Aaron Mehrotra

A note on the national contributions to euro area M3

Bank of Finland Research
Discussion Papers
2 • 2007

Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland
☎ + 358 10 8311

http://www.bof.fi

Bank of Finland Research
Discussion Papers
2 • 2007

Aaron Mehrotra

A note on the national contributions to euro area M3

The views expressed are those of the author and do not necessarily reflect the views of the Bank of Finland.

The major part of this paper was written when the author was a graduate student at the European University Institute in Florence, Italy and visiting the Statistics Department of the Bank of Finland in autumn 2004. The author is grateful to the Statistics Department for their hospitality. Thanks are due to Elisabeth Hintikka, Helka Jokinen, Iikka Korhonen, Antti Ripatti, Eero Savolainen, Jouko Vilmunen, and internal seminar participants at the Bank of Finland for helpful comments and suggestions. The views expressed in the paper are personal, and all errors are those of the author.
Author correspondence: Aaron Mehrotra, Bank of Finland, BOFIT, PO Box 160, 00101 Helsinki, Finland. E-mail: aaron.mehrotra@bof.fi.

http://www.bof.fi

ISBN 978-952-462-348-3
ISSN 0785-3572
(print)

ISBN 978-952-462-349-0
ISSN 1456-6184
(online)

Helsinki 2007

A note on the national contributions to euro area M3

Bank of Finland Research
Discussion Papers 2/2007

Aaron Mehrotra
Monetary Policy and Research Department

Abstract

We examine developments in national contributions to euro area M3 for a sample of nine euro area countries during 1999–2005. We investigate the co-movements of national contributions with euro area M3 and discuss possible reasons for divergencies in growth rates of national contributions. Finally, we evaluate the information content of national contributions to M3 using formal tests of causality between monetary aggregates, consumer prices and equity prices.

Key words: national contribution, M3, euro area

JEL classification numbers: E51, E31

Euroalueen M3:n kansallisten osuuksien kehitys

Suomen Pankin tutkimus
Keskustelualoitteita 2/2007

Aaron Mehrotra
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tutkimuksessa tarkastellaan yhdeksästä euroalueen maasta koostuvan otoksen perusteella, miten euroalueen M3:n kansalliset osuudet ovat kehittyneet vuosina 1999–2005. Työssä analysoidaan kansallisten osuuksien ja euroalueen M3:n kasvuvauhtien välistä korrelaatiota ja pohditaan mahdollisia syitä kansallisten kasvuvauhtien eroihin. M3:n kansallisten osuuksien informaatioarvoa tutkitaan analysoimalla kausaalisuussuhteita raha-aggregaattien, kuluttajahintojen ja osakehintojen välillä.

Avainsanat: kansallinen kontribuutio, M3, euroalue

JEL-luokittelu: E51, E31

Contents

1 Introduction

Money plays a prominent role in the monetary policy strategy of the European Central Bank (ECB). This is evidenced by the reference value for the growth rate of the broad monetary aggregate M3. The usefulness of monetary developments for a central bank hinges on their ability to provide information about risks to the primary objective of price stability. As inflation is widely agreed to be a monetary phenomenon, monetary developments provide information that enhances the robustness of monetary policy decisions (Pill, 2001). Nevertheless, recent years have witnessed a declining role for money in the monetary policy frameworks of central banks worldwide, and even its complete absence in the popular Taylor-type policy rules (Taylor, 1993).

Since ECB policymaking focuses on the euro area, it is natural that monetary developments in sub-euro area level have not been widely discussed. Furthermore, national contributions to euro area monetary aggregates are not equivalent to the national monetary aggregates that existed prior to the start of the monetary union. Whereas national monetary aggregates included the monetary liabilities of domestic monetary financial institutions (MFIs) only to the domestic money holding sector, national contributions to euro area aggregates include monetary liabilities to the whole euro area money holding sector. However, the amount of deposits from and loans to other euro area residents (excl. residents of the 'home' country), is still very small for most member states. Manna (2004) mentions some statistics in connection with the limited integration of the euro area retail banking: the share of cross-border deposits from non-MFIs was only 5.2% in 2002 (down from 6.0% in 1998) and the share of loans to non-MFIs was 3.2% in 2002 (up from 2.3% in 1998).[1] This suggests that national components of euro area aggregates may provide information about macroeconomic developments in individual euro area countries.

The information properties of national contributions are interesting in the context of recent increases in asset prices, notably in the housing sector, which have been pronounced in certain euro area countries. The ECB mentioned in the September 2004 issue of its Monthly Bulletin that aggregate euro area residential property prices hide considerable differences between euro area countries (European Central Bank, 2004a).[2] But differing consumer price inflation developments across euro area countries have also been noted, perhaps most prominently in the context of a threat of deflation in Germany, at a time when the

[1] Data from the Bank of Finland (2004) indicate that the share of deposits placed by Finnish non-MFIs to deposits placed by the whole euro area non-MFIs (held by Finnish MFIs) was 98.4% in July 2004 (compared to 99.8% in 1999). The corresponding figure for loans was 99.8% in July 2004 (99.7% in 1999).

[2] It was argued that these impact the rent sub-component of HICP and possibly consumption behaviour, residential investment and credit developments.

euro area HICP showed little sign of falling below the ECB definition of price stability (see eg Posen, 2003). More recently, the ECB has pointed to strong money and credit growth in the euro area and to the risks to price stability that these entail, especially when housing market developments are robust (European Central Bank, 2006).

The aim of our paper is to examine developments in a sample of national contributions to euro area M3. We examine co-movements of national contributions to M3 and the euro area aggregate, as synchronized monetary developments could point to converging inflationary (or deflationary) tendencies in the euro area economies. We investigate possible reasons for divergencies in growth rates of national contributions in a simple panel data estimation framework. Finally, we examine the information content of national contributions to M3 using formal tests of causality between monetary aggregates and consumer prices, considering money as an information variable for the outlook for price stability.

The usefulness of money as a policy indicator is emphasized by Masuch et al (2003), who suggest that money may provide information about the appropriate stance of monetary policy beyond that given by interest rate rules. Moreover, monetary developments can reflect movements in 'true' levels of income when the policymaker only sees a noisy measure of output. Nelson (2003) argues that money acts as a proxy for various yields that matter for aggregate demand, and money can therefore play a useful role even in macroeconomic models of the New-Keynesian type. Finally, control of the money stock is of special interest for a central bank close to or at the zero bound on interest rates. From a monetarist viewpoint, there is little reason to believe that an economy is in a liquidity trap as soon as the zero floor is hit, as an increase in monetary base can still induce portfolio rebalancing and have an impact on the economy (see Meltzer, 1999).

This paper is organized as follows. In the next section, we discuss some prominent data issues and provide a descriptive analysis of national contributions to euro area M3. Section 3 examines possible reasons for divergencies in growth rates of national contributions, and Section 4 looks at the causality issue with respect to national consumer and equity price developments. The final section concludes with a summary of findings.

2 Data issues and descriptive analysis

In our study, we use only publicly available data provided by central banks on national contributions to euro area M3. This results in the following sample of countries: Austria, Belgium, Germany, Spain, Finland, France, Italy, Netherlands, and Portugal. For Finland, Spain, Portugal and France, year-on-year (y-o-y)

growth rates of the national contribution to M3 are provided directly by the respective national central banks at their websites. For Germany, Italy and the Netherlands, we calculate the growth rate using formulae provided by the ECB, utilizing outstanding amounts and transactions. The latter are adjusted for reclassifications, exchange rate variations and other revaluations. In the case of Austria and Belgium, the growth rates are calculated on the basis of outstanding amounts only.[3]

Another data issue relates to Eurosystem accounting rules on euro banknotes. According to these rules, the ECB's monthly share is 8% of the value of euro banknote issuance by national central banks. The remaining 92% is allocated monthly to NCB balance sheets on the basis of respective paid-in shares of ECB capital (these in turn depend on the country's GDP and population). As noted by the Bank of Finland (2004), the item 'banknotes in circulation' in national central bank balance sheets may then differ considerably from the value of banknotes in circulation in the money-holding sector of that country. Thus we mainly use the national contribution to M3, excluding currency in circulation, for the entire sample. Exceptions are (due to data availability) France, where our data series includes currency in circulation for the entire sample, Germany during 1999–2001 and Finland before September 1999. We acknowledge the fact that monetary developments excluding currency in circulation may not fully reflect developments in the real economy before January 2002.

We commence with the descriptive analysis by looking at some statistics characterizing the mean and volatility of national contributions to euro area M3 (y-o-y growth rates). We display these statistics for both nominal and real growth rates in Table 1 below. Real growth rates were obtained by subtracting y-o-y changes in national HICP inflation from nominal annual growth rates.

[3] For Germany, only outstanding amounts are used to calculate the growth rates for 2002 for reasons of data availability. The use of outstanding amounts is admittedly problematic, especially in terms of reclassifications that may occur infrequently but can be rather large and revaluations of balance sheet items originally denominated in foreign currency.

Table 1. **Mean and standard deviation (sd) of national contributions to euro area M3 (y-o-y growth rates), 1999M1–2005M9**

Country	AT	BE	DE	ES	FI
mean nominal	6.08	5.70	4.72	8.46	5.80
mean real	4.40	3.75	3.31	5.38	4.19
sd nominal	2.36	2.62	3.22	2.80	4.12
sd real	2.75	2.92	3.61	2.66	4.85

Country	FR	IT	NL	PT
mean nominal	6.40	5.82	8.89	4.84
mean real	4.62	3.46	6.21	1.82
sd nominal	1.95	3.54	3.61	3.05
sd real	1.82	3.34	3.32	3.41

Table 1 suggests that the highest average growth rates in national contributions to M3 during 1999–2005 in our sample were in the Netherlands (8.89) and Spain (8.46). These are also the two sample countries where real monetary growth was highest, although higher inflation in Spain has reduced real money growth in that economy. Interestingly, the ECB mentions that, among the countries in our sample, Spain and the Netherlands experienced substantial and above-euro-area-average property price increases during 1999–2003 (European Central Bank, 2004). The highest volatility for national contributions to M3 in our sample was for Finland, both in nominal and real terms, whereas volatility was lowest for France. It does not seem to be the case that countries with the highest money growth rates also witnessed the greatest monetary volatility, as seen by comparing the descriptive statistics for Spain and Portugal; the latter having the lowest M3 growth rate in our sample. The volatilities of national contributions are always higher than those of the euro area aggregate. For our sample, the standard deviations of y-o-y growth rate of euro area M3 are 1.41 (in real terms) and 1.36 (in nominal terms).

How closely correlated were monetary developments in individual euro area countries with the area-wide aggregate? This is shown in Table 2 by examining correlation coefficients between national contributions to M3 and euro area M3, again using year-on-year growth rates.

Table 2. **Correlation coefficients, national contribution and euro area M3 growth (y-o-y), 1999M1–2005M9**

Country	AT	BE	DE	ES	FI
nominal	0.255	0.295	0.395	0.464	0.507
p-value	0.022	0.007	0.000	0.000	0.000
real	0.461	0.484	0.602	0.267	0.571
p-value	0.00	0.00	0.00	0.02	0.00

Country	FR	IT	NL	PT
nominal	0.308	0.622	0.252	-0.534
p-value	0.005	0.000	0.023	0.000
real	0.166	0.448	0.460	-0.289
p-value	0.14	0.00	0.00	0.01

Note: p-value refers to null hypothesis that coefficients are not significantly different from zero.

The highest correlation between national contribution and euro area M3 in nominal terms is for Italy. The correlation using real money is highest in Germany, which is not surprising given the importance of the country's monetary developments for the euro area aggregate. Portugal is the only country in our sample where the correlation is actually negative, for both nominal and real money. Overall, our results suggest moderately high correlations between national contributions and euro area M3, especially for real money. At the 5% significance level, only the correlation coefficient for France is not significantly different from zero for real money.

Next, for three countries for which longer time series were available, we examine whether the movements of national contributions with the euro area aggregate became more highly correlated after the ECB started to conduct policy on 1 January 1999. If we assume that the parameters of national money demand functions were similar in the individual euro area countries before the introduction of the single currency, a single interest rate for the euro area could have caused an increase in correlation coefficients (measured across countries) for broad money growth. A similar result would also arise if business cycles became more closely correlated after 1999 due to a country's ex-post suitability to join a monetary union, in the spirit of Frankel and Rose (1998), or if divergencies in inflation rates of different countries decreased.[4] Finally, similar developments in wealth (perhaps

[4] For a study on divergence of euro area inflation rates, see Honohan and Lane (2003). Alesina et al (2002) report evidence of currency unions increasing co-movements of prices.

measured by returns to equity or residential property prices), could increase the correlation coefficients of broad money growth across countries. Table 3 below displays the correlation coefficients during 1993–1998 (the second phase of the EMU), and 1999–2005 for Finland, France and the Netherlands.

Table 3. **Correlation coefficients, national contribution and euro area M3 growth (y-o-y), 1993M1–2005M9**

Country	FI	FR	NL
1993-1998	0.090	-0.093	0.657
1999-2005	0.507	0.308	0.252
p-value	0.00	0.01	0.00

Note: p-value refers to null hypothesis that coefficients for 1993–1998 and 1999–2005 are the same.

For Finland and France, there was a statistically significant increase in the correlation coefficient between national contribution and euro area aggregate. The increase seems almost equally pronounced for the two economies and could suggest that their monetary developments – at least if measured by national contributions to M3 – have moved more in line with the euro area average. This is perhaps not surprising given the start of the ECB's single monetary policy. However, this is not the case for the Netherlands, where a formal test suggests that the correlation coefficient has undergone a statistically significant decline from the relatively high value of 0.657 prior to the start of the single monetary policy in 1999. This may reflect the fact that Netherlands already maintained a fixed parity of the guilder vis-à-vis the Deutschmark during 1979–1998, which tied Dutch monetary policy closely to that of Germany – a core economy in the EMS.

We close the analysis of the correlation coefficients by briefly examining velocity developments across the countries of our sample. Velocity can be defined as the speed at which money is transferred between money holders in order to realize a required level of nominal transactions; it thus depends on the institutional features of a country's payment system, among other things. Utilizing quarterly data on national contributions to M3 (m), real GDP (y) and the price level measured by HICP (p), we obtain the velocity (v) for each individual country i from the traditional quantity equation

$$v_i = p_i + y_i - m_i \tag{2.1}$$

where all variables are expressed as logarithms. Table 4 displays the correlation coefficients between these 'national' velocities and that of the euro area aggregate.

Table 4. **Correlation coefficients, national contribution and euro area M3 velocity (y-o-y)**

Country	AT	BE	DE	ES	FI
correlation	0.956	0.823	0.796	0.981	0.536
p-value	0.00	0.00	0.00	0.00	0.00

Country	FR	IT	NL	PT
correlation	0.962	0.983	0.971	-0.585
p-value	0.00	0.00	0.00	0.00

Note: p-value refers to null hypothesis that coefficients are not significantly different from zero. Sample covers 1999Q1–2005Q3, except for the Netherlands (2001Q1–2005Q3).

Table 4 shows that the developments in individual velocities have been notably similar for the countries of our sample, as for the euro area on the whole. Indeed, for four countries the correlation coefficient is actually higher than 0.95, perhaps reflecting similarities in institutional features of the payment systems of these economies. Only for Portugal, where we already saw a negative correlation between national contribution and euro area M3 growth, do we find a negative coefficient. Velocity has actually been declining in all countries of our sample, again with the exception of Portugal, where developments have been more erratic (not displayed here). This decline in 'national' velocities confirms the decrease in the aggregate euro area level – the ECB assumes a decline in the M3 velocity of 0.5–1% *per annum* in setting its reference value for M3 growth (European Central Bank, 2004b).

3 Reasons for divergencies

In this section, we touch on possible reasons for divergencies in growth rates of national contributions to euro area M3. This is done using panel data estimation techniques, where we regress the growth differential of national contribution with respect to euro area M3 on variables conventionally used in studies of money demand (all expressed as differentials vs. euro area averages). In particular, we

consider the following specification for the i = 1, 2, …, 9 countries in our sample, excluding country-specific constants and time trends

$$m_{it} = \beta_0 + \beta_1 y_{it} + \beta_2 p_{it}^{share} + \beta_3 \pi_{it} + \beta_4 R_{it} + u_t \quad (3.1)$$

All variables are year-on-year growth rates expressed as differentials vs. euro area average. The dependent variable is the annual growth rate of real money (difference between national contribution and euro area average, deflated by HICP inflation). The transactions demand for money is accounted for by a measure of real economic activity, y_{it}, ie industrial production. π_{it} is the annual inflation rate, which captures the opportunity cost of holding money instead of goods. Lütkepohl and Wolters (1999) suggest that it may also represent economic agents' adjustment process, which may be an active adjustment of nominal portfolios or a passive one induced by price level changes.

Real share prices p_{it}^{share} are deflated by HICP inflation. Their inclusion is justified by conventional wealth effects on the demand for broad money. A rise in share prices leads to an increase in nominal wealth and, assuming wider fluctuations in share prices than in income, a higher ratio of wealth to income. This may lead to a higher money-to-income ratio or lower velocity. Friedman (1988) noted that a substitution effect may prevail over this wealth effect, as higher real share prices may make equities more attractive for an investor's portfolio. The return on shares then acts as a rival interest rate on M3 rather than as a wealth variable. Similarly, as stock prices started on a worldwide decline in March 2000 and increases in euro area M3 since 2001 have been particularly strong, a high precautionary demand for M3 may imply a negative coefficient of share prices. We use the national share price indices available at the OECD's MEI Database, as specified in the Appendix. The euro area share price index is the Dow Jones EURO STOXX broad index from the same source. For the long-run interest rate R_{it}, we use the 10-year government bond yield. This variable is again compared to the euro area average, where the 'euro area government bond' is the E12 10-year government bond reported on by the OECD. The periodicity of the data is monthly, spanning 1999M1–2005M9.

We acknowledge the fact that in integrated financial markets there is little reason for the money holding sector to invest in equities or government bonds in the 'home' country, other than considerations of asset returns. This could be reflected in statistically insignificant or wrongly-signed coefficients for these variables in Eq. (3.1). However, our approach is still relevant in the presence of home bias in investor portfolios.

Because the cross-sectional dimension in our system is small (9 countries), we examine data series orders of integration using the panel unit root test proposed by Levin et al (2002). For most variables included in the estimation, the null

hypothesis of unit root could be rejected at the 5% level, including a constant as a deterministic term. In the cases of inflation and share price differentials, the null hypothesis could not be rejected using the test by Levin et al (2002). However, in both cases the Breitung test (Breitung, 2000) still rejects the null of unit root even at the 1% level. We thus continue on the assumption that all series are stationary.

In Table 5 below, we present the estimation results of fixed effects estimations. In order to tackle a possible endogeneity problem, we include the right-hand side variables of (1) at first lags.

Table 5. **Estimation results**

	(1)	(2)	(3)
y_{it}	-0.040	0.021	-0.068
	(0.035)	(0.034)	(0.048)
π_{it}	-1.342***	-1.112***	-1.828***
	(0.183)	(0.183)	(0.268)
p_{it}^{share}	0.021***	0.019***	0.026***
	(0.008)	(0.009)	(0.008)
R_{it}	3.984	4.211	2.441
	(2.426)	(2.827)	(2.446)
R-squared	0.30	0.30	0.27

Note: Dependent variable is real M3 growth differential with respect to euro area average. Huber/White standard errors are displayed in parentheses. Column (1) reports results from the full sample. Column (2) excludes observations for 1999 and (3) excludes Netherlands and Portugal. Country-specific constants and time trends are not displayed.

It is notable that above-average economic activity in a euro area country, represented by industrial production, does not lead to above-average growth in national contribution to euro area M3. This need not be surprising. The European Central Bank (2003) argues in its January 2003 issue of Monthly Bulletin that the persistent strong growth in M3 reflects the preference of investors for safe and liquid assets in the context of high financial market, economic and geopolitical uncertainty. The ECB further claims that such monetary expansion would not likely lead to inflationary pressure in an environment of subdued economic growth.

Table 5 suggests that countries with inflation rates above the euro area average have experienced below-euro-area-average growth in real broad money M3. This result is in line with economic theory suggesting that inflation represents an opportunity cost for holding money. Another statistically significant result is the impact of share prices on national contribution to M3. In our sample, wealth effects dominate substitution effects, as higher real share price growth in a euro

area country led to above-average growth in the country's national contribution to M3 growth. Therefore, the results also suggest the possibility of home bias in investor portfolios.

Our results seem relatively robust to excluding 1999 from the sample, which was the first year of the single currency, and to excluding the Netherlands and Portugal, which respectively experienced the lowest and highest nominal growth in national contribution to M3. This is indicated by columns (2) and (3) of Table 5. Finally, the period of financial market uncertainty may be reflected in the relatively low value of R-squared for our estimated systems; traditional determinants of money demand may only weakly explain money growth during our estimation period, which includes periods of financial market uncertainty and portfolio shifts.

4 Causality between M3 and price indicators

Because monetary developments may provide information about risks to the central bank's primary objective of price stability, the leading-indicator properties of money are of interest. In this section, we evaluate the information properties of national contributions to euro area M3 via formal tests for causality. As pointed out by Trecroci and Vega (2000), reduced form models offer one possible framework for analyzing indicator properties of monetary aggregates. We follow this approach and address the causality issue using the standard Granger-causality tests, where causality is determined by a variable's ability to improve the forecasts of another variable. Importantly, as noted by Woodford (1994), if an indicator does not seem to possess forecasting power, this may simply be a consequence of the fact that the central bank is already using the variable and adjusting policy in an approximately correct manner. Therefore, if the null hypothesis of non-causality cannot be rejected in our tests, this cannot be taken to imply that the central bank should not pay attention to monetary developments.

Formally, following Lütkepohl (2004), in a bivariate vector autoregressive (VAR) model of order p

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \sum_{i=1}^{p} \begin{bmatrix} \alpha_{11,i} & \alpha_{12,i} \\ \alpha_{21,i} & \alpha_{22,i} \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} + u_t \qquad (4.1)$$

y_{2t} is Granger non-causal for y_{1t} if and only if $\alpha_{12,i} = 0$, i =1, 2, …, p.

Our Granger causality tests are based on bivariate vector autoregressions including national contribution to euro area M3 (y-o-y growth rate) and the increase (y-o-y) in national price level defined by the HICP. Of course, given our

finding that national contributions are often closely correlated with euro area M3, the 'national' data may not provide any information beyond that yielded by the area-wide aggregate. Therefore we also compare our results to those from a bivariate model including euro area M3 and national HICP inflation.[5]

Table 6. **Granger-causality tests, M3 and consumer prices**

Causality hypothesis	Lag length	Test statistic	p-value
m (Austria)→ p (Austria)	4	0.60	0.66
m (Euro area)→ p (Austria)	6	2.57	0.02**
m (Belgium)→ p (Belgium)	6	1.18	0.32
m (Euro area)→ p (Belgium)	5	0.82	0.54
m (Germany)→ p (Germany)	6	2.32	0.04**
m (Euro area)→ p (Germany)	4	2.46	0.05**
m (Spain)→ p (Spain)	5	0.15	0.98
m (Euro area)→ p (Spain)	4	0.85	0.49
m (Finland)→ p (Finland)	5	0.43	0.82
m (Euro area)→ p (Finland)	4	1.02	0.40
m (France)→ p (France)	6	1.24	0.29
m (Euro area)→ p (France)	5	0.27	0.93
m (Italy)→ p (Italy)	4	1.95	0.11
m (Euro area)→ p (Italy)	4	0.88	0.48
m (Netherlands)→ p (Netherlands)	5	1.24	0.30
m (Euro area)→ p (Netherlands)	10	1.61	0.11
m (Portugal)→ p (Portugal)	6	0.66	0.68
m (Euro area)→ p (Portugal)	3	1.08	0.36

Note: * indicates significance at 10% level, ** at 5%, and *** at 1%; sample covers 1999M1 to 2005M9. Series included as y-o-y growth rates in testing procedure.

The results of causality tests are displayed in Table 6.[6] We find causal relationships from money to prices at the 5% significance level for Austria and

[5] The order of integration of the variables naturally has a bearing on model specifications. Using a KPSS test for unit roots and including a constant as the deterministic term, the null hypothesis of stationarity could be rejected for the inflation rate at the 5% level for Finland and France. For the national contribution to M3 (y-o-y growth), the null of stationarity could be rejected for 6 economies in the KPSS test, but 3 of these cases are only borderline-significant at 5% level. In all other cases, the null hypothesis of stationarity could not be rejected. Acknowledging the possibility that some of the series may actually have a unit root, we continue on the assumption of stationarity of year-on-year growth rates.

[6] The lag length was chosen on the basis of misspecification tests, with the primary aim of removing autocorrelation and ARCH effects from model residuals. This results in most cases in a chosen VAR order of 4 to 6. Impulse dummy variables, specified in the Appendix, were sometimes needed in order to obtain satisfactory residuals. Using the adjusted Portmanteau test at 16 lags, the LMF test with 5, 4 and 1 lags, and the ARCH-LM test with 16 lags, there is no evidence of remaining residual autocorrelation or ARCH effects at the 5% significance level.

Germany. However, in the case of Austria, euro area M3 is found to be causal for prices whereas the national contribution is not, so that here the euro area aggregate is a better predictor of future inflationary pressures than the 'national' indicator. In the case of Germany, both national contribution and euro area M3 improve the predictions of HICP inflation for that economy. We do not find any case where the national contribution would provide information beyond the euro area aggregate, in the sense that we would not reject non-causality for the euro area aggregate but would reject it for the national contribution to M3.

Our results with bivariate models are similar to those for the aggregate euro area level by Trecroci and Vega (2000), who find little empirical evidence for rejecting the null hypothesis of non-causality from money to prices in the framework of a larger reduced form model. They could also reflect the fact that the relationship between money and prices is most evident at a medium to long-term horizon and may therefore not be easily captured by Granger-causality tests utilizing monthly data with a relatively short lag structure. Indeed, in his analysis of the ECB's two-pillar strategy, Gerlach (2004) proposes an empirical model for inflation where the long-run component of inflation depends on past monetary growth and the short-run component on the output gap. Finally and importantly, the finding that non-causality cannot in most cases be rejected may simply reflect the fact that the ECB was already reacting to monetary developments (at euro area level), and so these do not show up in future increases in inflation in the euro area countries.

Since the start of the single monetary policy in 1999, euro area M3 would be expected to capture the monetary component of inflation, possibly leaving little information value for national contributions to M3. However, up to that time national monetary aggregates may have had a close causal link with national inflation rates, with a possible structural break in January 1999 with the launch of the euro. We investigate this issue by performing causality tests on the old national monetary aggregates and inflation for 1992–1998, and compare these results with those of Table 6 for the national contributions to M3 and HICP inflation after 1999.[7] A caveat here is that for some countries the time series properties of the series are different for the disinflation period before euro introduction. In Germany, Spain, Italy, the Netherlands, and Portugal, both series appear to be integrated of order one, whereas for Finland and France only the inflation rate is integrated. Therefore, the tests for these countries are performed in the (stationary) first differences of year-on-year growth rates, rather than on the growth rates themselves.

[7] Belgium is excluded due to a lack of data availability.

Table 7. **Granger-causality tests, national monetary aggregates and consumer prices**

Causality hypothesis	Lag length	Test statistic	p-value
m (Austria)→ p (Austria)	5	3.61	0.00***
Δm (Germany)→Δp (Germany)	3	1.73	0.16
Δm (Spain)→Δp (Spain)	2	4.33	0.01**
Δm (Finland)→Δp (Finland)	3	1.97	0.12
Δm (France)→Δp (France)	5	1.30	0.27
Δm (Italy)→Δp (Italy)	3	4.72	0.00***
Δm (Netherlands)→Δp (Netherlands)	2	0.62	0.54
Δm (Portugal)→Δp (Portugal)	1	1.04	0.31

Note: * indicates significance at 10% level, ** at 5%, and *** at 1%. Sample runs from 1992M1 to 1998M12, except for Italy (1992M1–1998M2) and Netherlands (1992M1–1997M12). Series included as y-o-y growth rates in testing procedure for Austria, first differences of y-o-y growth rates for all other economies. M1 used for Austria; M3 for Germany, Spain, Finland and France; M2 for Italy, Netherlands and Portugal. Growth rates are based on data for stocks only. National CPI used for Germany and Spain, HICP for all other economies.

The results in Table 7 indicate that even prior to euro introduction in 1999, the evidence of causality between national monetary aggregates and consumer prices is relatively weak. However, for Austria, Italy, and Spain, we can now reject non-causality from money to prices, which was not the case for the national contributions to euro area M3 after 1999. For Germany we are not able to reject non-causality prior to the introduction of the euro, whereas it is rejected for the latter subsample (Table 6). This may reflect the Bundesbank's monetary targeting regime, which successfully kept inflation under control in this economy. In sum, there is weak evidence that the introduction of the euro would have created a structural break in the money-price relationship at the country level.

It may be of interest to replicate the analysis in Table 6 using a measure of asset prices, replacing consumer price inflation by share price growth (in real terms, deflated by HICP inflation). Issing (2002) argues that monitoring monetary developments may contribute to limiting the emergence of unsustainable developments in asset valuations, even if asset prices by themselves are not suitable goals for monetary policy. Indeed, expansionary monetary policy – reflected as rapid growth in money stock – may initially feed into asset valuations without corresponding increases in consumer prices. Issing (2002) mentions Japan of the 1980s as an example of an economy where consumer price data failed to capture the build-up of excess money that accompanied the rapid increase in asset prices, finally culminating in the bursting of the asset price bubble in the early 1990s.

Results from Granger-causality tests including money growth and real share prices are displayed in Table 8.[8]

Table 8. **Granger-causality tests, M3 and share prices**

Causality hypothesis	Lag length	Test statistic	p-value
m (Austria)→sp (Austria)	2	3.61	0.03**
m (Euro area)→sp (Austria)	2	0.31	0.73
m (Belgium)→sp (Belgium)	7	1.90	0.08*
m (Euro area)→sp (Belgium)	5	2.40	0.04**
m (Germany)→sp (Germany)	6	1.88	0.09*
m (Euro area)→sp (Germany)	2	1.78	0.17
m (Spain)→sp (Spain)	4	1.38	0.24
m (Euro area)→sp (Spain)	4	1.68	0.16
m (Finland)→sp (Finland)	7	2.19	0.04**
m (Euro area)→sp (Finland)	4	0.82	0.51
m (France)→sp (France)	6	1.66	0.14
m (Euro area)→sp (France)	7	1.21	0.30
m (Italy)→sp (Italy)	6	3.23	0.01***
m (Euro area)→sp (Italy)	2	2.42	0.09*
m (Netherlands)→sp (Netherlands)	2	1.28	0.28
m (Euro area)→sp (Netherlands)	7	1.49	0.18
m (Portugal)→sp (Portugal)	6	3.26	0.01***
m (Euro area)→sp (Portugal)	4	2.45	0.05**

Note: * indicates significance at 10% level, ** at 5%, and *** at 1%. Sample runs from 1999M1 to 2005M9. Series included as y-o-y growth rates in testing procedure.

Granger-causality tests using equity prices suggest that Granger non-causality from the national contribution to M3 to real equity prices could be rejected in the cases of Austria, Belgium, Germany, Finland, Italy and Portugal – 6 of 9 countries in our sample. Additionally, in the cases of Belgium and Portugal we are able to reject Granger non-causality from euro area M3 to real share prices. In contrast to developments in the HICP, the national contribution to M3 provides some information beyond that yielded by the euro area aggregate broad money when equity prices are considered. Our result on causality from broad money to equity prices could also indicate that the central bank does not react to asset price movements in the short run, in so far as they do not pose a threat to its primary objective of price stability.

[8] The estimated models pass the misspecification tests mentioned in Footnote 6 at the 5% level, except for Belgium where the Portmanteau test points to some remaining autocorrelation when euro area M3 is used. Several impulse dummies were used to remove residual outliers; these are specified in the Appendix. In the unit root tests, the null of stationarity for real share price growth (y-o-y) was rejected at the 5% level for Belgium and Austria.

5 Conclusion

In this paper, we examine developments in national contributions to euro area M3 for a sample of nine euro area countries in 1999–2005. Using descriptive methodology, we examine co-movements of various national components with the euro area aggregate and discuss possible reasons for divergencies in growth rates of national contributions in a panel data framework. Finally, we evaluate the information content of national contributions to M3 using the standard Granger-causality tests between monetary aggregates, consumer and equity prices.

Our results reveal some differences in the growth rates of national contributions across the euro area countries. Nevertheless, velocities calculated on the basis of these national contributions are strikingly similar across economies. We find that in those countries with inflation rates lower than the EMU average, the growth rates of national contributions to M3 in real terms have been higher than the euro area average. Similarly, higher real share price growth is also reflected in higher-than-average money growth rates. We find little evidence of causality in the Granger-sense from national contributions to consumer price inflation in the individual countries. Nevertheless, the national contributions to M3 seem to contain information about future growth in share prices in individual member states, as the null hypothesis of no causality can be rejected in some cases.

Because ECB policy has a euro area focus, the analysis of this paper is meant to provide a descriptive look at developments in national contributions without any implications for policy. Nevertheless, it cannot be ruled out that the national contributions yield some information on developments in individual euro area countries, thus emphasizing the value of the money stock as an information variable. Finally, our results are unlikely to remain robust far into the future in view of ever-increasing financial integration in the euro area.

References

Alesina, A – Barro, R J – Tenreyro, S (2002) **Optimal Currency Areas.** In: Gertler, M, Rogoff, K (eds.), NBER Macroeconomics Annual, Cambridge, MA: MIT Press.

Bank of Finland (2004) **Financial Markets – Statistical Review 9/2004.** Bank of Finland Publications.

Breitung, J (2000) **The Local Power of Some Unit Root Tests for Panel Data.** In: Baltagi, B (ed.), Nonstationary Panels, Panel Cointegration, and Dynamic Panels, Advances in Econometrics, Vol. 15, JAI: Amsterdam.

European Central Bank (2003) **Monthly Bulletin January 2003.** Frankfurt am Main, European Central Bank.

European Central Bank (2004a) **Monthly Bulletin September 2004.** Frankfurt am Main, European Central Bank.

European Central Bank (2004b) **The Monetary Policy of the ECB 2004.** Frankfurt am Main, European Central Bank.

Frankel, J A – Rose, A K (1998) **The Endogeneity of the Optimum Currency Area Criteria.** Economic Journal 108 (449), 1009–1025.

Friedman, M (1988) **Money and the Stock Market.** Journal of Political Economy 96, 221–245.

Gerlach, S (2004) **The Two Pillars of the European Central Bank.** Economic Policy, October 2004, 390–439.

Honohan, P – Lane, P R (2003) **Divergent Inflation Rates in EMU.** Economic Policy, October 2003, 357–394.

Issing, O (2002) **Monetary Policy in a Changing Economic Environment.** Symposium on 'Rethinking Stabilization Policy', hosted by the Federal Reserve Bank of Kansas City, 183–205.

Levin, A – Lin, C F – Chu C S (2002) **Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties.** Journal of Econometrics 108, 1–24.

Lütkepohl, H (2004) **Vector Autoregressive and Vector Error Correction Models.** In: Lütkepohl, H, Krätzig, M (eds.), Applied Time Series Econometrics. Cambridge: Cambridge University Press.

Lütkepohl, H – Wolters, J (1999) **A Money Demand System for German M3.** In: Lütkepohl, H, Wolters, J (eds.), Money Demand in Europe. Cambridge: Cambridge University Press.

Manna, M (2004) **Developing Statistical Indicators of the Integration of the Euro Area Banking System.** European Central Bank Working Paper No. 300. Frankfurt am Main, European Central Bank.

Masuch, K – Nicoletti-Altimari, S – Pill, H – Rostagno, M (2003) **The Role of Money in Monetary Policy Making.** In: Background Studies for the ECB's Evaluation of its Monetary Policy Strategy. Frankfurt am Main, European Central Bank.

Meltzer, A (1999) **The Transmission Process.** Paper Presented at the Bundesbank Conference on the Transmission Process: Recent Developments and Lessons for Europe.

Nelson, E (2003) **The Future of Monetary Aggregates in Monetary Policy Analysis.** Journal of Monetary Economies 50, 1029–1059.

Pill, H (2001) **Monetary Analysis. Tools and Applications.** In: Klöckers, H-J, Willeke, C (eds.), Monetary Analysis: Tools and Applications. Frankfurt am Main, European Central Bank.

Posen, A S (2003) **Is Germany Turning Japanese?** Institute for International Economics Working Paper 03-2. Washington DC, Institute for International Economics.

Taylor, J (1993) **Discretion versus Policy Rules in Practice.** Carnegie-Rochester Conference Series on Public Policy, 39, 195–214.

Trecroci, C – Vega, J L (2000) **The Information Content of M3 for Future Inflation.** ECB Working Paper No. 33. Frankfurt am Main, European Central Bank.

Woodford, M (1994) **Nonstandard Indicators for Monetary Policy: Can Their Usefulness be Judged from Forecasting Regressions?** In: Mankiw, N G (ed), Monetary Policy. Chicago: The University of Chicago Press.

Appendix

Data issues

The following national stock indices were used: VSE WBI index (Austria), All shares index (Belgium), HEX All Share index (Finland), Paris Stock Exchange SBF 250 (France), CDAX index (Germany), ISE MIB Storico Generale (Italy), AEX all shares (Netherlands), BVL general index (Portugal), IGBM general index (Spain).

Causality tests reported in Table 6 are estimated using the following impulse dummy variables: Finland (2004M3, using national contribution to M3), Spain (2001M1 and 2001M7, using euro area M3), Italy (2001M2, using national contribution), and Portugal (2004M6 and 2005M7, using national contribution).

Causality tests reported in Table 7 are estimated using the following impulse dummy variables: Portugal (1993M3, 1993M4 and 1995M3), and Austria (1995M12 and 1996M12).

Causality tests reported in Table 8 are estimated using the following impulse dummy variables: Belgium (2002M1, using national contribution to M3), Italy (2001M7 and 2001M9, using national contribution; 1999M9, 2000M2 and 2000M12, using euro area M3), and Portugal (1999M10, 1999M12 and 2000M2, using national contribution).

BANK OF FINLAND RESEARCH
DISCUSSION PAPERS

ISSN 0785-3572, print; ISSN 1456-6184, online

1/2007 Timo Korkeamäki – Yrjö Koskinen – Tuomas Takalo **Phoenix rising: Legal reforms and changes in valuations in Finland during the economic crisis.**
2007. 39 p. ISBN 978-952-462-346-9, print; ISBN 978-952-462-347-6, online.

2/2007 Aaron Mehrotra **A note on the national contributions to euro area M3.**
2007. 25 p. ISBN 978-952-462-348-3, print; ISBN 978-952-462-349-0, online.

Suomen Pankki
Bank of Finland
P.O.Box 160
FI-00101 HELSINKI
Finland