EMU Effects on Stock Markets: from Home Bias to Euro Bias

EMU Effects on Stock Markets: from *Home* Bias to *Euro* Bias

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Abstract

The shift of perspective from a national basis to a Euro area basis, inevitably induced by EMU, has led member countries to a parallel shift from equity *home* bias to equity *Euro* bias. We interpret this evidence by means of a standard mean-variance portfolio selection model modified in order to include information asymmetries, considering the effect of the EMU integration process on equity markets through informational channels, real and financial. We find a stronger informational impact of the financial channel relative to the real channel in shaping EMU countries' equity portfolios after integration.

JEL CLASSIFICATION: F21; F36; G11; G14; G15

Keywords: financial integration; portfolio choice; home bias; information asymmetries

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The main objective of the present paper is trying to assess the role of different aspects of the EMU integration process in determining the dramatic change of equity portfolio holdings by EMU investing countries.

The home bias phenomenon is well known in the literature (French and Poterba (1991); Tesar and Werner (1995) and Lewis (1999) among others). The preliminary question we want to investigate is whether the change of perspective from a national basis to a Euro area basis implied by EMU integration has led to a shift from home bias to Euro bias. The empirical evidence, indeed, supports this new phenomenon[1]. We try, therefore, to identify which elements of EMU integration can be recognized as responsible of this shift of perspective by EMU investors holding a portfolio composition very unbalanced towards EMU equities after integration. On the basis of Adler and Dumas (1983) model the possible reasons of different portfolios held by different investors are direct transaction costs, information asymmetries and inflation hedging. However, tax treatments were harmonized and controls on capital movements had been removed long before monetary union: the elimination of direct transaction costs, in fact, dates back to the beginning of the 90s. On the basis of the empirical evidence revealing the inadequacy of both direct transaction costs (Ahearne et al. (2004); Berkel (2004)) and inflation hedging (Cooper and Kaplanis (1994)) as possible explanations for portfolio allocation, we rely on a model considering information asymmetries as the only discriminatory factor among different international portfolios. Hence, we investigate which aspects characterizing the integration process may have created a new information network potentially responsible of the Eurobias phenomenon. We are, therefore, interested in verifying *how* the introduction of the Euro can have actually boosted integration on equity market. We identify the relevant elements characterizing the integration process in two basic factors: the common currency and the common monetary policy (Fratzscher (2002)). We consider the common currency's impact on real markets through the trade channel. The common monetary policy, on the other side, is captured by a measure of bilateral financial integration that we proxy through the covered interest deviations (*CID*s) on three-month money market instruments. We will use these measures of bilateral openness and financial integration on money market as reflecting, respectively, the real channel and the financial channel through which information spillovers to stock market, indirectly influencing equity portfolio allocation.

Finally, the informational channel allows us to estabilish the existence of a link between different financial segments (money market and stock market), while the literature usually focuses on investigating the integration process across countries within the same financial segment.

The paper is structured as follows. In the first section we briefly review the empirical literature on financial integration in the Euro area. In the second section we focus in particular on the empirical evidence revealing the shift to Eurobias by countries within

[1] Also Lane and Milesi-Ferretti (2007), in a recent paper, investigate the same issue under a different perspective confirming this finding.

EMU. In the third section we describe the model constituting the theoretical framework through which we try to interpret the striking evidence of the previous section. In the fourth section we describe the theoretical implications of EMU integration and its possible influence on stock market through informational channels. In the fifth section we show the empirical results on the plausibility of the proxies for information asymmetries and on the relative weight of real and financial channel for EMU countries before and after integration. Finally, in the sixth section, we draw the conclusions.

1 Empirical literature on Euro area financial integration

The EMU has been the greatest attempt ever made of financial integration. The literature has recently produced a great deal of work on alternative ways of measuring financial market integration with particular focus on EMU.

The Report by Adam et al. (2002) is the first systematic work trying to organize the different measures of integration in financial markets; their work has been followed, more recently, by Baele et al. (2004) who updated and integrated the previous work: our review of the empirical literature on Euro market integration inevitably draws extensively from these two contributions. Integration on financial markets is achieved when all economic agents face identical rules and have equal access to financial instruments or services: a perfect cross-market integration is understood as a situation in which there are no barriers such as taxes, tariffs, restrictions and information costs or any other costs that prevent investors from changing their portfolios instantaneoulsy. In general, it is not possible to apply the same measure to quantify integration in different markets. Some authors divide the measures of financial integration into quantity-based measures and price-based measures[2]. To rely on measures based on the law of one price, the risk characteristics of the assets must be comparable. The risk is made up of a systematic part and an idiosyncratic part; in some cases the systematic, non diversifiable risk, can be considered negligible as in the money market while it is crucial controlling for it, for instance, in the corporate bond and in the equity markets.

Since monetary policy is implemented through the financial system this system is determinant to guarantee an efficient transmission of monetary policy.

The construction of integration measures for the money and government bond markets is facilitated by the fact that relatively homogeneous assets are available across countries. This is not the case for corporate bond market, credit market and equity market where differences with respect to credit risk are relevant.

We will review financial integration in the Euro area considering the five key euro area markets: money, government bond, corporate bond, credit market and equity market. Different segments have reached different levels of integration and it is important to measure

[2] Actually, Baele et al. (2004) also introduce news-based measures that consist in measures capturing the way different assets react to local-based news or worldwide news.

accurately the state of integration in various segments of the market to identify areas where initiatives of promotion of further integration are needed.

Money market has a key role in the implementation of the single monetary policy of the euro area: it is the financial market most directly affected by central bank actions. Beyond the high sensitivity of the yield curve to tactical monetary policy actions, the architecture of the money market is closely associated with the chosen operating framework of the monetary authorities: the advent of EMU represents a fundamental change in the architecture of money markets in the single currency area brought about by the estabilishment of a new central bank.

Consequently, monitoring integration of the euro area money market is particularly important: indeed, the money market is regularly used by the Eurosystem to distribute liquidity to the market. Besides allowing a smooth flow of liquidity between markets and across country borders, money market integration is important for the efficient allocation of resources and for promoting a more efficient pricing of short-term debt in the euro-area. Since January 1999, the ESCB monetary policy operations have been implemented based on euro area-wide demand for liquidity, rather than on the needs of each member country and there was, therefore, a need to redistribute liquidity efficiently among the euro area countries. This enhanced the development of cross-border transactions in the money market and resulted, almost immediately in 1999, in a very high degree of integration in the unsecured money market, which is the segment where short-term liquidity redistribution is concentrated. For the unsecured money market the standard and widely used measure of integration is the interest rate differential between countries: as already pointed out the characteristics of money market instruments are similar enough for direct interest rate comparisons to be informative regarding the degree of integration.

Relatively few studies have been focused on integration on money market: Santillan et al. (2000) investigate the effects of the introduction of the euro in 1999 on euro area bond and money market. Based on measured interest rate differences across countries and market survey data, the authors of this early study conclude that, while the unsecured money market segment became highly integrated very quickly, the repo market lagged in this respect for lack of harmonisation and uneven distribution of collateral. Also Hartmann et al. (2001) conclude that the unsecured segment of the money market became very highly integrated almost immediately after the introduction of the euro. Gaspar et al. (2001) identify, on the overnight segment of the money market after the introduction of the euro, a "learning period" that took less than one month: the first few days after the introduction of the euro a number of inefficiencies were identified in this market segment but, as learning took place and banks adapted to the new environment, such inefficiencies were swiftly eliminated. Adam et al. (2002) use beta-and sigma-corvengence measures borrowed from growth theory applied to 3-months deposit rates to assess the high degree and speed of integration in euro area money market.

Galati and Tsatsaronis (2003) show the growth of cross-border interbank claims between banks located in the euro area, with different integration of the unsecured and the

collateralized segment within the money market.

Baele et al. (2004) consider the overnight market, the shorter-maturity segment, after the introduction of the euro and find that the cross-sectional standard deviation of EMU countries' rates collapsed to 1-4 basis points. After 1998, when exchange rate risk was eliminated, this measures tells a lot about the state of integration. Evidently, monetary integration strongly drives financial integration in the overnight money market, the segment most closely related to monetary policy. Also longer unsecured segment in money market experienced a swift move to a high degree of integration following the introduction of the euro: the cross-section standard deviation for both 1-month maturity and 12-month lending rates fell very close to zero (2 basis points).

The inception of EMU in January 1999 created the conditions for a substantially more integrated public debt market in the euro area. When focusing on the government bond market Baele et al. (2004) find that bond portfolios have become increasingly internationally diversified especially in the smaller euro area countries. The potential benefits of further integration on bond markets are evident: by promoting integration, governments can considerably reduce the cost of servicing their debt; it is, in fact, easier for investors to diversify geographically and, thereby, largely eliminate their exposure to purely local economic shocks. Furthermore, to the extent that the governments succeed in improving the liquidity of their outstanding bonds, investors will require a lower liquidity premium which further reduces debt servicing. Integration also increases transparency and government bonds of similar maturity become closer substitutes. The elimination of intra-euro area exchange rate risk and the efforts of debtors to make their issues more liquid induced investors to start taking a euro area-wide perspective rather than a national one when deciding their portfolio allocation. Parallely, regulatory changes have relaxed constraints on foreign holdings for certain categories of institutional investors not allowed to diversify internationally: institutional investors in smaller euro area countries diversified their portfolios more quickly than investors in larger countries partly as a result of their relatively smaller choice of domestic assets.

Government bond yield spreads have become very small as of early 1998 also because the restrictions on fiscal policies outlined in the SGP (Stability and Growth Pact) have helped keep perceived levels of credit risk relatively small.

However, Codogno et al. (2003) find that interest rates on euro-denominated bonds issued by different governments have not fully converged: spreads between them may reflect differences in liquidity and differences in the creditworthiness of sovereign issuers.

Galati and Tsatsaronis (2003) documented that, as the launch date of the new currency approached, yield curves converged across the founding members of EMU: in January 2003 non resident holdings accounted for 35% of the outstanding amount of French government bonds, more than doubling their share from 15% at the end of 1997 and three quarters of the Belgian government long term bonds in 2002, with 50% of bidders coming from the euro area. Foreign holdings of Irish government debt stood at about 63% in September 2002.

Price based integration measures suggest that corporate bond market is quite integrated: the level and evolution of corporate bond yield spreads in the euro area is to a large extent determined by credit rating, to a lesser extent by the fact of having in common the same coupon, maturity, liquidity and sector factors and the country issuing the bond has only a very marginal effect. Also the share of European-wide bond funds increases with a reduction of home bias in bond portfolios in euro area.

In relation to bank credit markets, it can be recorded integration on a legal perspective but price differentials are still quite high. Short-term corporate lending is more segmented than medium and long term while, for household lending mortgage, the loan rates are more uniform while segmentation in the consumer credit segment still persists.

Unsurprisingly, given the existence of a single monetary policy across the euro area, the money market is the most integrated of the markets where the repo market remains less integrated than the unsecured segment of money market because of differences in practices, laws and regulations. Also the government bond market integrated after the euro but yield on governent bonds with similar or, in some cases, identical maturity have not fully converged. Euro area corporate bond market seems reasonably well integrated while price differentials still persist in banking markets.

1.1 Integration on equity market

The cost of equity capital decreases as markets become more integrated because of better possibilities for international investors to eliminate country specific risks by diversifying their portfolios across countries: it typically increases the number of productive investments and contributes to economic growth.

Recent studies have analysed the degree of European equity market integration from various perspectives.

A first strand of literature studies whether expected returns are determined by global rather than by local risk factors based on some specific asset pricing models (Bekaert and Harvey (1995); Karolyi and Stulz (2002); Hardouvelis et al. (1999)). An important drawback of this methodology is that the results seem to depend heavily on the specification of the asset pricing model and, hence, on the correct identification of the relevant risk factors. A sub-group of the above literature can be considered the approach to equity market integration focusing on the relative importance of country and industry effect in explaining returns: a decrease in the importance of country effects is often interpreted as indicating increased equity market integration. Baca et al. (2000), Cavaglia et al. (2000) and Flavin (2004) show that the importance of global industry factors has increased relatively to country-specific factors. Adjouté and Danthine (2000) measure the relative importance of country and sector effects by simply calculating the cross-sectional dispersion in country and sector returns, respectively: the higher the cross-sectional dispersion, the lower the correlations and the higher the diversification potential. They find that the potential of diversifying across sectors increased considerably at the end of the 1990s to

levels even higher than those possible through country diversification. European stock markets have become more integrated over time, as evidenced by the observation that returns in different European markets have become dominated more by EU-wide factors rather than by country specific factors.

The second methodology of analysis relies on equity return correlations. Adam et al. (2002) consider correlation of monthly stock market returns: they use major stock indices correlations with monthly returns of German and then average cross-sectionally (1994-2001). They also compute the correlation between exchange rate-adjusted returns to investigate the role of the decreasing exchange rate volatility in the 90s. Only a small fraction of the increase in correlation appears to be related to the decrease in exchange rate risk as the correlation between exchange rate-adjusted returns is almost identical to the correlation between unadjusted returns. Fratzscher (2002) estimates a GARCH model with time-varying coefficients using data on daily returns from 1986 to 2000 finding an increase in correlation between stock returns within the euro area since the announcement in May 1998. Adjaouté and Danthine (2000) estimate the variance-covariance matrix of weekly returns from September 1990 to April 1999 and find that there has been a considerable increase in the correlation of stocks returns. Fratzscher (2002) and Adjaouté and Danthine (2000) differ, however, in the economic interpretation of the same evidence. Adjaouté and Danthine (2000) interpret the increase in correlation simply as a decrease in diversification opportunities due to the convergence of economic structure and the homogenisation of economic shocks rather than to the disappearance of currency risk since the increase in correlation results both considering adjusted and unadjusted correlations. On the contrary, Fratzscher (2002) interprets the increased correlations as a symptom of greater integration: he asserts that the elimination of exchange rate volatility and, to some extent, also monetary policy convergence, has played a central role in explaining the increased financial integration. More recently, Croci (2004) shows an increase in return correlations across the euro equity markets over the last ten years, which she interprets as a sign that these markets are now more integrated: the increase in correlation seems to depend not only on the relaxation of restrictions to capital mobility and of institutional barriers but also on higher informational market efficiency. The existence of strong linkages across markets implies that stock price changes reflect available information and suggests the existence of an international pattern of transmission of information (informationally efficient equity markets).

A third strand of literature analyzes linkages across stock markets through the cointegration analysis. Yang et al. (2003) study the impact of EMU on the long-run, short-run and contemporaneous structures of integration among eleven European stock markets and the US: the long-run linkages among these markets have generally been strenghtened after the estabilishment of EMU.

Finally, some authors consider quantity based indicators: these measures may convey interesting information about the dynamics of euro area equity market integration. A number of authors have interpreted the recent decrease in equity home bias as evidence of

further integration. Adam et al. (2002) report data on international portfolio diversification for European investment funds, pension funds and insurance companies: while the share of foreign equities has remained roughly constant over the period 1992-1998, a considerable rise has been observed since then. They also assess that, since the relative size of the local market is rather stable over time, the indicator of home bias is almost identical to the change in foreign assets with the advantage that the second one does not rely on a benchmark which might be open to criticism. Recent evidence confirms that the equity home bias has been reduced at least within the euro area: in all euro area countries, the share of equity funds investing non domestically over the period 1995-2003 increased. Investment funds' share of non-domestic equities increased from about 40% in 1995 to close to 70% in 2003. The degree of home bias in pension funds has been significantly reduced in the last few years with the share of non domestic equity holdings dramatically increasing after 1999. Similarly, also home bias in insurance corporations' equity holdings has decreased but domestic stocks are still quite high in portfolios. Galati and Tsatsaronis (2003) analyze international portfolio flows from Germany and find significant acceleration in German investors' purchases of euro area securities already in 1998 with an intensification in 1999 and 2000. They also report Italian mutual funds showing a decrease in the allocation to Italian bonds and equities and a rise in allocation to euro area.

2 From equity *home* bias to equity *Euro* bias: statistical analysis

In Table (1), by comparing the evolution of foreign assets in EMU countries' portfolios and in NON EMU countries' portfolios we can notice that between pre- (1997) and post-EMU (2001-2002) period, both EMU and NON EMU countries show more foreign assets in their portfolios but EMU countries show a larger increase in foreign assets than NON EMU countries both considering the weighted mean and the unweighted mean.

In the remainder of the section we will refer to a bias measure that is simply defined, in each period t, as one minus the ratio of the actual share of equities issued by country j held in country i's portfolio ($ACS_{i,j,t}$) to the market share of country j ($MS_{j,t}$):

$$B_{i,j,t} = 1 - \frac{ACS_{i,j,t}}{MS_{j,t}}$$

This measure can, of course, be extended, for descriptive reasons, to groups of country by simply substituting the ratio: the Eurobias (or EMU bias) measure for country i will show the ratio of the actual share of EMU countries in country i's portfolio to the market capitalization of euro area countries.

	1997		2001		2002	
	AFS(%)	TFS(%)	AFS(%)	TFS(%)	AFS(%)	TFS(%)
Australia	12.275	98.649	18.488	98.497	19.798	98.181
Austria	34.727	99.834	75.203	99.909	68.207	99.844
Belgium	33.766	99.359	44.676	99.397	49.104	99.382
Canada	12.017	97.536	18.443	97.728	20.950	97.537
Denmark	23.393	99.601	42.923	99.670	38.798	99.641
Finland	6.804	99.655	24.411	99.244	31.599	99.342
France	17.395	96.679	22.310	95.594	25.034	95.512
Germany	27.442	95.827	38.907	96.570	48.318	96.847
Italy	7.922	98.200	32.751	97.903	35.605	97.701
Japan	7.575	87.715	10.598	90.618	10.721	89.594
Netherlands	33.713	97.250	44.669	97.726	54.156	97.840
Portugal	15.344	99.701	20.490	99.792	22.516	99.771
Spain	3.656	98.754	15.166	98.551	16.688	98.427
Sweden	21.671	98.902	38.366	99.100	41.649	99.160
UK	23.776	96.235	29.848	95.719	31.066	96.583
US	10.994	54.957	11.598	50.084	12.034	53.428
Percentage variation in foreign assets	EMU countries		NON EMU countries		t-test (EMU-NON EMU)	
	2001-1997	2002-1997	2001-1997	2002-1997	2001-1997	2002-1997
unweighted Δ (%)	130.22	159.95	47.94	53.62	1.765*	1.977**
weighted Δ (%)	110.21	145.14	15.57	20.84	2.030**	2.311**

Table 1: Actual (AFS) and Theoretical foreign shares (TFS)

The Eurobias hypothesis that we want to verify suggests that the EMU integration could have induced member countries to consider euro area as home and, therefore, to hold a disproportionately high share of EMU assets. If we include home equities for EMU countries the overall EMU share hides also movements in the home share together with movements of other EMU countries' shares but these two movements go in the opposite direction for our analitical purposes. Let us consider, for instance, the two following cases in which the EMU share increases: in the first case the home share increases and the other EMU shares are constant (or even decreasing), in the second case the home share decreases and the other EMU shares increase. Then, even though the empirical evidence is the same, that is an increase in the EMU share, in the former setting we would conclude that the Eurobias hypothesis should be rejected since, instead of enlarging the home concept to the euro area, the EMU seems to have further segmented the markets; in the second setting, on the contrary, we could conclude that our null hypothesis cannot be rejected since the investors have shifted part of their resources from home to other EMU countries. For this reason, after having accounted for the change in home holdings, we focus on the foreign

portfolio bias comparing the actual foreign share to the market share net of home share.

	EMU (weighted, %)			NON EMU (weighted, %)		
	1997	**2001**	**2002**	**1997**	**2001**	**2002**
EMU share	87.94	83.05	80.95	3.35	3.71	3.54
EMU share (foreign)	7.32	14.64	17.04	3.35	3.71	3.54
NON EMU share	10.77	15.79	17.29	95.22	94.48	94.72
NON EMU share (foreign)	10.77	15.79	17.29	6.60	7.85	8.61
EMU bias	-484.32	-429.59	-416.48	77.77	76.37	77.44
EMU bias (foreign)	42.81	-10.87	-30.27	77.77	76.37	77.44
NON EMU bias	85.12	78.87	76.19	-31.50	-26.45	-30.44
NON EMU bias (foreign)	85.12	85.12	85.12	81.27	77.53	75.70

Table 2: Portfolio shares and portfolio bias: weighted averages (column heads: investing countries; row heads: destination countries)

It can be noticed, in Table (2), that, for EMU investing countries, the average share of EMU in the overall portfolio decreases by almost 5 percentage points (pp)[3] but, excluding home holdings, the share of EMU equities doubles and the share of NON EMU share incrases by 50%. The average bias in EMU is increased by more than 50 pp while, excluding home, we have a decrease of the same magnitude; bias in NON EMU also decreases but only by 6 pp. Considering NON EMU net of home holdings the NON EMU share increases by 1 pp. The average bias in EMU slightly decreases by 1.4 pp, while bias in NON EMU increases by 5 pp. When excluding home bias movements we have a reduction in bias in NON EMU by less than 4 pp. Again these results confirm our simple analysis on home bias: NON EMU countries have shifted less heavily their portfolios between 1997 and 2001 than EMU countries and have also reduced less consistently their home bias.

Just in order to make the figures interpretable let us consider the meaning of the bias measure; in case of no bias, i.e. bias equal to 0, the observed share is equal to the market capitalization while in case the actual share is equal to 0 the bias is maximum, i.e. equal to 1 (or 100% as we express it in percentage terms). Therefore, the bias measure has an upper bound but not a lower bound, since it can be also negative if the observed share is larger than the relative market capitalization (this is the case for home assets). If bias is equal to -2 (or -200%) it means that the actual share is 3 times as large as the market capitalization, when the bias is -30%, it implies that the actual share is 1.3 times the market capitalization and so on. As obvious, the average bias in portfolio investor is strongly driven by the home share. That is why investors show a negative bias towards their own group (*within bias*) and a positive bias towards the other group (*between bias*): EMU investors

[3] For simplicity, in the remainder of the section, we will discuss the results for 1997 and 2001 as representative of pre- and post-EMU period, leaving to the reader the similar analysis for 1997-2002. The unweighted counterpart is available in Appendix C.1, Table (7), with very similar evidence.

show a huge negative bias in EMU countries (-484.3%) and NON EMU investors show a correspondent negative, although more modest in size, bias in NON EMU assets (-31.5%); their *between bias* is quite similar: 85.1% for EMU investing in NON EMU and 77.8% for NON EMU investing in EMU. The most important thing to notice is that EMU investors' *within bias*, excluding home assets, shifts from 42.8% to -10.9%: there is clearly evidence of Eurobias! To make this datum interpretable, it means that the actual EMU share in EMU portfolios shifts from less than 60% of the relative market capitalization to almost 110% of the market capitalization to overcome 130% in 2002. For NON EMU investors the *between bias* remains largely positive in 2001 (76.37%) reducing only by a negligile amount (-1.4 pp) and similarly for EMU countries it remains largely positive in 2001 (78.9%) with a decrease of 6.25 pp. NON EMU *within bias*, excluding home assets, is even larger than NON EMU *between bias*: it shifts from 81.3 % to 77.5%. For both EMU investors and NON EMU investors we can notice a similar pattern in the sign of variation but a remarkable difference in size: the increase in the *between bias* is accompanied by a parallel decrease, almost of identical size, in the *within bias*, excluding home assets but, while for EMU investors the overall EMU bias increases by 55 pp due to the decrease in home holdings and the bias in EMU foreign assets decreases by almost the same amount (-54 pp), for NON EMU investors the overall bias towards NON EMU increases by 5 pp while the bias in foreign NON EMU decreases by less than 4 pp (-3.8): the change for EMU investors is 10 times larger than for NON EMU investors. This evidence seems to signal some major difference in the dynamics faced by the two groups which showed analogue mirror situation before EMU integration. Actually, the *overall within bias* of EMU countries was disproportionally larger than the analogous measure for NON EMU and the very high level of bias can partially explain the size of the change but the *foreign within bias* of EMU investors was lower in size: 42.8% against 81.3% of the corresponding measure for NON EMU investors and the drop has been of 54 pp for EMU countries against the 3.8 pp by NON EMU.

The analysis of the shares and bias in portfolios of EMU and NON EMU investors before and after integration goes in the direction of confirming our Eurobias hypothesis: first, the abrupt change in portfolio composition involves only EMU investing countries; then, EMU shows a higher propensity towards EMU assets other than home assets. The integration process seems to have induced EMU investors in the direction of holding more EMU assets and this implies that something must have changed in the *bilateral* relations among EMU stock markets more than influencing them as countries per se: if the change were connected with the EMU countries as investors (reduction of outward costs) they should have shown a higher propensity to foreign investments in general, while they neglect NON EMU assets to focus more on EMU foreign assets; if the change were, on the other side, only related to a deeper stock market created by EMU or to a more informationally efficient market (reduction of inward costs), it should be reflected also in a higher NON EMU investment in EMU assets; on the contrary, NON EMU investors only slightly increase their investment in EMU assets and, more broadly, they seem not to have been influenced by integration at all, leaving roughly unchanged their portfolio compositions.

3 Theoretical Model

It is worth stressing that, although our analysis starts from evidence on portfolio bias, we will develop our theoretical framework, and consequently our empirical implementation, on portfolio positions rather than on bias measures: as stressed by Adam et al. (2002), since the relative size of the local market is rather stable over time, investigating investments is almost equivalent to investigating the bias with the notable advantage of not having to rely on a predefined benchmark which might be open to criticism.

We consider L investors investing in N stocks: lacking data on the specific securities exchanged between individuals we assume that investors are restricted to holding national market indexes and, considering a single investor per country and a single asset per country, we end up with L source countries and N host countries.

The representative investor in each country maximizes an expected utility function over wealth, W with λ representing the coefficient of risk aversion[4]

$$U(W) = -\exp\left(-\lambda \frac{W}{W_0}\right)$$

To deal with an expected utility we need to find out the corresponding certainty equivalent (CE), i.e. the expression such that

$$U(CE) = E\left[U(W)\right]$$

For each asset j we have the gross realized return at time t

$$\mu_{jt} = (E_{t-1}(\mu_{jt}) - r) + \varepsilon_{jt} \ ,$$

$$E_{t-1}\boldsymbol{\varepsilon}_{jt} = \mathbf{0} \quad \text{and} \quad \boldsymbol{\varepsilon}_{jt}\,|I_{t-1} \sim N(\mathbf{0}, \sigma_j^2)$$

where r represents the riskless nominal rate of interest, I_{t-1} represents the information set available to investor at time $t-1$ and ε_{jt} represents a normally distributed idiosyncratic shock.

In vector form, for all assets contained in the portfolio ($\mathbf{i}$ represents a vector of ones)

$$\tilde{\boldsymbol{\mu}} = (E(\boldsymbol{\mu}) - r\mathbf{i}) + \boldsymbol{\varepsilon} = (\bar{\boldsymbol{\mu}} - r\mathbf{i}) + \boldsymbol{\varepsilon}$$

$$E_{t-1}\boldsymbol{\varepsilon}_t = \mathbf{0} \quad \text{and} \quad \boldsymbol{\varepsilon}_t\,|I_{t-1} \sim N(\mathbf{0}, \boldsymbol{\Sigma})$$

[4] This is a static optimization problem; we could alternatively adopt, excluding inflation hedging due to empirical evidence by Cooper and Kaplanis (1994), an Adler and Dumas (1983) dynamic portfolio model with a unitary coefficient of relative risk aversion, i.e. assuming investors holding logarithm portfolios. We would have ended up with a final equilibrium condition: $w_l^* = C_l^{-1}\Omega^{-1}(\bar{\mu} - ri)$ instead of equation (1) in the main text. In terms of econometric implementation it would not change anything since we deal with proxies and the parameters are strongly driven by the relationships of the proxies with the unobservables: the absence of the parameter $\frac{1}{\lambda}$ would leave unaffected our empirical application.

Therefore, denoting by $\mathbf{w}$ the vector of portfolio weights, the following result holds:

$$W(\tilde{\boldsymbol{\mu}}, \mathbf{w}) = W_0 \mathbf{w}' \tilde{\boldsymbol{\mu}} = W_0 \mathbf{w}'(\bar{\boldsymbol{\mu}} - r\mathbf{i}) + \underbrace{W_0 \mathbf{w}' \boldsymbol{\varepsilon}}_{\boldsymbol{\upsilon}} = \overline{W} + \boldsymbol{\upsilon}$$

$$\boldsymbol{\upsilon} \sim N(\mathbf{0}, \boldsymbol{\Psi}),\ W \sim N(\overline{W}, \boldsymbol{\Psi}) \ \text{ and } \ \boldsymbol{\Psi} = W_0^2 \mathbf{w}' \boldsymbol{\Sigma} \mathbf{w}$$

$$\begin{aligned} E(U(W)) = -E\left[\exp\left(-\lambda \frac{W}{W_0}\right)\right] &\xrightarrow{\text{Moment Generating Function}} \\ = -\exp\left[-\left(\frac{\lambda}{W_0}\overline{W} - \tfrac{1}{2}\left(\frac{\lambda}{W_0}\right)^2 \boldsymbol{\Psi}\right)\right] &= \\ = -\exp\left[-\left(\tfrac{\lambda}{W_0}\left(W_0 \mathbf{w}'(\bar{\boldsymbol{\mu}} - r\mathbf{i})\right) - \tfrac{1}{2}\left(\frac{\lambda}{W_0}\right)^2 \left(W_0^2 \mathbf{w}' \boldsymbol{\Sigma} \mathbf{w}\right)\right)\right] &= \\ -\exp\left[-\lambda\left(\mathbf{w}'\bar{\boldsymbol{\mu}} - \frac{\lambda}{2}\mathbf{w}'\boldsymbol{\Sigma}\mathbf{w}\right)\right] \end{aligned}$$

Maximizing the above expected utility under the constraint $\sum_{s=1}^{N} w_s = 1$ we get the optimal weights w^*

$$\mathbf{w}^* = \frac{1}{\lambda}\boldsymbol{\Sigma}^{-1}(\bar{\boldsymbol{\mu}} - r\mathbf{i})$$

This optimal condition holds in absence of transaction and information costs that may enter the above equation in two alternative ways: as a reduction of return or as an increase in the variance of the considered asset. Cooper and Kaplanis (1994) use the return reduction approach that is the most reasonable way of modelling direct transaction costs. However, since the recent literature has documented the failure of direct costs' explanation (Ahearne et al. (2004); Berkel (2004)), we focus exclusively on indirect costs, i.e information asymmetries. In fact, the role of information asymmetries in determining market segmentation has been widely documented by the literature on portfolio holdings ((Ahearne et al. (2004);Gehrig (1993); Kang and Stulz (1994); Coval and Moskowitz (1999); Pagano et al. (2002)) and also for portfolio flows by Portes and Rey (2001) and Portes et al. (2005). In particular we follow Gehrig (1993) approach of modifying the variance-covariance matrix to account for information costs: the foreign investor has a perceived variance of an asset issued by country k higher than an investor residing in k because of informational asymmetries while we assume that there are no information costs associated to home investments.

Let us consider $\mathbf{C}_l$ as the matrix capturing information costs

$$\mathbf{C}_l = \begin{bmatrix} (1+c_{l1}) & 0 & \cdots & \cdots & 0 \\ 0 & \ddots & \ddots & & \vdots \\ \vdots & \ddots & (1+c_{lj}) & \ddots & \vdots \\ \vdots & & \ddots & \ddots & 0 \\ 0 & \cdots & \cdots & 0 & (1+c_{lN}) \end{bmatrix}$$

$$\mathbf{C}_l^{-1} = \begin{bmatrix} \frac{1}{1+c_{l1}} & 0 & \cdots & \cdots & 0 \\ 0 & \ddots & \ddots & & \vdots \\ \vdots & \ddots & \frac{1}{1+c_{lj}} & \ddots & \vdots \\ \vdots & & \ddots & \ddots & 0 \\ 0 & \cdots & \cdots & 0 & \frac{1}{1+c_{lN}} \end{bmatrix}$$

where $\mathbf{C}_l$ is a positive definite matrix and c_{lj} is the bilateral cost of holding country j's stock by country l's investor.

We can, therefore, rewrite the personalized vector of weights for each investor l in the following way

$$\mathbf{w}_l^* = \frac{1}{\lambda}\mathbf{\Sigma}_l^{-1}(\bar{\boldsymbol{\mu}} - r\mathbf{i})$$

where $\mathbf{\Sigma}_l = \mathbf{\Omega}\mathbf{C}_l$ (and therefore $\mathbf{\Sigma}_l^{-1} = \mathbf{C}_l^{-1}\mathbf{\Omega}^{-1}$)

$$\mathbf{w}_l^* = \frac{1}{\lambda}\mathbf{C}_l^{-1}\mathbf{\Omega}^{-1}(\bar{\boldsymbol{\mu}} - r\mathbf{i}) \tag{1}$$

As $(1 + c_{lj})$ stands for the informational asymmetry cost between country l and j, its reciprocal $\dfrac{1}{1+c_{lj}}$ stands for a variable capturing the informational efficiency between country l and country j.

In this setting the minimum value that can be taken by $(1+c_{lj})$ is in the full information case, where investor l invests in country $l : c_{ll} = 0$.

If $c_{lj} = 0\ \forall l, j$ then $\mathbf{C}_l = \mathbf{C}_l^{-1} = \mathbf{I}$ and we come back to the usual formulation without information costs.

The equilibrium condition on stock j market in presence of information costs is such that the returns let the overall demand for stock j equal its supply, i.e. its market capitalization MS_j. The demand for asset j depends exclusively on the aggregate[5] demand

[5] It is obtained weighting each country demand by its market capitalization.

for *logarithm portfolio*, the demand driven by excess returns and variance-covariance considerations (corrected by information asymmetries).

Therefore the equilibrium condition will be

$$\mathbf{MS} = \mathbf{\Phi\Omega}^{-1}\left[\tfrac{1}{\lambda}(\bar{\boldsymbol{\mu}} - r\mathbf{i})\right] \tag{2}$$

$$\mathbf{\Phi} = \begin{bmatrix} \phi_1 & 0 & \cdots & \cdots & 0 \\ 0 & \ddots & \ddots & & \vdots \\ \vdots & \ddots & \phi_j & \ddots & \vdots \\ \vdots & & \ddots & \ddots & 0 \\ 0 & \cdots & \cdots & 0 & \phi_N \end{bmatrix}$$

where $\mathbf{\Phi}$ is a NxN positive definite matrix

and $\phi_j = \sum_{l=1}^{L} MS_l \dfrac{1}{1+c_{lj}}$ is the average informational efficiency of holding asset j.

Let us define $\mathbf{D}_l = \mathbf{C}_l\mathbf{\Phi}$ (where $\mathbf{D}_l$ is again a diagonal matrix). We can rewrite the above expression (1) as

$$\mathbf{w}_l = \mathbf{D}_l^{-1}\mathbf{\Phi\Omega}^{-1}\left[\tfrac{1}{\lambda}(\bar{\boldsymbol{\mu}} - r\mathbf{i})\right] \tag{3}$$

where $D_{lj} = \phi_j C_{lj}$ and $\dfrac{1}{D_{lj}} = \dfrac{\frac{1}{1+c_{lj}}}{\phi_j}$

and using the equilibrium condition (2) we get the following result

$$\mathbf{w}_l = \mathbf{D}_l^{-1}\mathbf{MS} \tag{4}$$

or in terms of individual asset

$$w_{lj} = \frac{1}{D_{lj}} MS_j \tag{5}$$

The way the demand for asset j depends on the market share is proportionally affected by the ratio of investor l's infomation efficiency to the average: investor l will hold a share of assets greater than the market share in proportion to $\frac{1}{D_{lj}}$ (inverse of relative information asymmetry cost).

As already noted, we consider information factors that are bilateral specific rather than considering separately source and host country specific factors; the reason behind this choice is exactly the objective of our analysis: we aim at explaining the dramatic change of EMU share in EMU portfolios trying to identify the elements linked to the EMU process and therefore trying to capture elements that are specific to the particular relations existing between member countries. At the same time, it has the notable advantage of allowing us to draw our conclusion without counstructing *ad hoc* functions merging together source country and host country factors that may be prone to criticism.

4 EMU effect on stock market

There is some controversy about the date that should be considered as the relevant year in EMU integration. EMU was formally created in 1999 but 1998 was the pivotal year and the effects of the union could be anticipated in advance: so the euro's impact might have been felt even before it was formally created. On March 1998 the European Commission and the European Monetary Institute published their convergence reports, recommending the 11 countries to be admitted into the EMU. At the beginning of May 1998 the decision was formally announced in a meeting of the Heads of States in Brussels during which the bilateral irrevocable conversion rates were set among the member currencies. This was followed on 1 June 1998 by the official creation of the European Central Bank. What is, anyway, commonly agreed is that in 1997 whether the euro would have become a reality was still in doubt. This is the year we consider as "pre-EMU" period plausibly not incurring in any dating problem.

In considering the relevant aspects of EMU integration that could have had an impact on the stock market we limit our analysis to two main factors: the introduction of the common currency and the single monetary policy. We study how these two pillars of the integration process may influence portfolio allocation. The first point to stress is that the elimination of exchange rate risk connected with a common currency cannot have a direct impact on equity portfolio as shown by Solnik (1974) and Sercu (1980), since it is exclusively reflected on bond portfolio. The literature (Rose and Van Wincoop (2001); Micco et al. (2003)) finds, anyway, a key role of common currency area on bilateral trade flows; this evidence, together with the informational role of trade flows recognized by the literature (Lane and Milesi-Ferretti (2004); Amadi (2004); Ahearne et al. (2004)), allows us to suppose an effect of the common currency factor on equity market through trade flows. We will label this effect as "*real* (informational) *effect*" since it operates through the goods market. As far as the common monetary policy is concerned, we can consider the money market as the one most directly connected with the implementation of the monetary directives of the European Central Bank and so we adopt a measure of integration in the money market to capture this feature: the idea is that integration on money market increases the efficiency of this market and, through the increase of financial flows, can have spillover effect on the stock market. We label this latter effect as "*financial* (informational) *effect*": it is again an informational effect but it works through a parallel financial market.

In the remainder of the section we will describe in detail the measures we adopt as candidate proxies for information channels.

4.1 Real channel

The recent literature has investigated the role of currency union on trade: Rose and Van Wincoop (2001) estimate a large effect of currency union on bilateral trade, Micco et al. (2003) find that monetary union seems to increase trade not just with EMU countries but

also with the rest of the world with no trade diversion from non-member states. However, lumping all euroland nations together, they find that intra-euroland trade flows increased more than bilateral flows between non euroland nations and trade between euro and non euro nations: using the euro can make trade easier for its members boosting both euro and non euro trade flows but intra-euroland trade flows may be boosted even more since the effect operates on both ends of the trade relationship.

When considering the euro effect on trade it is worth stressing that it is different from the case of assets hedging: there are ways to hedge against exchange rate volatility but it may be costly; furthermore, Kenen (2003) points out that it is not always possible to fully hedge against large, long-lasting changes in exchange rates since producers are uncertain not only about the price they will receive for their exports but also about the the demand for their products: thus, the producer does not know how much foreign currency she will earn and how much she should sell in the forward market.

That it is why it seems reasonable to argue that the elimination of exchange rate risk between the countries partecipating the EMU can have had an impact on trade flows among member countries.

In particular, we measure the bilateral trade link between markets through the openness measure

$OP_{l,j} = \frac{EXP_{l,j}+IMP_{l,j}}{GDP_l}$

It is a measure quite common in the literature (Lane and Milesi-Ferretti (2004); Amadi (2004); Ahearne et al. (2004)): the basic intution is that trade flows can have informational content relative to financial markets.

4.2 Financial channel

As shown in the first section, the recent literature has widely documented the integration on money market in the Euro area. What we need for our purposes is a measure that can capture the degree of bilateral market integration. The Interest Rate Parity theory can help us in this perspective: the theory of Covered Interest Rate Parity (CIP) holds that the return from buying the bonds of one's domestic country should be the same as that of investing abroad, once currency risk has been covered with a forward contract. Formally the condition may be stated in terms of Covered Interest Differentials (CIDs):

$\left(\frac{St}{F_t^k}\right)(1+i_t) - (1+i_t^*) = 0$

or through its logarithmic approximation

$\log F_t^k - \log St - (i_t - i_t^*) \approx 0$

where S_t represents the domestic price of foreign currency in the spot market at time t, F_t^k is the domestic price of foreign currency deliverable k periods forward at time t, i_t is the domestic interest rate at time t and i_t^* is the corresponding interest rate abroad at time t (with k periods to maturity). In any computation of CIP it is important to consider home and foreign assets which are comparable in terms of maturity and in terms of other characteristics such as default and political risk. In our case, considering the three-month

money market rates, we are sure enough, as underlined above, that they are comparable enough across countries. While a perfectly efficient market would lead to zero CIDs, the magnitude of the differential can be an important metric of international financial market integration.

Two competing strategies have been adopted by the literature for testing CIP: the first is a regression analysis that utilizes the following model

$\left(\frac{F_t - S_t}{S_t}\right) = \alpha + \beta\left(i_t - i_t^*\right) + \varepsilon_t$

where the validity of CIP implies $\alpha = 0$ and $\beta = 1$. Although some studies have found α significantly different from zero, the result does not necessarily violate CIP, as a positive constant may simply reflect transaction costs.

The second methodology measures the size of deviations from CIP, i.e. CIDs. Deviations from CIP are violations of the assumption of free capital flows and substitutability of assets from different countries: transaction costs, information costs, capital controls introduce a transaction band or "neutral band" around the theoretical parity condition whose size can provide interesting information about the degree of efficiency within the considered market.

The idea of testing market efficiency through deviations from CIP is not new: Taylor (1987, 1989) employing "high quality, high frequency" data finds that there are very few profitable violations of CIP. More recently Balke and Wohar (1998), examine the dynamics of deviations from CIP using daily data on the UK/US markets over the period 1974-1993 to check whether and when the CIP condition exceeds the transaction costs band. Obstfeld and Taylor (2002) [6] show that the CIDs display a tendency to fall over time in part because of greater competition among foreign exchange dealers that squeezed profits.

Juhl, Miles and Weidenmier (2004) make use of a weekly database of spot and forward US-UK exchange rates as well as interest rates to examine the integration of forward exchange markets in the period (1880-1914). They estimate the transaction cost band and find CIDs for US-UK generally larger during the classical gold standard than any period since: they argue that slower information and communication technology during the gold standard period led to fewer short-term financial flows, higher transaction costs and larger CIDs. Since the classical gold standard, due to technological advances, the cost of information has dramatically reduced and, compared to modern markets, the classical gold standard lacked well developed financial institutions and instruments to engage in covered interest arbitrage.

[6] Actually, Taylor (1987) criticizes previous work for using time-averaged data as opposed to point-in-time data. We, necessarily, use daily averaged data in order to construct our CIDs measures since we do not have possibility of dealing with point-in-time data. Also Obstfeld and Taylor (2002), more recently, in testing deviations from CIP over the last 130 years, employ time-averaged spot and 60-day forward exchange rates combined with short term interest rates of a different maturity (3 months). It is worth noticing, anyway, that we are not testing CIP here but we simply use CIDs as measures capturing the efficiency of the market.

5 Econometric implementation

We preliminarily check if the variables we propose to capture financial and real integration are plausible as information proxies relatively to the whole sample; we then focus on EMU countries in order to check which channel can be addressed as the main responsible of the Eurobias evidence comparing the relative weight of real and financial channel before and after EMU.

As already stressed, since the information asymmetries are not direclty observable, we have to make use of proxies.

In our application we use a proxy picking relative (to the average) information efficiency on goods market (real proxy, $real_{lj,t}$) and a proxy picking relative (to the average) information costs on financial market (financial proxy, $fin_{lj,t}$); in order to make them more easily comparable, especially after the needed normalization, we consider for the second proxy the reciprocal of information costs, i.e. information efficiency[7].

We instrument their current values by their past values in order not to incur in endogeneity problems always connected with the use of proxies.

We substitute the dependent variable by the observed actual country shares ACS_{lj}:

$$ACS_{lj,t} = q_0 + q_1 w_{lj,t} + \varkappa_{lj,t}$$

Finally, our estimable equation will be

$$ACS_{lj,t} = a_0 + \gamma t + \beta_1 real_{lj,t} + \beta_2 fin_{lj,t} + \beta_3 MS_{j,t} + \eta_{lj,t} \tag{6}$$

γ : coefficient of the deterministic trend.

Expected coefficients' sign: we expect a positive sign on the $MS_{j,t}$ and positive sign for the variables proxying information efficiency.

Expected coefficients' size: the magnitude of the coefficients of the various variables is a priori unpredictable and not so easily interpretable since it depends on a combination of the undisclosed relationship between the proxy and the unobservable variable.

5.1 Preliminary results: plausibility of proxies as measures of integration

The below Table (3) shows quite clearly that the proposed proxied seem to work quite well in capturing information efficiency: the coefficients result always of the expected sign and significative (except for the coefficient of the financial proxy in pre-EMU period).

We distinguish overall and foreign portfolio because we know that home assets could play a driving role in the regression: because of normalization, their information efficiency is the highest and since all countries show a home bias it inevitably can strongly determine the coefficient trend; we therefore purge the regression from the home component in order to check the robustness of the regression and we actually confirm our hypothesis.

[7] See Appendix A for details on proxies' normalization.

exogenous variables	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$real_{lj}$	0.316	0.405	0.265	0.184	0.152	0.194
	(0.098)***	(0.131)***	(0.108)**	(0.057)***	(0.073)**	(0.077)***
fin_{lj}	2.435	5.728	1.890	0.161	0.117	0.184
	(0.407)***	(1.730)***	(0.348)***	(0.053)**	(0.117)	(0.055)***
MS_j	0.340	0.327	0.352	0.162	0.105	0.188
	(0.035)***	(0.044)***	(0.033)***	(0.019)***	(0.004)***	(0.007)***
# obs	800	259	541	762	247	515
Adj R^2	0.285	0.412	0.240	0.506	0.495	0.530

Table 3: Overall portfolio ((1), (2), (3)) and foreign portfolio ((4), (5), (6)): real channel and financial channel (CID)

Notes: Dependent variable is $ACS_{lj,t}$. Costants and time dummies are included but not reported. White (1980) cross-section standard errors & covariance (d.f. corrected) are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

We consider also an alternative measure of financial integration to the one described in Section 4.2 (CID), that is the absolute value of the money market rate spread between investing and destination country: we report the results, analogous to the ones presented here, in Appendix C.2 (Table (8) and Table (9)). The reasoning behind this choice is the following: the interest rate spread of a country with respect to a benchmark rate is often adopted as a possible measure of financial integration. In this context, however, we aim at evaluating not the degree of financial integration of a given country but the bilateral degree of financial integration between two countries. By analogy, therefore, we choose to check whether also the interest rate spread among two countries can be considered a plausible measure of financial integration. We find evidence of the plausibility of this alternative measure of financial integration: the coefficients show all the expected sign and, compared to the CID's case, the real factor's coefficient and the host country market share's coefficient are quite similar while the coefficient for the financial factor is systematically higher.

For both alternatives of financial integration measures we can notice the relevant role of own country's equities in the size of all regressors' coefficients by comparing the coefficients for overall and foreign portfolios: all coefficients are strongly reduced when excluding own equities while the Adj-R^2 is boosted.

5.2 Final results: real and financial channel in EMU countries pre- and post-EMU

After having been reassured on the validity of the proxies employed, we now move to consider only the EMU source-EMU host sub-set trying to identify the prevailing channel

responsible of the Eurobias phenomenon recorded in the statistical analysis.

Again, we consider time split and separate analysis for overall portfolio and foreign portfolio. The signs are the ones expected according to the theory and the considerations we made about the whole sample are valid also for the EMU-EMU subset: the coefficients for the overall portfolio are always much higher than for the foreign portfolio although the Adj-R^2 are much closer than in the case including all countries.

exogenous variables	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$real_{lj}$	0.257	0.371	0.177	0.073	0.125	0.066
	(0.093)***	(0.125)***	(0.089)**	(0.032)**	(0.093)	(0.036)*
fin_{lj}	4.360	3.434	36.635	0.131	0.209	0.895
	(1.255)***	(1.358)***	(6.489)***	(0.088)	(0.086)**	(0.919)
MS_j	2.019	1.137	2.557	0.545	0.348	0.660
	(0.705)***	(1.519)	(0.472)***	(0.084)***	(0.077)***	(0.114)***
# obs	203	63	140	155	57	98
Adj R^2	0.267	0.395	0.226	0.350	0.384	0.307

Table 4: EMU source and EMU host. Overall portfolio ((1), (2), (3)) and foreign portfolio ((4), (5), (6)): real channel and financial channel (CID)

Notes: Dependent variable is $ACS_{lj,t}$. Costants and time dummies are included but not reported. White (1980) cross-section standard errors & covariance (d.f. corrected) are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

The lower number of observations affects the statistical significance of the coefficients: we have non significant coefficients in case (5) for the real proxy and in case (4) and (6) for the financial proxy. We can notice, anyway, that even when the significance of the single parameter is rejected, a clear pattern in both overall and foreign portfolio emerges: the coefficient of the real proxy decreases and the coefficient of the financial proxy increases after EMU integration and the variations are always very significant (See Appendix C.3).

Besides the statistical significance of the various regressors, we are also interested in their economic significance in order to capture how the importance of the two channels is reflected in portfolio holdings. We simply consider the relative weight ($rw_{s,t}$), in percentage terms, of the relevant (*real, fin* and MS) averaged regressors ($\bar{x}_s$) in determining portfolio allocation:

$$rw_{s,t} = \frac{\beta_s \bar{x}_s}{\sum_s (\beta_s \bar{x}_s)}$$

In Table (5) we can notice how, when considering the whole sample, the results are mixed according to whether we consider the overall or foreign portfolio: the MS_j regressor

averaged regressors	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$\overline{real}_{lj}$	19.6	17.0	18.3	19.2	23.4	17.6
$\overline{fin}_{lj}$	58.9	68.6	57.2	21.9	17.1	24.4
$\overline{MS}_j$	21.5	14.5	24.4	58.9	59.5	58.0
# obs	800	259	541	762	247	515
Adj R^2	0.285	0.412	0.240	0.506	0.495	0.530

Table 5: Overall portfolio ((1), (2), (3)) and foreign portfolio ((4), (5), (6)): average relative weight of MSj, real channel and financial channel (CID)

averaged regressors	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$\overline{real}_{lj}$	13.5	34.5	1.4	16.6	23.1	6.0
$\overline{fin}_{lj}$	70.3	49.6	95.5	24.6	27.9	70.2
$\overline{MS}_j$	16.2	15.9	3.1	58.8	48.9	23.8
# obs	203	63	140	155	57	98
Adj R^2	0.267	0.395	0.226	0.350	0.384	0.307

Table 6: EMU source and EMU host. Overall portfolio ((1), (2), (3)) and foreign portfolio ((4), (5), (6)): average relative weight of MSj, real channel and financial channel (CID)

shows an increase in the average relative weight considering the overall portfolio and a substantial stability in the foreign portfolio; the real channel slightly increases in the overall portfolio and decreases in the foreign portfolio with a reverse behavior of the financial channel. When considering only the EMU sub-sample, in Table (6), the results are much neater: both MS_j and the real channel sharply decrease in the post-EMU period while the financial channel shows a steep increase in the average relative weight. These results provide further support to our conclusions: the financial channel shows a higher impact than the real channel in determining portfolio shares for EMU countries, both in terms of statistical significance and in terms of economic significance, detecting a prevailing role, on the stock market, for the common monetary policy factor over the common currency factor within the EMU integration process.

6 Conclusions

In the present paper we document the Eurobias phenomenon, that is the overweighting of EMU assets in the portfolios of EMU investing countries. We try to interpret this result in the light of a mean-variance optimization model considering only information asymmetries as discriminatory factors among portfolios of international investors. We then identify, within the integration process, the factors that can have determined a change in

the informational setting available to EMU countries driving them towards Eurobias: the introduction of the common currency and the common monetary policies are indicated as the key factors possibly responsible of the dramatic change in portfolio composition. In particular, the common currency influences bilateral trade and the common monetary policy is almost automatically reflected in the money market: the integration on trade flows and on the money market are considered as proxies for informational efficiency factors embedding, respectively, the real and financial information channels. The empirical implementation actually supports our candidate proxies and, when analyzing only the subsample relative to EMU countries investing in EMU countries, the financial channel seems to have assumed a stronger relative weight with respect to the real channel. Eurobias can, therefore, be explained by an information spillover from both real and money financial markets on the stock market but the relative weight of the financial channel, compared with the real channel, increases after the EMU inception. In this work, differently from the existing literature focusing only on the integration within a given segment (money market, bond market, stock market) across countries, we also interestingly, albeit indirectly, assess the degree of integration between different financial segments of the same country (money market and stock market), through the informational link, an issue, to our knowledge, never investigated before and which might be object of further investigation in future research.

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A Technical Appendix: information asymmetries

The functional expressions for the average information efficiency $\mathbf{\Phi}$ and the $\mathbf{D}_l^{-1}$are the following

$$\phi_j = \left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{1}{1+c_{lj}} + MS_j \right)$$

$$0 \leq \frac{1}{D_{lj}} = \frac{\left(\frac{1}{1+c_{lj}}\right)}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{1}{1+c_{lj}} + MS_j\right)} \leq \frac{1}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{1}{1+c_{lj}} + MS_j\right)} = \frac{1}{D_{ll}}$$

where $\frac{1}{D_{lj}}$ represents the deviation of investor l from the world average information efficiency. It is equal to 1 if the investor has a composite information costs' structure equal to the average: in this case investor l will hold the same logarithm portfolio as the average one.

It can also be noted as the highest information efficiency is of course for investor l investing domestically and it will determine, ceteris paribus, a higher portfolio share in home assets.

In terms of econometric implementation, we use proxies capturing the *reciprocal* of information costs, i.e. we actually employ a proxy for information efficiency; therefore we define a variable χ_{lj} capturing $\frac{1}{c_{lj}}$[8].

By simple substitution,

$$\frac{1}{C_{lj}} = \frac{\chi_{lj}}{1+\chi_{lj}}$$

$$\frac{1}{D_{lj}} = \frac{\frac{\chi_{lj}}{1+\chi_{lj}}}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{\chi_{lj}}{1+\chi_{lj}} + MS_j\right)}$$

We use the proxies mentioned in the text in order to estimate χ and then we take this transformation in order to normalize it to the home holdings that, having null information costs c_{lj} will have infinite χ_{lj}, and therefore

$$\frac{1}{C_{ll}} = 1 \text{ and } \frac{1}{D_{ll}} = \frac{1}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{\chi_{lj}}{1+\chi_{lj}} + MS_j\right)}.$$

[8] It can be noticed as, in case of investor holding domestic assets, since $c_{ll} = 0$, then $\chi_{ll} = \infty$, i.e. infinite information efficiency.

As it can be immediately noticed $0 < \frac{\chi_{lj}}{1+\chi_{lj}} \leq 1$ and $\frac{\chi_{lj}}{1+\chi_{lj}}$ is an increasing function on χ_{lj}: the higher χ_{lj} (the lower c_{lj}, the information cost) the higher the share of the corresponding stock j in portfolio l.

It is worth emphasizing that the reason for the normalization of information costs and, consequently, of information efficiency proxies, is due to the fact that we had to deal also with home investing: since it is not possible to define, for instance, the degree of opennes of country k towards country k, we have been forced to set an upper bound to information efficiency (represented by home investments, normalized at 1) and scale the other proxies, accordingly.

The same procedure holds to normalize the measure of information cost. Of course, since the CID represents a measure of information cost rather than a measure of information efficiency, we have to normalize it properly:

$$\frac{1}{C_{lj}} = \frac{1}{1+c_{lj}}$$

$$\frac{1}{D_{lj}} = \frac{\frac{1}{1+c_{lj}}}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{1}{1+c_{lj}} + MS_j\right)}$$

so that when the CID is equal to zero in case of country k investing in country k, c_{lj} equal to 0 corresponds to the highest information efficiency

$$\frac{1}{C_{ll}} = 1$$

$$\frac{1}{D_{ll}} = \frac{1}{\left(\sum_{\substack{l=1;\\ l\neq j}}^{L} MS_l \frac{1}{1+\chi_{lj}} + MS_j\right)}$$

the higher the CID, c_{lj}, the lower the information efficiency with $\frac{1}{C_{lj}} = 0$ as an asymptotic lower bound corresponding to $c_{lj} \longrightarrow \infty$.

B Data appendix

Stock market capitalization, spot exchange rate, forward exchange rate, money market rates, government bond interest rates: DATASTREAM.

Bilateral import-export: *International trade in goods statistics* (OECD)

Equity holdings: *International Financial Statistics* (IMF) for data on foreign portfolio equities and foreign portfolio liabilities needed to derive the home share; *Coordinated Portfolio Investment Survey* (CPIS) by IMF for bilateral data in the pooled dataset[9]

[9] See (http://www.imf.org/external/np/sta/pi/datarsl.htm) for more details on the survey.

C Additional Tables

C.1

	EMU (unweighted, %)			NON EMU (unweighted, %)		
	1997	**2001**	**2002**	**1997**	**2001**	**2002**
EMU share	90.08	82.31	80.91	5.18	7.22	6.93
EMU share (foreign)	9.79	19.34	20.97	5.18	7.22	6.93
NON EMU share	8.60	16.19	16.90	93.52	91.16	91.19
NON EMU share (foreign)	8.60	16.19	16.90	10.09	16.46	17.06
EMU bias	-498.53	-424.86	-416.23	65.57	53.94	55.82
EMU bias (foreign)	29.37	-34.76	-47.88	65.57	53.94	55.82
NON EMU bias	88.12	78.33	76.73	-29.16	-22.01	-25.58
NON EMU bias (foreign)	88.12	78.33	76.73	83.26	74.52	72.89

Table 7: Portfolio shares and portfolio bias: unweighted averages (column heads: investing countries; row heads: destination countries)

C.2

The following tables consider the interest rate spread as alternative financial integration measure: the coefficients show the same pattern as in the specification adopting the CID as measure of financial integration.

exogenous variables	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$real_{lj}$	0.302	0.412	0.254	0.197	0.160	0.203
	(0.093)***	(0.134)***	(0.104)**	(0.060)***	(0.074)**	(0.079)***
fin_{lj}	7.973	7.415	8.350	0.369	0.112	0.635
	(1.472)***	(2.102)***	(1.866)***	(0.124)***	(0.121)	(0.174)***
MS_j	0.377	0.330	0.399	0.164	0.105	0.192
	(0.038)***	(0.046)***	(0.061)***	(0.019)***	(0.004)***	(0.008)***
# obs	839	272	567	801	260	541
Adj R^2	0.332	0.423	0.287	0.510	0.500	0.538

Table 8: Overall portfolio ((1), (2), (3)) and foreign portfolio ((1), (2), (3)): real channel and financial channel (interest rate spreads))

Notes: Dependent variable is $ACS_{lj,t}$. Costants and time dummies are included but not reported. White (1980) cross-section standard errors & covariance (d.f. corrected) are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

exogenous variables	(1) OVERALL	(2) OVERALL (before EMU)	(3) OVERALL (after EMU)	(4) FOREIGN	(5) FOREIGN (before EMU)	(6) FOREIGN (after EMU)
$real_{lj}$	0.257	0.359	0.188	0.075	0.128	0.070
	(0.092)***	(0.124)***	(0.092)**	(0.031)**	(0.093)	(0.038)**
fin_{lj}	6.134	5.968	56.070	0.194	0.281	2.639
	(2.710)***	(2.699)**	(15.464)***	(0.145)	(0.122)**	(2.579)
MS_j	1.912	0.674	2.284	0.530	0.338	0.664
	(0.747)***	(1.502)	(0.662)***	(0.093)***	(0.078)***	(0.111)***
# obs	203	63	140	155	57	98
Adj R^2	0.270	0.410	0.234	0.351	0.384	0.312

Table 9: EMU source-EMU host. Overall portfolio ((1), (2), (3)) and foreign portfolio ((1), (2), (3)): real channel and financial channel (interest rate spreads))

Notes: Dependent variable is $ACS_{lj,t}$. Costants and time dummies are included but not reported. White (1980) cross-section standard errors & covariance (d.f. corrected) are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

C.3

Here we report the results of the tests for the difference of the coefficients of real and financial factors before and after EMU integration for EMU countries considering both alternative financial integration measures.

Since we reject the hypothesis of constant variance over time we use the general t-test formulation with different variances.

$$t_{df(\overline{X_1}-\overline{X_2})} = \frac{\overline{X_1}-\overline{X_2}}{\sqrt{\frac{s_1^2}{n_1-1}+\frac{s_2^2}{n_2-1}}}$$

with degrees of freedom given by the following expression

$$df = \frac{\left(\frac{s_1^2}{n_1-1}+\frac{s_2^2}{n_2-1}\right)^2}{\left(\frac{s_1^2}{n_1-1}\right)^2\left(\frac{1}{n_1+1}\right)+\left(\frac{s_2^2}{n_2-1}\right)^2\left(\frac{1}{n_2+1}\right)} - 2$$

where s_j is the standard deviation of variable X_j

t-test difference (post-EMU-pre-EMU)				
	overall (1)	foreign (2)	overall (3)	foreign (4)
real	-11.036***	-4.555***	-9.730***	-4.457***
fin	57.563***	7.294***	36.957***	8.987***

Table 10: t-test on coefficient differences in pre- and post-EMU (CID in (1) and (2); interest rate spreads in (3) and (4))

As it can be easily noted the coefficients of the real factor decrease significantly after EMU integration while the coefficients of the financial factor increases significantly.