

SAE./No.224/December 2022

Studies in Applied Economics

**ON THE QUANTITY THEORY OF MONEY:
SOME MONETARY FACTS**

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Johns Hopkins Institute for Applied Economics,
Global Health, and the Study of Business Enterprise



On the Quantity Theory of Money: Some Monetary Facts

By Steve H. Hanke, Zixiang Ma, Ruiyuan Cheng

About the Series

The *Studies in Applied Economics* series is under the general direction of Prof. Steve H. Hanke, Founder and Co-Director of The Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise (hanke@jhu.edu). The views expressed in each working paper are those of the authors and not necessarily those of the institutions that the authors are affiliated with.

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On the Quantity Theory of Money: Some Monetary Facts

Part 1: Introduction

In his 1985 monograph *The Problem of Stagflation*, Gottfried Haberler clearly states and supports the monetarist position:

First, let me make it quite clear that I fully agree with the monetarists that inflation, including stagflation, is basically a monetary phenomenon, in the sense that there has never been a significant inflation or stagflation—prices rising, say, by 4 percent or more a year for two or more years—without a significant growth in the stock of money. This is an empirical proposition. Exceptions are thinkable. For example, if as a consequence of war or revolution or a series of disasters output declined sharply, prices would rise sharply even with a constant quantity of money. But I cannot think of cases where that has happened in modern times. True, wartime inflations have been aggravated by a drop in output, but the great bulk of the price rise in wartime has always been caused by an increase in the money supply to finance government deficits.

The velocity of circulation of money is, of course, subject to change. Apart from extreme circumstances, however, such as hyperinflation or wartime price control and rationing, the changes in velocity are not large enough to invalidate the basic proposition of the quantity theory as stated above. (Haberler 1985, p. 13).

Part 2: The Minneapolis Fed Study

In 2001, George T. McCandless and Warren Weber, writing in the *Federal Reserve Bank of Minneapolis Quarterly Review*, produced an empirical study “Some Monetary Facts” that fully supports Haberler’s wise observation. In their article, McCandless and Weber studied the relationship between changes in the money supply and changes in the price level. Their methodology was as follows:

This study is based on time series data for 110 countries. For each country, we calculate the long-run (up to 30 years) geometric average rate of growth for the standard measure of production, gross domestic product adjusted for inflation (real GDP); a standard measure of the general price level, consumer prices; and three commonly used definitions of money (M0, M1, and M2). We also look for correlations over two specific subsamples of countries. One of the subsamples consists of 21 OECD countries; the other consists of 14 Latin American countries. The countries within each of the two subsamples are more homogeneous than

those in the full sample in terms of available technology, education, and level of development of financial (and other) institutions. We consider the findings from these subsamples as a crude test of robustness of our full sample facts.

The data we use come from the CD-ROM version of the International Monetary Fund's International Financial Statistics (IFS). The period we consider is from 1960 to 1990. For each country with 10 or more years of data (110 countries), we calculate the geometric rate of growth for consumer prices (line 64 of the IFS tables); three definitions of money—M0, currency plus bank reserves (line 14); M1, money easily used in transactions (line 34); and M2, money easily used in or converted into use for transactions (the sum of lines 34 and 35)—and real GDP. The growth rate of real GDP is calculated by subtracting the growth rate of consumer prices from that of nominal GDP. (McCandless and Weber 2001)

The authors found that there is a high correlation between the rate of growth of the money supply (for both narrow and broad measures of the money supply) and the rate of inflation. As presented in Table 1, the correlation coefficient between the rate of change of the money supply growth rate (in M0, M1, M2) and the inflation rate (measured by CPI) is 0.925 or higher. The growth rate of broader definitions of money (M1 and M2) is slightly more correlated with inflation rates than M0. The authors also note that their finding of a strong, positive correlation between the growth rate in the money supply and the inflation rate is consistent with previous research including studies done by Vogel (1974), Lucas (1980), Dwyer and Hafer (1988), Barro (1990), Pakko (1994), Poole (1994), and Rolnick and Weber (1994). McCandless and Weber stated:

Vogel (1974, p. 112) finds that ‘an increase in the rate of growth of the money supply causes a proportionate increase in the rate of inflation within two years.

Lucas (1980) applies filters that progressively emphasize the long-run relationship in U.S. data between M1 and the consumer price index. He finds that the relationship becomes more regular, with a coefficient closer to one, the more the filter stresses the low frequencies (the long-run relationships). Lucas (1980, p. 1005) claims that the low-frequency relationship he finds represents ‘one way in which the quantity-theoretic relationships can be uncovered via atheoretical methods from time-series which are subject to a variety of other forces.

Dwyer and Hafer (1988, p. 9) find that ‘countries with higher money growth on average similarly have higher rates of inflation.

Barro (1990, p. 155) finds a ‘strong positive association across countries between the average rates of price change and the average rates of monetary growth.

Poole (1994) finds a strong positive relationship between the rate of inflation and the average annual change in a broad measure of money per unit of real GDP.

Pakko (1994) examines the relationship between money growth and inflation for 13 countries that were formerly Soviet republics. He finds that countries ‘with the highest rates of inflation tend to be those with the most rapid money growth rates.

Rolnick and Weber (1994) use long-run average rates of growth to study the relationship between money and inflation under commodity and fiat monetary regimes. They find that the correlation between money growth and inflation is almost unity for fiat money regimes, but much lower, 0.61 or less, for commodity money regimes. (McCandless and Weber 2001).

**Table 1: Correlation Coefficients for Money Growth and Inflation
(Based on Data from 1960 to 1990)**

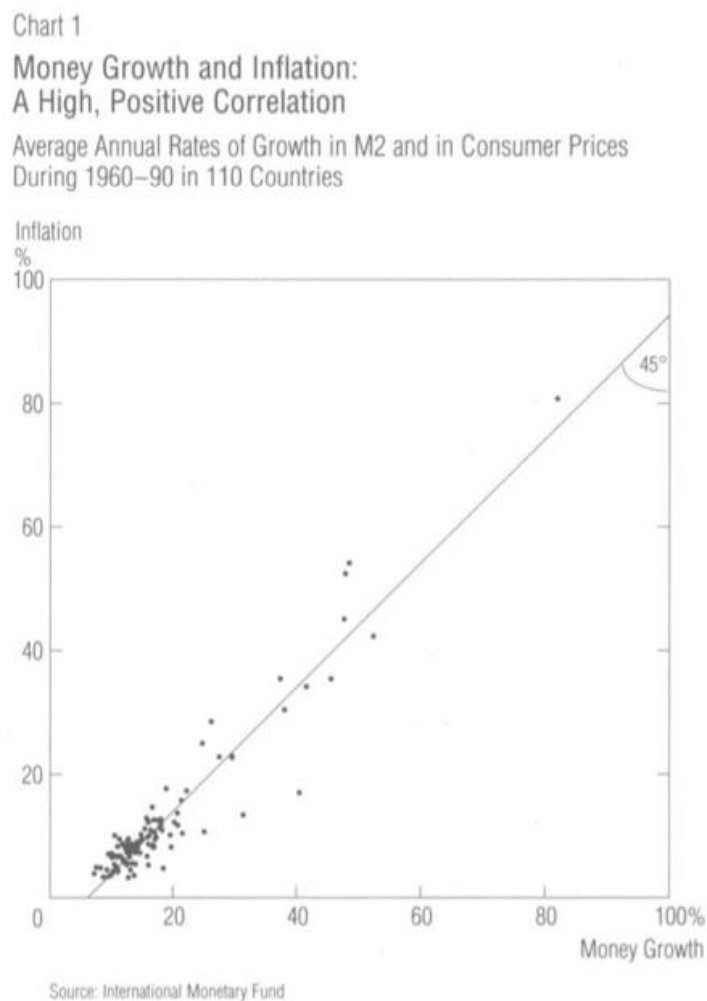
Sample	Coefficient for Each Definition of Money		
	M0	M1	M2
All 110 Countries	0.925	0.958	0.950
Subsamples			
21 OECD Countries	0.894	0.940	0.958
14 Latin American Countries	0.973	0.992	0.992

Source: McCandless and Weber (2001)

The authors present a scatter diagram of the relationship between the growth rate of the money supply and inflation of the 110 countries studies:

We plot average rates of change of the M2 definition of the money supply and average rates of change of consumer prices for the full 110-country sample. Each point in the chart represents the observations on money growth and inflation for a particular country. In the chart, we have also

drawn a 45-degree line through the grand means of the observations.
(McCandless and Weber 2001).



Source: McCandless and Weber (2001)

The authors refer to the equation of exchange $MV=PY$ (where M = money supply, V = velocity of money, P = price level, Y = real GDP) and the growth rate form of the equation of exchange ($m + v = p + y$, where the lowercase letters represent growth rates given as percentage changes). Assuming that v and y are constant, the growth rate form of the equation of exchange implies a linear relationship between the variables m and p . If that assumption held, the origin of the 45-degree line would be at the intercept $(0,0)$. As the data in Chart 1 show, the 45-degree line that has been drawn through the grand means of the 110 observed countries intercepts the x-axis at near-0. This implies that velocity and real output growth are very close to being constant, and that the money supply growth rate and inflation have a near one-to-one relationship. These results, among other things, confirm the observation and endorsement of monetarism by Gottfried Haberler.

Part 3: An Update of the Minneapolis Fed Study

Applying McCandless and Weber's methodology, we update their work using data from the three decades following their publication.

The source of our data is the IMF International Financial Statistics Database. The period we consider is from 1990 to 2021. The raw dataset included five series: price levels (CPI index), inflation (annual inflation rates measured by the CPI index), M2 old (M2 money supply in old IMF presentation before and including 2000), M2 new (M2 money supply in new IMF presentation after 2000), and M2 all (the combination of M2 old and M2 new). For each country with 20 or more years of data (147 countries), we calculate the geometric rate of growth for consumer prices and M2, money held by the public that can be easily used in transactions.

Our study is based on time series data for 147 countries. For each country, we calculate the long-run (up to 30 years) geometric average rate of growth for consumer prices and the M2 definition of money and the correlation between the two. We also calculate correlations between the growth rate in the money supply and inflation over four specific subsamples of countries, including a subsample consisting of 28 OECD countries, a subsample consisting of 33 Latin American countries, a subsample consisting of 28 former communist countries and China (29 countries in total), and a subsample consisting of the BRIC countries (Brazil, Russia, India, and China).

Our findings are remarkably similar to those of McCandless and Weber. For all 147 countries, we found a correlation of 0.94 between the M2 growth rate and inflation; whereas, McCandless and Weber found a correlation of 0.95 for their sample of 110 countries (see Table 2). The evidence from the subsamples of OECD countries, Latin American countries, former Communist Countries, and BRIC countries, also shown in Table 2, confirms the tight linkage between changes in the money supply and inflation. For these four subsamples, the average correlation coefficient between money growth and inflation is 0.93.

Table 2: Correlation Coefficients for Money Growth and Inflation

(Based on Data from 1990 to 2021)

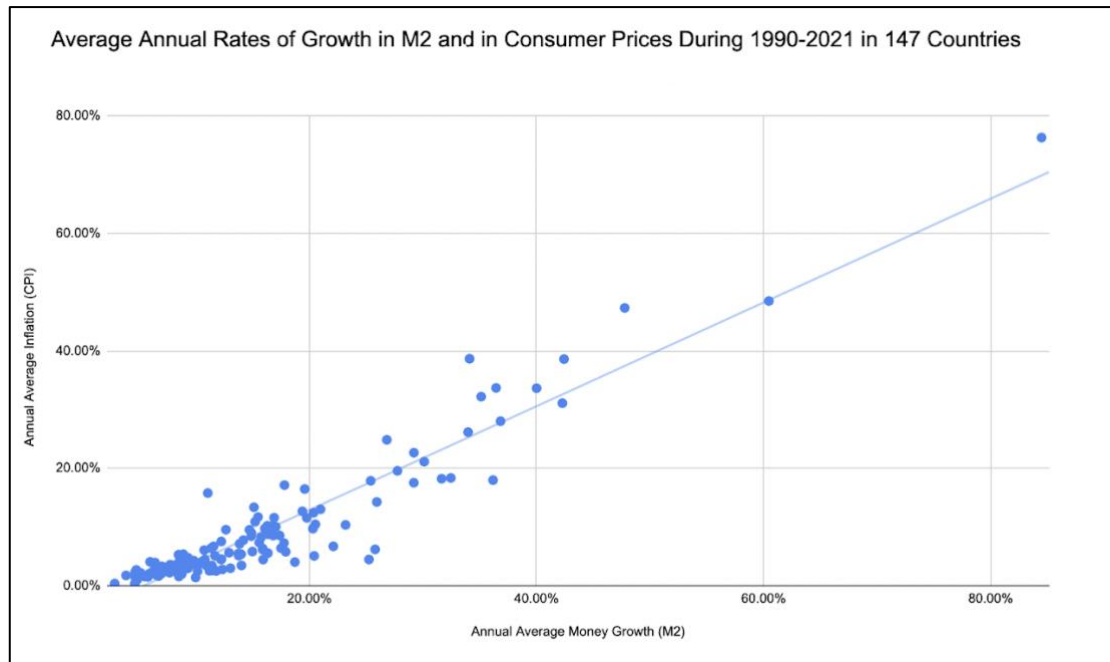
Sample	Coefficient for Each Definition of Money
	M2
All 147 Countries	0.944
Subsamples	
31 OECD Countries	0.820
28 Latin American Countries	0.956
17 Former Communist Countries + China	0.937
4 BRIC Countries	0.987

*See Appendix 1 for countries included in each subsample

In Chart 2, each blue point represents a country's geometric average money supply growth rate (measured by M2) and inflation (measured by CPI) across 20 or more consecutive years. We ran a simple linear regression using geometric average inflation as the dependent variable (y-axis) and geometric average money growth as the independent variable (x-axis). The equation we obtained from the regression is: $y = -0.0481 + 0.884x$.

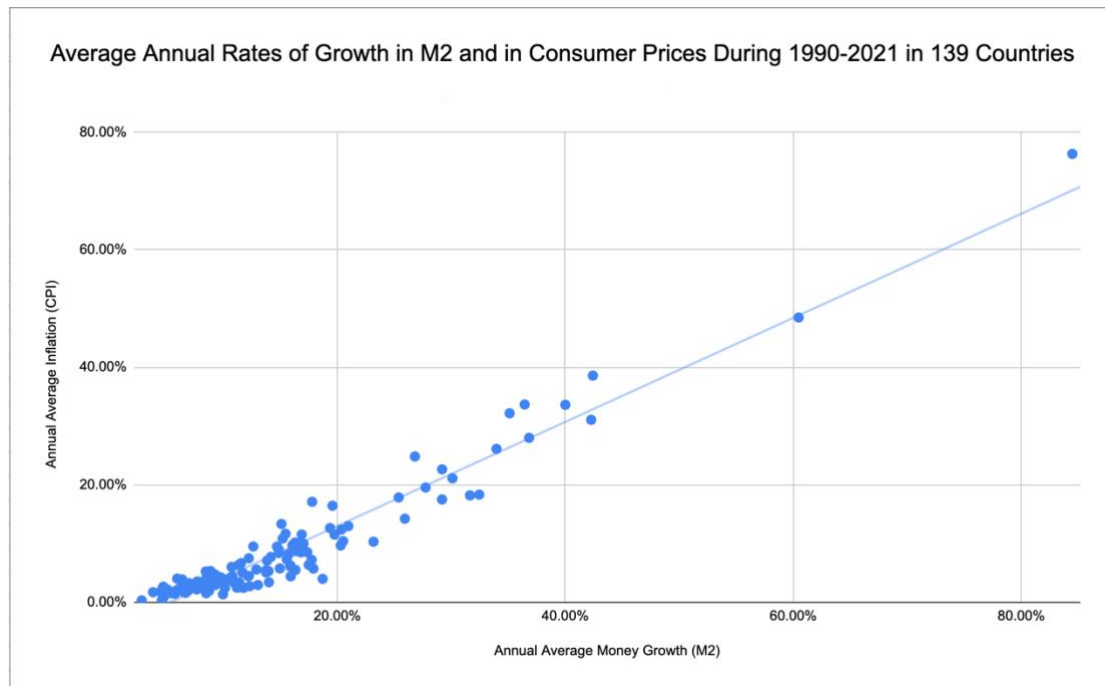
The slope of the regression (trend) line is 0.88, indicating a near one-to-one relationship between money growth and inflation. The R-squared value is close to 1, at 0.89, indicating that the "goodness of fit" is excellent.

Chart 2: Average Annual Rates of Growth in M2 and in Consumer Prices During 1990-2021 in 147 Countries



Outliers were identified by calculating the difference between average inflation calculated using regression results (equation $y = -0.0481 + 0.884x$) and the actual geometric average inflation for each country. Countries that fell outside two standard deviations from the mean of the difference (actual inflation minus inflation calculated using regression results) were identified as outliers. These included: Cambodia, Ecuador, Equatorial Guinea, Georgia, Laos, Moldova, Ukraine, and Vietnam. Chart 3 contains a scatterplot we constructed after excluding the outliers.

Chart 3: Average Annual Rates of Growth in M2 and in Consumer Prices During 1990-2021 in 136 Countries



The equation we obtained from the outlier-excluded regression is: $y = -0.0471 + 0.886x$. The slope of the outlier-excluded regression (trend) line is 0.89, almost the same value as that for the full sample of countries. Not surprisingly, the R-squared value increased to 0.94 after the outliers were excluded from the sample of countries, indicating an improved “goodness of fit.”

Part 4: Conclusion

Our update of the McCandless-Weber Minneapolis Fed study reaches the same conclusion as the original: there is a tight relationship between the growth rate in the money supply and inflation. In consequence, a higher (lower) rate of growth in the money supply will result in a proportionately higher (lower) rate of inflation.

These data also support Milton Friedman’s famous dictum: “Inflation is always and everywhere a monetary phenomenon” (Friedman 1970).

Appendix 1:

Subsamples	Countries
OECD Countries	Australia, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Lithuania, Mexico, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States
Latin American Countries	Antigua & Barbuda, Argentina, Bahamas, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Saint Kitts & Nevis, Saint Lucia, St. Vincent & Grenadines, Suriname, Trinidad and Tobago, Uruguay
Former Communist Countries + China	Albania, Armenia, Azerbaijan, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Kazakhstan, Lithuania, Macedonia, Rep. of Moldova, Poland, Romania, Russia, Serbia, Ukraine, China
BRIC Countries	Brazil, Russia, India, China

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