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Does Government Spending Affect Money Demand in the United States?

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Abstract
This paper elucidates the effect of government spending on money demand in the United States using quarterly data over the period 1973Q1–2013Q4. The related conventional literature has been developed with money demand defined as a function of income, interest rate, exchange rate, and inflation. I propose a new method of income decomposition to the public sector and private sector following Barro's (1990) spending model. I apply the autoregressive distributed lag cointegration approach (ARDL) and include government spending in the conventional money demand function to investigate its impact on the demand for money. The results confirm the long-run, significant effect of government spending on money demand, finding the elasticity of money demand with respect to government spending to be 0.62. In addition, I find that money demand tends to be unstable and shifts toward the edge of a structural break during recessions. The results do not support Friedman's (1969) idea that the demand for money is "highly stable." Instead, the findings suggest that money demand is "slightly stable" during a recession. This confirms that the current evidence is insufficient to switch to interest rate targeting instead of money targeting as an appropriate monetary policy in the United States.

Keywords: Monetary Policy, Money Demand, Stability, Government Spending

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1. Introduction

To conduct an appropriate monetary policy, the demand for money plays an essential role. For a long time, economists have studied money demand function and its primary determinants, but they have not investigated sufficiently to observe the effect of government spending on money demand. Since the Great Depression, following Keynesian demand management policies, the government has been spending much money. This has caused chronic budget deficits and a large national debt not only in the United States but also in all developed countries. The only action Central Banks, as an independent organization, could take is to control the inflationary effects of government spending using monetary policy tools. Sufficient evidence exists in advanced economies that central banks achieved their inflation targets.

The primary reason behind the ignorance of the effect of government spending is the classical view regarding the neutrality of government spending and its insignificant effect on total output. This assumption appears unrealistic, as recent works confirm the long-run effect of government spending on total output.[1] Since money demand is one of the most important factors in the decision-making process of monetary authorities, the new method of decomposition shed lights on the fact that conventional literature misses the importance of the public sector's effect on money demand. To scrutinize this effect, the U.S. economy appears to be suitable case as a center of global financial markets.

Recently, money demand is no longer centered in monetary policy debates (Duca, 2001). The reason is that central banks worldwide switched to interest rate targets. Though, theoretically the classical school of thought regarding neutrality of money was convincible assuming flexible prices, the Great Depression questioned the concept of flexible prices and full employment. The leader of a new school of thought, John Maynard Keynes (1936), had revolutionary influence on economic policy tools, which overcame the Great Depression. In his work, he considers a role for money other than as a medium of exchange and unit of account, which are the building framework for the transaction and the precautionary demand for money. While those two depend on the level of economic activity, the speculation demand for money derived from the store-of-value role for money, relies upon interest rate as an opportunity cost of holding money.

In the literature, there exists a consensus among economists that money demand is a function of income as a scale variable that represents the economic activity (Laidler, 1993) and interest rate.[2] However, conventional literature has evolved, adding new variables as a representative for opportunity costs of holding money. In addition to interest rate, the price level raised attention as another opportunity cost.[3] Theoretically, an increase in price level decreases the purchasing power of money balance and results in holding less money. Moreover, the exchange rate entered into the money demand function, as Mundell's (1963) conjecture raised some curiosity regarding the assumption (Bahmani, 2014).[4] Since, in this research, the focus is on the scale variable using the decomposition of total output to the public and private sectors to investigate the effect of government spending, I consider interest rate, price level, and exchange rate as representatives for opportunity costs. It is worth mentioning that the omitted variable and endogeneity do not cause any trouble if one could eliminate serial correlation using an econometrics approach such as autoregressive distributed lag (ARDL), which is discussed next in the paper.

Empirically, the money demand in the United States attracted some works using cointegration approaches to study the long-run relationship between monetary aggregates and their determinants. In the 90s, the cointegration approaches of Engel and Granger (1987), Johansen (1988), and

[1] For more information see Ebadi (2018).
[2] For example; see Meltzer (1963), Lucas (1988), Laidler (1966), Golinelli and Pastorello (2002), Carlson et al. (2000), Ball (2001), Hafer and Jansen (1991), Bahmani (1996), Bahmani and Shabsigh (1996), Bahmani-Oskooee and Gelan (2009).
[3] For example; see Friedman and Kuttner (1992).
[4] For example; see McNown and Wallace (1992), Arango and Nadiri (1981), Bahmani-Oskooee and Pourheydarian (1990), Bahmani-Oskooee and Bahmani (2014).

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Johansen and Juselius (1990) were the leading cointegration techniques applied by Miller (1991), Baba et al. (1992), McNown and Walac (1992), and Mehra (1993). While Sriram (2001) believes the error correction models (ECM) satisfy the criteria to obtain meaningful results, the ECM that uses the above approaches are not sufficiently reliable due to the assumptions made (Pesaran and Pesaran, 1997). Therefore, to acquire meaningful results, it is important to have a reliable model specification and an estimation method that is free of identification problems.

The autoregressive distributed lag (ARDL) approach overcomes the endogeneity problem, as it works even with endogenous regressors in the model (Pesaran and Shin, 2001). The ARDL procedure is an optimal estimator compared with other asymptotically efficient estimators such as DOLS, FMLS, and MLE (Panopoulou and Pittis, 2004). For this reason, this cointegration technique attracted many researchers worldwide to discover the new aspects of money demand.[5] A caveat should be noted here that the results derived from the ARDL model are not reliable without applying stability tests to ensure the coefficient estimates are stable.[6]
As mentioned above, money demand in the United States lost attention, and it appears the concept of "money matters for the determination of aggregate demand" (Mankiw et al. 1986) is no longer acceptable, at least in the United States. Therefore, this paper aims to apply the ARDL approach to investigate the money demand in the United States by decomposing the conventional scale variable. In addition, the stability of demand for money in the United States using the CUSUM and CUSUMSQ tests is discussed to ensure that the coefficients in the model are stable and reliable. Although these tests are required to conduct long-run relationships, they provide useful information regarding the time and duration of the probable structural break.

Section II discusses the model and estimation strategy. Section III provides empirical results. Finally, Section IV summarizes the conclusions of the study.

2. The Model and Estimations Strategy

Following the conventional demand for money, including income as a representative for scale variable and inflation, interest rate, and exchange rate as an illustrative for the opportunity costs, the model specification is as follows:

$$\ln M_t = c + \alpha \ln Y_t + \beta TBILL_t + \gamma \ln NEER_t + \delta \ln CPI_t + \varepsilon_t \quad (1)$$

where lnM is the logarithm of real M_2[7] (broad money), lnY is the logarithm of real GDP, lnTBILL is the logarithm of three-month Treasury bill rate, lnNEER is the logarithm of nominal effective

[5] For example see; Bahmani-Oskooee and Gelan(2009), Jihad and Kovanen (2011), Baharumshah et al. (2009), Akinlo (2005).
[6] For more information see Bahmani-Oskooee and Bohl (2000), Bahmani-Oskooee and Shin (2002), Bahmani-Oskooee and Rehman (2005).
[7] M2 is the preferable measure to study the long-run economic impacts. For more information see Daniele *et al.* (2016).

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exchange rate, lnCPI is the logarithm of consumer price index (CPI), c is the constant term, and ε is the error term.

Following Ebadi (2018), I decompose GDP to the public and private sectors and rearrange the demand for money as follows:

$$\ln M_t = c + \alpha \ln RGE_t + \beta \ln RK_t + \gamma TBILL_t + \delta \ln NEER_t + \zeta \ln CPI_t + \varepsilon_t \quad (2)$$

where lnRGE is the logarithm of real government spending, and lnRK is the logarithm of real capital stock.[8] All data has been collected from the Federal Reserve Economic Data (FRED) database.
I apply the ARDL approach to cointegration to estimate the long-run relationship between variables in the model. To ensure that no I(2) variable appears in the model, I employ the augmented Dickey-Fuller (1981) (ADF) test.[9] The ARDL model then proceeds as follows:

$$\Delta \ln M_t = c + \sum_{i=1}^{n} \alpha_i \Delta \ln M_{t-i} + \sum_{i=0}^{n} \beta_i \Delta \ln RGE_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta \ln RK_{t-i} + \sum_{i=0}^{n} \delta_i \Delta \ln TBILL_{t-i}$$
$$+ \sum_{i=0}^{n} \zeta_i \Delta \ln NEER_{t-i} + \sum_{i=0}^{n} \eta_i \Delta \ln CPI_{t-i} + \lambda_1 \ln M_{t-1} + \lambda_2 \ln RGE_{t-1} + \lambda_3 \ln RK_{t-1} + \lambda_4 \ln TBILL_{t-1}$$
$$+ \lambda_5 \ln NEER_{t-1} + \lambda_6 \ln CPI_{t-1} + \mu_t \quad (3)$$

The first portion of equation, with parameters α_i, β_i, γ_i, δ_i, ζ_i, η_i, and μ_i, depicts the short-run dynamics of the model. The second portion demonstrates the long-run relationship with parameters λ_1, λ_2, λ_3, λ_4, λ_5, and λ_6. The null and alternative hypothesis of existing cointegration are as follows: H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$ and H_1: $\lambda_1 \neq 0, \lambda_2 \neq 0, \lambda_3 \neq 0, \lambda_4 \neq 0, \lambda_5 \neq 0, \lambda_6 \neq 0$.

Following Pesaran and Shin (2001), I determine the optimal lags for the variables in the model, and then I estimate the parameters.

3. Empirical Results

I estimate equation (3) using quarterly data over the period 1973Q1–2013Q4. To select the optimal order, I do not follow the literature to impose maximum lags of eight.[10] Instead, I use maximum lags of 12 to address the serial correlation that occurs using the lower number of maximum lags. The lags should address serial correlation and endogeneity, and I find that misspecification can occur should we use a lower number of lags. The sample size plays an important role when we impose additional lags to the model.

[8] For more information, see Ebadi (2018).
[9] The ARDL approach is not applicable when we have an I(2) variable in the model (Pesaran and Shin, 2001).
[10] See Bahmani-Oskooee and Gelan(2009).

Although the ARDL model could not eliminate serial correlation using the Akaike information criterion (AIC) (Akaike, 1974) and Schwarz Bayesian information criterion (BIC) (Schwarz, 1978) to select the optimum lags, the Hannan- Quinn information criterion (HIQ) (Hannan and Quinn, 1979) solves the problem as the second-best model selection criterion.[11] Since the calculated LM statistic is less than its critical value (9.48), the LM (Lagrange multiplier test of residual serial correlation) test confirms the model does not suffer from an omitted variable problem and endogeneity with the selected optimal lags. In addition, the Ramsey RESET test strongly rejects the misspecification in the proposed model (Table.1, panel B, the calculated RESET statistic is less than its critical value of 3.48). The result is sufficiently strong to support the statement that the proposed model is correctly specified.

To establish the long-run relationship between the variables in the model, I conducted a bound test (Pesaran and Shin, 2001). Since the calculated F statistic (24.6) is far beyond the upper bound at a 5% significance level (3.8), the null hypothesis of no cointegration is strongly rejected. This indicates a long-run relationship among the variables in the model. In addition, the negative and significant error correction coefficient (-0.10) confirms adjustment toward equilibrium.

After conducting the diagnostic tests, I implement the CUSUM and CUSUMSQ tests[12] to ensure that the coefficients are stable. The results demonstrate that the coefficients in the proposed model are stable according to both tests. It is worth mentioning that the CUSUMSQ test reveals that during recessions, money demand tends to be unstable and shifts toward the edge of structural break. Furthermore, the tendency of instability lasted longer during the recession in the early 2000s compared with the Great Recession of 2007–2008. Moreover, the results do not support the idea that "money demand (M2) appeared to be stable until the early nineties, when the structural break occurred."[13] This paper confirms there was no structural break in money demand but does not support Friedman's (1969) idea that money demand is "highly stable." Instead, the results indicate that money demand is "slightly stable" during the recessions. However, the source that pushed M2 toward the edge of structural break remains unclear for the author. During the two recessionary periods mentioned above, the Federal Reserve sharply cut the interest rate and the government dramatically raised its spending. The question of whether the interest rate or government spending was the source requires further research.

[11] See Shikui and Lei (2012).
[12] See Brown *et al.* (1975).
[13] See Calaza and Sousa (2003).

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Table 1 - Full-information estimate of Equation 3

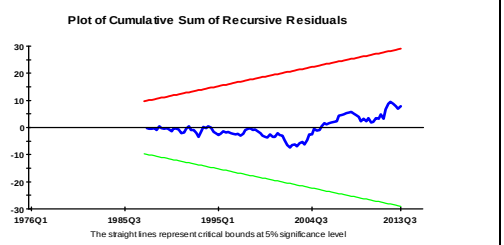
Panel A: Short-run coefficient estimates

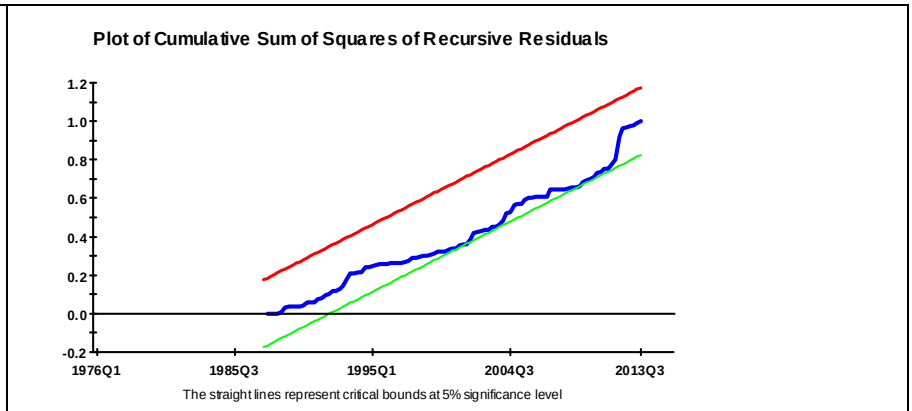
Lag order	0	1	2	3	4	5	6	7	8	9	10	11
ΔlnM		0.22	-0.01	0.21	-0.05	0.1	0.03	0.20	0.13			
		(3.88)	(0.22)	(3.28)	(0.82)	(1.71)	(0.59)	(3.29)	(1.97)			
ΔlnRGE	0.06											
	(2.05)											
ΔlnRK	0.04	-0.14	0.01	-0.04	-0.10	-0.002	-0.06	-0.07	-0.05			
	(1.58)	(4.38)	(0.34)	(1.18)	(2.89)	(0.06)	(1.80)	(2.25)	(1.74)			
ΔlnNEER	0.20	0.02	0.03	0.01	0.02	0.006	0.03	0.02	0.03			
	(1.25)	(1.35)	(2.20)	(0.76)	(1.40)	(0.38)	(2.22)	(1.53)	(1.79)			
ΔlnTBILL	-0.01	0.002	0.008	0.01	0.01	0.006	0.004	0.006	0.02	0.007	0.003	-0.01
	(6.30)	(1.13)	(3.44)	(5.19)	(3.78)	(2.41)	(1.95)	(2.37)	(7.1)	(2.27)	(1.31)	(4.36)
ΔlnCPI	-1.14											
	(12.4)											

Panel B: Long-run coefficient estimates and diagnostics

Constant	lnRGE	lnRK	lnNEER	lnTBILL	lnCPI	Adj.R^2	F^b	EC_{t-1}	LM	RESET
-0.0009	0.62	0.67	-0.21	-0.10	-0.27	0.99	24.68	-0.10	8.68	0.49
(0.82)	(4.10)	(3.27)	(4.63)	(5.35)	(2.90)			(3.80)		

Panel C: Stability tests





Notes: a. Numbers inside parentheses are absolute value of t-ratio
b. The upper bound critical value of the F test at the usual 5% level of significance is 3.88 (Pesaran and Pesaran, 2009, Microfit.5)
c. LM is the Lagrange multiplier test for serial correlation. It has a χ^2 distribution with one degree of freedom. The critical value at 5% level of significance is 9.48.
d. RESET is Ramsey's specification test. It has a χ^2 distribution with only one degree of freedom. The critical value at the 5% level of significance is 3.84.

As observable from panel B, all coefficients are strongly significant and carry the expected signs. The results reveal that the elasticity of money demand with respect to real government spending as a proxy for the public sector and with respect to the private sector representative was found to be 0.62 and 0.67, respectively. Moreover, the interest rate elasticity of money demand and consumer price index elasticity are -0.1 and -0.27, respectively. The coefficient of exchange rate in money demand (it can be positive[14] or negative[15]) is found to be negative, which supports the wealth effect of domestic currency in the United States. Finally, the adjusted R^2 portrays the high forecasting power of the proposed money demand model. Since "predictive performance" of money demand models was controversial (Barnett et al. 1992), the proposed model performs well in this manner alongside the reliable coefficients.

4. Conclusion

This paper sheds light on the effect of government spending on money demand as an essential determinant in conducting an appropriate monetary policy. Since the effectiveness of monetary tools relies on having a stable money demand, this paper attempts to provide a reliable estimate of the effect of government spending on money demand in the United States, which is the primary contribution this paper added to the conventional literature.

The results illustrate the positive and significant effect of government spending on money demand based on the model, which does not suffer from serial correlation and misspecification problems and has sufficient predictive performance. In addition, the diagnostic tests of the stability of coefficients in the proposed money demand model using the decomposition of the scale variable provide astonishing information regarding the stability of money demand in the United States. The empirical results reveal that no structural break in money demand occurred in the early 1990s and thereafter. Moreover, the notion of switching to interest rate as a target due to unstable money demand is unconvincing.

This study suggests targeting money rather than interest rate, as there exists insufficient evidence of instability of money demand in the United States. Although the proposed money demand is stable over the period of the study, it is not "highly stable" as Friedman (1969) believes. Instead, it is "slightly stable" during recessions and moves towards the edge of structural break, though it remains stable. Further research is needed to discover the source or sources that pushed money demand toward the edge of instability during the recession of the early 2000s and the Great Recession of 2007–2008. In the meantime, the author conjectures that both a considerable interest rate cut by the Federal Reserve and a dramatic increase in government spending were the reasons behind the phenomenon.

[14] Arango and Nadiri (1981).
[15] Bahmani-Oskooee and Pourheydarian (1990).

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