Claude Hillinger und Bernd Süssmuth:

# The Quantity Theory of Money is Valid. The New Keynesians are Wrong!

Munich Discussion Paper No. 2008-22

Department of Economics
University of Munich

Volkswirtschaftliche Fakultät
Ludwig-Maximilians-Universität München

# THE QUANTITY THEORY OF MONEY IS VALID--

# THE NEW KEYNESIANS ARE WRONG!

Claude HILLINGER* Bernd SÜSSMUTH**

Keywords: new Keynesian theory, quantity theory of money

JEL Codes: B22, E31, E41, E52

*Corresponding author
*University of Munich*
hillinger@lmu.de

***Munich University of Technology*
suessmuth@wi.tum.de

## ABSTRACT

We test the quantity theory of money (QTM) using a novel approach and a large new sample. We do not follow the usual approach of first differentiating the logarithm of the Cambridge equation to obtain an equation relating the growth rate of real GDP, the growth rate of money and inflation. These variables must then again be 'integrated' by averaging in order to obtain stable relationships. Instead we suggest a much simpler procedure for testing directly the stability of the coefficient of the Cambridge equation. For 125 countries and post-war data we find the coefficient to be surprisingly stable. We do not select for high inflation episodes as was done in most empirical studies; inflation rates do not even appear in our data set.

Much work supporting the QTM has been done by economic historians and at the University of Chicago by Milton Friedman and his associates. The QTM was a foundation stone of the monetarist revolution. Subsequently belief in it waned. The currently dominant New Keynesian School, implicitly or explicitly denies the validity of the QTM. We survey this history and argue that the QTM is valid and New Keynesians are wrong.

## 1. INTRODUCTION

In 1522 Copernicus testified before the Prussian diet regarding the principles of a sound currency. At the request of the king of Poland he put his observations into writing four years later. The key statement is: "Money usually depreciates when it becomes too abundant."

Regarding this first concise formulation of the quantity theory of money (QTM), the historian of economic thought Spiegel (1971) wrote:

> Copernicus's tract was not published until the nineteenth century and may not have had much influence on the thought of his contemporaries. In any event, his discovery, whatever its range and effect may have been, is especially remarkable because chronologically it antedates the large-scale movement of precious metals from America to Europe. By the power of reasoning and by the ability to invent fruitful hypotheses, a great mind may discover relations that ordinary people can recognize only if driven by the stimulus of observation. (p. 88).

The fame of Copernicus rests of course on his advocacy of the heliocentric hypothesis, not his advocacy of the QTM. The subsequent fate of these two hypotheses could not have been more different. The heliocentric hypothesis was fiercely opposed by the Church. The trial of Galileo, who had to renounce the hypothesis in order to avoid being tortured by the Inquisition, became one of the defining episodes of European history. The opposition of the Church was ultimately defeated and no sane person would today deny that the earth turns around the sun.

As indicated in the above quotation, the QTM encountered indifference rather than opposition. Belief in its validity has varied in the course of the history of economics and no stable consensus has emerged.

With the rise of classical economics the QTM was incorporated as a 'veil' that determined the general level of prices, while leaving relative prices untouched. David Hume ([1742], 1987) wrote: "All augmentation [of gold and silver] has no other effect than to heighten the price of labour and commodities;"[1] Like the other assumptions of classical and later neoclassical economics, the QTM was taken to be self evident and not in need of empirical verification.

During the first half of the Twentieth Century the QTM was impacted in opposite directions by two developments, the first empirical, the second theoretical.

The German hyperinflation of 1923-4 drew attention to the QTM as an empirical phenomenon. This was a time also of the increased availability of economic statistics coupled with a rising interest in the use of quantitative methods. The first empirical tests of the QTM

[1] The quotation is from Part II, Essay IV, Of Interest.

in relation to the German hyperinflation as well as other inflations began to appear. Studies of the QTM in relation to episodes of high inflation have continued to appear and they have uniformly tended to support the theory.[1]

With the rise of Keynesianism and later of monetarism, questions related to the role of money became intertwined with views about policy that were in turn influenced by ideological preferences. This intermixing of what is ultimately a purely empirical question with issues of policy, and increasingly also with assumptions about macroeconomic theory and methodology, has continued to the present. The issue is no longer being formulated as a purely empirical one of the validity of the QTM; instead, the question asked is whether monetary aggregates are of some use in predicting inflation and in formulating monetary policy, usually using a New Keynesian model for both purposes. Formulating the issue in this manner has not been conducive to finding an answer that is supported by robust evidence. The answers given have fluctuated widely with the bulk of opinion tending sometimes to one side, sometimes to the other.[2]

This instability of opinion calls for an explanation. One explanation is suggested by Dwyer and Hafer (1999). They first give the following list of authors who have more recently found a close association between changes in the nominal quantity of money and the price level; noting that the list could be extended: Lucas (1980), Dwyer and Hafer (1988), Barro (1993), McCandless and Weber (1997), Dwyer (1998).

They continue:

> Despite its long history and the substantial evidence, the predicted association between money and inflation remains disputed. One possible explanation for this seeming paradox is that the empirical relationship between money growth and inflation holds only over time periods that are so long that the relationship is uninformative for practitioners and policymakers, who are more concerned about inflation next month or next year. Some of the evidence above is based on average inflation rates and money growth rates over thirty years. If it takes a generation for the relationship between money growth and inflation to become apparent, perhaps it is not surprising that central bankers and practitioners put little weight on recent money growth.

The review of von Hagen (2004) comes to a similar, but more differentiated conclusion. He divides the work on the QTM into three broad categories: The first category involves work that is strongly empirical, usually employing regression analysis to determine the relationship between money growth and inflation. Here the finding is that the relationship is very strong in

[1] Capie (1991) reprints 21 such studies. A recent comprehensive study of many inflationary episodes is Fisher, Sahay and Vegh (2002).

[2] In an excellent survey of empirical and theoretical work on money, that is unfortunately available only in German, von Hagen (2004) assembled six recent statements of prominent economists that express completely contradictory opinions on the role of money.

the long run, with different authors defining the long run as covering from 5 to 30 years.[1] The shorter the time interval considered, the weaker this relationship becomes. The second category involves inferences by means of the VAR methodology. Here the statistical methods are more sophisticated and there are stronger prior assumptions involved, particularly regarding the specification of shocks that are presumed to drive the system. The tendency of the findings is the same as for the first category, but the relationships are weaker and there is a tendency to focus on the instability of the short-run effects of monetary changes. The third category considered by von Hagen is monetary theory. He first analyses how often the words 'money', or 'inflation' appear in the titles of the main articles of 7 leading journals between about 1970 and 2000. The finding is that those with 'money' declined sharply, while those with 'inflation' did not. The reason is that money does not play a role in the standard New-Keynesian (NK) model. As a standard reference for this kind of modelling, von Hagen cites Woodford (2003).

The NK model has become the standard of modern macroeconomics and is completely at odds with our (and other) empirical findings on the QTM. Either we are wrong, or there is something wrong with contemporary macroeconomics. Before exploring this conflict further, some explanatory remarks are in order.

All that any empirical investigation can directly demonstrate are associations between different kinds of observations that are either simultaneous, or separated by an interval of time. If these observations are persistent and widely observed, we tend to posit an explanation by attributing causality going from one set of variables *A*, to another *B*. The most common criterion for determining the direction of causation is the order of appearance of the observations. If *B* appeared after *A*, we may infer that *A* is the cause of *B*, never the opposite. Empirical investigations of the QTM have found that following an increase in the supply of money, the increases in expenditure and prices are fully realized only after several years. The universal belief among supporters of the QTM, including the present authors, has therefore been that causation runs from money to expenditure and prices. This conforms to our common experience that we tend to spend more if we have more money.

With these preliminaries out of the way, we turn our attention to the NK model. Our analysis will base primarily on the concise discussion of this model provided by Blanchard (2008). He begins with a brief history of macroeconomics since the '70s. The New Classicals are described as reacting to the perceived errors of the Keynesians. Blanchard describes their research program as follows:

[1] Far less often looked at is the correlation between money and nominal income. It is actually even higher than that between money and inflation. See Tables 1, 2 in Hafer (2001).

> Three principles guided the research: Explicit micro foundations, defined as utility and profit maximization; general equilibrium; and the exploration of how far one could go with no or few imperfections.

For the New Keynesian this went much too far:

> The new-Keynesians embraced reform, not revolution. United in the belief that the previous vision of macroeconomics was basically right, they accepted the need for better foundatiolls for the various imperfections underlying that approach. The research program became one of examining, theoretically and empirically, the nature and the reality of various imperfections, from nominal rigidities, to efficiency wages, to credit market constraints. Models were partial equilibrium, or included a trivial general equilibrium closure: It seemed too soon to embody each one in a common general equilibrium structure.

Blanchard describes how the NK model evolved into the current macroeconomic consensus:

> These joint beliefs are often presented in the form of three broad relations (I shall concentrate on a specific, more tightly specified, version, the so-called new Keynesian model, below): An aggregate demand relation, in which output is determined by demand, and demand depends in turn on anticipations of both future output and future real interest rates. A Phillips-curve like relation, in which inflation depends on both output and anticipations of future inflation. And a monetary policy relation, which embodies the proposition that monetary policy can be used to affect the current real interest rate…

The term 'monetary policy' above, though in line with common usage, is misleading since money does not appear in the model; 'interest rate policy' would be more accurate.

Under the heading 'A toy model; the new-Keynesian model' Blanchard begins his analysis of the currently standard NK model which he attributes to Clarida et al. (1999) and Woodford (2003):

> The model is simple, analytically convenient, and has largely replaced the IS-LM model as the basic model of fluctuations in graduate courses (although not yet in undergraduate textbooks). Like the IS-LM model, it reduces a complex reality to a few simple equations. Unlike the IS-LM model, it is formally rather than informally derived from optimization by firms and consumers. This has benefits and costs. The benefits are the ability to study not only activity, but also welfare, and thus to derive optimal policy based on the correct (within the model) welfare criterion. The costs are that, while tractable, the first two equations of the model are patently false (more obviously so than those in the more loosely specified IS-LM model)... The aggregate demand equation ignores the existence of investment, and relies on an intertemporal substitution effect in response to the interest rate, which is hard to detect in the data on consumers. The inflation equation implies a purely forward looking behavior of inflation, which again appears strongly at odds with the data. Still, the model yields important lessons, which could not be derived in the IS-LM model, and which are very general.

To anyone who has not been socialized into the culture of the contemporary macroeconomic mainstream this statement must be quite amazing. Blanchard celebrates the convergence of macroeconomic opinion on a model that in his own judgement incorporates assumptions that are empirically false. He then praises the model for the important conclusions that can be drawn from it. What is the nature of these conclusions? Evidently they apply to the model, not to reality.[1]

How can this sort of argumentation have become acceptable, as it evidently has in macroeconomics. The answer, which is also evident from Blanchard's paper, is that conformity has become the primary criterion for acceptance. Blanchard's own remarks are illuminating in this respect:

> Fifty years ago, Samuelson (1955) wrote:
>
>> In recent years, 90 per cent of American economists have stopped being "Keynesian economists" or "Anti-Keynesian economists." Instead, they have worked toward a synthesis of whatever is valuable in older economics and in modern theories of income determination. The result might be called neo-classical economics and is accepted, in its broad outlines, by all but about five per cent of extreme left-wing and right-wing writers.
>
> I would guess we are not yet at such a corresponding stage today. But we may be getting there.

The above perfectly illustrates the consequence of having conformity as the criterion of acceptance. Why should we assume that today's consensus will be any less ephemeral than the one preceding it?[2] Indeed, there was a consensus before Keynes that had assumptions similar to those much later adopted by RBC theorists. When conformity is used to determine validity, rather than objective criteria, the result is the alternation of fashions rather than the advance of knowledge.

Empirical work with the NK model has involved a combination of parameter estimation and calibration followed by the derivation of policy implications. Empirical validation of the model has not been part of the NK agenda. We know of three econometric attempts at evaluation of the standard NK model: Fair (2002) evaluated it in relation to his own macroeconometric model. Giordani (2003) used a VAR approach. Both authors find that the model is a poor representation of reality. Chari et al. (2008) argue that the New Keynesian model in its present form cannot be regarded as a valid structural model consistent with microeconomic evidence.

Formel-Kapitel 1 Abschnitt 1We discuss one more paper in the NK tradition because it refers directly to the empirical evidence on the QTM and argues that the usual (and our) interpretation that the QTM reflects causality going from money to inflation is spurious. Woodford (2007) uses the standard NK model to which he adds the following money demand function

[1] As a matter of pure logic, an incorrect argument can lead to a solution that is correct. However, in that case the correctness of the conclusion is unrelated to the argument.

[2] According to Blanchard himself, dynamic stochastic general equilibrium models (or DSGE's) are the hottest thing in macroeconomics today.

$$\log\left(M_t/P_t\right)=\eta_y \log Y_t-\eta_i i_t+\varepsilon_t^m . \quad (1.1)$$

The variables *P*, *Y* and *i* are all determined within the model, independently of *M*. The monetary shock $\varepsilon_t^m$ is i.i.d. Woodford states that this variable "exhibits little low-frequency variation" and that is has "substantial high-frequency variation". In fact, the variance of *any* i.i.d. variable goes to zero as the length of a moving average applied to it increases and "substantial high-frequency variation" can only mean that the disturbance has a high variance relative to other variables of the system.

Woodford calls (1.1) a demand equation, but it could equally be called a supply equation since he assumes that exactly the amount $M_t$ determined by (1.1) is supplied in each period by the central bank. Woodford does not explain how the central bank determines in each period what that period's monetary shock is.

Woodford uses his augmented model in simulations. The artificial data generated in this manner are subjected to either low-frequency, or high-frequency band pass filters. The QTM is then estimated by regressions using either low-frequency or high-frequency data. The QTM is clearly verified with the low-frequency data, but not with the high frequency data; a result analogous to what has been found with empirical data. Since money plays no causal role in in the NK model, Woodford concludes that one cannot infer from the empirical results on the QTM that money plays any role in an actual economy.

The first thing to note about Woodford's argument is that his results depend *solely* on the specification of (1.1), the rest of the apparatus that he deploys is irrelevant for this purpose. From that equation one sees immediately that if long-run averages are taken, the shocks will average out and the deterministic part of the equation will emerge clearly in the data. For the short-run, Woodford simply made the variance of the shocks sufficiently large so that the identification of the QTM is poor.

In the empirical section of this paper we show that the QTM fits well the data for 125 countries. If Woodford is to be believed, then the central banks of all of these countries have been following the policy postulated by Woodford. This is of course entirely implausible, particularly in view of the fact that they have never been advised by the New Keynesians that this is a policy that they *should* follow.

Woodfords explanation is similarly implausible for historical episodes. Following the discovery of the New World gold and silver began to flow first to Spain and then to the rest of

Europe, followed by major inflations. It was this experience that motivated the early advocates of the QTM.[1]

Mathematics can clarify a long and complex argument; it can also be used to obscure arguments that are rather simple. We conclude our discussion by contrasting simple verbal statements of the traditional QTM and Woodford's alternative.

The formulation of the QTM had gone hand in hand with the conceptualization of supply and demand.[2] A modern version of this analysis for the QTM goes as follows: When individuals have more money than they wish to hold, they try to reduce their balances by spending more. This does not change the stock of money in the aggregate, but it increases production and incomes if the economy is at less then full employment, or it leads to inflation at full employment, or a combination of the two. In either case the flow of nominal expenditures and incomes increases and with it the nominal demand for money. The process converges to an equilibrium at which the existing stock of money is also the desired one. If the stock of money is less than what is desired, an opposite process takes place.

Woodford's alternative has three parts: **a.** Money, though present everywhere, has no effect on anything. **b.** Even though money has no apparent function, individuals have a demand for it. This demand fluctuates substantially from period to period for unknown reasons. **c.** Whatever the demand for money in a given period, it is supplied by the central bank.

Woodfords theory does not appear to have been motivated by a desire to provide a better explanation of observed facts; rather, it is designed to immunise New Keynesian theory against them.[3]

If New-Keynesian models are as flawed as we think they are, how could they attain such a dominant theoretical position? The separation of much of economic theory from empirical reality has been a staple criticism since the beginning of economics. An interesting exchange on this subject took place recently in *Economists Voice*. A start was made by Bergman (2007) with an article titled: "Needed: A New Empiricism". This motivated a letter by Heigham (2007) who asked: "Why are Economists so Unscientific?" An answer was given in a further letter by Sällström Matthews (2008). We quote her elegant statement at some length:

> The scientific method consists of observing real world phenomena and finding the simplest model that can explain these observations. Since few economists are trained to do this, the theories they construct often do not satisfy Popper's criterion of falsification. […]

[1] Cf. Spiegel (1971, 86-92).
[2] Cf. Spiegel (1971, p.89).
[3] In the philosophy of science such an endeavour is known as 'saving the phenomena'. Plenty of references can be found on the Web.

The father of economic analysis, Alfred Marshall, noted that humans consume not only external goods but also internal goods, such as the satisfaction obtained from an elegant mathematical model. Thus a model which cannot be tested could still have value as an internal good. The taste for such an internal good is acquired. According to the Nobel Laureate Gary Becker such acquisition depends on the individual's private and social capital. In economics these would correspond to the individual's private skills and the number of other economists who possess the skills to appreciate their models.

When young economists enter the profession they must decide which "club" to join. If they acquire technical skills which enable them to join the "club" which produces theory for its own sake, their prospects will be greater the larger the number of economists who have already joined this particular "club." Those who join this "club" are, furthermore, those who can acquire these skills the most readily. Thus as economic analysis has become more technical, mathematicians have progressively realised that they have a future in economics. As this "club" has attracted more and more individuals who value technical elegance for its own sake, it has moved ever further away from addressing novel economic problems.

We hope that the preceding discussion supports our aim off empirically evaluating the QTM in the most direct manner possible and without the ballast traditional assumptions or the need to immediately make statements about policy relevance.

Our conclusion from this brief survey is that the long run relationship between money and inflation as well as nominal expenditure is well established and that the theoretical papers that cast doubt on the direction of causality from money to nominal expenditure and inflation cannot be taken seriously as empirical science. Our purpose in the following section is to strengthen this empirical finding further by evaluating the QTM in a simpler and more direct way than has been done in the past.

## 2. NEW EVIDENCE ON THE QUANTITY THEORYFORMELABSCHNITT 2

The simplest form of the QTM, also known as the Cambridge equation[1] is

(2.1) $$M = kY,$$

where $M$ is the money stock, $Y$ is nominal expenditure, in empirical applications usually identified with nominal GDP[2], A more usual form of the quantity equation is

(2.2) $$M = kPy,$$

where $P$ is a deflator and $y$ real expenditure. Taking logarithms and letting a dot stand for logarithmic differentiation, we obtain in proportional rates of change:

(2.3) $$\dot{M} = \dot{k} + \dot{P} + \dot{y}.$$

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[1] So named because it first appeared in an article by Cambridge economist A. C. Pigou (1917). The constant is referred to as 'Cambridge k'.

[2] In the original discussions of the QTM, $Y$ was taken to be total expenditure, including payments for goods that are traded many times. It was this conceptualization that led to the definition of $v = 1/k$ as 'velocity', i.e. the average number of times that a unit of currency changes hands in the course of transactions.

Looking at these equations without preconceptions, it should be clear that (2.1) is the proper starting point for testing the QTM. The usual method of regressing $\dot{P}$ on $\dot{M}$ is inferior for two weighty reasons. The first is that the simple regression does not take account of $\dot{y}$ and $\dot{k}$. The second reason is that the growth rates in (2.3) must be estimated by period to period, usually year to year, differences. As discussed above, this reduces the reliability of the relationships dramatically. To counteract this deterioration, the growth rates are then averaged over longer periods, amounting to a crude reintegration of the previously differentiated data. Unless one is specifically interested in the effect of $\dot{M}$ on $\dot{P}$ or $\dot{y}$, the entire procedure does not make sense. If the interest is in testing the QTM, the simplest and most effective method starts from (2.1).

The usefulness of the theory as an empirical regularity, rather than a mere tautology, depends on the stability of *k*. Suppose we have the time series $M^1,...,M^T$, $Y^1,...,Y^T$ and the derived coefficients $k^1,...,k^T$. The simplest measure of stability is simply the ratio

(2.4) $$\kappa = k^T / k^1 .$$

Relative to the usual comparison of the growth rate of the money stock with inflation, this test has several decisive advantages: **a.** Short-run variations in *k* are automatically averaged out. **b.** Even at low inflation rates, the variations in *M* and *Y* will be substantial over the entire range of a longer time series. **c.** The usual manipulations of the data, specifically the averaging of growth rates are avoided.

The statistic (2.4) does not eliminate transitory effects completely, since these are still contained in $k^1;k^T$, but it is to be expected that these effects will be small relative to systematic changes in *M* and *Y*. An improved statistic can be obtained by fitting a regression line of the $k^t$ against *t*. For each *t*, the point $\hat{k}^t$ on the regression line is an estimate of the equilibrium value of *k* at *t*. An improved estimate is therefore

(2.5) $$\hat{\kappa} = \frac{\hat{k}^T}{\hat{k}^1} .$$

In order to analyze (2.4) and (2.5) we draw data from NYU's Development Research Institute (DRI) Global Development Network Growth Database – Macro Time Series.[1] The series originate from the World Bank's Global Development Finance (GDF) & World Development Indicator (WDI) series. Our focus is on M2 (money and quasi money) as a percent of GDP time series.

[1] http://www.nyu.edu/fas/institute/dri.

The raw DRI series comprise 164 countries for a maximum period of 44 years from 1960 to 2003. The full list of included countries is given in the Appendix. If we adhere to the central limit theorem in combination with the empirical (three standard deviations outlier) rule, our distribution of measures (2.4) is based on the time series of 125 economies.[1]

The empirical distribution shows a mean value of $\kappa$ calculated according to (2.4) amounting to 1.57. The median $\kappa$ equals 1.53. Values range from 0.26 to 2.9. The implied standard deviation is 0.58.

We test the empirical distribution against a normal distribution with unity mean:

(2.6)
$$f\left(\kappa \mid \mu=1,\sigma\right)=\frac{1}{\sqrt{2\pi\sigma}}\exp\left(-\frac{1}{2\sigma^2}\left(\kappa-1\right)^2\right).$$

Asymptotic test statistics of the (i) Cramer-von Mises, (ii) Watson, and (iii) Anderson-Darling Tests can not reject the hypothesis that the data are generated by a normal distribution with unity mean. The estimated standard deviation is 0.82. The estimate is statistically significant at the one percent level.[2]

Figure 1 shows the kernel density (Silverman, 1986) of the obtained distribution for (2.4). In contrast to a histogram representation, this implies smoothing the empirical cross-sectional $\kappa$ values: The kernel density estimate of a set of values $K$ at a point $\kappa$ is estimated by

(2.7)
$$f\left(\kappa\right)=\frac{1}{Nh}\sum_{i=1}^{N}\Omega\left(\frac{\kappa-K_i}{h}\right),$$

where $N$ is the number of observations (here, $N = 125$) , $h$ is the bandwidth, and $\Omega$ is a kernel function that integrates to one. Here, we consider a Gaussian kernel, that is, $\Omega$ transforms $\left(\kappa-K_i\right)/h$ to

(2.8)
$$\Omega\left(\frac{\kappa-K_i}{h}\right)=\frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}\left(\kappa-K_i\right)/h\right).$$

We use the method suggested by Silverman (1986) to calculate the bandwidth $h$. It is solely based on sample size, standard deviation, and the interquartile range of observations. Figure 1 shows the kernel densities for the Silverman-bandwidth (solid line), half the Silverman bandwidth (dotted line), and 1.5-times the Silverman bandwidth (dashed line), respectively.

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[1] The vast majority of the countries identified as outliers are developing countries. In particular, for early points of the observation period (in most cases, only sporadically) these economies showed implausible high or low $\kappa$ values. In alphabetical order, the 39 excluded time series are: Bangladesh, Benin, Bolivia, Botswana, Burkina Faso, Cambodia, Chile, China, Cote d'Ivoire, Croatia, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Indonesia, Israel, Jordan, Kenya, (Rep.) Korea, Kuwait, Lao PDR, Malaysia, Mauritania, Morocco, Nepal, Nicaragua, Niger, Panama, Paraguay, Samoa, Saudi Arabia, Senegal, Seychelles, Thailand, Togo, Tonga, Uganda, and United Arab Emirates.

[2] An excellent survey of these statistics is given by Park (2006).

As can be seen from Figure 1, relying on the Silverman bandwidth (solid line) the expected value of $\kappa$ lies above unity but clearly falls below a value of 1.5. The distribution is unimodal and fairly normal.

Figure 2 below shows the histogram for our estimates of (2.5). The modal value is a clear-cut 1.0. Although again – as in the case of our (2.4) measures – both mean and median lie slightly above 1.5. Values range from 0.03 to 3.94. The implied standard deviation is 0.8. Standard tests fail to reject the hypothesis that the data are generated by a normal distribution with unity mean at the one percent level. The ML-estimated standard deviation is 1.02.

Figure 3 shows the corresponding kernel density estimates, where we used the same method as for our (2.4) measures.

Figures about here

## 3. THE IMPLICATIONS FOR MONETARY POLICYFORMELABSCHNITT 3

In this section we discuss how we view monetary policy in the light of our empirical findings as well as our theoretical views concerning the macroeconomy, as discussed in the introduction. Our principal conclusion is:

*The monetary authority should aim at letting the money supply grow at a constant rate given by*

(3.1) $$\dot{m}^r = \dot{p}^d + E\dot{y} + E\dot{k}$$

*where* $\dot{m}^r$ *is the long run money growth rate implied by the rhs of* (3.1), $\dot{p}^d$ *is the desired long run inflation rate,* $E\dot{y}$ *is the expected long term growth rate of the real economy and* $E\dot{k}$ *is the expected long term growth rate of the Cambridge constant. If no suitable estimate is available, the last term can be set equal to zero.*

This conclusion is based on the following considerations:

**a.** In the long run both $E\dot{y}$ and $E\dot{k}$ are fairly stable and $E\dot{k}$ is small. Following (3.1) as the monetary policy rule will lead to only modest deviations of the actual inflation rate from its desired level.

**b.** If (3.1) is not adhered to, the QTM is not put out of operation. Therefore, if over some period of time $\dot{m} > \dot{m}^r$, then for a subsequent period $\dot{m} < \dot{m}^r$ will be required if the target long run inflation rate is to be attained.

**c.** A policy such as described under **b** would be appropriate given some reliable knowledge both of the endogenous dynamics of the economy and of the implied rational stabilization policies. Given that such knowledge is not available even in rudimentary form, we agree with Friedman (1961, 1968) that attempted stabilization policies are more likely to add to instability.

**d.** A major component of contemporary macroeconomics is 'inflation targeting', which means that the central bank reacts to its short term inflation forecast. The problem here is that no distinction is made between demand induced and supply induced inflation, thereby ignoring the most fundamental distinction in economics. A supply induced inflation, such as is currently (2008) being experienced as a result of the increasing scarcity of oil and other natural resources, does not lead to a sustained inflation. In terms of domestic demand it is actually deflationary since, in the absence of new liquidity, there will be less spending on other sectors of the economy. The deflationary policy called for by inflation targeting will simply aggravate the depressed state of the economy.

For all of these considerations we feel that in the present state of knowledge the Friedmanian policy of constant money growth is best.

## CONCLUSION

Our findings largely confirm the original Friedman position on monetary theory and policy: The QTM is a stable relationship and the best monetary policy is one of letting the money stock grow at a constant rate.

## REFERENCES


Blanchard, Olivier J. (2008), The State of Macro. MIT Department of Economics Working Paper No. 08-12. vailable at: http://ssrn.com/abstract=1235536

Barro, Robert J. (1993), *Macroeconomics*, 4th ed. New York, Wiley.

Bergmann, Barbara R. (2007) Needed: A new empiricism, The Economists' Voice, 4, 2, Article 2. Available at: http://www.bepress.com/ev/vol4/iss2/art

Capie, Forrest H. (1991), *Major Inflations in History*, Edward Elgar.

Chari, Varadarajan V., Kehoe, Patrick J. and Mcgrattan, Ellen R. (2008), New Keynesian models: Not yet useful for policy analysis, *NBER Working Paper No. W14313.*

Dwyer, Gerald P. Jr. (1998), Is money a leading indicator of inflation? Unpublished paper, Federal Reserve Bank of Atlanta.

Dwyer, Gerald P. Jr. and Hafer, R. W. (1999), Are money growth and inflation still related? Federal Reserve Bank of Atlanta *Economic Review*, 84, 2, 32-43.

(1988), Is money irrelevant? Federal Reserve Bank of St. Louis *Review*, May/June, 3-17.

Fair, Ray C. (2002), On modeling the effects of inflation shocks, Contributions to Macroeconomics: 2, 1, Article 3.
Available at: http://www.bepress.com/bejm/contributions/vol2/iss1/art3

Fischer, Stanley; Sahay, Ratna; Végh, Carlos A. (2002), Modern hyper-and high inflations, *Journal of Economic Literature*, XL, 3, 837-880.

Friedman, Milton (1961), The lag in effect of monetary policy, *Journal of Political Economy*, 69, 5, 447−466.
(1968), The role of monetary policy, *American Economic Review*, 58, 1–17.

Giordani, Paolo (2003), On modeling the effects of inflation shocks: comments and some further evidence, Contributions to Macroeconomics: 3, 1, Article 1.
Available at: http://www.bepress.com/bejm/contributions/vol3/iss1/art1

Hafer, R. W. (2001), What remains of monetarism? Federal Reserve Bank of Atlanta *Economic Review* (Fourth Quarter), 13-33.

Heigham, David (2007), Letter: Why are economists so unscientific? The Economists' Voice: 4, 2, Article 5.
Available at: http://www.bepress.com/ev/vol4/iss2/art5

Hume, David ([1742], 1987), *Essays, Moral, Political, and Literary.* (Miller, Eugene F. ed.), Library of Economics and Liberty.
Available at: http://www.econlib.org/library/LFBooks/Hume/hmMPL27.html

Lucas, Robert E. Jr. (1980), Two illustrations of the quantity theory of money, *American Economic Review*, 70 (December), 1005-14.

McCandless, George T. Jr. and Weber, Warren E. (1995), Some monetary facts, Federal Reserve Bank of Minneapolis *Quarterly Review*, 19, 3, 2-11.

Park, Hun Myoung, (2006),Univariate Analysis and Normality Test Using SAS, STATA, and SPSS. Available at: www.indiana.edu/~statmath/stat/all/normality/normality.pdf

Pigou, A. C. ([1917], 1951), The value of money, *Quarterly Journal of Economics*, 32, 38-65. Reprinted in: Lutz, Friedrich A. and Mints, Lloyd W. (eds.), *Readings in Monetary Theory,* Homewood, Ill. Richard D. Irwin.

Sällström Matthews, Susanna (2008), Letter: Why are economists indeed so unscientific? The Economists' Voice: 5, 3, Article 6.
Available at: http://www.bepress.com/ev/vol5/iss3/art6

Samuelson, Paul (1955), *Economics*, 3rd ed. New York, McGraw-Hill.

Silverman, Bernard W. (1986), *Density Estimation for Statistics and Data Analysis*, London, Chapman and Hall.

Spiegel, H. W. (1971), *The Growth of Economic Thought*, Englewood Cliffs, NJ. Prentice-Hall.

von Hagen, Jürgen (2004), Hat die Geldmenge ausgedient? *Perspektieven der Wirtschaftspolitik*, 5, 4, 423-453.

Woodford, Michael (2003), *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press.
(2007), Does a "two pillar Phillips curve" justify a two-pillar monetary policy strategy? *Working Paper*, Columbia University.

## APPENDIX: COUNTRIES IN THE GLOBAL DEVELOPMENT NETWORK GROWTH DATABASE (DRI, NYU)

Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Azerbaijan, (the) Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, (Dem. Rep.) Congo, (Rep.) Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, (Arab Rep.) Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Gabon, (the) Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, (China) Hong Kong, Hungary, Iceland, India, Indonesia, (Islamic Rep.) Iran, Iraq, Israel, Jamaica, Japan, Jordan, Kazakhstan, Kenya, (Rep.) Korea, Kuwait, Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, (China) Macao, FYR Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, (Fed. Sts.) Micronesia, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, Antilles, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russian Federation, Rwanda, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Switzerland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United States, Uruguay, Vanuatu, (RB) Venezuela, Vietnam, (Rep.) Yemen, Zambia, Zimbabwe

Figure 1.

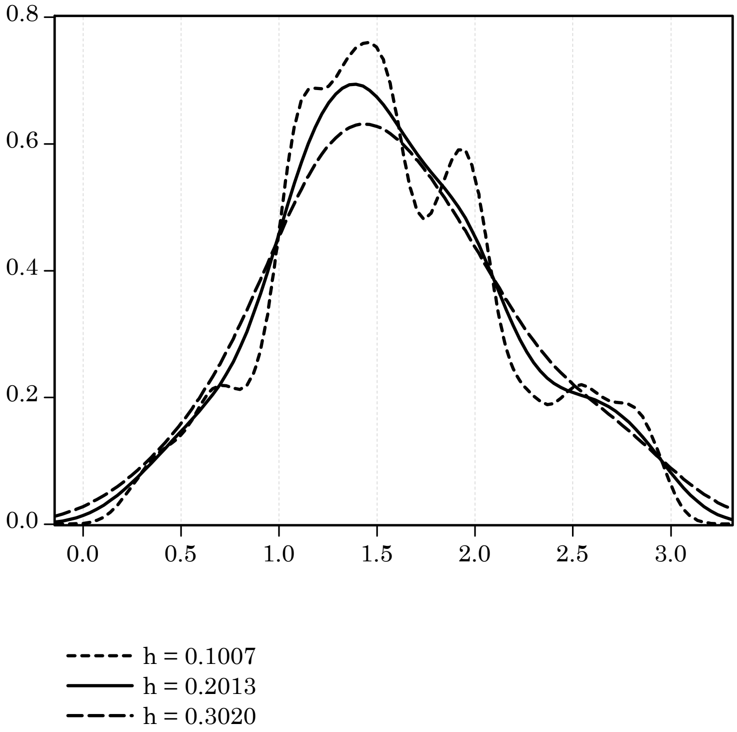

Figure 2.

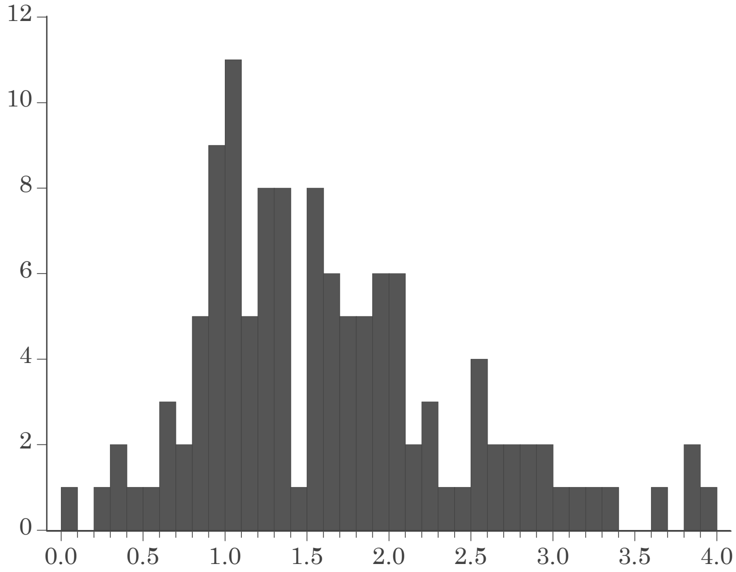


Figure 3.