimates implying that financial deepening is higher (and grows faster) in rich countries and economies with fast income growth.[6] The dynamic models in columns (2), (4), and (6), show that there is some persistence in financial deepening. The coefficient on the lagged dependent variable is positive (around 0.23-0.44) and statistically different than zero at the 99% confidence level. The coefficient on the lagged (log) level of financial development is negative and significant implying that there is some convergence in financial development (i.e. countries with relatively low levels of financial development experience faster financial deepening).

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[5] The update (September 2007) of the Financial Structure Database is available from: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

[6] Note that this positive correlation does not necessarily imply a causal effect of income growth and level on financial development.

Table 2.1 - Euro and Log Growth in Financial Development Measures

Financial Development Measure	Liquid Liabilities as a share of GDP		Private Credit by Banks as a share of GDP		Private Credit by Banks & Other Fin. Institutions	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Euro	0.0050	0.0060*	0.0110*	0.0112***	0.0074	0.0115***
	(0.0037)	(0.0033)	(0.0060)	(0.0038)	(0.0090)	(0.0042)
Lagged Log GDP p.c.	0.0123***	0.0147***	0.0114***	0.0130***	0.0126***	0.0181***
	(0.0028)	(0.0032)	(0.0030)	(0.0027)	(0.0034)	(0.0039)
Lagged GDP p.c. Growth	0.0351**	0.0480***	0.0767***	0.0868***	0.0773***	0.0807***
	(0.0143)	(0.0129)	(0.0149)	(0.0133)	(0.0164)	(0.0157)
Lagged Dependent Variable [Financial Development Growth]		0.2310***		0.4325***		0.3591***
		(0.0349)		(0.0418)		(0.0625)
2-year Lagged Log Level of Financial Development Measure		-0.0750***		-0.0477***		-0.0674***
		(0.0077)		(0.0087)		(0.0133)
Observations	4466	4347	4546	4428	4564	4449
Countries	158	158	158	158	158	158
Adjusted R-squared	0.040	0.150	0.06	0.27	0.04	0.22
within R-squared	0.0510	0.164	0.0663	0.279	0.0484	0.230

The dependent variable is the annual logarithmic growth of the financial development proxy. In columns (1)-(2) we measure financial development with the share of liquid liabilities to GDP. In columns (3)-(4) we measure financial development with the share of private credit by deposit banking institutions to GDP. In columns (5)-(6) we measure financial development with the share of private credit by deposit banks and other financial institutions to GDP. The financial development proxy measures are retrieved from the latest update of World Bank's Financial Structure around the World Database.

All models include country-specific and year-specific fixed-effects (coefficients not reported). The data span over the period 1961-2006 and cover 158 countries. Standard errors adjusted for country-specific (clustered) heteroskedasticity-and autocorrelation are reported in parenthesis below the coefficient estimates. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

The Euro is an indicator variable that takes on the value one in the year and all subsequent years in those countries that have adopted the euro, and zero otherwise. In all models we control for lagged log GDP per capita and lagged logarithmic GDP p.c. growth. In models (2), (4), and (6), we control for inertia in financial development adding in the set of explanatory variables the lagged dependent variable and the two year lagged log level of the financial development proxy.

Model (1) yields a positive (0.05) coefficient on *EURO* variable, but it is statistically insignificant at standard confidence levels. Once we control for differences in the initial level of financial development and inertia in liquidity growth, however, the coefficient on the euro indicator variable becomes statistically significant at the 10% confidence level. The estimate in column (2) implies that after the introduction of the euro liquidity growth accelerated by approximately 0.60% percent relative to the absence of the adoption of the single currency. In models (3)-(4) we repeat the estimation using bank credit as the dependent variable. The coefficient on the euro (dummy) variable is now significant at the

10% confidence level in the simple model and at the 1% level in the dynamic model that accounts for inertia and initial differences in the level of financial development. The estimate in (4) suggests that bank credit growth was higher by 1.1% in euro area member countries after the introduction of the single currency compared to all the other countries in the world (that serve as the control group). Models (5) and (6) employ a broader measure of market size that besides bank credit also includes private credit provided by other types of financial institutions. While the coefficient on the euro indicators is statistically indistinguishable from zero in the simple model, the estimate turns significant (at the 1% level) in the dynamic specification. The coefficient implies that following the introduction of the euro private credit increased in EMU countries by roughly 1.15% higher than in other countries.

Due to inertia in credit growth the long run impact is higher approximately 1.7%. The dynamic models enable us to quantify the long-run effect of euro on the level of financial development (this is given by the negative of the ratio of the coefficient on the euro dummy relative to the coefficient on the level of financial development). The estimates imply a long run effect of the euro on the level of financial development of 17%.

Yet the impact of the euro in capital markets deepening might not be monotonic. For example in the initial years there may have been some uncertainty about the durability of the new regime. Moreover naturally it took some time to establish new markets and to trade in the new currency. The replacement of the legacy currencies also took a couple of years. In Table 2.2 we allow the effect of the single currency to differ in the short term and medium term. We estimate specifications otherwise similar to Table 2.1, except that we now split the overall effect of the euro into a short-run impact and a medium-run impact. We add a *EURO1* dummy variable that takes on the value one for 1999 and the subsequent three years and zero otherwise. The coefficient on this indicator variable thus reflects the effect of the euro in EMU member countries' domestic financial system in the first four years (the period 1999-2002). The *EURO2* variable equals one for EMU countries after the fourth year following the introduction of the single currency and zero otherwise.

14

Table 2.2 - Euro and Log Growth in Financial Development Measures

Financial Development Measure	Liquid Liabilities as a share of GDP		Private Credit by Banks as a share of GDP		Private Credit by Banks & Other Fin. Institutions	
	(1)	(2)	(3)	(4)	(5)	(6)
Post Euro 2 [T*+4, T*+5,T*+6, T*+7]	0.0082** (0.0039)	0.0090** (0.0035)	0.0098 (0.0072)	0.0125** (0.0052)	0.0126* (0.0073)	0.0154*** (0.0056)
Post Euro 1 [T*, T*+1,T*+2, T*+3]	0.0007 (0.0056)	0.0014 (0.0047)	0.0124* (0.0066)	0.0093*** (0.0036)	0.0013 (0.0153)	0.0066 (0.0057)
Laged Log GDP p.c.	0.0123*** (0.0028)	0.0148*** (0.0032)	0.0114*** (0.0030)	0.0130*** (0.0027)	0.0126*** (0.0034)	0.0182*** (0.0039)
Lagged GDP p.c. Growth	0.0355** (0.0143)	0.0484*** (0.0129)	0.0765*** (0.0149)	0.0870*** (0.0133)	0.0781*** (0.0164)	0.0812*** (0.0156)
Lagged Dependent Variable [Financial Development Growth]		0.2309*** (0.0349)		0.4326*** (0.0418)		0.3584*** (0.0637)
2-year Lagged Log Level of Financial Development Measure		-0.0752*** (0.0077)		-0.0478*** (0.0087)		-0.0677*** (0.0134)
Observations	4466	4347	4546	4428	4564	4449
Countries	158	158	158	158	158	158
Adjusted R-squared	0.04	0.15	0.06	0.27	0.04	0.22
within R-squared	0.0513	0.164	0.0664	0.279	0.0490	0.230

The dependent variable is the annual logarithmic growth of the financial development proxy. In columns (1)-(2) we measure financial development with the share of liquid liabilities to GDP. In columns (3)-(4) we measure financial development with the share of private credit by deposit banking institutions to GDP. In columns (5)-(6) we measure financial development with the share of private credit by deposit banks and other financial institutions to GDP. The financial development proxy measures are retrieved from the latest update of World Bank's Financial Structure around the World Database.

All models include country-specific and year-specific fixed-effects (coefficients not reported). The data span over the period 1961-2006 and cover 158 countries. Standard errors adjusted for country-specific (clustered) heteroskedasticity-and autocorrelation are reported in parenthesis below the coefficient estimates. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

The Post Euro 1 is an indicator variable that takes on the value one in the year and the three subsequent years in those countries that have adopted the euro, and zero otherwise. The Post Euro 2 is an indicator variable that takes on the value one in the fourth, fifth, sixth, and seventh post euro years for those countries that have adopted the euro, and zero otherwise. In all models we control for lagged log GDP per capita and lagged logarithmic GDP p.c. growth. In models (2), (4), and (6), we control for inertia in financial development adding in the set of explanatory variables the lagged dependent variable and the two year lagged log level of the financial development proxy.

Model (1) shows that the euro had a significant medium-run impact on EMU member countries' capital markets. The *EURO2* indicator enters with a coefficient that is positive and significant at the 5% confidence level, suggesting that over the past four years financial deepening was faster in euro zone countries by 0.8% compared to liquidity growth in other parts of the world. Yet the short run effect of the euro is small, close to zero, and

15

statistically insignificant. The dynamic specification reveals a similar result. While in the short-run the euro had no significant impact, there is a significant medium-run effect. We obtain roughly similar results with the two measures of private credit in models (3)-(6). Our preferred specification (6) where we use the broad private credit measure and control for inertia in credit growth and initial differences in the level of financial development suggests that private credit growth is approximately 1.5% higher in EMU countries after the fourth post-euro year.

The euro might have played an important role in European financial markets before its introduction in 1999. In this case the estimates in Tables 2.1 and 2.2 would be conservative. Yet financial deepening might have been delayed in the years before euro's introduction, as market participants might have waited for the introduction of the single currency. To account for this, we augmented the models with two pre-euro indicator variables. In all permutations the coefficients on these variables are statistically insignificant, suggesting that compared to other countries, European countries that participated in the EMU did not experience faster credit growth in the nineties. Yet in all models the *POSTEURO2* dummy variable enters with a positive estimate, suggesting that the euro was associated with significant improvement in the level of financial development.

2.2. The Euro and asset trade

There is an interdependence and synergy between internationalization of the currency, financial asset trade, falling financial market transaction costs, and financial deepening. This was analyzed in detail by Portes and Rey (1998), who claimed that it is indeed the key to the process of currency internationalization.

We now have a body of empirical work that supports this analysis. Following the work that quantifies the impact of the euro on international trade in goods and services (e.g. Rose, 2000; Rose and van Wincoop, 2001; Micco *at al*. 2003; Baldwin and Taglioni, 2006; see Baldwin, 2006, for a critical assessment), recent studies examine the impact of the single currency on financial asset trade. Understanding the effect of the euro on international capital flows is important for a number of reasons. First, financial market integration enhances diversification, thus enabling better risk sharing and yielding potentially large

welfare gains (e.g. Obstfeld, 1994). Second, financial integration can bring sizable growth gains by moving capital to countries where it is most needed and thus speeding the process of convergence. Third, integration of capital markets may enhance competition in financial intermediation, lowering the cost of capital, and spurring investment. Fourth, by increasing the breadth and depth of capital markets, financial integration may spur innovation, since skilled entrepreneurs get an easier access to finance (Acemoglu and Zilibotti, 1997). This in turn will generate an increased number of (imperfectly correlated) projects, which will increase diversification benefits (e.g. Martin and Rey, 2004). Fifth, studying financial integration allows us to assess indirectly whether transaction costs in financial markets, broadly defined, declined after the introduction of the single currency.

It is not straightforward to predict the impact of the euro on trade in financial assets. On the one hand, the euro may spur cross-border capital movements among member countries, due to the fall in transaction costs and the elimination of exchange rate risk. In addition the liberalization policies that accompanied the monetary union may may have made euro area markets more attractive to outsiders. On the other hand the euro could lead to lower cross-border asset trade, because financial assets become more correlated, therefore lowering the potential gains of diversification.[7]

Recent work tries to disentangle these two countervailing effects. These studies model asset trade in a gravity equation context that links cross-border capital flows and holdings with *remoteness* (measured with distance and with indicator variables on whether the two countries have common colonial ties, speak the same language, or share a common border) and *size* (measured with GDP, stock market capitalization, and population).[8]

Bond holdings

Lane (2005) uses bilateral bond holdings from 11 euro area countries and 11 other high-income countries (as a control group) to examine the effect of the euro on cross-border

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[7] For example, Baele *at al*. (2004) and Cappielo *et al*. (2006) document that following the introduction of the euro the correlation in government bond returns has almost reached one. Similarly the correlations in equity markets have increased considerably after 1998 (although this pattern started in the early 1990s)..

[8] The gravity equation appears quite successful in explaining asset trade in equity (e.g. Portes, Oh, and Rey, 2001; Portes and Rey, 2005), bonds (e.g. Lane, 2005), and bank holdings (e.g. Papaioannou, 2008).

bond portfolios.[9] The data come from the IMF's Coordinated Portfolio Investment Survey (CPIS). His analysis yields a highly significant effect of the euro in explaining bilateral bond holdings. Controlling for time-invariant country characteristics, gravity-type variables, EU membership, exchange rate volatility, and (most importantly) bilateral trade (see Aviat and Courdacier (2005) for the complementarities of asset and goods trade), Lane finds that cross-border bond investment between two euro member countries is 230 percent higher than between any other country pair in the sample (in 2004). While this estimate seems (unrealistically) large it is similar to the early studies on the effect of currency unions on international trade (e.g. Rose, 2000).[10] Lane also quantifies the effect of the euro in explaining changes in bond holdings in the period 1997-2004. His regressions suggest that cross-border bond holdings increased by around 90 percent among euro area countries, even accounting for domestic policies and international trade in goods that also increased after 1999.

Similarly Courdacier and Martin (2007) find that the euro had a sizable effect in cross-border bond holdings. Using CPIS data in 2001 they estimate that euro increases bilateral bond holdings among EMU member states by 150%. In addition the authors find also a positive unilateral effect of the single currency, which seems to have made European markets more attractive to outside investors. The authors find that "*non-EMU countries hold twice as much bond holdings in the euro area, compared to what standard gravity controls and international trade predict*" (that they should hold in the absence of the monetary union). The authors also find a similar estimate when they examine a Swedish dataset. These findings suggest that, since 1999, European bonds have become more attractive for both EMU and non-EMU countries.

While the focus of the literature is on examining the impact of the single currency in fostering cross-border capital movement, financial integration can take various forms. In a recent paper Bobba, Della Corte and Powell (2007) focus on the unit of account role of an international currency and examine the effect of the euro on the currency of issuance of

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[9] The control group consists of the US, the UK, Denmark, Sweden, Switzerland, Norway, Japan, Canada, Iceland, Australia and New Zealand.
[10] These estimates might suffer from the same drawbacks of the early studies quantifying the effect of currency unions on trade (e.g. Rose, 2000; Rose and van Wincoop, 2001). Baldwin (2006) argues that these studies may fail to control for unobserved country-pair heterogeneity and general trends. These problems are less severe in panel studies that explore the effect of the euro in EMU member states across time.

international debt securities using a database from the BIS. The dataset covers debt issuance for the five major international currencies, namely the US dollar, the euro, the Japanese yen, the Swiss franc, and the British pound sterling, for 64 developing countries and 42 industrial countries. The authors estimate panel models that account for unobserved heterogeneity and hard-to-account-for time-invariant factors, and perform a before-after analysis that quantifies the liquidity effects of the introduction of the euro. The estimates show that conditional on economic links, financial factors, and inertia, the *euro has brought a significant boost in the liquidity of international debt markets*. Not only the volume of debt issuance in euro has increased after 1999, but *more countries have switched to issuing euro-denominated securities*. The authors interpret these two findings by positing the crucial role played by network externalities. In turn, this suggests instability in currency choices and gives empirical support for the possibility of sudden changes and multiple equilibria in international currency status.

Bank Loans

Early studies on the effects of the euro in financial integration suggest that wholesale banking is most likely the sector that became the most integrated (e.g. Cabral, *et al*. 2002; Hartmann, Manganelli, and Maddaloni, 2003). While cross-border M&A activity in the banking sector has been minimal in the years following the introduction of the euro, cross-border bank to bank lending increased significantly. Banking integration started well before the introduction of the euro with the First (in 1977) and Second (in 1988) Banking Directives. Yet the euro and the Financial Services Action Plan of 1999 accelerated the process by speeding reforms and eliminating exchange rate risk.

Courdacier and Martin (2007) quantify the impact of the euro on bank loans using data from the BIS. They find that *EMU is associated with an increased lending of foreign banks to the euro area and by increased lending among euro zone countries*. This effect is quantitatively smaller, however, than the analogously estimated effect of the euro on bond (and equity) holdings.

Equity

Courdacier and Martin (2007) also use the CPIS database to examine the effect of the euro on international equity holdings. As with bonds, they report highly significant estimates on

the impact of EMU in spurring cross-border equity integration. Their bilateral cross-sectional regressions yield some noteworthy regularities. First, *investors outside the euro area hold 60% more euro equities compared to other (non-EMU) economies*. Second, when both countries participate in the euro-zone, cross-border equity holdings increase by around 45%.

Working on a slightly different sample, Lane and Milesi- Ferretti (2005) reach similar results, documenting that common membership of the euro area raises bilateral portfolio equity holdings by 62 percent. De Santis (2006) also uses CPIS data in 2001 to estimate the impact of the single currency on international equity flows. De Santis carefully controls for various institutional and financial features, (such as the discretion, the independence, and the transparency of monetary authorities), as well as return chasing and diversification motives, trying to isolate the direct effect of the EMU. He estimates that a cross-border equity movements within the euro area increased by USD 22-47 billion in equity securities. De Santis and Gerard (2007) further investigate the effect of the EMU in portfolio rebalancing of foreign equity investors. Their analysis shows that over the 1997-2001 and the 1997-2005 periods the portfolio weight assigned by euro area investors to euro area securities increased by 8-15 percentage points in equity portfolios and by 22-31 percentage points increase in bond portfolios. Part of this large effect is accompanied by 3-5 percentage point decline in the portfolio weight in the British bond market, suggesting that the EMU was associated with a trade-diverting effect.

Courdacier and Martin (2007) also examine the extent of asset trade diversion comparing equity holdings among EMU members with Scandinavian countries, which with the exception of Finland do not participate in the euro area. While there seems to be an overall positive bias of investing in Scandinavian countries, EMU members invest significantly less (roughly by 65%) in the Scandinavian stock markets. This suggests that the euro was associated with some diversion in equity investment towards EMU countries, compared to similarly close and developed Scandinavian nations. The authors also document that *Swedish holdings and capital outflows are significantly higher in the euro area, compared to what a standard gravity model would predict*. The results are also robust to the inclusion of tax proxy measures, international trade, institutional quality indicators, and exchange rate volatility.

FDI

In the same vein Papageorgiou (2005), De Sousa and Lochard (2006), Flam and Nordstrom (2007), and Petroulas (2007) quantify with gravity models the effects of the euro on cross-border FDI.

Papageorgiou (2005) employs two datasets of FDI flows in the period 1990-2004 and examines the reaction of FDI after the introduction of the euro in a before-after event study approach. The first dataset comes from the United Nations Conference on Trade and Development (UNCTAD) and covers aggregate FDI to 22 developed countries. The second source is OECD's International Direct Investment Statistics database that reports bilateral FDI flows in the same group of industrial nations. The nice feature of this study is that the author can employ panel techniques and account for unobservable characteristics. His panel estimates thus examine whether, conditional on country and time fixed-effects, FDI inflows increased after the introduction of the euro in countries that participated in the EMU, compared to non-participating nations (that serve as the control group). Papageorgiou finds that overall FDI increased by 60% after 1999 in euro-area countries compared to countries that did not participate in the EMU. Interestingly the positive effect of the euro on FDI increases (quantitatively and statistically) over time. The bilateral FDI flow dataset results suggest that *FDI from non-EMU countries increased considerably* (by roughly 60% to 100%) in the euro area after 1999 (and especially 2000). FDI from euro-area countries to non-EMU countries also increased after 1999-2000. FDI flows between EMU-countries increased after 1999 by 100%-200%.

De Sousa and Lochard (2006) also examine the effect of the euro on FDI stocks and flows in OECD economies over the 1980-2002. They also document that FDI flows among EMU member countries increased after the introduction of the euro. Yet they find significantly smaller estimates than Papageorgiou (2005). Their specifications suggest that within EMU FDI stocks and flows increased by 30% and 40% respectively. Petroulas (2007) similarly examines the effect of the euro on FDI, using however a Eurostat dataset that covers 19 countries in the period 1992-2001.[11] His estimates suggest that that the introduction of the

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[11] Petroulas's sample covers 12 EMU members: Austria, Belgium-Luxemburg (considered as one country), Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain and 7 non-EMU members: Denmark, Japan, Norway, Sweden, Switzerland, UK, USA.

euro raised FDI flows by 16% within the euro area. Cross-border FDI from non-member countries into the euro area increased slightly, roughly by 8%, while FDI flows from euro area countries to non-EMU economies increased by roughly 10%. His sample is considerably smaller than that of the other two studies, and so is the number of post-1998 observations.

2.3 Liquidity premium.

The early analysis of Portes and Rey (1998) pointed to what they called a 'liquidity discount' accruing to the issuer of the international currency, deriving from the additional demand for its bonds from foreign residents. This demand comes from both official and non-official sources: foreign central banks wish to keep a large share of their foreign exchange reserves in low-risk securities denominated in the major international currency or currencies; and private-sector foreign residents, primarily firms engaging in international trade, need to keep substantial short-term balances in liquid form and again denominated in international monies. This international currency effect reduces the real yield paid by bond issuers in the country of the international money. The primary effect will be in the government bond market.

Portes and Rey offered 'back of the envelope' estimates of a 25-50 basis point effect. When applied to the then outstanding stock of $2000 billion of US Treasuries, this gave a supplementary source of seigniorage, in the amount of $5-10 billion dollars, at that time very close to their estimates of the conventionally defined seigniorage: about 0.1% of GDP (see our discussion of seigniorage in Sec. 4.1 below).

We now prefer to use the term 'liquidity premium' rather than 'discount'. Krishnamurthy and Vissing-Jorgensen (2007) (KVJ) attribute the premium to the 'convenience yield' from holding US Treasuries, which in turn they believe is derived from three factors: (i) a liquidity motive; (ii) a 'neutrality' motive, insofar as some investors may not wish to privilege any issuers and therefore choose the largest issuer, with no sectoral associations; (iii) a risk-minimising motive. They estimate the convenience yield econometrically, and they then specifically consider the effect of foreign official demand on Treasury yields.

They find that the demand for Treasuries from the foreign official sector is highly inelastic. Based on their estimated aggregate demand curve, they calculate that if foreign official investors were to exit the Treasury market entirely, the sale would raise Treasury yields relative to corporate bond yields by an amount between 19 bps and 55 bps.

This effect would certainly be significant, but the estimates of Warnock and Warnock (2006) (WW) are substantially higher. Part of the difference seems to be that WW use a much higher estimate of the share of foreign ownership in the US Treasury market. WW find that 'if foreign governments did not accumulate US government bonds over the twelve months to end-May 2005, our model suggests the [10-year] Treasury yield would have been 90 bps higher.' Note that this supposes only that the net inflow would stop, rather than that all holdings would be sold! So on the latter (KVJ) hypothesis, the effects would be very much greater. WW find also that the impact on corporate bond yields as well as the 30-year Treasury yield is of similar magnitude (but not on two-year Treasuries, whose yields are much more strongly influenced by the Fed's policy rate).

We find the WW hypothesis more realistic in the context of a shift from the dollar towards the euro in the international currency role. It seems unlikely that foreign official holders would exit entirely from the US Treasury market, or indeed divest any substantial proportion of their existing holdings, if only because of the potentially huge capital loss on remaining holdings that would result from the consequent dollar depreciation. But as discussed in Papaioannou and Portes (2008), we might expect the foreign official sector to wind down their net acquisitions of US Treasuries, in part because even to the extent that they stay in dollar-denominated assets, they will be seeking portfolio diversification and higher yields.

A 90 bps effect is nevertheless quite large. Applied to the US outstanding government debt of USD 4000 bn in mid-2005, the liquidity premium would be USD 36 bn – a significant loss to the United States, if the net inflows were to cease. On the (heroic) assumption that a corresponding inflow into euro-denominated government bonds would bring an equal liquidity premium to the euro area, applied to the euro area outstanding government debt of 4600 bn euros, the liquidity premium would be 41.5 bn euros, slightly over 0.5% of GDP.

2.4. Summary

A voluminous literature suggests that financial development and capital market integration can boost economic growth by lowering the cost of capital and by enabling the quick reallocation of productive resources to sectors and firms with good prospects and innovative projects (e.g. Levine, 2005). European countries implemented various reforms in financial markets in the 1990s to speed financial integration. In addition the introduction of the euro eliminated transaction costs in the foreign exchange market and minimized exchange rate risk, further boosting financial integration. Most importantly the rising internationalization of the euro has boosted confidence in the new currency accelerating its usage by both European firms and non-resident investors; and transaction costs in euro bond, equity and foreign-exchange markets have fallen correspondingly.

In this Section we have first estimated dynamic panel models trying to quantify the direct effect of the euro on some widely used proxy measures of financial markets size. The (static and dynamic) panel estimates reveal that the euro had a positive and in most specifications significant effect in the depth of the European financial markets (as proxied by private credit and the overall liquidity of the financial system). The results suggest that the positive effects of the euro did not come immediately, but occurred in the medium-term. There are some significant caveats. First, the proxy measures of financial development are arguably rough. Yet most of the financial development proxy measures are not available for the very recent period. Second, our analysis used just 8 years of post-euro observations, while we used 37 pre euro years. This is of course not ideal for a before-after analysis. Third, even if these results appear to be robust across other measures of financial efficiency and other checks, they do not necessarily imply a causal relationship. While the inclusion of both country and year fixed effects assuages concerns that our results might be driven by other factors, it is quite hard to establish causal relationships with such an approach. Fourth, the euro might have contributed to the depth and size of euro area capital markets even before its advent in 1999. This is because euro area member countries implemented legal and financial reforms well before 1999. The evidence is in line with other work that uses more detailed data and shows that the euro has spurred cross-border equity and bond flows and has increased banking activities across EMU member states (e.g. Masten, *et al*. 2008). Hartmann *et al* (2007) construct a variety of indicators for

the 2001-2005 of financial efficiency for 2001-05 for the euro area, the UK, Denmark, Sweden Japan, and the US, showing that euro-zone counties have seen a notable improvement in these measures over the past five years.

Second, we reviewed recent work that quantifies the effect of the single currency in spurring financial integration. The evidence suggests that the process of financial integration accelerated after the introduction of the single currency. Bond, equity, FDI, and bank flows among euro area member countries increased significantly after 1999. Most importantly for our purposes here, flows from non-EMU countries to euro-zone capital markets also increased significantly. At the same time, capital market integration, as measured by the time-varying correlations in equity and bond returns, has also increased over the past decade (e.g. Cappielo, *et al*. 2007, 2008; Hardouvelis, *et al*. 2007, 2008; ECB, 2008). As the correlation of returns across EMU member countries increases, this lowers the portfolio gains associated with international diversification within the euro area, giving an incentive for portfolio investment from euro to non-euro countries. Thus the high levels of cross-border capital flows since 1999 prima facie reflects the success of monetary union in lowering transaction costs (broadly defined) in capital markets and homogenizing capital markets.

Third, in the spirit of Portes and Rey (1998) we discuss the potential gains in euro area from a reduction in the cost of borrowing arising from the international status of the euro in government and private portfolios-the liquidity premium. Recent work on the U.S. suggests that the gains to the euro area from the fall of the liquidity premium could be large, in the range of 25 to 90 basis points, or alternatively up to 0.5% of euro area GDP.

3. The vehicle currency role and transaction costs

We have been able to obtain from the BIS the detailed bilateral data underlying the foreign exchange market survey of April 2007. This has enabled us to construct data that shed new light on the *transaction cost implications of taking on the vehicle currency role of an international currency*. It is important to investigate the structure of the foreign exchange market, so as to get a full picture of the international role of the major currencies in this highly liquid global market. In this Section we use these data to assess the *implicit transaction costs* associated with currency trading. The turnover in each currency transacted in foreign exchange markets implicitly proxies for these costs and the relative international currency status of the monies.

A significant strand of literature in international macroeconomics studies the causes of the rise and fall of national currencies as a medium of international exchange. This work tries to identify the underlying characteristics of a national economy that make its national currency a candidate for being a *vehicle currency* in international markets.

Krugman (1980), taking the simplest case, that of a three-country, three-currency world, examines under what conditions payments between two of the countries will be made using the third country's currency. The model highlights the importance of volumes and transaction costs in determining the actual pattern of transactions in the currency market (i.e. the structure of exchange). Kiyotaki and Wright (1989), Matsuyama, Kiyotaki and Matsui (1993) build on Krugman's theory. They provide more sophisticated search theoretical models in which vehicle currencies arise endogenously from strategic complementarities in the exchange process between the patterns of international trade in goods and the associated currency exchange. Rey (2001) takes a different approach, with a similar outcome: persistence in the structure of the foreign exchange market, since transaction costs depend negatively on volumes of transactions. These models generate path dependence, yet this inertia does not necessarily imply that an international currency will enjoy its dominant role permanently. There are multiple equilibria, and changes in expectations, which may arise from relatively small changes in fundamentals, may bring abrupt swings in the foreign exchange market.

Flandreau and Jobst (2008) provide a historical analysis of several key issues in the economics of international currencies. The authors use data from the late 19th century, when the pound sterling was the leading currency, to construct an "exchange matrix" that reflects whether a particular currency pair is traded in the foreign exchange market. The authors then examine empirically which factors affect the likelihood that a particular currency pair is traded in the international foreign exchange market. Their findings confirm the dependence of transaction costs on volumes and provide support to the existence of strategic externalities between money and trade. While this analysis corroborates the importance of persistence, the authors reject the pure path-dependence hypothesis. Indeed the dollar replaced the pound sterling as the dominant currency in the international foreign exchange market during the interwar period. So although there is path dependence, this does not by any means imply that a currency should enjoy its dominant position indefinitely. Analyzing the structure of the volumes of transactions that go through a particular bilateral foreign exchange market is the most direct way of testing the theoretical work of Krugman (1980) and Rey (2001). In fact, in equilibrium, low transactions cost routes are employed while high transaction cost routes are abandoned. Studying the exchange structure - *i.e.*, the reasons why certain routes are employed but not others - is thus tantamount to studying the transaction costs associated with alternative foreign exchange operations. The exchange matrix is therefore a very neat measure of the *implicit transaction costs* associated with currency trading. Hence, the turnovers in each currency transacted in foreign exchange markets implicitly proxy for the relative international currency status of the monies.

In this section we provide a similar analysis using a unique dataset extracted from the 2007 BIS triennial survey that reports consolidated bilateral turnover in foreign exchange (FX) transactions for the US dollar, the euro and the domestic currency of each reporting country vis-à-vis the other major international currencies (pound sterling, Japanese yen, Swiss franc, Canadian dollar, Australian dollar, Swedish krona and a residual category defined as "Other").

The April 2007 issue of the BIS triennial survey on the average daily turnover in traditional FX markets highlights several important features of the evolution of the currency composition in these markets. First, FX turnover has become *more diversified*. As Table 3.1

shows, the four most traded currencies, the US dollar, the euro, the yen and the pound sterling, are involved in 8 percentage points fewer transactions than they were in 2004. Second, among the four main international currencies, the euro has been the only currency whose shares have remained stable. The share of the euro in total transactions is around 37%, whereas the shares of the yen, the pound sterling, and the US dollar have fallen by 3%-4%. Third, currencies of other developed countries (such as the Australian and the Canadian dollar) are becoming more important. These currencies have gained liquidity, as bid-ask spreads are nowadays minimal. These currencies also offer attractive money market returns[12]..Fourth, there appears to have been an increase in the share of emerging market currencies in total turnover.

Table 3.1: Currency distribution of the foreign exchange market

Table 1. Currency distribution of reported foreign exchange market turnover. Percentage shares of average daily turnover in April 2007				
	2001	*2004*	*2007*	*Diff '07-'04*
US dollar	90.3	88.7	86.3	**-2.4**
Euro	37.6	36.9	37	**0.1**
Yen	22.7	20.2	16.5	**-3.7**
Pound sterling	13.2	16.9	15	**-1.9**
Other developed countries currencies	20.7	21.7	25.5	**3.8**
Emerging market currencies	16.9	15.4	19.8	**4.4**

Notes: Because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200% instead of 100%. Other developed countries currencies are Swiss Franc, Australian Dollar, Canadina Dollar, Norwegian Krone, New Zealand Dollar and Danish Krone. Emerging market currencies are defined as the residual after accounting for the US dollar, euro, yen, pound and the Other developed country category.
Source: BIS Triennal Survey. Foreign exchange turnover net of local inter-dealer double-counting.

Several factors drove the recent increasing trend in emerging markets currency trading: greater investor activity in high yielding currencies between 2004 and 2007, better economic fundamentals and the increasing depth and openness of financial markets in these

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[12] Taking into account the valuation effects arising from the appreciation or depreciation of a currency relative to the US dollar, i.e. at constant exchange rates, yields a similar conclusion. For further details, see BIS Report on 2007 Triennial Survey, Table D.3.

economies. In addition, trade and financial flows from and to large emerging economies, such as China, Brazil, India, and Russia (the BRICs) have increased over the past years. From our point of view, the key point from these statistics is that the euro has been the only international currency not losing market share in FX trading, whereas since 2001, the dominant currency - the US dollar - has seen a slow but steady decline in its dominant position. Yet one has to bear in mind that the share of the euro in the FX market is still less than half of the share of the dollar. In what follows we will abstract from the historical comparison and instead focus on the 2007 data in order to shed some light on the role of the US dollar vis-à-vis the euro as the leading international currency in FX transactions.

A more direct way to investigate the extent to which a major currency is used in the international foreign exchange market is to examine the volumes of transactions denominated in the domestic currency of each country against the other currencies. Figure 3.2 displays the relative volumes of transactions in FX trading summed across the 54 countries covered by the 2007 Triennial BIS survey.
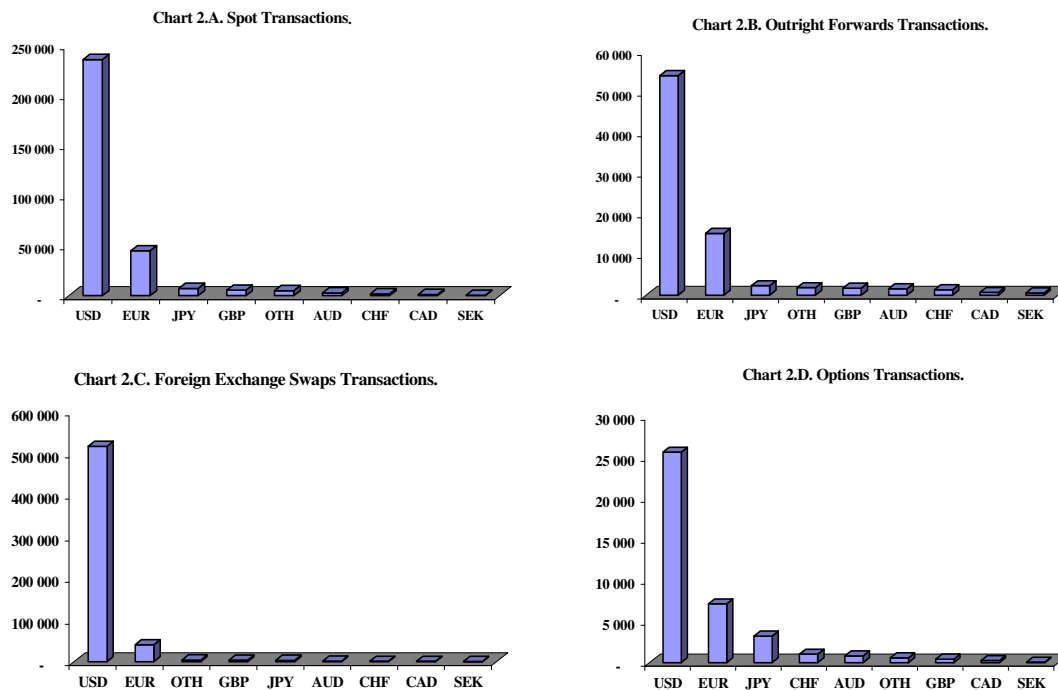
Figure 3.2: Domestic trade against the other International Currencies
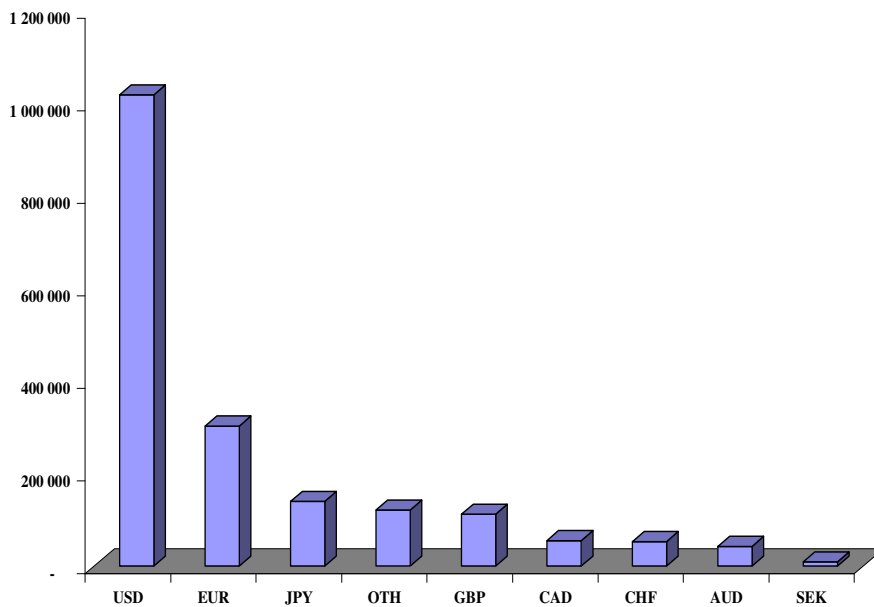
Source: BIS Triennal Survey. Foreign exchange turnover net of local inter-dealer double-counting, summed across instruments for each currency in April 2007. Daily averages, in millions of US dollars.

29

The US dollar is by far the most transacted currency against domestic monies, with more than three times the volumes of transactions of its primary competitor, the euro, which in turn is used almost three times more than the Japanese yen and the pound sterling. Yet these statistics also include transactions among the 12 euro area countries. Thus we also excluded the euro-area countries and the US, as this allows us to investigate the *vehicle role* of the two currencies. When we drop the US and the euro area, the dollar's dominance is even stronger.

We also split total transactions across the different instruments that the Survey reports – Spot, Outright forwards, Options and FX swaps. Figure 3.3 displays the results.

Chart 2.A. Spot Transactions.

Chart 2.B. Outright Forwards Transactions.

Chart 2.C. Foreign Exchange Swaps Transactions.

Chart 2.D. Options Transactions.

Source: BIS Triennal Survey. Foreign exchange turnover net of local inter-dealer double-counting, summed across instruments for each currency in April 2007. Daily averages, in millions of US dollars.

These charts confirm the US dollar's dominant position. We can go further and compare the US dollar and the euro with regard to the vehicle currency role. To this end, we have summed across the 54 countries the volumes of transactions having either the US dollar or the euro as counterparts. Figure 3.4 displays the total volume of transactions in FX trading denominated in either euro or US dollar against the other major currencies.

Figure 3.4. Vehicle Role. Total volumes of transactions in euro and US dollars against the other currencies
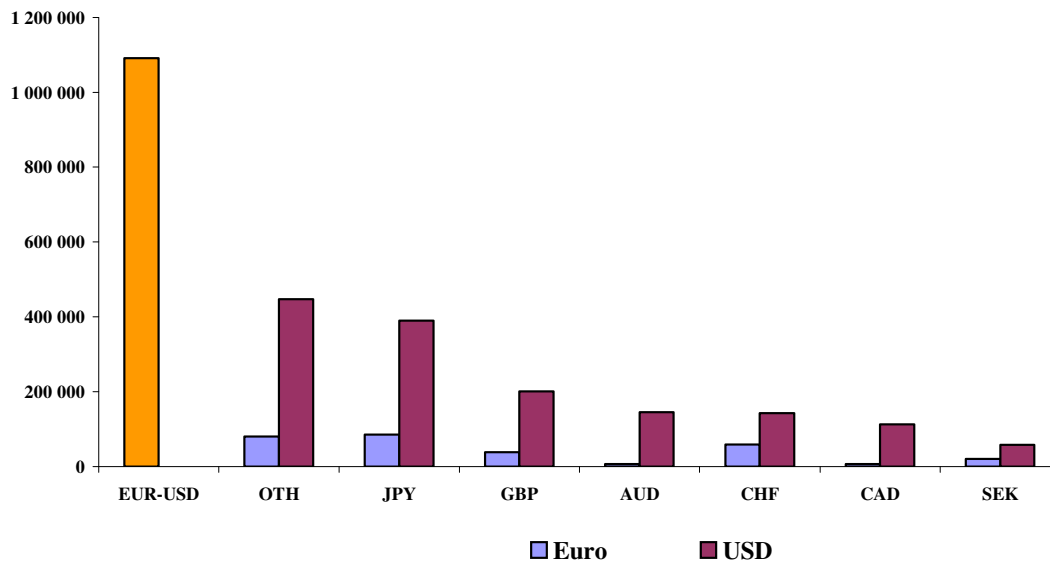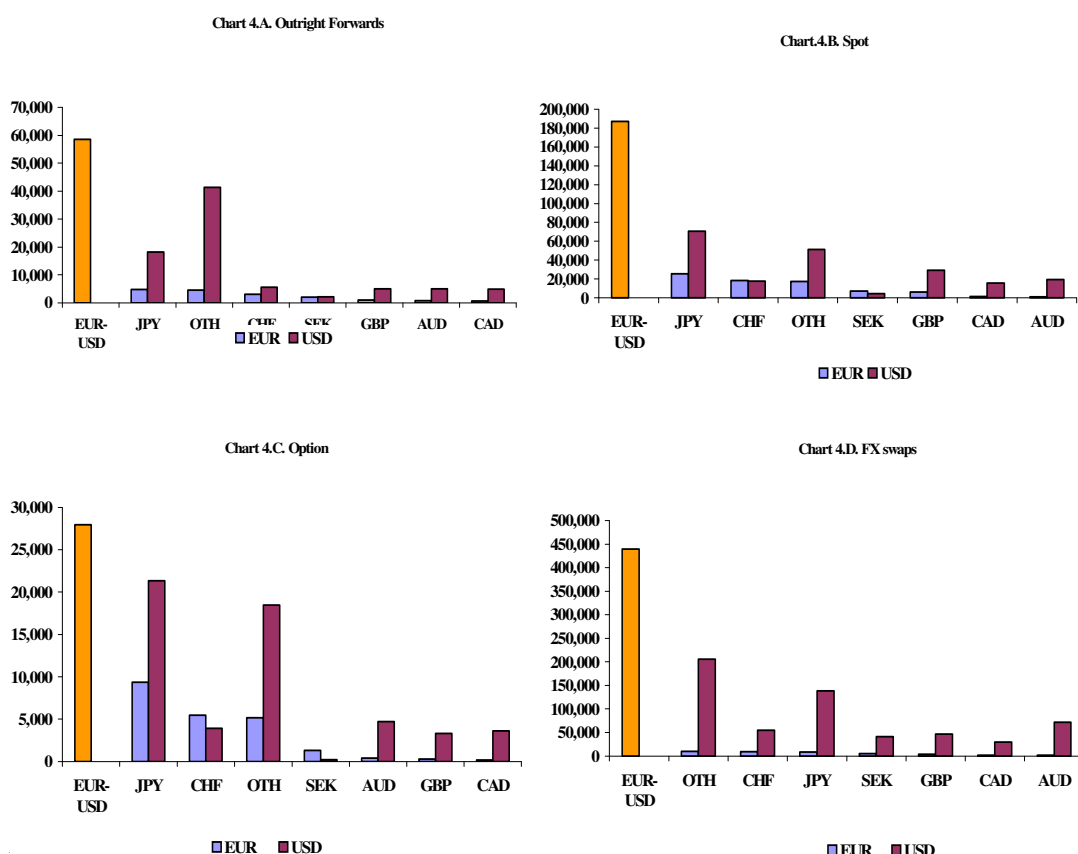

Source: BIS Triennial Survey. Foreign exchange turnover net of local inter-dealer double-counting, summed across instruments for each currency in April 2007. Daily averages, in millions of US dollars.

The first bar refers to the two-way transactions between the two main international currencies, the euro and the dollar, whereas the remaining bars report the volumes of transactions of the US dollar (in the red bar) and the euro (in the blue bar) vis-à-vis the other currencies. The first observation from Figure 2 is that more than a trillion dollars is settled daily at the euro-dollar market, which is by far the largest currency market. Second, when we compare transactions in the main international currencies (the yen the pound, the Australian dollar, the Swiss franc, the Canadian dollar, and the Swedish krona) against the dollar or the euro, there is clear evidence that the US dollar is the dominant transaction currency. While the share of the euro is noticeable in trades that involve the pound sterling, the yen, and the Swiss franc, the daily turnover in the euro Canadian dollar or the euro Australian dollar is almost zero.

Yet there are some noteworthy differences when we examine transactions by instrument. Figure 3.5 displays disaggregated volumes of transactions by instrument.

Figure 3.5. Vehicle Role:

Chart 4.A. Outright Forwards

Chart.4.B. Spot

Chart 4.C. Option

Chart 4.D. FX swaps

Source: BIS Triennial Survey. Foreign exchange turnover net of local inter-dealer double-counting. Forward, spot, Option and FX swaps transactions for each currency in April 2007. Daily averages, in millions of USD.

The US dollar is the dominant currency in all four markets. Yet the euro seems to enjoy a more important role in the option contract market.

Besides distinguishing transactions across instruments, the bilateral BIS data enable us to examine the role of the main international currencies in the FX market by region. We have thus disaggregated the turnover data of the developing countries across six regions following the World Bank regional classification, namely, East Asia and Pacific, Latin

33

America and Caribbean, Middle-East and North Africa, South Asia, Eastern Europe. Among them, the US dollar appears as the indisputable dominant currency, both in terms of domestic currency trade and vehicle role, with the notable and not surprising exception of Eastern Europe. In fact, due to geographic and economic proximity of this region to the euro area, the two main international currencies appear to be sharing the market of FX transactions there almost equally. Figure 3.5 displays the turnover data for Eastern Europe for both domestic currency transactions against the major monies and the vehicle role.

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Chart A. Domestic currency trade against the other international currencies

USD ■ EUR □ CHF □ OTH ■ GBP □ JPY ■ SEK □ AUD ■ CAD
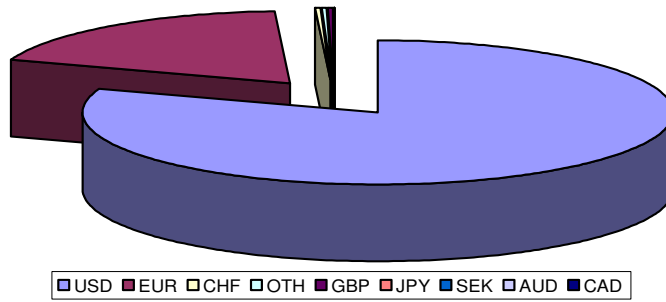
Chart B. Vehicle Role:
Total Volumes of Transactions in Euro and Dollars against the other
international currencies

■ EURO   ■ USD
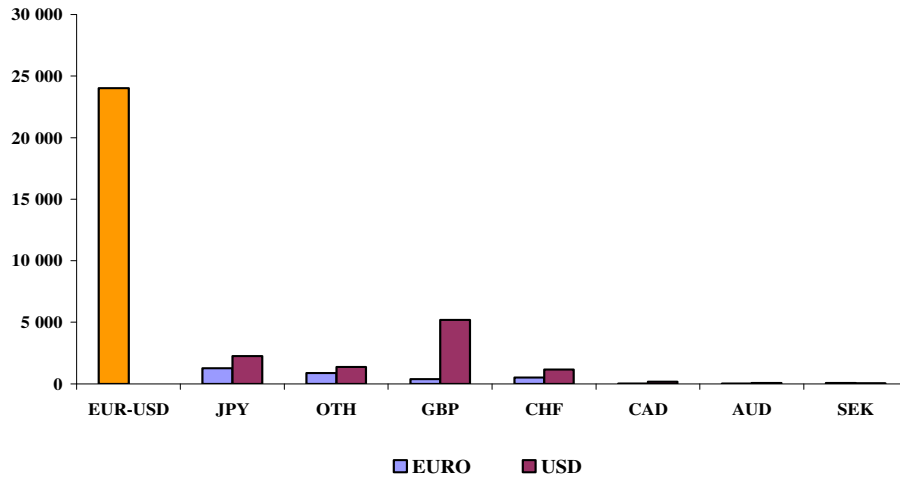
Source: BIS Triennial Survey. Eastern Europe countries considered are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic and Turkey.

From the charts, it is evident that in that region the euro and the dollar share the market almost equally for both domestic trading and the vehicle role, with the dollar still being used slightly more. For Eastern Europe, it is thus fair to say that two dominant currencies currently co-exist and, given the recent historical trends in currency shares outlined above and the economic, geographical and political proximity to the euro area, one might expect the euro will take over the dollar in the next several years.

4. Seigniorage, terms-of-trade, and invoicing

4.1. Seigniorage

A direct and quantifiable benefit of running an international currency is international seigniorage. Since the end of the Second World War foreign residents across the world have held US currency in large quantities. Foreigners also held some sterling and to a lesser extent Deutsche marks (and Japanese yen). Yet the dollar was the predominant currency across the globe. Rogoff (1998) estimates that dollar holdings by non-US residents were roughly 50% of the total stock of US currency outstanding. This is the source of international seigniorage: the ability to obtain real resources (net imports) in exchange for almost costless notes, or alternatively, the interest-free loan that non-resident holders of currency notes provide to residents. The flow of this international seigniorage to the United States is estimated to be approximately 0.1%-0.2% of GDP.

As discussed in Sec. 2.3 above, however, there is another, often neglected source of seigniorage accruing to the issuer of the international currency: a liquidity discount. Non-resident holdings of US government securities are 25% of the total stock, compared with 17% in other major markets and the volume of transactions in US government bonds is an even more disproportionate share (relative to the size of stocks outstanding) of the global bond markets. This international currency effect reduces the real yields that the United States government has to pay. Furthermore, efficiency gains arise from the deepening of exchange and financial markets. Portes and Rey (1998) estimated that for the countries in EMU these gains would be of the same order of magnitude as the two sources of seigniorage just mentioned. These results suggested that Europe would gain by promoting the use of the euro as a rival international currency to the dollar, but such a policy would go against the interests of both Japan and the USA.

Since 1999 an increasing number of foreigners hold euros. How large, however, are the direct seigniorage gains to the euro area from the rising internationalization of the euro?

Seigniorage gains increase with the holdings of euros by non-residents and are higher the higher the domestic inflation rate (or the nominal interest rate). To quantify the direct

seigniorage gains we have assembled series of net currency holdings abroad for the euro from 1999 onwards from ECB data. Euro currency circulation outside the euro area started from a very low base in 1999 (essentially, foreign holdings of DM that were converted to euros at the beginning of 1999). Not surprisingly, therefore, the growth rates of those holdings were extremely high (around 21%) in the 2002-2007 period. As this growth rate is likely to fall, we have projected up to 2020 the series of net currency holdings abroad for the euro with alternative annual growth rates of 5%, 10%, and 15%. We did the same for the US dollar, by using the actual average growth rate of net dollar currency holdings abroad for the period 2000-2007, which was 5.19%. To investigate the sensitivity of our results we also used annual growth rates for the dollar of 3% and 7%. Then we have constructed a measure of seigniorage for 2020 by multiplying those values by the respective 3-month government bond rates at the end of 2007 (3.8% for the euro and 3.5% for the US dollar).

In Figures 4.1 and 4.2 we plot our projections. According to the different scenarios, forecasted seigniorage revenues in 2020 in nominal terms range from USD 7 to 25.5 bn for the euro and from USD 19.28 to 31.65 bn for the dollar. In this domain, we would almost see parity by 2020 between the two currencies in their international role.

We have also projected the nominal GDP of the two regions up to 2020 using the respective average growth rates of nominal GDP over the period 2000-2007 (4.1% for the euro and 5.15% for the US dollar). This projection yields similar results to IMF's forecast of real per capita GDP growth over the next five years (see Figure 1.1).[13] For robustness we also assumed that real growth will be similar in the two regions at 2% (+/-1). This seems like a more plausible scenario now that there is high uncertainty on the macroeconomic effects of the banking crisis. On inflation we also went over various sources to obtain reliable forecasts of the relative price differences. Most studies (and the IMF) suggest that inflation rates are going to be similar across the Atlantic over the next several years. If anything inflation in the US is expected to be somewhat higher than that of the euro area. In the first scenario we find that seigniorage as a share of GDP in 2020 would range from 0.13% to 0.44% for the euro area and from 0.07% to 0.12% for the US. In the second

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[13] These numbers do not take into account the potential GDP decline in the next year due to the ongoing financial crisis.

scenario, we find that shares range from 0.18% to 0.57% for the euro area and from 0.11% to 0.18% for the US.

Two underlying factors are worth mentioning as possible explanations for the observed difference in the seigniorage gains in the two areas as a share of the respective GDP..

First, for data compatibility, we restricted the euro area to 13 members, hence the resulting overall GDP may not be representative of the euro area economic size currently and as it expands in the future. The second factor is the faster rate of growth of nominal GDP for the US. This in turn reflects a higher inflation rate in the US – one factor behind the shift from the dollar towards the euro in the international currency role

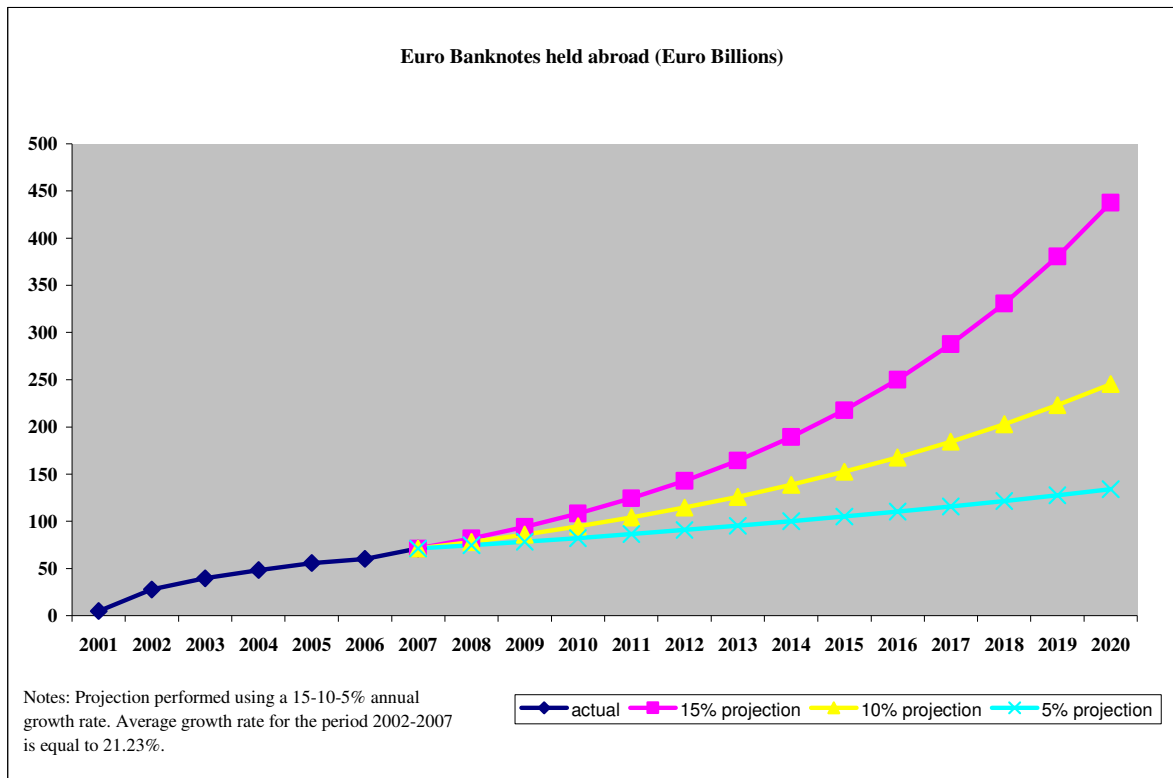**Figure 4.1. Euro Area Seigniorage Potential Benefits**

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Notes: Projection performed using a 15-10-5% annual growth rate. Average growth rate for the period 2002-2007 is equal to 21.23%.

Figure 4.2. U.S. Seigniorage Potential Benefits

US dollar banknotes held abroad (USD Billions)

Notes: Projection performed using 7-5-3% annual growth rate. Average growth rate for the period 2000-2007 is equal to 5.19%.
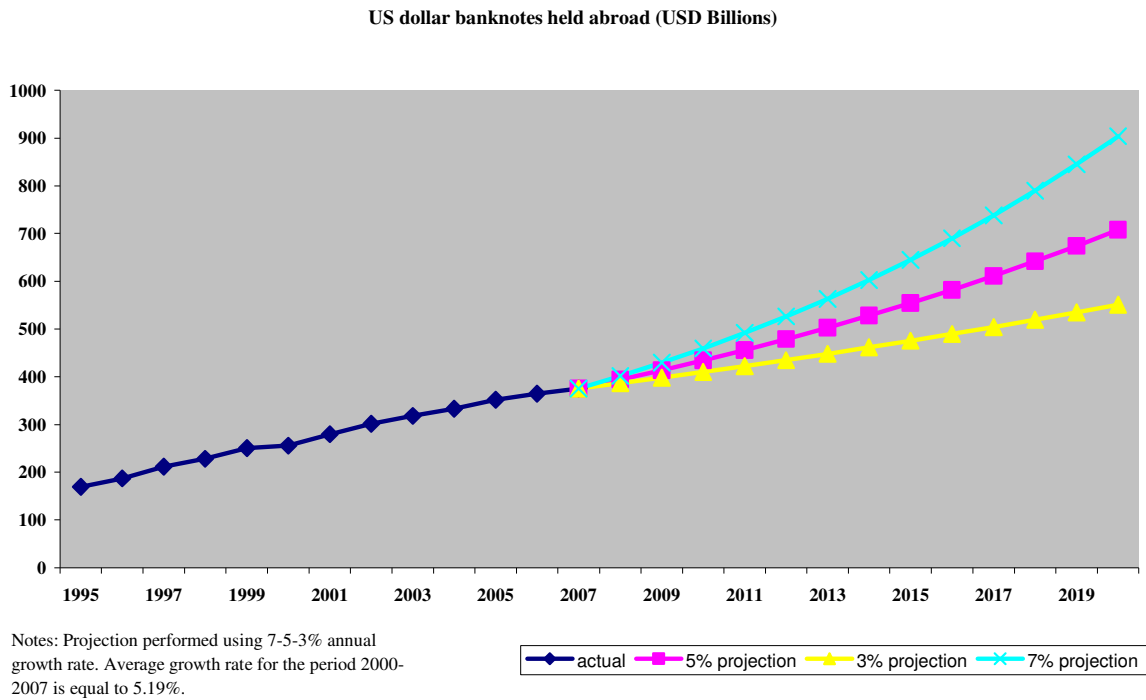
4.2. Terms of Trade

In addition to the standard benefits of seigniorage and the liquidity discount emphasized in Portes and Rey (1998), in a recent paper Kannan (2007) emphasizes an alternative channel that might be quantitatively important. Kannan builds a money search model in which, over and above the seigniorage gains, there is a terms of trade benefit from running an international currency. The model features two channels through which a gain in welfare can occur for the residents of a country that issues an international currency. Beyond the standard seigniorage revenues, the second channel operates through trade. As more people

40

use the domestic currency in international trade, its value in terms of the quantity of goods that can be purchased for a unit of the currency increases. In other words, the issuing country experiences a terms-of-trade improvement. The model also allows for straightforward calibration of the parameter through trade shares. The author then partitions the world into three groups, the US, the EU and the rest of the world, and compares consumption-equivalent welfare changes across three plausible scenarios for the world economy, according to international currency status of the US dollar and the euro. The welfare benefit for the euro area in having its currency internationally used ranges from 1.7% to 2.1% of consumption, depending on the inflation rates in other parts of the world. The trade channel appears to explain around 75% (i.e. accounts for 1.2%-1.5% in consumption for EMU citizens) and seigniorage benefits the remaining 25% (i.e. around 0.4%).[14]

4.3. The use of the euro as an invoicing currency in international trade

Invoicing in the home currency offers exchange-rate stability to both importers and exporters. Internationalization of the currency is both a cause and a consequence of invoicing behaviour. Thus a rising international role of the euro benefits euro-area firms in this respect. The gain to firms is difficult to quantify, but we can assess how far and how fast the process is likely to go.

Transactions invoiced in euros have increased over the past decade, as the single currency has spurred trade within the euro area and has raised trade flows of euro member countries with outsiders (see Baldwin, 2006). While data on international trade invoicing are scant, most studies illustrate the primary role of the dollar throughout the past fifty years. The dollar has enjoyed a prominent role in international trade for three main reasons.

First, before the creation of the euro area, the US was by far the largest market in the world. As firms tend to invoice their exports in either their own currency or that of the importer (to smooth demand fluctuations) and the US was the largest market, it comes as no surprise that most imports to and exports from the US were settled in dollars. Market size is a key

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[14] Kannan's calibration results depend (naturally) on parameter values that are hard to estimate precisely.

determinant of invoicing patterns. Theoretically exporters have a high incentive to invoice in the currency of the large markets as their competitors in these countries will be most likely domestic companies. In other words, in large markets the strategic externality (to herd with your competitors' pricing) is stronger. In line with this conjecture, Goldberg and Tille (2008) find that country size is a highly significant predictor of invoicing patterns. Size appears particularly important for the invoicing of small countries.

Now, however, the euro area economy equals the size of the US economy. In addition the euro area is a market equally important as the US for most big emerging market economies (such as the BRICs). While the dollar is the major invoicing currency in East Asia, the large market size of the integrated euro area economy will most likely switch some of the exports from these countries from dollar to the euro. Both theories of network externalities and the limited empirical evidence suggest that invoicing in euros will be more than the sum of the legacy currencies (see Goldberg and Tille, 2008).

Kamps (2006) studies a large number of countries and shows that the prospect of joining the single currency also raises use of the euro, both with existing euro area countries and also with third parties. Wilander (2004) presents evidence that the euro has increased its status in Swedish exports. In this study, however, the increased share of the euro compared to the legacy currencies comes at the expense of the Swedish krona rather than the dollar. Kamps also shows that the role of the euro in international trade is high in countries that peg their monetary policy to that of the euro area.

Second, trade invoicing is affected positively by low "transaction costs", broadly defined. Exporting and importing firms face higher costs when invoicing in currencies that are volatile, suffer high inflation, and operate in underdeveloped capital markets, with high costs in the forex market. Traditionally, the US was the main currency with low inflation, deep financial markets, low exchange rate volatility, and small transaction costs in the foreign exchange market.[15] Yet the euro now offers an attractive alternative. The ECB has kept inflation low; the euro exchange-rate volatility is not higher than that of the dollar; the

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[15] Tavlas (1991) shows that the importance of the deutsche mark in international goods markets rose considerably in the 1970s and 1980s, when US inflation was high.

euro area has developed sophisticated capital markets; and spreads in the foreign exchange markets are now very low for both currencies.

Third, the major factor behind the dollar's dominance in international trade arises from the use of the dollar in reference-priced and organized-exchange traded goods. For example, most commodities, including oil, are settled in international markets in dollars. Indeed McKinnon (1980) and Krugman (1980) have argued that when a currency has established itself in a particular market, then a small price-taking firm always finds it optimal to follow, because if it were to choose another invoicing currency this would yield more volatile sales. The key insight is that once a currency has acquired a dominant role due to historically low costs, then it will continue to enjoy this status, even if alternative currencies offer similar (or even smaller) costs.

Recent theoretical and empirical work by Goldberg and Tille (2006, 2008) stresses the effects of the structure of demand and production on invoicing. These models yield a herding effect, implying that the exporter has an incentive to follow its competitors and use the same currency, because this limits output volatility. Yet when the goods are highly differentiated, then pricing is not sensitive to the competitors' actions, as the firm enjoys some monopoly power. The main empirical prediction is that reference-based pricing is more likely in homogeneous goods, such as oil, gold, and basic commodities. The intuition is simple. If a firm produces and sells differentiated goods, then it faces (the usual) downward-sloping demand curve and thus can choose to index sales in the currency of the exporter. When the good is homogeneous, the producer is typically a price taker and thus will use the currency in which the good is settled to minimize loss of sales and profits arising from exchange-rate fluctuations.

Goldberg and Tille (2008) assemble invoicing data from 24 countries and show that the dollar's importance in international transactions is mainly driven by its predominant role in reference-priced goods, usually traded on organized exchanges.[16] Kamps (2006) reaches

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[16] A critical assumption of these models is that actions are taken by small firms/individuals, who are price takers. Yet in many commodities, like oil, a small number of countries control most of global supply. There might be big changes if a large player decides to switch to an alternative currency. The invoicing choice may also be affected by currency pegging. Among major oil exporters, Russia and Kuwait have already moved to basket pegs in which the euro plays a major role; other GCC countries are coming under increasing pressure to move from their dollar pegs.

similar results, showing that the dollar is still the dominant vehicle currency, mainly because of its role in settling commodities and oil transactions. Network externalities suggest that it is unlikely that these markets will switch to another currency, unless transaction costs (broadly defined to include exchange rate volatility, inflation) in the dollar increase significantly. The euro might still play a role in newly established markets (as for example natural gas, where the share of European trade is high).

5. Internationalization, excess returns, and the 'exorbitant privilege'[17]

In 1965, Valery Giscard d'Estaing criticized the 'exorbitant privilege' accruing to the issuer of the international currency. He was referring to the 'automatic' way in which other countries financed US balance-of-payments deficits by semi-involuntarily accumulating dollar-denominated assets, typically US government securities. The 'exorbitant privilege' has also been interpreted as the ability of the issuer of the international currency to earn excess returns on its gross foreign assets relative to the returns non-residents earn on gross US liabilities. This can have two components: higher returns within each asset class; and relatively high portfolio weights on high-yielding asset classes and low-yielding liabilities.

A recent paper by Gourinchas and Rey (2007) presents a disaggregation of the 'exorbitant privilege' into these 'return' and 'composition' effects by performing a detailed analysis of the historical evolution of US external assets and liabilities at market value since 1952. They find strong evidence of a sizeable excess return of gross assets over gross liabilities. Interestingly, this excess return increased after the collapse of the Bretton Woods fixed exchange rate system. It is mainly due to a return discount: within each class of assets, the total return (yields and capital gains) that the US has to pay to foreigners is smaller than the total return the US gets on its foreign assets. They also find evidence for the composition effect: the US tends to borrow short (low yield) and lend long (high yield). Interestingly, the composition effect plays a smaller role over the entire period, but its relevance has increased significantly over time. Between a quarter and a third of the current excess return can be explained by the asymmetry in the US external balance sheet and the fact that the US earns an equity premium. They then conclude that as financial globalization accelerated its pace, the US transformed itself from a world banker into a world venture capitalist, investing greater amounts in high-yield assets such as equity and FDI.

Until now, no comparable data have been published for the euro area. We are fortunate that the ECB has provided us for the first time quarterly data for several years that permit some

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[17] We are grateful to Pierre-Olivier Gourinchas and Hélène Rey for helpful discussions and for providing the updated version of their database (which is, however, currently under extensive revision – we use the original series, updated).

comparisons with Gourinchas and Rey estimates for the US. This is also important as we can have an early assessment of the intertemporal evolution of the euro area's international balance sheet.

We have gathered data on total returns on gross assets and liabilities of the euro area in two broad categories: direct investment and portfolio investment.[18] These returns have two components: a flow of investment income (net of reinvested earnings[19]); and a valuation effect, which includes asset price changes, exchange-rate changes, and 'other adjustments'. The US data have a similar 'other adjustments' category, which includes omitted income flows, omitted capital gains and losses, and errors in initial external positions.[20]

Figures 5.1 graphs the differential ('excess') returns for the portfolio asset class for both the euro-zone and the US. It is evident that far from exhibiting any exorbitant privilege, euro-zone investors on the whole do not do particularly well in comparison with non-residents investing in the euro area. In fact, differential returns for portfolio investment have been oscillating from positive to negative values with a reduction in the amplitude of these cycles in the last four years. For the US, we see the expected positive excess returns for both components of the portfolio investments: debt and equity. In accordance with the Gourinchas and Rey explanation, this valuation effect in the US external positions has been particularly important in the last period. Figure 5.2 shows the excess returns for the US in the 1990s, on FDI, equity and debt.

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[18] Unfortunately there are no data on government and corporate bond returns and other non-traded assets.
[19] Including them would be double counting, since they should show up in equity price changes, which enter the valuation effect (see below).
[20] The flow data are reconciled annually with a survey of positions, and it is believed that the quality of these survey data rises over time.

Figure 5.1:Differential Returns for the euro and the dollar (quarterly data, 1999-2007)
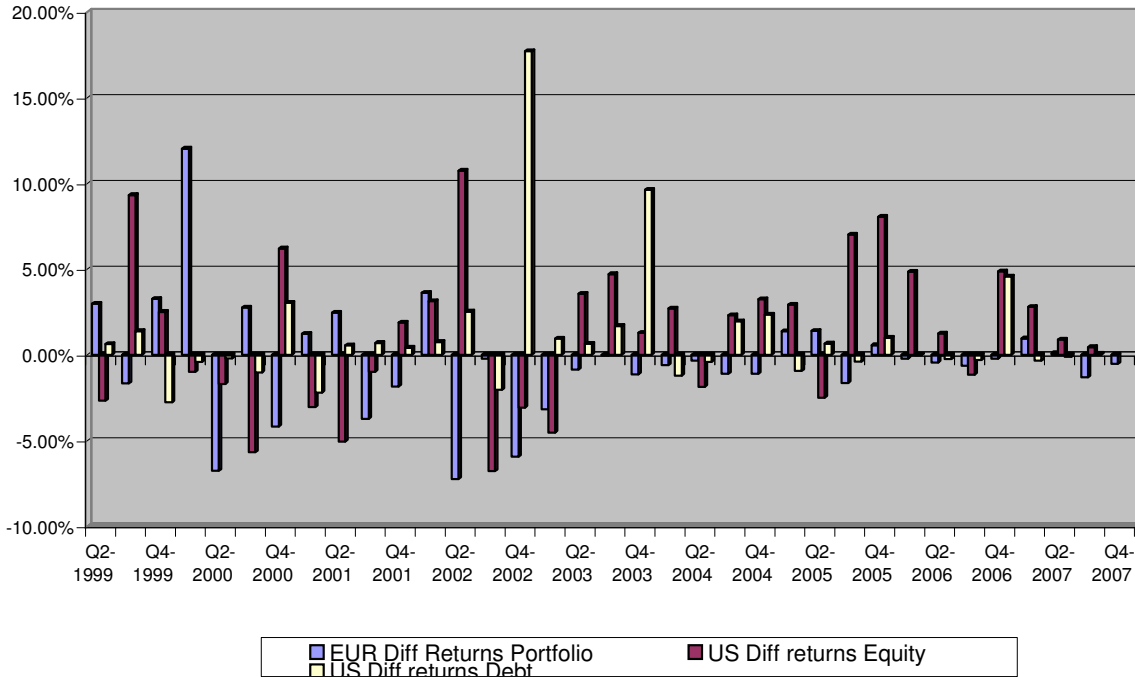
One extension of the analysis, if the data were available, would be to compare gross asset returns between the EU and the US, for each asset class. If, for example, gross portfolio asset returns are similar for the EU and the US, then the smaller excess return for the EU is indicating something about covariances: assets and liabilities are better hedged on the EU side, or (equivalently) there is more risk-taking (and implicit intermediation) on the US side. If the gross returns are different, could it possibly be that US investors are better at 'picking winners'? Or is there an alternative, more plausible explanation?

Figure 5.2. Differential Returns for USD. Quarterly data (1990-1999)
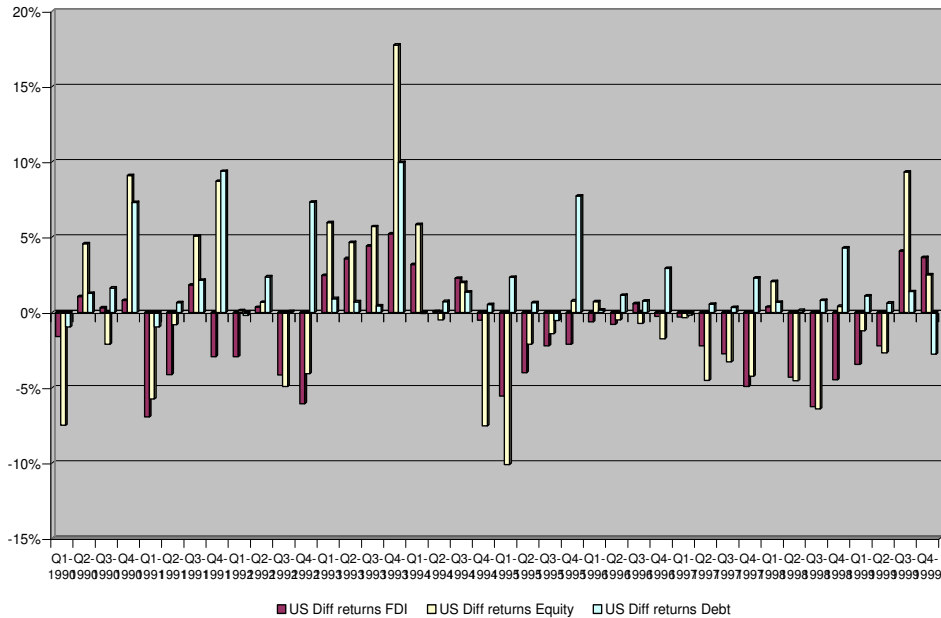
A major difference between the EU and US data is in the exchange-rate component of valuation effects. For each year of EU data we have, this effect has the same sign for both assets and liabilities (negative in all years except 2005, when the euro exchange rate was not appreciating). The absolute values are lower for liabilities than for assets. This suggests that although assets are indeed denominated mainly in foreign currencies, a significant share of euro-area liabilities to foreigners is also still foreign-currency-denominated, rather than euro-denominated (whereas a very high share of US liabilities is dollar-denominated). This is confirmed by the European Central Bank, which states that 'the euro area's external assets are mostly denominated in foreign currencies and its external liabilities in euro.' [21] We should expect the share of liabilities denominated in euros to rise as internationalization of the euro proceeds.

There are two further important observations we can make about the data at this point. First, the US has been historically more highly leveraged than the euro area, another sense

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[21] Press release at http://www.ecb.int/press/pr/stats/bop/2008/html/ba081106.en.html . Unfortunately, the ECB does not give the data underlying this statement.

in which it is still more a 'world banker'. That is, the ratio of foreign assets to foreign liabilities has been lower for the US. Nevertheless, as Table 5.1 below shows, this ratio has been steadily rising in the last five years, whereas it has remained pretty much stable for the eurozone: that is, eurozone leverage constant, US leverage falling, and the ratio is now almost identical. Moreover, relative to GDP, euro area assets and liabilities are both higher than for the US. So the euro area is at least as highly leveraged as the US.

Table 5.1. Cumulative Leverages in the US and euro-zone (2003-2007)

Eurozone (data from ECB in Eur millions)

year	Total Assets	Total Liabilities	A/L	A/GDP	L/GDP
2003	7817.7	8608.3	0.91	1.04	1.15
2004	8609.8	9497.9	0.91	1.10	1.21
2005	10737.9	11575.7	0.93	1.33	1.43
2006	12195.1	13226.4	0.92	1.44	1.56
2007 Q3	13645.2	14948.0	0.91	1.55	1.70

US (data from GR in USD millions)

| year	Total Assets	Total Liabilities	A/L	A/GDP	L/GDP
2003	8811089,4	11454561.5	0.77	0.79	1.02
2004	10863530.2	13577703.7	0.80	0.91	1.14
2005	12600553.4	14774811.6	0.85	0.99	1.16
2006	.16021979.9	17654511.4	0.91	1.20	1.32
2007 Q3	18179298.9	19733228.5	0.92	1.30	1.41

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Second, another aspect of the 'world banker' role is maturity transformation. We cannot get at this directly from the data, but we can look at the relationship between 'liquid' and 'illiquid' assets, and similarly for liabilities, and compare the two. We treat portfolio assets (equity and debt) as liquid, in addition to 'other', which we believe to be primarily inter-bank loans[22];.

Figure 5.3 depicts the evolution over time of the share of illiquid assets and liabilities over the total for both the US and the euro zone. We can make three remarks on these data. First, the euro-area illiquid asset ratio has risen over time – but the illiquid liability ratio has risen more. Second, this is not so for the US, where the illiquid asset ratio has risen but the illiquid liability ratio has fallen. Third, the euro area ratio is only a little more than half that of the US, indicating that the US economy does more maturity transformation than the euro area, and this may partly explain the observed difference in excess returns shown above.

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[22] It can be argued that equity and long-term debt (at least) both carry substantial liquidity risk. According to this view, portfolio assets should be treated as illiquid. We have performed the same analysis using this alternative definition and results do not change significantly. Results available upon request.

Banks borrow short, lend long – typically, their liabilities are liquid, their assets are illiquid. In that sense, the first two of our three remarks suggest that the US has actually become more a 'world banker' over the recent period, whereas the euro area has not yet taken on this role. And that is consistent, too, with the observation that the US does more maturity transformation. Moreover, we saw that the US does enjoy the 'exorbitant privilege' (in the Gourinchas-Rey sense of excess returns), especially since 2002, whereas the euro area does not. So in these respects, the dollar has so far maintained its unique role in asset markets. On the other hand, the euro area is at least as highly leveraged (on a standard definition) as the US.

Figure 5.3. Share of illiquid assets and liabilities in the US and eurozone

USA

Euro-zone
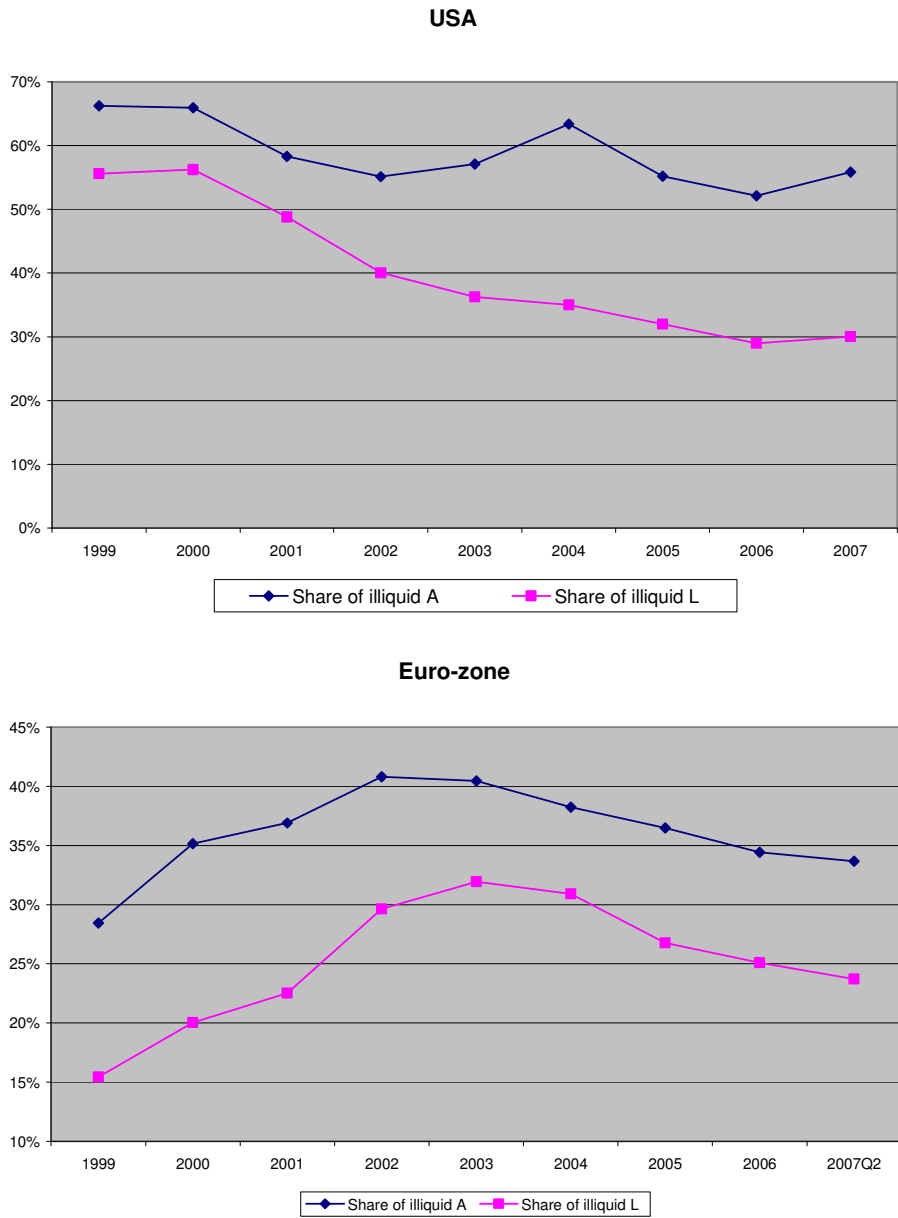
6. Exchange-rate volatility

Immediately before the introduction of the euro, there was extensive analysis of the likely differences between the volatility of the legacy currencies (either the ECU or the DM in practice) and the volatility of the new single currency. The evidence on implied volatility derived from option prices given by Breedon and Chui (1998) clearly showed that *expectations* in November 1998 of volatility between May and November 1999 were substantially higher than they were in August 1998 and also much higher than 'historic volatility'.

This discussion then ignored the likely internationalization of the euro. One argument started from the 'size effect' of EMU. The euro zone is a substantially larger economy than any individual member – even Germany represents only about a third of euro area GDP. From a macroeconomic perspective, the euro zone is less open. This, it was thought, would lead the European Central Bank to attach less importance to the euro's exchange rate than did the Bundesbank or the Banque de France to their exchange rates. Since exchange rate changes have a smaller impact on the domestic price level in a large country, the ECB was expected to follow a policy of 'benign neglect', rather like the normal policy of the Federal Reserve. Cohen (1997) cited the example of the reactions of the Fed and the central banks of Europe to the recession of the early 1990s. Whereas in the US the Fed did not hesitate to lower interest rates aggressively, the European central banks reacted much less strongly, in part because of their fear of the consequences both for their own bilateral exchange rates and for the exchange rate with the dollar. Cohen maintained that since such concerns would be eliminated or at least reduced with EMU, monetary policy and fiscal policy would be more reactive to domestic shocks and therefore less stable. With perfect capital mobility, this in turn would lead to *less stable exchange rates*.

On the other hand, Martin (1997) argued that a large country has less incentive to use its monetary policy strategically to stabilize its economy than a small country. Again, this is because output of the former depends less on the exchange rate than does output in the latter. Reduced use of the exchange rate as a strategic instrument should lead to a more stable exchange rate. From that point of view, the *euro should be a more stable currency*.

Martin found empirically a strong positive relationship between size and volatility for relatively small countries. But the relationship is non-linear and appears to be reversed for large countries. In other words, the larger a *large* country, the less volatile its currency. Since the euro area is a very large monetary zone, his empirical model actually predicts a small *decrease in nominal exchange rate variability*. This decrease should be more significant the larger the monetary union.

Breedon and Chui (1998) did not impose any structural specification. Instead, they simply regressed volatility of the real effective exchange rate (standard deviation of monthly percentage change) on the ratio of imports to GDP and the level of GDP for a sample of 92 countries, including a term in the square of GDP to allow for the non-linear relationship predicted by Martin. They found coefficients on all three regressors significant and of the predicted sign: volatility falls with openness and the square of GDP and rises with the level of GDP. But the estimated coefficients are such that evaluating volatility using the point estimates gives an 'openness effect' twice the 'size effect' for the comparison of EMU relative to Germany. Thus the fact that EMU will be a less open economy than Germany dominates the fact that it will be bigger, indicating that volatility of the euro *real effective* exchange rate will be *higher* than that of the DM.

The welfare implications are clear. With a weaker exchange-rate constraint, large countries are able to focus more on domestic stabilization of output and inflation. If EMU generates increased exchange rate variability because of 'benign neglect', this would only reflect the fact that monetary policies will react more, and more optimally, to domestic shocks. So from a purely macroeconomic point of view, and considering only the welfare of euro-area residents, the scenario of increased exchange-rate volatility under EMU should not be of great concern. The microeconomic consequences, however, would be negative, obliging euro-area firms to reinforce their hedging strategies, either through financial engineering or relocation. And there would be unambiguous costs for the rest of the world.

We now have data on the actual euro exchange rates for a period somewhat longer than nine years. We have done various comparisons between the volatility of the euro exchange rates and those of the DM and a 'synthetic euro' pre-1999. The results are very interesting. The central finding is that the *volatility of the nominal effective exchange rate of the euro is unambiguously higher than that of the synthetic rate for the period 1992-1999*. We find this

for the 'crude' volatility and even more strongly when we 'scale' or normalise it to take account of global macroeconomic volatility, which was particularly low in recent years, until August 2007.

The first graph (Figure 6.1) below shows the annualised daily volatilities of the bilateral exchange rates against the US dollar, the pound sterling, the Japanese yen, and the Swiss franc. We then give the results of standard nonparametric tests of whether the volatility in the earlier period exceeded that of the period from the beginning of 1999. The results of these tests are ambiguous.

Figure 6.2 shows nominal effective exchange rate volatility. These data are available only from the beginning of 1992. Below that, we show a composite index of global macroeconomic volatility taken from Ferguson *et al.*(2007). Then we present the nominal effective exchange rate volatility 'normalised' by this index of global volatility. Even the 'raw' exchange rate volatility is higher in the euro period than before. And it is essential to allow for the fall in global volatilities from 2004 onwards (not just for exchange rates, but also for interest rates and equity prices). When we do so, we find that *exchange-rate volatility is clearly higher from 1999 onwards* than before (the visual impression is confirmed by the statistical tests). This holds even if we ignore the volatility spike in the year 2000 – although there is no reason why we should, since this was probably not the result of any external shock, but rather the consequence of exchange-rate policy (intervention) itself. Note that volatility was not especially high in 1999 relative to 2000 or 2001, and roughly the same as 2002: there was no noticeable effect of the newness of the euro and the need to establish its credibility in the markets.

Finally, we show the volatility of the real effective exchange rate. This is clearly greater in the euro period than before.

Our evidence gives a different picture from that in the recent European Commission report on 'EMU@10' (European Commission, 2008). There are several reasons for this. First, the Commission use quarterly data, and this dampens the measured volatility of series that show a lot of daily movement. It is conventional to use higher frequencies, partly for good economic reasons: the negative effects of exchange-rate volatility arise from short-run as well as medium-run fluctuations. Second, the Commission use simple standard deviations

to measure volatility, whereas we use an approach similar to a GARCH model. Their procedure tends to smooth out the large volatility spike and cluster during 1999-2001. Third, we believe it is essential to normalize for global macroeconomic volatility. It is the only way to allow for the likelihood that exchange-rate volatility, like the volatilities of other major macroeconomic variables, are affected by a wide range of exogenous shocks that are independent of and irrelevant to the introduction of the single currency. The Commission stresses the decline in volatility after the spike of 1999-2001, but if we similarly omit the spike of 1992-93, we find that both crude and normalized volatility is higher in 2002-mid 2007 than it was in 1994-98 (note that we end our series just after the beginning of financial market turmoil in early August 2007, so our results are not affected bv this).

It is very tempting to see in the increase of volatility from pre-EMU period to the euro not only the effect of size, as suggested in the earlier literature, but also an effect of internationalisation of the currency. Wider and deeper financial markets, including the foreign exchange markets, should mean that internationalisation will bring greater exchange-rate stability. Moreover, the ECB's monetary policies have been decidedly non-aggressive, contrary to the arguments of Cohen (1997). But it would seem that the increased exposure to and prominence in the international financial environment has outweighed these influences.

Figure 6.1

Annualised Daily Volatilities
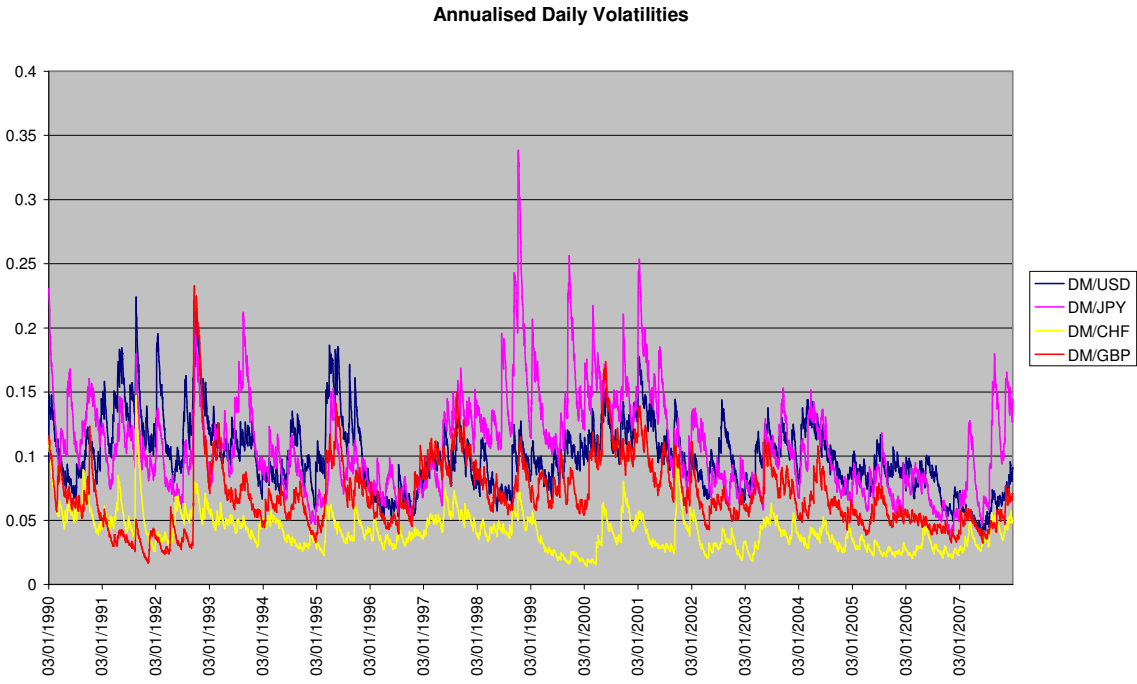
Note: The series are for the DM prior to 1999 and the euro thereafter.

Table 6.1: Nonparametric Tests for Differences in Volatility Distributions

Both tests assess the DM sample (1990-1998) against the EUR sample (1999-2007).

Test Statistic	DM/USD	DM/JPY	DM/CHF	DM/GBP
Mann – Whitney – Wilcoxon: **equality in median**	**No** (0.00) *i.e. EUR median lower*	**No** (0.00) *i.e. EUR median lower*	**No** (0.00) *i.e. EUR median lower*	**Yes** (0.80) *i.e. equal medians*
Kolmogorov – Smirnov: **EUR vola < DM vola**	**Yes** (0.00)	**Uncertain** (empirical cdfs cross)	**Yes** (0.00)	**Uncertain** (empirical cdfs cross)

p – values are in parentheses. Mann-Whitney-Wilcoxon performs a two-sided test of the null hypothesis that the data are independent samples from identical continuous distributions with equal medians, against the alternative that they do not have equal medians. Kolmogorov-Smirnov performs a two-sample test to compare the distributions of values in the two samples. The null hypothesis for this test is that the two samples are drawn from the same continuous distribution. *The alternative hypothesis is that the EUR sample has more of its probability mass on low volatilities than the DM sample*).

Figure 6.2:

Daily Annualised Nominal Effective Euro 15 Volatility - 12 major trading partners

Figure 6.3

Global Vola Corrected EUR Daily Nominal Effective ER
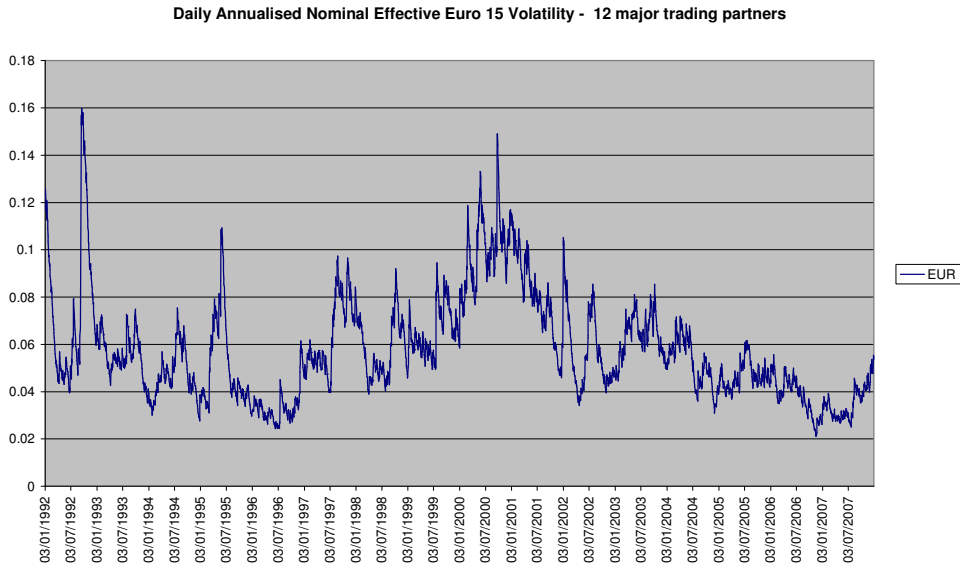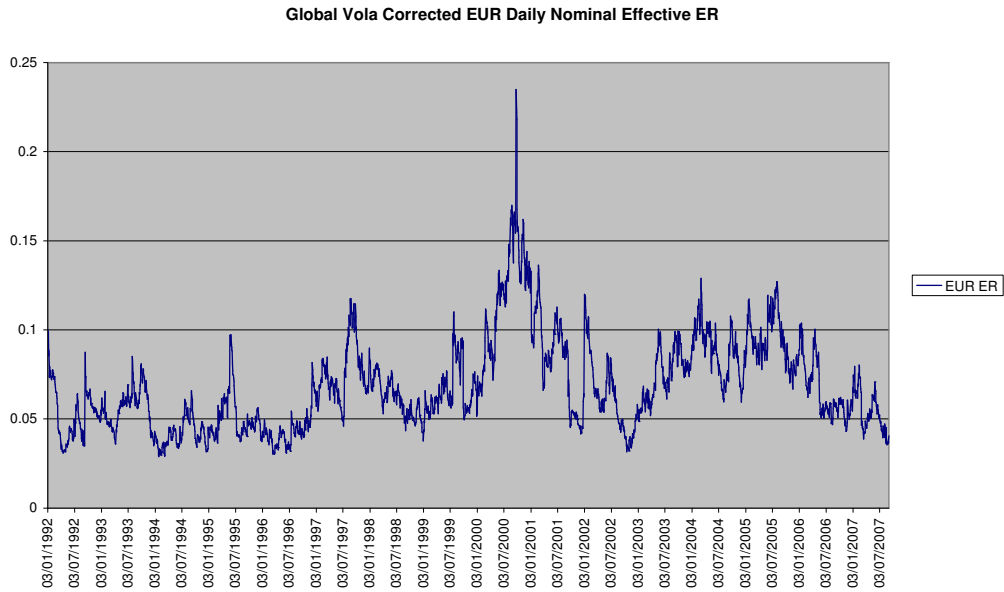
Kolmogorov-Smirnov test for distribution equality (1992-1998 vs. 1999-03/09/2007) rejects null hypothesis of equal distributions on the 1% level, *i.e.* "accepts" alternative hypothesis that early period has *lower* volatility than EUR period. That is, cumulative distribution of DM period has relatively more probability mass on low volatilities than EUR period.

Figure 6.4

Monthly Annualised Real Effective Euro 15 Volatility - CPI deflated, 12 major trading partners
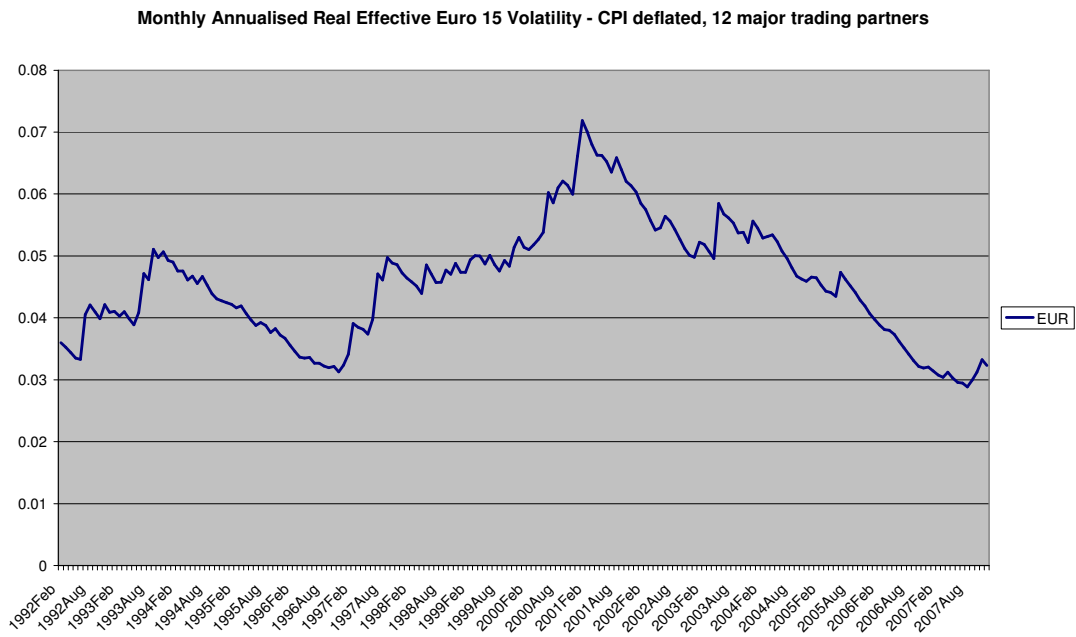
7. The euro and global currency diversification

The advent of the euro has coincided with a surge in financial globalization. Cross-border capital flows have grown at a remarkable pace in the past two decades, especially among industrial countries. For example, the BIS international banking statistics indicate that external bank assets and liabilities have grown more than fourfold since 1990. Similarly the IMF CPIS (Coordinated Portfolio Investment Survey) data and the Lane and Milesi-Ferretti (2007) databases show that international portfolio investment in debt, equity, and FDI more than doubled over the past five years.

These trends are forcing investors to consider diversification and hedging strategies to manage their rising exposures in foreign markets. For example, central banks manage nowadays more than 7 trillion dollars in reserves. Likewise, the assets of sovereign wealth funds that aim to enhance the return-risk tradeoff (see Portes, 2007) are now estimated at well over 2 trillion dollars. The unprecedented size of these asset holdings is forcing private agents, governments and central banks to consider diversification strategies. In addition the low yields on traditional safe assets, such as US T-bills and money market rates, are forcing even risk-averse investors to consider alternative assets in their portfolios.

There is ample evidence showing the desire of foreign investors to hedge and diversify. First, foreign exchange turnover has increased greatly in derivative instruments that enable investors to hedge currency risk (BIS Triennial Survey 2007). Second, central banks with large reserve holdings employ active portfolio strategies in an effort to increase the return-variance tradeoff. Surveys conducted by the Royal Bank of Scotland (e.g. RBS, 2005, 2006, 2007), case studies (see ECB 2006) and anecdotal evidence all point out that central banks are slowly but steadily moving to more risky assets and seek to diversify across currencies by setting up specialized funds or consulting portfolio managers (for a summary, see Papaioannou and Portes, 2008). Third, private investors have also increased their exposure in emerging market economies, and the "home bias" in portfolio investment, albeit still present, is decreasing.

The incentives to diversify and hedge currency risk are nowadays higher than ever. The historically low yields in US and in other industrial countries' government bonds have

induced conservative investors, such as central banks and pension funds, to consider investing in alternative assets, such as corporate bonds, asset-backed securities, hedge fund composites, even equity. In addition the prolonged US current account (see Figure 1.2) deficit has increased concerns over an abrupt dollar adjustment, inducing investors to lower their exposure in US markets. Moving away from the dollar is now cheap, as transaction costs in the bond, equity, and foreign exchange markets of most developed countries have fallen drastically over the past ten years. For example bid-ask spreads in the FX markets of G7 economies are almost zero. Likewise spreads in the government bond markets are also quite small. Information technology and the expansion of investment banks have also lowered information costs that have been a major impediment to cross-border investment (e.g. Portes and Rey, 2005). Furthermore the recent downturn in U.S. home market and the financial problems of the U.S. mortgage agencies, Freddie Mac and Fannie May, have raised fears on the attractiveness of these alternative assets[23].

7.1 Currency hedging for global bond and equity investors

The theory of financial diversification suggests that investors should hold foreign currency for two main reasons: First, there is a speculative component. Foreign assets (bonds, equities and currencies) might offer superior returns over domestic securities at a lower risk (variance). Therefore by investing abroad investors can increase the Sharpe ratio (the return-standard deviation ratio) of their portfolio. Second, investors can lower the riskiness of their positions by adding imperfectly correlated assets to their portfolios. Ideally investors should search for assets and currencies that are weakly or even negatively correlated with domestic returns, as hedging becomes more attractive the lower the covariance among assets. In addition fixed-income investors may want to hold foreign bonds and notes, since domestic nominal bonds contain some inflation risk. By diversifying across currencies that offer stable real interest rate returns investors can hedge against unanticipated inflation shocks (e.g. Adler and Dumas, 1983).

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[23] Having said that, it seems that in response to the current financial turmoil investors are investing in US treasuries.

Given the notoriously difficult to predict bond, equity, and currency returns, however, it is hard to quantify the direct benefits of the speculative component. For example, while standard international macro (UIP) theory predicts that currencies with high interest rates should depreciate against monies with low rates (in order to equalize returns), in fact high-yield currencies tend to appreciate, especially in the short-run and medium-run (e.g. Fama, 1984). Yet exploiting this anomaly usually requires taking large positions that often have a non-negligible price impact and thus are hard to implement (Burnside, Eichenbaum, and Rebelo, 2007).[24] In addition "carry trades" entail considerable risk, as exchange rate movements between high interest rate and low interest rate currencies are negatively skewed (Brunnermeier, Nagel, and Pedersen, 2008). The recent unwinding of the yen-Australian dollar carry illustrates that while such strategies may be quite profitable, they are indeed risky.

In a recent paper, Campbell, Serfaty-de Medeiros, and Viceira (2007) sidestep the speculative motive and focus on the risk management problem of global equity and bond investors, who can hedge their exposure in the main bond and equity markets by going long or short in the main international currencies. Campbell *et al.* study the correlation (covariance) structure of equity, bond, and exchange returns over the 1975-2005 in seven economies' currencies, the US, the euro area, Japan, Switzerland, the United Kingdom, Canada, and Australia.[25] Abstracting from expected abnormal returns, they examine the implications of the covariance of returns for hedging. Before discussing their interesting results on the role of the euro in global hedging strategies of global equity and bond investors, we summarize the main empirical regularities.

1. Annualized excess equity returns over the 30-year period are around 7% across the seven countries. Equity returns were somewhat lower in Japan and Canada (around 5%) and around 8% in the UK. Annualized volatilities are around 18% (15% for the US).

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[24] It should be stressed that it is hard to estimate precisely the returns to carry trades as data on actual transaction costs for large bets are not available.
[25] The authors use a synthetic currency for the euro area countries before 1999 and proxy euro area stock and bond returns with the value-weighted average returns in Germany, France, Italy, and the Netherlands.

2. Annualized excess bond returns are around 2.5%-2.9% for all currencies except euro area bonds, which have only a 1% excess return. Yet European bond returns are much less volatile than US and UK bond returns (3.9% compared to 7.3% and 6.7%).

3. Equity returns are positively correlated among all countries (around 0.4-0.6). The correlation of euro area stock markets with the US and the UK equity markets is quite high (0.66) and interestingly has increased over time. European stock market returns are strongly correlated with Swiss returns, and similarly US stock returns are strongly correlated with Canadian equity returns (correlations of 0.75). The correlation of the main equity markets is the lowest with respect to the Japanese equity returns.

4. The correlations in bond returns are in general lower than in equities (around 0.2-0.4), implying larger diversification gains for global fixed-income investors that invest in all seven markets. This result also suggests that the diversification gains are large for central banks which usually invest their reserves almost exclusively in fixed-income instruments. Still, the correlation of euro area bond returns with US and UK bond returns is high, around 0.5.

5. During this period the dollar strengthened vis-à-vis the Canadian dollar, the Australian dollar, and the pound sterling. While the euro-dollar exchange rate fluctuated substantially (the annualized volatility was around 10%), the euro-dollar exchange rate remained relatively stable.

Campbell *et al.* examine the optimal currency exposure of equity and bond investors assuming that they are either solely investing in their domestic market or equally in the seven markets (i.e. they hold 14.3% in each market) or they hold value-weighted global (bond or equity) portfolios.[26] The authors estimate optimal hedging strategies for bond and equity investors, assuming 1-month, 3-month, 6-month, and 12-month investment horizons. Starting with the optimal hedging strategy of equity investors, the authors obtain the following results. First, the euro is a good hedge for equity investors in all countries. It is a particularly appealing hedging currency for investors in Australia, Canada, and Japan, and to some lesser extent in the US and the UK. The euro is a nice hedging currency, as it tends

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[26] The authors also perform their estimation excluding Canada and Switzerland as the US markets are highly correlated with Canada and the euro area markets are highly correlated with the Swiss market.

to appreciate against all these currencies when these countries' stock markets fall. Interestingly this pattern is present across all three decades and if anything it is strongly present in the period 1990-2005, suggesting that euro is an attractive currency for hedging equity risk. Second, the dollar has also nice hedging properties, but it is almost always dominated by the euro or the Swiss franc. Yet, US equity investors have an alternative appealing hedging strategy. Due to the high correlation of US equity returns with the Canadian dollar, these investors could cover their position by shorting the Canadian dollar.

Overall the numerous specifications on the optimal hedging currency allocation of global equity investors suggest that agents investing in the seven major stock markets should try to minimize their exposure by going long on the euro and/or the Swiss franc and to some lesser extent on the US dollar. In addition the optimal exposure to the euro has increased in the second sub-period (1990-2000), an interesting result as this rising role coincides with the EMU. Campbell *et al*. show that such hedging strategies can bring significant gains, as investors could lower their portfolio volatility by up to 300 basis points.

Campbell *et al*. then examine the optimal hedging strategy of bond investors. This analysis is particularly relevant as now the euro offers to central banks with large reserve holdings an attractive alternative to the dollar. Their analysis yields that overall currency demand for global bond investors is considerably smaller than that for equity investors. Regressions results suggest quite small and in general statistically insignificant exposure to all seven currencies. This is because bond returns across the seven countries are weakly correlated; consequently global bond investors who are diversified have little extra need to hedge the exchange rate risk.

However, there is a notable exception. For almost all countries, when domestic bond returns fall, domestic currencies depreciate with respect to the dollar. This dollar appreciation makes the greenback a good hedge for foreign bond investors. Yet the allocations to the dollar are small (around 10%-20%) and in many models statistically insignificant. Most importantly when the authors split their sample period, they find that *while the dollar was a good hedge for bond investors in the seventies and the eighties, this is no longer the case for the period 1990-2005*.

The analysis and results in Campbell *et al*. are quite important for the role of the euro in international financial markets. This is because in a world with increasing cross-border investment, a sizable part for the demand for currencies comes from global equity and bond investors who want to hedge the exchange rate risk implicit in their investment. While the Campbell *et al*. results are still tentative, their analysis shows an increased demand for euros and Swiss franc since the early 1990s. This stems from the increased negative correlation of the euro with equity returns across the world. This may be driven by the growing importance of the euro in international markets, as in periods of market turmoil equity investors tend to find resort in the traditionally safe Swiss franc and the new European currency. The evidence further shows that while the US dollar initially had nice hedging properties for fixed-income investors (as it appreciates when global bond returns fall), its attractiveness has deteriorated in the period 1990-2005.

7.2 Diversification across currencies for central banks

Papaioannou, Portes, and Siourounis (2006) try to quantify the potential gains from diversification of foreign exchange reserves across currencies, employing a dynamic mean-variance currency portfolio optimizer of the five main international currencies, namely the U.S. dollar, the euro, the Swiss franc, the British pound sterling, and the Japanese yen. In contrast to Campbell *et al.* (2007) they do not however isolate the variance minimization component of the optimization problem. Using data in the 1995-2005 in a before-after analysis they examine how the "optimal" share of the euro changed after 1999, compared to the optimal pre-1999 allocation of the three main euro predecessor currencies, the French franc, the Deutsche mark and Dutch guilder.

The analysis proceeds in two steps. First, an optimization for a global "representative central bank" is performed and the resulting estimated optimal currency shares are compared with the reported aggregate reported shares. This enables the authors to construct a measure of currency internationalization, defined as the difference between the optimal and the actual allocations. Second, the authors perform some simulations for optimal currency allocations for four large emerging market countries, Brazil, Russia, India, and China (the BRICs), incorporating into the optimization framework some constraints

capturing central banks' interest in holding a sizable portion of their portfolios in the currencies of the peg, the foreign debt and international trade.

The analysis reveals some noteworthy results. First, the mean-variance optimization yields quite unstable results. Small changes in the variance-covariance matrix or minimal perturbations alter the optimal allocations noticeably. In addition, the optimal allocations change considerably across years; since the actual allocations do not, this suggests high rebalancing costs. The results are sensitive to the various assumptions about expected currency returns. The authors also find that if central banks could take short positions in low interest rate currencies, then the optimal allocation implies that one should apply "carry strategies" This result may explain the high inertia in reserves and shows that while diversification is a theoretically plausible argument, it is not easy to implement. Second, the currency optimizer can match the high allocation of the dollar in reserve holdings (about 65% according to the IMF COFER database) when the dollar is used as the base-reference currency (risk-free asset). Thus the high share of the dollar should not come as a surprise, since most central banks (even in industrial currencies) express their returns in dollar terms. Third, the optimizer yields roughly equal allocations of about 10% to each of the four non-dollar currencies. Since the actual share of euro-denominated assets in global foreign exchange reserves is significantly higher (around 25%), this may be interpreted as tentative evidence of an increasing international role of the euro as a reserve currency. Fourth, the constraints reflecting the currency of external debt and international trade have a small effect compared to the reference currency in explaining the currency composition of reserves.

7.3. Welfare implications

A key aspect of the growing international role of the euro, as we have seen, is its rising presence in international bond and equity portfolios. This in turn has opened up diversification possibilities for global investors and has raised the prominence of the euro as a hedging instrument. Moreover, it appears that the euro has some particularly desirable hedging properties. All this has important consequences for the welfare of euro-area residents and for global welfare.

First, the advent of the euro and its consequent positive impact in spurring cross-border capital flows are likely to enable better risk sharing among countries. Note, however, it is quite hard to establish causality increased globalization and risk sharing with standard empirical approaches between. Moreover, estimates based on model calibrations are usually sensitive to parameter values. Yet, standard international business cycle models unambiguously predict that the establishment of liquid capital markets and the associated spur to cross-border financial flows enhances global welfare as investors can smooth consumption both across regions and across time (Backus, Kydland, and Prescott, 1994).

Second, the establishment of liquid euro-denominated asset markets allows investors to diversify idiosyncratic risk further and thus also to reduce global risk. Note that a priori the replacement of the legacy currencies with the euro could have resulted in lowering diversification and global welfare. This is because global investors have access to one rather than a dozen of available currencies to invest in. Yet the sizable reduction in transaction costs in European financial markets and the significant increase in liquidity associated with increasing returns have clearly outweighed any diversification losses associated with a smaller number of available currencies. Even before the introduction of the euro, the legacy currencies were highly positively correlated and thus were not very attractive for diversification. In addition the advent of the euro has increased the supply of financial instruments and securities, therefore increasing diversification possibilities.

8. Issues posed for monetary policy by the international currency role[27]

In a country which issues a major international currency, there may be some complications for the operation of monetary policy. Internationalization of the currency may make it more difficult to interpret changes in monetary aggregates and interest-rate spreads. Also, the monetary policy of a country may have a higher profile than otherwise if the country's currency is used widely abroad.

In what follows the word "country" is used to refer to a "monetary area" which may or may not be a country. The term "monetary aggregates" includes credit aggregates.

There may be substantial holdings of the currency by foreign residents, in the form of notes or bank deposits. Banks outside the issuing country may accept deposits and make loans denominated in the international currency. The banks' counterparties may include foreign officials, foreign private residents, and home private residents. There is still debate about how to treat such currency holdings, deposits, and loans when constructing monetary aggregates. One important consideration is how hard it is to predict these items.

This said, the quantitative implications may not be great. Even if, as for the United States, foreign holdings of dollar notes are somewhat more than half the total value of notes outstanding, this is still small relative to M3 (say). Moreover, the nature of such holdings suggests that they are unlikely to vary significantly in the short to medium term (see the time series data in our discussion of seigniorage in Section 4.1 above). There is little research on the determinants and behaviour of foreigners' holdings of dollar notes or their holdings of dollar-denominated bank deposits.[28] The Federal Reserve system itself has not generated research on the implications of the international use of the dollar for the stability of monetary aggregates in the US.

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[27] We are grateful to Dale Henderson and Andrew Levin for discussions (but nothing here represents the views of their employer, the Federal Reserve Board).

[28] Sprenkle (1993) and Rogoff (1998) consider foreign use of US dollar notes. Rogoff observes that the European authorities appear to have encouraged foreign (and underground) use of euro notes by printing very large denomination (€ 500) bills. Neither author discusses any significant implications for monetary policy of foreign holdings of the domestic currency.

The spread between the rate on short-term government liabilities (bills) and rates at which private agents can borrow is in part an indicator of risk premia. There may be complications in the interpretation of changes in this spread in any country because government debt securities may provide liquidity services (or a 'convenience yield' – see Sec. 2.3 above) in addition to their pecuniary returns. The interpretation becomes more difficult if a significant part of demand comes from foreign official holdings of government securities, as is the case for a major international currency. If there are two international currencies, shifts between them may affect spreads in both key-currency countries.

The liabilities and assets of many foreigners are denominated in the international currency, so changes in monetary policy in the issuing country can have a very direct effect on their spending decisions. In particular, changes in the currency's exchange rate will entail 'valuation effects' that may be very large (see Sec. 5 above). But to the extent that these foreign holdings are in the hands of the official sector (central banks), the effects on spending are unlikely to be substantial.

There might be pressure on the authorities in a country with an international currency to take account of the interests of foreigners even if they were not the same as those of home residents. Still, monetary policy in a large country can have big effects on foreigners even if its currency is not an international currency. It is not clear how much its profile is raised if more transactions come to be denominated in its currency.

There is no evidence that the current problems regarding the spreads between market rates (such as LIBOR) and policy rates have any connection with reserve currency status.[29] There seem to be no significant differences between the problems experienced by monetary authorities in US and the euro area on the one hand, and the UK on the other (taking the dollar as the major international currency, the euro as a lesser international currency, sterling as only a very minor international currency). Japan has not experienced these difficulties at all.

On the other hand, international currency status and the desire to preserve it may influence the authorities' views on how to deal with these problems. As an example, take the recent

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[29] For example the TED spread has been recently more than 200 basis points, even reaching 4.5%, while historically it has been a few bps.

private-sector initiative to establish a 'NYBOR', which would mainly reflect the borrowing rates paid by US banks in New York, to compete with the dominant LIBOR. The US Federal Reserve appears to oppose this initiative, specifically because it might threaten the dollar's international role:

> 'This reflects the Fed's desire to support the role of the dollar as the world's dominant international currency. Fed officials believe that since the dollar is the global currency, it makes sense to have a main benchmark borrowing rate that reflects the cost of funds for global institutions, not just US banks. But they think it would be hard to set this rate in New York, not London, because of the time zone advantage London has.' (*Financial Times,* 5 May 2008)

Under current international monetary arrangements, countries need to hold stocks of reserve currencies, even when their currencies are floating. The ongoing crisis and the continuous market interventions illustrate this. Indeed, the exceptional growth of foreign exchange reserve holdings since the 1997-98 Asian crisis is often attributed to countries' desire to insure against 'sudden stops' or reversals of capital inflows. Circumstances involving international liquidity shortages or sharp increased demands for international liquidity have normally entailed increased demand for the dollar as a reserve currency or international money. Such situations highlight the responsibilities of an international lender of last resort. In such cases, the international lender of last resort should prevent any sharp decline in international liquidity or a collapse of international money: i.e. it should provide conditions supporting a stable price anchor for the international monetary system. This too could in principle present problems to monetary policy-makers.

The IMF is often characterized as an actual or potential international lender of last resort since it has substantial financial resources, the power to both raise additional funds and to issue Special Drawing Rights (SDRs), as well as a sizable gold stock. As currently structured, however, the IMF cannot qualify as a genuine lender of last resort because it lacks several of the necessary characteristics of such an institution, such as: (a) effective sovereign power to create international money or reserves, (b) quick response and decision-making in response to crises and (c) transparency in pre-announced objectives and procedures in order to generate stabilizing expectations working to avert panics. In fact,

SDRs are limited and not readily acceptable as international reserves; and SDR issues are administratively clumsy, since they cannot be made without prior authorization from the membership. Similarly, the IMF gold stock is a (one-time) source of funds which, under current practice is relatively illiquid, because of fears that sizable gold sales will bring about sharp gold price declines in a thin gold market. Moreover, IMF decision-making is ordinarily slow and cumbersome. For example, in providing money to a borrowing country, the IMF conducts lengthy negotiations involving reform programs and related conditionalities.

In fact, as sovereign debt and financial crises from 1982 onwards have demonstrated, the United States is effectively the 'international lender of last resort', and US officials have dominated the IMF decision-making in these matters[30] as well as taking the lead in international bailout packages (the 1982 debt crisis, Mexico 1994-5, Russia 1998, Argentina 2001, Brazil 2002, …). Yet the ongoing crisis clearly shows that the US, or in fact any other country, cannot alone provide liquidity and manage the situation in a highly integrated financial world. Still, the Federal Reserve unlike the IMF has international reserve or money-creating powers and, accordingly, can act to satisfy increased demands for liquidity. In addition to its power to create acceptable international money, the Fed can act to create liquidity quickly via open market operations rather than through the slower, more cumbersome mechanisms of the IMF.

In short, the responsibilities of an international lender of last resort currently fall on reserve currency central banks. Since the dollar is the dominant reserve currency and the Federal Reserve is the principal institution that can create world dollar reserves, this responsibility falls largely on the U.S. central bank. In serving as an international lender of last resort, the Federal Reserve can prevent a collapse in international money or liquidity, help stabilize or anchor the value of international money, and thereby prevent various (e.g., credit) disturbances from developing into world monetary crises. This has clear political economy benefits for the United States – it is one of the 'harder' forms of 'soft power', and the international relations literature emphasizes this benefit of running an international currency. Under current institutional arrangements the euro area would find it more

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[30] The political economy literature on US political influence in IMF policies is quite extensive. See for example Krueger (1998), Bordo and James (2000), Thacker (2001) and Barro and Lee (2005).

difficult to exercise such power, because it is not effectively unified in its external economic and financial policies (see Papaioannou and Portes, 2008, Sec. 4).

9. Internationalization of the euro and international financial stability

There are several dimensions to international financial stability (see Ferguson, *et al.*, 2007). We have already discussed financial crises in the context of the international lender of last resort role of the issuer(s) of international currency (Sec. 8). But stability goes beyond the absence of financial crises and the capacity to respond to them when they arise. Here we focus on stability of exchange rates, capital flows, and financial institutions, and the maintenance of liquidity in international financial markets. The growing international role of the euro is likely to affect global stability in these dimensions. This will in turn have implications for welfare both in the euro area and globally.

History suggests there is a risk of instability arising from 'currency competition'. As outlined in Eichengreen (2005), the pound sterling was the premier international currency of the gold standard period. Britain was the world's preeminent trading nation. London was by far the most influential financial center of the world and the most important source of long-term overseas investment. That Britain was a major imperial power reinforced sterling's role. During the years following 1914, the US passed from net debtor to net creditor while the UK moved in the opposite direction. As the US economic dominance was emerging, its use in international trade and finance widened increasingly.
As England was losing its dominant role as the global center for trade and finance, the importance of the pound was falling and that of the dollar rising. During the inter-war period the pound retained its dominant position as the key international currency, but the dollar's role strengthened considerably. According to Chinn and Frankel (2005) and Flandreau and Jobst (2005), this is due to inertia and path dependence in international currency status. At the same time, the interwar period was marked by unprecedented economic and financial instability in the world economy[31]. The Great Depression propagated quickly from the US to the other gold standard adherents and eventually led to international monetary collapse in 1931. Charles Kindleberger (1973) argued that the instability of the world economy between the wars reflected the absence of a dominant

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[31] See Bordo (2007) for an extensive and detailed historical account of financial crises during that period.

power willing and able to stabilize the international system. The world economy lacked an international lender of last resort with the ability and desire to stabilize intrinsically unstable international markets.

From a present-day vantage point, however, there seems to be little causal relation between periods of financial instability and the degree of market power in the world economy. From the second half of the 20th century onwards, the global economy and the international monetary system have been unambiguously dominated by the United States. During this period of "hegemonic stability", we have witnessed a historically high level of financial crises, both in terms of frequency and severity. According to Bordo (2007), crises appear to be growing more frequent in the recent era than ever before. Crisis frequency since 1973 exceeds even the unstable interwar period and is now three times as great as the pre-1914 earlier era of globalization, in which Britain was the international hegemonic power.

All this is related to the present debate on the sustainability of the current global imbalances embodied in the large US current account deficit and the corresponding surpluses of a few Asian and oil exporter countries, as well as apparent misalignments of their exchange rates[32]. Abrupt unraveling of the imbalances could cause large and disorderly capital flows and asset price changes, including abrupt exchange-rate adjustments. On the other hand, both theory and historical experience suggest that the reversal of capital flows and the correction of exchange-rate misalignments need not be abrupt, nor have systemic consequences. If adjustment is gradual and is foreseen, then there should be no systemic crisis, unless even gradual adjustment reveals mispricing and threatens balance sheets (see the discussion in Ferguson, *et al.*, Ch. 3).

Obstfeld and Rogoff (2004, 2005) argue that the US current account deficit is unsustainable, and that a substantial, possibly abrupt, exchange-rate depreciation will occur as a result. The recent depreciation of the dollar in 2007 and 2008 has been accompanied by some reduction in the deficit. Yet the deficit is still close to 5% (see Figure 1.2). From a

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[32] See for example IMF Global Financial Stability Reports (2005, 2007) and World Economic Outlook, BIS Annual Reports (2006, 2007), ECB (2006, 2007), and the Bank of England (2007) *Financial Stability Report* and the chapter on International Financial Stability of the Geneva Report of the World Economy 9 (2008).

theoretical standpoint in their model there is no dynamics, however, and they focus only on the *trade adjustment channel* - i.e. future net export growth - in order to stabilize the external accounts of the US.

Gourinchas and Rey (2007) show, however, that the *valuation adjustment channel* – i.e. future increases in the returns of the net foreign asset portfolio – operates at short to medium horizons and explains one-third of the external adjustment, while the trade channel operates in the medium to long run and explain the remaining two-thirds. Valuation effects profoundly transform the nature of the external adjustment process. By absorbing a substantial fraction of the external imbalances, valuation effects substantially relax the external budget constraint of the US. The valuation effects are directly related to the international currency role of the dollar: US assets are denominated primarily in foreign currencies, whereas foreigners are willing to hold very large stocks of dollar assets, so most of US liabilities are dollar-denominated. Hence dollar depreciation gives the US a capital gain. Consequently, despite the large US current account deficits of recent years, the ratio of US net foreign assets (negative) to US GDP has not risen.

Some authors argue that the current configuration of capital flows and exchange rates is sustainable, since surplus countries are either willing or constrained to invest their surpluses in US dollar-denominated assets (Dooley, *et al.*, 2004; Caballero, *et al.*, 2007; Mendoza, *et al.*, 2007). A common theme in these analyses is the superiority of US financial markets. But another major factor is the international currency status of the dollar, which makes foreign central banks (if not foreign private investors) willing to accumulate large dollar-denominated foreign exchange reserves.

Nevertheless, the consensus view agrees with Obstfeld and Rogoff in holding that such US current account deficits are not sustainable in the long term. Overall, whether the adjustment will be abrupt or gradual depends substantially on the role of market expectations about the dominant position of the US dollar as an international currency. Never before has the issuer of the dominant international currency run a long-standing current account deficit while carrying a substantial international debt.

Meanwhile, the US current account deficit and corresponding foreign reserve accumulation has fed a massive growth in international liquidity. Some hold this primarily responsible for

the low real interest rates and associated 'search for yield' and asset price bubbles that led to the current international financial turmoil.

An underlying theme of all this literature is that the international currency status of the dollar confers upon the United States both power and responsibility in the international financial system. The responsibility for international financial stability goes well beyond the international lender of last resort function. The euro has in fact already taken on some of this responsibility. For example, since August 2007, the ECB has played a major role in dealing with problems of liquidity in financial markets. This role was doubtless not desired, but when it appeared necessary, the ECB responded. The response affected global markets, not just those in the euro zone. Indeed, partly because of the importance of large, complex financial institutions with global reach, partly because of the size of international financial flows and cross-border assets, we see that *liquidity pools are now global*. And euro-denominated financial assets and markets are now a major feature of the system. Thus the new international status of the euro has made liquidity in euro markets important around the world. It is not evident that this imposes any costs on the euro area. It is an open question, however, whether sharing this international currency dimension with the United States is stability-enhancing at the global level. Answering positively requires that the euro zone authorities consider their responsibilities for the configuration of exchange rates and associated global imbalances. Sharing international currency status with the United States means sharing this responsibility as well.

10. Conclusions

Our own research and that of others has led us to the following conclusions:

- After an initial period of three years, transactions costs in financial markets and services in the euro area have fallen noticeably. Although we lack accurate and comparable cross-country time-series data on transaction costs for households and investors, there is evidence that the euro is associated with greater depth of financial markets in euro-area countries (financial development). The effect is observable in the medium run (after the fourth post-euro year), not the short run, and not pre-EMU. This hints that the fall in transaction costs in financial markets did spur financial deepening.

- The euro is associated with greater asset trade (bonds, bank loans, equities, FDI), not just among euro-area countries, but *also between non-EMU and EMU countries.* This implies that the single currency spurred financial integration and helped homogenize the European capital markets. It also suggests that the European markets have become more attractive to foreigners.

- The euro has raised liquidity in the international debt markets, and the number of countries issuing euro-denominated securities has grown. Most likely this has contributed to a fall in the cost of borrowing –the so-called liquidity premium, for European governments. This may also help stabilize the international financial system in period where traditionally safe assets, such as mortgage backed securities and AAA corporate bonds in the other side of the Atlantic have fallen in recent months.

- Recent research suggests that the 'liquidity premium' deriving from currency internationalization is in the range of 20-90 bps. If this were transferred to the euro area, the high estimate would correspond to € 41.5 bn, i.e., about 0.5% of GDP (annual flow).

- The internationalisation of the euro has accelerated its usage by both euro-area firms and non-resident investors. This has potentially important consequences for euro area resident's welfare as it increases seignorage gains.

- Alternative projections of international seigniorage to 2020 show it rising to the level of $ 7-25.5 bn for the euro area, in the range of 0.13-0.44% of GDP (annual flow).

- The evidence supports the assertion of synergies and feedback between internationalization of the euro and financial market development (including a reduction in transactions costs in financial markets).

- A recent paper (Kannan 2007) argues that internationalization of the euro would bring terms-of-trade as well as seigniorage gains to the euro area, the former amounting to 1.2-1.5% of consumption for euro-area countries. This is on the assumption that the euro would share with the dollar an equal status in trade invoicing.

- Invoicing in the home currency offers exchange-rate stability to both importers and exporters. Internationalization of the currency is both a cause and consequence of invoicing behaviour. Country (economic) size is an important determinant of invoicing. There is substantial evidence that invoicing in euros is rising, both in euro-area countries and outside, especially for countries that peg their currencies at least in part to the euro.

- A major factor in the dollar's dominance of invoicing is the use of the dollar fpr reference-priced and organised exchange-traded goods. Network externalities and herding effects are high here. But shifts in currency pegging towards the euro may bring some switch in invoicing here too.

- The recent 2007 BIS Triennial Survey on foreign exchange market shows shown that the euro is the only currency that has not lost market share in foreign exchange trading over the past several years. Bilateral foreign exchange market data show, however, that the US dollar is still the dominant vehicle currency, although the euro's role in option contract markets has risen significantly, and the euro shares with the dollar the vehicle currency role for Eastern Europe.

- New quarterly data from the ECB permit us to calculate excess returns on euro-area foreign assets and liabilities and to compare them with the Gourinchas-Rey (2007) estimates for the United States. We find that so far, the euro area has *not* benefited from the 'exorbitant privilege'. One reson suggested by the data is that a significant share of

euro-area liabilities to non-residents is still denominated in foreign currencies rather than in euros. We should expect this share to fall as internationalization of the euro proceeds.

- The US is more highly leveraged than the euro area, but the difference is falling. In regard to maturity transformation, the euro-area share of illiquid assets and liabilities in the totals has risen over time, although it is still less than that for the US>

- The volatility of the nominal effective exchange rate of the euro post-1999 exceeds that of the 'synthetic euro' pre-1999. This holds even if we ignore the volatility spike of the year 2000. At a macro level, this is not a concern, but it does impose micro-level costs on euro-area firms and both macro and micro costs on the rest of the world. The contrary EU (2008) assertions ignore the fall in global volatility from 2004 through August 2007. We suggest that the rise in exchange-rate volatility is an effect not only of economic size (as argued in the previous literature), but also of the increased exposure to and prominence in the international financial environment that are associated with currency internationalization.

- The euro is a good hedge for equity investors in all countries, better than the US dollar. Moreover, since 1990, the dollar is not a good hedge for bond investors. The euro's role in international reserve portfolios exceeds its 'optimal' shares, suggesting a currency internationalization effect. Internationalization of the euro, raising its role in equity and bond markets, has opened up diversification possibilities for global investors, with likely positive welfare implications.

- There is no evidence that currency internationalisation makes it more difficult to run monetary policy. The current problems with spreads between market and policy rates are common to both the US and the euro area, as well as to the UK, but not to Japan.

- The United States, as the issuer of the dominant international currency, functions as the international lender of last resort, insofar as the current international financial system permits and requires this role. This has clear 'political economy' benefits for the US. Under current institutional arrangements, the euro area would find it difficult to

exercise this power, because it is not effectively unified in its external economic policies.

- The evidence does not support the 'hegemonic stability' interpretation of international financial and monetary arrangements.

- Current global imbalances have contributed to international financial instability (excessive liquidity creation through foreign exchange reserve accumulation). Although the euro has become the second most important international currency, the euro area has not been a source of this international liquidity creation. In that sense, the euro has exercised a stabilising function for the international financial system..

- International currency status of the dollar confers on the US both power and responsibility in the international financial system. The euro and the ECB have already taken on some of this responsibility, partly because liquidity pools are now inescapably global. This would not seem to impose costs on the euro area, and it is stability-enhancing at the global level.

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