

# Central Bank Credibility and Income Velocity in a Monetary Union

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## Abstract

This paper examines the relationship between the ECB's inflation fighting credibility and income velocity in a monetary union.

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In this paper, we propose an explanation for this in terms of a measure of the ECB's inflation fighting credibility. This credibility gain variable, which is derived in this paper, is based on the ECB's performance in maintaining price stability relative to the respective member states' inflation experiences from the legacy monetary-inflation regimes of the past. Our empirical analysis reveals that this credibility gain variable has a highly significant and sizeable impact on income velocity in member states. On average across member states, a one per cent increase in credibility gain, according to our measure, leads to a decrease in income velocity of half a per cent. The model and results presented suggest that the ECB should, in formulating the second pillar of its monetary policy strategy, factor in its own price stability credibility. Our results also imply that, if inflation fighting credibility is lost temporarily, it is hugely important to re-establish it as soon as possible.

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## 1. Introduction

Money demand is probably one of the most actively researched areas of economics. The special role for money in the ECB's monetary policy strategy has prompted a flurry of papers in this area especially from the ECB itself. Although there is a good deal of differentiation among these papers, this is mostly in relation to econometric technique rather than novel theoretical approaches<sup>1</sup>.

The objective of this article is to look at one aspect of money demand in a currency union with a central bank having, as in the case of the ECB, price stability as its primary statutory responsibility. Our examination starts from an observation of a salient fact of money behaviour in the euro area: since the start of EMU the income velocity of money has been trended downwards throughout almost the full time period of EMU in all of the founding eleven member states of the monetary union<sup>2</sup>. No generally accepted and plausible rationale seems to have been offered for this phenomenon. Some major countries outside of the euro area, for example, the US, do not exhibit the same systematic pattern, with US income velocity of money not subject to a trend

and apparently evolving with the business cycle.

There is also a systematic difference in the behaviour of the income velocity of money across member states of the monetary union since the start of 1999. Member countries with consistently poor records on inflation before the start of monetary union have experienced a substantially larger reduction in income velocity since the start of monetary union. This has persisted up until recently. It is truly an extraordinary pattern and so salient that it is somewhat surprising that it does not appear to have been noticed before now.

We argue that this cross-country pattern of income velocity is systematically related, indeed driven by, the respective price level/inflation experiences of those member states *before* monetary union commenced relative to their respective expectations of price level evolution *after* the start of monetary union. This, in turn, depends on money holders' expectations of the ECB's performance in maintaining price stability. These expectations are assumed to evolve in real time as money holders learn from experience how credible the ECB is in delivering on its statutory objective of price stability. We propose a measure of central bank credibility gain with respect to price stability which we then relate to the evolution of income velocity.

<sup>1</sup> For example, Coenen & Vega (2001), Gerlach & Svensson (2003), Greiber & Lemke (2005), Carstensen (2006), Greiber & Setzer (2007), Boone & Van Den Noord (2008) and Bjornland & Leiterno (2008).

<sup>2</sup> We do not consider Luxembourg given its exceptional role in international financial markets.

**Chart 1: Scatter Plot of Cumulative Changes in Monetary Credibility and Money Velocity (1999-2010)**

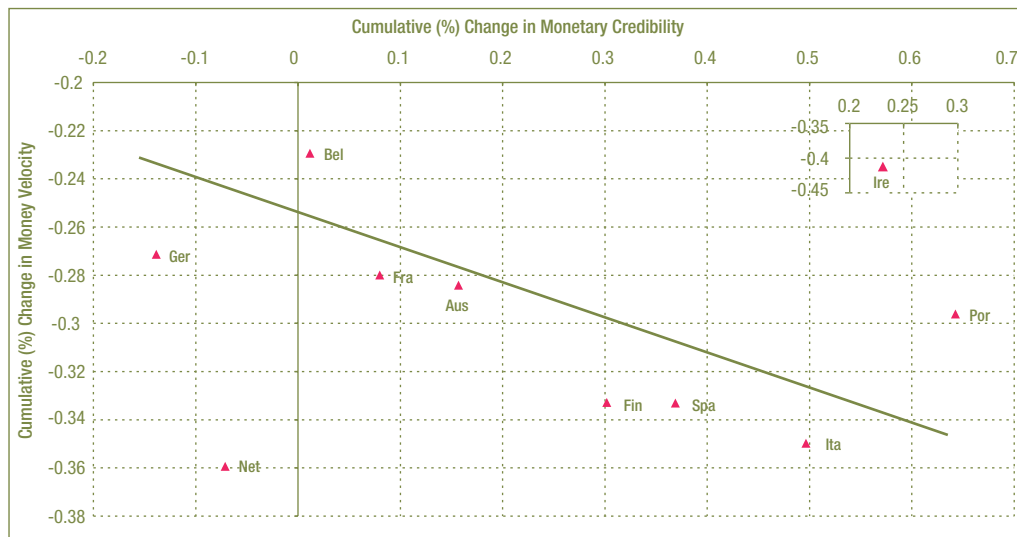
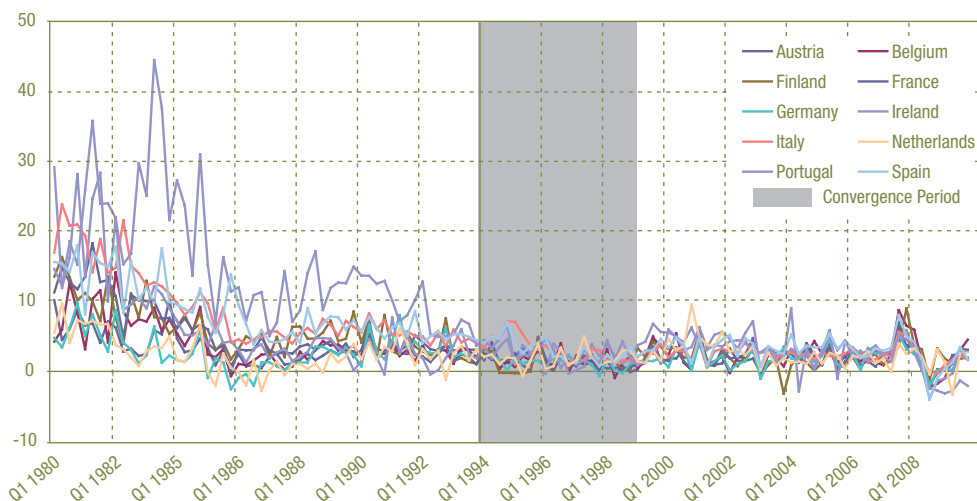


Chart 2: EMU Participants Inflation Rates (HICP)

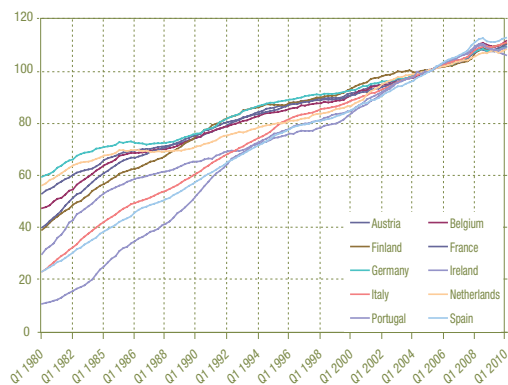


The systematic pattern between these two variables across the member states of the monetary union is displayed in the scatter plot in Chart 1. The horizontal axis in the chart shows our measure of the cumulative percentage change in price stability credibility. The precise formula used to derive this variable is postponed until Section 2 of the paper where it is explained in detail. Briefly, it compares the legacy inflation regimes of member states with their inflation experiences in monetary union. This legacy inflation regime is taken to be best represented by the ten-year period from 1984 to 1994. We set the end-point of this regime at 1994, and not at the start of monetary union itself (1999), since some of the benign inflation experience in this five-year “interim period” (1994-1999) may be due to the efforts countries were making to qualify for monetary union (as documented in the various Convergence Reports prepared for application countries) and, therefore, in a sense, due to monetary union itself. Indeed, the inflation performance of member states during this interim period was remarkably good with both a lower level and lower volatility of inflation than even in monetary union itself (see Chart 2). The vertical axis (in Chart 1) shows the cumulative fall in the income velocity of circulation since the start of monetary union for all ten countries in our sample.

For those core countries that belonged to the narrow ERM bands and that were subject to Bundesbank monetary policy before the start of

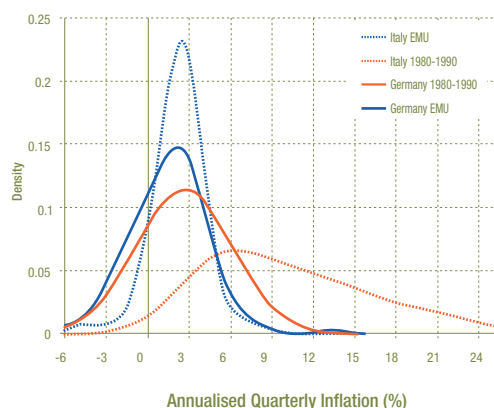
monetary union and, on foot of this, enjoyed price stability (i.e., Germany itself, France, Austria, the Netherlands and Belgium) there has been either no fall in velocity or at best only a very moderate downward trend since the start of monetary union. In the scatter plot, four of these five countries are located in the upper left hand corner of Chart 1. The countries towards the bottom right hand corner (i.e., Finland and Portugal) were the ones that experienced the steepest cumulative reductions in income velocity in monetary union and suffered the sharpest cumulative increase in inflation in the decade and a half before the commencement of the “interim period” leading up to the start of monetary union. Countries with intermediate experiences (i.e., Italy and Spain) lie in the middle as our theory suggests. To further illustrate this point, Chart 4 presents non-parametric distributions fitted to core (German) and periphery (Italian) inflation rates over two sample periods: (i) a pre-EMU regime from 1980-1990 and (ii) a post-EMU regime 1999-2010. There are only modest gains to German inflation rates after EMU, with small reductions in mean and variance. Italian inflation underwent a much greater transformation, with the mean decreasing by over 4 percentage points and considerably smaller variance. In fact, in the post-EMU era, Italian inflation rates are a tighter fit around their mean than German rates.

Chart 3: HICP Convergence (1980-2010)



Notes (Chart 4): A kernel smoothing technique is used to estimate nonparametric density functions of inflation rates over two sample periods; (i) Pre EMU (1980-1990) and (ii) Post EMU (1999-2010)

Chart 4: Fitted Distributions to German and Italian Inflation Pre and Post EMU



For most countries adopting the euro, monetary union constituted a double regime shift. The first was the adoption of the single currency, albeit only as a scriptural currency between January 1999 and January 2001 when the new euro notes and coin were introduced. The second was coming under a new monetary regime governed by a central bank (the ECB) which was statutorily committed to price stability. For the first group of countries noted above, this latter was not such a major regime shift since this was more or less exactly the kind of regime they had already enjoyed. But for the latter group it did, indeed, amount to a major regime shift given their higher inflation records before the start of our “interim period” leading up to monetary union. From the point of view of the argument here, it is the monetary policy regime shift that is relevant.

The paper is essentially about past price level movements, taken from high inflation regimes, relative to the experience of price level movements in EMU under the new statutory framework directed at price stability governing the ECB’s monetary policy. Money holders see the tax on money as being much lower than in the past under pre-EMU monetary policy regimes. With the fall in the inflation tax, people are willing to hold more money balances. It is therefore about comparing the actual experience of inflation in the past with the unfolding inflation experience in EMU and the

effect of this on money velocity; it is mostly a backward-looking variable. It is not therefore about inflation expectations, a forward-looking variable. That is why an inflation expectations variable has been included as a separate argument in the demand for money (velocity specification) used below which yields sensible theoretical results.

The approach is new in that it is something that money demand functions have not looked at in the past. In a sense, EMU provides the ideal context within which to look at this issue since a clear break in the monetary regime can be identified for a group of countries that came into EMU from endemically high inflation regimes. There is also a control group of countries which came from price stability regimes and for whom there was little or no change in monetary regime on entering monetary union. The increase in the demand for money (fall in velocity) was much greater for the former than the latter as shown in our scatter plot above.

This article proceeds as follows: Section 3 proposes an explanation for the systematic country-specific trend behaviour of income velocity since the start of monetary union and the role of price stability credibility in this (our theory); Section 4 documents informal graphical evidence in support of the theory. Section 5 reports on the supporting

econometric results of the relationship between central bank credibility and income velocity using a co-integration framework; Section 6 discusses the one exception to the pattern uncovered, Ireland (see Chart 1), and tries to explain what might account for this. There are no references in the economic literature which deal with the type of issue being discussed here. There is only one of which the authors are aware and even this is only tangentially relevant. The next section of the paper discusses it briefly. Section 7 looks at some potential policy issues in a preliminary way.

## 2. Money Demand (Velocity) and Monetary Union

Honohan (1984) has argued that the break-up of a monetary union increases the demand for money. The logic behind this argument suggests that the corollary should also hold: the creation of a monetary union should lead to a fall in the aggregate demand for money.

In March 1979, the long-standing currency union between the Irish pound and sterling was discontinued. Transactions between the two currencies became costly. Over the following several quarters there was a substantial increase in non-bank holdings of Irish currency, which could not be explained by statistical models which had worked well up to then. In this context, it seems worthwhile to note that a standard model of money demand predicts a discrete jump in equilibrium money demand as a result of such a regime shift.

Honohan's rationale for why an increase (and decrease, presumably, although he does not deal with this case) would result from a break-up (creation) of a monetary union arises exclusively from transactions cost considerations in the foreign-exchange market. For some combination of endowments of domestic and foreign goods, the absence of foreign-exchange transactions costs under a monetary union would lead to the transfer of funds back and forth across international frontiers in successive periods. With the introduction of foreign-exchange transactions costs, there is an incentive to hold balances in both currencies to economise on these transactions costs. The economies in money

holdings coming from the single currency would mostly affect the corporate sector rather than the household sector. In the lead up to monetary union proper (i.e., so-called Stage Three of EMU), they are likely to have held transactions balances in many, if not all, of the member countries even if they had a presence in only one or at best a few member countries. They would be even more likely to have held transactions balances in the denominations of all the member countries if they had a presence in these same countries. Therefore, the sums involved are potentially quite substantial and, accordingly, the savings in transactions balances to be made all the more substantial.

Yet another factor that would serve to reduce the demand for money is not only the improvement in both retail and wholesale payments systems but the introduction of new payments systems. It has been mentioned as far back as July 1998 in the ECB's "TARGET brochure" that: "With TARGET, international corporate cash management will be able to make substantial efficiency gains. The real-time execution of TARGET payments will reduce the float and make it possible to optimise cash management in euro. Participants' corporate customers might therefore be particularly interested in having their financial payments executed via TARGET". In other words, by using one currency instead of several, the corporate sector in particular should have enjoyed considerable economies in the holdings of transactions' balances related to cross-border trade. In addition, it also says that: "The high speed with which payments in TARGET will be processed will facilitate and improve cash management. Moreover, this will enable participants to increase their turnover of funds". The speed with which payments are processed with the increasingly available electronic payments systems at the retail level (e.g., prepaid and debit cards) may also have encouraged considerable economies in the holdings of not only bank deposits but also notes and coin.

All of these effects stem from monetary union and payment innovation both at the wholesale and retail levels, rather than from a new

monetary regime devoted to price stability which coincided with the start of monetary union. Since our focus is on the latter rather than the former we do not explore these interesting theories further here. They do, however, all point to further economies in the holding of money balances. If the effect of these economies in money holdings were present in the data they would have placed upward pressure on income velocity. This implies that the actual observed reduction in velocity might even understate the downward effect on income velocity coming from the growing price stability credibility of the ECB — the phenomenon to which we are bringing attention in this paper.

### 3. Price Stability and Income Velocity — the Mechanism

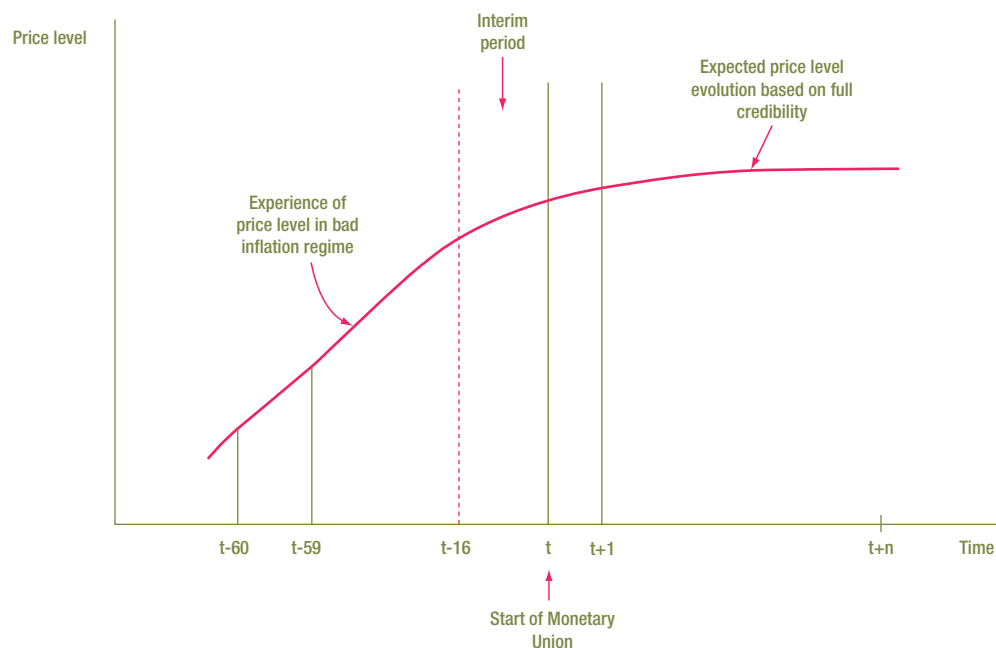
Chart 1 shows the effect of price stability credibility on money velocity across the member states of the Eurosystem. Credibility is taken as an average of the respective countries' experiences of price stability *after* the start of monetary union and cumulative price level increases for fifteen years *before* the start of what we are calling the “interim period”

leading up to the commencement of monetary union in January 1999. This average cross-section evidence supports our proposition that credibility for price stability increases the demand for money relative to the demand that would have been justified by purely transactions needs, as proxied by nominal income, especially in cases where this credibility was previously lacking.

So much for the cross-country evidence! But how does this effect manifest itself in an individual-country time-series context? We attempt to address this using Figure 1. This displays a highly stylised version of the mechanism which we think is behind the systematic behaviour of income velocity since the start of monetary union for a representative individual member state.

Inflation is a tax on money holdings; therefore lower inflation increases holdings of money. A sustained reduction in inflation that is credible should have the effect of reducing the income velocity of circulation, i.e., the ratio of nominal income to the money stock. A measure of that credibility should therefore be correlated with income velocity.

**Figure 1: Price Level before and after the Start of Monetary Union:  
A Stylised Representation**



To examine this, we develop a variable to capture price stability credibility. It is measured by comparing the inflation experience in EMU with the legacy inflation regimes of the respective member countries. The appropriate time span needed to reflect the pre-EMU legacy monetary and inflation regime has to be selected first. This is chosen as starting ten years prior to the start of the “interim period”. What is relevant here is not individual episodes of short-lived inflation but rather what we are calling inflation regimes. These are monetary regimes or arrangements that generate persistent patterns of inflation over lengthy periods of time, such as the ten year period (1984–1994) on which we have chosen to focus. For the ten member states these regimes vary from price stability to high, variable and persistent inflation.

Although the ECB was, and of course still is, statutorily committed to price stability, there was no guarantee at the start of monetary union that it would always succeed in achieving it successfully in an entirely new and unprecedented setting for monetary policy. Starting from the inception of monetary union, the legacy inflation experience from the old regime is summarised by the ratio of the price level at the start of monetary union relative to what it was in the past. We choose to go back 15 years, or 60 quarters, or ten years before the start of the “interim period”, to fully capture this past experience. This means starting in 1984.

The variable used to capture credibility is the ratio of the price level at any point in time in monetary union relative to what it was 60 quarters previously, i.e., the cumulative percentage increase in the price level. Therefore, the monetary credibility variable, CRED, is given as,

$$\text{CRED} = \frac{P_{t+i}}{P_{t+i-60}} * 100$$

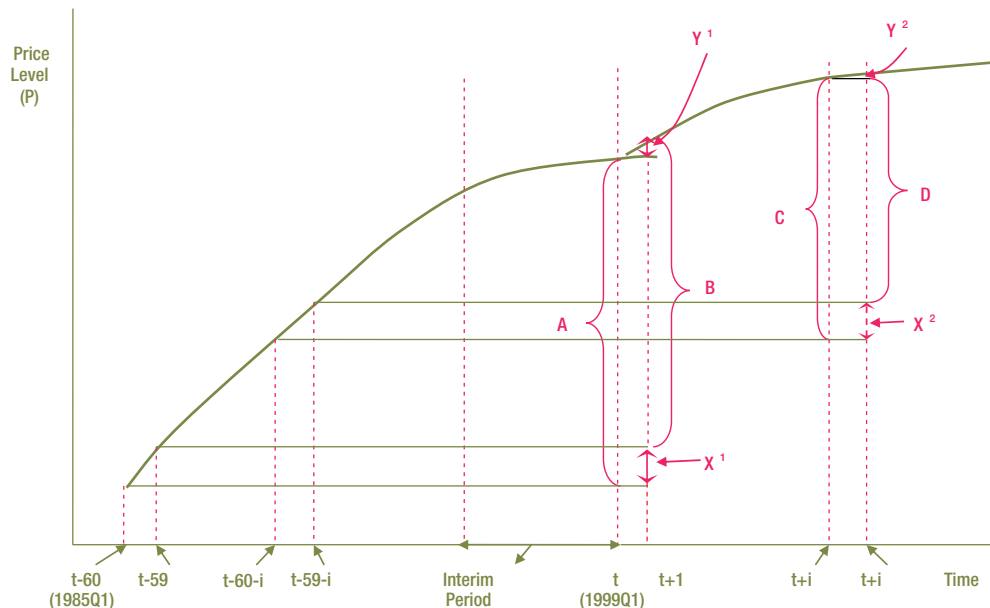
This assumes that money holders have fixed memories of 15 years (60 quarters) and, as they live through monetary union, this memory horizon remains fixed. For a central bank that is perceived as credible in its declared objective of price stability, this variable would fall systematically since the start of the new

monetary regime which was also the start of monetary union (this is clear from Figure 1). However, it would only decline for those countries which previously suffered high inflation regimes. This decline would be accompanied by a similar decline in income velocity arising from the belief that the inflation tax on money holdings had been finally eliminated. And, the bigger the credible and sustainable fall in inflation the greater the increase in the demand for money and the bigger the knock-on fall in income velocity. As we have seen, this pattern is reflected in Chart 1.

CRED is therefore the price stability credibility gain in moving between two different monetary regimes. So, the credibility gain for Italy is much greater than the credibility gain for Germany. We take the realised inflation rate as the indicator of whether the ECB is delivering on its price stability objective. This, relative to the inflation in the old pre-EMU (indeed, pre-“interim period”) regime, is an indicator of the gain in price stability credibility.

In Figure 2, A represents the level of credibility at the start of monetary union. Just one period into monetary union, the level of credibility is B, a gain relative to A (i.e.,  $P_{t+1}/P_{t-59} * 100$  falls relative to  $P_t/P_{t-60} * 100$ ). This gain in credibility ( $A-B$ ) is equal to  $(X^1 - Y^1)$  where  $X^1$  is the price level increase in the old regime and  $Y^1$  the price level increase in monetary union, where the difference in time interval is the constant memory horizon of money holders. So the gain in credibility is the difference in the inflation performance in the two monetary regimes. Progressing through monetary union from A to B to C to D indicates a growing level of ECB inflation fighting credibility. As depicted in Figure 2, the increase in the price level ( $Y^1, Y^2$ ) gets smaller and smaller relative to the increase in the price level in the old inflation regime (i.e.,  $X^1, X^2$ ). It is therefore clear from Figure 2 that what we are comparing, in effect, is the slope of the path of the price level in monetary union with the slope of the path of the price level before the “interim period” before monetary union at a 15-year (60-quarter) memory horizon displacement. If the ratio of these two slopes falls throughout the period of monetary union then the ECB will have gained credibility consistently.

Figure 2: Case of Growing ECB Credibility



The expectation on adopting the euro was that the inflation regime for the countries coming from high inflation regimes was about to change radically. However, money holders in these countries would only find out if this was so with the passage of time. They would only find out, in effect, from the performance of the ECB in delivering on its price stability pledge. They were therefore subject to a learning process. Our theory suggests that, as credibility was strengthened over time, it would be mirrored in the gradual but systematic fall in the variable  $P_{t+i}/P_{t-60}$ . And, accordingly, a belief that tax without representation would finally have come to an end, led to a gradual and equally systematic fall in income velocity. This stems from an increased money demand relative to the need for money for transactions purposes as proxied by nominal income, in other words, a fall in the income velocity of money.

If both monetary union and the ECB's price stability objective had been fully and unequivocally credible at the start of monetary union then there would have been a sharp steep reduction in income velocity at that time. However, it would not be reasonable to expect this to have happened. The ECB was operating

monetary policy in an unprecedented pan-European federal institutional arrangement, in a new financial setting and for a group of countries for which the one cap was unlikely to fit all. Gaining, and maintaining, a reputation for price stability would not have been inevitable. Money holders would only learn about ECB credibility by way of its performance in hitting its declared price stability target. We would therefore expect our credibility variable and income velocity to both move in tandem as the ECB's reputation as an inflation fighter was confirmed over time.

For those countries adopting the euro in January 1999 but coming from a monetary regime which was already one of price stability, or close to it, our theory would point to two patterns of behaviour. First, the  $P_{t+i}/P_{t-60}$  would be close to a straight line both before the start of monetary union and following the start of monetary union, and secondly, income velocity would similarly follow the pattern of a straight line but not necessarily the same straight line as that for the credibility variable.

#### 4. Informal Graphical Evidence

The national charts all (see Appendix) display the downward trend in the price stability



credibility measure (i.e., representing gains in ECB credibility). In virtually all cases this is accompanied by a trend reduction in the income velocity of circulation. In most cases the two cumulative changes from the start of monetary union up to, and including 2010Q2, are not dissimilar. The cumulative percentage fall in income velocity and credibility variable (i.e., improvement in credibility) between the start of monetary union and 2009Q4 were 27 and 32 per cent, respectively.

As expected, the smallest reductions are for the four core countries in the sample. The biggest reductions in both the credibility variable and the velocity variable have been for the countries with the worst inflation records before the start of the “interim period” leading up to the start of monetary union.

This is quite an extraordinary result since one variable that is taken predominantly from a data sample up to fifteen years before the commencement of monetary union is highly correlated with another variable taken exclusively from monetary union itself.

The general commonality of trends is impressive. The next step in this exercise involves examining the role of our price stability credibility variable in an otherwise fairly standard demand for money function which, for the purposes of the analysis and comparison with the graphical analysis, is converted to a velocity function.

## 5. Econometric Evidence

As noted already, despite almost full financial market integration in the euro area, banking assets and liabilities still remain stubbornly national — one of the strong stylised facts to emerge from the ECB’s *Financial Integration in Europe April 2010* report. This means that the money stock reported for any particular country of the union is used almost exclusively by residents of that country. Although the money stock in any one country of the union is perfectly fungible with that of any other country, it is nevertheless possible to explain the

developments in any country’s money stock by conditioning variables relating just to that country. So, despite a single currency and full fungibility of euro-denominated money across the whole of the euro area, it still makes sense to talk of member states’ national demand for euro-denominated money.

Since the anti-inflation credibility effects vary across the member states of the monetary union, there are important country-specific influences on money demand in the EMU. A disaggregated approach to money demand that takes account of these should, when aggregated, provide a better account of money stock behaviour at the aggregate monetary union level than a money demand function estimated for the whole of the monetary union area. Therefore, we propose modelling money velocity as,

$$\frac{Y}{M3} = f(\text{CRED}, (r^L - r^S), \text{INF})$$

where  $Y$  is nominal income,  $M3$  is the contribution of the representative euro area member state  $M3$  money stock,  $\text{CRED}$  is the inverse of the price stability credibility measure described in Section 2,  $r^L - r^S$  is the net opportunity cost variable capturing the slope of the yield curve and  $\text{INF}$  is the expected one period ahead inflation rate.

This model of money velocity dynamics is estimated in a panel cointegration framework. Non-stationarity is tested using Levin & Lin (1992) methodology finding unit roots in money velocity and in the credibility term but not in the interest-rate differentials or expected inflation terms. It is notable, therefore, that the long-term downward trend in velocity as shown in Chart 1 for individual member states is determined exclusively by the trend improvement in ECB credibility.

It follows, therefore, that interest rates and inflation expectations only explain the adjustment towards this long-run equilibrium and not the long-run equilibrium itself. The resulting semi-log linear equations to be estimated are accordingly:

(1)

$$\frac{Y_{i,t}}{M3_{i,t}} = \alpha_0 + \alpha_1 \text{CRED}_{i,t} + e_t$$

(2)

$$\Delta \frac{Y_{i,t}}{M3_{i,t}} = \beta_0 + \sum_{j=1}^n \phi_j \Delta \frac{Y_{i,t-j}}{M3_{i,t-j}} + \sum_{j=1}^n \phi_j \Delta \text{CRED}_{i,t-j} + \gamma \text{INT}_{i,t} + \lambda \text{INF}_{i,t} + \zeta \hat{e}_{t-1} + \varepsilon_t$$

where  $Y_i$  is the log of nominal GDP in country  $i$ ,  $M3_i$  is the contribution of country  $i$  to euro area aggregate M3.  $\text{CRED}_i$  is the credibility of the ECB's monetary policy based on country  $i$ 's HICP as outlined in Section 2 above.  $\text{INT}_i$  is the difference between country  $i$ 's 5-year government bond yield and the 3-month EURIBOR rate.  $\text{INF}_i$  is the expected inflation in the next period as proxied by the one-period-ahead HICP in county  $i$ . All data are quarterly observations over the period 1999Q1 to 2009Q4.

A panel cointegration test approach is used to detect the cointegration properties of the variables. Allowing for a constant, there is strong evidence for exactly one cointegrating vector in the  $(Y/M3, \text{CRED})$  system, consistent with a long-run relationship between these variables<sup>3</sup>.

In terms of estimating the long-run relationship between the variables, we follow the Pedroni (2000) approach, adopting a fully modified OLS (FM-OLS) framework where the coefficient on credibility is estimated for each individual country to provide the group estimate presented in Table 1<sup>4</sup>. Consistent with graphical evidence above, an increase in credibility increases the velocity of money. To be more precise, a reduction in the CRED variable (which is an increase in credibility) leads to an increase in the demand for money,

an increase in M3 as supply responds, and a reduction in income velocity ( $Y/M3$ ). Credibility has a fairly sizable effect on income velocity with a 1 per cent increase in credibility leading to a decrease in money velocity by 0.51 per cent. The cost of holding money is reduced leading to a situation in which the pace of money growth exceeds that of income.

In terms of short-run dynamics, the long-run relationship is set equal to 0.51 for all countries based on the FM-OLS group estimate. The model is estimated allowing for fixed effects, with all of the intercepts showing a significant negative value. However, Burggeman (2000) concludes that no direct implication can be taken as it captures both the long- and short-run constant term. However, one could interpret the negative sign as an increase in the unconditional growth of money velocity during the sample period.

The two short-run explanatory variables ( $\text{INT}$ ,  $\text{INF}$ ) are both significantly positive. This is consistent with the traditional theory of money demand. Higher long-run interest rates relative to short rates increase the opportunity cost of holding money now which impacts positively on velocity. Inflation is also a cost on holding money. In both cases, holding of money relative to output will fall, resulting in an increase in money velocity.

Estimates show a negative coefficient on the error correction term,  $\zeta$ , which is consistent with error correction theory. Any deviations from the long-run equilibrium are corrected by  $\zeta$  in each time period through the short-term dynamics discussed above. Although negative,  $\zeta$  is small indicating a slow speed of adjustment towards the long-run equilibrium. One reason often given for slow adjustment is the small cost of being out of equilibrium or the high cost of adjusting the money holding to equilibrium. Also, real side shocks such as oil-price hikes are often said to be responsible for the long term persistence of disequilibrium.

## 6. Accounting for the Exception: Ireland

There is only one outlier from the sample of the ten member states included in the study. This is Ireland. For Ireland, there was almost no change in the credibility measure since the

<sup>3</sup> The Kao (1999) & Pedroni (1999, 2004) panel cointegrating tests using the underlying Engle-Granger methodology are conducted and a relationship of rank 1 is found at the 95 per cent confidence level. A comprehensive outline of results is available upon request.

<sup>4</sup> Only group estimates are reported for brevity, with individual country estimates available upon request. Contact: [Robert.Kelly@centralbank.ie](mailto:Robert.Kelly@centralbank.ie)

**Table 1: Error Correction Model Estimates**

**Long Run**

Variable	Coefficient	T-Statistic
CRED	0.51*	19.832

**Short Run Dynamics**

Variable	Coefficient	T-Statistic
Constant	-0.011*	-3.144
$\Delta Y/M3_{t-1}$	0.102*	1.983
$\Delta Y/M3_{t-2}$	0.055	1.056
$\Delta Y/M3_{t-3}$	0.111*	2.089
$\Delta Y/M3_{t-4}$	0.060	1.118
$\Delta CRED_{t-1}$	0.022	0.510
$\Delta CRED_{t-2}$	0.011	0.255
$\Delta CRED_{t-3}$	-0.042	-0.997
$\Delta CRED_{t-4}$	-0.043	-0.997
INT	0.003*	3.292
INF	0.002*	3.019
ECT	-0.016**	-1.662

**Notes:** The constant in the ECM is the grouped estimate from the fixed affects and the appropriate number of lags (in this case 4) is selected according to AIC. \* and \*\* denotes different from zero at 0.05 and 0.10 significance levels, respectively.

start of EMU and only a very slight improvement since 2003Q1. It started out at a value of 0.3 and ended up at virtually the same value, having increased slightly during the 10-year period before converging back to its original value at the start monetary union.

The factors contributing to regional inflation differentials in monetary union (such as the Balassa-Samuelson effect, price-level and standard-of-living forces of convergence as well as differences in cyclical positions) seem to have been especially potent in the Irish case. Very rapid capital and money-market convergence following financial market liberalisation and the advent of monetary union along with the much more sluggish, but none the less ineluctable, convergence of income and price levels threw up a very powerful dynamic and helped sustain a boom especially in the non-traded sector of the economy.

The example of Ireland in the 1990s and into the new millennium suggests that in such an environment, the real cost of debt capital may fail to respond to domestic economic fundamentals. This would have the effect of suppressing a natural self-correcting market mechanism. This was at least partly responsible for the boom in the non-traded sector of the economy, especially in the real estate and construction industries. This resulted in the price level in Ireland converging on and then overshooting that in the core countries of the monetary union.

Honohan and Lane (2003) have also brought attention to this effect. In flagging the negative correlation between pre- and post-EMU real short-term interest rates, they note that the fall in real interest rates in those EMU countries with higher-than-average inflation is a potentially destabilising factor, since it has the effect of placing even further upward pressure on inflation in those EMU countries with already high inflation, thereby militating against inflation convergence.

The failure of the credibility variable to perform similarly to that in the other member states is therefore, somewhat ironically, partly attributable to monetary union itself which had the effect of hampering the self-correcting market mechanism which would otherwise have been present. This released a dynamic that drove the Irish price level above that of the core countries and by a substantial margin. This is the reason why we think that the price stability credibility variable does not seem to work in the Irish case. Other member states in our sample did not have their price stability credibility variable distorted by powerful short-run dynamics in the same way or to the same extent.

## 7. Concluding Remarks

The model and results presented here suggest that the ECB should, in formulating the second pillar of its monetary policy strategy, factor in its own price stability credibility. More rapid

money growth than would be forecast on the basis of a conventional demand for money function should not necessarily feed into a more restrictive monetary policy stance if attributable to a gain in its own inflation fighting credibility. This additional money growth would not be inflationary but rather the result of the ECB reinforcing its reputation as an inflation fighter. The corollary is also valid. Slower money growth than would be predicted by standard money demand models should not serve as an input into a more relaxed monetary policy stance if this slower money growth can be ascribed to a loss of price stability credibility. Our graphical and econometric evidence suggest this credibility/reputational effect is fairly substantial. This would suggest, in turn, that if it is not taken into account in the formulation of monetary policy, then there is a significant potential for mistakes to be made in the stance of monetary policy.

The ECB would have to be aware that its own growing price stability credibility would have this systematic effect on money demand and velocity and that it should allow for this effect in the second pillar of its monetary policy strategy in formulating its monetary policy stance.

According to our model, a gain in price stability reputation is self-reinforcing. It increases the asset demand for money and, for a given supply, reduces inflationary pressures and, other things being equal, actual inflation. This disinflation further enhances a central bank's credibility. Unfortunately, the corollary is also true. Our model and results point to the danger that any short-run loss of credibility by a central bank with respect to its main statutory objective of price stability can be self-reinforcing. An upward shift in the price level relative to what had been expected drives up our credibility indicator and points to a loss of some reputation by the ECB as an inflation fighter. The higher tax on nominal money balances reduces the demand for money and, relative to a given supply, places upward pressure on inflation which is ultimately realised in actual inflation.

It should be noted that this reduction in the demand for money does not, *per se*, lead to a

reduction in the stock of nominal money balances outstanding, unless in the case where the counterparty is a non-resident of the euro area. However, the collective attempt of money holders to offload money balances, on account of the impending implicit tax, puts upward pressure on expenditures and, depending on the cyclical position of the economy, on inflation. Previous money hoarding becomes dishoarding with a wall of money spilling over into household and corporate expenditures and putting upward pressure on inflation. The attendant loss of credibility tends to prompt more dishoarding and cause even greater inflation and loss of credibility.

This could therefore be a potential source of instability emanating from the second pillar. However, in invoking the second pillar in the formulation of monetary policy, allowance would have to be made for this.

For most of the sample period since the commencement of monetary union in 1999, this mechanism worked benignly. The ECB's success in maintaining price stability, relative to the poor inflation record in the legacy regimes of many of the member states, has resulted in a trend fall in money velocity of circulation in the euro area, as our theory suggests. By corollary, the loss of credibility should drive the income velocity of circulation higher. There is also some supporting evidence for this in our very limited sample afforded by the history of monetary union to date.

From a policy perspective, there is indeed an additional reason why our theory and results would seem to place a lot of weight on the importance of a central bank not losing credibility in the first place. It is because, in the context of the multi-country setting of our model, monetary union makes it more difficult to regain credibility once lost. The problem is that credibility is lost or gained at a national level. What is important for the ECB's reputation is national inflation rates relative to the same national inflation rates in the past even, as our theory and results suggest, this is the fairly distant past. Member countries with inflation above the ECB's target may not be compensated by countries with inflation below

the target if this inflation is negative, which is not consistent with price stability. So, the ECB may lose credibility even if area-wide inflation for the euro area is consistent with price stability.

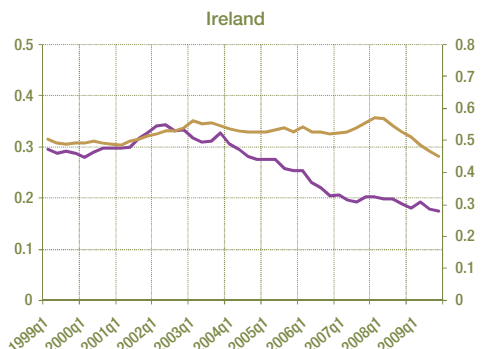
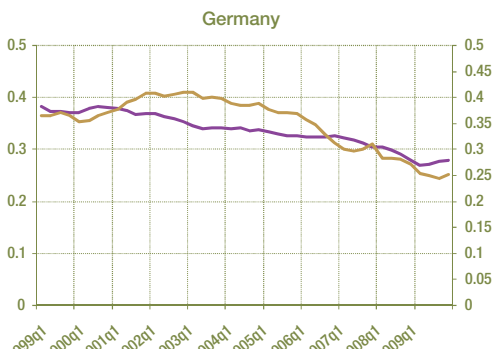
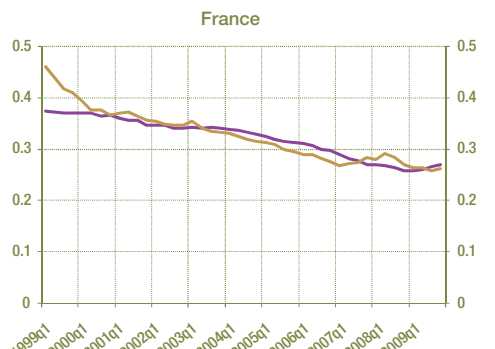
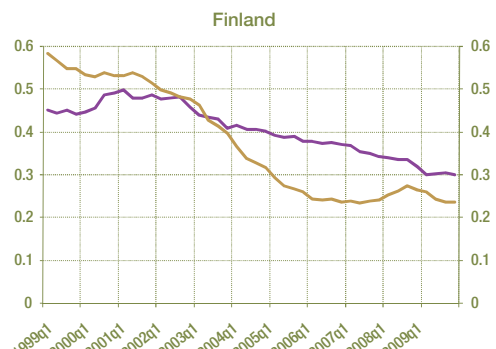
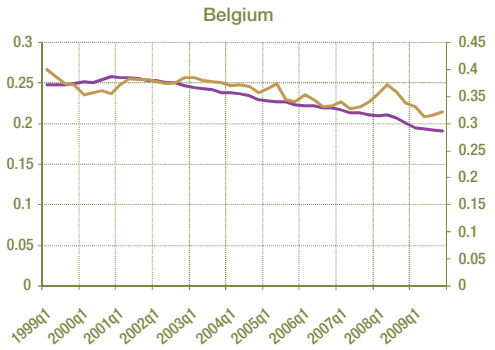
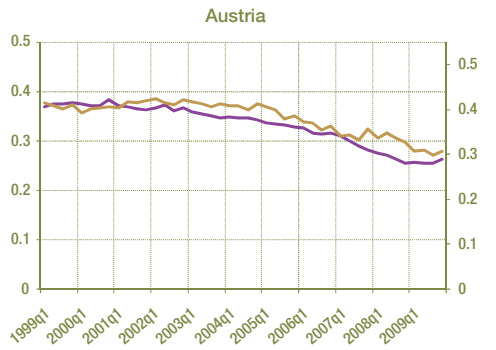
In other words, the ECB's credibility may be affected adversely by relative price movements across member countries of the euro area. This poses a potentially substantial problem for the ECB. Part of this stems from the fact that it might be placed in a position in which it loses price stability credibility due to factors which are outside of its control.

This stems from the past chequered record in relation to inflation in many of the member states of the Eurosystem. Any reminder of the abuses of the old national high inflation regimes results in a reduction in the demand for money and inflationary pressures. So, even for an unchanged stance of monetary policy, a loss of inflation fighting credibility at the national level can, by itself, generate an acceleration of inflation. It also implies that, if credibility is lost temporarily (because of say a blip in the price level due to a random shock), it is hugely important to re-establish it as soon as possible.

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Appendix: Time Series Charts of Money Velocity and Monetary Credibility for EMU Participants (1999-2010)



Appendix: Time Series Charts of Money Velocity and Monetary Credibility for EMU Participants (1999-2010) (contd)

