The demand for money instability:  
Notes on the empirical literature

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Abstract
This study presents a critical assessment of money demand literature focusing on money demand instability. The main message of the overview is that, not only a dynamic mis-specification but also an invalid conditioning and a change in the relevant variable space (due to a policy regime change and/or financial innovation) should be taken as potentially complementary explanations of a money demand instability. These results are also interpreted in the context of the Lucas (1976) critique, tests for "super exogeneity" and econometric modelling methodology. Alternative economic theories often postulate not only non-nested systems for a given set of parameters of interest but also different partitioning of a variables in a given system into conditional and marginal processes. In this context, the paper emphasises the role of alternative adjustment mechanisms to a monetary disequilibrium in formulating a conditional money demand system.

1. Introduction
An empirical model is a conditional system, the variable space of which is chosen under a given theory prior maintained to explain the parameters of interest. Alternative economic theories often differ from each other not only by their conditioning hypothesis for the variables in a given system.

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but also by their postulates of non-nested systems for a given set of variables of interest. A money demand variable space provides an example of this. In the literature, whilst there appear to be no substantive differences of views about the components of a money demand variable space, there is controversy about the exogeneity/endogeneity status of the variables within this space. In the quantity theory framework, a money demand variable space is postulated to explain inflation conditioned upon exogenous nominal money growth. However, rejection of the long-run endogeneity of the price level in this variable space is consistent with a Keynesian argument which states that the system can be postulated to explain money conditioned upon the demand arguments.

The literature on money demand is large and several comprehensive reviews of it are available (see Judd and Scadding, 1982; Artis and Lewis 1990; Goldfeld and Sichel, 1990; Leventakis and Brissimis, 1991; Cuthbertson and Barlow, 1991; and Laidler, 1993); therefore we content ourselves here with a highly selective overview of the main points. Our focus is on the instability of conditional money demand equations specified for a given variable space across different policy regime periods. Section 2 presents a demand for money specification and a critical overview of the discussions of instability in money demand in the literature. The main message of the overview is that, not only a dynamic mis-specification but also invalid conditioning and a change in the variable space (due to a change in the economic environment) postulated to be relevant for the demand function should be taken as potentially complementary explanations of the instability. Section 3 discusses the exogeneity-endogeneity hypotheses and the corresponding adjustment mechanisms postulated for the variable space. As these hypotheses explicitly define (and are defined by) the "parameters of interest", one cannot obtain evidence from a given parameter space to compare the theories which assign different parameters of interest to the given variable space. In this section, the money demand instability due to a conditioning mis-specification in the case of a policy regime change is further discussed, and the results are interpreted also in the context of the Lucas (1976) critique. In the literature, a constant money demand equation conditioned upon the demand arguments is interpreted as evidence against the Lucas critique if the constancy is "invariant" to the changes in the conditioning variables (see Engle and Hendry, 1993). This section notes that such a result may become blurred if the variable space across the regimes is not the same; that is, if agents learn and adapt to the additional influences brought to bear by the regime change. Finally, Section 4 provides some concluding remarks.
2. Defining a money demand equation

Money is an asset which can be used also as a medium of exchange\(^1\). As a medium of exchange, the demand for money can be defined as an increasing function of the volume of transactions which can be proxied by income or wealth. Money is the unit of account both for nominal income and expenditure streams; therefore both the volume of transactions and money can be deflated by the same price index to give the real transactions demand as a function of real income (or wealth). As one of several assets in which wealth may be held, the speculative (or portfolio balance) demand for money is a decreasing function of returns on alternative assets. The alternative assets to a monetary aggregate \(M_i\) may include a wide array of financial instruments such as government bonds, bank deposits which are not included in the \(M_i\), and real assets like durable goods and real estate\(^2\). The transactions and speculative motives for holding a monetary aggregate may vary from one aggregate to another, and we can expect that the narrower the definition of the aggregate the higher the transactions motive and the lower the speculative motive.

In the literature there is a general agreement on the core variable space relevant for a money demand specification. In general, the demand for a monetary aggregate \(M_i\) can be defined as being determined in a variable space containing real income \((X)\) (transactions and precautionary demand), a representative interest rate \((R)\) for the opportunity costs in terms of the corresponding alternative assets, the own yield of the monetary aggregate \(M_i\) \((R_{M_i})\), and the expected rate of inflation \((\Delta P_t)\) representing the expected decline in the real value of the aggregate in terms of real assets due to...

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\(^1\) The classic studies for the transaction motive are the inventory-theoretic models of Baumol (1952) and Tobin (1956). Miller and Orr (1966) further developed the inventory approach by defining precautionary demand (based on the transactions motive) in a stochastic context. For the asset demand approach, the pioneering study is Friedman (1956). Recent accounts of this approach are provided by Friedman and Schwartz (1982) and Friedman (1987). The reviews of the literature on the motives for holding money and the implied money demand specifications are contained in Goldfeld (1987), McCallum and Goodfriend (1987), Artis and Lewis (1990), Cuthbertson and Barlow (1991) and Laidler (1993).

\(^2\) Note that in an open economy, the asset portfolio of economic agents includes also foreign financial instruments such as foreign currency and foreign currency denominated deposits in the domestic banking system. Therefore, the demand for a monetary aggregate may vary also in response to changes in the rates of return on foreign assets. This phenomenon is often referred to as currency substitution in the literature. It is beyond the scope of this study to discuss the possible implications of currency substitution on the empirical domestic money demand equations. Giovannini and Turtelboom (1994) and Özmenn (1994, Ch. 6) provide recent critical surveys of the currency substitution literature.
inflation. If we further assume that the demand is homogeneous of degree one in prices, then the long-run demand for real balances \((m^d - p)\), denoted as \(m^d\), can be specified as

\[
m^d = m^d = f(x, r, r_{min}, Ap^s) + \varepsilon
\]

where \(z^d\) is the vector of variables containing the demand arguments for \(m^d\), and \(\beta\) is the corresponding coefficient vector. The expected signs of the coefficients for the demand are given in parentheses below the variables. For a given \(z^d\), the long run money demand \(m^d\) can be defined as stable if the disequilibrium

\[
(m^d - p) - m^d_i = \varepsilon
\]

is stationary. If \((m^d - p)\) and each of the variables in \(z^d\) are non-stationary with the same order of integration, then the stationarity of the disequilibrium term in Eq. (2) indicates a cointegration between \((m^d - p)\) and \(z^d\). As cointegration implies (and, is implied by) an error correction mechanism (or, ECM) (see Engle and Granger, 1987), the disequilibrium term \(\varepsilon\) in Eq. (2) can be referred to as defining the ECM.

Despite the general agreement on the core variable space relevant for a money demand specification, the demand equations estimated for the periods up to the early 1970s failed to be stable thereafter for most of the industrialized countries (see Artis and Lewis, 1974; 1976 for the U.K., and Goldfeld, 1976 for the U.S.). There are ample potential explanations for the instability (see Judd and Scadding, 1982; Goldfeld and Sichel, 1990; Artis and Lewis, 1990; Leventakis and Brissimis, 1991; and Laidler, 1990a, 1993 for insightful documentations). These can be classified to contain three main interrelated categories: (i) mis-specified dynamics, (ii) invalid conditioning, (iii) a change in the variable space relevant for the specification of the demand.

\[\text{All lower case letters denote the natural logarithms (ln) of the corresponding capitals, except the interest rate. For the interest rate, } r = \ln(1 + R). \Delta \text{ denotes the first log difference.}\]

\[\text{Note that another potential explanation (complementary to these three) can be based on the definitions of the monetary aggregates themselves. A research agenda along this line is initiated by Barnett (1980). Barnett (1980) suggests that the components of a given (official) monetary aggregate should be weighted by the degree of their "liquidity" or "moneyness" to form a consistent series for money (Divisia aggregate; for further details on the approach, see Barnett (1990) and the literature cited therein). The Divisia aggregates, however, as pointed out by Laidler (1990b: 149) "have not performed better than conventional sums of various classes of deposits" for the data of countries possibly other than the U.S.}\]
For a given correctly specified set of determinants of demand, $z_{itd}$, dynamic specification is critical for the constancy of the estimated equation. In this context, the restriction of the dynamics in the conventional money demand models to the partial adjustment mechanism (PAM) can be taken as a potential reason for their instability (see Hendry and Ericsson, 1991a, 1991b; Baba et al., 1992 and the related literature cited therein). As the PAM can be encompassed by a general dynamic specification (see Hendry et al., 1984), the restriction is testable. However, dynamic misspecification alone may not be adequate to account for the instability. For the post-breakdown sample, attempts to "repair" the unstable PAM demand functions have often shown that not only a general dynamic structure but also additional variables may be needed to obtain a constant parameter model and to explain the instability (for an example, see Baba et al., 1992). This issue is related to (iii) and is discussed below.

Given that both the dynamics and the nominated variables to explain the demand ($z_{itd}$) are correctly specified, instability in a money demand equation corresponds to a case in which there is a shift either in supply or/and the processes generating the demand arguments. This is closely related to the conditioning hypothesis postulated for the variable space for demand. Particularly, if there is a change in the money supply process, such as a shift from an endogenous money supply process to an exogenous one, then a money demand equation obtained under the maintained endogenous money hypothesis can be expected not to remain stable. The pioneering approach to explain the money demand instability by such a conditioning mis-specification is provided by Artis and Lewis (1974, 1976). The instability of the equation in the case of a changing conditional process is consistent with the Lucas (1976) critique. Similarly, for the endogenous money case, the Lucas critique implies an unstable demand equation if there are changes in the processes generating the demand arguments. If the demand is stable while the processes generating the $z_{itd}$ are not, that is, if the arguments are "super exogenous" for the parameters of the demand, then the "invariance" can be taken as evidence against the Lucas critique (Engle and Hendry, 1993). Therefore, in the absence of (iii), both valid conditioning and correct dynamic specification are critical for the stability of a demand equation. In the following section, we will discuss the conditioning hypotheses postulated for the variable space defined for the demand and the corresponding adjustment mechanisms in detail.

Breakdown of money demand equations has generally coincided with a period of policy regime changes and financial innovation. Policy regime changes included not only an exchange rate regime change, but also
liberalization of money and capital markets (financial liberalization). Financial liberalization policies in most of the developing countries took the form of moving from a fixed nominal interest rate policy to a positive real interest rate policy. Furthermore, these policy regime changes have often been accompanied by relaxation of controls on international capital mobility, development of domestic financial markets and the introduction of new financial instruments. While the effects of policy regime changes such as movements to floating interest and/or exchange rate regimes can be analyzed in the context of (ii), they can also introduce new variables to the system defined for the demand. The omission of the "new" variables (that is, the specification of the demand in the variable space defined for the pre-change period) can yield the instability. That is, when the relevant "new" variables are omitted then the disturbances $\varepsilon$ in Eq. (2) can be expected not to be stationary without drift even in the absence of the explanations given by (i) and (ii).

The arguments presented up to this point suggest that the potential explanations given by (i), (ii) and (iii) should be considered as complementary rather than being alternatives. The following sections focus on (ii) and (iii) in the context of policy regime changes and adjustment mechanisms.

3. Demand for money as a conditional equation, policy regime changes and instability

Short-run monetary disequilibrium can arise either due to a change in the nominal money supply at the pre-existing levels of the demand arguments $z_i$, or due to a change in one or more of the variables in $z_i$ at the pre-existing level of the supply. The latter case corresponds to endogenous money where the nominal supply adjusts to changes $z_i$. In the former case, nominal money is exogenous and one or more of the demand arguments are postulated to adjust to the disequilibrium caused by the exogenous change. The exogeneity term we refer to is not "strong" but "weak" exogeneity (see Engle et al., 1983), since a feedback from the adjusting variables to the adjusted variable is precluded by neither of the cases. Note that, in the monetarist exogenous money case, the adjusting variable is the price level in

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the long-run (and, consequently, the interest rate through the Fisher relation), and a real income adjustment can take place only due to an unexpected money supply (hence price level) change in the short run.

Statistically, the partitioning of the variable space (system) \( z_t = (m_t, p_t, x_t, r_t, \Delta p_t) \) into endogenous \((z_1^1)\) and exogenous \((z_2^2)\) variables corresponds to the partition of the joint distribution of \( z_t = (z_1^1, z_2^2) \) into a conditional distribution for \( z_1^1 \) given \( z_2^2 \), and a marginal distribution for \( z_2^2 \) (see Engle et al., 1983). The partition of a system defines (and is defined by) the parameters of interest (the parameters of the maintained conditional process) conditioned upon the marginal processes. That is, the system is assigned to explain different parameters of interest corresponding to the partitioning hypotheses. Under the quantity-theoretical price adjustment hypothesis, the parameters of interest are the parameters of the price equation (or, the inverted real money demand \((m_t - p_t)\) equation for the endogenous variable \( p_t \)) and nominal money is postulated to be determined outside the system. In the polar opposite endogenous money case, the parameters of interest are the parameters of nominal money with the price level determined outside the system. An important implication of these arguments is that the variable space may not be taken as a sufficient base to corroborate and compare the hypothesis of rival frameworks on maintained parameters of interest. This is because, by construction, the space does not include the relevant variables of a conditional model of the alternative framework. That is, the system does not contain the relevant variables for inflation from a Keynesian (endogenous money) perspective and for nominal money from a monetarist perspective. Therefore, if the parameters of interest are either of these relations, the system does not provide the set of variables sufficient to compare the theory postulates. The rejection of a test of the conditioning hypothesis (testing for weak exogeneity), however, can show a need to build a conditional model considering the postulates of the alternative framework.

Existence of a cointegration relation amongst the demand arguments and money can encompass either direction of the causality. Therefore a stable long run money demand equation may be argued to be consistent both with the exogenous and endogenous money hypotheses. However, this argument may be valid only for a single policy regime. To discuss this and some other related issues, we consider the partition of the joint probability

\footnote{This is analogous to an argument that a correlation amongst nominal money growth and inflation is compatible both with the hypothesis that inflation is determined by money growth and with the hypothesis that money growth accommodates inflation.}
distribution of the variables in \( z \) (denoted as \( D(z_{i},z_{j}) \)) as a product of the conditional distribution of \( z_{i} \) given \( z_{j} \) \( (D(z_{i}/z_{j})) \) and the marginal distribution of \( z_{i} \) \( (D(z_{i})) \).

For \( i,j=1,2 \); the partition can be written as:

\[
D(z_{i},z_{j}) = D(z_{i}/z_{j})D(z_{j}) = D(z_{i}/z_{j})D(z_{j}).
\]  

(3)

For a single policy regime period, the stability of the joint distribution implies (and, is implied by) the stability of both of the partitions. As noted by Hoover (1991), in such a case, the two partitions are observationally equivalent. This can lend support to the argument that, for a single policy regime, a stable long run money demand equation such that \( \varepsilon_{i} \) in Eq. (2) is stationary without drift (cointegration) cannot be taken as a sufficient evidence against or in favour of an hypothesis on money endogeneity. This argument may be a controversial one, as stability is generally interpreted as evidence supporting the quantity-theoretical hypothesis with instability favouring the Keynesian alternative in the literature. The money demand stability, with nominal money being exogenous in the variable space defined for the demand is obviously a sine qua non of the monetarist policy prescriptions such as monetary targeting for inflation control. Consequently, a stable money demand with exogenous price level precludes the monetarist prescriptions at the outset. In this context, testing the exogeneity-endogeneity status of the variables in the system defined for the demand rather than a general notion of "money demand instability" may be more helpful in interpreting the validity of the postulates of the theories.

The cointegration approach offers a test for the conditioning hypothesis. Given that the demand arguments and money are cointegrated, the necessary condition for the long-run weak exogeneity of a variable for the parameters of the conditional model is the absence of the cointegration relation (or the ECM term) from the maintained marginal process for the variable in question (Johansen, 1992, 1995; Boswijk and Urbain, 1994 and Hendry, 1995b). This implies the non-rejection of an hypothesis that the marginal process is independent of the disequilibrium \( (\varepsilon_{it} = m_{it} - m_{it}^{d}) \) in Eq. (2). If the conditioning hypothesis is invalid, then the maintained conditional model can be unstable when there are changes in the processes generating the conditioning variables (Anderson and Mizon, 1989). As discussed below, this offers a potential explanation for the instability of the (conventional) money demand regressions.

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7 See also Hoover (1988: Ch.8) for a discussion of observational equivalence.
In the quantity theory framework, nominal money is exogenous only under freely floating exchange and interest rates. Thus, the conventional money demand functions with the real money conditioned upon the demand arguments can be hypothesized as to be stable by both the Keynesian and quantity theoretical frameworks if estimated for the fixed rates period. However, a policy regime change from fixed rates to a freely floating one may be expected to result in an unstable money demand function if money is exogenous. For the endogenous money case, on the other hand, demand can be expected to remain stable even in the case of a policy regime change if the conditioned variables are super exogenous for the parameters of the demand (Hendry and Ericsson, 1991a, 1991b). In the context of the partitioning given by Eq. (3), therefore, interventions in the processes generating \( z_t^\prime \) or \( z_t^\prime \) can be informative on the validity of the conditioning hypothesis.

The instability of a money demand function conditioned upon the demand arguments in the case of a change in the conduct of a monetary policy was first explained in terms of an invalid conditioning by Artis and Lewis (1974, 1976). In Artis and Lewis (1976), nominal money is exogenous and the adjusting money demand argument to a monetary disequilibrium is the interest rate in the short-run. The idea was later employed in the quantity-theoretical exogenous money-endogenous price level case where a real money demand function is postulated to be inverted to obtain a price equation conditional upon the exogenous money (Carr et al. 1985).

In general, for a given monetary aggregate \( m_t \), the adjustment of a demand argument \( z_{jtd}^d \) to a monetary disequilibrium \( (m_t - m_{td}) \) can be defined as

\[
\Delta z_{jtd}^d = g_j(m_t - m_{td}) + W_j \gamma_j + \omega_j
\]

In Eq. (4), \( W_j \) is the vector of exogenous or deterministic variables relevant for \( \Delta z_{jtd}^d \), \( \gamma_j \) is the corresponding coefficient vector and \( \omega_j \) is the error term. In the spirit of the Artis and Lewis (1976) approach, the adjusting variable in Eq. (4) can be taken as the interest rate \( r_t \). Furthermore, if we consider the cointegration relation \( \beta z_{td}^d \) assigned to the long run demand \( (m-p) \), earlier, then the adjusting variable can be taken as a function of the (lagged) disequilibrium (ECM) term \( (m_t - p_t - \beta z_{td}^d) \). If \( (m_t - m_{td}^d) \) is interpreted as the unexpected change in the money stock and the adjusting variable is defined as the price level, Eq. (4) gives a specification in line

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8 Hoover (1991) provides a detailed discussion of this issue in terms of money-income causality and empirical evidence.
with the quantity-theoretical endogenous price level-exogenous money supply buffer stock money approach. In the context of the ECM/cointegration approach, the price level can be hypothesised to adjust to the lagged ECM term. Several other adjustment mechanisms can be postulated (see Milbourne, 1988; Cuthbertson and Barlow, 1991; and Mizen, 1994 for surveys), including a specification which allows more than one adjusting variable (for example, Laidler and Bentley, 1983). However, the main conclusion appears to remain valid. That is, money demand instability can be the result of an invalid conditioning in the case of exogenous money when there is a change in the conduct of monetary policy.

In the endogenous money case, explaining the instability in terms of invalid conditioning may not be appropriate since the endogeneity, by definition, corresponds to the maintained hypothesis that the conditioning variables are determined outside the system. Furthermore, the unstable demand equations are the "conventional" specifications with money conditioned upon the demand arguments, therefore an "invalid conditioning" argument rejects the maintained endogeneity at the outset. While retaining the endogeneity, several alternative explanations in the context of instabilities in the maintained marginal processes can be suggested. One example is a change in the conduct of monetary policy, such as shifting from a policy of nominal income accommodation to a policy of interest rate accommodation, or vice versa. A promising alternative, which can encompass also a monetary accommodation rule change, is the shifts in the generating processes for the demand arguments. Cuthbertson and Taylor (1990) suggest instabilities in the expectations-generating equations for the demand arguments as an explanation for demand instability. Specific causes for such shifts may be perceived shifts in policy regimes, or sharp alterations in the time series behaviour of a demand argument. However, the most common result of the money demand estimations obtained by following the procedures outlined in Hendry and Ericsson (1991a, 1991b), Baba et al. (1992) and Hendry and Mizon (1993), is that money is endogenous and the demand remains stable even in the case when there are changes in the processes generating the conditioning variables. Consequently, the (unstable)

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demand arguments are interpreted as being "super exogenous" for the parameters of the money demand. As the constant parameters of the conditional money demand are not rejected to be "invariant" to the parameters of the non-constant marginal processes which are subject to policy regime changes, the result is interpreted as evidence against the Lucas (1976) critique. The super exogeneity of a demand argument (particularly the price level) precludes inversion of a real money demand function for the maintained marginal process. These results support the postulate that "price equations are not simply money demand equations on their heads" (MacKinnon and Milbourne, 1988). The instability of the "conventional" endogenous money demand equations, in this context, is explained in terms of the dynamic misspecification which is particularly the outcome of the partial adjustment hypothesis maintained.

The exogeneity-endogeneity status of variables in a system corresponds to the parameters of interest in the maintained conditional model. As the long-run cannot be taken as a cumulative sum of successive short-runs, the partition of the variable space for the long-run parameters of interest may not be supported by the same variable space if the partition is maintained as to be valid also for the short-run parameters of interest. The money exogeneity in the quantity theory framework is a long-run concept and a feedback from the demand arguments to the supply in the short-run is not precluded. Furthermore, as "only surprises matter", unexpected fluctuations in nominal money supply can yield fluctuations in the real variables such as real income in the demand arguments. Consequently, the neutrality of money which corresponds to the price adjustment hypothesis is a long-run phenomenon (or, is a phenomenon that can occur when there is no systematic expectational errors, if we consider the new classical arguments) in the quantity theory framework. The dynamic money demand models are generally specified to contain not only the long-run relation (through the ECM/cointegration term) but also to capture the short run effects of the variables postulated for the long-run relation together with the effects of the relevant stationary variables (and/or a stationary combination of non-stationary variables each of which are not cointegrated with the variables postulated for the long-run system). A feedback/feedforward relation amongst the variables is not precluded for a short run money demand model in the quantity theory framework. In this context, what is precluded in a short-run quantity-theoretical money demand model is not the weak exogeneity but the strong or super exogeneity of the demand arguments for the parameters of the equation. Therefore, it can be argued that the non-invertibility of a short-run money demand equation is not inconsistent
4. A change in the variable space, the Lucas critique and instability

A policy regime change can alter the stability of the joint probability distribution of the variable space not only due to changes in the partitioned relations given by Eq. (3) but also due to a case that the variable space itself may become inadequate to represent any of the conditional models. An example is the possible introduction of a set of new relevant variables to the maintained conditional model with a new policy regime. The developments of new types of monetary instruments and assets (either those included in the definitions of broader monetary aggregates such as certificates of deposits, foreign exchange-denominated deposits, or those not included such as the private sector securities by the development of domestic capital markets or foreign currencies in the case of currency substitution) can affect the demand (and, possibly also the supply). Similarly, financial innovations potentially affect the specification of demand as agents learn and adapt to use them\(^\text{12}\). When the relevant "new" variables introduced by the changes in the economic environment are omitted, then the disturbances \(\varepsilon\), in the long-run money demand equation (2) can be expected not to be stationary without drift.

The central message of the Lucas (1976) critique is that the agents are rational beings capable of learning and adapting to the environment in which they find themselves. This is why Sargent (1986: 2) argues that "models should let behaviour change with the rules of the game". If "the rules of the game" are the parameters of a constant variable space econometric model

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11 Note that, while the real effect of monetary fluctuations is explained by the expectational errors in the monetarist framework, Laidler (1982) suggests another explanation which is consistent with a Keynesian approach. In Laidler (1982: Chapter 2), price level stickiness is the reason for the real effects of exogenous monetary fluctuations (in the short-run) and therefore, for the non-invertibility of a short-run money demand equation.

12 Early studies on the effects of financial innovations are provided by Minsky (1957) and Artis (1961). These studies suggest that institutional innovations such as "industrial integration, the creation of new financial institutions whose liabilities are considered to be nearly good as money, the widening of formerly narrow markets ... and so on" (Artis, 1961: 356) and product innovations (such as "the provision of money substitutes". Artis, 1961: 356) can result in a velocity shift. Artis (1961) discusses the issue also in the context of financial adaptation and learning, and provides an early analysis of which is now called an "hysteresis" effect. Ireland (1995) provides a recent theoretical work on the possible effects of financial liberalization on the demand for money.
postulated by one or another economic school of thought, then an "invariance" to the changes of the rule precludes the case that the rational agents form expectations with respect to the attractor model (i.e. the "correct" model of the economy) and behave accordingly. In such a case, the "invariance" of the conditional model parameters to the changes in the marginal process with a policy regime can be taken as evidence against the Lucas (1976) critique as shown by Favero and Hendry (1992) and Engle and Hendry (1993). However, if the new policy regime introduces new variables to the system postulated for the conditional model, and if agents are capable of learning, therefore behaving accordingly, then the arguments against the Lucas critique which are based on a constant variable space across policy regimes may become blurred.

An example of a change in the relevant variable space associated with a policy regime change can be given by a shift from a fixed nominal interest rate policy to a positive real interest rate policy. In the literature, the fixed interest rate policy of most of the developing countries is often referred to as "financial repression" as the fixed rates generally involve negative real rates (McKinnon, 1991). The policy regime change can introduce a new variable, the time deposit interest rate, to the system for the conditional money demand equation. Consider a case that the sample contains both interest rate regime periods and the estimation results do not reject the significance of the interest rate in the constant parameter money demand equation. The marginal process (for the whole sample) for the interest rate will not be stable and this result can potentially be interpreted as the "super exogeneity" of the rate for the parameters of the demand. Testing the significance of a dummy variable relevant for the marginal process as a test for the "super exogeneity" will not be appropriate since the interest rate variable itself acts as a dummy variable (as it contains the fixed rates) in the money demand equation. Furthermore, including the interest rate for only the flexible period, again, will not be helpful for avoiding the dummy variable interpretation. If the introduction of the positive real interest rate policy can be interpreted as a change in the rules of the game, then the significance of the rate shows that economic agents have learned the environment and behaved accordingly.

An interesting example in this context can be given by the results of the influential article by Favero and Hendry (1992) on "Testing the Lucas Critique". In Favero and Hendry (1992), the Lucas critique is empirically refuted by considering the Baba et al. (1992) money demand model for the U.S. which contains not only "learning adjustment" variables for the new assets introduced but also interest rate variables which take nil values prior to their introduction (NOW and SuperNOW account rates). Furthermore, agents' behaviour is
contemporaneously and uniformly, the expected rate of inflation can be retained as the representative opportunity cost variable without including the interest rate, and the money demand equation can still yield constant parameters in the face of the policy regime change. In such a case, the constancy of the conditional model does not necessarily mean that the agents are invariant to the policy regime change. This is because the expected inflation rate, which can be interpreted as representing the opportunity cost in terms of real assets for the pre-policy regime change period, now represents the opportunity cost also in terms of the deposits.

There is a vast literature which shows that a stable money demand equation can be obtained only when the additional influences brought to bear by changes in the economic environment are taken into account. Recent examples include Muscatelli and Papi (1990) for Italy; Adam (1991) for the U.K.; Bordo and Jonung (1990) and Siklos (1993) for the U.K., the U.S., Canada, Sweden and Norway; Leventakis and Brissimis (1991) and Baba et al. (1992) for the U.S.; Viren (1992) for Finland; Choudhry (1994) for Argentina, Israel and Mexico; Juselius, (1994) for Denmark; and Melnick (1995) for Israel. Modelling the effects of financial innovations has been extremely difficult basically due to the lack of adequate data. In consequence, investigators have often used proxy variables or a time trend to take into account their effects on the demand for money (see, for a recent example, Arrou et al. (1995) for ten developing countries).

Changes in the policy regime and/or in the relevant variable space have recurrently led investigators to include dummy variables in their regressions to obtain empirically valid results. Dummy variables are of course a direct confession of ignorance, and their significance can indicate the instability of the underlying equation possibly arising from the omission of a set of relevant "new" variables. Unfortunately, there is a lack of consistency on the interpretation of the significance of a regime shift dummy variable in the money demand literature. Some investigators, correctly interpret a significant shift dummy as evidence against the constancy of the underlying equation during the sample period (see, for example, Juselius and Hargreaves, 1992). Some others ignore the presence of it when they present their equation as stable over different policy regime periods. Psaradakis (1993) and Hoffman

found not to be invariant also to a change in credit policy indicated by the significance of their "credit control dummy" in the regression. In the study, the "constancy" of the money demand equation, which contains dummy and dummy-like variables, in the face of changing marginal processes (for inflation and interest rate) is taken as evidence against the Lucas critique. The arguments presented in this study suggest that their result might be blurred by the inclusion of the new variables for the policy regime changes.
et al. (1995) provide two most recent interesting examples for the latter case. In Psaradakis (1993) an equation with eleven "regime-shift dummy variables" is interpreted as being "constant" in the face of regime changes. Hoffman et al. (1995) exclusively aim to investigate money demand stability. They argue that their study "provides strong evidence for the stability of long-run demand functions for narrowly defined money in five industrialized countries (U.S., Japan, Canada, U.K., and Germany) ....". However, "in all five countries a (mean shift) dummy variable ... is included in all regressions ... to allow for a possible break in the deterministic trends in velocities and interest rates ..." (322). Obviously, in contrast to their arguments (Hoffman et al., 1995: 321) their results provide further evidence supporting the hypothesis that the demand for money may not remain constant in the face of changing economic environment.

5. Concluding notes

Empirical money demand models have been the major focus of research especially during the last two decades, not only due to the theoretical advances intensified by the breakdown of the conventional equations, but also due to advances in econometric methods. With a well defined variable space, the demand for money has provided the base-line theory model to present and evaluate a new econometric method. Consistent with the Lucas critique, the variable space itself, however, has appeared not to remain stable in the face of changing economic environment. In consequence, the base-line theory model has often needed to be augmented by the new set of variables to obtain stable money demand equations.

Alternative economic theories often postulate non-nested systems for a given economic phenomenon. The theory prior restrictions postulate not only the variable space for a given set of parameters of interest, but also the partitioning of the space into conditional and marginal processes. A long-run money demand variable space provides an example. The variable space can be postulated to explain money conditioned upon the demand arguments under a Keynesian theory prior. In the quantity theory framework, under a flexible exchange rate and interest rate regime, the parameters of interest are the parameters of a price equation (or the inverted real money demand equation for the endogenous variable price level) and nominal money is postulated to be determined outside the system. In the absence of significant interventions to either money or price determination processes, these two rival partitions of the variable space into endogenous and exogenous variables are observationally equivalent. Thus, for a given policy regime, a stable
money demand equation is not necessarily in conflict with either of the rival frameworks. If the conditioning hypothesis is invalid, then the maintained conditional model may not remain stable in the face of a policy regime change. This offers a potential explanation for the instability of the conventional money demand equations estimated under the maintained money endogeneity hypothesis.

As invalid conditioning and dynamic mis-specification are both identified as potential sources of the money demand instability, a promising research strategy may be to commence the analysis from the joint density of the variables in a dynamic system and test for the identification restrictions (see, *inter alia*, Hendry and Mizon, 1993; Hendry and Doornik, 1994; Hendry, 1995a; Johansen and Juselius, 1994; Johansen, 1995; Boswijk, 1995 and Pesaran and Shin, 1995). As has been for the case for the traditional simultaneous equations modelling approach, the identification restrictions for the system are almost unavoidably tested under the axiom of correct specification14. As already discussed, the system is often defined under a given theory prior (i.e., under the axiom of correct specification for the maintained parameters of interest), hence it may not be consistent with the postulates of an alternative theory. A system containing money and the demand arguments provides an example. By construction, the system does not contain the relevant variables for inflation from a Keynesian perspective and for nominal money from a monetarist perspective; therefore, if the parameters of the interest are either of these relations, the system does not provide the right set of variables to compare the alternatives.

An important feature of the system analysis is that both the conditioning null to define the long-run variable space and the variable space itself are maintained to be the same through the short-run and long-run analysis. This may not be a valid restriction as the long-run is not the cumulative sum of successive short-runs. Furthermore, in the empirical literature, the partitioning of the system into conditional and marginal processes is maintained to be the same across different policy regime periods. As already noted, under the quantity theory prior, a policy regime change from fixed interest and exchange rates (endogenous money) to a freely floating one (exogenous money) may be expected to result in an unstable money demand equation. This hypothesis is yet to be tested within the system context in the

14 Our argument is consistent with Pesaran and Shin (1995: 2): “As with identification of simultaneous equations system a la Cowles Commission, it is important that these additional restrictions are obtained from our a priori knowledge of the long-run equilibrium relations, often characterized by economic theory”. See also Özmen (1994: Ch.8) for a detailed discussion of the issue.
Although explaining money demand instability by invalid conditioning lends support to the quantity theory, monetarists may be expected to embrace more willingly an explanation which allows them to justify their monetary targeting policy prescriptions during also the "endogenous" money periods. Inverted money demand equations, price-adjustment buffer stock money models, or the recent P-Star models (Hallman et al. 1991) are of little help to overcome this dilemma, since all of them are subject to invalid conditioning under the monetarist prior if the sample contains also fixed interest and exchange rate regime periods. The issues raised in this paper also question monetarists' reliance on money demand stability to justify their policy prescriptions. Without the stability of the equation for the ultimate target variable and the exogeneity of money for the parameters of this equation, monetary targeting policies are obviously meaningless. That is, the sine qua non of quantity-theoretical monetary targeting policy prescription to control inflation is not a stable money demand equation per se, but a stable inflation equation conditioned upon exogenous money.

It will come as no surprise to students of monetary economics that our study fails to find a constant variable space money demand specification which is stable over different policy regime periods in a continuously changing economic environment. There are ample potential explanations - "perhaps embarrassingly many" as noted by Goldfeld (1987: 623) - for the instability. The theoretical advances intensified by the difficulties with the conventional models and the advances in the econometric methods, however, has made a well-worn research field, the demand for money, once again an exciting and a promising one.

References


——— (1991), Money in Britain: Monetary Policy, Innovation and Europe, New York: Philip Allan.


——— (1991), "The Encompassing Implications of Feedforward versus Feedback


Özet
Para talebinin istikrarsızlığı: Ampirik yazın üzerine notlar