The demand for Divisia money by the personal sector and by industrial and commercial companies

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This article updates previous Bank analysis of Divisia money. It assesses the demand for Divisia money by the personal sector and by industrial and commercial companies (ICCs). Divisia money weights the component assets of M4 according to an estimate of the transactions services they provide. As an index of total liquidity in the economy Divisia might therefore be more closely related to spending than simple-sum monetary aggregates. The article concludes that a sectoral analysis of Divisia money can contain important information about future spending.

Introduction

Since 1993, the Bank has published time-series for a Divisia index of money for the economy as a whole, as well as for the personal and corporate sector separately, dating back to 1977 Q1.(1) These Divisia measures are part of the set of information variables used for the assessment of future developments in spending and inflation.(2) The Bank monitors Divisia money alongside simple-sum monetary aggregates, such as M4, because transactions balances as measured by Divisia money might be expected to feed into spending more quickly and more directly than M4 balances—which are held both for payments and savings purposes.(3) This article considers what determines the demand for personal sector and industrial and commercial companies' (ICCs) Divisia money (using a similar approach as for sectoral M4)(4) and how this information may be used in formulating monetary policy. It updates previous Bank analysis of Divisia money.(5)

Over the past 20 years, target and monitoring ranges for the growth of various definitions of money have been published in the United Kingdom. Under the new monetary framework (announced in October 1992) the government has adopted an inflation target of 2.5% or less over the medium term. To achieve this target, a wide range of economic indicators is used to provide information about future developments in nominal demand and inflation. As part of this set of indicators, monitoring ranges for M0 and M4 have been set so as to be consistent with the government's inflation target.

The usefulness of monetary aggregates for policy purposes should be assessed on the basis of whether they have a close and predictable relationship with activity and inflation. M0 and notes and coin are very narrow aggregates, and do not capture all the liquidity services money provides. And broad money balances are increasingly held for savings purposes, thereby sometimes obscuring M4's relationship with current nominal spending.(6)

In principle, Divisia money should not suffer from these drawbacks, since it weights the components of aggregate and sectoral M4 to reflect estimates of the extent to which these assets provide transactions services. For example, interest-bearing time deposits are likely to be held primarily for savings purposes and carry a low weight in Divisia money, whereas notes and coin are used largely for transactions purposes and so carry a higher weight. The liquidity of an M4 component asset is proxied by its opportunity cost—the asset's rate of return relative to the interest return on a benchmark asset which offers no transactions services. The Divisia weights are two-period moving averages of expenditure on each component asset relative to expenditure on all components in the Divisia index. Expenditure on an asset is proxied by the product of the asset's opportunity cost (which is effectively a shadow price) and the value of balances held in that asset.(7) The growth rate of Divisia money then measures the growth in transactions services provided by the M4 component assets by adding their growth rates, with the weights of all assets adding up to one, although individual weights can vary over time.(8) If liquidity is critical to the relationship between money and activity and inflation,(9) then Divisia indices should in principle be more closely related to total spending and inflation than are M0 and M4.(10)

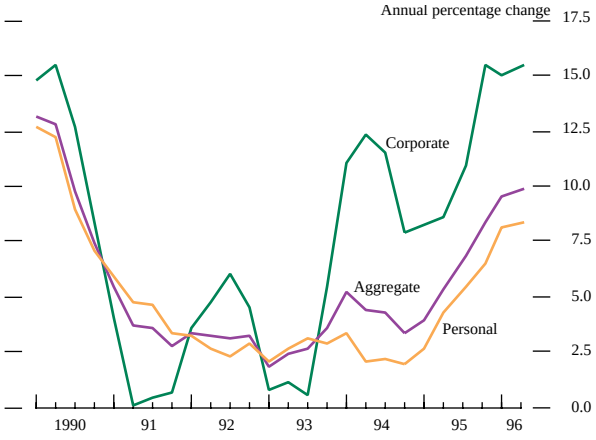
(1) See Fisher, P, Hudson, S and Pradhan, M (1993a, 1993b), (referred to as FHP in this article). Central banks in Canada, Germany, Japan, the Netherlands, Spain, Switzerland and the United States have also analysed and become increasingly interested in Divisia indices.
(2) See the Bank's *Inflation Report* for details of this assessment.
(3) See Thomas, R (1996).
(4) Thomas, R, *op cit.*
(5) See FHP.
(6) The demand for M0 and M4, both of which do not take into account the differing degrees of liquidity of monetary assets, has been discussed in recent *Quarterly Bulletins*; see Janssen, N (1996) and Thomas, R, *op cit.*
(7) See FHP for a formal specification of the Divisia weights.
(8) The Divisia index then approximates transactions balances in the economy relative to a base period.
(9) The credit channel may also be an important mechanism through which monetary policy affects activity and inflation, see Ganley, J and Salmon, C (1996).
(10) FHP discuss some of the problems with Divisia as a proxy for transactions money. Spencer, P (1994) provides evidence of a close long-run relationship between aggregate Divisia and economic activity and prices.

Divisia money as a proxy for transactions balances

Although Divisia money might be expected to be more closely correlated with nominal demand[1] than is M4, the two are not directly comparable because the Divisia measure only provides a proxy for the *liquidity of holdings* of monetary assets in index number form. The Divisia measure of liquidity is well-founded in economic theory, as it assumes that agents derive utility from holding liquid monetary assets. For monetary policy purposes it would be useful to have a measure of the *value* of monetary assets held as transactions balances. But if we were to derive a value measure for Divisia, we would have to determine a base period in which most of M4 balances were held for transactions purposes, and assume that the sterling value of Divisia equalled total M4 holdings in that period. Since this procedure always contains a highly arbitrary element, Divisia is only useful as an index number of liquidity.

Aggregate Divisia's annual growth rate has been increasing steadily since 1994 Q4 and was 9.9% in the year to the second quarter of 1996 (see Chart 1), similar to the increase in aggregate M4. The two sectoral measures of Divisia

Chart 1
Annual growth rates of aggregate, personal and corporate sector Divisia money



money have also accelerated in recent years. But over the past three years, corporate sector Divisia has consistently grown around twice as fast as personal sector Divisia; in the year to 1996 Q2, corporate sector Divisia increased by 15.5% and personal sector Divisia by 8.4%.

In both the personal and the corporate sector the gap between M4 and Divisia has increased almost continuously since the mid 1980s. This suggests that the average liquidity of M4 holdings has fallen gradually and that M4 balances have become increasingly held for savings purposes. Since the beginning of the year, however, personal sector Divisia has grown at a faster rate than M4, indicating a rise in average liquidity of personal sector M4 balances.

As a result of increased competition between banks and building societies, building society deposit rates had risen relative to other rates in the mid 1980s. This was reflected in lower weights of building society deposits in the personal sector Divisia index, although the transactions services of these deposits had not changed. Consequently, personal sector M4 recorded higher growth rates than Divisia at the time. Hence, the Divisia measure does not always provide a perfect approximation of transactions services in the economy. Since the early 1990s, however, the weight of building society deposits in personal sector Divisia has increased significantly, due to the decreasing return on building society deposits relative to bank time deposits and the benchmark asset, and the growing stock of building society deposits. This suggests that personal sector holdings of building society deposits have been used increasingly for transactions purposes and bank time deposits more for savings purposes. This seems reasonable because TESSAs, which offer a higher rate of return and which are not included in the Divisia measures, have been available to the personal sector since 1991 as an alternative store of value.

The gap between personal sector M4 and personal sector Divisia has generally been smaller than the corresponding gap for the corporate sector. This may be partly explained by the lower interest rates that the personal sector receives on most of its monetary assets compared with the corporate sector. Loan demand was weak in the early 1990s, while personal savings were high. The optimal strategy for banks and building societies may have been to reduce interest rates offered on personal sector deposits, because this sector is the least interest sensitive. The lower interest rates on personal sector deposits imply that opportunity costs of interest-bearing assets are higher than in the corporate sector. The weights of interest-bearing deposits are consequently also higher in the personal sector. And because most of the growth in M4 has been in interest-bearing assets, the gap between M4 and Divisia has been smaller in the personal sector than in the corporate sector.

Within the corporate sector, other financial institutions (OFIs) in particular have increased the proportion of their M4 balances which appear to be held for savings, rather than transactions purposes since about 1985. If a large part of OFIs' M4 balances is related to merger and acquisition activity, their transactions balances as measured by Divisia might have been expected to have increased at a slower rate than M4, in particular over the past two years.

The relationship between personal sector and ICCs' Divisia money and nominal demand

Previous Bank research into Divisia adopted a single equation framework to analyse the demand for Divisia money at the aggregate and sectoral level. Divisia has also been tested as a leading indicator of nominal GDP and RPIX

(1) See FHP for evidence on this.

growth using Granger-causality tests.[1] But estimates of the long-run relationships between Divisia money and real variables were not very conclusive in the single equation approach.[2]

To understand better the implications of Divisia money growth for future nominal spending, we may need to look at the fundamental determinants of Divisia money and its interactions with other real and financial variables. That means modelling the demand for Divisia money jointly with these variables and adopting an approach similar to that used recently in the Bank when modelling sectoral measures of M4.[3] Here, estimates are derived for personal sector and ICCs' Divisia money; OFIs' transactions balances as measured by Divisia are excluded from the analysis, because research has shown that OFIs' deposits are unlikely to be directly related to real activity.

Personal sector

In this section we discuss how a model of the demand for Divisia money (reported in the Appendix) may be used to determine whether transactions money is likely to feed through into future spending. Because Divisia's main function is as a medium of exchange, personal sector Divisia money is modelled jointly with consumption, in line with previous Bank work on personal sector M4. In the long run, personal sector Divisia appears homogeneous[4] in consumption and gross (financial and tangible) wealth. If we consider wealth a proxy for permanent income, the demand for Divisia money may increase as wealth rises, because a higher permanent income induces agents to increase their transactions. Additionally, personal sector Divisia is modelled as a function of two opportunity cost terms. The first opportunity cost variable is an *ex post* real interest rate (the three-month Treasury bill yield minus the annual inflation rate), which proxies the opportunity cost of holding Divisia money rather than real assets. The second is the dual user-cost index of personal sector Divisia money. This is essentially a weighted interest differential between the three-month local authority rate[5] and the own rates on the components of Divisia. It measures the opportunity cost of holding wealth in liquid form rather than in non-monetary (interest-bearing) assets.

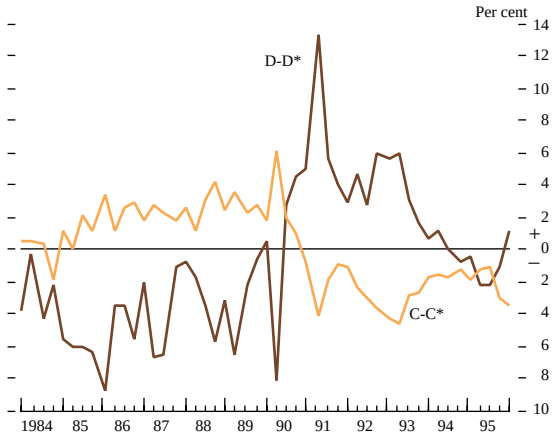
The long-run consumption function is similar to the one estimated jointly with personal sector M4; it depends on real disposable income, wealth, and short-term real interest rates. There is no evidence of a 'precautionary saving' effect on consumption, because such saving is likely to be in interest-bearing assets, which should receive a low weight in the Divisia index as a proxy for transactions money.

As theory suggests, the main difference is that wealth is less important for the demand for Divisia money than for personal sector M4 in the United Kingdom. Due to substitution between financial and real assets an increase in real interest rates leads to a shift into interest-bearing financial assets, which may increase financial wealth. This in turn causes indirect wealth effects for Divisia money. Alternatively, the positive effect from *ex post* real interest rates could be interpreted in combination with the Divisia user-cost effect. Then the results suggest that the demand for Divisia money depends positively on its weighted own rate, and negatively on annual inflation as a proxy for the return on real assets.

The dynamic interactions between Divisia money and consumption (see the Appendix) are similar to those between personal sector M4 and consumption. In the short run, the demand for Divisia money is found to decrease when consumer spending rises. This provides additional evidence that a rise in consumption is initially financed by a reduction of transactions balances (as measured by the Divisia index), suggesting that transactions balances are used as a buffer against short-term fluctuations in spending. In the short run consumption function, however, there is a strong positive relation between Divisia money and consumption, as would be expected.[6] This means that an increase in personal sector Divisia money allows agents to spend more.

The estimated Divisia model for the personal sector may be used to assess the likely consequences of recent Divisia growth for future spending. The long-run relationships for Divisia and consumption allow us to derive proxies for the deviations of actual Divisia money and consumption from their respective desired equilibrium levels, which depend on the determinants of the long-run functions. Chart 2 shows how personal sector Divisia money and consumption interact in the long run; it appears that Divisia money (denoted by D) is generally above equilibrium (D*) when consumption (C) is below its equilibrium (C*). This may be

Chart 2
Personal sector: Divisia money and consumption relative to long-run equilibrium

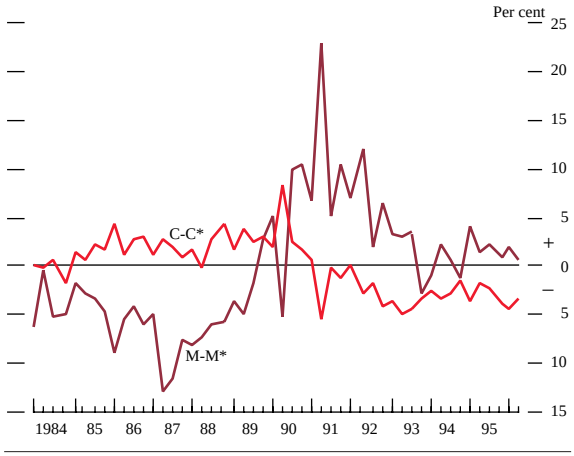


(1) FHP and Astley, M S and Haldane, A G (1995).
(2) See FHP.
(3) Thomas, R, *op cit*.
(4) This means that the coefficients on consumption and gross wealth add up to one.
(5) The three-month local authority rate is the benchmark interest rate on a non-monetary asset used in the construction of Divisia. See FHP for a discussion of the importance of the benchmark interest rate.
(6) The dynamic relationship between personal sector Divisia and consumption appears stronger than found in Astley, M S and Haldane, A G, *op cit*.

expected, because Divisia measures transactions money, which is likely to fall when spending increases and may rise when consumption is reduced.

The recent increase in average liquidity of personal sector M4 may be due to a portfolio shift towards more liquid assets. It is also in line with personal sector M4 balances having been above equilibrium for some time now, as Chart 3 shows (where M-M* indicates the deviation of personal sector M4 holdings from their equilibrium).(1)

Chart 3
Personal sector: M4 and consumption relative to long-run equilibrium



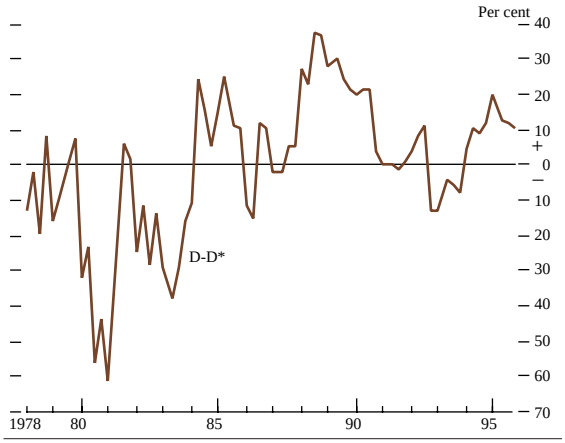
Industrial and commercial companies

The demand for Divisia money by ICCs is analysed in a similar framework to that used for ICCs' M4. This implies joint modelling of ICCs' demand for Divisia money with ICCs' investment and the real cost of capital.(2)(3) The estimates (see the Appendix) show that, in the long run, ICCs' real Divisia money is homogeneous in real GDP and also depends on the real cost of capital and the dual user-cost index of ICCs' Divisia money, which proxies the opportunity cost of ICCs holding wealth in liquid form rather than in non-monetary (interest-bearing) assets. The most distinctive result of the Divisia model for ICCs is the absence of wealth effects, which are unlikely to be as important for a measure of transactions money as they are for M4. ICCs' investment (measured by real whole-economy gross fixed capital formation) is modelled to be homogeneous in real GDP, and depends negatively on the cost of capital and the three-month Treasury bill rate, which proxies the return on short-term financial assets. The cost of capital is a constant in the long run, as it is in the model for ICCs' M4.

The real cost of capital has a strong negative effect on ICCs' demand for Divisia money. If a high cost of capital indicates an undervalued stock market, it may lead firms to expand their business by taking over other companies rather than by investing in real assets. The long-run Divisia function can be interpreted as suggesting that ICCs finance a considerable part of this take-over activity by drawing down transactions balances as measured by the Divisia index. The negative effect of higher short-term interest rates on ICCs' investment may indicate some substitution between real and financial investment, possibly due to wealth effects. The dynamics of the Divisia model for ICCs suggest that excess transactions balances have real effects. A positive shock to ICCs' demand for Divisia money reduces the cost of capital, which in turn increases investment in the short and longer term.

Chart 4 shows that ICCs' Divisia money (D) has been above its desired level (D*) almost continuously since 1987. Since the Divisia index proxies transactions money in the economy, the sustained excess liquidity of ICCs may feed into future spending (and into investment in particular) more directly than do excess M4 holdings,(4) part of which are also held for savings purposes. In general, the risks to nominal demand may materialise sooner when Divisia money is above its desired level than when M4 is above equilibrium, because of Divisia's nature as a proxy for transactions services.

Chart 4
ICCs' Divisia money relative to long-run equilibrium



Overall, the estimated sectoral Divisia models suggest that the demand for Divisia money is slightly less predictable than the demand for M4, although aggregate Divisia can be modelled more easily than aggregate M4.(5)

Summary

In the United Kingdom's current monetary framework, the major role of monetary aggregates is to provide information about future trends in nominal demand and inflation. The Bank's Divisia indices of transactions money weight the broad money components according to the liquidity services they provide. As measures of transactions money, Divisia aggregates may have a closer relationship with spending and inflation than do M0 and M4.

(1) Chart 3 is derived from the model for personal sector M4, as discussed in Thomas, R, *op cit*.
(2) Drake and Chrystal (1994) estimate the demand for ICCs' Divisia money with a single equation.
(3) Stockbuilding and mergers and acquisition activity, which may also partly explain ICCs' demand for Divisia money, are not specifically analysed in this system.
(4) Astley, M S and Haldane, A G, *op cit*.
(5) This is consistent with results reported in FHP.

The econometric analysis of personal sector and ICCs' demand for Divisia money—modelled jointly with other real and financial variables—largely corroborates the results for sectoral M4. But at a sectoral level the demand for Divisia money appears slightly less predictable than the demand for M4, reversing the findings at the aggregate level. The models for the personal sector and for ICCs may be used to draw inferences about the interaction between Divisia money and consumption, and between Divisia money and investment, respectively.

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Appendix

Estimates of the demand for Divisia money by the personal sector and ICCs

The analysis for M4 suggests that the demand for Divisia money is also best modelled at a sectoral level and jointly with other real and financial variables. The methodology used is the 'encompassing VAR' approach, which was described in detail for M4.[1]

Personal sector

Real personal sector Divisia money (D_p / P_c) is modelled jointly with real consumption expenditure (C). All real variables in the analysis of personal sector Divisia are deflated by the consumer price deflator (P_c). The estimated personal sector system also consists of: real disposable income (Y_d), real gross financial and tangible wealth of the personal sector (W_p / P_c), the user-cost index for personal sector Divisia money (ρ_p),[2] short-term interest rates (i) as measured by the three-month Treasury bill yield, and annual consumer price inflation (π_c). All data except interest rates are seasonally adjusted and *Ln* indicates the natural logarithm of a variable. The personal sector model is estimated over the sample period 1978 Q1 to 1996 Q1 and suggests that there are two long-run relationships in the data; one of them can be interpreted as a demand for Divisia money function and the other as a consumption function:

$$Ln\ D_p / P_c = 0.75\ Ln\ C + 0.25\ Ln\ W_p / P_c + 1.30\ (i - \pi_c) - 0.01\ Ln\ \rho_p$$

$$Ln\ C = 0.9\ Ln\ Y_d + 0.1\ Ln\ W_p / P_c - 0.44\ (i - \pi_c)$$

In the long-run relationships, Divisia money and consumption have been constrained to be homogeneous in the sum of consumption and wealth, and in the sum of disposable income and wealth, respectively. Weak exogeneity tests suggest that the dynamic relations for Divisia money and consumption can be modelled simultaneously. The resulting error-correction model consists of the following variables (with ECM_D and ECM_C denoting the deviations of actual Divisia money and consumption from their long-run levels, Δ indicating first differences and time subscript t):

$$\Delta Ln\ D_p / P_{ct} = -\underset{(0.37)}{0.69}\ \Delta Ln\ C_t - \underset{(0.14)}{0.23}\ \Delta Ln\ D_p / P_{ct-1} + \underset{(0.13)}{0.31} \sum_{i=0}^{1} \Delta Ln\ Y_{dt-i} + \underset{(0.05)}{0.18}\ \Delta Ln\ W_p / P_{ct}$$

$$+ \underset{(0.05)}{0.07}\ \Delta Ln\ W_p / P_{ct-1} + \underset{(0.04)}{0.11}\ \Delta Ln\ W_p / P_{ct-2} - \underset{(0.12)}{0.06}\ \Delta i_t - \underset{(0.14)}{0.36}\ \Delta i_{t-2} - \underset{(0.05)}{0.24}\ \Delta \pi_{ct} + \underset{(0.01)}{0.02}\ \Delta Ln \rho_{pt}$$

$$+ \underset{(0.01)}{0.02}\ \Delta Ln \rho_{pt-2} - \underset{(0.03)}{0.13}\ ECM_{Dt-1} - \underset{(0.30)}{1.28}$$

$$\Delta Ln\ C_t = \underset{(0.11)}{0.59}\ \Delta Ln\ D_p / P_{ct} + \underset{(0.07)}{0.23}\ \Delta Ln\ D_p / P_{ct-3} + \underset{(0.04)}{0.14}\ \Delta Ln\ Y_{dt} + \underset{(0.07)}{0.13}\ \Delta Ln\ Y_{dt-1}$$

$$- \underset{(0.04)}{0.14}\ \Delta Ln\ Y_{dt-2} + \underset{(0.03)}{0.05}\ \Delta Ln\ W_p / P_{ct-1} + \underset{(0.03)}{0.05}\ \Delta \pi_{ct} - \underset{(0.01)}{0.01}\ \Delta Ln \rho_{pt} - \underset{(0.05)}{0.21}\ ECM_{Ct-1} + \underset{(0.01)}{0.01}$$

Figures in parentheses are coefficient standard errors. The model is estimated under FIML and passes all misspecification tests, though sometimes only marginally. The standard errors of the equations are similar as in the M4 model, although the standard error of the dynamic Divisia equation is slightly larger than that for personal sector M4. This could imply that the demand for

(1) Thomas, R, *op cit*.
(2) The user-cost index for Divisia is constructed using the same weights as in the Divisia index of transactions money. It adds the weighted changes in the M4 component assets' opportunity costs to obtain the change in the user-cost index. This change can easily be transformed into the level of the user-cost index. The Divisia user-cost index should be interpreted as the weighted opportunity cost of transactions money as measured by Divisia.

Divisia money is less predictable than for M4, which may be explained by the imperfect approximation of the amount of transactions services in the economy that Divisia can provide.

ICCs

The model used for the demand for Divisia money by ICCs consists of: ICCs' real Divisia money (D_i / P_g) (all real variables are deflated by the GDP deflator P_g), real GDP (Y), real whole-economy gross fixed capital formation (I), a term in capacity utilisation (cu)—the percentage of firms reported to be working below capacity from the CBI survey, an equity based measure of the real cost of capital (c_k), the three-month Treasury bill rate (i), the dual user-cost index of ICCs' Divisia money (ρ_i), and annual GDP inflation π_g. The model for ICCs is estimated over the sample 1978 Q1 to 1994 Q4 and suggests that there are three long-run relationships in the data; one of them can be interpreted as a demand for Divisia money function, one as an investment equation and the other is the cost of capital (Divisia money and investment have both been constrained to be homogeneous in GDP):

$$Ln\ D_i / P_g = Ln\ Y - 10.18\ c_k - 0.53\ Ln\ \rho_i$$

$$Ln\ I = Ln\ Y - 1.75\ c_k - 0.44\ i$$

$$c_k = \overline{c_k}$$

We proceed with a three equation dynamic error-correction model for ICCs' demand for Divisia money, investment and the real cost of capital. ECM_D, ECM_I and ECM_C denote deviations of actual Divisia money, investment and the cost of capital from long-run equilibrium.

$$\Delta Ln\ D_i / P_{gt} = 0.82\ \Delta c_{kt-1} - 0.06\ \Delta Ln\ \rho_{it} - 0.04\ \Delta Ln\ \rho_{it-1} - 1.15\ \pi_{gt} - 0.96\ \pi_{gt-1}$$
$$(0.46) \qquad (0.04) \qquad (0.04) \qquad (0.44) \qquad (0.46)$$

$$- 0.31\ cu_{t-1} - 0.24\ ECM_{Dt-1} - 1.53$$
$$(0.05) \qquad (0.04) \qquad (0.26)$$

$$\Delta Ln\ I_t = 1.30\ \Delta i_t - 0.94\ \Delta i_{t-1} + 0.16\ \Delta Ln\ I_{t-1} - 0.11\ \Delta Ln\ \rho_{it}$$
$$(0.37) \qquad (0.28) \qquad (0.09) \qquad (0.04)$$

$$- 0.18\ cu_{t-1} - 1.23\ \Delta c_{kt} - 0.32\ ECM_{It-1} - 0.36$$
$$(0.03) \qquad (0.72) \qquad (0.06) \qquad (0.07)$$

$$\Delta c_{kt} = -0.01\ \Delta Ln\ D_i / P_{gt-1} + 0.21\ \Delta i_t + 0.15\ \Delta i_{t-1} - 0.21\ \pi_{gt-1} - 0.21\ \pi_{gt-2}$$
$$(0.02) \qquad (0.08) \qquad (0.09) \qquad (0.10) \qquad (0.10)$$

$$- 0.14\ ECM_{Ct-1} - 0.04\ ECM_{Dt-1} + 0.05\ ECM_{It-1} - 0.18$$
$$(0.06) \qquad (0.01) \qquad (0.02) \qquad (0.05)$$

Figures in parentheses are coefficient standard errors. The model is estimated under FIML and passes all misspecification tests. As for the personal sector the Divisia model for ICCs has larger standard errors than the M4 system.