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GOVERNMENT FINANCE AND THE DEMAND FOR MONEY—THE RELATION BETWEEN TAXATION AND THE ACCEPTABILITY OF FIAT MONEY

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Summary

Requiring taxes to be paid in domestic money provides a valuable characteristic for a state's money. In the case of a state's fiat money, it is the foundation for money demand and hence to the development of a financial system built around state money. Except for relatively highly taxed countries, where taxes may encourage tax avoidance and holding bank deposits, the level of taxation is a positive factor boosting financial development. Granger causality tests for 65 countries over the past half-century test the relationship between money and government finance. Except for the low-income countries, where there are only five with adequate data, the causal relationship between taxation and money demand is generally supported in the 60 countries making up the three higher income groups.

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GOVERNMENT FINANCE AND THE DEMAND FOR MONEY—THE RELATION BETWEEN TAXATION AND THE ACCEPTABILITY OF FIAT MONEY

The role of institutions in the theory of economic development regained critical significance in the last decade, and nowhere is this more trenchant than in efforts to explain the importance of monetary institutions in providing stable-valued money.[1] At the same time, attention has returned to the issue of the role of financial development as a factor affecting economic growth and development.[2] Inflation has long been recognized as providing an incentive to avoid holding deposits in financial institutions and instead to employ barter. Analogously, tax evasion or engaging in illegal economic activity has provided a strong incentive to hide economic activity by avoiding the use of legitimate financial institutions' products—i.e., bank accounts. On the other hand, government enforcement of taxation entails a motivation for holding fiat money, as taxes must be paid in the state's fiat money. Thus, the need to pay taxes in government money potentially creates a positive relation between government finance and bank money.

The linkages between taxation and monetary development are not simple ones, however. Standard monetary theory emphasizes transactions cost savings as the foundation for money demand; since this requires an intrinsic value for the medium of exchange, this approach gave rise to a so-called "metalism" theory of money. Yet this theory has an internal paradox in modern monetary systems that are based on fiat money: Why is the worthless token accepted in exchange? There is an alternative theory called "chartalism" which provides an answer to this

[1]An important example in this renewal is North (1990). The literature on central bank independence, monetary constitutions, the role of transparency and credibility all reflect the growing importance of institutional development in promoting economic performance.
[2]Early proponents of the importance of financial development for economic growth are Shaw (1973) and McKinnon (1973). See Levine (1997) for a more recent survey of the literature on the significance of this linkage.

conundrum; it focuses on the state's role in facilitating the use of money to pay taxes by requiring that these payments be made in monetary form. A German economist Georg Friedrich Knapp in a book published in the late 19th century formalized this view; its fourth edition was translated into English in 1924, *The State Theory of Money*. Near the mid-century, an American economist Abba Lerner (1947) also promoted the view that the demand for domestic fiat money is rooted in the ability to use it to pay domestic taxes. In effect, taxation is the basis for a legal tender approach to money demand and hence to the development of a financial system that produces and distributes financial assets based on domestic money. Near the end of the century, this view was enunciated by Charles Goodhart in "The Two Concepts of Money" (1998) that has been republished in a volume addressing the comparative strengths of the two approaches with commentary by a panel of critics in *The State, the Market and the Euro,* edited by Stephanie A. Bell and Edward J. Nell, 2003.[3]

In the chartalist view, taxation forms the institutional basis for money demand. Consistent with this understanding, in new states the process of financing government is a positive factor in boosting financial development. Beyond some level, however, taxation, like inflation, provides an incentive to reduce money demand and thereby reduces the size and contribution of the financial sector. Thus taxation takes on a special role in institutional development in new transition or emerging economies.

This special role is the focus of this article, and it embodies the extent to which government finance can explain the demand for money in a broad collection of countries, developed and advanced. This paper examines the connection between the use of domestic money—currency and deposits—and the effects of the government's taxation in enhancing the demand for money in economies at all levels of development. This investigation is conducted in the broader context of effects of taxes in both emerging markets and developed countries to clarify the channels of influence. Broadly speaking, most transition and emerging economies are beset by numerous

[3] See Ott and Tatom (2006) for a related discussion of Knapp's theory that also provides other evidence supporting it. Earlier discussions of the taxation-money demand link can be found in Smith (1776, Book II, Chapter II), Keynes (1930, volume 1, chapter 1), who explicitly attributes the idea to Knapp, though both discussed only specie and commodity-backed money. More recently, Starr (1974, 2003) and Goldberg (2012) have provided a theoretical foundation for a tax-based theory of value for fiat money. We are indebted to an anonymous referee for pointing out the latter discussions.

challenges to effective development and growth of the financial sector. These challenges include:

- mistrust of banks due to their history of frozen accounts, outright expropriation, lack of privacy,
- recurring bouts of high inflation reducing the credibility of the value of domestic currency deposits,
- associated devaluations of domestic currency reducing money's purchasing power,
- ineffective tax administration, lowering the cost of tax evasion and increasing the proportion of underground economic activity,
- high tax rates on visible activities increasing the incentive to go underground,
- relatively large size of the underground economy, reducing the utility of recorded transactions,
- ineffective tax treatment of services,
- lack of contract enforcement, in particular, ineffective seizures of liens on collateral, and
- lack of land or real property transferability.

This list, by no means exhaustive, suggests that money is less useful or more costly to use in transition and emerging economies than in mature market economies.[4]

Still, there is a strong relation between financial development and economic growth. Financial development here refers to the increased division of labor fostered by the expansion of demand for money and that manifests itself in an improving payments system and expanding intermediation of monetary and financial services. Summarized by Levine in his review, "countries with larger banks and more active stock markets grow faster over subsequent decades, even after controlling for many other factors underlying economic growth."[5] Continuing, he lists the functions that financial systems—including banks—provide:

- facilitate the trading, hedging, diversifying, and pooling of risk,
- allocate resources,
- monitor managers and exert corporate control,
- mobilize savings, and
- facilitate the exchange of goods and services.

We do not investigate the forms of financial development in this paper—other than the simple one that money demand is enhanced, including a rise in deposits, a link that is well established

[4] Beim and Calomiris (2000) discuss several other features that characterize financial repression (or result from it) including low real rates of interest, small shares of private sector credit and of bank lending, high reserve ratios and small market capitalization of financial firms relative to GDP.
[5] Levine (1997), pp. 690-691.

between financial development and economic growth. We also assume in this connection the broad tendency that money growth is predominantly in deposits. [6]

The principal focus in this paper is the relation of money to tax policy—namely, the hypothesized link between tax administration and the demand for money. In the next section, the notion of money backed by implied tax liabilities set out by Knapp, later by Lerner and more recently by Goodhart and his critics, is reviewed. From this discussion, the relation between money demand and taxation is inferred and differentiated from other effects of taxation. These relations are specified as a hypothesis in section 2, while section 3 presents time-series tests on 65 individual countries during the past half century. Brief concluding remarks are offered in section 4.

2. MONEY AS A CREATURE OF THE STATE

For as long as fiat money has been used, philosophers, historians and economists have debated the conundrum of its acceptability in exchange. According to historians, when Marco Polo returned to Venice near the end of the 13th century and reported that the Chinese used paper money, the proffered rationalization was alchemy; that is, somehow, the Chinese were able to convert paper to gold.[7] Of course, this explanation is substantially valid: When paper money is backed by a commodity such as gold, the use of the relatively worthless surrogate is understood to be a claim check on the underlying asset.[8] When money is not transformable into a commodity, but is simply declared to be legal tender as with contemporary currencies in the OECD economies, the apparent mystery remains.

A variety of explanations have been offered, most of which depend on some version of the greater fool theory—i.e., that the next seller is expected to accept it, so I will accept it. In comparison with commodity-backed money or bank money where either a real store of value or services is offered to compensate for the risk of devalue or dishonor, pure fiat money has no

[6] For example, during 2000-2006, Argentina's quasi money (non-transaction deposits) was about six times its currency outside of banks; in South Korea this ratio was more than 20; in Peru, Mexico, and Portugal, the ratio was more than six, according to the IMF *International Financial Statistics.*

[7] See DeSoto (2000), p. 222.

[8] This is the logic of the traditional goldsmith story used in money and banking courses, based on the origins of partial reserve banking by goldsmiths in Restoration England in the 1660s.

inherent rationale for its acceptability*: I accept it in exchange because I expect the next trading agent will be as naive as I am.*[9]

Georg Friedrich Knapp—and later Abba Lerner—offered a simple and sensible alternative to the greater fool theory for fiat money's acceptance. Knapp's argument was developed earlier and in more detail, but Lerner was apparently unfamiliar with it. Knapp was quite explicit about the importance of the role of compulsory use of domestic money for tax payments in laying the basis for money demand. Indeed, he emphasized that a legal tender basis was not enough to motivate the demand for domestic money:

> "In the autumn of 1895, in a course of lectures in Berlin, I put forward my views fully for the first time, laying down: that *the money of a State is not what is of generally compulsory general acceptance, but what is accepted at the public pay offices.*" p.vii (emphasis added)

Lerner's explanation, like Knapp's, for the acceptability of fiat money relies on the need for fiat money balances to pay tax liabilities: the government is not just willing, it *requires payment in fiat currency* for tax liabilities.[10] Thus, in order to pay his taxes, each person must accumulate fiat money balances equal to his tax liability by the end of the tax period. This anticipated transaction—which requires a payment in fiat money—provides a convertibility guarantee for the fiat money during the period. Further, assuming that the tax liability is accepted and that the individual anticipates paying it punctually, he would have to accumulate money balances in advance of its due date. This implies that an effective tax program would create incentives to acquire and hold fiat money balances because, unlike the greater fool theory, it is certain that the tax collector will exchange—at a fixed and certain rate—the accumulated fiat money balances offered for the tax liability. The required money balances will be positively related to the size of the anticipated tax bill—and more generally, the size of the government's needed revenues—which, in turn, is positively related to the individual's tax rate. Consequently, the demand for money balances should be positively related to some measure of the government's financing effort. While the anticipated tax liability provides an incentive to hold fiat money balances, they do not need to be held in physical form as cash; a more efficient alternative would be bank

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[9] Kovenock and DeVries (2002) provide a model of demand for money based on a variant of the "greater-fool" theory.

[10] This is not to argue that the existence of tax payments requires the introduction of fiat money. To the contrary, the sovereign could dictate that commodity money or foreign money of any type be used. The requirement that tax payments be made in domestic fiat money, including bank deposits backed by domestic outside money, however, gives rise to a demand for domestic fiat money.

deposit balances, either to facilitate other interim transactions or to earn interest. Thus, a broad measure of money (M2) that is convertible on reasonable notice into transferable funds should be the measure of the relevant asset whose demand is boosted by this requirement to pay taxes with fiat money.[11]

A systematic direct and positive relation is therefore expected to hold between tax effectiveness and both money demand and the size of the domestic financial sector. The higher the taxes that are collected, the higher will be the demand for domestic money in the economy relative to foreign or private money and relative to GDP. This implies a positive relation between the efficacy of tax administration and (1) the use of domestic money in financing GDP expenditures—i.e., money demand, or the ratio of money to GDP, and (2) the size of the monetary sector, at least for "low-to moderate" levels of taxation and development. It also follows that both money demand and the size of the monetary sector should be enhanced by greater tax effort. Note that this implies that the institution or existence of taxation requiring payment in domestic money not only generates a demand for domestic money, but the level of the tax liability incrementally affects the quantity of this money demand.

Taxation has several effects beyond providing a basis for the demand for money. None of these are tested in this paper, but they set out an agenda for further research and empirical testing. Typically, a large share of economic activity in emerging economies and especially in transition economies is underground. There are only two reasons for economic activities to be underground—either the activity is per se illegal or the entrepreneur is avoiding taxes on otherwise legal activity.[12] Thus, in the transition economies tax compliance is not high, taxes are actively evaded or avoided, and, as a result, measured GDP is understated. Furthermore, banks are not trusted—both because of the frequency with which deposits are frozen and because bank deposits and transactions using them provide data to the tax authorities about the income of the depositor. Thus, for tax-evaders, bank accounts do not provide a low-cost transactions medium. So, there is reason to expect that the relation between money demand and taxes could be attenuated by the relative size and growth of the underground economy.[13]

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[11]We assume here that bank deposits backed by domestic fiat money are also fiat money. A basis for holding fiat money also bolsters the financial system according to the tax hypothesis.

[12]For simplicity, bureaucratic costs such as licensure and regulation can be thought of as part of tax load.

[13]Cagan (1958) and Feige (1985) emphasize the importance of taxation in affecting the demand for currency and the size of the underground economy. See Hill and Kabir (2000) for a recent review and evidence of tax effects on

At a sufficiently high tax rate, individuals have an incentive to use barter, foreign money or domestic currency instead of domestic deposits for transactions and, in the latter cases, as liquid stores of value. The same effects arise in traditional tax avoidance behavior in the legal economy. Substitution of domestic currency for bank deposits reduces the relative size of the financial sector and would be indicated in the money multiplier – the ratio of M2 to the monetary base. In addition, tax avoidance reduces the overall demand for money. A third channel of tax influence is that the average tax rate reduces wealth and disposable income and could further reduce money demand. Thus, a non-linear relation of tax rates to money demand and the size of the money multiplier is likely. Only at low tax rates and low real GDP per capita levels will the tax rate have a positive effect on money demand and the money multiplier.[14]

Finally there is a fourth channel of influence of taxation, though not relevant to emerging or transition economies. Taxation of capital market returns implies that the return to risk-taking is subject to taxation. A higher tax rate reduces the return on risky assets relative to that on safe assets such as bank deposits. At a sufficiently high tax rate, the demand for safe assets could actually be boosted by tax increases. This implies a second switch in high income countries in which money demand and/or the money multiplier is raised when taxes increase, just as in very low income, emerging or transition economies, but for very different reasons. If such a switch occurs, it casts serious doubt on potential growth effects of financial sector development. Such instances of a broader type of capital market repression are most likely only at high levels of taxation. In fact, there is evidence below of precisely this sort of re-switching. It is important to bear in mind that a positive relation between tax rates and the demand for money at low tax/income levels is beneficial to financial development and presumably growth, while the same positive relationship in high-tax countries would represent a broader form of financial repression.[15]

Canadian currency demand. Feige (1994) points out the importance of both the US underground economy and foreign underground economy for US currency demand. He argues that the latter is more substantial than the domestic underground economy and points up the importance of the issue for other major currencies.

[14] The tax rate and real GDP per capita are strongly positively correlated and can, with caution, be used interchangeably for low-income countries, presumably due to Wagner's Law. There are certainly other factors that can lead to low tax rates in relatively high income countries; indeed low tax rates often are cited as factor boosting the level of real GDP per capita (the US, Japan, Switzerland, Singapore, Hong Kong and Taiwan come to mind).

[15] There is no distinction here between different forms of taxation, particularly whether direct or indirect. It would be useful to investigate whether this difference matters, but data limitations preclude it here. Tax-based money demand is not dependent on the type of tax system, in principle. Kesselman (1993) has examined the effect of the

3. EMPIRICAL TESTS AND STATISTICAL EVIDENCE OF TAXATION EFFECTS

Individual Country Time Series Evidence of the Tax-Money Demand Hypothesis

As noted in the introduction, an earlier version of this paper was criticized for its lack of testing the maintained hypothesis in individual countries' time series. Rather in the earlier version of this paper, the empirical tests were limited to time-series-cross-section evidence. In what follows, the criticism is addressed by testing the relationship between government revenues and money holding using financial data for a large set of countries whose financial data are tested for Granger Causality during the half century, 1960-2012.

The theory—Granger Causality

To test whether government tax effort can be said to provide an incentive to hold money balances, time series financial data were accumulated for economies during the past half century 1960-2012.[16] The time series data were then used to test whether in each country government revenues could be said to "Granger-cause" the monetary aggregate, M2. Further, the share of the trials that reject the null of no-causality in 77 trials to be reported is used to test the aggregate null hypothesis of whether the linkage between government revenues and money demand is simply a coin-toss.

Granger Causality is a relationship based on a one-period-ahead forecast equation, an autoregression of the dependent variable, which is then augmented by lagged observations of the candidate variable: If the added candidate variables increase the explanatory power (based on an F-test for the added variables) of the estimated equation, non-causality is rejected. Specifically, in the case of money (M) and government revenues (G), an autoregression of money on its lagged values is estimated,

$$(1) \qquad M_t = a_0 + \sum_{j=1,4} b_{t-j} M_{t-j} + \varepsilon_t,$$

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tax mix on underground activity. Hill and Kabir (2000), following Smith (1994), note that similar evasion incentives exist for indirect taxes as exist for direct taxes. They find direct taxes have somewhat larger effects on currency demand in Canada than do value added taxes, however. Schneider (1994) shows that direct taxes in Canada have insignificantly larger positive effects on currency demand than do indirect taxes. The elasticities of real currency per capita with respect to direct taxes and indirect taxes are (standard errors in parentheses) 0.173 (0.056) and 0.117 (0.062), respectively, for the period 1956-91. Schneider also shows that the complexity of the tax system and the intensity of regulation have important effects on the currency ratio and underground economy. Indeed he argues that the effects of a major tax reform that lowered rates in 1989 was more than offset by a rise in the complexity of the tax system and increased burden of regulation. Schneider does not include inflation as a factor reducing real currency demand.

[16]The sample is described in the next section.

and then (2) is augmented by the addition of lagged values of government revenues,

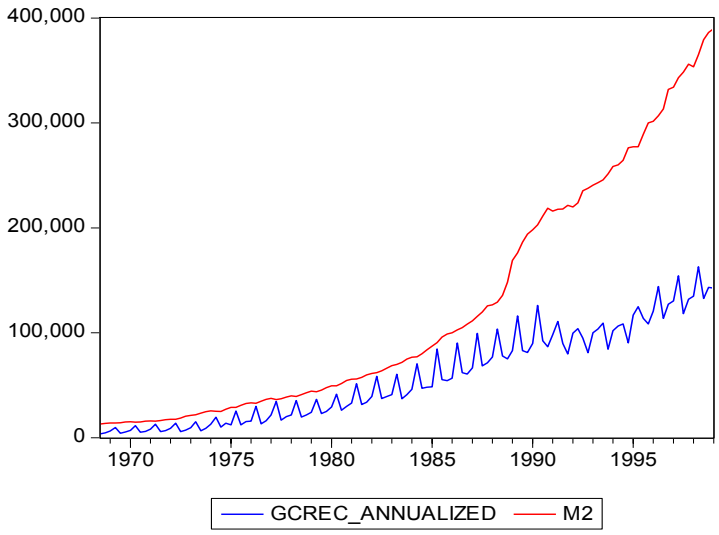
$$(2) \qquad M_t = a_0 + \sum_{j=1,4} b_{t-j} M_{t-j} + \sum_{j=1,4} c_{t-j} G_{t-j} + \varepsilon_t ,$$

$$(3) \qquad H_0: \ c_{t-j} = 0, \text{ all } j.$$

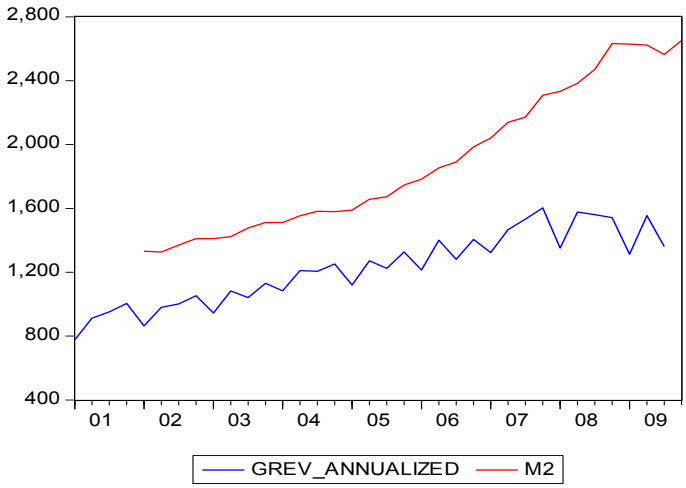
The coefficients a, b, c are parameters and the ε are normally distributed constant variance random error terms. The null hypothesis, (3), government revenue does not cause money, is rejected, if any of the coefficients in the augmented regression, c_{t-j}, j =1,4, are significantly different from zero. In such a case, the addition of the lagged values of government revenues enhances the one-period ahead forecast of money holdings—i.e., government revenues Granger-cause money. The range of lagged values (j =1,4) is set at four because the data are quarterly and the tax-money demand relationship will be recurrent over the years**.** Essentially, what is being tested is whether there is a relationship between the seasonal pattern in money holdings and the seasonal pattern in government revenues collected. For this reason, not-seasonally-adjusted data were used, as it is the relation between the pattern in money and the pattern in government revenues that reveals the dependency of money on government revenues. We also test reverse causality, where M in equation (1) and (2) is replaced by G both on the left-and right hand sides, M on the right-hand-side of equation 2 is replaced by G and the c coefficients are tested to see whether as a group they have a significant effect on M, as in equation (3).

As illustrated below in the data for government revenues and M2 in Australia, 1968-1999 and Czech Republic, 2001-2009, there tends to be a much stronger pattern of seasonal variation in the quarterly data for government revenues than is apparent in the monetary aggregate data. Thus, the test for Granger Causality would seem to be ideal test for addressing whether taxation can be said to provide a motivation for holding monetary balances.

Australia, Central Government Cash Receipts and M2:



Czech Republic, General Government Revenue and M2:



The Data, Sample Selection and Coverage

The hypothesis set out in the previous section was tested on individual time series samples of 65 countries drawn from the IMF's *IFS December 2012 CD-ROM,*[17] comprising about one-third of the 197 countries reported by the World Bank in four income classes—high income, upper-

[17]The data are drawn from the IFS "Country Tables," and are augmented as necessary by drawing on the "Historical Country Tables for Countries Reporting the SRFs." About a third of the countries in the sample had completely adequate monetary data in this latter section of the IMF *IFS CD-ROM* in those cases where their "Country Data" lacked money data. As noted in note 1, the data are available on request from the authors.

middle income, lower-middle income, and low income.[18] All countries in the IFS data set were included that had quarterly data on government revenues and either M2 or monetary data adequate to generate an M2-like measure (M2Q) which is the sum of "money" and "quasi-money" during any ten year (40 quarter) continuous period within 1960-2012; the cutoff (minimum) observation was 10 years of quarterly data—40 quarters providing a minimum of 31 degrees of freedom in the estimates discussed in the next section. When both M2 and M2Q were available, the longer of the two time series was used in the tests. While all but Israel and the Slovak Republic of the 31 high-income OECD countries in the Bank's 2012 taxonomy had the required length of data on money and government finance for at least the recent thirteen years, 1999-2012, many of the three other country-income groups either lacked data on government finances or had only annual data on government finances. As a result, of the 197 countries listed by income class in the World Bank's classification, 65 had adequate data to permit testing, as observed below.

Of these 65 included countries—observed over 77 test periods—more than half are in the high-income group—29 OECD countries and 4 non-OECD. As implied, 12 countries are observed in more than one period—e.g., for at least part of their time series, in the Euro. Five of these 12 also had data covering pre-Euro as well as Euro periods.[19] At the other extreme, only four countries of the World Bank's 23 high-income-non-OECD group had the requisite data for testing.[20] Also, only five of the 36 member low-income group had data allowing testing, but these five countries had relatively long accessible time series.[21] For example, the length of Kenya's time series at 41 years (1969-2009) exceeded all the others except for those of Colombia (1960-2006), South Africa (1965-2009), Venezuela (1960-2003), and the United States (1968-2009). Other quirks in the data:

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[18] The World Bank income classification includes 22 non-nations in its taxonomy—e.g., Puerto Rico, Guam, Bermuda, Greenland, the British Channel Islands, Hong Kong, Macao, etc.; some of these non-nations do provide financial data to the IMF—e.g., Hong Kong and Macao. Eighteen of these are from the high-income non-OECD class, two from the upper middle-income class, and two from the lower-middle income class. Curiously, financial time series data for Taiwan are not provided in the IFS nor is it listed in the World Bank taxonomy, although its international reserve holdings are noted in the Fund's world tables, denoted "Taiwan, Province of China."

[19] Germany, France, Italy, Netherlands, and Spain.

[20] Bahamas, Croatia, Kuwait, and Singapore.

[21] The near unanimity of the high-income OECD countries—relative to the dearth of non-OECD countries in the high-income class—is no coincidence. The OECD was formed in 1948 as an organization of European countries to share policy effectiveness and identify good practices; it requires substantial and timely reporting of economic, financial and government data; it was expanded in 1961 to included advanced non-European economies under the same aegis. Conversely, the non-OECD countries are comparatively private and taciturn about government data and financial practices.

- Japan with a long-standing non-compliance with IMF government financial reporting criteria had data only for earlier years, 1967-1980.
- Republic of Korea (South Korea) had 40 years of data, but they ended in 2000.

One other quirk of these data is that all but four of the 65 countries had data during some portion of the 1999-2012 period as the IFS data became notably improved in scope and inclusive countries from the first quarter of 1999—both in reporting general government revenues and in reporting standard monetary aggregate definitions, M1, M2, M3. In Europe, this period coincided with the implementation of the Euro and covered 12 countries; of the 30 middle income countries included in the sample, 18 had data only or primarily in this recent decade.[22]

Table 1
Income Classes, Numbers of Countries and Number of Countries in Each Sample

World Bank Income Class	**Number in class**	**Number in Test Sample**
High Income OECD	31	29
High Income Non-OECD	26	4
Upper-Middle Income	52	18
Lower-Middle Income	52	9
Low Income	36	5
Totals	197	65

Besides the financial regime shift due to the implementation of the Euro, three countries had changes in financial definitions or political regime change. Starting with the latter, West Germany unified with the former German Democratic Republic in 1990, and then the unified Germany joined the Euro in 1999. Consequently, Germany is reported in the tables subdivided into three eras—1966.1-1990.2 (West Germany/Deutschemark), 1990.3-1998.4 (Unified Germany/Deutschemark), 1999.1-2009.3 (Unified Germany/Euro). In Spain, the sample has been divided into its period under the late Franco regime (1962-1979), the ensuing liberalization pre-Euro (1985-1998), and the switch to the Euro (1999-2012). The other adjustment is for the United Kingdom, which implemented a change in the definition of M2Q in January 1987 and then reversed this change in September 1992; thus the UK results during 1960-1998 are divided into two intervals, omitting this 5-year span. Since the second part of this interval comprises less

[22]Besides Japan (1980) and Korea (2000), only four low income countries' data ended well before the new millennium: Mauritius (1986), Paraguay (1989), Malawi (1993) Nigeria (1982)

than 8 years, it is not included, but the UK's relation during 1999.1 -2012.2 is then also reported as a separate interval reflecting the changed IFS reporting that was initiated at the implementation of the Euro.

Time Series Results for Individual Countries

The results for estimating (3) and testing H_0 are summarized in Table 2 below; the full results for the 65 included individual countries are tabulated in the Appendix. The test results are arrayed by World Bank income group.[23] The third column provides the number of test periods, which differs from the number of countries due to multiple samples for some countries—e.g., for Germany and the UK and the Euro as discussed above. Finally, the last three columns report the test results:

- The number of test periods in which non-Granger Causality of money by government revenue was rejected at the 5% level of confidence or greater;
- The number of test periods in which two-way non-Granger Causality (Revenues cause money and money causes revenues) was rejected at the 5% level of confidence or greater;
- The number of test periods in which only *reverse* non-Granger Causality (Money causes revenues) was rejected at the 5% level of confidence or greater.

Detailed results for each included country are reported in the Appendix for the 65 countries.[24]

Table 2

[23]Note that both general government revenues (GREV) and central government cash receipts (GCREC) were generally not both available in overlapping time series. As noted above, this could only occur in the 1999-2009 decade, and both series were concurrently available for the minimum of 32 quarters only for Sweden.

[24] The p-values for the F-tests on estimating equation (3), for rejecting Granger-causality by government revenues of money holdings, the dates of the observed money and revenues, the form of money and revenues.

Results of Testing for Granger Causality in 65 Countries:

H_0: Government Revenues Do Not Granger Cause Money (M2)[1]

	Number of Countries in Class[2]	# Countries in Sample	# Test Periods	# Test periods Rejecting H_0 at 5% or better	# Test Periods Rejecting Two-Way H_0 at 5% or better[7]	# Test Periods Rejecting Reverse Causality at 5% or better[8]
High [3]	57	33	42	38	19	0
Upper-Middle[4]	52	18	20	17	3	1
Lower-Middle[5]	52	9	10	8	6	2
Low [6]	36	5	5	2	1	1

Notes: [1] On quarterly data, 1960-2012, for countries with at least 40 observations.
[2] World Bank Income Classifications, 2012
[3] Per capita GNI > $12,475
[4] Per capita GNI in range $4,036-$12,475
[5] Per capita GNI in range $1,026-$$4,035
[6] Per capita GNI < $1,026
[7] H_0: Revenues do not cause money and money does not cause revenue
[8] H_0: Money does not causes government revenue

High Income Group.[25] Of the included 33 countries, there were 42 trials under differing time periods, domestic currency or Euro, across Europe, Asia and North America. In 38 of the 42 trials the null hypothesis—no Granger-Causality—was rejected at the 5- percent level of confidence; of these, 19 countries exhibited two-way Granger Causality. Of the four trials (3 countries) not rejecting the null hypothesis, two countries—Austria and Iceland—rejected reverse causality from M2 to government revenues, while only Switzerland rejected reverse causality in the later of its two test periods.

Upper Middle Income Group.[26] As shown in Table 2, 18 upper-middle income countries were included in the tests over 20 test periods; in 18 of these test periods non-Granger Causality from revenues to money was rejected at the 5-percent level of confidence or greater. Three test periods exhibited two-way causality and one rejected non-reverse causality.

Lower-Middle Income Group.[27] Of the 9 lower middle-income countries in the sample (with El Salvador having two test periods) 8 rejected non-Granger Causality from revenues to money;

[25] Per capita Gross National Income (GNI) greater than $12,475 in 2012.
[26] Per capita GNI in range $4,036-$12,475
[27] Per capita GNI in range $1,026-$$4,035

six of them exhibited two-way causality and the two countries that did not reject non-causality of revenues to money both exhibited significant reverse causality. While bi-directional causality appears to be stronger proportionally than in the higher income samples, this may simply be a characteristic of the small sample size relative to the number of countries in this class—i.e., a sample of 9 countries in a class of 54.

Low Income Group.[28] Finally, of 36 countries in this income group, only 5 had adequate observations for testing. Of these 5, 2 rejected non-causality, one of which displayed two-way causality.

Overall, the null hypothesis of non-causality from government revenues to money was rejected in 65 of the 77 test periods for the 65 countries.[29] With the curious exception of the non-OECD high-income countries, the rate of rejection of the null hypothesis was highest for the high-income countries, declining with per capita income. Consider that, at the 5 percent level of confidence,

- of the 33 high income OECD countries, 29, all but Austria, Iceland, and Switzerland, rejected the null hypothesis—93%;[30]
- of the 17 upper-middle income countries, 14 rejected the null hypothesis and of the those three that did not, Bulgaria with two test periods did not reject in the earlier period and did reject in the later —82%;
- of the 9 lower-middle income countries, 8 rejected the null hypothesis—89%;
- of the 5 low-income countries, 2 rejected the null hypothesis—40%.

Thus, as anticipated, higher income nations demand money and exhibit a closer relation to government revenues; however, there is not a significant inverse relation between the extent of the underground economy as, estimated by Schneider (2005) and the likelihood of rejecting the null of no-Granger-causality.[31]

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[28] Per capita GNI < $1,026

[29] There were multiple trials for 13 countries.

[30] That is, for at least one of the trials where multiple trials occurred. Germany and Switzerland each failed to reject non-causality in, respectively, one trial of three and one trial of two. These are in addition to Canada and Estonia, which did not reject H_0 on their only trial.

[31] One other check on the strength of the relationship was investigated—the effect of testing the relation with M1, instead of M2. Of the 17 cases where the revenue-money relation failed to reject non-causality, only in 10 cases did the M1 substitution change the result from not rejecting the null of non-causality to rejecting the null at the 5 percent level.

Finally, what do the results of the 77 tests of H_0 tell us about the overall likelihood of the maintained hypothesis that government revenues cause money holding? We have seen from the array of results in Table 2 that there appears to be a stronger likelihood of this relation holding the higher is income as the rejection at the 5 percent level of confidence declines from 90% for high income to 85% for upper-middle income, 80% for lower-middle income, and 40% for low income. If we assume for a null hypothesis that the underlying likelihood of the relation between government revenues and money demand is equally likely to be sufficient to reject and not-to reject—that is, the incidence of a sufficiently strong relation between government revenues and money to reject non-Granger causality is 50% and its obverse is also 50%—then this null hypothesis can be tested using the results reviewed in Table 2. Presuming for the null hypothesis that this likelihood is binomially distributed, its standard deviation, σ, would be the square root of the product of the number of observations (n) times the assumed rate of incidence (p) times the rate of non-incidence (1-p), or

(5) $\sigma = [n*p*(1-p)]^{0.5} = [77*0.5*0.5]^{0.5} = [21.25]^{0.5} = 4.387.$

Then, we have the following test, at the 5-percent level of confidence:

(6) Reject H_0 if the share of rejections of the null hypothesis exceeds $0.5 + 1.96*\sigma$.[32]

Numerically, this null hypothesis characterizes the incidence of the strong relation between government revenues and money as simply a coin toss. This null hypothesis is rejected if the number of rejections in Table 2, 65, is greater than 47.1, which it is. Similarly, this test can be applied to each income group which shows the null rejected at the 5% level or greater for the high and upper middle income groups but not rejected for the lower middle income or low income groups. These results are shown in Table 3 below.

Table 3
Test for Aggregate Relation between Government Finance and M2
H_0: No relation between M2 and government finance

[32] See Theil (1971, pp. 96-100) for a discussion of such a standard test.

Income Class	Number of Test Periods	Critical Value for Number of Test Periods rejecting H_0 at 5% or better[2]	Number of Test periods Rejecting H_0 at 5% or better[1]	Percentage Rejecting H_0 at 5% or better
Overall	77	47.1	65*	84.4
High	42	27.4	38*	90.5
Upper-Middle	20	14.4	17*	85.0
Lower-Middle	10	8.1	8	80.0
Low	5	4.7	2	40.0

Notes: [1]Asterisk indicates rejection of H_0, no relation, at 5% level

[s]Critical value equals n*.5 +1.96σ, where, assuming a binomial distribution, $\sigma=(n*.25)^{0.5}$

4. CONCLUSIONS

To our knowledge, the insight of Knapp restated by Lerner and most recently elaborated by Goodhart concerning the beneficial tax effects enhancing money demand and financial sector development has not been previously examined or tested empirically. The orthodox view that individuals would react to taxes negatively in forming decisions about the use of domestic financial sector transaction deposits and holding non-transaction assets just as they rationally react to the other major cost of M2—inflation—has seemed so reasonable that orthodox money courses, undergraduate and graduate, have not questioned this view. However, the research here is motivated by an interest in financial development in developed and emerging economies and the implications of government finance in economies at all levels of development.

For these purposes the chartalist view first enunciated by Georg Friedrich Knapp near the end of the 19th century, restated independently by Abba Lerner in mid-20th century, and strongly restated by Charles Goodhart and his critics at the beginning of the new century in the volume edited by Nell and Bell serves as our focus.[33]

[33]As noted above, this idea was apparently first set out by Knapp in Germany in the last quarter of the 19th century and published later in English (1924), a translation of its 4th German edition (1905). We conjecture that Knapp's notion—and probably Lerner's, too—is that rarest of birds, a true innovation. We have searched the legal tender literature, surveys of the taxation literature, and reviewed what has been published in the *Encyclopedia of the Social Sciences* on money and on taxation. Overlooked is the Bell and Nell (2003) volume and, generally, Charles Goodhart's vigorous promotion of Chartalism. Martin Shubik (1987) in the *New Palgrave Dictionary of Economics* omits any mention of this possibility while reviewing all of the standard elements on the history of fiat and token money.

We find evidence supporting this hypothesis in the experience of both emerging and developed economies. Yet, the evidence also shows that the significance of the relation between government finance and money demand strengthens as income rises—the relation is strongest for high income and upper middle-income countries. This result is also implied in the availability of data, which rises with the level of income. Hence, there may be a relation between the level of development and the discipline with which taxes are administered. We intend to test this relation in future extensions of this work.

Governments can promote financial development through efforts to achieve price stability and through a moderate degree of taxation. Both policies promote an increased demand for domestic money, raising the size of the financial sector as a share of GDP. Efforts to support tax effort through efficient enforcement and collection efforts that maximize taxpayer compliance are perhaps more important than the size of the tax rate itself, though the evidence here is only suggestive of this conclusion, another topic for our future research.

Appendix: Data and Granger Causality Test Results

Data Sources and Definitions

The tests reported in this paper covered all of the countries for which IMF data on Government Receipts/Revenues and monetary data (described below) were available for at least 10 years—forty quarterly observations—in the 53 years spanning 1960-2012. 65 countries of the 197 countries that the World Bank classified as High Income, Upper Middle Income, Lower Middle Income, or Low Income in its 2012 compendium were selected by this criterion:

- 33 High Income countries of 57 independent nations in the World Bank classification;
- 18 of 52 Upper –Middle Income nations in the World Bank classifications;
- 9 of 52 Lower-Middle Income nations in the World Bank classification;
- 5 of 36 Low Income nations in the World Bank Classification.

Not surprisingly, a much lower share of the lower income countries had sufficient data for inclusion, but what was surprising was that both monetary and government revenues were missing in many of the countries that could not be included.

The data used in these empirical tests are from the IMF's International Financial Statistics (IFS) CD-ROM for December 2012 augmented, in some cases, by the earlier CD-ROM of April 2010. The primary source was the December 2012, but occasionally the Fund would omit data that the earlier IFS CD-ROMs contained, and in two cases then the data set was augmented by the earlier source:

- When the data observations ended prior to the later CD-ROM, then the earlier data were used;
- When there were gaps in the data in the later CD-ROM that were covered in the earlier CD-ROM, then the earlier data were used in combination with the later CD-ROM.

Government Finance Data. Two alternative data for government finance were used, depending on which was provided in the IFS CD-ROM—Government Revenues (GREV) or Government Cash Receipts (CREC); generally, only one of the two data series was provided. Both data series aggregate the four main sources of "transactions that increase the net worth of government, namely taxes, social contributions, grants and other revenues." (*International Financial Statistics*, December 2007, page xxiii)

- Government Revenues (GREV) is reported on an accrual basis;

- Government Cash Receipts (CREC) is reported on a cash basis.

As will be noted in the table that follows, there was generally a greater availability of the cash receipts (CREC) than of the revenues (GREV).

Monetary Data. Generally, the preferred monetary measure was M2, country definition. Frequently, however, M2 was not available, but the sum of money and quasi money (M2Q) was. Also, Broad Money (MB), which in most cases is very close to M2, sometimes with some minor additional deposits, was used for several countries. The *desideratum* was whatever broad money definition closely analogous to M2 was available to match government receipts.

Variable and Composition	**IFS line #**
GREV= Government revenues, accrual basis	a1
CREC= Cash Receipts of Government	c1
M2 = M1 + MQ	34, 35
M2=National Definition	59mb

Granger Causality (GC) Tests, High Income Countries

H_0: Revenues do not GC Money (R≠>M); Money does not GC Revenues (M≠>R)

		R≠>M	M≠>R	#Obs	Dates	Variables	Eras
Australia	F-Stat	8.86883	3.61239	123	68.3-99.1	M2Q,GREV	
	Probability	0.00000	0.00832				
Austria	F-Stat	1.60665	0.11834	54	99.1-12.2	M2Q, GREV	Euro
	Probability	0.19093	0.97523				
Bahamas	F-Stat	5.30067	4.31884	139	76.3-11.1	M2Q, REC	
	Probability	0.00056	0.00262				
Belgium	F-Stat	2.86456	1.22397	58	99.1-12.1	M2Q, GREV	Euro
	Probability	0.03503	0.31555				
Canada	F-Stat	2.73015	2.12267	90	99.1-12.1	M2, GREV	
	Probability	0.03557	0.08673				
Croatia	F-Stat	3.15495	5.43548	76	94.2-12.1	M2Q, REC	Non-Euro
	Probability	0.02037	0.00086				
Czech Rep	F-Stat	21.03270	0.35995	50	01.1-12.2	MB, GREV	
	Probability	0.00000	0.83525				
Denmark	F-Stat	3.56488	1.36437	54	99.1-12.2	M2,GREV	Non-Euro
	Probability	0.01385	0.26300				
Estonia	F-Stat	3.54372	4.86791	48	99.1-10.4	M2Q,GREV	Non-Euro
	Probability	0.01574	0.00315				
Finland	F-Stat	11.90790	3.69325	54	99.1-12.2	M2Q,GREV	Euro
	Probability	0.00000	0.01171				
France	F-Stat	12.13750	5.46035	85	77.4-98.4	M2,CREC	Pre-Euro
	Probability	0.00000	0.00068				
	F-Stat	5.42690	0.87526	52	99.1-11.4	M2Q,GREV	Euro
	Probability	0.00143	0.48752				
Germany	F-Stat	3.80535	4.79459	98	66.1-90.2	M2Q, CREC	West Germany
	Probability	0.00679	0.00155				Pre-Euro
	F-Stat	5.51210	1.07901	38	90.3-98.4	M2QG, CREC	Unif. Germany
	Probability	0.00253	0.38797				Pre-Euro
	F-Stat	4.04077	0.44955	52	99.1-11.4	M2QE,GREV	Unif. Germany
	Probability	0.00777	0.77206				Euro
Greece	F-Stat	7.55672	1.78665	46	01.1-12.2	M2Q,GREV	Euro
	Probability	0.00019	0.15505				
Hungary	F-Stat	9.95638	0.98481	54	99.1-12.2	M2,GREV	Euro
	Probability	0.00001	0.42651				
Iceland	F-Stat	1.74396	0.60097	51	00.1-12.3	M2,CREC	
	Probability	0.16052	0.66422				

		R≠>M	M≠>R	#Obs	Dates	Variables	Eras
Ireland	F-Stat	3.64918	4.22141	54	99.1-12.2	M2Q,GREV	Euro

	Probability	0.01240	0.00593				
Italy	F-Stat	8.31477	2.61338	97	74.4-98.4	M2,CREC	Pre-Euro
	Probability	0.00001	0.04097				
	F-Stat	3.91331	0.91548	54	99.1-12.2	M2Q,GREV	Euro
	Probability	0.00880	0.46411				
Japan	F-Stat	2.57247	0.79623	54	67.1-80.2	M2,CREC	
	Probability	0.05189	0.53456				
Korea, Rep	F-Stat	25.06040	3.45569	163	60.1-00.3	M2Q,CREC	
	Probability	0.00000	0.00986				
Kuwait	F-Stat	8.43090	2.68537	41	01.4-11.4	BM,CREC	
	Probability	0.00014	0.05180				
Luxembourg	F-Stat	5.77229	2.11318	54	99.1-12.2	M2Q,GREV	Euro
	Probability	0.00088	0.09655				
Netherlands	F-Stat	5.35012	0.32988	152	60.1-97.4	M2,CREC	Pre-Euro
	Probability	0.00049	0.85751				
	F-Stat	4.73071	1.11165	54	99.1-12.2	M2Q,GREV	Euro
	Probability	0.00313	0.36412				
New Zealand	F-Stat	49.91470	1.55984	60	60.2-75.1	M2Q,CREC	
	Probability	0.00000	0.20060				
Norway	F-Stat	3.16062	0.32618	51	96.1-08.3	MB,GREV	
	Probability	0.02451	0.85865				
Poland	F-Stat	5.30686	1.05390	63	96.4-12.2	M2,CREC	Non-Euro
	Probability	0.00122	0.38910				
Portugal	F-Stat	11.43980	0.71903	58	99.1-12.2	M2Q,GREV	Euro
	Probability	0.00000	0.58386				
Singapore	F-Stat	8.24226	2.59664	170	69.1-12.2	M2Q,CREC	
	Probability	0.00000	0.03844				
Slovenia	F-Stat	4.06223	3.07794	48	95.1-06.4	M2,CREC	Non-Euro
	Probability	0.00828	0.02843				
Spain	F-Stat	18.06570	3.68722	72	62.1-79.4	M2,CREC	Franco
	Probability	0.00000	0.00955				
	F-Stat	3.73244	3.37471	56	85.1-98.4	M2,CREC	Pre-Euro
	Probability	0.01079	0.01732				
	F-Stat	4.71595	5.16347	50	00.1-12.2	M2Q,GREV	Euro
	Probability	0.00355	0.00208				
Sweden	F-Stat	4.65232	6.20583	43	99.1-09.3	M2,GREV	Non-Euro
	Probability	0.00484	0.00092				
Switzerland	F-Stat	1.03151	3.06325	52	71.1-83.4	M2Q,CREC	
	Probability	0.40324	0.02749				
	F-Stat	1.97921	8.86912	69	90.4-08.1	M2Q,CREC	
		R≠>M	**M≠>R**	**#Obs**	**Dates**	**Variables**	**Eras**
UK	F-Stat	3.45196	2.9924	108	60.1-86.4	M2Q,CREC	
	Probability	0.01115	0.02251				
	F-Stat	3.71327	1.34318	54	99.1-12.2	M2Q,GREV	
	Probability	0.01141	0.27038				

USA	F-Stat	12.98920	6.68395	178	68.1-12.2	M2,CREC
	Probability	0.00000	0.00005			

33 countries, of which p-ratio for 38 of 42 trials* >5% *(Multiple test periods for France, Germany,
Italy, Netherlands, Spain, Switzerland, UK)

Granger Causality (GC) Tests, Upper-Middle Income Countries

H_0: Revenues do not GC Money (R≠>M); Money does not GC Revenues (M≠>R)

		R≠>M	M≠>R	#Obs	Dates	Variables
Botswana	F-Stat	0.64150	1.72180	42	01.4-12.2	MB,CREC
	Probability	0.63722	0.17217			
Brazil	F-Stat	8.16129	4.13618	77	89.4-08.4	M2,CREC
	Probability	0.00002	0.00483			
	F-Stat	4.11466	8.64274	46	01.1-12.2	M2,GREV
	Probability	0.00818	0.00007			
Bulgaria	F-Stat	1.07245	3.45382	70	95.2-12.3	MB,CREC
	Probability	0.37865	0.01351			
	F-Stat	3.37577	13.03940	54	99.1-12.2	MB,GREV
	Probability	0.01775	0.00000			
Colombia	F-Stat	18.87860	9.07374	188	60.1-06.4	M2,CREC
	Probability	0.00000	0.00000			
Costa Rica	F-Stat	9.05764	1.91672	64	87.1-02.4	M2,CREC
	Probability	0.00001	0.12183			
Iran	F-Stat	10.36740	3.54650	68	91.2-08.1	M2Q,CREC
	Probability	0.00000	0.01207			
Jordan	F-Stat	2.75586	4.24764	163	60.1-00.3	M2Q,CREC
	Probability	0.03006	0.00276			
Kazakhstan	F-Stat	1.65019	1.90235	43	01.4-12.2	MB,CREC
	Probability	0.18762	0.13590			
Lithuania	F-Stat	14.41570	26.57910	53	99.2-12.2	M2,GREV
	Probability	0.00000	0.00000			
Malaysia	F-Stat	4.50695	6.34255	121	69.4-99.4	M2,CREC
	Probability	0.00209	0.00013			
Mexico	F-Stat	5.90457	6.02347	108	85.4-12.3	M2,CREC
	Probability	0.00027	0.00023			
Panama	F-Stat	5.25189	1.33563	73	881.-06.1	M2Q,CREC
	Probability	0.00108	0.26720			

		R≠>M	M≠>R	#Obs	Dates	Variables	Eras
Peru	F-Stat	11.94850	3.29916	98	85.2-09.3	M2Q,CREC	
	Probability	0.00000	0.01456				
Romania	F-Stat	6.96908	0.28689	43	01.4-12.2	M2,GREV	
	Probability	0.00043	0.88416				
Russia	F-Stat	12.34540	13.45920	59	95.2-09.4	M2,CREC	

	Probability	0.00000	0.00000			
South Africa	F-Stat	15.23870	31.39460	191	65.1-12.3	M2,CREC
	Probability	0.00000	0.00000			
Thailand	F-Stat	15.29820	0.74371	144	68.1-03.4	MB,GREV
	Probability	0.00000	0.56389			
Venezuela	F-Stat	13.82070	12.88900	176	60.1-03.4	M2Q,CREC
	Probability	0.00000	0.00000			

18 countries, 20 trials of which p-ratio for 17 trials*>5% (two test periods for Brazil, Bulgaria)

Granger Causality (GC) Tests, Lower-Middle Income Countries

H_0: Revenues do not GC Money (R≠>M); Money does not GC Revenues (M≠>R)

		R≠>M	**M≠>R**	**#Obs**	**Dates**	**Variables**
Bolivia	F-Stat	3.83513	7.10225	54	93.1-06.2	M2,CREC
	Probability	0.00974	0.00019			
El Salvador	F-Stat	2.18873	3.18360	128	69.1-00.4	M2Q,CREC
	Probability	0.07458	0.01605			
	F-Stat	2.75000	0.71530	42	01.4-12.1	M2,CREC
	Probability	0.04686	0.58830			
Guatemala	F-Stat	2.92865	4.40340	59	97.4-12.2	M2,CREC
	Probability	0.03071	0.00426			
Honduras	F-Stat	18.07810	19.66960	163	65.1-06.4	M2Q,CREC
	Probability	0.00000	0.00000			
Indonesia	F-Stat	4.03727	1.45510	51	00.1-12.3	M2,CREC
	Probability	0.00797	0.23498			
Jordan	F-Stat	2.75586	4.24764	163	60.1-00.3	M2Q,CREC
	Probability	0.03006	0.00276			
Mongolia	F-Stat	1.82232	8.94396	44	01.4-11.4	M2,CREC
	Probability	0.14966	0.00006			
Nicaragua	F-Stat	4.14388	3.57081	82	89.1-09.2	M2Q,CREC
	Probability	0.00457	0.01049			
Paraguay	F-Stat	4.78545	10.63950	50	77.1-89.2	M2Q,CREC
	Probability	0.00326	0.00001			

9 countries, of which p-ratio for 8 of 10 trials >5% (El Salvador has two trials)

Granger Causality (GC) Tests, Low Income Countries

H_0: Revenues do not GC Money (R≠>M); Money does not GC Revenues (M≠>R)

		R≠>M	**M≠>R**	**#Obs**	**Dates**	**Variables**
Burundi	F-Stat	3.83655	1.92892	62	97.1-12.2	MB,CREC
	Probability	0.00863	0.12047			
Kenya	F-Stat	11.04600	8.80117	160	69.3-09.2	M2Q,CREC

	Probability	0.00000	0.00000			
Kyrgyz Rep	F-Stat	0.78812	1.39992	40	98.1-07.4	M2,CREC
	Probability	0.54304	0.26063			
Malawi	F-Stat	1.99284	4.30584	97	69.3-93.3	M2Q,CREC
	Probability	0.10300	0.00323			
Tanzania	F-Stat	0.64965	0.27504	57	96.3-10.3	M2,CREC
	Probability	0.63015	0.89252			

5 countries of which p-ratio for 2 trials >5%

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