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Modelling Money Demand:
Further Evidence from an International Comparison

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ABSTRACT

This paper aims at estimating money demand for the euro area, the US and the UK using a dynamic ordinary least squares estimator (DOLS). Our findings show that: (i) wealth effects on money demand are important in the euro area and the UK; (ii) the impact of changes in the interest rate on real money holdings is negative and small; (iii) goods are a reasonable alternative to money; and (iv) international currency substitution has a major influence on the behaviour of real money demand in the UK.

Keywords: Money demand, dynamic OLS.
JEL classification: C2, E21, E44, D12.

1. Introduction

The achievement of long-term price stability is the major goal of the European Central Bank (ECB), the Fed Reserve Board (Fed) or the Bank of England (BoE). Yet, the recent financial turmoil highlighted that the conduct of monetary policy cannot be detached from the establishment of a macro-prudential framework given the close links between the economic policy and the wealth dynamics (Sousa, 2010; Afonso and Sousa, 2012; Sousa, 2012a, 2012b). Moreover, shocks to money demand may prove crucial to understand the deepness of an economic recession. Thus, the investigation of the money demand dynamics and its dependence on macroeconomic variables is extremely relevant for central bank policies.

In this context, the existing literature has often made use of single equations models or error-correction approaches to specify the money demand equation (Sriram, 1999; Duca and van Hoose, 2004). While different econometric techniques have been employed, linear models are the workhorse to assess the relationship between real money balances, real GDP, nominal interest rate and real effective exchange rate (Sousa, 2010, 2012a).[1]

In this paper, we apply the Dynamic Least Squares (DOLS) method to estimate the money demand equation for the euro area, the US and the UK, which constitutes an important contribution to the literature. Its use enables us to control for endogeneity, which can be expected due to the existence of reverse causality between money demand and its determinants.

Our findings point out several interesting results. We show that the income elasticity of money demand is positive and large in magnitude, while the response of real money holdings to changes in the interest rate is negative and small. With regard to the inflation elasticity, it is also small but its sign changes across countries. Finally, we uncover the existence of international currency substitution in the case of the UK, as the elasticity of money demand to the real effective exchange rate is negative.

2. Estimation methodology

We estimate the money demand function in accordance with the work of Stock and Watson (1993), that is, we use Dynamic Ordinary Least Squares (DOLS) estimator to specify the following equation

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[1] Other studies made use of nonlinear frameworks. See, for instance, Khadaroo (2003) and the references therein.

$$m_t^d = c + \beta_y\, y_t + \beta_i i_t + \sum_{i=-k}^{k}\Delta y_{t+i} + \sum_{i=-k}^{k}\Delta i_{t+i} + \sum_{i=-k}^{k}\Delta fx_{t+i} + \varepsilon_t, \qquad (1)$$

where m_t^d is the real money demand, y_t is the real GDP, i_t is the nominal interest rate, fx_t is the real effective exchange rate, Δ denotes the first difference operator, c is a constant, k is the number of leads and lags of the explanatory variables, and ε_t is the error term. The parameters, β_y, β_i, β_π and β_{fx} denote the long-run elasticity of money demand with respect to the real output, the nominal interest rate, the inflation rate and the real effective exchange rate, respectively.[2] The inclusion of the sum of the leads and lags of the first differences of the regressors constitutes the best approximation to the instrumental variables approach and it enables us to control for endogeneity.

3. Data

We use quarterly data over the following periods: 1980:1-2010:4 (euro area); 1959:1-2011:1 (US); and 1963:1-2011:1 (UK). Data is provided by: the European Central Bank, in the case of the euro area; the Board of Governors of the Federal Reserve System, the Bureau of Economic Analysis, the Bureau of Labor Statistics and the Main Economic Indicators of the Organisation for Economic Co-Operation and Development, for the US; and the Datastream and the Office for National Statistics, in the case of the UK. Money holdings and GDP are expressed in logarithms of real domestic currency. The monetary aggregate is: M_3 (euro area), M_2 (US) and M_4 (UK). The central bank rate is defined in nominal terms. The inflation rate is computed using the GDP deflator. Finally, the real effective exchange rate is the CPI-based narrow index provided by the Bank for International Settlements (BIS).

4. Empirical results

We start by considering the standard specification, where money demand is a function of real income and nominal interest rate. Then, we add inflation to the set of explanatory variables in order to capture the link between real money holdings and goods. Finally, we include the real effective exchange rate among the regressors to track potential currency substitution at the international level.

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[2] For an assessment of the role played by nonlinearity in the short-run behaviour of money demand, see Khadaroo (2003) among others. In the same context, Jawadi and Prat (2012) show financial and monetary variables relationships exhibit nonlinearity and switching regimes..

In line with the economic theory, Table 1 shows that while the semi-elasticity of money demand with respect to income is positive, the interest rate semi-elasticity is negative. This finding is in line with the Keynesian theory, as it highlights the existence of a money demand for transactions, as well as the speculative motive. Such result is also in accordance with the works of Sousa (2010, 2012a). The income semi-elasticity is relatively large in magnitude (ranging between 0.81 in the US and 1.85 in the UK), while the semi-elasticity of money demand with respect to the interest rate is small (i.e. -0.01 in the US and -0.02 in the euro area and the UK). This quasi-null effect of the interest rate on the money demand – which provides some support that the quantitative theory of money demand is a good description of the behaviour of money demand - can be associated with the low level of central bank interest rates, in particular, after the global financial crisis. Furthermore, the fact that, for the euro area and the UK, the income elasticity of money demand is above unity provides evidence in favour of wealth effects and against the Baumol-Tobin model of money demand.

Table 1: Money demand - income and interest rate.

$$m_t^d = c + \beta_y\, y_t + \beta_i i_t$$

	β_y	β_i
Euro area	1.22***	-0.02***
	(19.51)	(-6.48)
US	0.81***	-0.01***
	(69.20)	(-5.07)
UK	1.85***	-0.02***
	(72.36)	(-7.55)

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10%, 5%, and 1% level, respectively. For brevity, we do not report the first-difference coefficient estimates

In Table 2, we assess the interaction between money demand and inflation. The empirical findings regarding the semi-elasticities of money demand with respect to income and to interest rate are similar, as the income elasticity is positive and large in magnitude, especially, in the UK (1.82). In what concerns the inflation elasticity, it is generally small in magnitude. However, while it is negative for the UK (-0.03) and the euro area (-0.01, although not statistically significant) – highlighting that goods are a reasonable alternative to holding domestic currency -, it is positive for the US (0.01).

Table 2: Money demand - income, interest rate and inflation.

$$m_t^d = c + \beta_y\, y_t + \beta_i i_t + \beta_\pi \pi_t$$

	β_y	β_i	β_π
Euro area	1.23***	-0.02***	-0.01
	(18.78)	(-5.84)	(-0.38)
US	0.82***	-0.01***	0.01
	(58.84)	(-4.55)	(1.15)
UK	1.82***	-0.01***	-0.03***
	(71.86)	(-5.65)	(-4.33)

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10%, 5%, and 1% level, respectively. For brevity, we do not report the first-difference coefficient estimates

Finally, Table 3 accounts for the role played by the real effective exchange rate on the dynamics of real money holdings. As before, the income elasticity of money demand is positive and larger than unity for the euro area and the UK, uncovering the existence of wealth effects. With regard to the interest rate, we find evidence of a negative elasticity of money demand, albeit small in magnitude. In what concerns the elasticity of money demand with respect to inflation, it is statistically significant and negative for the UK, corroborating the idea that goods are a good substitute for money holdings. Finally, the elasticity of money demand with respect to the real effective exchange rate is negative only in the case of the UK, which suggests that international currency substitution is important.

Table 3: Money demand - income, interest rate, inflation and real effective exchange rate.

$$m_t^d = c + \beta_y\, y_t + \beta_i i_t + \beta_\pi \pi_t + \beta_{fx}\, fx_t$$

	β_y	β_i	β_π	β_{fx}
Euro area	1.21***	-0.02***	0.02	0.26***
	(20.26)	(-7.23)	(1.27)	(4.84)
US	0.85***	-0.00**	0.00	0.05
	(52.16)	(-2.40)	(0.52)	(1.26)
UK	1.78***	-0.01***	-0.03***	-0.29***
	(66.72)	(-5.50)	(-4.79)	(-4.30)

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10%, 5%, and 1% level, respectively. For brevity, we do not report the first-difference coefficient estimates

4. Conclusion

This paper provides an international comparison of the money demand equations for the euro area, the US and the UK, based on the use of the Dynamic Ordinary Least Squares (DOLS) estimator. We uncover the presence of wealth effects on money demand in the case of the euro area and the UK. The interest rate elasticity of money demand is negative but small in magnitude, highlighting that the quantitative theory of money demand is a good description of the behaviour of real money holdings, in particular, after the global financial turmoil. In addition, goods seem to be an alternative to money in the UK. Finally, our findings support the existence of an important component of international currency substitution in the money demand of the UK, possibly reflecting a stronger reliance on international capital flows..

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