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Validity of Laidler Hypothesis: Evidence from Selected High Income Countries

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ABSTRACT

This study has investigated the validity of Laidler (1985) hypothesis, a long-forgotten issue, for 34 selected countries with various model specifications, updated data and vogue econometric techniques. Countries and data period (2000-2022) are selected based on the availability of data. We have applied panel data estimation techniques and the analysis is based on inequality of income distribution. The obtained results show that the Laidler hypothesis on money demand is highly valid. Precisely, the results indicate that inequality of income distribution decreases money demand, and the impact of this variable is higher than traditionally considered two variables, interest rate and income levels. The implication of this result is that central banks around the world should take into account the degree of inequality of income distribution, in addition to income and interest rate, in the money demand function during projection, estimation and forecasting of money demand of an economy. Otherwise, monetary policy may miss to achieve its desired targets. Further, as data used in the study are picked from almost all leading economies of all continents it can be assumed that the implication of this research is ubiquitous across developed and developing countries.

ملخص

بحثت هذه الدراسة في صحة فرضية لايدلر (1985)، وهي مسألة طال نسيانها، وذلك في 34 بلدا مختارا بمواصفات نموذجية متعددة وبيانات محدثة وتقنيات اقتصادية قياسية رائجة. وتم اختيار البلدان وفترة البيانات (2000-2022) بناء على مدى توافر البيانات. وقد تم استخدام تقنيات تحليل بيانات اللوحة، استنادا إلى عدم المساواة في توزيع الدخل. وأظهرت النتائج المتوصل إليها إلى أن فرضية لايدلر بشأن الطلب على النقود تتمتع بدرجة عالية من الصحة. وعلى وجه التحديد، تشير النتائج إلى أن عدم المساواة في توزيع الدخل يؤدي إلى انخفاض الطلب على النقود، وأن تأثير هذا

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المتغير يتجاوز تأثير المتغيرين المعتادين، وهما سعر الفائدة ومستويات الدخل. وتتمثل دلالة هذه النتيجة في أن البنوك المركزية حول العالم ينبغي أن تأخذ بعين الاعتبار درجة عدم المساواة في توزيع الدخل، إلى جانب الدخل وسعر الفائدة، عند التنبؤ وتقدير واحتساب دالة الطلب على النقود في الاقتصاد. وإلا، فقد تفشل السياسة النقدية في تحقيق أهدافها المنشودة. بالإضافة إلى ذلك، وبما أن البيانات المستخدمة في الدراسة مأخوذة من معظم الاقتصادات الرائدة في جميع القارات، فإنه يمكن الافتراض أن نتائج هذه الدراسة تنطبق بشكل عام على كل من البلدان المتقدمة والنامية.

RÉSUMÉ

Cette étude a examiné la validité de l'hypothèse de Laidler (1985), une question longtemps oubliée, pour 34 pays sélectionnés à l'aide de diverses spécifications de modèles, de données actualisées et de techniques économétriques en vogue. Les pays et la période couverte par les données (2000-2022) ont été sélectionnés en fonction de la disponibilité des données. Nous avons appliqué des techniques d'estimation de données de panel et l'analyse est basée sur l'inégalité de la répartition des revenus. Les résultats obtenus montrent que l'hypothèse de Laidler sur la demande de monnaie est tout à fait valide. Plus précisément, les résultats indiquent que l'inégalité de la répartition des revenus diminue la demande de monnaie, et que l'impact de cette variable est plus important que celui des deux variables traditionnellement prises en compte, à savoir le taux d'intérêt et le niveau de revenu. Ce résultat implique que les banques centrales du monde entier devraient tenir compte du degré d'inégalité de la répartition des revenus, en plus des revenus et des taux d'intérêt, dans la fonction de demande de monnaie lors de la projection, de l'estimation et de la prévision de la demande de monnaie d'une économie. Sinon, la politique monétaire risque de ne pas atteindre les objectifs souhaités. En outre, comme les données utilisées dans l'étude sont tirées de presque toutes les principales économies de tous les continents, on peut supposer que les implications de cette recherche sont omniprésentes dans les pays développés et en développement.

Keywords: Money Demand, Income Distribution, and Laidler Hypothesis.
JEL Classification: C12; C22; E41

1. Introduction

Canadian economist David N Laidler (1985, p. 153) said, ‘‘Key prediction of Baumol (1952) transaction and precautionary motive theories is that there should exist economies of scale in money holding”. Likewise, Cover and Hooks (1993, p. 522) said, “Transaction theories indicate that ratio between money holding and income level is lower for high income individuals than low-income individuals, so money demand declines as aggregate income is more unequally distributed". Laidler further added (P. 64), "It is highly necessary to examine the relationship between the aggregate money demand and the income distribution". Additionally, Baumol (1952) and later Tobin (1956) have also hinted that money holding by an individual is a monotonically increasing and concave function of transactions (thus, income) which verifies that the more unequally distributed income lowers the demand for money. This notion invented by Laidler (1985) is less investigated and forgotten by the economists and central bank monetary policy formulators across the world. Monetary policy practitioners only put their focus on the level of income and interest rate and always omit the impact of inequality of income distribution of the economy. However, if income distribution inequality really has an impact on money demand, then estimation of traditional money demand function without considering this variable will be mis-specified and thus, the conventional monetary policy formulation technique and implementation of monetary policy by the central bankers in the present world will not be accurate. Injecting and pulling back money ignoring an important active factor of money demand function may lead untoward consequence of monetary policy like failing to achieve monetary policy targets which may lead to opposite direction of intended targets of inflation, credit flows, growth and unemployment rate of the economy. Therefore, the omission of the income distribution inequality from money demand model may lead to biased and misleading empirical results.

Empirical research on money demand and income distribution inequality nexus has been ignored, and hence literature on this important issue is extremely limited. To the date, no reliable study is conducted to investigate the impact of income distribution inequality on money demand of a country; so there is an urgent need of empirical study to bridge this vast and prolonged knowledge gap. The research findings will provide a comprehensive understanding of the impact of income distribution inequality on money demand of the economy. Therefore, this paper aims to investigate, for the first time, whether the effect of inequality of income distribution on money demand is really negative. Given the lack of empirical research coupled with theoretical knowledge gaps, this study investigates the issue with a panel data for 34 countries that are mostly high-income countries for the period of 2000-2018. The period and countries are selected on the basis of data availability. The visual inspection of the data says that inequality is still increasing in the selected countries which also indicates the importance of investigation as fiscal policies of these countries are known as very cautious to reduce inequality of income distribution (Gallo and Sagales, 2011). Knowledge earned from this research can be applied for the developing countries subject to data availability where speed of increase of inequality is relatively higher than developed countries. While monetary policy is working to deteriorate the degree of income inequality, the fiscal policy works to curb the inequality of a nation. Therefore, it is crucial to understand how inequality of income distribution affects the money demand to formulate the correct and best fitting monetary policy of the economy. The selected countries provide about fifty per cent of world GDP. Therefore, understanding the impact of income distribution inequality on money demand will have vital implications for monetary policy stakeholders across the nations. If income distribution inequality has impact on money demand of a country central banks and economist across the world will have to reform their money demand functions more accurately so that forecasting the monetary policy aggregates will be more accurate.

Given the above motivation for the study, this paper freshly contributes to the economic literature in several ways: Firstly, the paper identified that income distribution inequality causes money demand of the economy regardless of the development status of the country. Secondly, different income distribution indicators could have disparate impacts on economic growth; so, implication of different inequality indicators also could have different implications on money demand. Therefore, the study uses possible all available indicators of income distribution inequality to gauge the multitudinous impacts on money demand. Thirdly, to avoid the assumption of homogeneous impact of income distribution inequality on money demand across countries, the study also accounts for heterogeneities of the countries in the model. Finally, the study applies almost all necessary econometric tests for panel data estimation techniques so that no biased or wrong decision is reached because of spurious regression estimation.

We have searched thoroughly to find out any vogue paper that investigates the impact of income distribution inequality either by time series or cross sectional or panel data technique. No research paper of money demand for an individual or a group of countries after Cover and Hooks (1993) has attempted to examine this issue. Since there is only one paper in this topic, we are not describing literature reviews in a separate section. In their paper Cover and Hooks (1993) have used the annual time series data of the United States for the period of 1947-1988 and have reached in a conclusion that Laidler (1985) hypothesis is invalid since they have not got any evidence that money demand and income distribution inequality have negative relationship. In their OLS regression, reserve money or base money is used as dependent variable where weighted average deposit rate, real GDP, Gini coefficient are used as explanatory variables. They have not conducted any diagnostic test for their fitted model. Further, perhaps due to the non-advancement of time series econometrics until that time they have not properly addressed the different time series properties of the data, resulting poor reliability of the estimated model to reach in a confirming decision. Therefore, this current research is unique and the findings will be contributory to the existing literature.

The rest of the paper is organized as follows. Methodology is presented in section 2. Section 3 describes data. Research results and result analysis are placed in sections 4 and 5, respectively. Section 6 concludes and provides the policy implications.

2. Methodology

2.1The Model

The main aim of this study is to investigate the effect of inequality of income distribution on aggregate money demand function. To this end, we have followed the augmented version of commonly used money demand function, where money demand is a function of interest rate, income and inequality of income distribution. Since the used data are panel, which also have time series properties, we have used growth of per capita adult of base and broad money, and national income to avoid autocorrelation problem. However, rate of interest and income distribution inequality index are kept in level form. We have relied on four types income distribution inequality indices which are top 1%, top 10%, bottom 40% and bottom 50% people's income share of each country. We have taken logarithm of base money (BM), broad money (M2), per capita adult GDP and per capita adult GNP. However, we do not use logarithm of interest rate and index of income distribution inequalities since traditionally researchers do not use logarithm for any rate or index. We have not used wealth distribution inequality index in our money demand function. Since data frequency is very low and it has probability of high multicollinearity with income distribution inequality. We have assumed linear functional form about this money demand function. Therefore, our money demand model looks like the equation (1) below

Per Capita Adult Money Demand$_{1t}$ = Constant + α_1 Rate of Interest $_{it}$ + α_2 Per Capita Adult Income $_{it}$ + α_3 Income Distribution Inequality Index $_{it}$ + ε_{it} (1)

Where $\alpha_{1,}$ α_2 andα_3 are coefficients of related variables and ε_1 is error term. Since deposit rate affects the money demand level of the individuals very much (Bitrus, 2011), we have used it in place of rate of interest variable. Since money demand is not only affected by individuals' income within national boundary, we have used both per capita adult GDP and GNP in place of per capita adult income of the function. Only adult people are considered as non-adults have no impact on money demand.

2.2. Panel Unit Root Tests

Unlike cross sectional dependence problem, unit root is a problem that is related to time dimension of the data. If the unit root or non-stationary problem exists in the data and if it is not considered in estimation process, the estimated coefficients will give spurious estimation. To this end, we have chosen to conduct panel unit root tests, which are Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), and Fisher ADF (1979) panel unit root tests. Panel unit root tests has confirmed that our data does not suffer from unit root problem i.e., they are I(0). The outcome of the unit root test is reported in the Appendix III.

2.3. Cross Sectional Dependence, Autocorrelation, and Heteroscedasticity Tests

Our sample consists of 34 high income countries with yearly data for the period of 2000-2018 (19 years). Cross sectional dependence is not a problem for a sample for the case where time dimension is smaller than space dimension or cross-sectional units, (Baltagi, 2012). As per this rule of thumb devised by Baltagi (2012) our sample does not need to conduct cross sectional dependence test. However, even though our data have larger number of countries and lesser number of years we want to conduct cross sectional dependence test to be confirmed about this disturbing problem since cross sectional dependence can also exist due to unobserved common characteristics that turn out to be an element of the error terms, (Kashem & Rahman, 2020). If cross sectional dependence exists in the data but not accounted in the estimation process, it may give inconsistent standard errors and t-statistics of the estimated coefficients (Driscoll and Kraay, 2001). We relied on Breush-Pagan (1980), the Peseran CD test (2007), and the Baltagi et. al., (2012) bias corrected LM test to detect the presence of cross-sectional dependence. The result of the cross-sectional dependence test is reported in the Appendix III.

The obtained results indicate that for every variable, our model is not free from the cross-sectional dependence. One way to handle this problem, we have an option of OLS estimation with Panel Corrected Standard Error (PCSE) method developed by Beck and Katz (1995) and later again suggested by Reed and Ye (2011). By default, the estimates of PCSE are free from Heteroscedasticity, Autocorrelation and Cross-Sectional Dependence if the country number is greater than the number of years of the data.

2.4.Pooled Ordinary Least Squares (OLS)

Assuming all coefficients and intercepts are uniform or fixed for all years and countries a regression can be estimated for panel data which is called as pooled model. In this case, all effects of time and individuals variation are reflected in the error terms of the model. The equation (2) can be such model for our assumed money demand function:

$$MD_t = \alpha_{1t} + \alpha_{2t} Y_t + \alpha_{3t} IR_t + \alpha_{2t} INEQ_t + \varepsilon_t \quad (2)$$

Where, MD, Y, IR and INEQare money demand, income, interest rate and inequality of income distribution and ε is the error term.

2.5.The Fixed Effect Model (FEM)

In FEM, each country has an individual intercept term but the slope coefficients are considered fixed across countries and in our present case, the model is as follows:

$$MD_{ti} = \alpha_{1ti} + \alpha_{2ti} Y_{ti} + \alpha_{3ti} IR_{ti} + \alpha_{2ti} INEQ_{ti} + \varepsilon_{ti} \quad (3)$$

The subscript *i* stands for the intercept term as they are different for individual countries. As the intercepts and slope coefficients are fixed effects over the whole period, this model is also called as least-squares dummy variable (LSDV) model.

2.6.Random Effect Model (REM)

Since the fixed effect or LSDV model needs to use an individual dummy variable for all countries, such model is highly expensive model in terms of degrees of freedom. To overcome this unbearable cost of degrees of freedom, REM or Error Component Model (ECM) is suggested (Gujrati, 2011). This model stands as follows:

$$MD_{ti} = \alpha_{1ti} + \alpha_{2ti} Y_{ti} + \alpha_{3ti} IR_{ti} + \alpha_{2ti} INEQ_{ti} + u_{ti} \quad (4)$$

In this model, instead of consideringa_{1ti} as fixed, we assume that a_{1ti}itself is a random variable with a mean value of a_1. We can express the intercept for an individual country as follows:

$$a_{1ti} = a_{1t} + \varepsilon_i$$

Where i = 1, 2, 34.

Further, $\varepsilon_i$is a random error term with a mean value of zero and variance σ_ε^2.Here the idea is that all 34 countries have a common mean value for the intercept which is a_1 and the differences of each country's actual intercept from mean value a_1 are reflected by the error term ε_i.
So, the new equation should be

$$MD_{ti} = \alpha_{1t} + \alpha_{2ti} Y_{ti} + \alpha_{3ti} IR_{ti} + \alpha_{2ti} INEQ_{ti} + u_{ti} + \varepsilon_i$$

$$MD_{ti} = \alpha_{1t} + \alpha_{2ti} Y_{ti} + \alpha_{3ti} IR_{ti} + \alpha_{2ti} INEQ_{ti} + e_{it} \quad .(5)$$

Where $e_{it} = u_{ti} + \varepsilon_i$

The composite error terms consist of two components which are the cross section or country specific error components (u_{ti}) and the combined time series and cross section error component (ε_i).

2.7.Hausman Test (FEM Versus REM)

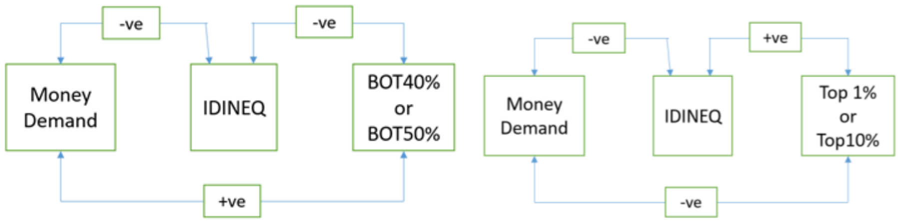
To know the time and space effects (year and country effects in our present case) or difference of variance of error terms researchers use panel data model. There are two types of panel data model (a) fixed effect model (FEM) and (b) random effect model (REM). The first one is useful to investigate the variation of time and space effects and the differences in error variances are examined by the later one. However, which one is useful and under what condition?

To answer this question, Hausman (1978) testis used for model selection. Precisely, this test infers if the FEM and REM estimators have any substantial difference. The test statistic of this famous test follows the chi-square distribution. If the null hypothesis is rejected, FEM is preferable to REM.

3.Data

We have used annual data of 34 countries over the period, 2000-2022. The list of the countries is noted in Appendix II. Here, money demand is measured by the supply of base money (BM) and broad money (M2) in yearly change/growth form; interest rate is considered the yearly weighted average deposit rate of the country; in case of income, we have used per capita adult GDP and GNP of the respective country; and income distribution inequality is measured by top 1%, top 10%, bottom 40% and bottom 50% income share of the common people. Data are collected from the website of *https://wid.world/data/*.Data of interest rate, broad money (M2) and base money (BM) are collected from International Financial Statistics (IFS February, 2024) published by International Monetary Fund (IMF). Laidler (1985) has specifically emphasized on base money. However, in modern world a true representative of money supply is represented by broad money (like M2, M3 etc.). So, we have considered both base money and broad money in our analysis. Again, different index of inequality could have different implications on money demand. Therefore, it is important to use various inequality indicators to examine their effect on money demand. Therefore, in this study, four index/indicators of income distribution inequality variables are used to investigate the effect of income inequality on money demand.

In regards to the expected sign of different indicators of income distribution inequality, Laidler (1985) hypothesis assumes that increase of income distribution inequality would reduce money demand in the economy. Since income share of top 1% or top 10% peoples increase means increase of income distribution inequality, the expected sign of money demand (MD) with these two indicators of inequality (INEQ) should be negative. Similarly, since income share of bottom 40% or bottom 50% people decrease means increase of income distribution inequality, the expected sign of money demand (MD) with these two indicators of inequality (INEQ) should be positive. Why we are assuming negative sign of top1% and top10% and positive sign of bottom 40% and bottom50% income share with MD can be postulated more clearly from the following schematic representations:



Another point, aggregate supplied money is considered overall demanded money (MD) by the economy by many studies (Hossain, 1994). Aggregate money supply is tantamount to the aggregate money demand since Central Bank supplies money to the economy as per the revealed demand. If it observes that there is extra liquidity in the banking system it pulls out the extra liquidity and in converse situation, it injects liquidity. Therefore, researchers use supplied money as a proxy or surrogate of the demanded money in an economy.

3.1 Descriptive Statistics

Table 1 of Appendix I presents the descriptive statistics of the variables. It tells that mean of growth of base and broad money of the selected nations are about 15%. Since, the growth rate is the same, it means that money multiplier (broad money / base money) is equivalent to one meaning that there is no multiplier effect of additional change of base money. It also indicates monetary policy is less effective and perhaps transaction velocity of money decreases drastically due to the increase of money supply. The mean value and standard deviation of interest rate on deposits are 4.56% and 5.62%, indicating that deposit rates among the selected countries have less variability. It may be due to ultra-interconnectedness of the economies of present world where investment shift to high interest rate incurring countries quickly. Very high standard deviation of per capita adult GDP and GNP show that the selected countries have very high variation. This is also confirmed by the minimum (13,792) and maximum (1,12,505)values of per capita adult GDP values. Income distribution inequality indexes show much similarities of the selected countries. Since standard deviation of all indexes like top1%, top10%, bottom 40% and bottom 50% people of these nations own about 9%, 31%, 18% and 25% of national income, it also shows that bottom 40% people are miserably suffering in economic hardship.

3.2. Correlation Matrix

The results of correlation matrix presented in Table 3 of Appendix Ishow that strong positive correlation exists between per capita adult GDP and GNP between inequality index of bottom 40% and 50% people's income share and between Inequality index of top 1% and top 10% people's income share. Other interesting result is that correlation coefficient of both base and broad money growth with interest rates are negative and per capita adult GDP and GNP are positive, supporting the traditional theoretical notions that if money supply increases interest rate will fall and income will increase. Further, top 1% and 10% rich people's income share will increase if both base money and broad money supply increases. Conversely, bottom 40% and bottom 50% poor people's income share will increase for an increase of money supply meaning that if money supply increases income distribution inequality decreases. Obviously, the phenomenon is opposite if interest rate increases meaning that an increase of interest rate makes worse the equality of income distribution in the selected countries. However, if per capita adult GDP and GNP increase, income share of top 1% and top 10% rich people increases, and income share of bottom 40% and bottom 50% poor people decrease implying that additional income increases inequality in these countries.

4. Analysis of the Results

We have estimated total 16 models with different specifications of pooled regression model. The results of such models are shown in Appendix III in the models 1-16. It is confirmed that income distribution inequality variable is significant either 1% or 5% or 10% level of significance. The sign of the coefficient is also in line with theoretical expectation. These models are also passed by the F-test and DW tests. Precisely, the results of pooled regression model indicate that income distribution inequality affects money demand negatively. However, all coefficients and intercepts are time invariant is a very rigorous assumption. So, we should explore fixed effect model of panel data whether income distribution inequality has any impact on the money demand of these countries.

The fixed effect model accepts that differences among spaces and time. To capture such differences FEM uses dummy variable techniques. However, intercepts are the same for all spaces. The results of the FEM are shown in the models 17-32 of Appendix III. By observing the results, we can say that almost in every case income distribution inequality variable is significant with theoretically expected signs meaning that inequality negatively affects the money demand.

The random effect model is estimated by OLS technique. REM model estimates by relying on maximum likelihood model. In REM, the differences of different intercepts are captured by error terms. Cross section and time effects are also reflected in error terms. The results of the REM are shown in the models 33-48 of Appendix III. Almost all models provided the similar results of FEM. They are showing that money demand decreases if inequality of income distribution increases.

We have also performed Hausman test to check whether FEM or REM performs better, and the results of which model are more reliable for our estimation. In case of two REM models (34 and 38) we have got Chi-Square statistic of Hausman test is significant meaning that in these two cases, FEM performs better that REM. However, counterpart FEM results of the two models also have given significant coefficients of income distribution inequality. So, conclusion about the impact of inequality is not changed due to the results of the Hausman test.

If panel data suffers from autocorrelation, heteroscedasticity and cross-sectional dependence problems, estimation derived from Pooled or FEM or REM will not provide best, linear and unbiased estimator (BLUE). To overcome such problems all 48 models' estimation is done by the technique of Panel Corrected Standard Error (PCSE) model which takes care of these three problems.

We have investigated the validity of the Laidler (1985) hypothesis for 34 countries by applying panel data econometric techniques for the first time. Our findings confirmed the validity of the hypothesis. Almost every format of specification proves efficacy that this hypothesis, which is ignored by the researcher and practitioners for long time since the invention of this theory, is valid. Among the other variables, interest rate is found significant with expected sign for all 48 models and but income level has given insignificant result in each model. The target variable income distribution inequality has provided significant results with theoretically expected signs almost in all cases. However, when top1% is considered as an indicator of income distribution inequality, insignificant results are found in six cases out of 12 models in total. Perhaps top1% income share is not a good and representative indicator of income distribution inequality of a nation.

Another notable fact is that in some cases size of the coefficients of income distribution inequality is much larger than that of interest rate level implying that impact of inequality on money demand is larger than that of interest rate. This finding is striking in the sense that this ignored factor deserves higher emphasis than the traditional determinants of money demand, which have been considered across the world by monetary policy practitioners. It also postulates that traditional money demand function determined only by the interest rate and income level is flatly wrong or mis-specified.

Just as an example, we can note an interpretation of model 41here. The coefficient on d(IR) has percentage interpretation when it is multiplied by 100% i.e., if interest rate (IR) increases by 1%, the demand for broad money decreases by 1.23%. Similarly, the demand for broad money would be decreased by 23.21% due to increase of 1% of top1% people’s income share. A similar interpretation can be done for all other 47 models too.

5. Conclusion and Policy Implications

We have empirically examined an old and longtime ignored theory given by David N. Laidler (1985), which says that income distribution inequality negatively affects money demand of a country. However, later economists and even monetary policy practitioners have not shown much interest in this theory. Still today monetary authorities of all countries throughout the world do not take into account this hypothesis in their monetary policy formulation exercise. Even economists and researchers also show their aloofness to this theory. Due to such backdrop, we have investigated this missing hypothesis by a panel data set of 34 high income (mostly OECD) countries for the period of 2000-2022. Monetary policy of a country is highly important, as this policy has stalwart impact on two most important macroeconomic variables, inflation and unemployment rates. However, for achieving desired target of these two most important macroeconomic variables, formulation a correct policy and its subsequent proper implementation are absolutely essential. The findings of the research proves that conventional money demand function (Money Demand = f (interest rate, income)) presently assumed and used by the central banks across the world is wrongly specified and flawed due to the omitted variable problem as it has not been using "income distribution inequality" as an explanatory variable of this function. Misspecification of money demand function leads to wrong monetary policy formulation. Flawed designing of any policy will ultimately lead to an inaccurate implementation and missing of target achievement. Therefore, inclusion of income distribution inequality into money demand function is very much urgent. Here another eye catching concern is that most of the country in the world do not have a reliable and regular data for this variable. To do this end, keeping and maintaining data series of income distribution inequality is necessary. All countries should measure and maintain this important variable data series and use it in the monetary policy formulation process. Otherwise, monetary policy will never earn accuracy and perfection in anywhere in the world.

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Appendix I

Table 1: Summary Statistics

	GBM	GM2	IR	PADGDP	PADNY	TOP1	TOP10	BOT40	BOT50
Mean	0.154290	0.149670	4.562454	42115.28	33838.47	0.092512	0.310985	0.176728	0.248638
Median	0.060463	0.063822	3.767850	40621.14	34146.29	0.082950	0.296950	0.180100	0.253550
Maximum	7.146337	4.544297	74.69920	112504.9	91702.90	0.234400	0.554400	0.252800	0.336200
Minimum	-0.959123	-0.956528	-1.266700	13792.83	10238.87	0.048000	0.221500	0.070900	0.116700
Std. Dev.	0.587024	0.461395	5.621494	17935.65	13367.09	0.035866	0.058764	0.032409	0.040375
Skewness	6.532903	4.454715	6.045055	1.435975	0.933850	1.850384	2.033175	-0.895931	-1.012839
Kurtosis	60.65282	33.04964	61.88413	5.832019	4.363076	6.499094	7.666859	4.374786	4.489782
Jarque-Bera	73094.60	20547.67	75582.62	340.2813	111.8263	542.5645	801.4175	106.6918	132.2524
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	77.45357	75.13454	2290.352	21141870	16986914	46.44095	156.1144	88.71761	124.8161
Sum Sq. Dev.	172.6430	106.6555	15832.20	1.61E+11	8.95E+10	0.644478	1.730048	0.526208	0.816719
Observations	568	568	568	568	568	568	568	568	568

Source: Authors' own calculations

Table 2: Correlation Matrix

	GBM	GM2	IR	PADGDP	PADNY	TOP1	TOP10	BOT40	BOT50
GBM	1								
GM2	0.400046	1							
IR	-0.014666	-0.023157	1						
PADGDP	0.041029	0.043907	0.283165	1					
PADNY	0.037030	0.042843	0.286601	0.953318	1				
TOP1	-0.066372	-0.058692	0.310385	0.009381	0.047250	1			
TOP10	-0.074188	-0.074923	0.387347	0.068367	0.045926	0.938400	1		
BOT40	0.088073	0.091911	-0.171272	-0.007390	-0.024731	-0.779417	-0.88756	1	
BOT50	0.085520	0.090307	-0.207087	-0.022195	-0.003102	-0.8053646	-0.916467	0.996413	1

Source: Authors’ own calculations

Appendix II:

Country list

1. Australia 2. Austria 3. Belgium 4. Canada 5. Chile 6. Czech Republic 7. Denmark	8. Estonia 9. Finland 10. France 11. Germany 12. Greece 13. Hungary 14. Iceland	15. Ireland 16. Italy 17. Japan 18. Korea 19. Latvia 20. Lithuania 21. Luxemburg	22. Netherland 23. New Zealand 24. Norway 25. Poland 26. Portugal 27. Slovakia 28. Slovenia	29. Spain 30. Sweden 31. Switzerland 32. Turkey 33. USA 34. UK

Appendix III:

The Results of Estimated Models

POOLED OLS

Dep. Variable→	**D(log(BM))**							
Exp. Variable↓	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
C	0.1088**	0.1739	-0.1232	-0.1518	0.1074***	0.1731***	-0.1256	-0.1544*
D(IR)	-0.0208***	-0.0209***	-0.0203***	-0.0204***	-0.0206***	-0.0208***	0.0201***	-0.0202***
D(Log(PADGDP))	0.0859	0.0719	0.1149	-0.1030				
D(Log(PADGNP))	-	-			0.0457	0.0539	0.0001	-0.0070
Top1%	0.3609***	-			-0.3661**			
Top10%	-	0.3085**				0.3116*		
Bottom40%	-	-	1.1175**				1.1214**	
Bottom50%	-	-		0.9085**				0.9124**
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	28	28	34	34	28	28
Observation	676	676	568	568	568	676	568	568
R-Squared	0.0210	0.0237	0.0278	0.0280	0.0209	0.0237	0.0277	0.0279
Adjusted R-Sq.	0.0161	0.0188	0.0219	0.0222	0.0161	0.0189	0.0218	0.0221
DW-Stat.	2.1504	2.0253	2.1670	2.0685	2.1499	2.2519	2.1667	2.1826
F-stat.	4.3305	4.903875	4.7436	4.7901	4.3223	4.0938	4.7196	4.7710
Prob.(F-Stat)	(0.0049)	(0.0022)	(0.0028)	(0.0027)	(0.0049)	(0.0022)	(0.0029)	(0.0027)
Pesaran CD	9.4552***	7.0168***	5.9580***	5.9667***	9.4694***	9.3259***	5.8838***	8.9000***
Levin-Lin-Chu	4.6592***	9.2371***	-15.8978***	-15.9314***	-7.0180***	-6.9806***	-15.9239***	-15.8440***
Im-Pesaran-Shin	9.8284***	8.2250***	-12.1518***	-12.0986***	-9.2040***	-9.2175***	-12.2179***	-12.1606***
Fisher-ADF	229.4350***	207.031***	270.7350***	269.5450***	207.116***	207.099***	272.182***	270.932***

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.

POOLED OLS

Dep. Variable→	D(log(M2))							
Exp. Variable↓	**Model 9**	**Model 10**	**Model 11**	**Model 12**	**Model 13**	**Model 14**	**Model 15**	**Model 16**
C	0.0754***	0.1003***	0.0237*	0.0183	0.1066***	0.1625***	-0.0543	-0.0731*
D(IR)	-0.0085***	-0.0185***	-0.0080***	-0.0080***	-0.0123***	-0.0125***	-0.0103**	-0.0103**
D(Log(PADGDP))	0.4198*	0.4183**	0.4018***	0.4043***				
D(Log(PADGNP))					0.3285**	0.3148***	0.3025*	0.2944***
Top1%	-0.1396*				-0.2321**			
Top10%		-0.1178**				-0.2413***		
Bottom40%			0.2345**				0.7971**	
Bottom50%				0.1880***				0.6417***
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	28	28	34	34	28	28
Observation	676	676	568	568	676	676	568	568
R-Squared	0.0311	0.0332	0.0342	0.0354	0.8764	0.1097	0.1124	0.1129
Adjusted R-Sq.	0.0263	0.0284	0.0284	0.0283	0.3857	0.0607	0.0528	0.0532
DW-Stat.	1.8489	1.8447	1.8412	1.8409	2.0425	2.0469	2.0498	2.0503
F-stat.	6.4784	6.9401	5.8837	5.8706	17.8606	2.2402	3.9887	3.0543
Prob.(F-Stat)	(0.0003)	(0.0000)	(0.0006)	(0.0006)	(0.0000)	(0.0825)	(0.0408)	(0.0101)
Pesaran CD	10.5339***	10.9936***	7.6266***	7.6242***	10.7660***	10.6913***	8.0187***	8.0010***
Levin-Lin-Chu	-11.1044***	-11.1044***	10.7164***	-10.7164***	-11.1044**	-11.1044***	-11.1044***	-11.1044***
Im-Pesaran-Shin	-10.3971***	-10.1054**	-9.0068***	7.2759***	-10.3971***	-10.3971***	-10.3971***	-10.3971***
Fisher-ADF	234.669***	234.669***	202.706***	369.201***	234.669***	234.669**	3.8999***	234.669***

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.

FIXED EFFECT MODEL

Dep. Variable→	D(log(BM))							
Exp. Variable↓	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
C	0.1009***	0.1621***	-0.0968	0.1237	0.0992***	0.1611***	-0.1101	-0.1274
D(IR)	-0.0173***	-0.0175***	0.0173***	-0.0173***	-0.0169***	0.0171***	-0.0167***	-0.0167***
D(Log(PADGDP))					0.2388	0.2488	0.1381	0.1465
D(Log(PADGNP))	0.0720	0.0927	0.0909	0.0732				
Top1%	-0.2969				-0.3012*			
Top10%		-0.2773**				-0.2803**		
Bottom40%			0.9708***				0.9714***	
Bottom50%				0.7972***				0.7997***
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	28	28	34	34	34	28
Observation	676	676	568	568	676	676	568	568
R-Squared	0.0846	0.0870	0.0919	0.0922	0.0853	0.08779	0.0921	0.0925
Adjusted R-Sq.	0.0535	0.0656	0.0541	0.0545	0.0542	0.05568	0.0543	0.0548
DW-Stat.	2.1736	2.1783	2.1932	2.1947	2.1714	2.1463	2.1906	2.1122
F-stat.	2.7202	2.8070	2.4331***	2.4439	3.7475	2.8342	2.4386	2.4511
Prob.(F-Stat)	(0.0000)	(0.0000)	(0.0005)	(0.0005)	(0.0000)	(0.0001)	(0.0005)	(0.0005)
Pesaran CD	3.5430**	3.5513***	2.6619***	2.6601***	3.5405***	3.5463***	2.6699***	2.6656***
Levin-Lin-Chu	-8.2917***	-8.2402***	-15.0448***	-15.0929***	-8.2916***	-8.2161***	-15.2166***	15.2641***
Im-Pesaran-Shin	-10.8763***	-10.8601***	-12.1239***	-12.1805***	-10.8939***	-10.8721***	-12.1838***	12.2426***
Fisher-ADF	237.350***	237.138***	266.230***	267.479***	273.778***	237.4320***	267.795***	269.119***

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.

FIXED EFFECT MODEL

Dep. Variable→	**D(log(M2))**							
Exp. Variable↓	**Model 25**	**Model 26**	**Model 27**	**Model 28**	**Model 29**	**Model 30**	**Model 31**	**Model 32**
C	0.0957***	0.1494***	-0.0407*	-0.0588	0.0969	0.1504***	-0.0408*	-0.0586
D(IR)	-0.0075*	-0.0077**	-0.0063*	-0.0064*	-0.0076*	-0.0178**	-0.0068*	-0.0064**
D(Log(PADGDP))	0.1845	0.2028	0.0046	0.0079				
D(Log(PADGNP))					0.1278	0.1371	0.0004	0.0027
Top1%	-0.1903				-0.1905			
Top10%		-0.2221**				-0.2215**		
Bottom40%			0.6999**				0.7059**	
Bottom50%				0.5692***				0.5691**
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	34	34	34	34	28	28
Observation	676	676	676	676	676	676	568	568
R-Squared	0.0897	0.0917	0.0923	0.0925	0.0897	0.9175	0.0924	0.0925
Adjusted R-Sq.	0.0588	0.0609	0.0546	0.0547	0.0588	0.0608	0.05463	0.0548
DW-Stat.	2.0123	2.0165	2.2024	2.0209	2.0132	2.0175	2.0201	2.0209
F-stat.	2.9022	2.9741	2.4475	2.4510	2.9021	2.9737	2.4475	2.4510
Prob.(F-Stat)	(0.0000)	(0.0000)	(0.0005)	(0.0005)	(0.0000)	(0.0000)	(0.0005)	(0.0005)
Pesaran CD	3.1346***	3.1549***	2.2487***	2.2502***	3.0878***	3.1022***	2.2494**	2.2483***
Levin-Lin-Chu	-15.6324***	-15.6606***	-15.1899***	-15.1851***	-15.5642***	-15.5625***	-15.1880***	-15.7111***
Im-Pesaran-Shin	-13.0623***	-13.0059***	-12.4835***	-12.4928***	-13.0350***	-12.9718***	12.4767***	-12.4835***
Fisher-ADF	302.451***	303.052***	271.011***	271.143***	302.718***	302.299***	270.860***	270.922***

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.

RANDOM EFFECT MODEL

Dep. Variable→	D(log(BM))							
Exp. Variable↓	**Model 33**	**Model 34**	**Model 35**	**Model 36**	**Model 37**	**Model 38**	**Model 39**	**Model 40**
C	0.1088***	0.1739***	-0.1232*	-0.1518***	-0.1074***	-0.1731***	-0.1256*	-0.1544***
D(IR)	-0.0208***	-0.0209***	-0.0203***	-0.0204***	-0.0206***	-0.0208***	-0.0201***	-0.0202***
D(Log(PADGDP))	0.0859	-0.0719	-0.1149	-0.1030				
D(Log(PADGNP))					0.0457	0.0539	0.0004	0.0071
Top1%	-0.3609				-0.3661			
Top10%		-0.3085**				-0.3116***		
Bottom40%			1.1175***				1.1214***	
Bottom50%				0.9085***				0.9125***
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	28	28	34	34	28	28
Observation	676	676	568	568	676	676	568	568
R-Squared	0.0204	0.0237	0.0277	0.0280	0.0209	0.0237	0.0276	0.0279
Adjusted R-Sq.	0.0161	0.0189	0.0219	0.0222	0.0161	0.0189	0.0218	0.0221
DW-Stat.	2.2504	2.1554	2.1670	2.1685	2.1499	2.1548	2.1667	2.1682
F-stat.	4.3305	4.9039	4.7436	4.7901	4.3224	4.9038	4.7196	4.7710
Prob.(F-Stat)	(0.0049)	(0.0022)	(0.0028)	(0.0027)	(0.0050)	(0.0023)	(0.0029)	(0.0027)
Pesaran CD	9.4552***	9.3061***	5.9580***	5.9667***	9.4694***	9.3259***	5.8838***	5.9000***
Levin-Lin-Chu	-20.7624***	-20.6680***	-20.3362***	-20.3693***	-20.7731***	-20.6661***	-20.3862***	-20.3085***
Im-Pesaran-Shin	-18.0047***	-17.9784***	-16.4557***	-16.4223***	-18.0005***	-17.9656***	-16.5354***	-16.4961***
Fisher-ADF	382.428***	381.430***	346.771***	346.070***	382.493***	381.290***	348.425***	347.567***
Hausman Test								
Chi- Sq.-Stat.	5.8951	14.0677***	3.5982	3.3612	5.3149	13.8645***	3.3379	3.1635
Degrees of Freedom	3	3	3	3	3	3	3	3

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.

RANDOM EFFECT MODEL

Dep. Variable→	D(log(M2))							
Exp. Variable↓	**Model 41**	**Model 42**	**Model 43**	**Model 44**	**Model 45**	**Model 46**	**Model 47**	**Model 48**
C	0.1066***	0.1625***	-0.0543	-0.0731	0.1048***	0.1611***	-0.0567	-0.0755
D(IR)	-0.0123***	-0.0125***	-0.0103***	-0.0102***	-0.0122***	-0.0124***	-0.0102***	-0.0102***
D(Log(PADGDP))	0.3285	0.3148	-0.3025	0.2934				
D(Log(PADGNP))					0.2227	-0.2144	-0.2379	-0.2331
Top1%	-0.2321*				-0.2335			
Top10%		-0.2413**				-0.2428**		
Bottom40%			0.7971				0.8020**	
Bottom50%				0.6417**				0.6460**
Period Included	22	22	22	22	22	22	22	22
Cross-Sect Included	34	34	34	34	34	34	34	34
Observation	676	676	676	676	676	676	676	676
R-Squared	0.0088	0.0109	0.0112	0.0113	0.0085	0.0108	0.0113	0.0114
Adjusted R-Sq.	0.0039	0.0067	0.0053	0.0053	0.0036	0.0058	0.0054	0.0054
DW-Stat.	2.00425	2.0469	2.0980	2.0503	2.0438	2.0481	2.0495	2.0499
F-stat.	2.7861	2.2402	2.8871	2.8919	2.7403	2.1997	2.9053	3.9113
Prob.(F-Stat)	(0.0149)	(0.0825)	(0.0131)	(0.0129)	(0.0015)	(0.0870)	(0.0127)	(0.0013)
Pesaran CD	10.7660***	10.6913***	8.0187***	8.0010***	10.6004***	10.5320***	7.8337***	7.8211***
Levin-Lin-Chu	8.0058***	-18.0282***	-17.1127***	-17.1537***	-18.0136***	-18.0248***	-17.2813***	-17.3225***
Im-Pesaran-Shin	-14.9555***	-14.9321***	-14.4464***	-14.4541***	-15.0237***	-14.9970***	-14.5524***	-14.5577***
Fisher-ADF	313.801***	313.466***	302.851***	303.006***	315.164***	314.631***	305.098***	205.192***
Hausman Test								
Chi- Sq.-Stat.	0.6488	3.8110	0.6251	0.8713	3.3538	3.6281	1.8065	1.8000
Degrees of Freedom	3	3	3	3	3	3	3	3

***, ** and * Indicate that estimated coefficients are significant at 1%, 5% and 10% levels.