



A Broader Portfolio-Balance Approach of Exchange Rate Determination

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Abstract

Another theory of exchange rate determination is the (broader) portfolio-balance approach, which is part of the Asset Market Models and is largely attributed to economists after 1978 when the exchange rate had become flexible (market determined). This article first introduces the setting of the model embedded in the portfolio balance approach that encompasses three assets (money, bonds, and stocks) and two returns (interest rate on bonds and stock markets' returns), which deviates a little from the models and approaches used for the monetary approach to the balance of payment, the overshooting model, and from the associated market equilibrium. The effects of monetary policy, of current account, and of wealth (money, bonds, and stocks or stock market indexes) under the portfolio-balance approach are examined, here, theoretically and empirically. The current statistical and econometric results show that the exchange rate is determined mostly by the money supply, value of the bonds, the level of the stock indexes, and the interest rates; but, there is only a very little effect from the returns of the stock markets. All these variables are affected by the monetary policy. Thus, the central banks are the institutions that cause the effects on these independent variables and consequently, on the exchange rate (as a monetary phenomenon).

Keywords: Foreign Exchange, Forecasting and Simulation, Monetary Policy, Demand for Money, Model Evaluation and Testing, Consumption and Saving, Interest Rates

JEL classification numbers: F31, F47, E52, E41, C52, E21, E43

1. Introduction

The monetary approach focuses only on a single-asset (money), monetarist view. The portfolio balance approach deals with multi-assets and integrates the analysis of the exchange rate behavior with these other financial assets (money, bonds, stocks, etc.). This augmented second approach of exchange rate determination allows the current account imbalances () to affect the exchange rate through its equivalent, the capital account, Figure 1. Thus, the portfolio balance model contains features provided by the Monetary Approach and the broader Balance of Payment Approach. Residents of both countries hold assets issued by these two countries. Domestic residents wish to hold a greater proportion of their wealth in domestic assets and foreign residents wish to hold a greater proportion in foreign assets ("perfect local habitat") to eliminate also the exchange rate risk and the foreign country (political) risk. The current account will redistribute world wealth in such a way as to raise net world demand for the surplus country's assets; thus, raising the price of its currency.

$$-CA = KA \Rightarrow CA < 0 \Rightarrow FA \downarrow \Rightarrow MB \downarrow \Rightarrow m_M \Rightarrow M^s \downarrow \Rightarrow \$ \uparrow \Rightarrow e \downarrow \quad (1)$$

where, CA = the current account, KA = the capital account, FA = foreign assets, MB = monetary base, m_M = money multiplier,¹ M^s = money supply, and e = exchange rate.

Six types of assets are available to the economic agents. First, is cash, Money in both countries (M, M^*) that does not yield any interest (actually has a negative real return, $r_M = -\pi^e$ and $r_{M^*} = -\pi^{*e}$), but is useful for the purpose of purchasing products and services and assets in general (medium of exchange). Second, are domestic Bonds (B) that yield a nominal interest rate, i and foreign Bonds (B^*) yield an interest rate, i^* . Third, are domestic stocks (S) that have a nominal return R and foreign stocks (S^*) with a return R^* . The central banks, the governments, and the firms provide all the six types of assets that are mentioned, here.

The household sector in each country makes a choice from these five types of assets in domestic economy (M, B, S, B^*, S^*) and in the foreign (M^*, B^*, S^*, B, S) to form the portfolio. The nominal wealth of an individual in the domestic country is: $W = M + B + S + eB^* + eS^*$ (2) where, e = the exchange rate. The real wealth can be determined by dividing both sides by the price level,

$$\frac{W}{P} = \frac{M}{P} + \frac{B}{P} + \frac{S}{P} + \frac{eB^*}{P} + \frac{eS^*}{P} \tag{3}$$

The portfolio balance approach determines the equilibrium exchange rate (e), the domestic (i) and international interest rate (i^*); also, the domestic (R) and foreign stocks return (R^*) that would clear the domestic bond market, stock market, and the money market, and consequently, the foreign bond and stock market.

1.1 Money Market

Let's assume that the dollar suffers a 10% depreciation ($e \uparrow$), due to an increase in liquidity, money supply has increased (easy money policy).² This would increase the foreign asset value by 10%, eq. (2). In turn, it causes an increase in the total wealth that would lead to an expansion in the demand for all kinds of assets, which would also include money. The wealth effect and the inflation premium ($IP = \pi^e$) of this depreciation in currency would lead to a rise in the domestic interest rate ($i \uparrow$). With all parameters fixed, a depreciation of the currency ($e \uparrow$) is accompanied by a rise in the money market interest rate ($i \uparrow$).³

1.2 Domestic Bond Market

With this dollar depreciation ($e \uparrow$) and increase in wealth ($W \uparrow$), the demand of domestic bonds will increase ($B^d \uparrow$). This would result to an increase in bond prices ($P_B \uparrow$) and in a reduction of interest rate ($i \downarrow$). Domestic and foreign bonds have different risk exposures although they may be a part of the same portfolio.

¹The $M^s = m_M \cdot MB$; thus, $m_M = \frac{M^s}{MB}$. Before March 15, 2020, the $m_M \cong \frac{1+c}{c+r}$, where, c = currency/deposits ratio and r = reserves/deposits ratio. Now, $r = 0$ and banks decide how much reserves they require to hold to satisfy demand for withdrawals. The rest of the banks liabilities are invested (in loans and securities) to maximize banks' profitability. Actually, the money multiplier was a little more complex function:

$m_M = \frac{1+c}{c+r} = f(c, r) = f(c; i, i_D, r_R, \sigma)$, where, i = market rate of interest, i_D = discount rate, r_R = reserve requirements ratio, σ = risk factor, and $\frac{\partial m_M}{\partial c} > 0, \frac{\partial m_M}{\partial i} > 0, \frac{\partial m_M}{\partial i_D} < 0, \frac{\partial m_M}{\partial r_R} < 0, \frac{\partial m_M}{\partial \sigma} < 0$; then, money supply: $M^s = m_M \cdot MB$; and demand for money:

$M_t^d = f(Q_t, P_t, i_t, e_t)$, where Q_t = real income, P_t = price level, i_t = nominal rate of interest, and e_t = spot exchange rate. See, See, Kallianiotis (2019a, 2017 and 2013).

²The U.S. Fed has kept the federal funds rate zero ($i_{FF} \cong 0\%$) for more than 12 years by increasing the money supply from \$7,771.6 billion (9/1/2008) to \$19,299 billion (12/28/2020); and increase by \$11,527.4 billion or 148.33% (12.11% per annum). (Sic). See. M2 Money Stock (M2), <https://fred.stlouisfed.org/series/M2>

³Through the IRP: $i_t - i_t^* = e_{t+1}^e - e_t$. When, $e_{t+1}^e \uparrow \Rightarrow i_t \uparrow$ to preserve the interest rate parity between the two countries. See, Kallianiotis (2019a, p. 205).

1.3 Domestic Stock Market

With the depreciation of the dollar ($e \uparrow$), due to the enormous money supply ($M^s \uparrow$) and zero deposit rate ($i_D = 0.05\%$),⁴ the demand for stocks will increase ($S^d \uparrow$). This will increase the prices of stocks ($P_S \uparrow$) and the value of the indexes ($DJIA \uparrow$) and their return will fall ($R_S \downarrow$).

1.4 Foreign Bond Market

In response to 10% dollar depreciation ($e \uparrow$) the supply of foreign bonds increases, eq. (2). Due to the wealth effect the demand for foreign bonds also rises ($B^{*d} \uparrow$), their prices ($P_{B^*} \uparrow$) will go up and their return will fall ($i^* \downarrow$). Then, keeping all parameters fixed, the depreciation of the currency would lead to a fall in the domestic interest rate ($i \downarrow$) via the foreign bond market.

1.5 Foreign Stock Market

Also, the depreciation of the dollar ($e \uparrow$) will increase the demand of foreign stocks ($S^{*d} \uparrow$), due to wealth effect and their price will increase ($P_{S^*} \uparrow$), then, their return will fall ($R_{S^*} \downarrow$).

The portfolio balance approach gives the equilibrium interest rate (i_t and i_t^*) and the rate of return on stocks (R_t and R_t^*), in both domestic and foreign markets, as well as the exchange rate (e_t) that would clear all the five markets, domestic money, bond, and stock markets and foreign bond and stock markets.

2. Current Account and Domestic Wealth

The release by the U.S. government of unexpected figures on the trade balance and the current account appear to have large immediate “announcement effects” on the exchange rate (dollar depreciates or appreciates depending on “bad” or “good” news). The current account figures reveal information about shifts in the long run terms of trade (TOT).

$$TOT_t = \frac{P_{M_t}}{P_{X_t}} = \frac{e_t P_t^*}{P_t} \quad (4)$$

Of course, the important point is that the unexpected component (CA^u) of the current account ($CA = CA^e + CA^u$) can have a large effect; the expected component (CA^e) has already been taken into account by the foreign exchange market,⁵ Figure 1.

The decomposition of the current account is written as,

$$CA_{t+1} = CA_{t+1}^e + CA_{t+1}^u \quad (5)$$

where, CA_{t+1} = the actual current account balance, CA_{t+1}^e = the expected current account balance based on information today [$CA_{t+1}^e = E(CA_{t+1} | I_t)$], and CA_{t+1}^u = the unexpected part of the current account balance, the “surprise”, the “news”, the risky part of the CA_{t+1} .

⁴This monetary policy is anti-social, unfair, and unethical because it forces risk-averse depositors to invest in risky stocks. Now, with the risk of the “innovated” COVID-19 and the global control by the liberal elite (Illuminati) the financial risk will be soon enormous. The current stock market bubble will burst in the near future. The globalist David Rockefeller was thanking the controlled media because they obey to the dark powers’ orders to conceal their objective, the creeping globalization (global slavery): “We are grateful to the Washington Post, the New York Times, Time Magazine and other great publications whose directors have attended our meetings and respected their promises of discretion for almost forty years. It would have been impossible for us to develop our plan for the world if we had been subjected to the lights of publicity during those years. But, the world is more sophisticated and prepared to march towards a world government. The supranational sovereignty of an intellectual elite and world bankers is surely preferable to the national auto-determination practiced in past centuries.” (Sic). (David Rockefeller, Speaking at the June, 1991 Bilderberger meeting in Baden, Germany. A meeting also attended by then-Governor Bill Clinton and by Dan Quayle.). It is grievous for us to see the breakdown of our democratic system after 2,500 (from the Ancient Athens) of its relatively humane operation. See, <http://www.rense.com/general17/quote.htm>

⁵The decomposition of the CA is given in Figure 1 and the Leas Square Estimation of the USXRI on the OPD, USCA^e, and USCA^u are:

$$USXRI_t = 104.319^{***} - 0.089^{***} OPD_t + 0.023^{***} USCAF_t + 0.014^{***} USCAU_t + 1.668^{***} \varepsilon_{t-1} + \dots + 0.293^{***} \varepsilon_{t-7} .$$

(1.006) (0.021) (0.003) (0.003) (0.036) (0.036)

$$R^2 = 0.985, \quad SER = 1.736, \quad F = 3,905.902, \quad D - W = 1.808, \quad N = 648$$

Source: *Economagic.com*

$$CA_t = \alpha_0 + \alpha_1 AR(1) + \alpha_2 AR(2) + \dots + \beta_1 MA(1) + \beta_3 MA(2) + \dots \tag{6}^6$$

$$\Rightarrow CAF_t \equiv CA_t^e$$

$$CAU_t \equiv CA_t^u = CA_t - CAF_t \tag{7}$$

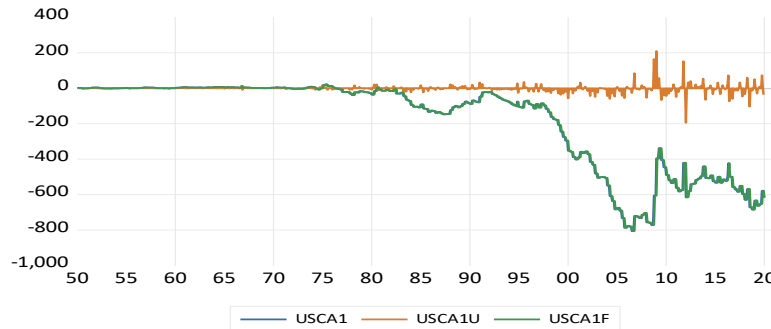


Figure 1: U.S. current account, expected current account, and unexpected current account

Note: USCA1 = U.S. current account, USCA1U = the unexpected part of the U.S. current account, and USCA1F = the expected current account.

Source: *Economagic.com*

A current account surplus ($CA > 0$) is a transfer of wealth (W) from foreign residents to domestic residents (and a transfer of unemployment from the domestic economy to the foreign one).⁷ This increase in domestic wealth ($W_t \uparrow$) can appreciate the currency ($e_t \downarrow$) through the following variables:

- (1) It can raise domestic expenditure by increasing domestic consumption:

$$C_t = f(W_t) \tag{8}$$

where, C_t = consumption and W_t = domestic wealth.

Then, aggregate demand ($AD = C + I + G + X - M$) will increase, which will affect production (Q), income (Y), and employment ($u \downarrow$). This higher income will increase the demand for money (M_t^d).

- (1) It can raise the demand for domestic money directly if wealth (bonds and stocks) enters the money demand function:⁸

$$M_t^d = \alpha_0 + \alpha_1 W_t + \alpha_2 P_t - \alpha_3 i_t + \varepsilon_t \tag{9}$$

where, M_t^d = demand for money, P_t = price level, i_t = nominal interest rate (opportunity cost of capital), and ε_t = the error term.

- (2) If domestic bonds and stocks, and foreign bonds and stocks are imperfect substitutes, domestic residents have a greater tendency to hold wealth in the form of domestic bonds and stocks; then, the increase in domestic wealth will raise the demand for domestic bonds and stocks:

⁶The estimation of eq. (6) is:

$$CA_t = -249.841 + 0.996^{***} CA_{t-1} + 0.997^{***} \varepsilon_{t-1}$$

(288.905) (0.006) (0.004)

$$R^2 = 0.995, \quad SER = 17.775, \quad F = 54,499.02, \quad D - W = 2.017, \quad N = 840$$

⁷In 2019, the U.S. had a current account deficit of: $CA = -\$480.226$ billion, Figure 1. See, *BEA*, Table 1. U.S. International Transactions. https://www.bea.gov/sites/default/files/2020-12/trans320_0.pdf. Thus, we had a transfer of wealth from U.S. residents to foreign ones and an import of unemployment from foreign countries to the U.S.

⁸The estimation of eq. (9) is as follows:

$$m_t = -3.386^{***} + 0.029^{**} rdjia_t + 2.271^{***} p_t - 0.017^{***} i_t + 1.453^{***} \varepsilon_{t-1} + \dots + 0.372^{***} \varepsilon_{t-6}$$

(0.258) (0.012) (0.050) (0.003) (0.061) (0.061)

$$R^2 = 0.999, \quad SER = 0.010, \quad F = 34,322.39, \quad D - W = 1.821, \quad N = 252$$

where, $rdjia$ = real DJIA (real wealth), p_t = ln of CPI, and i_t = S-T interest rate (3-month T-Bills rate).

$$B_t^d = f(W_t) \quad (10)$$

$$S_t^d = f(W_t) \quad (11)$$

where, B_t^d = demand for domestic bonds and S_t^d = demand for domestic stocks.

A shock in the economy, in the form of a change in wealth, produces a wealth effect, which is an increase in the demand for each financial asset, and a substitution effect, substituting a high return financial asset for the low return alternative. Consequently, the exchange rate, interest rates, and rates of return have to adjust to ensure portfolio equilibrium. The portfolio balance approach states that the exchange rate and interest rates are determined simultaneously by the portfolio equilibrium conditions for asset holders in these two different countries.

3. The Broader Theoretical Model

The portfolio-balance approach is based on the following assumptions: (1) The purchasing power parity (PPP) does not hold because goods are not identical in the two countries. (2) The uncovered interest parity (UIP) does not hold. (3) The exchange rate is expected to be unchanged. (4) Only five assets are available for investment for each domestic household: money, domestic bonds, domestic stocks, foreign bonds, and foreign stocks. (5) Bonds and stocks are not perfect substitutes. (6) It assumes perfect capital mobility without capital controls and similar barriers to investment. (7) It assumes narrow transaction costs and high completion in the money markets. (8) The size of the domestic economy is relatively small, so it cannot have any effect on the foreign rate of interest and on the foreign market return.

A simple version of the portfolio balance model can be presented with the following equations:

$$\text{Demand for money: } M_t^d = m(i_t, i_t^*, R_t, R_t^*, W_t) \quad (13)$$

$$\text{Demand for domestic bonds: } B_t^d = b(i_t, i_t^*, R_t, R_t^*, W_t) \quad (14)$$

$$\text{Demand for domestic stocks: } S_t^d = s(i_t, i_t^*, R_t, R_t^*, W_t) \quad (15)$$

$$\text{Demand for foreign bonds evaluated in the domestic currency: } e_t B_t^{*d} = f(i_t, i_t^*, R_t, R_t^*, W_t) \quad (16)$$

$$\text{Demand for foreign stocks in domestic currency: } e_t S_t^{*d} = f(i_t, i_t^*, R_t, R_t^*, W_t) \quad (17)$$

The supply of these assets is given as follows: M_t^s , B_t^s , S_t^s , B_t^{*s} , and S_t^{*s} , and we assume equilibria,

$$M_t^d = M_t^s = M_t \quad (18)$$

$$B_t^d = B_t^s = B_t \quad (19)$$

$$S_t^d = S_t^s = S_t \quad (20)$$

$$B_t^{*d} = B_t^{*s} = B_t^* \quad (21)$$

$$S_t^{*d} = S_t^{*s} = S_t^* \quad (22)$$

where, B_t^d = demand for bonds, B_t^s = supply of bonds, B_t = the equilibrium amount of bonds, S_t^d = demand for stocks, S_t^s = supply of stocks, S_t = the equilibrium amount of stocks, and an asterisk (*) denotes the foreign variable. The financial portfolio makes up the total wealth (W_t),⁹ which is equal to the sum of the five assets,

$$W_t = M_t + B_t + S_t + e_t B_t^* + e_t S_t^* \quad (23)$$

At any point in time, the existing stocks of these assets are fixed and the domestic interest rate (i_t), rate of return (R_t) and exchange rate (e_t) must adjust so that the assets are willingly held by investors (maximization of

⁹The narrow economic objective of an individual is the maximization of his wealth. But the most accurate objective must be: The efforts to Reach Perfection («τὸ καθ' ὁμοίωσιν») = f (knowledge of Truth, free will, divine Grace, faith to Christ, personal struggle). Subject to Constraints: [misinformation, ignorance, external (environment, peers) and internal (war of thoughts) pressure]

their return). The stocks of financial assets change over time. When the budget deficit¹⁰ is increasing, the government issues bonds to finance it, which increases the supply of domestic government bonds (B_t). Autonomous growth of money supply (expansionary monetary policy)¹¹ or monetization of the government debt (open market purchase) increases the stock of money (M_t), which is invested on stocks, due to high return and increases the stock prices (bubbles). Current account surpluses increase the net domestic holdings of foreign (bonds and stocks) assets (B_t^* and S_t^*).

Then, the exchange rate (S_t) of the portfolio balance model will be given from eq. (16) and eq. (23), as follows:

$$e_t = s(M_t, B_t, S_t, B_t^*, S_t^*, i_t, i_t^*, R_t, R_t^*) \tag{24}$$

The domestic interest rate (i_t) is determined by the Fed (monetary policy) and the U.S. bonds market, as follows:

$$i_t = r(M_t, B_t) \tag{25}$$

The domestic rate of return (R_t) is determined by the Fed (monetary policy) and the U.S. stock market conditions:

$$R_t = r(M_t, S_t) \tag{26}$$

The foreign interest rate (i_t^*) is determined by the foreign central bank and their bonds market,

$$i_t^* = r(M_t^*, B_t^*) \tag{27}$$

The foreign rate of return (R_t^*) is determined by the foreign central bank policy and their stock market:

$$R_t^* = r(M_t^*, S_t^*) \tag{28}$$

Substituting eqs. (27) and (28) into eq. (24), we have,

$$e_t = s(M_t, B_t, S_t, M_t^*, B_t^*, S_t^*, i_t, i_t^*, R_t, R_t^*) \tag{29}$$

Equation (29) specifies the relationship between exchange rates, assets supplies (money, bonds, and stocks), and their returns (interest rates and returns of the stock markets) in the two countries. When the exchange rate is quoted in American terms (direct quotes), the expected signs of the independent variables effects are presented in eq. (29). But, when the quotations are in foreign terms (indirect quotes), the signs will be the opposite.

(1) An expansionary monetary policy, as an exogenous increase in money supply (M_t) means an increase in (nominal) wealth (W_t), eq. (2), especially after 2008, due to zero deposit ($i_D = 0.05\%$).¹² The wealth effect leads to excess demand for domestic and foreign bonds and stocks. With given foreign interest rate (i_t^*) and rate of return (\bar{R}_t^*), excess demand for domestic bonds and stocks would raise their price, so the domestic interest rate and rate of return will fall. The excess demand for foreign bonds and stocks will increase the demand for foreign currency (foreign currency will appreciate), leading to a depreciation of the domestic currency (spot rate will increase).

$$M^s \uparrow \Rightarrow W \uparrow \Rightarrow EX \downarrow B \& B^* \text{ and } S \& S^* \Rightarrow \bar{i}^* \text{ and } \bar{R}^* \Rightarrow P_B \uparrow \text{ and } P_S \uparrow \Rightarrow i \downarrow \text{ and } R \downarrow;$$

$$EX \downarrow B^* \& S^* \Rightarrow D_{euro} \uparrow \Rightarrow euro \uparrow \& \$ \downarrow \Rightarrow e \uparrow$$

(2) An increase in domestic government bonds (B_t) will increase the domestic wealth, eq. (2), and through a wealth effect, would increase the demand for foreign bonds and stocks, eqs. (16) and (17), and consequently, the demand for foreign currency will go up. This will lead to an appreciation of the foreign currency and a depreciation of the domestic currency. Also, an increase in domestic debt (D_t) will increase the supply of bonds,

¹⁰The U.S. National Debt is \$27.780 trillion and the Budget Deficit is \$3.192 trillion (1/11/2021), due to this unique global health, economic, and social crisis with the suspicious Wuhan coronavirus. <https://www.usdebtclock.org/>. See also, *Truth in Accounting*. https://www.truthinaccounting.org/about/our-national-debt?gclid=Cj0KCQJwqfz6BRD8ARIsAIXQCf1220_4SPCsu5r1dTqjy1fBhxLLHgZarRUDTEm axrlut3mU3cH2eXEaAkvoEALw_wcB. In addition, the two stimulus packages of the government: \$2.2 trillion in May 2020 and \$900 billion in December 2020. See, <https://www.forbes.com/sites/advisor/2020/03/27/your-guide-to-the-federal-stimulus-package/>

¹¹Our stranger expansionary monetary policy [this zero interest rate policy ($i_r = 0.00\%$) by the Fed is a disincentive to save because the real return on saving is negative ($r_s = -\pi$)] since 2008, it has generated a money supply of \$19.072 trillion (12/28/2020) from \$8.131 trillion in December 2008; a growth by \$10.941 trillion or 134.559% (11.213% per annum). <https://fred.stlouisfed.org/series/M2>. For this reason the inflation rate is on the average about, $\pi = 10\%$ p.a., after 2008. See, CPI 1980-Based (blue line), SGS inflation rate and CPI-U (red line), official inflation rate. http://www.shadowstats.com/alternate_data/inflation-charts

¹² The optimal interest rate on deposits (savings accounts) must be: $i_{D_t}^* = \pi_t^e + 1\%$. See, Kallianiotis (2017, p. 54) and (2020a).

which will reduce their price and increase the domestic interest rate. This higher domestic interest rate ($i_t > i_t^*$) would make foreign bonds less attractive. If this substitution effect dominates the previous wealth effect, the domestic currency will appreciate, due to increase in investment on domestic bonds

$$B \uparrow \Rightarrow W \uparrow \Rightarrow B^{*d} \uparrow \& S^{*d} \uparrow \Rightarrow D_{euro} \uparrow \Rightarrow euro \uparrow \& \$ \downarrow \Rightarrow e \uparrow$$

$$D \uparrow \Rightarrow B^s \uparrow \Rightarrow P_B \downarrow \Rightarrow i \uparrow \Rightarrow B^{*d} \downarrow \Rightarrow B^d \uparrow \Rightarrow \$ \uparrow \Rightarrow e \downarrow$$

(3) An increase in domestic stock prices (stock indexes, DJIA, or S_t), due to excess liquidity (quantitative easing), Figure 2, increases the domestic wealth,¹³ which will increase the demand for foreign bonds and stocks, eqs. (16) and (17), and will affect positively the demand for foreign currency (foreign currency will appreciate and the U.S. dollar will depreciate). An increase in the stock indexes ($S_t \uparrow$) will decrease the rate of return ($R_t \downarrow$); then, $R_t < R_t^*$ and it will make foreign stocks more attractive and the demand for foreign currency will increase. This effect will depreciate the domestic currency, due to decline in investment in U.S. stocks.

$$P_S \uparrow \Rightarrow S \uparrow \Rightarrow W \uparrow \Rightarrow B^{*d} \uparrow \& S^{*d} \uparrow \Rightarrow D_{euro} \uparrow \Rightarrow euro \uparrow \& \$ \downarrow \Rightarrow e \uparrow$$

$$S \uparrow \Rightarrow R \downarrow \Rightarrow S^d \downarrow \Rightarrow S^{*d} \uparrow \Rightarrow \$ \downarrow \Rightarrow e \uparrow$$

(4) An increase, now, in net holdings of foreign bonds (B_t^*) and stocks (S_t^*), induced by a current account surplus ($CA > 0$), increases the domestic wealth. This wealth effect will increase the demand for domestic assets, which will increase their prices and the interest rate and the rate of return will fall. This will depreciate the domestic currency (exchange rate will increase).

$$CA \uparrow \Rightarrow B^* \uparrow \& S^* \uparrow \Rightarrow W \uparrow \Rightarrow B^d \uparrow \& S^d \uparrow \Rightarrow P_B \uparrow \& P_S \uparrow \Rightarrow i \downarrow \& R \downarrow \Rightarrow \$ \downarrow \Rightarrow e \uparrow$$

Based on the theory, these are the expected effects of the independent variables on the spot exchange rate. Eq. (29) gives also the signs of these effects and Table 1 shows the correlation coefficients of these independent variables (X_s) with the exchange rate (e) and their causality effect on the dependent variable.

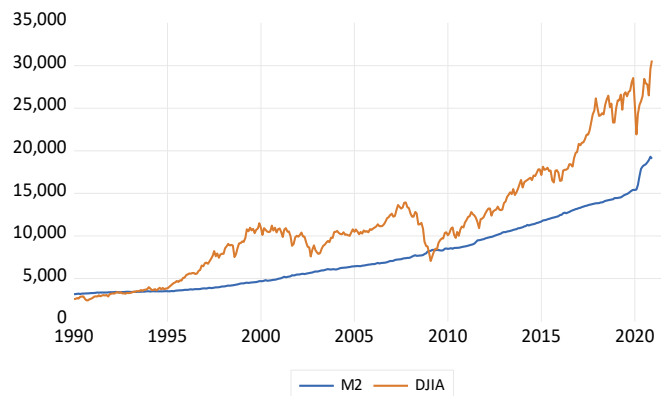


Figure 2: U.S. Money Supply (M2) and Stock Market Index DJIA

Note: M2 = money supply and DJIA = Dow Jones Industrial Average Index.

Correlation: ($\rho_{M2, DJIA} = +0.948$) and causality: $DJIA \Rightarrow M2$ (F=10.617***) and $M2 \Rightarrow DJIA$ (F=8.186***).

Source: *Economagic.com* and *Yahoo/Finance*

¹³The money supply ($M2$) from \$8.313 trillion (March 2009) reached \$19.299 trillion (December 2020), a growth of \$10.986 trillion or 132.154% (12% p.a.); and the DJIA from 6,547.05 (March 2009) became 31,097.97 (January 8, 2021); a growth of 24,550.92 points or 374.99% (34% p.a.), Figure 2. The correlation coefficient between DJIA and M2 is: ($\rho_{M2, DJIA} = +0.948$) and the causality: $DJIA \Rightarrow M2$ (F=10.617***) and $M2 \Rightarrow DJIA$ (F=8.186***).

4. Some Empirical Results

We test eq. (29) by using data for the U.S. (domestic country) and five foreign countries (Australia, India, Japan, Mexico, and Switzerland). First, correlation ($\rho_{e,X}$) and causality ($X_t \Rightarrow e_t$) tests are taking place between the exchange rate and the independent variables (Table 1 in the Appendix). Most of these results are statistically significant and have the correct signs and the expected effects. Then, the OLS estimation of eq. (29) is given in Table 2 and after a correction of the serial correlation of the error term, the new results are presented in Table 3. The data are monthly and the number of observations are given for each country; they are coming from Economagic.com and Bloomberg. They are: AS_t = Australian spot rate (\$/A\$), $INDS_t$ = Indian spot rate (rupee/\$), JS_t = Japanese spot rate (yen/\$), MS_t = Mexican spot (pesos/\$), SWS_t = Swiss spot (SF/\$); low case letters are the natural logarithms of the capital ones, $as_t = \ln$ of AS, M_t = U.S. money supply (M2), B_t = U.S. bonds, S_t = U.S. stock index (DJIA), i_t = U.S. 3-month T-Bill rate, R_t = the return of the stock market, M_t^* = the foreign money supply, B_t^* = the foreign bonds, and i_t^* = the foreign interest rate, and R_t^* = the foreign market return.

	as_t	$inds_t$	js_t	ms_t	sws_t
c	-0.728 (1.192)	-11.681*** (1.896)	-9.366* (5.172)	-4.549** (1.796)	-8.599*** (0.737)
m_t	1.238*** (0.154)	0.716** (0.286)	-0.023 (0.163)	0.433* (0.247)	-1.504*** (0.058)
b_t	-1.118*** (0.088)	0.727** (0.286)	-0.377*** (0.128)	0.521*** (0.197)	2.007*** (0.087)
s_t	0.228*** (0.030)	0.255*** (0.084)	0.083* (0.046)	-0.390*** (0.068)	0.120*** (0.041)
m_t^*	-0.369*** (0.086)	-0.049 (0.059)	2.473*** (0.560)	0.482*** (0.092)	-
b_t^*	.455*** (0.026)	-0.083 (0.086)	-0.882*** (0.039)	-0.395*** (0.038)	-0.702*** (0.050)
s_t^*	0.132*** (0.042)	-0.299*** (0.052)	-0.062 (0.037)	0.001 (0.058)	-0.133*** (0.033)
i_t	-0.020*** (0.004)	-0.134*** (0.022)	0.005 (0.005)	-0.005 (0.010)	0.024*** (0.004)
i_t^*	0.051*** (0.003)	0.028*** (0.009)	0.013 (0.017)	0.016** (0.006)	-0.039*** (0.008)
R_t	-0.001 (0.001)	0.001 (0.001)	-0.001** (0.001)	0.001** (0.001)	-0.001 (0.001)
R_t^*	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
R^2	0.927	0.963	0.899	0.980	0.957
SSR	0.347	0.048	0.478	0.083	0.424
F	246.571	183.268	186.219	549.280	556.772
$D-W$	0.590	0.700	0.554	1.110	0.606
N	206	81	219	123	237

Table 2. Exchange Rate Determination (Portfolio-Balance Approach)

Note: as_t = ln of Australian spot (\$/A\$), $inds_t$ = ln of Indian spot (Rupees/\$), js_t = ln of Japanese spot (yen/\$), ms_t = ln of Mexican spot (Mexican Pesos/\$), sws_t = ln of Switzerland spot (SF/\$), c = constant term, m_t = ln of U.S. money supply (M2), b_t = ln of

amount of U.S. bonds, $s_t = \ln$ of stock index (DJIA), $i_t =$ U.S. 3-month T-Bill rate, $R_t =$ rate of return of the stock index, a star (*) on a variable is the foreign variable, a lower case letter is the natural logarithm of the capital [$m_t = \ln (M_t)$], *** = significant at the 1% level, ** = significant at the 5% level, * = significant at the 10% level, $R^2 =$ R-squared, $SSR =$ Sum of Squared Residual, $F =$ F-statistic, $D - W =$ Durbin-Watson statistic, and $N =$ number of observations.

Source: *Economagic.com* and *Bloomberg*.

	as_t	$inds_t$	js_t	ms_t	sws_t
c	-5.166* (2.867)	-6.882*** (1.617)	-9.526 (6.657)	-3.843 (2.528)	3.706* (2.032)
m_t	-0.380 (0.270)	1.564*** (0.319)	-0.426* (0.247)	0.662** (0.332)	-0.157 (0.191)
b_t	0.219 (0.158)	-0.057 (0.247)	0.114 (0.153)	0.236 (0.248)	-0.083 (0.163)
s_t	0.193** (0.080)	0.114 (0.120)	-0.166*** (0.062)	-0.169* (0.100)	-0.115** (0.052)
m_t^*	0.154 (0.159)	-0.003 (0.059)	1.355** (0.637)	0.249*** (0.083)	-
b_t^*	0.082** (0.039)	-0.073 (0.083)	-0.148*** (0.044)	-0.013 (0.061)	-0.106** (0.052)
s_t^*	0.124 (0.099)	-0.291*** (0.081)	0.190*** (0.051)	-0.331*** (0.109)	0.156** (0.070)
i_t	-0.006 (0.010)	-0.116*** (0.039)	0.021** (0.010)	-0.027 (0.037)	0.027*** (0.009)
i_t^*	0.033*** (0.009)	0.010 (0.011)	0.003 (0.012)	0.016** (0.008)	-0.006 (0.010)
R_t	-0.001* (0.001)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)
R_t^*	-0.001 (0.001)	0.001** (0.001)	-0.001** (0.001)	0.001** (0.001)	0.001 (0.001)
$AR(1)$	0.974*** (0.015)	0.677*** (0.114)	0.963*** (0.021)	0.923*** (0.044)	0.969*** (0.018)
$MA(1)$	0.332*** (0.071)	0.343** (0.152)	0.160** (0.072)	0.128 (0.105)	0.162** (0.069)
R^2	0.977	0.984	0.979	0.987	0.989
SSR	0.024	0.020	0.102	0.052	0.112
F	666.027	333.643	779.750	710.954	1,753.257
$D - W$	2.066	1.918	1.964	1.982	1.981
N	205	80	218	122	236

**Table 3. Exchange Rate Determination (Portfolio-Balance Approach)
(Correcting Serial Correlation of the Error Term, ϵ_t)**

Note: See, Table 2, $AR(1) =$ Autoregressive process and $MA(1) =$ Moving Average process.

Source: See, Table 2.

Table 2 gives the results of eq. (29) by using the spot rate between the U.S. dollar and the foreign currencies (direct, \$/A\$) or its reciprocal (indirect, FC/\$). Most of the coefficients are statistically significant at the 1% level and they have also the correct signs, except the foreign stock markets returns. The problem with these regressions is the low D-W statistics (serial correlation of the error terms). In Table 3, we correct the serial correlations of the error terms by using an $AR(1)$ and a $MA(1)$. The D-W became closed to 2. These regressions give, now, almost all coefficients as significant, except the U.S. bonds and the rate of return in the U.S. stock market. This is an indication that the domestic financial market has not any significant effect on the spot exchange rate. The results show that the most important variables are money supplies, stock indexes, foreign bonds and stocks, and interest rates. Thus, monetary policy and the value of the stock indexes (bubbles) have stronger effects on exchange rates.

5. Conclusion

The Asset Market Approach (the Monetarist Model, the Overshooting Model, and the Broader Portfolio-Balance approach) assumes that whether foreigners are willing to hold claims in monetary form depends on an extensive set of investment considerations or drivers. The main drivers include the following: (1) Relative real interest rates are a major consideration for investors in foreign bonds and short-term money market instruments.¹⁴(2) Prospects for economic growth and profitability are an important determinant of cross-border equity investment in both securities and foreign direct investment. (3) Capital market liquidity is particularly important to foreign institutional investors. Cross-border investors are not only interested in the ease of buying assets, but also in the ease of selling those assets quickly for fair market value if desired. (4) A country's economic and social infrastructure is an important indicator of that country's ability to survive unexpected external shocks and to prosper in a rapidly changing world economic environment, as it is the current unique one. (5) Political safety is exceptionally important to both foreign portfolio and direct investors. The outlook for political safety is usually reflected in political risk premiums for a country's securities and for purposes of evaluating foreign direct investment in that country.¹⁵

The list continues with some secondary investment considerations: (6) The credibility of corporate governance practices is important to cross-border portfolio investors. A firm's poor corporate governance practices can reduce foreign investors' influence and cause subsequent loss of the firm's focus on shareholder wealth objectives. (7) *Contagion* is defined as the spread of a crisis in one country to its neighboring countries and other countries that have similar characteristics; at least in the eyes of cross-border investors. Contagion can cause an 'innocent' country to experience capital flight with a resulting depreciation of its currency. (8) Speculation can cause a foreign exchange crisis or can make an existing crisis worse. (9) Political corruption and lack of democratic values can cause serious distortions and will have negative effects on the economy, its growth, and its future prospects.¹⁶(10) Public policy, institutional, and elections integrity are necessary conditions to attract foreign and domestic investments. Irregularities and apostasy (*ἀποστασία*) in government, people, and value system can demote the reputation of the country and undermine its existence.¹⁷

The Broader Portfolio-Balance Approach is an augmented Portfolio-Balance model by including the stock markets and their return. It provides the following key points: (1) It emphasizes the importance of global financial markets (especially, the bond markets and the stock markets in the two countries). (2) It assumes the existence of arbitrage between these two economies. (3) It offers a realistic analysis framework by looking at the monetary policy effects on wealth (money illusion), on financial markets, interest rates, and rate of returns. (4) The Broader Portfolio-Balance approach, based on empirical evidence (U.S. and Australia, India, Japan, Mexico, Switzerland) has proven as a relatively accurate predictor (determinant) of exchange rates.

Thus, the empirical results, Tables 1, 2, and 3 show that for the exchange rate determination by using the broader portfolio-balance approach, the five exchange rates are affected by most of the variables of the theoretical model. Important variables (significant) are almost all of them, with very few minor exceptions (domestic bonds and stock market returns). Of course, there are interventions, speculations, and other impediments and imperfections in our foreign currency market that cause difficulties in accurate exchange rate determination and even worse in forecasting.

¹⁴This driver does not hold for the U.S. the last 12 years because ($r < 0$), but the low risk is offsetting this deficiency of the real rate of interest.

¹⁵Political risk can be eliminated, if firms are producing domestically, which affects positively domestic production, employment, and income. The last 40 years, the outsourcing of manufacturing has caused serious problems to U.S. and Europe and lately, it caused a health, economic, and social crisis, the worst in our economic history, due to the suspicious Chinese coronavirus. The global financial crisis in 2008 and the current health, financial, and social crises give to us the true "globalization effect", which is an enormous and destructive system risk. "Ten Facts about COVID-19 and the U.S. Economy": (1) Small business revenue is down 20 percent since January. The COVID-19 pandemic has been ... (2) So far, only Chapter 11 bankruptcies have increased relative to last year. The decline in business ... (3) New business formations fell off in the spring, but are on track to outpace recent years. At the ... (4) Layoffs and shutdowns—and not reduced average hours—are driving in total hours worked. The ... (5) The number of labor force participants not at work quadrupled from January to April. During ... (6) The number of people not in the labor force who want a job spiked by 4.5 million in April and has ... (7) In April 2020 the U.S. personal savings rate reached its highest recorded level. One of the ... (8) Low-income families with children were most likely to experience an income shock. During the ... (9) In 26 states, more than one in five households was behind on rent in July. Although the increase in ... (10) From 2018 to mid-2020, the rate of food insecurity doubled for households with children. During ... See, <https://www.brookings.edu/research/ten-facts-about-covid-19-and-the-u-s-economy/>

¹⁶Political corruption has destroyed the countries all over the world and lately, this "contagious virus" became the number one problem even for the U.S.A. See, Clarice Feldman, "Election Fraud, Political Corruption, and its Consequences", *American Thinker*, December 6, 2020. https://www.americanthinker.com/articles/2020/12/election_fraud_political_corruption_and_its_consequences.html

¹⁷Historically, it has happened to all previous Empires, like, the Roman Empire, the Byzantine Empire, etc. See, <https://sagaciousnewsnetwork.com/empires-like-the-u-s-fall-when-corruption-becomes-rampant/>. See also, <https://www.amazon.com/Decline-Fall-American-Empire-Corruption/dp/0738208833>

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