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Impact of Fed's Credit Easing on the Value of U.S. Dollar

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Abstract

Our study tests the monetary theory of exchange rate determination between the U.S. dollar and the Canadian dollar using the data over the period, 1960-2008. We also empirically evaluate the impact of Fed's credit easing on the value (exchange rate) of U.S. dollar. Our findings partially validate the monetary theory of exchange rate determination. That is, while the changes in U.S. money supply or Canada's real GDP have positively affected the exchange rate, the U.S. real GDP has negatively affected the exchange rate of U.S. dollar. However, Canada's money supply has no impact on the value of the dollar. Our study also finds that the increase in U.S. money supply caused by the Fed's credit (quantitative) easing has, in fact, increased the exchange rate (lowered the value) of U.S. dollar.

Key Words: purchasing power parity, equation of exchange, quantitative (credit) easing, cointegration, cointegrating vector
JEL Classification: F3

I. Introduction

The objective of this study is two-fold: testing the monetary theory of exchange rate determination and assessing the impact of Fed's credit easing on the value of U.S. dollar. Following the beginning of the financial crisis in 2008, the Federal Reserve introduced a number of new policy tools that have altered both the size and composition of the Federal Reserve's balance sheet (see Clevelandfed.org). These policy tools are aimed at supporting the functioning of financial markets during the crisis and to help the economy recover from the recession. These non-traditional policy tools, termed as "credit easing" by the former chair of the Board of Governors, are divided into three categories: (a) lending to financial institutions, (b) providing liquidity to key credit markets, and (c) purchasing longer-term securities. A number of researchers, such as, Bouakez and Normandin (2010) studied the impact of U.S. monetary policy on the U.S. economy and concluded that the channel through which the monetary policy worked was via the movement in the value of dollar. Glick and Leduc (2013) studied the effect of unconventional and conventional U.S. monetary policy on the dollar using intra-daily data and concluded that the U.S. credit easing does have effect on the value of the dollar and has the same effect as that of conventional U.S. monetary policy. Hudson (2010) looks from a different perspective at the effect of Fed's credit easing. In his study he concludes that although intended to stabilize the U.S. financial market and stimulate the economy it is hurting the global economy by flooding the world market with U.S. keyboard money making the rest of the world's export more expensive and making them lose the value of their U.S. dollar reserves. However, he does not empirically test his claim. Other studies on the impact of recent U.S. unconventional monetary policy include those by Neeley (2010), Gagnon et al (2011), Krishnamurthy and Vissing-Jorgenson (2011), Hamilton and Wu (2012), and Li and Wei (2012). While all these studies examine the effect of Fed's credit easing on various aspects of the U.S. and world economy, our study is different from theirs in many respects and, therefore, is a net addition to the literature. First, we use a model of exchange rate determination based on the hypothesis of purchasing power parity and the Fisher's equation of exchange and empirically test the model. Second, we use the model to also empirically evaluate the impact of Fed's credit easing on the value (exchange rate) of U.S. dollar.

This paper has been organized as following: section II lays out the model, section III explains the methodology, section four identifies the data source, section five reports the empirical findings, and finally, section VI concludes the study.

II. The Model

In our model, we make use of the purchasing power parity condition with no transportation costs, tariffs, and other trade restrictions, which is represented as,

$$R = \frac{P}{P^*} \quad (1)$$

That is, the exchange rate between the currencies of any two countries is equal to the relative prices in the two countries. Here R is the exchange rate of the domestic currency (e.g. U.S. dollar) with a foreign currency (e.g. Canadian dollar) – expressed as the number of U.S. dollar units needed to purchase one Canadian dollar, – P is the domestic price level (U.S. price level), and $P^*$is the price level in the foreign country (Canada). We also make use of the Fisher equation, which is given as,

$$MV = PY \quad (2)$$

Here M is the quantity of money, V is the velocity of money defined as the number of times a dollar bill is used in purchasing goods and services, P is the price level, and Y is the real output (gross domestic product, GDP). Dividing both sides by Y yields,

$$P = \frac{MV}{Y} \quad (3)$$

Since the relationship shown in equation (3) also holds for any other country, equation (3) for a foreign country (Canada) can be rewritten as,

$$P^* = \frac{M^*V^*}{Y^*} \quad (4)$$

Dividing equation (3) by (4) yields,

$$\frac{P}{P^*} = \frac{MVY^*}{M^*V^*Y} \quad (5)$$

Substituting equation (1) into (5) yields,

$$R = \frac{MVY^*}{M^*V^*Y} \quad (6)$$

Taking total differential of equation (6) yields,

$$dR = dM + dV + dY^* - dM^* - dV^* - dY \quad (7)$$

If velocities of money are assumed to be constant, so that $dV = 0 \; and \; dV^* = 0$ then equation (7) can be rewritten as,

$$dR = dM + dY^* - dM^* - dY \quad (8)$$

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Equation (8) is simplified as,

$$e = m + y^* - m^* - y \quad (9)$$

In context of United States and Canada, equation (9) is interpreted as: the percentage change in the exchange rate of U.S. dollar is equal to the percentage change in the money supply in the U.S. plus the percentage change in Canada's real GDP minus the percentage change in Canada's money supply minus the percentage change in U.S. real GDP.

III. Methodology

In stochastic and estimable form, equation (9) can be rewritten as,

$$e_t = \alpha_0 + \alpha_1 m_t + \alpha_2 y_t^* + \alpha_3 m_t^* + \alpha_4 y_t + u_t \quad (10)$$

The sign of $\alpha_1$is expected to be positive, because when domestic money supply (m_t) rises, the interest rate at home falls, causing a capital outflow and thereby forcing the exchange rate of domestic currency (e_t) to rise. On the contrary, the sign of $\alpha_3$is expected to be negative, because when foreign money supply (m_t^*) rises, the interest rate there falls, causing a capital outflow from the foreign country and into the domestic country, and thereby forcing the exchange rate of domestic currency (e_t) to fall. Similarly, the sign of $\alpha_4$is expected to be negative, because when domestic real GDP (y_t) rises, the transaction demand for money rises causing the interest rate at home to rise, which, in turn, causes a capital inflow and thereby forcing the exchange rate of domestic currency (e_t) to fall. On the contrary, the sign of $\alpha_2$is expected to be positive, because when the foreign real GDP (y_t^*) rises, the transaction demand for money in the foreign country rises also, causing the interest rate in the foreign country to rise, which, in turn, causes a capital inflow into the foreign country and out of the domestic country, thereby forcing the exchange rate of domestic currency (e_t) to rise. Since the purpose of this study is the examine the effect of the Federal Reserves' recent monetary policy – called quantitative or credit easing – and since the policy is intended at increasing the money supply, thereby lowering the interest rate, and subsequently stimulating the economy, our interest is in the sign and significance of the coefficient α_1. If α_1 turns out to be positive (negative) and significant, we will conclude that the Fed's credit easing policy will raise the exchange rate of U.S. dollar lowering the value of U.S. dollar.

Also, if all the coefficients in equation (10) turn out to be statistically significant with a positive sign for α_1 *and* α_2 and a negative sign for α_3 *and* α_4, the monetary theory of exchange rate determination and, thereby, the underlying theories of purchasing power parity and the equation of exchange are validated.

IV. Data

Our model uses the data on U.S. real GDP and the money supply, Canada's real GDP and the money supply, and the exchange rate of Canadian dollar with respect to the U.S. dollar over the period, 1960 – 2008, obtained from the World Development Indicators, 2015. We then compute the exchange rate of U.S. dollar as the inverse of the exchange rate of Canadian dollar with respect to the U.S. dollar. The money supply, in our study, is defined as M2 (Money and quasi money in local currency unit)

V. Empirical Findings

Most macroeconomic variables are trended (have a time trend). If two time series follow a similar trend, even if unrelated, they show a high correlation with each other. Such a spurious

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correlation poses a problem in econometric analysis, as the residuals obtained from the regression of such variables on each other are not independently and identically distributed (iid). In order to find out if such problem exists in our data, we applied the Johansen cointegration test on our time series, $e_{t,} m_{t,} y^*_{t,} m^*_{t,}$ and y_t. The detailed results of the cointegration test are reported in the Appendix. All trace statistics for all hypothesized number of cointetration are higher than their 5% critical values indicating that there are 5 cointegrating equations at 5% significance level. Based on the normalized cointegrating coefficients, we obtained the following estimation of our model (equation (10)):

$$e_t = 0.095676m_t + 3.853839y^*_t + 0.031702m^*_t - 4.311256y_t \qquad (11)$$

(0.01617)	(1.08407)	(0.11547)	(1.23787)
[5.9165]	[3.5550]	[0.2746]	[-3.4828]

The numbers in parentheses and in square brackets are corresponding standard errors and t-statistics respectively. From the sign of the estimated coefficients and associated t-statistics shown in equation (11), it is clear that except for variable m^*_t (the percentage change in Canada's money supply) all other independent variables are significant and have expected sign. Thus our study validates the monetary theory of exchange rate determination and finds that a change in the domestic money supply or in foreign real GDP does have a positive impact on the domestic currency's exchange rate, that is, a negative impact on the value of domestic currency. Our study also finds that a change in domestic real GDP negatively affects the exchange rate – that is positively affect the value of the domestic currency. However, we do not find the evidence that a change in foreign money supply has any impact on the value of domestic currency. Thus, our study partially validates the monetary theory of exchange rate determination.

Also, the coefficient associated with the independent variable, m_t in equation (11) has turned out to be statistically significant and positive implying that the increase in domestic money supply (m_t) caused by the Fed's credit (quantitative) easing has, in fact, increased the exchange rate (lowered the value) of U.S. dollar.

VI. Summary and Conclusion

The objective of this study is two-fold: testing the monetary theory of exchange rate determination and assessing the impact of Fed's credit easing policy on the value of U.S. dollar. Since the implementation of this non-conventional monetary policy (credit easing) in 2008 there have been several studies that have examined the effect of Fed's credit easing on various aspects of the U.S. and world economy. However, our study is different from theirs in many respects and, therefore, is a net addition to the literature. First, we use the monetary model of exchange rate determination based on the hypothesis of purchasing power parity and the Fisher's equation of exchange and empirically test the model. Second, we use the model to also empirically evaluate the impact of Fed's credit easing policy on the value (exchange rate) of U.S. dollar.

We test the model using the data on U.S. and Canada's money supply and real GDP and the exchange rate of U.S. dollar over the period 1960 – 2008. Our findings partially validate the monetary model of exchange rate determination. That is, while the changes in domestic (U.S.) money supply and foreign (Canada's) real GDP have positive effects, that in the domestic (U.S.) real GDP have negative effects on the exchange rate of domestic currency (U.S. dollar). However, the changes in foreign (Canada's) money supply have no impact on the value of U.S. dollar.

Also, since the estimated coefficient associated with the independent variable, m_t has turned out to be significant and positive, we conclude that the increase in domestic money supply (m_t) caused by the Fed's credit (quantitative) easing has, in fact, increased the exchange rate (lowered the value) of U.S. dollar.

References

Bouakez, H. and M. Normandin (2010): "Fluctuations in the foreign exchange market: How important are monetary policy shocks?" *Journal of International Economics,* vol. 81, issue 1, pp. 139-153.

Federal Reserve Bank of Cleveland: https://www.clevelandfed.org/en/Our%20Research/Indicators%20and%20Data/Credit%20Easing.aspx

Gagon, J., Raskin, M, Remache, J., Sack, B. (2011): "The financial market effects of the Federal Reserve's large-scale asset purchases," *International Journal of central Banking,* Peterson Institute for International Economics, Federal Reserve Bank of New York.

Glick, R. and S. Leduc (2013): "Effects of unconventional and conventional U.S. monetary policy on the dollar," Federal Reserve Bank of San Francisco.

Glick, R. and S. Leduc (2012): "Central bank announcements of asset purchases and the impact on global financial and commodity markets," *Journal of International Money and Finance,* vol. 31, no. 8, pp. 2078-2101.

Hamilton, J., Wu, J. (2012): "Effects of index-fund investing on commodity futures prices," *International Economic Review,* vol. 56, issue 1, pp. 187-205.

Hudson, M. (2010): "U.S. credit easing is fracturing the global economy," *Working paper no. 639,* Levy Economic Institute of Bard College.

Krishnamurthy, A., A. Vissing-Jorgensen (2011): "The effects of credit easing on interest rates," Working paper, Northwester University, Kellogg School of Business.

Li, C. and M. Wei (2012): "Term structure modeling with upply factors and the Federal Reserve's large scale asset purchase programs," Finance and Economics Discussion Series, Board of Governors, pp. 2012-2037.

Neely, Christopher (2010): "The large-scale asset purchases had large international effects," Federal Reserve Bank of St. Louis, Working paper no. 2010-018C.

Appendix

Date: 08/03/15 Time: 12:14
Sample (adjusted): 1962 2008
Included observations: 47 after adjustments
Trend assumption: Linear deterministic trend
Series: **DE DUSM2 DCRGDP DCM2 DUSRGDP**
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.512221	106.8798	69.81889	**0.0000**
At most 1 *	0.435866	73.13884	47.85613	**0.0000**
At most 2 *	0.410595	46.23303	29.79707	**0.0003**
At most 3 *	0.260205	21.38686	15.49471	**0.0057**
At most 4 *	0.142434	7.221886	3.841466	**0.0072**

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.512221	33.74096	33.87687	0.0519
At most 1	0.435866	26.90581	27.58434	0.0609
At most 2 *	0.410595	24.84617	21.13162	0.0143
At most 3	0.260205	14.16497	14.26460	0.0518
At most 4 *	0.142434	7.221886	3.841466	0.0072

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

DE	DUSM2	DCRGDP	DCM2	DUSRGDP
11.13973	-1.065810	-42.93073	-0.353152	48.02623
-11.67006	-0.519716	28.37551	2.973178	-36.90214
4.892123	0.009907	-19.87786	0.646495	-44.24870
12.61252	-0.187473	56.11116	-3.648698	-47.86419
-18.79547	-0.009469	1.972305	-7.081246	-20.71120

Unrestricted Adjustment Coefficients (alpha):

D(DE)	-0.005761	0.019583	-0.013592	-0.009665	-0.000327
D(DUSM2)	0.855644	0.518247	-0.063629	0.430043	-0.130877
D(DCRGDP)	0.007442	0.001921	0.003927	-0.005586	0.004771
D(DCM2)	0.011697	-0.050392	-0.092328	0.054846	0.064337
D(DUSRGDP)	0.001464	0.006296	0.008693	-1.35E-05	0.004949

1 Cointegrating Equation(s): Log likelihood 250.0670

Normalized cointegrating coefficients (standard error in parentheses)

DE	**DUSM2**	**DCRGDP**	**DCM2**	**DUSRGDP**
1.000000	**-0.095676**	**-3.853839**	**-0.031702**	**4.311256**
	(0.01617)	**(1.08407)**	**(0.11547)**	**(1.23787)**

Adjustment coefficients (standard error in parentheses)

D(DE)	-0.064171
	(0.07307)
D(DUSM2)	9.531642
	(2.58519)
D(DCRGDP)	0.082904
	(0.03427)
D(DCM2)	0.130306
	(0.45707)
D(DUSRGDP)	0.016305
	(0.03732)

2 Cointegrating Equation(s): Log likelihood 263.5199

Normalized cointegrating coefficients (standard error in parentheses)

DE	DUSM2	DCRGDP	DCM2	DUSRGDP
1.000000	0.000000	-2.883254	-0.183918	3.527113
		(0.87499)	(0.09504)	(1.00373)
0.000000	1.000000	10.14445	-1.590948	-8.195769
		(11.3430)	(1.23203)	(13.0119)

Adjustment coefficients (standard error in parentheses)

D(DE)	-0.292711	-0.004038
	(0.09330)	(0.00686)
D(DUSM2)	3.483674	-1.181295
	(3.50288)	(0.25746)
D(DCRGDP)	0.060481	-0.008931
	(0.04939)	(0.00363)
D(DCM2)	0.718383	0.013722
	(0.64935)	(0.04773)
D(DUSRGDP)	-0.057174	-0.004832
	(0.05161)	(0.00379)

3 Cointegrating Equation(s): Log likelihood 275.9429

Normalized cointegrating coefficients (standard error in parentheses)

DE	DUSM2	DCRGDP	DCM2	DUSRGDP
1.000000	0.000000	0.000000	-0.950743	33.68084
			(0.82651)	(6.55221)
0.000000	1.000000	0.000000	1.107050	-114.2887
			(2.90192)	(23.0052)
0.000000	0.000000	1.000000	-0.265958	10.45823
			(0.27573)	(2.18585)

Adjustment coefficients (standard error in parentheses)

D(DE)	-0.359206	-0.004173	1.073180
	(0.09051)	(0.00637)	(0.29617)
D(DUSM2)	3.172393	-1.181925	-20.76309
	(3.65645)	(0.25719)	(11.9649)
D(DCRGDP)	0.079692	-0.008892	-0.343038
	(0.05054)	(0.00355)	(0.16537)
D(DCM2)	0.266701	0.012808	-0.096783
	(0.63234)	(0.04448)	(2.06921)
D(DUSRGDP)	-0.014646	-0.004746	-0.056977
	(0.04870)	(0.00343)	(0.15936)

4 Cointegrating Equation(s): Log likelihood 283.0254

Normalized cointegrating coefficients (standard error in parentheses)

DE	DUSM2	DCRGDP	DCM2	DUSRGDP
1.000000	0.000000	0.000000	0.000000	-10.09954
				(2.09228)
0.000000	1.000000	0.000000	0.000000	-63.31059
				(14.6644)

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0.000000	0.000000	1.000000	0.000000	-1.788769
				(0.28124)
0.000000	0.000000	0.000000	1.000000	-46.04859
				(8.90301)

Adjustment coefficients (standard error in parentheses)

D(DE)	-0.481101	-0.002361	0.530885	0.086735
	(0.10836)	(0.00618)	(0.40497)	(0.02452)
D(DUSM2)	8.596318	-1.262547	3.367117	-0.371565
	(4.33625)	(0.24726)	(16.2061)	(0.98116)
D(DCRGDP)	0.009233	-0.007844	-0.656501	0.026007
	(0.06031)	(0.00344)	(0.22540)	(0.01365)
D(DCM2)	0.958442	0.002526	2.980667	-0.413760
	(0.76833)	(0.04381)	(2.87150)	(0.17385)
D(DUSRGDP)	-0.014815	-0.004744	-0.057731	0.023872
	(0.06082)	(0.00347)	(0.22730)	(0.01376)

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