The Declining American Dollar: Econometric Estimates of Impact on the GDP and Trade Deficit

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Falling exchange rates increase the prices of imports, creating (1) A positive substitution effect that increases demand for domestic goods and (2) A negative income effect that reduces total real income, and therefore demand for, both domestic and foreign goods. Using 1960 - 2000 data, this paper develops an econometric model of the U.S. economy to test the effects of exchange rate changes on consumer and investment spending, controlling for other relevant influences. The paper finds the income effect dominates, causing the declining U.S. exchange rate 2000 -2007 to have a net negative effect on the GDP, reducing it from what it would have been by an estimated 3.4% over this period, or about one half percent per year on average. However, the declining exchange rate is also estimated to have significantly reduced the U.S. trade deficit, U.S. exports increasing $4.01 billion annually per point decrease in the rate, and imports declining an estimated $7.3 billion annually per point decrease. Had other things remained equal, we estimate this would have caused the trade deficit to decline about 35% over the period. This would have been a decline from 4.3 to 2.9 percent of the GDP.

INTRODUCTION

Falling exchange rates, by raising import prices, may decrease import demand and increase demand for domestic goods (the substitution effect). Or might we purchase less domestic goods as well as less imported goods, because higher import prices are paid for in part by reducing domestic consumption (the income effect). This paper seeks to answer this question. The effect of the Federal Reserve's Real Broad exchange rate index on U.S. demand for consumer and investment goods and services is estimated econometrically. The estimates are used to assess the impact on the GDP of the decline in U.S. exchange rate that occurred 2000 - 2007. Also examined is how associated reductions in the trade deficit reduce transfers of ownership of U.S. assets to others, as is usually required to pay for trade deficits.

METHODOLOGY

Data were taken from the *Economic Report of the President, 2002, 2001 or 1997*. Exchange rate values 1960 - 1970 were assumed constant at 1970 levels, per the Bretton Woods protocols.

All data are in 1996 dollars. Regressions were estimated using 1960-2000 data. Regression coefficients with a t-statistic of 1.8 were significant at the 8% level, 2.0 at the 5% level and 2.7 at the 1% level Two stage least squares was used. Newey-West heteroskedasticity corrections were made. Separate equations for domestically produced, imported, and total demand for consumer and investment goods were estimated. Import statistics definitions are taken from Heim (2007). Investment imports are defined as imports of capital goods, industrial supplies & materials (M_{ksm}). Total imports (M) minus investment imports are defined as consumer goods imports ($M_{m\text{-}ksm}$).

THE CONSUMER DEMAND MODEL

This paper assumes that the determinants of the demand for consumer goods are those suggested by Keynes (1936), plus two other variables. Keynes argues in chapter 8 of the General Theory of Employment, Interest and Money (1936, pp.95-96) that income, wealth, fiscal policy (taxes) and possibly the rate of interest might influence consumption. In chapter 9 he also notes the need for saving might affect the level of consumption spending. Also, a "crowd out" variable is added, similar to the one used in investment studies to control for periods of limited credit availability which may occur in response to government deficits. Second, we also add an exchange rate variable. Heim (2008A) found that regression results on a modified Keynesian function of the following type explained about 90% of the variance in consumer spending in the 1960 - 2000 period:

$$C = \beta_1 + \beta_2 (Y\text{-}T_{\mathbf{G}}) + \beta_3(T_G - G) - \beta_4 (PR). + \beta_5 (DJ)_{-2} + \beta_6 (XR)_{AV0123}$$

Where,

- $(Y\text{-}T_{\mathbf{G}})$ = Disposable income defined as the GDP minus the government receipts net of those used to finance transfer payments
- $(T_G – G)$ = The government deficit, interpreted as a restrictor of consumer as well as investment credit. It was found highly significant in a preliminary study (Heim 2008A), and is regressed as two separate variables because of earlier findings of differential effects.
- PR = The Prime interest rate for the current period. It is deflated to get the "real" rate using the average of the past two year's CPI inflation rate.
- DJ_{-2} = A stock market wealth measure, the Dow Jones Composite Average, lagged two years
- XR_{AV0123} = The trade - weighted exchange rate (XR An average of the XR value for the current and past three years is used to capture what preliminary studies showed was slow, multiyear process of adjustment to exchange rate changes (Heim, 2007)

The regression results for consumer demand were as follows:

$$\Delta C_0 = .66\Delta(Y\text{-}T_G)_0 + .49\Delta T_{G(0)} + .04\Delta G_0 - 6.92\ \Delta PR_0. + .62\ \Delta DJ_{-2} + 2.83\ \Delta XR_{AV0123} \qquad R^2=92\%$$
(t =) (29.2) (5.7) (0.3) (-3.2) (4.9) (3.2) D.W.= 2.0

$$\Delta(M_{m\text{-}ksm})_0 = .11\Delta(Y\text{-}T_G)_0 + .30\Delta T_{G(0)} - .20\ \Delta G_0 - 5.00\ \Delta PR_0. + .34\ \Delta DJ_{-2} + 3.03\ \Delta XR_{AV0123} \qquad R^2=85\%$$
(t =) (6.3) (5.0) (-2.0) (-3.5) (4.5) (5.6) D.W.= 1.8

$$\Delta(C\text{-} M_{m\text{-}ksm})_0 = .55\Delta(Y\text{-}T_G)_0 + .19\Delta T_{G(0)} + .24\ \Delta G_0 - 1.92\ \Delta PR_0. + .28\Delta DJ_{-2} - .20\ \Delta XR_{AV0123} \qquad R^2=74\%$$
(t =) (16.2) (1.5) (1.3) (-0.6) (1.9) (-0.2) D.W.= 1.8

THE INVESTMENT DEMAND MODEL

The investment model includes variables traditionally thought to influence investment. See, for example, Jorgenson (1971). Imported investment goods are defined as imported capital goods and imported industrial supplies and materials.

$$\Delta I_D = (\Delta I\text{-}\Delta M_{ksm}) = \beta_{D1}\,\Delta ACC + \beta_{D2}\,\Delta DEP + \beta_{D3}\,\Delta CAP_{-1} + \beta_{D4}\,\Delta T_G - \beta_{D5}\,\Delta G - \beta_{D6}\,\Delta r_{-2} + \beta_{D7}\,\Delta DJ_{-2} + \beta D_{I8}\,\Delta PROF_{-2} + \beta_{D9}\,\Delta XR_{AV0123}$$

$$\Delta I_M = (\Delta M_{ksm}) = \beta_{M1}\,\Delta ACC + \beta_{M2}\,\Delta DEP + \beta_{M3}\,\Delta CAP_{-1} + \beta_{M4}\,\Delta T_G - \beta_{M5}\,\Delta G - \beta_{M6}\,\Delta r_{-2} + \beta M_{I7}\,\Delta DJ_{-2} + \beta_{M8}\,\Delta PROF_{-2} + \beta_{M9}\,\Delta XR_{AV0123}$$

The variables included in these equations are

ΔACC = An accelerator variable $\Delta(Y_t - Y_{t-1})$
ΔDEP = Depreciation
ΔCAP_{-1} = A measure of last year's capacity utilization
$\Delta PROF_{-2}$ = A measure of business profitability two years ago

The other variables have the same meanings as in the consumption equations, with lags as noted there. Previous studies (Heim 2008b) had shown these variables would explain almost 90% of the variance in total investment demand 1960-2000, but did not break this into separate estimates for imports and domestic goods. Econometric estimates of the investment model above show the following:

$$\Delta I = .28\Delta ACC + 1.37\Delta DEP + .69\Delta CAP_{-1} + .52\,\Delta T_G - .61\Delta G - 8.46\Delta r_{-2} - .10\,\Delta DJ_{-2} + .35\,\Delta PROF_{-2} + 4.97\,\Delta XR_{AV0123} \quad R^2=.89$$
(t =) (6.9) (4.7) (0.4) (5.3) (-3.4) (-3.5) (-0.4) (2.0) (4.2) DW =2.3

$$\Delta(M_{ksm}) = .05\Delta ACC + .46\Delta DEP + 1.25\Delta CAP_{-1} + .07\,\Delta T_G - .14\Delta G + 1.12\Delta r_{-2} + .30\,\Delta DJ_{-2} - .11\,\Delta PROF_{-2} - .40\,\Delta XR_{AV0123} \quad R^2=.64$$
(t =) (1.9) (4.5) (1.4) (2.0) (-1.7) (0.7) (3.4) (-1.09) (-0.7) DW =2.1

$$\Delta(I\text{-}M_{ksm}) = .24\Delta ACC + .91\Delta DEP - .15\Delta CAP_{-1} + .45\,\Delta T_G - .47\Delta G - 9.59\Delta r_{-2} - .40\,\Delta DJ_{-2} + .47\,\Delta PROF_{-2} + 5.37\,\Delta XR_{AV0123} \quad R^2=.88$$
(t =) (7.8) (3.0) (-0.4) (6.0) (-2.9) (-7.3) (-1.9) (4.1) (4.1) DW =2.1

The coefficients on the accelerator variable (ACC) represent the marginal propensity to invest in domestic (MPI_D) vs. imported (MPI_M) investment goods. Results indicate that the accelerator effect of a decline in current year real income on investment is principally on domestically produced investment goods, with demand decreasing \$ 0.24 billion for every billion decrease in the size of the change in current year GDP. Demand for imported goods on the other hand only decreases \$0.05 billion. There appears to be a \$5.37 billion decrease in demand for domestically produced investment goods for every one - point decline (~ 1%) in the Federal Reserve's trade weighted broad exchange rate. We hypothesize that this reflects the effect on investment due to the drop in real savings caused by declining real income associated with the exchange rate decline. This income effect seems to swamp the substitution effect to cheaper domestic goods we would expect to see here. Similarly, the steep decline in income may cause some shifting to imports (\$0.40B) despite the fact that their price has recently risen, because they are still cheaper than U.S. investment goods, though at higher U.S. income levels, perhaps not as desirable on other grounds, e.g., quality.

THE EXPORTS DEMAND MODEL (USING THE REAL BROAD XR INDEX)

A lower exchange rate increases the demand for exports. A rough estimate of this effect can be obtained by regressing exports on the 4-year average exchange rate above and the growth in the American GDP over the 1960-2000 period. The GDP serves as a proxy for the growth in our major trading partners' economies, which systematically affects export demand.

$$\Delta X_0 = .05\ \Delta(Y)_0 - 4.01\ \Delta XR_{AV0123} + .45\ \Delta AR(1) + .59 \Delta AR(3) \qquad R^2 = 54\%$$
$$(t) \quad (2.3) \quad (-8.7) \quad (1.9) \quad (2.9) \qquad D.W.= 2.0$$

THE TAX GROWTH MODEL

Part of tax growth is endogenous, i.e., tied to income growth. Below we estimate the effect of a change in total income on government revenues raised to purchase goods and services.

$$\Delta T_G = .26\ \Delta(Y) \qquad R^2 = 47\%$$
$$(t =) \quad (7.7) \qquad D.W. = 1.4$$

The consumption and investment equations above show a positive effect on demand of an increase in tax revenues, presumably by reducing credit crowd out. Hence, in calculating the full effects of a change in GDP due to exchange rate changes, it is important to also measure the change in income resulting from changes in taxes collected as income grows. If we define tax changes that are government - enacted, i.e., exogenous, as approximately ΔT_{EX}, we have

$$\Delta T_G = .26\ \Delta(Y) + \Delta T_{EX.}$$

(We say "approximately, because T_{EX} also contains the regression error term.)

A MODEL FOR CALCULATING A KEYNESIAN SPENDING "MULTIPLIER" THAT ALSO INCLUDES ACCELERATOR AND CROWD OUT EFFECTS

The following definitions and derivations of the multiplier and accelerator are presented, using simplified versions of our above consumption and investment equations for ease of exposition. These simplified versions include variables with a "Y" or "Y-T" determinant, but exclude determinants which do not affect the multiplier implied by the regression models:

(1) $Y = C + I + G + (X-M)$

(2) $C = c_0 + (c_1 + m_{c1})(Y-T_G) + (c_2 + m_{c2})\ T_G + (c_3 + m_{c3})\ G$ (Consumer Demand)

where $(Y- T_G)$ is total income generated producing the GDP minus taxes; $c_1 + m_{c1}$ are the marginal propensities to consume domestic and imported goods, $c_2\ T_G + c_3\ G$ represent the consumer credit crowd out variables resulting from government deficits. The disaggregated form of the deficit is used.

(3) $I = I_0 + (I_1 + m_{I1})\ \Delta Y - (I_2 + m_{I2})\ r + (I_3 + m_{I3})\ T_G + (I_4 + m_{I4})\ G$ (Investment Demand)

where ΔY is an "accelerator" variable, r is the real interest rate, (I_1 + m_{I1}) are the marginal propensities to purchase domestically produced or imported investment goods in response to a change in the GDP, and (I_2 + m_{I2}) are the marginal propensities to invest in these goods when interest rates change. $I_3 T_G + I_4 G$ represent the investment credit crowd out variables, again disaggregated.

$$(4)\ M = M_C + M_I = m_0 + m_{c1}(Y-T) + m_{I1}\Delta Y - m_{I2} r + (m_{c2} + m_{I3}) T_G + (m_{c3} + m_{I4}) G$$
(Import Demand)

i.e., the demand for imported consumer or investment goods is driven by the same variables as is domestic demand. Substituting (2), (3) and (4) into equation (1) gives

$$(5)\ Y = (c_0 + I_0 - m_0) + c_1(Y - T_G) + I_1 \Delta Y - I_2 r + G + X + (c_2+I_3) T_G + (c_3+I_4) G$$

from which we can derive the theoretical "M/A/C" multiplier value and a Keynesian "IS" curve.

$$(6)\ \Delta Y = \left[\frac{1}{(1-c_1-I_1-[-c_1+c_2+I_3][.26])} \right] [- c_1 \Delta T_{EX} - I_1 \Delta Y_{-1} - I_2 \Delta r + \Delta G + \Delta X + (c_2+I_3) \Delta T_{EX} + (c_3+I_4) \Delta G]$$

Inserting the regression coefficients from our consumption and investment equations above into equation (6), we find the numerical value of the "M/A/C" multiplier is 1/ (1-.55-.24-.02) = 5.26.

INCOME AND SUBSTITUTION EFFECTS OF A DECLINING EXCHANGE RATE

Economic theory suggests both the income and substitution effects of a declining exchange rate should be negative for imports, causing decreased purchases of imported consumer and investment goods. For domestically produced goods, it suggests the income and substitution effects should work in opposite directions: substitution effects increasing domestic demand, income effects decreasing it.

Our regression model results for consumption are fully consistent with this theory. As indicated by the regression coefficients on the disposable income variable, the initial income effect of an exchange rate - induced $1 billion decline in disposable income reduces demand for domestic consumer goods by $0.55 billion and imports by $0.11 billion, and reduces savings by $0.34 billion ($MPS = .34 = 1-MPC_D-MPC_M$). Multiplier effects increase these estimates, as we show in the next section. In addition, the substitution effect, as measured by the coefficients on the exchange rate variable, reduces consumer imports by $3.03 billion and increases domestic demand for consumer goods by $0.20 billion, for each single point decline in the exchange rate.

In the regressions for investment goods, the income effect is shown by the coefficient on the accelerator variable. The income effect caused by a $1 billion decline in economic growth in the current year causes a small decline in imported investment goods ($0.05 billion), and a larger decline in the demand for domestically produced investment goods ($0.24 billion). Using the exchange rate coefficient as a measure of substitution effects, this variable in the investment imports equation shows a negative sign suggesting declining exchange rates raise demand for imports,($0.40 billion) contrary to substitution effect theory. Domestic investment demand declines markedly ($5.37 billion), with a one point decline in the exchange rate, also counter to substitution effect theory. This probably indicates overwhelming dominance of negative income effects on investment, forced by the large decline in savings, not completely captured by accelerator variable in the equation. Increased import purchases we attribute to a "Wal-Mart" effect – substitution to less desirable, but more affordable good when income goes down.

In the consumption model, the regression coefficients on the exchange rate variable in both the total consumption and consumer imports equations are statistically significant. The coefficient in the domestic consumption equation is not. However, it is exactly the same as that obtained by subtraction of the statistically significant estimates for imports from that for total consumption. Hence, these coefficients seem reliable for use. For the investment equations, the situation is much the same.

A one point decrease in the Federal Reserve's "Broad" trade-weighted real exchange rate index (approximately a 95 hundredths of one percent (0.95%) decrease in its 2000 level) could increase import prices by the same percent, if passed entirely through to the consumer. However, evaluation by Federal Reserve staff of the "pass through" of exchange rate changes suggests import prices only change about half as much as the exchange rate change (Hellerstein, Daly & Marsh, 2006). In the year 2000, U.S. total real imports (1996 dollars) were $1,532 billion. A one index point (0.95%) decrease in the exchange rate, then, would be expected to increase import costs by half this percentage, or $7.28 billion, decreasing real incomes in the U.S. by the same amount. Real disposable income decreases the same amount, since there is no tax effect: nominal (taxable) income is the same; only real income has decreased.

THREE METHODS FOR CALCULATING THE IMPACT ON THE GDPOF A CHANGE IN THE EXCHANGE RATE

Three separate methods, all yielding the same results, are used to compute the effect of a one index point change in the exchange rate on the GDP (Y):

Method 1: Use marginal effects estimates from the above investment and consumption regressions to estimate the initial drop in real income. The M/A/C multiplier (5.26) is applied to the result.

Method 2: Use the method favored in many large scale econometric models of the economy (Fair 1986, Pindyck & Rubinfeld 1991). This involves separately estimating ΔC_D, ΔI_D, ΔG and ΔX (using the equations above), and simply summing the results to get ΔY.

Method 3: Formally Construct a Keynesian IS curve, and predict ΔY from its determinants and the multiplier implied by the function. It is a slightly more formal presentation of Method 1.

Each of the methods serves as a check on the estimates obtained from the others. As we will show below, each produces the same results.

Method 1

$ 4.81B Initial Y Decline from: $ -7.28B (M price Increase @ .50 x ΔM prices)

+ .80B (.11MPC_M x -7.28 Initial $\Delta(Y\text{-}T_G)$ =Portion of 7.28 not spent on U.S. goods (Note: -7.28 +.80 = -6.48)

- 5.37B (I_D: Decrease in investment)

+ .20B (C_D: Sub. effect increase in C_D)

+ 2.83B (C_D Effect Due to upward ΔMPC_D: 3.03 decline C_M – 0.20 Direct Substitution to $C_{D)}$

<u>$+4.01B</u> (X: Increase in exports)

$ - 4.81B (Initial real income (Y) decline)

<u>x 5.26</u> Multiplier/Accel/Crowd Out (M/A/C)Effect

$ 25.30B Decline in Real Income (Y) after Multiplier/Accel/Crowd Out (MAC)Effects

- 4.89B ΔTaxes due to M/A/C Effect @ Historic .26 Rate = .26(25.30 – (7.28-.80=6.48)) where 6.48 is the portion of the initial non-taxable 7.28 billion decrease in real income affecting domestic demand =(MPC_D + MPI_D)(7.28) = (.55 + .34)(7.28) where we assume the MPS = MPI_D

$ 20.41B $\Delta(Y\text{-}T_G)$ = Decline in disposable income

Also, let

- 0.93B = ΔC_D Due to Crowd Out Effect Caused By Decreased Taxes = (.19)($-8.26B)
- 1.47B = ΔC_M Due to Crowd Out Effect Caused By Decreased Taxes = (.30)($-8.26B)

+/- 3.03B = ΔC_{DorM} Due to +/-.20B Direct Substitution Effect & +/-2.83 Indirect Sub. Effect Due to ΔMPC_D

With this information we can summarize the changes in consumption and saving resulting from the increase in disposable income of $20.41 as follows:

$ -20.41B $\Delta(Y\text{-}T_G)$	$ -20.41B $\Delta(Y\text{-}T_G)$	$ -20.41B $\Delta(Y\text{-}T_G)$
<u>x .55</u> MPC_D	<u>x .11</u> MPC_M	<u>x .34</u> MPS
$-11.23B ΔC_D (Inc. Effect)	$ - 2.25B ΔC_M (Inc. Effect)	$ - 6.94B <u>Δ Savings</u> (Reduction in Domestic Funds Available to Fund Investment)
- 0.93B Crowd Out Effect	- 1.47B Crowd Out Effect	
<u>+ 3.03B</u> Substitution Effect	<u>- 3.03B</u> Substitution Effect	
$ - 9.13B <u>Total ΔC</u>$_D$	$ - 6.75B <u>Total ΔC</u>$_M$	

Method 2

From our earlier regression equations, we see three variables through which investment is affected by changes in the exchange rate:

1. the <u>decrease in the accelerator</u> income variable in the investment equation due to the decrease in gross real income caused by the downward change in the exchange rate XR_{AV0123}

2. the decline in tax collections because of the decline in real income, all of which was taxable, except the initial decrease caused by the 0.5%% increase in import prices, and
3. through the one -point change in the exchange rate variable

Hence, the estimated decline in domestic investment (I_D)and imported investment goods (I_M) will be

$$\begin{aligned}\Delta I_D = \Delta(I-M_{ksm}) &= .24\ \Delta ACC \quad +.45\ \Delta T_G \quad + 5.37\ \Delta XR_{AV0123}\\ &= .24\,(-25.30) \quad + .45(-4.89) \quad + 5.37(-1)\\ &= \$ - 18.27B\end{aligned}$$

$$\begin{aligned}\Delta I_M = \Delta(M_{ksm}) &= .05\ \Delta ACC \quad +.07\ \Delta T_G \quad - 0.40\ \Delta XR_{AV0123}\\ &= .05(25.30) \quad +.07(-4.89) \quad - 0.40(-1)\\ &= \$ - 2.09B\end{aligned}$$

By similar reasoning, we see the changes in the demand for domestic and imported consumer goods are:

$$\begin{aligned}\Delta C_D = \Delta(C-M_{m-ksm}) &= .55\ \Delta(Y-T_G) \quad + .19\ \Delta T_G \quad - (0.20+2.83)\ \Delta XR_{AV0123}\\ &= .55(-20.41) \quad + .19(-4.89) \quad - 3.03(-1)\\ &= \$ - 9.13B \text{ (same result as method 1)}\end{aligned}$$

and

$$\begin{aligned}\Delta C_M = \Delta(M_{m-ksm}) &= .11\ \Delta(Y-T_G) \quad +.30\ \Delta T_G \quad + 3.03\ \Delta XR_{AV0123}\\ &= .11(20.41) \quad +.30(-4.89) \quad + 3.03(-1)\\ &= \$ - 6.75B \text{ (same result as method 1)}\end{aligned}$$

So, by Method 2 we have

$$\Delta Y = \Delta C_D + \Delta I_D + \Delta G + \Delta X \quad (-6.48 \text{ Exogenous } \Delta XR \text{ rate effects on real income due to price decreases, where } -6.48 = (MPC_D + MPI_D)(-7.28) = -(4.00 + 2.48))$$

$$= \$ - 9.13 - 13.64 + 0 + 4.01 - 6.48$$

$$= \$ - 25.24 \text{ (Same result as Method 1, except for rounding)}$$

Method 3

Using the formal Keynesian "IS" curve method for calculating GDP from Section 7 above:

$$\begin{aligned}\Delta Y &= \Delta C_D + \Delta I_D + \Delta G + \Delta X - 6.48 \text{ (exogenous change)}\\ &= [.55\Delta(Y-T_G) + .19\Delta T_G - (0.20 + 2.83)\Delta XR_{AV0123}] + [.24\ \Delta ACC + .45\ \Delta T_G + 5.37\Delta XR_{AV0123}] + \Delta G + \Delta X - 6.48\\ &= [.55(-20.41) + .19(-4.89) - 3.03(-1)] + [.24(25.30) + .45(-4.89) + 5.37(-1)] + (0) + (4.01) - 6.48\\ &= \$ - 25.24 \text{ (Same result as by Methods 1and 2)}\end{aligned}$$

EXCHANGE RATE EFFECTS ON THE TRADE DEFICIT AND GDP

The estimated decline in the trade deficit from a one index - point decline in the U.S. real broad exchange rate is the sum of the decrease in imports and the increase in U.S. exports:

\$ 6.75B - Decline in C_M	
0.52B - Decline in I_M	\$ 2.48B - Initial Δ Savings = (.34 MPS)(-7.28 Initial ΔY)
. 4.01B - Increase in X	6.94B - MAC Induced Subsequent ΔSavings =.34Δ(Y-T_G)
\$11.28B - Decrease in the Trade Deficit	\$ 9.41B - Decrease In Growth of Domestic Owned Wealth

The initial decline in real savings (\$2.48B) stemming from the exchange rate drop forces a comparable decrease in investment. This initial decrease in domestic investment and the initial decline in domestic consumption (\$6.48), and other effects noted in Method 1, generate a subsequent decline in disposable income of 20.41 of which 34% = 6.94 is a decline in savings. Hence the savings decline totaled \$ 9.41B.

The estimated decrease in the trade deficit (\$11.28) is more than the decline in U.S. saving (\$9.41B) due to the exchange rate drop. This means the declining exchange rate reduced the need to annually transfer U.S. assets to foreigners (to finance the deficit) more than, by reducing GDP, it cut U.S asset growth (by lowering annual savings). The net effect is an annual \$1.9 billion increase in net assets owned by the U.S.

The decrease in domestic demand causes a substantial drop in the GDP. The associated trade deficit, though it declines in dollars, barely declines as a percent of GDP. Using baseline measures of the real GDP, exports and Imports data for the year 2000, we see only about one tenth of one percent decrease in the trade deficit as a percent of GDP when the trade weighted exchange rate index falls one point, as noted in Table 1:

TABLE 1
EXCHANGE RATE EFFECTS

	Real GDP	Imports	Exports	Trade Deficit Dollars (% of GDP)
Actual 2000 Data	\$9224.00	\$1532.00	\$1132.00	\$400.0 (4.3%)
Effect of 1Pt. Drop XR	9198.70	1524.73	1136.01	\$388.7 (4.2%) .
Effect of 12.5Pt Dr.XR	8907.75	1441.13	1182.12	\$259.0 (2.9%) .

In the period 2000 – 2007, The U.S. real broad exchange rate actually dropped 12.5 index points. This drop would have been associated with a decrease in the trade deficit as a percent of GDP by 1.4 percentage points, from 4.3% to 2.9%, or about \$141B, (ceteris paribus). This decrease would have been accompanied by a 3.4% decrease in the GDP or \$316B in year 2000 dollars over the seven years (again, ceteris paribus). or an average of \$45.2B a year over the seven years. Using the numbers from Method 2, multiplied by 12.5, we have:

$$\Delta Y = \Delta C_D + \Delta I_D + \Delta G + \Delta X$$
$$\$ -316 = \$ -164B - \$ 202B + 0 + \$ 50B$$

The real GDP actually grew 18.7% during 2000 - 2007. Had the exchange rate decline not occurred, it might have grown by 3.4%more, to 22.1%, increasing average annual growth rates from 2.7 to 3.2%.

REFERENCES

__________. Economic Report of the President. Washington. U.S. Government Printing Office. 2002 (also 2001 and 1997 reports)

Fair, R. (2004). Estimating How the Macroeconomy Works, Appendix A: U.S. Model.. Available at http://fairmodel.econ.yale.edu/rayfair/pdf/2003A.PDF

Heim, J. J. (2007). Does A Strong Dollar Increase Demand for Both Domestic and Imported Goods? Journal of International Business and Economics. Gale Group/Thomson Publishing, Vol. VII (3). or the more comprehensive study from which it was developed: Do Falling Import Prices Increase Market Demand for Domestically Produced Consumer Goods? RPI Working Papers in Economics, No. 707, Department of Economics, Rensselaer Polytechnic Institute, July 2007

Heim, J.J. (2008a). The Consumption Function. Review of Business Research. Vol. 7(1) Oct. 2007 (or) Rensselaer Polytechnic Institute, Department of Economics. *RPI Working Papers in Economics, No. 805*.

Heim, J.J. (2008b). What Determines Market Demand For Investment Goods. International Journal of Business Strategy. Vol 6 (1). Oct. 2008 (or) The Investment Function. Rensselaer Polytechnic Institute, Department of Economics. RPI Working Papers in Economics, No. 806. 2008b

Hellerstein, R., Daly, D. and Marsh, C. (2006) Have U.S. Import Prices Become Less Responsive to Changes in the Dollar? Current Issues in Economics and Finance, Federal Reserve Bank of New York, Vol.12, No. 6.

Jorgenson, D. Econometric Studies of Investment Behavior: A Survey, Journal of Economic Literature. 9(4), Dec. 1971, pp. 1111-47.

Keynes, J.M. The General Theory of Employment, Interest and Money. New York. Harcourt, Brace and World, Inc. 1936 (1964 print)

Pyndick, R. & Rubinfeld, D. Econometric Models & Economic Forecasts. New York.: McGraw – Hill, Inc. 1991

Samuelson, P. Interactions Between the Multiplier Analysis and the Principle of Acceleration. Review of Economics and Statistics. Vol. 21, No. 2, Aug. 1939, pp. 75-78.