The Quantity Theory of Money: An Assessment of its Real Linchpin Prediction

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Abstract

This study approaches the Quantity Theory of Money at a conceptual level, asking how it can be most reasonably interpreted and quantitatively assessed. The resulting approach is straightforward. Unlike studies relying on other methods we find evidence of its linchpin prediction that is not limited to periods of high inflation.

JEL-Code: B22, E31, E41, E52.

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1. INTRODUCTION

The quantity theory of money (QTM) is the oldest quantitative relationship that has been considered in economics. It also has the longest history of investigation by quantitative methods. In spite of all of the intellectual and empirical efforts that have been devoted to it, the validity of the QTM has remained controversial and the role that it has played in macroeconomic theory and policy has fluctuated largely over time. We believe that this unsatisfactory performance is due to deficiencies in how the empirical work on the QTM was done.

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

(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) $$M = kPy,$$

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

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

Empirical work on the QTM has invariably been done in relation to (3) because it contains the variables of greatest interest, $\dot{M}$ and $\dot{P}$. Usually, episodes of high inflation were selected for these studies since the large variations in $\dot{M}$ and $\dot{P}$ could be expected to dwarf variations in $\dot{k}$ and even in $\dot{y}$. Studies of this type have found a rough equality of $\dot{M}$ and $\dot{P}$ and interpreted this as a confirmation of the QTM. The collection edited by Capie (1991) offers good examples. The exclusive concentration on periods of high, or at least moderately high, periods of inflation is somewhat unsatisfactory since nothing in the conceptual derivation of the QTM suggests such a limitation.

More recent studies focus on testing an explicit null hypothesis that is taken to be the implication of the QTM: It is that k must be constant, or equivalently that $\dot{M} = \dot{P} + \dot{y}$. As

[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.

representative of this approach we take the papers of Moroney (2002) and Brumm (2005). Both use the same dataset of 81 countries over the period 1980-1993. Moroney finds:

> The quantity theory predicts inflation with stunning accuracy for all countries experiencing actual inflation greater than 60% but less accurately of 16 OECD countries characterized by low money growth. These results strongly suggest that high long-run inflation is driven by equally high long-term money growth. The relation is essentially one for one. But to forecast inflation within an important group of countries marked by low long-run money growth, the one-for-one relation breaks down.

A fundamental criticism that we level at both papers is their focus on testing an exact version of the QTM. In our formulation this is equivalent to asserting the constancy of the Cambridge coefficient. We argue that this assumption, derived from a thought experiment, is implausible when applied to an empirical time series. Moroney had falsely thought that he could confirm this version. Brumm was able to get a significant result, but only in a more complex model incorporating a dependence of real GDP growth on money growth. Both papers thus fail in validating a traditional form of the QTM.

We view the empirical work done on the QTM based on equation (3) as being methodologically flawed. Differentiation of the theoretical equation leads to the requirement that series are logarithmically differentiated, thereby creating an instability that must in turn be reduced by averaging the differenced observations over long periods. The differentiation is in effect reversed by a crude ad hoc form of numerical integration. Ultimately the issue is the stability of k, and this can be investigated much more directly and efficiently in relation to (1) than in relation to (3).

A further problem with the standard approach is that the statistical agencies have not employed methods for computing inflation that can be justified from a theoretical point of view (Hillinger, 2008). The decomposition (2) of nominal expenditure is therefore also problematic.

2. NEW EVIDENCE ON THE QUANTITY THEORY

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

(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 (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

$$\hat{\kappa} = \frac{\hat{k}^T}{\hat{k}^1} \tag{5}$$

In order to analyze (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 nominal GDP time series. We rely on a subsample of the raw DRI series for which we have reliable data that comprise 125 countries for a maximum period of 44 years from 1960 to 2003.

Figure 1 shows the histogram for our estimates of equation (5). Both mean and median lie slightly above 1.5, the modal value is a clear-cut 1.0.

As our measure of stability we take the average rate of change of *k* over the interval. It is derived from:

$$\hat{\kappa} = \frac{\hat{k}^T}{\hat{k}^1} = \exp T\dot{k}\,. \tag{6}$$

The average growth rate of *k* is therefore given by

$$\dot{k} = \frac{\ln \hat{\kappa}}{T}\,. \tag{7}$$

Figure 2 provides a histogram of the distribution of $\dot{k}$ in our sample. The mean is 0.016, the median 0.015, the std. dev. is 0.028 and the associated range around the mean is (-0.012, 0.044). We interpret these values as showing that *k* is sufficiently stable for the purpose of monetary policy. This will be elaborated in the next section.

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

3. IMPLICATIONS FOR MONETARY POLICY

For the purpose of this section we reinterpret equation (3) as

$$\dot{m}^r = \dot{p}^d + E\dot{y} + E\dot{k} \quad , \tag{8}$$

where $\dot{m}^r$ is the long run money growth rate required to validate the rhs of (8), $\dot{p}^d$ 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. The empirical results of the previous section show that when this is done, the resulting error in $\dot{m}^r$ and hence in $\dot{p}^d$ will be 1.6 percent in the mean and in the range (-1.2, 4.4) percent for around two thirds of all countries. Furthermore, it should be possible to reduce these errors substantially by basing the estimate of $\dot{m}^r$ on econometric estimates of $E\dot{k}$ such as those of the present paper.

Over the past decades central banks, particularly in the United States, have pursued policies for the active short-term stabilization of the macroeconomy. They thereby hindered the natural process of using recessions to rectify the imbalances created during the preceding boom. Imbalances could therefore build up over several cycles, resulting in the current deep financial/economic crisis. This experience, along with the stability of the QTM relationship that we have demonstrated, suggests a return to a Friedmanian position[1] on monetary policy: *The money supply should be expanded at a constant rate that in accordance with the QTM equation would yield the desired long-run inflation rate.*

4. CONCLUSION

Empirical work in economics is too often done with a heavy load of prior commitments, either to some particular economic theory or to some specific econometric method. We have first of all approached the QTM at a conceptual level, asking how it can be most reasonably interpreted. Then we asked for the simplest possible way to quantify it. The resulting approach is straightforward, and in our view superior to methods that have thus far been employed. Unlike the usual methods, ours is not limited to periods of high inflation. In our sample of 125 countries, we found the QTM to be a relationship that is stable over long periods and therefore suitable for the conduct of long-range monetary policy.

[1] See Friedman (1961, 1968).

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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.
Distribution of κ

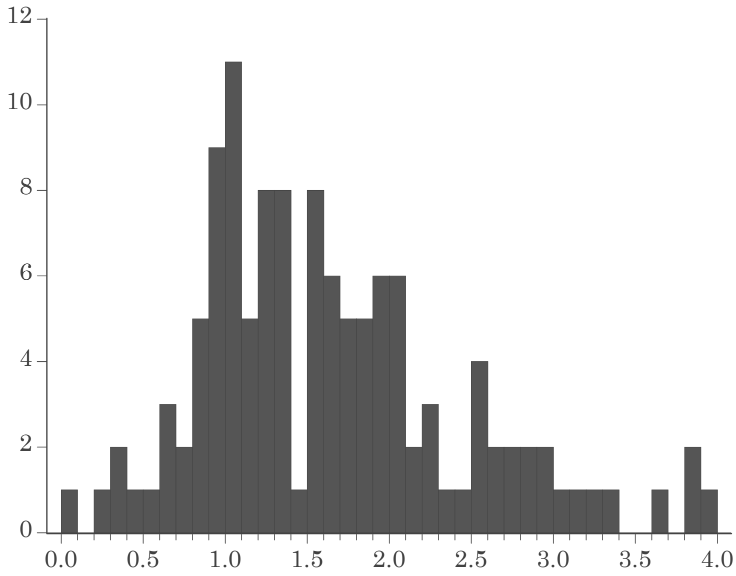
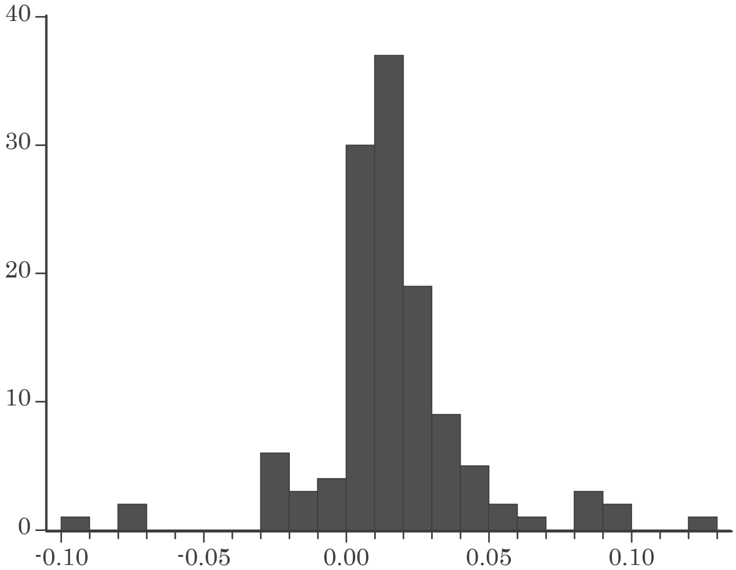


Figure 2.
Distribution of $\dot{k}$



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