UDC: 336.741.236.2
DOI: 10.2478/jcbtp-2025-0010

Journal of Central Banking Theory and Practice, 2025, 1, pp. 183-214
Received: 07 January 2024; accepted: 07 June 2024

Muhammad Azam Khan [*], ***Salim Rashid*** [**]

* Department of Economics, Faculty of Business & Economics, Abdul Wali Khan University Mardan, KP, Pakistan and School of Business and Social Sciences, Albukhary International University Malaysia, Kedah, Malaysia

E-mail: drazam75@yahoo.com; drazam75@awkum.edu.pk

** University of Illinois Urbana, Champaign, USA

E-mail: srashid@illinois.edu

Monetary Facts or Monetarist Facts? A Re-Examination

Abstract: The Quantity Theory of Money claims to provide one of the few long-run guides to economic policy by providing specific numbers to characterise the correlation between money growth and inflation. Acceptance of the Quantity Theory has been greatly helped by the claim, propounded most effectively by Robert Lucas, that the evidence for the central claims of the Quantity Theory can be corroborated by 'a theoretical' examination of the data. We re-examine this empirical claim in two ways. First, we show how, for both theoretical and statistical reasons, the facts accepted by Lucas lack the force he attributes to them. Secondly, we then examine the data from 102 countries in three parts: first as an aggregate, then again across five regions, and finally in a sample of specific countries. There is a positive relationship between money supply growth and inflation, but the correlation is not the proportional one predicted by the Quantity Theory - either for the full sample or any of the sub-samples. These results are inconsistent with the primary empirical claims made for the general applicability of the Quantity Theory.

Key words: Inflation, money supply, quantity theory of money.

JEL Code: E31, E51

1. Introduction

Inflation as primarily a monetary phenomenon has long been a hallmark of the Quantity Theory of Money (QTM). The QTM starts with the innocuous identity PY = MV. Upon adding the usual Quantity Theory assumption that the velocity of money, V, can be taken to be constant, this can be algebraically manipulated to P^ =M^ - g^

Where the ^ indicates the rate of change of a variable, and the rate of growth of Y is indicated by g.[1] It is notable that a very simple framework has led to the remarkably strong prediction that the inflation rate P^ is the simple difference between the rate of growth of the money supply, M^, and the growth rate of real output, g^. Referring to the general framework, Lucas (1980, p. 1005) states that these propositions "possess a combination of theoretical coherence and empirical verification shared by no other propositions in monetary economics"[2].

It has been claimed that this equation is dramatically confirmed by the data using only elementary statistical procedures, and therefore constitutes one of the basic facts that Macroeconomics should focus upon. According to Lucas (1980, p. 1005) "Readers may find the results of interest as additional confirmation of the quantity theory, as an example of one way in which the quantity-theoretic relationships can be uncovered via a theoretical method from time-series which are subject to a variety of other forces, or as a measure of the extent to which the inflation and interest rate experience of the post-war period can be understood in terms of purely classical, monetary forces".

Friedman (1973) preceded Lucas (1980) in emphasising the importance of the regularities of monetary facts in guiding one to theory, but Friedman's partial equilibrium formulations are not adopted by Lucas[3]. Both Friedman and Lucas stress the relative independence of the 'facts' from any country-specific factor or policy. Friedman claimed: "I have studied the data not only for the United States but also for Israel, for Japan, for India, and for a number of other countries. Some of our students have studied it for Canada and for several South American countries…...". In a subject that is frighteningly short of constants, the proportionality of P and M seemed to provide an anchor in the storms of macroeconomic turbulence[4].

---

1 This convenient notation is adapted from Cline (2015) who also examines the QTM for the U.S. data.

2 However, Smith (1988) pointed out that besides the theoretical coherence, Lucas (1980) does not mention what this empirical verification comprises of. Smith maintains that "Lucas' propositions have been so firmly held by economists that they are often built into (rather than derived from) economic models (p. 18). If these theoretical claims lack empirical confirmation, then they cannot be the principal findings that economists have to explain and are not of significant interest to monetary economists or policy makers (Smith, 1988).

3 Thus, Friedman (1970) readily concedes that Money influences Income first, for five years, or even ten years, but Lucas minimises any such impact. In Lucas (1985) there is a footnote reflecting on the difference between Friedman's Monetary sector focus and Lucas's desire to find general equilibrium foundations.

4 For an early clear and balanced account of Monetarism, see Money and the Economy: A Monetarist View, Poole (1978).

The central point of importance is the empirical regularity and universality of the QTM.[5] If this is established to everyone's satisfaction then economists have a well posed problem: find an explanation for the proportionality of P and M, which we will refer to often hereafter, as "P^M^" for brevity. Supporters of the QTM have said that the only plausible explanation for the correlations lies in believing that it is increases in M that have caused the increases in P. There are two questions that arise:

1. Are the 'facts' plain facts, or are they contaminated with statistical artifact?
2. Are their alternative ways to present the 'facts'?

Of course, the interpretation of the second question follows largely upon those facts established by the first question. We are hardly the first to raise these questions. To take only a recent incisive examination, Cline (2015) provided the somewhat remarkable finding that the U.S. economy has not experienced monetarist inflation since at least the mid-1980s, perhaps the contrary. Cline (2015, p.2) indicates: "In 1985-2013 there was a negative relationship between inflation and average excess money growth. The quantity theory of money broke down as an explanation of inflation". Moosa, Al-Saad & Khatatbeh (2024) note that historically, prices increased in line with the growth of the money supply. However, a divergence between monetary inflation and price inflation started to emerge quickly. This discrepancy contradicts the quantity theory of money, which states that inflation occurs when there is an excess of money relative to goods available in the economy.

Let us remember that the opponents of QTM do not deny that inflation can be caused simply by printing and distributing money to the public. What the opponents do say is that there are many other potential factors involved, and in country specific instances these 'other factors can overrule the importance of money. It so happens that many alternative explanations of inflation have been offered---cost-push, structural, state balance sheet, etc.; there are also queries that can be raised about the monetary mechanism, such as whether deposits create loans or vice versa, whether money is endogenous or exogenous, and so on. None of these issues concern us directly here. It is not so much the truth of QTM which concerns us ere, as the statistical evidence which appears to both inspire and cor-

[5] In his study, Goodfriend (2007) provided a popular account of the apparent universality of the principles of modern monetary economics.

roborate QTM. Our goal is to explore as simply as possible the global nature of the connectedness between M, P and Y[6].

As Lucas has been one of the most forceful proponents of the view that economists must take seriously the fundamental importance of the factual correlation of M and P, making it the theme of his Nobel memorial lecture, it will be convenient to refer primarily to him in what follows.

The facts Lucas wishes to emphasise are:

1. P^ M^ - Proportionality of Price changes and Money supply changes,
2. Universality, that this Proportionality is a feature of all market-based economies.

Let us see what is implied for the data by these two propositions.

Since P^= M^- g^ , for a wide span of countries and time periods two corollaries follow:

1. If we regress the appropriate data on P^=α + β M^- γg^ , this will provide α=0, β=1, γ=0[7]
2. Since α, β, and γ are equal for all countries. If we even sample at random from the countries[8], the relationship should still hold. In particular, it should hold for regions, and for individual countries.

However, there is an empirical caveat in looking at the statistical tests of these propositions. In 1980, Lucas was quite definite that QTM is not a short-run proposition, but he does not indicate if there *is* a preferred way to get to the long-run values sought by QTM. The use of Vogel's (1974) results by Lucas suggests that two periods may suffice. But by 1986 Lucas was quite emphatic on the need for tests using averaged data "Without such averaging, the quantity theory…does not provide a serviceable account of co-movements in money and inflation" (Lucas, 1986, p. S405). The data of McCandless and Weber (1995), used by Lucas for his Nobel lecture, are averages. While there is a plausible economic rationale for averages—they are meant to represent the unobservable, but desired, long-run val-

[6] While this barebones method is also claimed by Lucas, there are alternatives to Fourier series when one wishes to be simple. Whiteman (1984) questioned Lucas on very different grounds. Our attempt is more like the recent paper of Cassidy, Tower, and Wang, (2016) on Manufacturing Fetishism.

[7] For Friedman, γ=1. This is an important difference between Friedman and Lucas.

[8] Actually, for any random subsample.

ues--, what is the statistical effect of such averaging? Statistically, with averaged data, as the number of years per average increases, the coefficient values improve automatically. This improvement *may* be due to the strength of the long-run effects, but we need to examine whether the use of moving averages is not somehow influencing the consistency of the empirical result. QTM says the averaged data reflect an approach to equilibrium---but are other explanations possible?

The empirical basis for QTM is Vogel (1974), followed by Lucas (1980) and then McCandless and Weber (1995). We begin by stating three reasons why the empirical evidence presented so far needs re-examination---1. there is an inappropriate extension of equilibrium theory, 2. the full implications of $\alpha=0$, $\beta=1$, $\gamma=0$ not drawn out by QTM advocates, and 3 the use of moving averages is questionable. We then rework the data without using moving averages. The formulation given above has been the workhorse of the Monetarist argument, hence re-examining it is our primary focus---some recent modifications which use interest rates are discussed in the conclusion.

A guide to our procedure is as follows: First, we examine the relationship of P^ to M^ and g^ for 102 countries for the period 1982-2014. This provides moderate but not substantial support for P^M^. Secondly, we divide the data into subsamples by region and estimate the same relationship for each region separately. Now P^M^ becomes hard to find. Finally, since policymakers are worried only about their own economies, we ask whether P^M^ is also a reliable 'fact' when we consider individual countries.

The remainder of this paper is structured as follows: Section 2 questions the evidential basis of QTM as posed by Lucas (1980). Section 3 deals with the data and methodology used in our reworked empirics. Section 4 presents the empirical results and discussion. Section 5 concludes the paper.

2. Examining the existing evidence

What is the evidential basis of the claim by Lucas? In 1980, Lucas used a study of Vogel (1974) and in 1996 he referred to the study of McCandless and Weber (1995). Using data on inflation from 16 Latin American countries (1950-1969), Vogel runs a pooled regression with the growth rates of current money supply and money supply lagged one year as explanatory variables. The coefficients of both money growth variables are highly significant and, if added together, sum close to one. This suggests that an increase in the money supply causes a proportionate increase in the inflation rate within two years, with the greater part of this increase taking place within the first year. In using Vogel, Lucas (1980) plots the data from Vogel on a graph, and on drawing a line with a 45-degree slope through the mean of Vogel's data finds that it fits the data remarkably well using an eyeball test[9]. Lucas appears to have added the coefficients of both years to present his graph but fails to note that Vogel's use of such a sum is not based on the theory Vogel presents[10]. Now, this is awkward. Vogel explicitly uses the QTM as an equilibrium theory and states the equilibrium theory $M_D = CPY$, $M_S = M_D \Rightarrow M_S = CPY$ or $MV = PY$.

For his empirical test Vogel's data has to refer to a time period during which equilibrium is attained; from his text, it appears that this data is annual. In interpreting his results, Vogel adds the coefficients of this year and the last. How is it legitimate to refer to data from beyond the equilibrium period to support an equilibrium theory? If the theory is meant to refer to two periods, then the regressions have to be reformulated accordingly and the influence of next year's money supply etc., has to be somehow accounted for.

Using quarterly U.S. time-series data (1953-1977) and moving averages of the relevant variables, Lucas (1980) himself empirically illustrates the two dominant implications of the QTM: "that a given change in the rate change in the quantity of money induces (i) an equal change in the rate of price inflation; and (ii) an equal change in nominal rates of interest" (p. 1005). Apart from referring to steady states of growth models, consequences of changes in money supply as changes in units; and the need to use general equilibrium thinking, there is little explicit theorising[11] in Lucas[12]. Lucas considers Vogel (1974) to provide a particularly 'clean' example but since Vogel explicitly uses the Money Demand approach of Friedman it is clear that Lucas is somewhat eclectic in his consistency[13].

---

9 Lucas does not explain his procedure in any detail beyond referring to a 'free parameter', and this is our interpretation of what he did.

10 Lucas does not indicate if there is some alternate theory supporting his procedure.

11 Admittedly, these concepts conceal much theory, but no explicit modelling is involved.

12 Lucas sometimes speaks as though the theory has been proven, and what needs doing is finding better ways to make the truth apparent---see the last Para of section 1 in Lucas (1980). Hence his claim that the Fourier series filters he uses will be tested by 'the quality of the pictures it yields (Lucas, 1980, p. 1008). By pictures Lucas means nothing more exotic than ordinary graphs. Graphs and Tables are also prominent in Teles and Uhlig (2013).

13 Lucas also refers to empirical work by Schwartz but provides no references. Since Friedman and Schwartz worked closely, this does not clarify the methodological point about partial versus general equilibrium, or the use of multi-year averages versus annual data.

In 1996, instead of Vogel, Lucas uses, to the same effect, the McCandless and Weber (1995) finding that the growth rates of the money supply and price level are very closely correlated[14]. In "Some Monetary Facts", McCandless and Weber (1995) use geometric averages of data over the period 1960-1990, covering a total of 110 countries and two subsamples with 21 OECD countries and 14 Latin American countries[15]. They examine the correlation coefficient for money supply growth and inflation and note that "There is a high (almost unity) correlation between the rate of growth of the money supply and the rate of inflation. This holds across three definitions of money and across the full sample of countries and two subsamples" (p.2).[16]

The first point to be raised about all such QTM evidence is the importance of the intercept in any regression of P on M. Let us remember that $\alpha=0$ is one of the *predictions* of QTM. If the intercept is positive, then we can conclude that inflation is possible *without* any changes in the money supply; if the intercept is negative, we reach the conclusion that inflation results *only when* the money supply increases beyond a certain level. Both conclusions belie the strict implications of QTM and deny the rule-like character of QTM policy. It is, therefore, surprising to find Vogel, Lucas as well as McCandless and Weber presenting, without comment, diagrams of M^P^ with positive intercepts (Figure 1 and Figure 2)[17].

[14] McCandless and Weber (1995) do not clarify whether they are using simple correlation coefficients or the coefficients of a regression, but this probably does not matter.

[15] We tried to obtain details of their data, without success.

[16] The factual basis of QTM, and of Monetarism, is so important that it has aroused considerable interest earlier. Smith (1988) thinks that American colonial data provide much evidence against the QTM. Grauwe and Polan (2005) find, for a sample of 160 countries, a close positive correlation between long-run inflation and the growth rate of money supply during 1969-1999 but the correlation is not proportional or unitary. Omer and Saqib (2009) observe that the estimated coefficient for the growth rate in money supply is far below 1 and thus it does not support M^P^. Teles and Uhlig (2013) examine whether the QTM is still alive for 20 OECD countries during 1970-2005. The data is divided into two subsamples with the data break in 1990. Empirical results suggest that the sample after 1990 indicates significantly less inflation variability, worsening the fit of a one-for-one correlation between money growth and inflation, and generates a reasonably low elasticity of money demand.

[17] Although phrased differently, Teles and Uhlig (2013) also make this point in their Figure 2. Recent attempts to revive the QTM by introducing an interest rate to modify the growth of real money may produce better fits but they miss the central impact of facts predicted with minimal theory because the results are embedded in some growth model, hence limiting applicability to advanced economies, and take interest elasticity formulations of the demand for money which ignore the fundamental critique of such formulations made by Sprenkle.(1969)

Figure 1: Lucas (1980: 1006). Lucas's data taken from Vogel (1974)

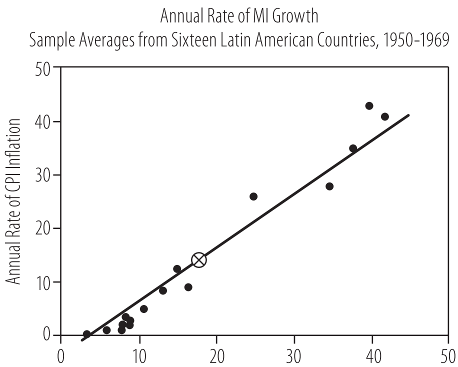
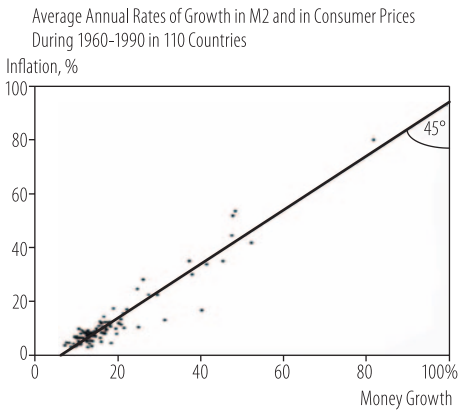


Figure 2: McCandless and Weber (1995: 5)



There is also a statistical point which arises when dealing with data that is possibly from distinct populations. Suppose we have data from 2 regions, A and B, and with 5 and 6 observations respectively. We estimate regressions $\hat{y}_i = \hat{\alpha} + \hat{\beta} x_i$ for each region. Suppose the $\hat{\beta}$ is equal in both regions and we now estimated a pooled regression;

$$\hat{y}_1 = \hat{\alpha}_A + \hat{\beta} x_1$$

$$\vdots \quad \vdots \quad \vdots$$

$$\hat{y}_5 = \hat{\alpha}_A + \hat{\beta} x_5$$

$$\hat{y}_6 = \hat{\alpha}_B + \hat{\beta} x_6$$

$$\vdots \quad \vdots \quad \vdots$$

$$\hat{y}_{11} = \hat{\alpha}_B + \hat{\beta} x_{11}$$

Whence $\hat{y} = \frac{\sum \hat{y}_i}{11} = \frac{\sum \hat{\alpha}_A + \sum \hat{\alpha}_B}{11} + \hat{\beta} \frac{\sum x_i}{11} (= \hat{\beta} \bar{X})$

But $\bar{\hat{y}} = \bar{y}$, and if we run the pooled data $\hat{\alpha}_P = \bar{Y} - \hat{\beta} \bar{X} = 5\hat{\alpha}_A + 6\hat{\alpha}_B$

If $\hat{\alpha}_A$ and $\hat{\alpha}_B$ are of opposite signs, then $\hat{\alpha}_P$ will clearly tend to zero[18].

[18] The $\hat{y}_i$ above are from two separate regional regressions and so are distinct from the $\hat{y}_i$ of the pooled regression.

It follows that, in using panels, the probative value of the zero intercept cannot be accepted if there is a reasonable chance that the sum of the intercepts across the partitions can sum to zero. In our data, this does happen; it is evident from Table 5, columns 4 and 6, using up to six year moving averages data, that some intercepts are negative, while some are in positive and statistically significant.

If we next focus only on the slope of the M^P^ line, then it has to be admitted that the slopes of lines drawn with moving averages do look very much like 45^0. Supporters of QTM claim that this is because the averaged data represent the unobservable but desired long-equilibrium values that QTM seeks. But is long-run equilibrium the only reason for moving averages to cause improvements in the empirical fit? Let us consider the formation of a say 3 year moving averages. We start with years 1, 2, 3 to get our first observation on the year moving averages. Let us assume that QTM holds for β.

$$P_1 = \alpha_1 + \beta M_1 + \varepsilon_1$$

$$P_2 = \alpha_2 + \beta M_2 + \varepsilon_2$$

$$P_3 = \alpha_3 + \beta M_3 + \varepsilon_3$$

$$P_1^- = \left(\frac{\sum \alpha_i}{3}\right) + M^- + \frac{\sum \varepsilon_i}{3} = \alpha_1^- + M_1^- + \varepsilon_1^-$$

If we now regress a sequence of P_i^- on M_i^-, all formed as above, then.

1. $(\sum \alpha_i) = \alpha^-$, may go to zero because of opposing α_i signs.
2. There can be correlations between the terms in each ε_i^-, causing the regression variance to be smaller than it should and thereby making it more likely to produce statistically significant $\beta^\wedge$[19].
3. While the two points above are statistical questions, there is also an economic objection to such averages. It is that M may be dependent on P, so that price changes cause changes in the money supply. A preliminary indication lies in performing causality tests. In Table 13, we see that the opposite hypotheses 'M causes P' and 'P causes M' are each supported by the data. Furthermore, if we regress M on P, we do get statistically significant coefficients, albeit with lesser force than in regressions of P on M. In view of this bi-causal relation, the interpretation of regressions using moving averages is unclear.

[19] The opposite error is also possible of course.

The drawback of the moving average approach is that it does not respond to changes that arise for a reason, for example cycles and seasonal effects. So, factors that produce such changes are usually overlooked while taking moving averages. The moving average approach is basically a "mechanical" method, which reproduces original data in another shape. Svensson (2012), among others, objected to long-run correlations, which need the use of moving averages, on the grounds of policy irrelevance; from a different viewpoint, McCallum and Nelson (2010) object to averaging of time series as unnecessary, and prefer to use non-averaged time series data with explicit lags. In our case, regressions for the 102 countries using either one or two lags of Money supply as the explanatory variable did much worse and will not be considered further. If we consider current M and add two lagged values of M in the same regression, we get a peculiar result; there is a slight improvement in the cumulative impact of M with one lag, but the second lag is significant and of the *opposite* sign [See Table 4, column 2]. In short, the use of lagged values does little to improve the case for QTM and we continue with the use of M.

3. Data and Empirical Methodology

3.1. Data

This study is based on annual data over the period of 1982-2014 for a group of 102 countries across the world. Our variables are inflation, money supply, and real GDP. Inflation (consumer prices (annual %)) as measured by the Consumer Price Index (CPI), and the data have been obtained from the World Development Indicators (2018) and International Monetary Fund (IMF) databases. Money and quasi money growth (annual %) which is the aggregate of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition is normally called money supply (M_2); this definition is parallel to lines 34 and 35 in the International Financial Statistics (IFS). Similarly, the growth of real GDP is used where the current GDP (USD) has been divided by the CPI appropriately. A brief summary of the descriptive statistics and correlation matric are given in Table 1. It is evident from Table 1 that the relationship between the growth of money supply and the inflation rate is positive, whereas that between the growth rate of real GDP and inflation is negative.

McCandless and Weber (1995) sought an empirical regularity based on the most recent and comprehensive data available and we try to follow them in this regard. Due to the non-availability of balanced data for all the countries, our study consists of a total of 102 countries. Its five subsamples include 36 African countries, 18 Asian countries, 6 Persian Gulf countries, 17 OECD countries and 25 Latin America and Caribbean Countries (LAC) (See list of countries used in Appendix Table A1). We use more recent and longer period panel data for the group regressions, and time series for the individual countries over a 33-year period ranging from 1982 to 2014.

Our central aim is to empirically verify the relationship between the growth rate of the money supply and inflation using contemporaneous panel and time series data as well as some moving averages. For this purpose, the following regression equation(s) are to be estimated, which can symbolically be written as follows;

$$P_{it} = \alpha_i + \beta M_{it} + \gamma Y_{it} + \mu_{it} \quad (1)$$

$$P_{it} = \alpha_i + \beta M_{it} + \gamma Y_{it} + v_{it} + w_{it} \quad (2)$$

Where, P represents inflation, consumer prices (annual %), M is annual growth rate in money supply, and Y is the growth rate of real GDP (output). In Equations (1 and 2) β and γ are the coefficients; i and t denote the i^{th} country and the t^{th} time period, respectively, and μ_{it} is error term. The term α in Equation (1) indicates the constant parameter that varies across countries, but not over time; it controls for country-specific differences. The error terms (μ_{it}) are supposed to be independent, with mean zero and constant variance (σ_ε^2) for all included countries and through the time periods. Similarly in Equation (2), the vit term is the country-specific random-effects that take the variation across countries. It is supposed to be random and are not correlated with the independent variables built-in in the model; w_{it} term is the country-specific error.

Table 1: Descriptive statistics and correlation matrix (102 countries)

Statistics/Variables	P	M	Y
Mean	30.4232	33.3019	-0.3502
Median	5.38454	13.0366	0.4469
Maximum	13109.50	12513.14	2226.899
Minimum	-14.9360	-72.4949	-99.6137
Std. Dev.	380.5916	321.3306	61.8457
P	1.0000		
M	0.6369	1.0000	
Y	-0.0650	-0.07213	1.0000
Observations	3366	3366	3366

Source: Authors` computation

4.Results and Discussion

As McCandless and Weber (1995) refer to correlation coefficients, we first use non-averaged annual data to calculate the correlation coefficient between money growth and inflation for the full sample of 102 countries as well as for five subsamples using Excel. Repeating the point made at the end of section 2, the wider prevalence of economic rationality, as well as the electronic dissemination of data both suggests a short time lag between M and P, while contemporaneous data also have the most policy relevance. The results are given in Table 2, which suggests weak correlation between the money growth and inflation. Figure 3-13 shows the trend of correlation between money supply and inflation. To explore further, we employ panel regression.

Table 2: Correlation coefficient for money supply growth and inflation

Sample	Coefficient for M	Observations
All 102 countries	0.6369	3366
Subsamples		
6 Persian Gulf Countries	0.2883	198
18 Asian Countries	0.2924	594
36 African Countries	0.6291	1188
17 OECD Countries	0.7463	561
25 Latin America & Caribbean	0.6334	825

Source: Authors` own work

Prior to the empirical analysis, it is mandatory to know the integrating properties of the panel data. We use the widely used panel unit root tests of, for example, Levin, Lin and Chu (2002) (LLC) and Im, Pesaran and Shin (2003) (IPS). Statistical analysis was done with EViews9. A summary of the panel unit root results of IPS, and LLC tests are reported in Table 3; these indicate that inflation rate, money supply growth and growth of real GDP are all stationary at level. Therefore, we employ the traditional panel approach, which encompasses fixed-effects and random-effects models, to estimate M^P^. The Hausman test[20] is applied to choose between the use of a fixed-effects or random-effects estimator is to be used in parameter estimation. The Hausman test suggests that we employ in some cases the fixed-effects, while, in others, the random-effects model. The empirical results are given in Table 4. Overall, our empirical results, the R^2, adj. R^2, F-ratios, D-W values, are theoretically and statistically acceptable.

The regression on the full sample of 102 countries show results on growth rate of the money supply and inflation found are positive and statistically significant at the one percent level but the estimated coefficient of money supply growth is 0.715, or well below the predicted value of one. Similarly, in the regional subsamples--- 26 countries from LAC, 17 countries from OECD, 6 Persian Gulf countries, 18 Asian countries, 36 African countries--- the estimated coefficients of money supply growth are 0.715, 0.534, 0.138, 0.056, 0.510, which are statistically significant. However, all estimated coefficients for M, in the full sample as well as the five subsamples, are well below 1, the value predicted by QTM (See Table 4).

Table 3: Panel unit root tests results (102 countries)

Item	Level			
	Constant		Constant + Trend	
	LLC	IPS	LLC	IPS
P	-13.7809 (0.0000)	-15.6875 (0.0000)	-12.9237 (0.0000)	-14.1598 (0.0000)
M	-16.2501 (0.0000)	-19.0255 (0.0000)	-15.9066 (0.0000)	-16.9855 (0.0000)
Y	-16.3478 (0.0000)	-19.9320 (0.0000)	-15.3009 (0.0000)	-17.7834 (0.0000)

Source: Authors` computation

[20] Hausman (1978)

Table 4: Panel estimates (dependent variable is inflation rate)

Variables	102 Countries		25 LAC Countries		17 OECD Countries		6 Persian Gulf Countries		18 Asian Countries		36 African Countries	
	1	2	3	4	5	6	7	8	9	10	11	12
Intercept	6.5484 [5.1109] (1.2812)	11.5290^{c} [5.2930] (2.1782)	31.8903 [20.946] (1.5224)	46.1689^{c} [21.7902] (2.1188)	1.6951 [1.0193] (1.6630)	-3.6676^{a} [0.9493] (3.8634)	1.8822^{b} [0.6746] (2.7900)	0.9942 [0.6691] (1.4859)	6.2237^{a} [0.3224] (19.301)	3.7069^{a} [0.4919] (7.5359)	2.6305^{a} [0.6011] (4.3757)	-3.7937^{a} [0.6574] (5.7708)
M	0.7158a [0.0165] (43.2166)	0.7662^{a} [0.0176] (43.4598)	0.7150^{a} [0.0335] (21.2925)	0.7663^{a} [0.0357] (21.4464)	0.5285^{a} [0.0282] (18.7368)	0.3749^{a} [0.0196] (19.1614)	0.1384^{a} [0.0292] (4.7257)	0.0872^{b} [0.0334] (2.6075)	0.0565^{a} [0.0169] (3.3461)	0.0674^{a} [0.0187] (3.6013)	0.4941^{a} [0.0271] (18.2256)	0.3518^{a} [0.0265] (13.2694)
Y	-0.10259 [0.0840] (1.2199	-0.1091 [0.0844] (1.2932)	-0.2215 [0.2709] (0.8177)	-0.2417 [0.2723] (0.8875)	-0.7751^{a} [0.0704] (11.0094)	-0.3133^{a} [0.0518] (6.0519)	-0.0498^{a} [0.0170] (2.9344)	-0.0496^{a} [0.0176] (2.8222)	-0.0514^{a} [0.0086] (5.9655)	-0.0464^{a} [0.0084] (5.4722)	-0.0576^{a} [0.00951] (6.0665)	-0.0444^{a} [0.0085] (5.2417)
M-1	-	0.0730^{a} [0.0175] (4.1552)	-	0.0707^{c} [0.0356] (1.9874)	-	0.5593^{a} [0.0204] (27.4007)	-	0.1180^{a} [0.0343] (3.4390)	-	0.0785^{a} [0.0174] (4.5008)	-	0.2876^{a} [0.0274] (10.5017)
M-2	-	-0.2573^{a} [0.0176] (14.6004)	-	-0.2588^{a} [0.0356] (7.2537)	-	-0.0729^{a} [0.0181] (4.0384	-	0.0210 [0.0326] (0.6449)	-	0.0714^{a} [0.0168] (4.2322)	-	0.2211^{a} [0.0263] (8.4094)
R^2	0.4183	0.4569	0.4128	0.4519	0.6361	0.8379	0.1234	0.1995	0.4599	0.4990	0.4887	0.5980
adj. R^2	0.4000	0.4383	0.3937	0.4313	0.6348	0.8366	0.1145	0.1819	0.4421	0.4794	0.4722	0.5834
F-ratio	22.7829	24.4926	21.5793	21.9723	487.7071	674.3105	13.737	11.2836	25.7335	25.4264	29.7077	41.0465
DW	1.61122	1.6196	1.6095	1.6195	2.0877	1.5979	1.3000	1.2644	1.4646	1.4126	1.6819	1.1208
HT	59.5051 (0.0000)	98.8317 (0.0000)	12.7913 (0.0017)	21.9376 (0.0002)	2.3572 (0.307)	5.2222 (0.2652)	0.6465 (0.7238)	2.8132 (0.5896)	40.6225 (0.0000)	25.9683 (0.0000)	130.8533 (0.0000)	14.5166 (0.0058)
Estimators	FE	FE	FE	FE	RE	RE	RE	RE	FE	FE	FE	FE

Note: Asterisks a, b, and c shows significant at 1%, 5 % and 10% levels respectively. Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

DW= Durbin Watson test HT= Correlated Random Effects - Hausman Test FE= fixed-effects RE= random-effects

Further regressions were used to examine more carefully the correlation between money supply growth and inflation. When we estimate the model including one and two periods lagged of money supply growth, lagged values of M do worse (See Table 4). The R^2, or proportion explained, is still only 40 per cent in the full sample and never exceeds 60 per cent in any subsample, and all estimated coefficient values are evidently less than 1. Therefore, empirically, this study does not support the QTM prediction of P^M^. Regarding the relationship between the growth of real GDP and inflation relationship, in the case of full sample of 102 countries, and subsample 25 LAC, the impact of growth of real GDP on inflation rate are found to be negative but statistically insignificant (Table 4, column 1-4). However, the empirical results presented in Table 4 shows that the impact of growth of real GDP on inflation are significantly negative at one percent level of significance for other subsamples - 17 OECD, 6 Persian Gulf, 18 Asian, and 36 African countries. Table 4 with comments on coefficient of g^ plus scatter on outliers affecting results, especially LAC.

We also used 2-6 years moving averages for the full sample of 102 countries and five subsamples in order to see the difference between non-averaged data and average data empirical results. The empirical results of moving averages are given in Table 5, where the fixed-effects and random-effects model are used based on the Hausman test. It is evident from Table 5 that as the numbers of years of moving averages increases from 2 toward 6, all estimated coefficients of money supply growth progressively increase. If there were no other questions about the use of lagged values, the long-run equilibrium interpretation desired by QTM advocates would be confirmed. Lucas (1996) "The central predictions of the quantity theory are that, in the long run, money growth should be neutral in its effects on the growth rate of production and should affect the inflation rate on a one-for-one basis" [p.656]. But the difficulties in interpreting moving averages--- constants can cancel, error terms can interact, and reverse causation cannot be ruled out--- were noted in section 2. Furthermore, income is not supposed to have any role according to Lucas, but in Table 5 the coefficient on g persists as we lengthen the moving average, and it even gains in significance[21].

To test for reverse causation, we also ran regressions to evaluate whether price level caused money supply growth. Causality tests suggested two-way causality and are shown in Table 7 and Table 8. The empirical estimates of regression of P on M on full sample and subsamples are given in Table 7, while those on individual countries are reported in Table 8. Inflation consistently and significantly affects monetary growth, thus contaminating the use of moving averages as ap-

[21] Though the significance of M is much greater.

propriate for tests of QTM. We also empirically investigated the impact of growth of real GDP (income) on growth rate of the money supply and the results are given in Table 6. While inflation continues to impact positively on the money supply, it is odd to note that, statistically, real GDP growth appears to retard the growth of money[22].

[22] We also run regression for a panel of 77 countries from full sample out of 25 LAC in order to see the money supply and inflation relationship, where the intercept found is negative large and the estimated coefficient of M plus M-1 found is 0.3378 +0.4878= 0.8256 which against of the QTM prediction.

Table 5: Panel estimates using moving averages data (dependent variable is inflation rate)

Sample	2 years moving averages	3 years moving averages	4 years moving averages	5 years moving averages	6 years moving averages
102 Countries	$P=3.292+0.785M^a-0.699Y^a$ [4.1129] [0.0168] [0.216] (0.801) (46.609) (3.223) adj. $R^2=0.482$, F-ratio=30.534	$P=1.191+0.846M^a-0.834Y^a$ [3.513] [0.016] [0.231] (0.339) (52.999) (3.617) adj. $R^2=0.571$, F-ratio=41.918	$P=-0.211+0.885Ma-1.020Y^a$ [3.111] [0.016] [0.234] (0.068) (56.890) (4.368) adj. $R^2=0.630$, F-ratio=51.652	$P=-1.937+0.929M^a-1.032Y^a$ [2.672] [0.015] [0.221] (0.725) (63.284) (4.671) adj. $R^2=0.695$, F-ratio=66.477	$P=-4.475+0.982M^a-0.880Y^a$ [2.202] [0.013] [0.197] (2.0318) (74.922) (4.458) adj. $R^2=0.768$, F-ratio= 92.759
25 LAC	$P=9.729+0.741M^a-3.335Y^a$ [17.580] [0.038] [1.050] (0.553) (19.743) (3.176) adj. $R^2=0.479$, F-ratio=29.267	$P=6.440+0.803M^a-3.119Y^a$ [15.106] [0.036] [0.995] (0.426) (22.211) (3.134) adj. $R^2=0.567$, F-ratio=39.926	$P=2.371+0.836M^a-3.417Y^a$ [13.409] [0.035] [0.947] (0.177) (23.575) (3.608) adj. $R^2=0.625$, F-ratio=49.195	$P=-1.241+0.884M^a-3.154Y^a$ [11.560] [0.033] [0.860] (0.1073) (26.418) (3.665) adj. $R^2=0.691$, F-ratio=63.149	$P=-6.257+0.948M^a-2.423Y^a$ [9.575] [0.029] [0.750] (0.653) (31.629) (3.229) adj. $R^2=0.763$, F-ratio=87.659
17 OCED	$P=-0.9961+0.696M^a-0.586Y^a$ [0.933] [0.024] [0.060] (1.067) (28.261) (9.755) adj. $R^2=0.782$, F-ratio=977.56	$P=-1.797^c+0.748M^a-0.553Y^a$ [0.933] [0.023] [0.056] (1.924) (32.406) (9.784) adj. $R^2=0.840$,F-ratio=1386.82	$P=-2.546^b+0.805M^a-0.523Y^a$ [0.919] [0.022] [0.052] (2.770) (36.174) (10.039) adj. $R^2=0.878$, F-ratio=1842.10	$P=2.763^a+0.823M^a-0.513Y^a$ [0.906] [0.022] [0.050] (3.049) (37.170) (10.201) adj. $R^2=0.893$, F-ratio=2072.20	$P=-3.058^a+0.841M^a-0.502Y^a$ [0.474] [0.022] [0.050] (6.452) (37.034) (9.853) adj. $R^2=0.932$, F-ratio=365.072
36 African	$P=-1.539^a+0.7342M^a-0.138Y^a$ [0.535] [0.025] [0.013] (2.874) (28.659) (9.955) adj. $R^2=0.596$, F-ratio=69.152	$P=-1.979^a+0.748M^a-0.207Y^a$ [0.513] [0.026] [0.015] (3.854) (28.467) (13.129) adj. $R^2=0.701$, F-ratio=71.938	$P=-3.281^a+0.818M^a-0.261Y^a$ [0.470] [0.024] [0.016] (6.979) (33.190) (16.238) adj. $R^2=0.773$, F-ratio=100.576	$P=-4.317^a+0.878M^a-0.301Y^a$ [0.439] [0.023] [0.016] (9.814) (37.334) (18.690) adj. $R^2=0.822$, F-ratio=131.300	$P=-5.043^a+0.920M^a-0.331Y^a$ [0.419] [0.022] [0.016] (12.017) (40.287) (20.501) adj. $R^2=0.854$, F-ratio=160.482
18 Asian	$P=5.709^a+0.095M^a-0.080Y^a$ [0.327] [0.018] [0.010] (17.438) (5.032) (7.868) adj. $R^2=0.568$, F-ratio=40.893	$P=5.122^a+0.1364M^a-0.092Y^a$ [0.334] [0.020] [0.010] (15.327) (6.743) (8.493) adj. $R^2=0.651$, F-ratio=55.820	$P=4.685^a+0.164M^a-0.089Y^a$ [0.348] [0.021] [0.011] (13.441) (7.626) (7.847) adj. $R^2=0.703$, F-ratio=68.427	$P=4.511^a+0.173M^a-0.075Y^a$ [0.368] [0.023] [0.012] (12.24) (7.552) (6.152) adj. $R^2=0.732$, F-ratio=76.048	$P=4.065^a+0.204M^a-0.073Y^a$ [0.373] [0.023] [0.012] (10.883) (8.627) (5.7529) adj. $R^2=0.765$, F-ratio=87.313
6 Persian Gulf	$P=1.387^b+0.203M^a-0.087Y^a$ [0.652] [0.029] [0.019] (2.125) (6.882) (4.470) adj. $R^2=0.215$, F-ratio=27.239	$P=1.179^c+0.235M^a-0.103Y^a$ [0.631] [0.029] [0.021] (1.866) (8.117) (4.734) adj. $R^2=0.268$, F-ratio=34.907	$P=1.069^c+0.250M^a-0.101Y^a$ [0.614] [0.028] [0.023] (1.742) (8.699) (4.353) adj. $R^2=0.294$, F-ratio=38.259	$P=1.087^c+0.248M^a-0.093Y^a$ [0.597] [0.028] [0.024] (1.821) (8.679) (3.824) adj. $R^2=0.301$, F-ratio=38.242	$P=1.168^c+0.250M^a-0.103Y^a$ [0.587] [0.028] [0.025] (1.986) (8.774) (4.031) adj. $R^2=0.325$, F-ratio=39.760

Note: Asterisks a, b and c show significant at 1%, 5% and 10 % levels respectively. Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

Fixed-effects and random–effect models are used based on the Hausman test.

Table 6: Panel estimates using moving averages data

Full sample of 102 Countries	
2 years moving averages	M= 15.344 -1.390Y[a] +0.519P[a] [3.334] [0.175] [0.0111] (4.602) (7.945) (46.609) adj. R^2 = 0.49 , F-ratio=32.21, HT=92.13
3 years moving averages	M= 13.764 -1.696Y[a] +0.566P[a] [2.861] [0.187] [0.011] (4.811) (9.091) (52.999) adj. R^2 =0.59, F-ratio=44.33, HT=92.06
4 years moving averages	M= 13.296 -1.712Y[a] +0.591P[a] [2.529] [0.189] [0.011] (5.257) (9.067) (56.890) adj. R^2 =0.64, F-ratio= 54.55, HT=100.46
5 years moving averages	M= 12.724 -1.485Y[a] +0.629P[a] [2.187] [0.180] [0.009] (5.819) (8.227) (63.284) adj. R^2 = 0.71, F-ratio=70.04 HT=106.98
6 years moving averages	M= 12.155 -1.159Y[a] +0.683P[a] [1.824] [0.164] [0.009] (6.664) (7.078331) (74.922) adj. R^2 = 0.78, F-ratio=100.16, HT= 146.49

Note: Asterisk a show significant at 1% level. Dependent variable is money supply growth rate Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

HT denotes Hausman test values.

Table 7: Panel estimates (dependent variable is money supply growth)

Variables	102 Countries	25 LAC countries	17 OECD countries	36 African countries	18 Asian countries	6 Persian Gulf countries
Intercept	17.789[a] [4.299] (4.137)	39.105[b] [17.607] (2.220)	8.287[a] [1.140] (7.265)	11.320[a] [0.465] (24.299)	12.861[a] [0.839] (15.326)	8.598[a] [0.773] (11.113)
P	0.509[a] [0.011] (43.365)	0.509[a] [0.023] (21.460)	0.765[a] [0.032] (23.375)	0.456[a] [0.024] (18.822)	0.312[a] [0.098] (3.178)	0.679[a] [0.161] (4.207)
R^2	0.419	0.413	0.571317	0.461	0.159	0.146
F-ratio	23.123	22.565	42.568	27.387	6.047	5.453
DW	1.760	1.758	2.433	1.674	1.912	1.318
HT	67.957 (0.000)	14.915 (0.000)	7.285 (0.007)	83.081 (0.000)	10.424 (0.001)	0.044 (0.832)
Estimators	FE	FE	FE	FE	FE	RE

Note: Asterisks a and b show significant at 1% and 10 % levels.

FE and RE are fixed-effects and random-effects

Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

HT= Correlated Random Effects - Hausman Test DW= Durbin Watson

Table 8: Least squares estimate (dependent variable is money supply growth)

Variables	Australia	Belize	India	Kenya	Qatar
Intercept	7.272[a] [1.562] (4.653)	9.907[a] [1.426] (6.946)	15.567[a] [1.349] (11.537)	11.862[a] [2.421] (4.898)	10.211[a] [2.677] (3.814)
P	0.888[a] [0.318] (2.792)	0.061 [0.424] (0.143)	0.145 [0.159] (0.915)	0.334[c] [0.156] (2.132)	1.140[c] [0.501] (2.274)
R^2	0.201	0.0006	0.026	0.127	0.143
F-ratio	7.797	0.021	0.837	4.547	5.175
DW	1.693	1.996	1.400	1.619	1.411

Note: Asterisks a, b and c show significant at 1%, 5 % and 10 % levels.
Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

Finally, we turn to individual countries. Our goal is economic policy, and it is individual countries that interests policymakers most. As argued at the beginning of this section, of the many ways in which data can be presented, the most natural appears to be that using contemporaneous values. We 'randomly' selected one country from each of the five regional subsamples to verify the money supply growth and inflation relationship. Here the fit seems to give results *contrary* to all QTM expectations. The correlation coefficient for money supply growth rate and inflation rate in case of time series data, on India (Asia), Kenya (Africa), Belize (LAC), Australia (OECD) and Qatar (Persian Gulf) found are less than 40 percent (Table 9). For stationarity we used the Augmented Dickey Fuller (ADF) test and found all variables stationary at level. The ADF test results are given in Table 10, while the OLS estimates are in Table 11. The OLS estimates of the present study do not reveal M^P^ but are often far from doing so.[23]

Overall, our empirical estimates contradict the findings of McCandless and Weber (1995), that growth rates of the money supply and the general price level are highly correlated. Using non-averaged data over the period of 1982-2014, for the full sample of 102 countries, for five subsamples, as well as country studies on India (Asia), Kenya (Africa), Belize (LAC), Qatar (Persian Gulf) and Australia (OECD) we are unable to reproduce their results, with the difference being particularly sharp for individual countries.

[23] Azam and Rashid (2015) did a study on Pakistan using 1972-2011 but their empirical findings reject the hypothesis that inflation in Pakistan is exclusively a monetary phenomenon; rather, it provides strong support to the alternative hypothesis of structural factors.

Table 9: Correlation coefficient for money supply growth and inflation (Annual data)

Sample	Coefficient for M	Observations
Australia (OECD)	0.4482	33
Kenya (Africa)	0.3576	33
Belize (LAC)	0.0254	33
India (Asia)	0.16217	33
Qatar (Persian Gulf)	0.37824	33

Source: Author computation

Table 10: Augmented Dickey-Fuller test results (for individual countries)

	India (Asia)	
	Level	
Variables	Constant	Constant & Trend
P	-3.615258	-3.603129
M	-3.890104	-3.922061
Y	-4.519167	-4.803567
	Belize (LAC)	
P	-1.424508	-2.966310
M	-5.242786	-5.355412
Y	-4.970543	-5.207235
	Australia (OECD)	
P	-3.057850	-3.212134
M	-3.925063	-4.174853
Y	-4.301161	-4.531113
	Qatar (Persian Gulf)	
P	-3.173961	-3.200792
M	-3.352629	-4.170610
Y	-4.405658	-5.580255
	Kenya (Africa)	
P	-3.268615	-3.285437
M	-3.443232	-3.387058
Y	-3.596147	-3.743576

Source: Author computation

Table 11: Least Squares estimates (dependent variable is inflation rate)

Countries	Estimated equations	adj. R^2	SE	F- Stat	D-W
Australia (OECD)	P= 1.302+ 0.278M[a] - 0.089Y[b] [0.937] [0.079] [0.039] (1.389) (3.493) (2.245)	0.270	2.407	6.927	1.105
Kenya (Africa)	P= 4.214[a]+ 0.422 M[a] - 0.450Y[a] [2.054] [0.112] [0.063] (2.051) (3.763) (7.044)	0.649	5.380	30.654	1.755
Belize (LAC)	P=2.460[a] +0.093 M - 0.218Y[a] [0.748] [0.069] [0.063] (3.288) (1.347) (3.446)	0.236	2.048	5.953	2.057
India (Asia)	P= 4.092 + 0.229M - 0.170Y[a] [2.935] [0.173] [0.052] (1.393) (1.325) (3.248)	0.231	2.639	5.825	1.659
Qatar (Persian Gulf)	P= 1.633[c]+ 0.102M[c] -+0.054Y [1.026] [0.057] [0.045] (1.591) (1.774) (1.211)	0.128	3.806	3.366	1.299

Note: Standard errors of coefficients are in parentheses and t-ratios are in brackets. SE is standard error of regression. Asterisks a, b, and c shows statistically significant at 1%, 5%, and 10 % levels respectively.

Table 12: Least Squares estimates using moving averages data (dependent variable is inflation rate)

Countries	2 years moving averages	3 years moving averages	4 years moving averages	5 years moving averages	6 years moving averages
El Salvador	$P = 5.02 + 0.243M^a - 1.09 Y^a$ [0.845] [0.062] [0.088] (5.93) (3.89) (12.33) adj. R^2= 0.83, F-ratio= 76.0	$P = 4.40 + 0.325 M^a - 1.12 Y^a$ [0.749] [0.060] [0.074] (5.87) (5.38) (15.10) adj. R^2=0.88 , F-ratio=114.17	$P = 3.944 + 0.389 M^a -1.143 Y^a$ [0.669] [0.057] [0.063] (5.89) (6.79) (18.15) adj. R^2= 0.91, F-ratio= 165.45	$P = 3.338+ 0.464M^a - 1.193Y^a$ [0.5242] [0.047] [0.048] (6.37) (9.90) (24.80) adj. R^2=0.96 , F-ratio=308.51	$P = 3.145+ 0.483M^a -1.202Y^a$ [0.523] [0.048] [0.047] (6.01) (10.17) (25.70) adj. R^2=0.96, F-ratio=332.54
Japan	$P = 0.082 + 0.214M^a- 0.038 Y^b$ [0.178] [0.035] [0.015] (0.46) (6.06) (2.52) adj. R^2=0.56 , F-ratio=52.9	$P = 0.027 + 0.225M^a - 0.036Y^c$ [0.160] [0.034] [0.017] (0.17) (6.57) (2.14) adj. R^2= 0.59, F-ratio=22.41	$P = -0.017+ 0.220M^a - 0.017Y$ [0.1388] [0.036] [0.019] (0.12) (6.06) (1.42) adj. R^2=0.61 , F-ratio=23.67	$P = -0.048+ 0.222M^a-0.019Y$ [0.124] [0.037] [0.022] (0.39) (6.03) (0.85) adj. R^2= 0.70, F-ratio=33.95	$P = -0.065+ 0.220M^a - 0.012Y$ [0.102] [0.036] [0.023] (0.64) (6.04) (0.51) adj. R^2= 0.78, F-ratio=49.80
Kenya	$P = 2.09 + 0.565 M^a - 0.418 Y^a$ [1.698] [0.096] [0.056] (1.23) (5.84) (7.47) adj. R^2= 0.75, F-ratio=48.06	$P = 0.99 + 0.646 M^a - 0.366 Y^a$ [1.461] [0.084] [0.053] (0.68) (7.64) (6.96) adj. R^2=0.87 , F-ratio=63.52	$P = 0.351+ 0.691M^a - 0.337Y^a$ [1.332] [0.078] [0.053] (0.27) (8.80) (6.38) adj. R^2= 0.84, F-ratio=78.19	$P = -0.119+ 0.725M^a- 0.305Y^a$ [1.228] [0.074] [0.054] (0.09) (9.82) (5.64) adj. R^2=0 .87, F-ratio=96.90	$P = 0.113+ 0.723M^a - 0.293Y^a$ [1.119] [0.069] [0.054] (0.10) (10.49) (5.43) adj. R^2=0.89 , F-ratio=114.82
India	$P = 2.66 + 0.315 M^c - 0.243Y^a$ [3.022] [0.178] [0.052] (0.88) (1.76) (4.62) adj. R^2=0.39 , F-ratio= 10.93	$P = 1.82 + 0.361 M^c - 0.258 Y^a$ [2.868] [0.169] [0.049] (0.63) (2.14) (5.19) adj. R^2=0.46 , F-ratio=38.20	$P = 0.654+ 0.429M^b - 0.277Y^a$ [3.088] [0.182] [0.049] (0.21) (2.36) (5.60) adj. R^2=0.51 , F-ratio=16.15	$P = -1.381+ 0.549M^b -0.294Y^a$ [3.539] [0.208] [0.049] (0.39) (2.64) (5.89) adj. R^2=0.55 , F-ratio=17.87	$P =-4.266 + 0.716M^a-0.313Y^a$ [3.807] [0.224] [0.047] (1.12) (3.20) (6.70) adj. R^2=0.62 , F-ratio=23.04
Qatar	$P = 1.10 + 0.159 M^b + 0.0153Y$ [0.959] [0.064] [0.056] (1.15) (2.45) (0.27) adj. R^2= 0.20, F-ratio= 4.92	$P = 0.767 + 0.195 M^a - 0.009Y$ [0.865] [0.066] [0.061] (0.89) (2.96) (0.16) adj. R^2= 30.0, F-ratio= 7.28	$P = 0.752+ 0.206M^a - 0.020Y$ [0.777] [0.065] [0.060] (0.97) (3.16) (0.34) adj. R^2=0.36 , F-ratio=9.12	$P = 0.929+ 0.192M^a -0.0115Y$ [0.696] [0.064] [0.060] (1.34) (3.02) (0.19) adj. R^2=0.40 , F-ratio=10.45	$P = 1.157+ 0.182^a - 0.010Y$ [0.586] [0.060] [0.059] (1.97) (3.02) (0.17) adj. R^2=0.48 , F-ratio=13.55

Note: Asterisks a, b and c show significant at 1%, 5% and 10 % levels respectively. Standard errors and t-ratios are in brackets [ ] and parentheses ( ) respectively.

Table 13: Dumitrescu Hurlin Panel Causality Analysis

	Null Hypothesis	W-Stat.	Zbar-Stat.	Prob.
102 countries	M does not homogeneously cause P	44.3556	87.8993	0.0000
	P does not homogeneously cause M	3888.50	8821.61	0.0000
17OECD countries	M does not homogeneously cause P	17.0564	10.5642	0.0000
	P does not homogeneously cause M	7.75414	1.93618	0.0528
25 LAC countries	M does not homogeneously cause P	149.139	161.376	0.0000
	P does not homogeneously cause M	15844.8	17815.5	0.0000
36 African countries	M does not homogeneously cause P	8.45441	3.76272	0.0002
	P does not homogeneously cause M	6.61230	1.27636	0.2018
6 Persian Gulf countries	M does not homogeneously cause P	8.00932	1.29087	0.1967
	P does not homogeneously cause M	3.71721	-1.07421	0.2827
18 Asia countries	M does not homogeneously cause P	9.39799	3.56122	0.0004
	P does not homogeneously cause M	6.56746	0.85973	0.3899

Note: Lag 5
Source: Author computation

5. Concluding Remarks

The adherents of QTM say that P^M^ is true and that it is universal. Therefore, QTM has long been considered a strong foundation to guide economic policy in many developing countries. While our aim is not to examine QTM per se but rather the empirical evidence on the basis of which QTM is recommended for policy worldwide, a few words on its application are warranted. Since developing countries have their own defining characteristics, it is important that developing countries be allowed to decide monetary policy based on the conditions prevailing in *their* own economy. No one can deny that too much money causes inflation, but money growth may not be the only factor involved, and therefore other factors should also be considered. Developing countries have repeatedly argued that much inflation has arisen from non-monetary factors. Structuralists argue that the main drivers of inflation are food prices (because of the sluggish productivity growth of the agriculture), costs of production, wages and import prices[24]. Several studies, for example, Fischer and Mayer (1981) support structural arguments for six Latin American countries namely Bolivia, Brazil, Chile, Colombia, Ecuador, and Peru, where the fundamental inflationary pressures from the agricultural sector appear to dominate. Mortaza and Hasnayen (2008) find that

[24] See Sunkel, 1960; Saini, 1982; Downes & Leon., 1987; Ndanshau, 2010.

inflation is largely driven by higher food prices in Bangladesh. Cooray (2008) finds that supply side factors influence the general prices level in Sri Lanka, while Barnett, Bersch and Ojima (2012) suggest that food prices are the key driver of inflation in Mongolia. Khan (2015) claimed that inflation in Pakistan had lessened considerably, and this was mainly due to lower energy and food prices, as monetary policy had stayed relatively unchanged. Anand, Kumar and Tulin (2016) observe that domestic food demand and supply factors strengthen food price dynamics in India, due to the limited responsiveness of agricultural production[25].

Several recent papers have modified the above approach by using interest rates to influence the demand for money, and then to apply the modified demand and supply functions of money, together with an equilibrium assumption, to assess the validity of the Quantity theory. Whether or not this succeeds, it does nothing to remove a critique based on a version of QTM that has been widely used for decades. From an empirical point of view, which is our focus here, this modification does little to improve the modified QTM case when applied to our data [we used the real rate of interest from the same database as our interest rate variable].[26] Once we adopt the framework involving interest rates, we not only restrict our attention to a much smaller subset of countries, typically the USA and some European countries, but the argument also requires more elaboration, especially in justifying the exact manner in which the interest rate affects money demand. From a theoretical point of view, the extant Baumol-Tobin type analyses were severely criticised long ago by Sprenkle (1969), but whose objections have not been seriously incorporated; and from an empirical point of view, one is hard pressed to know how the US dollar can be accurately modelled, when such an uncertain part of the supply actually circulates in the USA[27].

It was claimed by Lucas (1996): "The central predictions of the quantity theory are that, *in the long run*, money growth should be neutral in its effects on the growth rate of production and should affect the inflation rate on a one-for-one basis" [p. 656, emphasis added]. Our primary aim was to re-examine the factual basis for this claim. There is an impasse in seeking validation for QTM in the data since the long run does not supply us its data, and when we try to approach the

[25] It is somewhat ironic, in view of the strong Latin American support for Structuralism that the regional sample which is probably most supportive of QTM is that of Latin America, as a comparison of both figures and Tables of the Full sample with those for LAC will demonstrate.

[26] To save space, we have not described these regressions here.

[27] Sprenkle (1969). Also see Rogoff (2016) has called for the abolition of cash and, in the process, has provided a wealth of information about the fluid travels of the dollar. Sprenkle (1993) made the point about the uncertain whereabouts of the currency much earlier.

long run through moving averages new complications arise. As noted earlier, the wider prevalence of economic rationality, as well as the electronic dissemination of data, both suggest a short time lag for the effects of M on P. We examine the practical usefulness of QTM by seeking its validity with contemporaneous data. Our estimates reveal that there is a positive relationship between the growth rate of money supply and inflation, but the estimated coefficient is below 1 and does not confirm the QTM predictions. The effect of real GDP growth is to reduce inflation and is almost always statistically significant[28]. Our country studies for India, Kenya, Belize, Australia, and Qatar find no support for QTM. Perhaps the long-run proportionality between money growth and inflation is the exception rather than the rule? The empirical result of the study fails to support the inflation is exclusively a monetary phenomenon. Central banks may be unable to overcome inflation through monetary manipulation alone, and importance should also be given also to non-monetary factors[29].

It is probably true that 'atheoretical' facts do not exist; this is certainly the case for facts which have any interest, since interest alone implies a viewpoint and an implicit theory. Despite this philosophical caveat, obtaining statistical regularities with a minimum of theory is laudable since it provides us with the beams, we must find foundations for. Much as we may want P^M to be the factual underpinning of the QTM, the facts to date do not justify such a belief.

[28] This takes us back to Friedman and away from Lucas.

[29] Interest rates have been given considerable attention recently because of the new phenomenon of negative interest rates. In a study done in much the same spirit as this paper, Aizenman, Cheung and Ito (2016) also find the impact of interest rates on savings to be quite varied across the world---thus emphasising the fragility of globally applicable economic theory.

References

1. Aizenman, J., Cheung, Y.-W., and Ito, H., (2016). The interest rate effect on private saving: alternative perspectives, NBER working paper series no 22872. Retrieved from http://www.nber.org/papers/w22872
2. Anand, R., Kumar, N., and Tulin, V., (2016). Understanding India's food inflation: the role of demand and supply factors. IMF Working Paper, WP/16/2. Asia and Pacific Department
3. Azam, M., and Rashid, S., (2015). The monetarist hypothesis of inflation in Pakistan – a critique. *Journal of the Asia Pacific Economy*, 20 (4), 559-576
4. Barnett, S., Bersch, J., and Ojima, Y. (2012). Inflation in Mongolia: understanding the roller coaster. IMF Working Paper, WP/12/192. Asia and Pacific Department. Retrieved from https://www.imf.org/external/pubs/ft/wp/2012/wp12192.pdf
5. Cassidy, A. W., Tower, E., and Wang, X., (2016). Manufacturing fetishism: the neo-mercantilist preoccupation with protecting manufacturing (September 1, 2016). Economic Research Initiatives at Duke (ERID) Working Paper No. 227. Available at SSRN: https://ssrn.com/abstract=2833529
6. Cline, W. R. (2015). Quantity theory of money redux? Will inflation be the legacy of quantitative easing? Peterson Institute for International Economics, Policy Brief Number PB15-7, pp 1-13
7. Cooray, A.V. (2008). A model of inflation for Sri Lanka. *Review of Applied Economics*, 4(1-2), 35-44
8. Downes, H. and Leon, (1987). Inflation in Barbados: a co-integration approach. Central Bank of Barbados Working Papers, pp.173-177
9. Fischer, B. and Mayer, T. (1981). On the structural view of inflation in some Latin American countries: a reassessment. *The Developing Economies*, 19(1), 31–51
10. Friedman, M., (1973). *Money and economic development*. New York, Praeger
11. Friedman, M., (1970). The counter-revolution in monetary theory. Institute of Economic Affairs (IEA) Occasional Paper, No. 33. First published by the Institute of Economic Affairs, London
12. Goodfriend, M., (2007). How the world achieved consensus on monetary policy. *Journal of Economic Perspectives*, 21 (4), 47–68
13. Grauwe, P. D., and Polan, M., (2005). Is inflation always and everywhere a monetary phenomenon?, *Scandinavian Journal of Economics*, 107(2), 239-259
14. Hausman, J. A., (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251-1271.

15. Im, K.S, Pesaran, M.H, and Shin, Y., (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115 (revise version of 1997's work), 53-74
16. International Monetary Fund (2015). Retrieve from http://www.imf.org/en/Data
17. Khan, M. (2015). Is Pakistan's economy out of the woods? East Asia Forum: Economics, Politics and Public Policy in East Asia and the Pacific. Available at http://www.eastasiaforum.org
18. Levin, A., C. Lin, and C. J. Chu (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1–24.
19. Lucas, R. E., (1980). Two illustrations of the quantity theory of money. *The American Economic Review*, 70 (5), 1005-1014.
20. Lucas, R. E., (1986). Adaptive behavior and economic theory. *The Journal of Business*, 59(4), S401-S426
21. Lucas, R. E., (1996). Lecture: monetary neutrality. *Journal of Political Economy*, 104(4), 661-682
22. McCandless, G.T., and Weber, W. E. (1995). Some monetary facts. *Federal Reserve Bank of Minneapolis Quarterly Review*, 19(3), 2–11
23. McCallum, B.T., and Nelson, E., (2010). Chapter 3 – Money and inflation: some critical issues. *Handbook of Monetary Economics*, 3 (2010), 97–153. doi:10.1016/B978-0-444-53238-1.00003-X
24. Mortaza, G. M., and Hasnayen, S., (2008). Inflation accounting across different income groups: does inflation hurt the poor relatively more in Bangladesh? *Bangladesh Bank Quarterly*, V (3), 30-41.
25. Moosa, I.A., Al-Saad, K., & Khatatbeh, I. N., (2024). The quantity theory of money, quantitative easing and the missing inflation phenomenon. *Journal of Central Banking Theory and Practice*, 2: 71-88
26. Ndanshau, M.O.A. (2010). Money and other determinants of inflation: the case of Tanzania. *Indian Journal of Economics and Business*, 9 (3), 503-545.
27. Omer, M. and Saqib, O. F. (2009). Monetary targeting in Pakistan: a skeptical note. *SBP Research Bulletin*, 5(1),53-81. State Bank of Pakistan, Karachi.
28. Poole, W., (1978). Money and the Economy: A Monetarist View. Addison-Wesley Publishing Company.
29. Rogoff, K., (2016). Why we need a 'less-cash society'. Retrieved from https://www.weforum.org/stories/2016/09/kenneth-rogoff-why-we-need-a-less-cash-society/
30. Saini, K.G. (1982). The monetarist explanation of inflation: the experience of six Asian countries. *World Development*, 10 (10), 871-884.

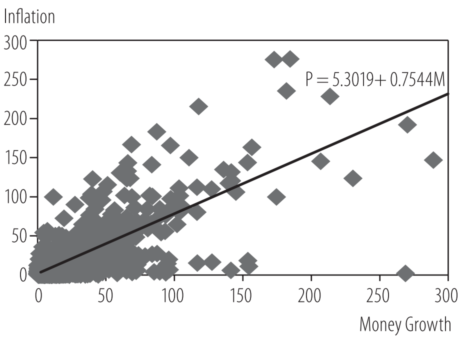
31. Svensson L.E. O. (2012). Differing views on monetary policy Speech by Prof Lars E O Svensson, Deputy Governor of the Sveriges Riksbank, at SNS/SIFR Finanspanel, Stockholm, 8 June 2012. https://www.bis.org/review/r120612c.pdf
32. Smith, B. D. (1988). The relationship between money and prices: some historical evidence reconsidered. *Federal Reserve Bank of Minneapolis Quarterly Review*, 12(3), 18-32
33. Sprenkle, C., (1969). The uselessness of transactions demand models. *Journal of Finance*, 24: 835-847
34. Sprenkle, C. M., (1993). The case of the missing currency. *Journal of Economic Perspectives*, 7(4), 175-184
35. Sunkel, O., (1960). Inflation in Chile: an unorthodox approach. *International Economic Papers*, 10: 107-131.
36. Teles, P. and Uhlig, H., (2013). Is quantity theory still alive? Working Paper Series NO 1605/November 2013. European Central Bank (ECB), Germany.
37. Vogel, R. C., (1974). The dynamics of inflation in Latin America, 1950-1969. *The American Economic Review*, 64(1), 102-114
38. Whiteman, C. H. (1984). Lucas on the quantity theory: hypothesis testing without theory. *The American Economic Review*, 74(4), 742-749
39. World Development Indicators (2018), The World Bank database. Retrieved from http://data.worldbank.org/country

Appendix

Table A1: List of 102 countries

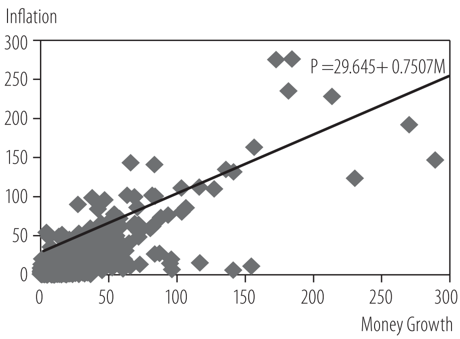
Sample	Countries
18 Asian Countries	Bangladesh, Bahrain, China, Fiji, India, Indonesia, Iran, Sri Lanka, Malaysia, Nepal, Pakistan, the Philippines, Papua New Guinea, Singapore, Thailand, Samoa, Solomon Islands, and Vanuatu
36 African Countries	Algeria, Benin, Burundi, Burkina Faso, Botswana, Central African Republic, Cote d'Ivoire, Cameroon, Congo, Rep., Cabo Verde, Chad, Egypt, Arab Rep., Ghana, Gambia, Gabon, Kenya, Lesotho, Libya, Morocco, Madagascar, Mali, Malta, Mauritius, Malawi, Seychelles, Swaziland, , Niger, Nigeria, Sudan, Senegal, South Africa, Togo, Tunisia, Tanzania, Uganda, and Zambia
6 Persian Gulf Countries	Jordan, Kuwait, Oman, Qatar, Kingdom of Saudi Arabia, and United Arab Emirates
25 Latin America & Caribbean (LAC)	Bahamas, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominica Rep., Ecuador, El Salvador, Grenada, Guatemala Honduras, Haiti, Jamaica, Mexico, Nicaragua, Paraguay, Panama, Peru, Suriname, Trinidad and Tobago, Uruguay, and Venezuela
17 OECD Countries	Australia, Cyprus, Denmark, Finland, Hungary, Iceland, Israel, Italy, Japan, Korea, Rep., Netherlands, Poland, Sweden, Switzerland, Turkey, United Kingdom, and United States

Figure 3: 102 Countries[30]



Correlation coefficient= 0.6334

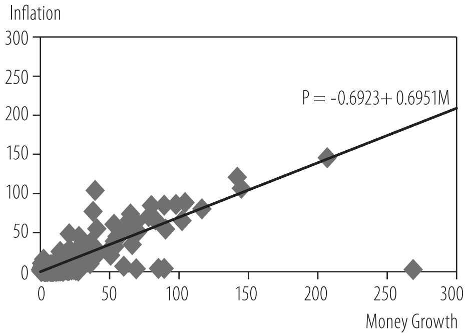
Figure 4: 25 LAC



Correlation coefficient= 0.6369

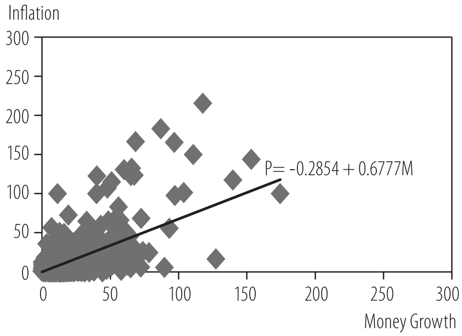
[30] Using panel data in Figure 3-8, for trend line estimation, the programmed regression techniques i.e. pooled regression is used, while results in Table 4 are fixed- and random-effects results based on the Hausman test.

Figure 5: 17 OECD countries



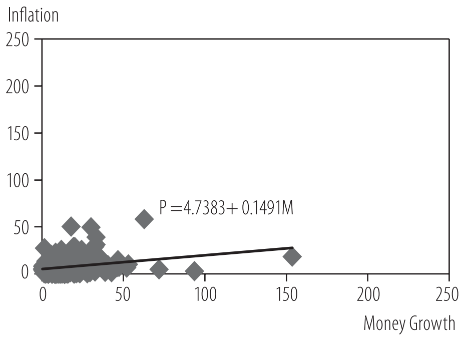
Correlation coefficient=0.7463

Figure 6: 36 African countries



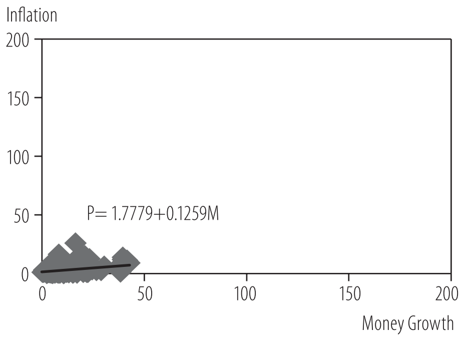
Correlation coefficient= 0.6291

Figure 7: 18 Asian Countries



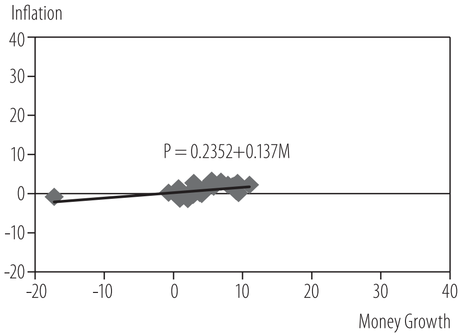
Correlation coefficient= 0.2924

Figure 8: 6 Persian Gulf countries



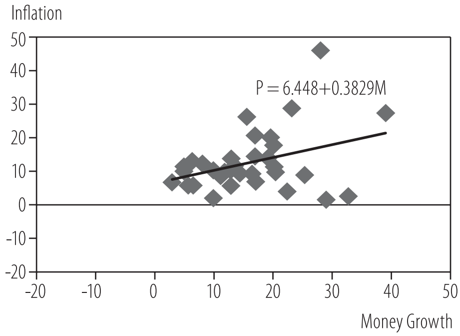
Correlation coefficient= 0.2883

Figure 9: Japan (OECD)



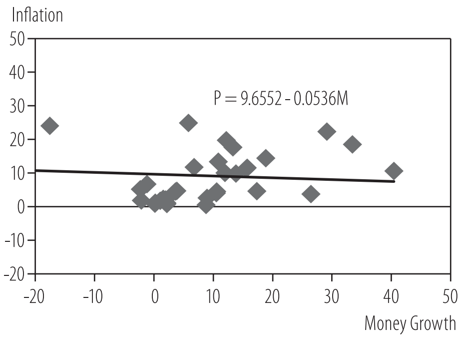
Correlation coefficient= 0.553

Figure 10: Kenya (Africa)



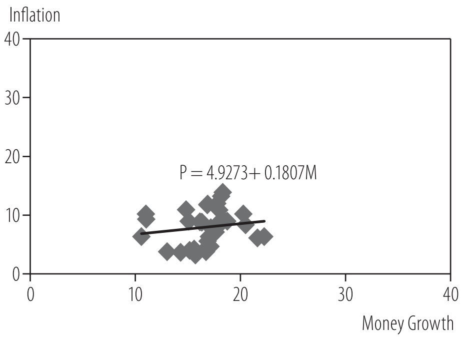
Correlation coefficient= 0.3576

Figure 11: El Salvador (LAC)



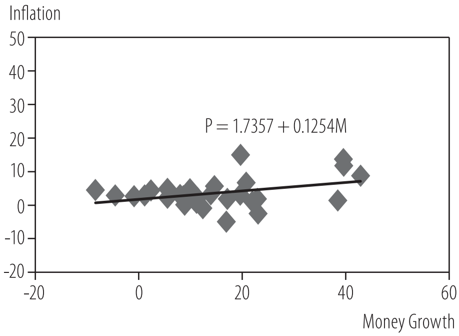
Correlation coefficient= -0.0898

Figure 12: India (Asia)



Correlation coefficient= 0.16217

Figure 13: Qatar (Persian Gulf)



Correlation coefficient= 0.3782