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TRADE DEFICIT AND CURRENCY DEVALUATION: TESTING THE J-CURVE

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Abstract

This paper is testing empirically the effect of a devaluation of a currency on the trade account of the country, the J-curve effect, by using the trade between the U.S. and seven countries (Euro-zone, Mexico, Canada, United Kingdom, Switzerland, Japan, and Australia). A devaluation (depreciation) of the U.S. dollar is increasing the spot exchange rate ($/FC) and increases the price of imports and reduces the price of exports. Then, imports are falling and exports are increasing and the trade account is improved in the long-run. In the short-run, the trade account is deteriorated because the international trade transactions are pre-arranged and the invoices are in foreign currency, so it cannot be adjusted. This J-curve hypothesis is tested by using a regression equation and a VAR model, where the volatility of the real exchange rate (TOT) is specified with a GARCH-M process. Also, different stationary tests are taking place, like, unit root and cointegration ones. The empirical results mostly are supporting the J-curve effect.

Keywords

Demand for Money and Exchange Rate, Foreign Exchange, Current Account Adjustment, Forecasting and Simulation, Information and Market Efficiency, International Financial Markets

JEL (Classification): E4, F31, F32, F47, G14, G15

«Πονηροί δέ ἄνθρωποι καί γόητες
προκόψουσιν ἐπί τό χείρον,
πλανῶντες καί πλανώμενοι.»

- Β΄ Τιμ. γ΄ 13

I. Introduction

A continuing U.S. trade deficit after 1980 is a proof of a major structural problem of the country. This situation is detrimental to the nation's economy and to citizens' wellbeing because it affects negatively production, employment, income, competitiveness, independence, and causes reductions of foreign assets of the Fed, because are used in financing the trade deficits, which are foreign currencies, SDRs, gold or debt. A country can buy more goods from abroad than it makes domestically by borrowing from its trading partners. This can only continue as long as the lending country trusts the borrowing one to repay the loan. One day, the lending countries could decide to ask the borrower to repay not only the interest, but the entire debt, which could generate serious effects in the domestic economy.[1] However, this is not likely to happen because it would have adverse effects (depreciation) on those borrowing countries' currencies and imports will fall and trade will be reduced, which will deteriorate lender's economy. Another concern regarding the trade deficit is about the competitiveness of the deficit country's economy itself. By purchasing goods overseas for a long enough period, the companies of the country lose their expertise and even the factories[2] to make those products. As a nation loses its competitiveness, it outsources more jobs, more companies, and more income, which reduce its standard of living. Countries must be self-sufficient and

[1] It might make its debt unsustainable. See, Kallianiotis (2018, p. 164).
[2] See, Niko J. Kallianiotis, America in a Trance. https://www.nikokallianiotis.com/book , where this problem is depicted in photos.

in an autarky situation and this depends on the competence of domestic leadership and its public (monetary, fiscal, and trade) policies.

Countries can use trade policies (devaluation of their currencies) to reduce the trade account deficits, given that the Marshall-Lerner condition holds (elastic domestic and foreign demands for imports). Devaluation increases the price of imports and reduces the price of exports and due to the law of demand, imports are falling and exports are increasing and the trade account is improved. Let us start with a country that has a trade account deficit and decides to devaluate (depreciate) its currency to reduce the deficit, as it appears in Figure 1. At time t_1, the depreciation of the domestic currency takes place and a further deterioration in the trade balance occurs and gradually the trade balance improves, after time t_2; this path of adjustment takes the shape of a "j" and for this reason it called the J-Curve adjustment. There is a theoretical rational behind this hypothesis, but in Finance and mostly in its mother Economics (Οικονομικός), everything must be proved beyond mathematics and assumptions with actual data from the trading partners.

A sudden unexpected depreciation of the domestic currency has the following impact, in the current period (t_1), due to the contracts for exports (in $) and imports (in €), which are already in effect. All or most of the imports are priced in foreign currencies. Thus, a sudden depreciation of the U.S. dollar will cause an increase in the trade deficit after time t_1 because the cost of imports will be higher in dollars, due to its depreciation, while the revenue from exports will remain unchanged because of the already existing export contracts. As the time is passing, the price of imports is increasing and imports are falling, but the price of exports might fall (the price of imported raw material or other inputs for their production will increase) and we will reach period t_2, where the trade account is improving, due to reduction of imports and increase to exports. After time t_2, the trade account becomes positive (in surplus).

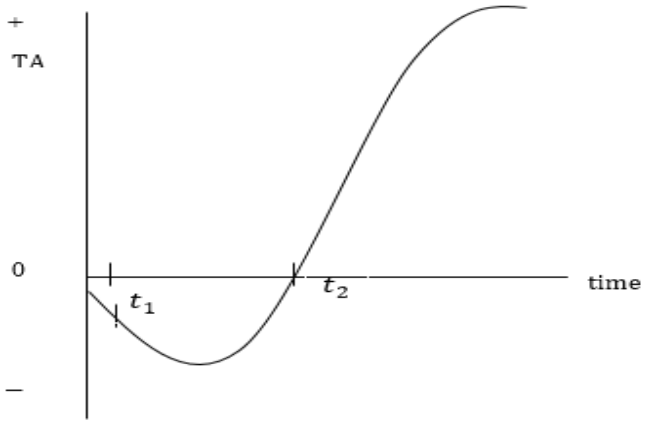


Figure 1. The J- Curve (TA Adjustment)
Note: t_1 = depreciation of the domestic currency period and t_2 = TA improvement period.

$$S\uparrow(\$\downarrow)\Rightarrow(M\uparrow \text{ and } \bar{X})_{S-R}\Rightarrow TA_{S-R}\downarrow(\text{international trade transactions are pre-arranged and cannot adjust})$$
$$\Rightarrow(M\downarrow \text{ and } X\uparrow)_{L-R}\Rightarrow TA_{L-R}\uparrow(M^d \text{ and } M^s \text{ are more inelastic in the short-run than in the long-run})$$

where, S = spot exchange rate ($/FC), M = imports, X = exports, and TA = trade account.

The adjustment of the trade account takes place over a prolonged period of time. In some industrial countries the total time elapsing between the time of the depreciation of the currency and the improvement of the trade account varies between 3 to 12 months (depending on the payments grace period). For example, a depreciation of the U.S. dollar will have the following effects on its trade account:

$$TA_{t_1}<0\Rightarrow S\uparrow(\$\downarrow)\Rightarrow \bar{X}-M\uparrow=(\bar{P}_X^{\$}\bar{Q}_X)-(S_{\$/euro}\uparrow\bar{P}_M^{euro}\bar{Q}_M)\Rightarrow TA\downarrow\downarrow$$

where, P_X = price of exports, Q_X = quantity of goods exported, P_M = price of imports, and Q_M = quantity of goods imported.

With the passing of time the current contracts will mature and the new contracts will be written with the new prices, which will reflect the changes of cost, due to the depreciation of the currency and the trade account[3] will be improved because imports will fall, due to higher cost and exports will increase because of the lower cost (lower prices in foreign currency) of the U.S. products. The objective of this study is to test the J-curve hypothesis by using a regression and a vector autoregression (VAR) model based on the trade account variables and the exchange rate volatility by applying a GARCH-M specification.

[3] The U.S. Current and Trade Account Deficits

II. A Theoretical Model of the Trade Account

Specification of Currency Volatility

As it was mentioned, countries can use trade policies (the traditional, like, tariffs, import taxes, and quota or the less reactionary one, devaluation of their currencies) to reduce the current account and the trade account deficits. The trade account can be presented with eq. (1), as following,

$$TA = X - M = f_1(p, Y^*) - f_2(p, Y) \quad (1)$$

(+ +) (− +)

where, Y = domestic income, Y^* = foreign income, and p = the relative price level (TOT) or real exchange rate.

The terms of trade (TOT) are:

$$p = TOT = \frac{P_M}{P_X} = \frac{S\,P^*}{P} \quad (2)$$

where, p = terms of trade or real exchange rate, P_M = price of imports, P_X = price of exports, S = spot exchange rate ($/€), P = domestic price level, and P^* = foreign price level.

By presenting the natural logarithm of a variable with its lower-case letter ($\ln X_t \equiv x_t$), eq. (2) becomes:

$$p = tot_t = s_t + p_t^* - p_t \quad (3)$$

We will test the J-curve hypothesis by using, first, a regression analysis and a GARCH-M model for the exchange rate fluctuation by writing eq. (1) as follows:

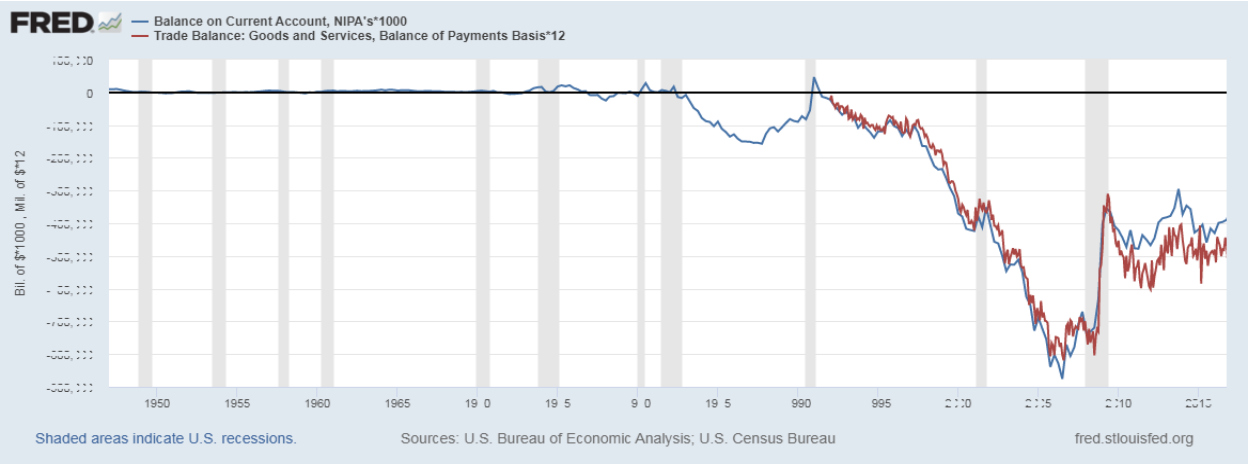
$$TA_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 Y_t^* + \gamma_3 TOT_t + \varepsilon_t \quad (4)$$

Now, by taking the logarithms of the variables (the lower case letters are the ln of the capital counterpart), we have from eqs. (4) and (3) the following eq. (5):

$$ta_t = \delta_0 + \delta_1 y_t + \delta_2 y_t^* + \delta_3 p_t^* - \delta_4 p_t + \delta_5 s_t + \varepsilon_t \quad (5)$$

A Generalized Autoregressive Conditional Heteroscedasticity (GARCH)[4] model can be used, here, to model and forecast the conditional variance of the spot exchange rate. The variance of the dependent variable (ta_t) is modeled as a function of exogenous or predetermined macro-variables (X_t') from both countries and of the conditional variance (σ_t^2) of the (s_t), which are included in the mean eq. (6) and give the GARCH-in-Mean (GARCH-M) model:

$$ta_t = X_t'\theta + \lambda\sigma_t^2 + \varepsilon_t \quad (6)$$



Graph 1. Current Acount and Trade Balance

Note: -----Blue line: Balance of CA (goods and services) and ----- Red line: Trade balance (goods).

Source:https://fredblog.stlouisfed.org/2017/02/demystifying-the-trade-balance/?utm_source=series_page&utm_medium=related_content&utm_term=related_resources&utm_campaign=fredblog

[4] See, Bollerslev (1986).

The GARCH-M (q, p) variance is:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i\,j}^2 \tag{7}$$

We can determine the volatility of the exchange rate (σ_t^2) in eq. (7) if it is statistically significant by using the multivariate GARCH-M model.[5] We can begin with the simplest GARCH (1, 1) specification or a higher order GARCH model, GARCH (q, p) to test the significant of its lagged values on (ta_t), where q is the order of the autoregressive GARCH terms and p is the order of the moving average ARCH terms, eq. (7).

Then, we combine eq. (5) the trade account and eq. (7) the conditional variance or volatility of the spot exchange rate (s_t). This volatility can show the significant effect of past exchange rates movements on our trade account. We care for the periods of time that the spot rate has caused a positive adjustment on the trade balance.

$$ta_t = \zeta_0 + \zeta_1 y_t + \zeta_2 y_t^* + \zeta_3 p_t^* - \zeta_4 p_t + \zeta_5 s_t + \zeta_6 \sigma_{st}^2 + \varepsilon_t \tag{8}$$

or

$$ta_t = \tau_0 + \tau_1 y_t + \tau_2 y_t^* + \tau_3 \left(s_{t-j} + p_{t-j}^* - p_{t-j}\right) + \tau_4 \sigma_{st}^2 + \varepsilon_t \tag{9}$$

Now, eq. (1), domestic exports (x_t) or foreign imports (m_t^*) and domestic imports (m_t) or foreign exports (x_t^*) can be written with the following linear functions:

$$m_t^* \equiv x_t = \alpha_0 + \alpha_1 (s_t + p_t^* - p_t) + \alpha_2 y_t^* + \varepsilon_{1t} \tag{10}$$

$$x_t^* \equiv m_t = \beta_0 - \beta_1 (s_t + p_t^* - p_t) + \beta_2 y_t + \varepsilon_{2t} \tag{11}$$ [6]

If the Marshall-Lerner condition (price elasticity of supply of exports and demand for imports), eq. (12), holds (elastic domestic and foreign demands for imports), a devaluation of the dollar can improve the trade account. Devaluation increases the price of imports and reduces the price of exports; and due to the law of demand, imports are falling and exports are increasing and the trade account is improved. The *Marshall-Lerner condition* holds when,

$$|\beta_1| + |\alpha_1| > 1 \tag{12}$$

In addition, a vector autoregression (VAR) model is used based on exports, eq. (10) and imports, eq. (11) to test the effects of the lagged (tot_{t-j}) on x_t and m_t, which is the following VAR system, eqs. (13):

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[5] See, Engle, Lilien, and Robins (1987). Also, Smith, Soresen, and Wickens (2003).

[6] The empirical results (regressions) are as following for the logarithm of the U.S. imports (m_t) from U.K.,

$$x_t^* \equiv m_t = \underset{(4.939)}{-4.418} - \underset{(0.116)}{0.060}\,(s_t + p_t^* - p_t) + \underset{(0.535)}{1.276^{**}}\, y_t + \underset{(0.004)}{0.996^{***}}\, AR(1) - \underset{(0.30)}{0.643^{***}}\, MA(1)$$

$$R^2 = 0.981,\ SER = 0.110,\ F = 5{,}891.758,\ D-W = 1.875,\ N = 569,\ RMSE = 0.109208$$

and the U.S. exports (x_t) to U.K.,

$$m_t^* \equiv x_t = \underset{(1.564)}{-8.077^{***}} + \underset{(0.138)}{0.122}\,(s_t + p_t^* - p_t) + \underset{(0.124)}{1.268^{***}}\, y_t^* + \underset{(0.030)}{0.904^{***}}\, AR(1) - \underset{(0.067)}{0.421^{***}}\, MA(1)$$

$$R^2 = 0.899,\ SER = 0.097,\ F = 652.166,\ D-W = 1.886,\ N = 372,\ RMSE = 0.096649$$

The empirical results show that the price elasticity of demand for imports has correct sign (-0.060), but it is statistically insignificant. The income elasticity is not very high (+1.276) and statistically significant at 5% level. The price elasticity of supply of exports is (+0.122), but insignificant and the British income elasticity for demand for U.S. exports is (+1.268), statistically significant at 1% level. Thus, the Marshall-Lerner condition, eq. (12), does not hold: $0.060 + 0.122 = 0.182 < 1$ (inelastic demand and supply; thus, a depreciation of the U.S. dollar cannot improve the trade account). Only, it can cause an increase in prices (inflation), due to excess supply of money, as the following correlation and causality statistics show: $\rho_{M2,CPI} = +0.923$, $CPI \Rightarrow M2$ ($F = 11.313^{***}$); $\rho_{m2,cpi} = +0.989$, $cpi \Rightarrow m2$ ($F = 8.436^{***}$); also, $\rho_{MB,CPI} = +0.803$, $CPI \Rightarrow MB$ ($F = 4.181^{**}$); $\rho_{i_{FF},\ CPI} = -0.508$, $i_{FF} \Rightarrow CPI$ ($F = 13.708^{***}$). Thus, the zero federal funds rate since 2008 has caused this enormous inflation (official π = 9.1% in June 2022 and 7.7% in October 2022) in the country; but, (SGS π = 17%) and other independent studies insist that it is over 30%.

$$x_t = \alpha_{10} + \alpha_{11}x_{t-j} + \beta_{11}m_{t-j} + \gamma_{11}y_t + \delta_{11}y_t^* + \zeta_{11}(s_{t-j} + p_{t-j}^* - p_{t-j}) + \varepsilon_t$$
$$m_t = \alpha_{20} + \alpha_{21}x_{t-j} + \beta_{21}m_{t-j} + \gamma_{21}y_t + \delta_{21}y_t^* + \zeta_{21}(s_{t-j} + p_{t-j}^* - p_{t-j}) + \varepsilon_t \quad (13)$$

The interrelated objective variables x_t and m_t of the trade account ($ta_t = x_t - m_t$) are the endogenous variables of the VAR as a function of the lagged values of these two endogenous variables plus the lag tot_{t-j} and the two income (y_t and y_t^*) variables to test the real exchange rate volatility and its effects on trade.

III. Some Empirical Results

The data are monthly and are coming from *Economagic.com*, *Eurostat*, and *Bloomberg*. For the Euro-zone (€), the data are from 2004:12 to 2020:12; for Mexico (MP), they are from 1994:08 to 2021:02; for Canada (C$), they are from 1981:03 to 2020:12; for U.K. (£), the data are from 1990:01 to 2018:05; for Switzerland (SF), the data are from 2001:11 to 2021:02; for Japan (¥), they are from 1990:01 to 2021:02; and lastly, for Australia (A$), the data are from 1986:10 to 2021:02. The variables are U.S. exports to (*usxfc)* and imports from (*usmfc*) these foreign countries, trade accounts (*ustafc*), incomes (y_t and y_t^*), exchange rates (s_t) quoted in American terms ($/FC), price levels ($p_t$ and p_t^*), terms of trades (tot_t), and the exchange rates volatilities (σ_t^2).

We start estimating eq. (9) by using the GARCH-M model of eq. (7). The results appeared in Table 1. We see that the sum of the ARCH and GARCH coefficients (α+β) are very close to one (1) for Mexico, Canada, U.K., Switzerland, Japan, and Australia, indicating that volatility shocks are quite persistent for these countries. The only exception is the Euro-zone. These results are often observed in high frequency financial data. The J-curve hypothesis is that the trade account deteriorates in the S-R and improves in the L-R.[7]

Table 1 shows that a devaluation of the dollar has significant effects in period (tot_{t-3}) by reducing the *ustaeu* and improves it later in (tot_{t-4}). The residual (ARCH) ε_{t-1}^2 has a significant positive effect at the 5% level and the variances (GARCH) are highly positive significant at σ_{t-1}^2 (5% level) and negative at σ_{t-2}^2 (1% level). The devaluation of the dollar has no significant effects on *ustam.* The residual (ARCH) ε_{t-1}^2 and ε_{t-4}^2 have significant positive effects at 1% level and a significant negative effect ε_{t-3}^2 at 1% level; the variance (GARCH) is positive and significant at σ_{t-2}^2 (5% level). Also, a devaluation of the dollar has a positive significant effect on *ustac* at tot_{t-8} (at 1% level). The ARCH has a significant negative effect at ε_{t-2}^2 (at 5% level) and a positive at ε_{t-1}^2 (1% level) and the GARCH a significant negative effect at σ_{t-2}^2 (at 1% level). Then, in σ_{t-3}^2 the effect becomes positive at 1% level. With U.K., a devaluation of the dollar has a significant negative effect on *ustauk* at tot_{t-7} (1% level) and another negative one at tot_{t-9} (at 10% level). The ARCH has positive effect at ε_{t-1}^2 (at 1% level) and the GARCH has a significant negative effect at σ_{t-3}^2 (at 1% level) and two positive effects at σ_{t-1}^2 (10% level) and at σ_{t-2}^2 (5% level).

Now, with respect the *ustasw*, the results are: The devaluation of the dollar has a significant negative effect at tot_{t-8} (at 5% level) and a positive at tot_t (at 5% level). The ARCH has a positive significant effect at ε_{t-1}^2 (at 1% level). The depreciation of the dollar has a significant positive effect on *ustaj* at tot_{t-7} (at 10% level). The ARCH has a significant positive effect at ε_{t-1}^2 (at 1% level) and a GARCH significant negative effect at σ_{t-2}^2 (at 5% level). Lastly, the devaluation of the dollar has a significant negative effect on *ustaa* at tot_{t-8} (at 5% level) and a positive at tot_{t-9} (at 1% level). The ARCH has significant negative effect at ε_{t-2}^2 (at 10% level) and a positive at ε_{t-1}^2 (at 5% level) and at ε_{t-3}^2 (at 10% level). The GARCH has significant negative effect at σ_{t-5}^2 (at 1% level) and positive at σ_{t-1}^2 (at 1% level) and at σ_{t-4}^2 (at 1% level). There are some S-R negative effects and some L-R positive ones that prove the J-curve effect, as Figure 1 shows. The income effects (y_t) is negative, except with Australia and the (y_t^*) is positive except with Japan and Australia.

Further, the long run estimates of the U.S. exports ($usxfc$) and U.S. imports ($usmfc$) from foreign countries, eq. (13), are taking place by using a VAR model and are presented in Tables 2a and 2b. The VAR model is estimated by using lags of terms of trade (tot_{t-j}) up to nine lags (j = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9). The *usxeu* and *usmeu* are positively affected by the U.S. income (y_t) at the 1% level of significant. The devaluation of the dollar increases x_t and m_t at tot_t and reduces imports at tot_{t-1} (at 5% level). The *usxm* and *usmm* have significant positive effects from y_t^* (at 1% level) and *usmm* has a positive effect from y_t (at 10% level). The devaluation of the dollar has significant positive effects on x_t and m_t at tot_{t-1} (1% level) and significant negative effect at tot_{t-2}

[7] The J-curve hypothesis: (M↑ and X↓) => TA↓ (S-R) => (M↓ and X↑) => TA↑ (L-R).

(1% level). The *usxc* and *usmc* have significant positive effects from y_t (at 1% level) and negative from y_t^* (at 5% level and 1% level respectively). The devaluation of the dollar has significant positive effects on x_t and m_t at tot_{t-1} period (at 10% and 5% level respectively). The devaluation of the dollar has negative effects on x_t at tot_{t-2} (at 5% level). The *usxuk* and *usmuk* have significantly been affected by y_t (at 10% and 1% level) and negatively the m_t by y_t^* at 1% level. The devaluation has a positive effect on x_t at tot_t (at 5% level) at tot_{t-3} (at 1% level) and at tot_{t-8} (at 10% level); it has a negative effect at tot_{t-1} (at 1% level) and tot_{t-7} (at 1% level). No significant effects on U.S. m_t from U.K.

The *usxsw* are positively affected and significant by Swiss income y_t^* at 1% level, by tot_t (at 1% level), and negatively by tot_{t-1} (at 1% level). The *usmsw* are positively affected by U.S. income (y_t) at the 10% level and negatively by tot_{t-8} at 1% level. Now, the *usxj* are positively affected by y_t and y_t^* at 1% level. The devaluation of the dollar has positive effects at tot_t (at 1% level) and tot_{t-5} (at 10% level); it has a negative effect at tot_{t-1} (at 10% level). The *usmj* have positive significant effects from y_t and y_t^* (at 1% level). The devaluation of the dollar increases imports at tot_t (at 10% level), at tot_{t-5} (at 5% level) and at tot_{t-9} (at 5% level). The devaluation of the dollar reduces *usmj* at period tot_{t-3} at 5% level. Lastly, the *uuxa* are affected positively by y_t (at 1% level) and negatively by y_t^* (at 10% level). The devaluation of the dollar increases exports to Australia at tot_t period (1% level of significant). The *usma* have a positive significant effect from y_t (at 5% level). The devaluation of the dollar increases imports from Australia at tot_{t-3} (at 5% level) and decreases imports at tot_{t-2} (at 5% level). The results for these seven countries trading with U.S. show that there are some J-curve effects.

The Graphs A1a, A2a, A3a, A4a, A5a, A6a, and A7a, in the Appendix, show the *ustafcf* (U.S. trade forecasting with the seven different foreign countries) and their variances. Graphs A1b, A2b, A3b, A4b, A5b, A6b, and A7b give the responses to Cholesky innovations, where imports are increasing up to 5 months and then, they decline. The exports are declining in the S-R and then, they stay constant (flat lines). Consequently, the J-curve has been tested by examining the pattern of distributed effects of the tot_t (real exchange rate) on exports and imports, which make up the trade account ($ta_t = x_t - m_t$). These coefficients of the lag real exchange rate depreciation (tot) show that the depreciation of the dollar leads to deterioration of trade in the short-run and to an improvement in the trade account after some periods. (Tables 1, 2a, and 2b and the Graphs in the Appendix). These tables are giving some mixed results; but overall, the devaluation of the dollar improves the trade with a delay for all the countries (J-curve) with Euro-zone, Mexico, Canada, U.K., Switzerland, Japan, and Australia.

Table 3 gives the results by testing the stationarity of our variables used in our regression and VAR models, with a unit root test (Augmented Dickey-Fuller test). Some variables are stationary series, I(0); but their difference stationary series are all integrated as I(1) that there is one unit root; except *LSWCPI*, which is I(2), a second order integration (two unit roots). Table 4 reports the Johansen cointegration test of the VAR estimates. Trace and Max-Eigenvalue tests indicate cointegration at the 1% level.

IV. Policy Implications of Trade Balance

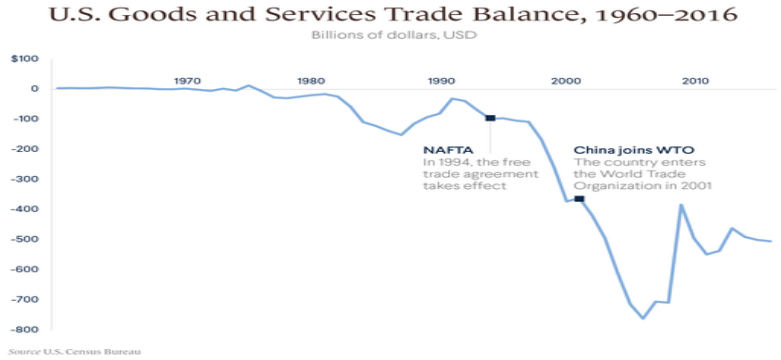
The J-curve hypothesis says that after the depreciation of a currency ($) or increase of the spot exchange rate ($/€), in American terms, the balance of trade worsens in the short-run, but improves in the long-run, (Figure 1). The trade balance ($TA = 0$) is very important for a country and shows its competitiveness, production, employment,[8]

[8] «Μέ τήν ἐργασία φεύγει τὸ ἄγχος, ἡ ἀγωνία, ἡ ἀνία, ἡ κατάθλιψη καί τό κενό τῆς ψυχῆς καί ζεῖ ὁ ἄνθρωπος εὐτυχισμένα, πολιτισμένα καί ἰδανικά, ἀφοῦ μέ τήν ἀμοιβή τῆς ἐργασίας του ἀπολαμβάνει τά ἀγαθά καί γίνεται κοινωνικός καί δημιουργικός.» Παῦλος Ἀθ. Παλούκας.

resources, self-sufficiency, autarky, public policy effectiveness, leadership, independence, etc. The U.S. trade deficit after 1980 is enormous,[9] showing and proving the inefficiency of the public policies and the aggravation of

the structural problems of our economy. Two important events that have contributed to deterioration of the U.S. trade account, Graph 2, were: First, the NAFTA agreement in 1994, signed by President Clinton[10] and second, the

[9] The U.S. trade deficit increased from $676.7 billion in 2020 to $1,076.8 billion in 2021. The trade deficit in January 2022 was $107.571 billion and up to June 2022, it was $647.7 billion. See, "Trade in Goods with World, Seasonally Adjusted", https://www.census.gov/foreign-trade/balance/c0004.html .The U.S. current account the last 60 years is as follows (Graph 2). See, Petros C. Mavroidis, André Sapir, "China and the WTO: An uneasy relationship", April 29, 2021. https://voxeu.org/article/china-and-wto-uneasy-relationship



Graph 2: U.S. Current Account

Note: In 1994, the free trade agreement (NAFTA) takes place and the CA deficit increased. In 2002 China joins the WTO and the CA deficit increased enormously. The current account was in balance until late 1970s and it had the highest deficit during the years 2005-2008. The current account gap in the U.S. widened to $214.8 billion or 3.7% of the GDP in the third quarter of 2021 from an upwardly revised $198.3 billion in the prior period and compared to forecasts of a $205 billion shortfall. It was the largest current account deficit since Q3 2006 as imports surged to a record and companies were trying to fill up inventories. Reduced surplus on services and expanded deficits on secondary income and on goods were partly offset by an expanded surplus on primary income. The services surplus shrank to $49.9 billion from $62.6 billion in Q2, the goods (TA) deficit rose to $274.8 billion in Q3 of 2021from $269.6 billion in Q2 of 2021, it became $291.4 billion in Q2 of 2022, led by imports of industrial supplies and materials, mainly petroleum products and metals and nonmetallic products, and the secondary income shortfall advanced to $38 billion from $30 billion.

In 2021, the U.S. had a $915.0 billion deficit with its top ten trading partners. With China, it was $355.3 billion, with Mexico $108.2 billion, with Vietnam $91 billion, with Germany $70.1 billion, with Japan $60.2 billion, with Ireland $60.2 billion, with Canada $49.5 billion, with Malaysia $41 billion, with Taiwan $40.2 billion, and with Italy $39.3 billion. https://www.thebalance.com/u-s-trade-deficit-causes-effects-trade-partners-3306276

Source: U.S. Bureau of Economic Analysis

and https://tradingeconomics.com/united-states/current-account

Also, Foreign Trade. https://www.census.gov/foreign-trade/balance/c0004.html

Further, See, Foreign Trade. https://www.census.gov/foreign-trade/balance/c0004.html

[10] "NAFTA is over 1,700 pages long--741 pages for the treaty itself, 348 pages for annexes, and 619 pages for footnotes and explanations. It is difficult to see how 1,700 pages of government rules and regulations can free trade. By definition, free trade is the removal of government from the trading process, not its expansion." See, Joe Ogrinc, "The NAFTA Analysis: Not Free Trade", Saturday, May 1, 1993. https://fee.org/articles/the-nafta-analysis-not-free-trade/?gclid=EAIaIQobChMItPzezpCC9QIVArjICh1dPwHqEAAYAiAAEgJEsfD_BwE . Unfortunately, no one from the Senators is reading these long bills or laws; they just vote "Yea" or "Nay" going with the party's will and against their citizens' and voters' will. (*Sic*). Joseph Stiglitz, Clinton's economic advisor, had insisted to the president to avoid to sign the NAFTA agreement because, it will be disastrous for the U.S. economy. But, he signed NAFTA ignoring his advisor's suggestion. The problem is just a leadership problem. Who is controlling these pseudo-leaders? On September 30, 2018, an agreement was reached during re-negotiations on changes to NAFTA. The next day, a re-negotiated version of the agreement was published, and referred to as the United States-Mexico-Canada Agreement (USMCA). In November of 2018, at the G20 summit, the USMCA was signed by President Donald Trump, Canadian Prime Minister Justin Trudeau and then-Mexican President Enrique Peña Nieto. See, Anne Sraders, "What Is NAFTA? History, Purpose and What It Means in 2019". https://www.thestreet.com /politics/nafta-north-american-free-trade-agreement-14651970 . "Since NAFTA was ratified, U.S.-Mexico trade—excluding services and petroleum, which are not addressed by NAFTA—has grown three and a half times faster than U.S. GDP. The United States ran a small trade surplus with Mexico in 1993; today, the U.S.-Mexico trade deficit is America's second largest. If NAFTA were solely responsible for all that trade, it might appear that renegotiating it to obtain more favorable terms for the United States would have big payoffs, and that repealing it might improve the U.S. deficit." See, Russell A. Green and Tony Payan, "WAS NAFTA GOOD FOR THE UNITED STATES?" June 2017.

file:///C:/Users/JK/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.IE5/51F9Y8AK/BI-pub-NAFTA-062317.pdf . See also, Kallianiotis, Niko J. "America in a Trance" Damiani.

https://www.amazon.com/Niko-J-Kallianiotis-America-Trance/dp/8862085958

entrance of China to the World Trade Organization (WTO) on December 11, 2001.[11] Now, China has become the number one producer and net exporter of the world ("everything is Chinese"). This dependence on Chinese products will destroy domestic production, existing industries, employment, incomes, and social welfare in U.S.

and EU, too. The U.S. and the entire world will be very soon in big trouble with Chinese aggression.[12] It is another culture and has nothing in common with the traditional (Christian) West.

The country to recover must satisfy the following equation:

$$Y - E = T - G + S - I = X - M \geq 0 \quad (14)$$

where, Y = GDP or national income, E = expenditures (absorption = C+I+G), T = taxes, G = government spending, S = saving, I = investment, X = exports, and M = imports.

But, $X - M < 0$ because $Y - E < 0$, which shows that the national production is less than the domestic spending. Also, $T - G < 0$ the government budget is in deficit, due to enormous spending, inefficiencies, corruption, wastes, and businesses (corporations) do not pay taxes.[13] Further, $S - I < 0$ because the cost of living is enormous (high inflation) and the real return on savings is negative ($r_D = i_D - \pi^e = 0.05\% - 8.5\% = -8.45\%$); thus savings are declining.[14] Lastly, $X - M < 0$ because the country does not produce the goods needed for domestic consumption, investment, and government spending. The real GDP growth was negative (-1.6%) for the 1st quarter of 2022 and (-0.6%) for the 2nd quarter of 2022.[15] The economy is in a stagflation, (Fedflation and Bidenflation), Figure 2.

The monetary policy has some small significant effects on the value of the dollar and the trade account,[16] but this easy monetary policy since 2008 has caused an enormous inflation and much other harm to people

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[11] On 11 December 2001, China officially joined the WTO. Its achievements since then have been truly remarkable. In 2001, China was the sixth largest exporter of goods in the world (fourth, if the European Union is counted as one unit). Since 2009, it has been the world's largest goods exporter, surpassing even the EU bloc from 2014 onwards. See**, Petros C. Mavroidis, André Sapir, "**China and the WTO: An uneasy relationship**",** April 29, 2021. https://voxeu.org/article/china-and-wto-uneasy-relationship

[12] The neo-pagan ("economic elites") forced the pseudo-leaders to go against Russia, which is a European Christian Orthodox nation, with the highest moral and ethical values in the world. The principal accessory (aider abettor) of the war in Ukraine is the U.S. and NATO. Actually, it is a U.S. war against Russia in the land of poor Ukrainians.

[13] In U.S., 55 companies with pre-tax income $40.482 billion, paid in 2020, zero taxes and received a tax refund of $3.49 billion; thus, their effective tax rate was -8.6%. See, "55 Corporations Paid $0 in Federal Taxes on 2020 Profits". https://itep.org/55-profitable-corporations-zero-corporate-tax/ . So, the budget deficit ($1.986 trillion) and the national debt ($31.281 trillion) are going up daily. The Treasury Secretary, Janet Yellen, said that "deficits do not matter". (*Sic*) or Sick? See, https://www.usdebtclock.org/

[14] See, Personal Saving Rate. https://fred.stlouisfed.org/series/PSAVERT . See, also, Personal saving as a percentage of disposable personal income. https://fred.stlouisfed.org/series/A072RC1Q156SBEA . Further, Gross saving as a percentage of gross national income, https://fred.stlouisfed.org/series/W206RC1Q156SBEA . The U.S. official inflation rate (July 2022) was: $\pi = 8.5\%$ and the SGS inflation was: $\pi = 18\%$. Then, $r_D = -17.95\%$.

[15] See, *BEA*, "Gross Domestic Product", https://www.bea.gov/data/gdp/gross-domestic-product

[16] See, Table A2: Measuring the correlation (ρ) and testing the causality ($\Rightarrow$) between the instruments (i_{FF_t} , MB, and M^s) and the objective variables (TA and e)

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(1) The Previous Zero Interest Rate Regime, ZIRR (2008:12-2015:11):

$\rho_{i_{FF},ta} = -0.358$ $i_{FF} \Rightarrow \neq ta$ and $ta \Rightarrow i_{FF}\,(F = 6.068^{***})$

$\rho_{i_{FF},e} = -0.073$ $i_{FF} \Rightarrow e\,(F = 2.877^{*})$ and $e \Rightarrow \neq i_{FF}$

$\rho_{mb,ta} = +0.663$ $mb \Rightarrow ta\,(F = 2.726^{*})$ and $ta \Rightarrow mb\,(F = 3.747^{**})$

$\rho_{mb,e} = -0.501$ $mb \Rightarrow e\,(F = 4.433^{**})$ and $e \Rightarrow \neq mb$

$\rho_{m,ta} = +0.697$ $m \Rightarrow ta\,(F = 3.371^{**})$ and $ta \Rightarrow m\,(F = 4.519^{**})$

$\rho_{m,e} = -0.625$ $m \Rightarrow e\,(F = 3.416^{**})$ and $e \Rightarrow \neq m$

$\rho_{i_{FF},\pi} = +0.015$ $\pi \Rightarrow i_{FF}\,(F = 2.891^{*})$

$\rho_{i_{FF},p} = -0.614$ $i_{FF} \Rightarrow \neq p$ and $p \Rightarrow i_{FF}\,(F = 4.743^{**})$

$\rho_{mb,p} = +0.973$ $mb \Rightarrow \neq p$ and $p \Rightarrow mb\,(F = 4.617^{**})$

(enormous social cost, bail out cost to taxpayers and bail in cost to depositors),[17] by paying IOR, IONRRP, and forcing a $r_D < 0$. Then, a combination of monetary and trade policy is necessary to increase the terms of trade ($TOT \uparrow = \frac{P_M \uparrow}{P_X \downarrow}$) and improve the TA. This policy can be more effective through a pure trade one, like, a tariff or a quota or anything else that can affect positively the terms of trade and improve the trade account and consequently, competitiveness, production and employment in the country and reduction of outsourcing. The trade among countries must be fair and satisfy the social welfare of the country's citizens.

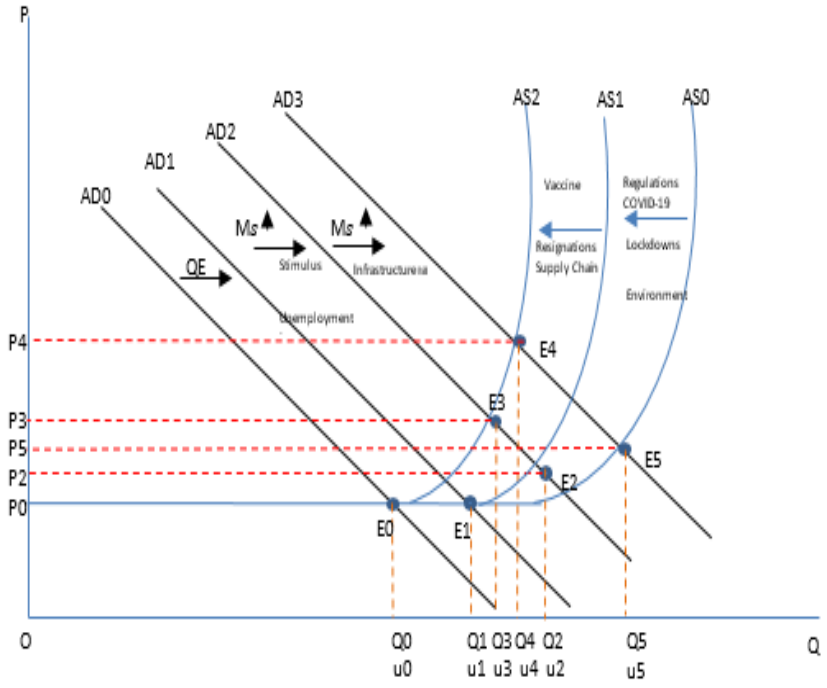

Figure 2 U.S. Current Aggregate Demand and Supply
Note: The quantitative easing (QE) moved the AD_0 to AD_1 from point E_0 to E_1. The continue increases in money supply and the COVID-19 stimulus increase the AD to AD_2 ; Biden's regulations and businesses' lockdowns shifted the AS_0 to AS_1 and the equilibrium output (Q_2) and employment (u_2) to point E_2 . Then, the new money supply and the "infrastructure" bill moved the AD to AD_3 and the vaccine mandates, resignations, layoffs, supply chain problems, "protection of the environment" by going against fossil fuels, etc, pushed the AS_1 to AS_2 and the equilibrium to E_4 , which cause reduction in output (Q_4) and high unemployment (u_4) and at the same time an enormous inflation in P_4 (Stagflation). If the AS had been at AS_0 and the AD at AD_3 , the output would have been to E_5 with the economy almost at full employment and moderate inflation at P_5. Then, moderation is the only solution, but our policy makers do not follow these historic traditions, values and virtues.

The latest expansionary monetary policy (zero interest rate from December 16, 2008 until December 16, 2015, and then again from March 16, 2020 until March 16, 2022: $0.00\% \leq i_{FF} \leq 0.25\%$)[18] and the similar fiscal one with the stimulus money plus the unemployment insurance and the questionable "infrastructure" bill and lately, the "inflation reduction act" have increase aggregate demand (AD). The COVID-19 "innovation", the irrational vaccine mandates, the other inhumane restrictions, the lockdowns, the layoffs and the resignations of people from their jobs because they were unvaccinated, the supply chain problems, the traveling

$\rho_{m,p} = 0.971$ $m \Rightarrow\neq p$ and $p \Rightarrow\neq m (F = 8.994^{***})$

(2) The Current New Regime, NR (2015:12-2020:12):

$\rho_{i_{FF},ta} = +0.111$ $i_{FF} \Rightarrow ta\ (F = 6.286^{***})$ and $ta \Rightarrow\neq i_{FF}$

$\rho_{i_{FF},e} = +0.139$ $i_{FF} \Rightarrow\neq e$ and $e \Rightarrow\neq i_{FF}$

$\rho_{mb,ta} = -0.279$ $mb \Rightarrow\neq ta$ and $ta \Rightarrow\neq mb$

$\rho_{mb,e} = +0.297$ $mb \Rightarrow e (F = 5.393^{***})$ and $e \Rightarrow\neq mb$

$\rho_{m,ta} = -0.314$ $m \Rightarrow ta\ (F = 8.792^{***})$ and $ta \Rightarrow m (F = 3.180^{**})$

$\rho_{m,e} = +0.281$ $m \Rightarrow\neq e$ and $e \Rightarrow\neq m$

$\rho_{i_{FF},\pi} = +0.125$ $\pi \Rightarrow i_{FF}\ (F = 7.570^{***})$

$\rho_{i_{FF},p} = +0.320$ $i_{FF} \Rightarrow p\ (F = 2.929^{*})$ and $p \Rightarrow\neq i_{FF}$

$\rho_{mb,p} = +0.146$ $mb \Rightarrow\neq p$ and $p \Rightarrow\neq mb$

$\rho_{m,p} = +0.871$ $m \Rightarrow\neq p$ and $p \Rightarrow m (F = 5.208^{***})$

Note: i_{FF} = federal funds rate, ta = trade account, e = exchange rate, mb = monetary base, m = money supply, p=ln of price level, π = inflation rate, $\rho_{m,c}$ = correlation coefficients between m and e, $mb \Rightarrow e(F)$) = causality test between mb and e mb causes e and F-statistic in parenthesis), $mb \Rightarrow\neq ta$ = no causality between mb and ta , a lower-case letter (mb) is the logarithm of the capital one (MB), i.e., mb = ln MB.
Source: Kallianiotis (2021a, Table A2, pp. 107-108).

[17] See, Kallianiotis (2022).

[18] See, "Open Market Operations", https://www.federalreserve.gov/monetarypolicy/openmarket.htm

restrictions, the tough regulations, the reduction of use of coal, oil and natural gas in production ("green fraud"), etc. have reduced aggregate supply (AS), Figure 2. Then, U.S. prices

went up (huge inflation)[19] and a reduction in production has increased imports and reduced exports; and consequently, the trade account has deteriorated (TA<0), Graph 2. The Trade Account deficit was $1,076.8 billion in 2021 and up to June 2022, it was $647.7 billion.[20] The enormous money supply (M2 = $22.072 trillion in April 2022 and fell to $21.338 trillion with September 2022)[21] has also generated a very dangerous bubble in the stock market.[22] In March 17, 2022, the Fed started to increase the federal funds target to $0.25\% \leq i_{FF} \leq 0.50\%$ and from November 2, 2022, it became $3.75\% \leq i_{FF} \leq 4.00\%$.[23] But, prices continue to grow. Thus, our public policies are inefficient, ineffective, and anti-social.

The country cannot be dependent on foreign production (Chinese goods), but we have to increase domestic production (agricultural and manufacturing) to satisfy domestic demand and export also these products to other nations. The reduction in oil production will cause serious economic and social problems in U.S., the gasoline prices have increased by 50%. The price of fertilizers is skyrocketing and together with the price of fuel, gas, the cost of agricultural products continues to go up, which increases their prices. The uncontrolled outsourcing, the unfair trade, the oligopolist high tech censorship and propaganda, the corruption of our politicians and institutions, and the anti-social globalization have destroyed the country's social welfare, its independence, its freedoms, its value system, its national income, and its citizens' wellbeing. The risk of the stock market bubble has to be controlled. Monetary policy must increase the federal funds rate to reduce inflation and make American products less expensive domestically and for our exports. Real interest rate must be positive ($r > 0$)[24] and the growth in the stock market enough to cover only the historic risk premium ($HRP = 8.9\%$). A 36% growth in the financial market is just a dangerous deception to the poor citizens (investors), who will lose their wealth and their retirement income (IRA).

V. Concluding Remarks

[19] The official inflation was 9.1% (June 2022), the SGS inflation was 18%, but the average consumer's inflation (cost of living) exceeds 30%. See, https://tradingeconomics.com/united-states/inflation-cpi. See also, http://www.shadowstats. com/alternate_ data/inflation-charts

[20] See, "Foreign Trade", https://www.census.gov/foreign-trade/balance/c0004.html . See also, https://www.bea.gov/news/2022 /us-international-trade-goods-and-services-january-2022 . Also, https://tradingeconomics.com/united-states/balance-of-trade . Further,https://tcf.org/content/report/true-state-u-s-economy/?gclid=EAIaIQobChMIxLTQ3tL49gIVpQiICR0Teg9nEAA YBCAAEgK61fD_BwE

[21] See, https://fred.stlouisfed.org/series/WM2NS.

[22] The money supply (M2) was in March 2009: $8,438.3 billion and in March 2022: $21,768.8 billion, a small reduction; in January 2022 it was $21,844.7 billion, an annual growth of 12.12%, and continues to grow; in April 2022 reached $22,072.1 billion and in October 2022 fell to $21,409.7 billion. See, https://fred.stlouisfed.org/series/WM2NS

The DJIA was on 3/9/2009: 6,547.05 and on 1/4/2022 reached 36,799.65 a growth of 36.242% p.a. This enormous liquidity was not necessary and it causes this colossal bubble in the stock market, which will burst and will generate a new global crisis even worse than the coronavirus one. See, *Macrotrends.* https://www.macrotrends.net/1319/dow-jones-100-year-historical-chart . The bubble has started losing air with the Ukrainian crisis that we have created. The DJIA from 36,799.65 (1/4/2022) has fallen to 28,725.51 (9/30/2022), a decline by 8,074.14 points or -21.941%.

[23] See, https://fred.stlouisfed.org/series/DFEDTARU

[24] The Fisher equation gives: $i = r + \pi^e$, where r = 0.5%, π^e = 8.5%; then, an i = 9% is fair for the entire economy and it can reduce the bubble in the financial market. Kallianiotis (2019b) rule is an expansion of Taylor's rule by using an extra term, the growth of the financial market (g_{DJIA_t}), as follows:

$$\bar{i}_{FF_t} = \pi_t + r_t^* + \alpha_\pi(\pi_t - \pi_t^*) - \alpha_u(u_t - u_t^N) + \alpha_{DJIA}(g_{DJIA_t} - g^*_{DJIA_t})$$

where, g_{DJIA_t} = the actual growth of the DJIA index, $g^*_{DJIA_t}$ = the optimal (the bubble prevention) growth of the DJIA ($g^*_{DJIA_t} \leq 7\% \cong i_{10YTB} + 5\% \quad or\ HRP \cong 8.7\%$), and $\alpha_\pi = 0.25, \quad \alpha_u = -0.50, \quad \alpha_{DJIA} = 0.25.$

Kallianiotis rule with June 2021 gives: (1) With official data, the target federal funds rate ($\bar{i}_{FF}$) must have been:

$i_{FF} = 5.4\% + 1\% + 0.25(5.4\% - 2\%) - 0.50(5.9\% - 4\%) + 0.25\,(18.22\% - 8.7\%) = 8.68\%$, but it was close to zero.

(2) With SGS data, the $\bar{i}_{FF}$ should have been:

$i_{FF} = 13\% + 1\% + 0.25(13\% - 2\%) - 0.50(25.8\% - 4\%) + 0.25\,(18.22\% - 8.7\%) = 8.23\%$

(3)With February 2022, $\bar{i}_{FF}$ = 7.5%+1%+0.25 (7.5%-2%)-0.50 (4%-4%)+0.25 (18.73%-8.7%) = 12.383% (with official data) and with SGS data (u=24.5%), $\bar{i}_{FF}$ = 2.075% and it was very low, $0.00 \leq \bar{\imath}_{FF} \leq 0.25\%$.

The current paper examines the short-run (up to nine months) relationship between the trade account and changes in real exchange rates (TOT) of seven countries with respect the U.S. dollar ($/FC). It was found that real exchange rate changes have a significant impact on the U.S. trade balance. The empirical results show that there exists a long-run relationship between the trade account (TA) and the income (domestic, Y and foreign, Y^*), the terms of

trade (TOT), and volatility of the exchange rate, the residual ε^2 (ARCH) and the variance σ^2 (GARCH) have a significant effect on the TAs, Table 1. The VAR estimations give similar results of the same independent variables on exports (X) and imports (M) between the U.S. and the other seven countries (Euro-zone, Mexico, Canada, U.K., Switzerland, Japan, and Australia), Tables 2a and 2b. A unit root and a cointegration test are given in Tables 3 and 4, too.

The results of this analysis could be relevant regarding the impact of exchange rate changes on trade account (mostly, U.S. trade deficits). While the short-run effects of changes in the exchange rate on the balance of trade of a county may be perverse (J-curve), in the long-run the impact of exchange rate changes on trade volumes are expected to be sufficiently large, so a depreciation of the domestic currency will improve the country's trade account. Number of factors may explain the persistence of the J-curve effect. In the short-run, a combination of price and volume effects, following a currency depreciation may increase a country's spending on imports by more than it increases its export earnings, thus accounting for the observed J-curve effect; then a devaluation will likely result in an initial deterioration of the trade balance. Furthermore, differences in the degree of the restrictiveness of devaluing countries trade regimes also may affect the duration of the J-curve effect. The graphs in the Appendix support our argument of existing J-curves between the U.S. and the seven partners in trade countries.

Finally, as far as policy implications are concerned, it is important for the country to use public policies (monetary, fiscal, and trade) to improve the domestic economy and the social welfare of its citizens. The economy has some structural problems and must be considered as soon as possible, otherwise the country will lose completely its competitiveness, as it has already lost its manufacturing output and the agricultural one follows, compared with China.[25] The liberal views of globalization, the new monetary and fiscal policies, which have caused inflation and high risk, the "protection" of the environment by going against fossil furls, and the disregard of people, and of "nothing matters" are going to lead the country to a permanent negative trend. The trade must be fair among the nations and in favor of the domestic economy and not "the allies first" policy that the U.S. is using since 1980. It seems (it is obvious by now) that there is a serious political ("leadership") problem in the western "democracies" the last fifty years.

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[25] See, Mark J. Perry, "Chart of the day: China is now world's No. 1 manufacturer". https://www.aei.org/carpe-diem/chart-of-the-day-china-is-now-worlds-no-1-manufacturer/

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Variables	$ustaeu$	$ustam$	$ustac$	$ustauk$	$ustasw$	$ustaj$	$ustaa$
C	-0.487	-11.400***	5.298***	-6.293***	22.683***	3.122**	-1.742***
	(0.934)	(0.430)	(0.198)	(0.684)	(1.135)	(1.220)	(0.609)
y_t	-0.065	-2.416***	-0.753***	-1.293***	-4.194***	0.062	1.041***
	(0.107)	(0.074)	(0.030)	(0.117)	(0.346	(0.040)	(0.144)
y_t^*	0.110***	2.279***	0.249***	1.447***	1.834***	-0.313***	-0.525***
	(0.037)	(0.073)	(0.014)	(0.118)	(0.291)	(0.082)	(0.068)
tot_t	-	0.002	-	0.668***	0.970**	-	0.744**
		(0.064)		(0.197)	(0.409)		(0.295)
tot_{t-1}	-	-0.223	-	-0.758***	-0.597	-	-0.351
		(0.104)		(0.104)	(0.410)		(0.324)
tot_{t-2}	0.540***	0.174	-	-	-	-0.272	-
	(0.071)	(0.120)				(0.215)	
tot_{t-3}	-0.375**	0.014	-	0.306	-	0.279	-
	(0.179)	(0.151)		(0.274)		(0.253)	
tot_{t-4}	0.198*	-0.045	-	-	-	-	-
	(0.119)	(0.158)					
tot_{t-5}	-	0.026	-	0.732*	-	-0.307	-
		(0.141)		(0.387)		(0.230)	
tot_{t-6}	-	0.126	-	-0.847**	-	0.344*	-
		(0.129)		(0.388)		(0.207)	
tot_{t-7}	-	-0.191	-	0.574	-0.328**	-	-0.226**
		(0.125)		(0.475)	(0.137)		(0.103)
tot_{t-8}	-	0.075	0.249***	-0.604*	-	-	0.581***
		(0.104)	(0.020)	(0.345)			(0.108)
tot_{t-9}	-	0.062	-	-	-	-	-
		(0.076)					
			Variance Equation				
C	0.006***	0.001	0.001**	0.003	0.010	0.004**	0.003
	(0.001)	(0.001)	(0.001)	(0.005)	(0.007)	(0.002)	(0.002)
ε_{t-1}^2	0.204**	0.503***	0.461***	0.398***	0.667***	0.397***	0.259**
	(0.100)	(0.136)	(0.112)	(0.116)	(0.157)	(0.120)	(0.109)
ε_{t-2}^2	0.064	-0.373	-0.414**	-0.193	-0.058	-0.053	-0.286*
	(0.140)	(0.311)	(0.182)	(0.172)	(0.389)	(0.239)	(0.159)
ε_{t-3}^2	-	-0.379***	0.201	-0.047	0.218	-	0.295*
		(0.187)	(0.145)	(0.207)	(0.449)		(0.161)
ε_{t-4}^2	-	0.333***	-	-	-	-	-0.029
		(0.176)					(0.157)
ε_{t-5}^2	-	-	-	-	-	-	-0.046
							(0.109)
σ_{t-1}^2	0.553**	0.673	1.111***	0.534*	-0.016	0.525	1.013***
	(0.227)	(0.604)	(0.226)	(0.296)	(0.551)	(0.393)	(0.266)
σ_{t-2}^2	-0.674***	0.734**	-0.772***	0.600**	-0.269	-0.192**	-0.316
	(0.152)	(0.347)	(0.296)	(0.255)	(0.595)	(0.086)	(0.269)
σ_{t-3}^2	-	-0.430	0.378***	-0.407***	0.151	-	-0.171
		(0.387)	(0.124)	(0.148)	(0.167)		(0.244)

Appendix

σ_{t-4}^2	-	-0.108 (0.193)	-	-	-	-	0.625*** (0.240)
σ_{t-5}^2	-	-	-	-	-	-	-0.412*** (0.109)
R^2	0.409	0.607	0.565	0.064	0.469	0.006	0.121
SER	0.081	0.056	0.082	0.181	0.233	0.124	0.225
$D-W$	1.106	0.889	0.614	0.641	0.487	0.586	0.730
N	193	319	478	341	224	367	404
$RMSE$	0.079504	0.054466	0.081895	0.178658	0.229648	0.122846	0.223410

Table 1: Estimation of Eq. (9) with the use of GARCH-M Model, Eq. (7): Trade Account and Real Exchange Rate

Note: $ustaeu$ = ln of U.S. Trade Account with EU, $ustam$ = ln of U.S. Trade Account with Mexico, $ustac$ = ln of U.S. Trade Account with Canada, $ustauk$ = ln of U.S. Trade Account with U.K., $ustasw$ = ln of U.S. Trade Account with Switzerland, , $ustaj$ = ln of U.S. Trade Account with Japan, , $ustaa$ = U.S. Trade Account with Australia, y_t= ln of U.S. Income (GDP), y_t^*= ln of foreign Income (GDP), tot_t= ln of Terms of Trade (Real Exchange Rate), ε_{t-j}^2 = lag of Residual (ARCH), σ_{t-j}^2= lag of Variance (GARCH), R^2 = R-squared, SER = S.E. of regression, $D-W$ = Durbin-Watson statistic, F = F statistic, N = number of observations, $RMSE$ = Root Mean Squared Error, *** significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level. Source: *Economagic.com*, *Bloomberg*, and *Eurostat.*

Variables	$usxeu$	$usmeu$	$usxm$	$usmm$	$usxc$	$usmc$	$usxuk$	$usmuk$
$usxfc_{t-1}$	0.375***	0.077	0.139	-0.284***	0.450***	0.023	0.594***	0.121**
	(0.084)	(0.092)	(0.110)	(0.119)	(0.079)	(0.068)	(0.056)	(0.059)
$usxfc_{t-2}$	0.078	0.314***	0.344***	0.241**	0.005	-0.125*	0.142**	0.057
	(0.088)	(0.096)	(0.116)	(0.125)	(0.085)	(0.073)	(0.063)	(0.067)
$usxfc_{t-3}$	0.031	-0508***	0.218**	-0.052	0.114	-0.085	0.063	-0.156***
	(0.079)	(0.086)	(0.106)	(0.114)	(0.077)	(0.066)	(0.055)	(0.059)
$usmfc_{t-1}$	-0.191***	0.285***	0.343***	0.748***	0.194**	0.542***	0.005	0.439***
	(0.069)	(0.076)	(0.101)	(0.109)	(0.091)	(0.079)	(0.051)	(0.055)
$usmfc_{t-2}$	-0.080	-0.096	-0.243***	-0.185	-0.026	0.197***	-0.191***	0.120**
	(0.076)	(0.083)	(0.112)	(0.121)	(0.097)	(0.083)	(0.056)	(0.059)
$usmfc_{t-3}$	0.128**	0.442***	-0.072	0.110	-0.083	0.181***	0.148***	0.217***
	(0.070)	(0.077)	(0.098)	(0.105)	(0.091)	(0.078)	(0.051)	(0.055)
C	-14.070***	-9.182***	-10.348***	-11.930***	-2.898***	-2.871***	0.178	2.142**
	(1.973)	(2.154)	(2.011)	(2.164)	(0.680)	(0.585)	(0.970)	(1.032)
y_t	2.151***	1.462***	-0.250	0.508*	0.696***	0.625***	0.410*	0.743***
	(0.280)	(0.306)	(0.268)	(0.289)	(0.130)	(0.112)	(0.229)	(0.244)
y_t^*	-0.015	-0.006	1.023***	0.759***	-0.054**	-0.070***	-0.168	-0.590***
	(0.036)	(0.040)	(0.271)	(0.292)	(0.027)	(0.023)	(0.221)	(0.236)
tot_t	0.273*	0.382**	0.096	0.009	-0.176	-0.180	0.444**	-0.212
	(0.173)	(0.189)	(0.116)	(0.125)	(0.211)	(0.181)	(0.215)	(0.229)
tot_{t-1}	-0.122	-0.500**	0.493***	0.646***	0.565*	0.548**	-0.790***	-0.092
	(0.246)	(0.269)	(0.178)	(0.192)	(0.308)	(0.265)	(0.334)	(0.355)
tot_{t-2}	0.197	0.050	-0.480***	-0.710***	-0.586**	-0.383	-0.366	0.083
	(0.246)	(0.268)	(0.184)	(0.198)	(0.310)	(0.267)	(0.336)	(0.357)
tot_{t-3}	-0.016	0.447*	0.197	0.212	0.126	0.163	1.018***	0.208
	(0.244)	(0.267)	(0.187)	(0.201)	(0.311)	(0.267)	(0.332)	(0.353)
tot_{t-4}	-0.223	-0.364	-0.145	0.039	0.289	0.137	-0.403	0.085
	(0.244)	(0.267)	(0.186)	(0.200)	(0.309)	(0.266)	(0.335)	(0.357)
tot_{t-5}	0.432*	0.063	-0.210	-0.259	-0.448	-0.307	0.204	-0.185
	(0.245)	(0.267)	(0.181)	(0.195)	(0.308)	(0.265)	(0.338)	(0.356)
tot_{t-6}	-0.178	0.266	0.376**	0.303	0.239	0.020	0.294	0.243
	(0.248)	(0.271)	(0.180)	(0.194)	(0.309)	(0.266)	(0.330)	(0.351)
tot_{t-7}	0.127	0.124	-0.317*	-0.068	0.003	0.018	-0.844***	-0.183
	(0.250)	(0.273)	(0.181)	(0.195)	(0.309)	(0.266)	(0.326)	(0.347)
tot_{t-8}	0.017	-0.096	0.107	-0.044	-0.088	0.002	0.551*	0.030
	(0.249)	(0.272)	(0.181)	(0.195)	(0.308)	(0.265)	(0.325)	(0.346)
tot_{t-9}	0.007	-0.154	-0.065	-0.026	0.162	0.015	-0.210	-0.041
	(0.178)	(0.194)	(0.118)	(0.128)	(0.211)	(0.181)	(0.211)	(0.224)
R^2	0.860	0.897	0.982	0.980	0.972	0.985	0.904	0.889
SEE	0.060	0.066	0.070	0.076	0.093	0.080	0.092	0.097
F	58.178	82.413	896.547	823.612	896.769	1644.213	169.298	143.474
N	190	190	319	319	478	478	341	341

Table 2a VAR Estimates of Eq. (13): Effects of Terms of Trade on Exports and Imports

Note: See, Table 1. $usxeu$ = ln of U.S. exports to EU, $usmeu$ = ln of U.S. imports from EU, $usxfc$ = ln of U.S. exports to foreign country, $usmfc$ = ln of U.S. imports from foreign country, SEE = S.E. of equation. Source: See, Table 1.

Variables	$usxsw$	$usmsw$	$usxj$	$usmj$	$usxa$	$usma$
$usxfc_{t-1}$	0.855***	0.372	0.244***	-0.136**	0.285***	0.085
	(0.070)	(0.337)	(0.058)	(0.065)	(0.050)	(0.066)
$usxfc_{t-2}$	0.013	-0.505	0.394***	-0.064	0.138***	-0.104*
	(0.093)	(0.447)	(0.056)	(0.062)	(0.051)	(0.068)
$usxfc_{t-3}$	-0.119*	0.432	0.113**	0.027	0.274***	-0.066
	(0.070)	(0.336)	(0.058)	(0.065)	(0.049)	(0.065)
$usmfc_{t-1}$	-0.118	0.593***	0.069	0.580***	-0.103***	0.402***
	(0.014)	(0.070)	(0.052)	(0.058)	(0.038)	(0.051)
$usmfc_{t-2}$	0.013	0.159**	-0.200***	-0.085	0.060	0.096*
	(0.017)	(0.080)	(0.058)	(0.064)	(0.042)	(0.056)
$usmfc_{t-3}$	-0.007	0.039	0.146***	0.255***	-0.062*	0.198***
	(0.015)	(0.072)	(0.050)	(0.056)	(0.039)	(0.052)
C	-4.497***	-3.888***	-4.339***	-7.824***	-3.379***	-3.090***
	(0.898)	(4.331)	(1.645)	(1.827)	(0.865)	(1.149)
y_t	0.093	0.905*	0.153***	0.224***	0.886***	0.607**
	(0.097)	(0.469)	(0.041)	(0.046)	(0.219)	(0.291)
y_t^*	0.568***	-0.580	0.447***	0.822***	-0.148*	-0.001
	(0.134)	(0.646)	(0.145)	(0.161)	(0.087)	(0.116)
tot_t	0.986***	-0.178	0.653***	0.320*	0.710***	-0.040
	(0.095)	(0.460)	(0.159)	(0.178)	(0.218)	(0.290)
tot_{t-1}	-0.883***	0.369	-0.413*	-0.099	-0.335	0.262
	(0.159)	(0.767)	(0.256)	(0.285)	(0.358)	(0.475)
tot_{t-2}	0.225	0.364	-0.257	0.186	-0.277	-0.922**
	(0.172)	(0.830)	(0.257)	(0.286)	(0.369)	(0.491)
tot_{t-3}	0.019	-1.009	0.010	-0.567**	0.120	1.020**
	(0.158)	(0.761)	(0.257)	(0.286)	(0.371)	(0.492)
tot_{t-4}	0.025	0.679	-0.103	0.031	-0.013	-0.298
	(0.137)	(0.662)	(0.253)	(0.282)	(0.372)	(0.494)
tot_{t-5}	0.068	0.102	0.427*	0.551**	0.428	0.233
	(0.136)	(0.655)	(0.252)	(0.280)	(0.372)	(0.494)
tot_{t-6}	-0.066	-0.818	-0.230	-0.225	-0.457	0.049
	(0.136)	(0.653)	(0.253)	(0.281)	(0.370)	(0.491)
tot_{t-7}	-0.107	0.691	0.090	-0.065	0.026	-0.026
	(0.137)	(0.660)	(0.253)	(0.281)	(0.368)	(0.488)
tot_{t-8}	0.082	-1.032*	-0.225	-0.232	0.055	0.290
	(0.137)	(0.659)	(0.250)	(0.277)	(0.355)	(0.471)
tot_{t-9}	-0.016	0.578	0.233	0.349**	0.060	-0.363
	(0.092)	(0.442)	(0.156)	(0.173)	(0.217)	(0.288)
R^2	0.993	0.936	0.755	0.728	0.930	0.895
SEE	0.030	0.144	0.070	0.078	0.107	0.143
F	1,728.493	166.034	59.269	51.543	285.422	182.242
N	223	223	365	365	404	404

Table 2b: VAR Estimates of Eq. (13): Effects of Terms of Trade on Exports and Imports

Note: See, Tables 1 and 2a. $usxsw$ = ln of U.S. exports to Switzerland, $usmsw$ = ln of U.S. imports from Switzerland, $usxj$ = ln of U.S. exports to Japan, , $usmj$ = ln of U.S. imports from Japan, $usxa$ = ln of U.S. exports to Australia, $usma$ = ln of U.S. imports from Australia. Source: See, Table 1.

Variables	Level (y), I(0)	1st Difference [Δ(y)], I(1)	2nd Difference [Δ^2(y)], I(2)
LUSXEU	-3.162041**		
LUSMEU	-0.792457	-3.978001***	
USTAEU	-0.368738	-6.092984***	
LUSRGDP	-1.640910	-8.998455***	
LEUGDP	-1.179551	-19.40762***	
LEUHICP	-1.904826	-17.22646***	
LUSCPI	-6.418572***		
LEUS	-1.777332	-13.57573***	
TOTEU	-1.080653	-14.11127***	
LUSXM	-2.322441	-6.206835***	
LUSMM	-1.768286	-7.132625***	
USTAM	-2.435575	-23.69309***	
LMGDP	-1.433629	-18.77435***	
LMCPI	-2.780290*		
LMS	-3.344312**		
TOTM	-2.419574	-12.25298***	
LUSXC	-1.946904	-5.867487***	
LUSMC	-2.684839*		
USTAC	-1.590967	-8.307771***	
LCGDP	0.014997	-22.15808***	
LCCPI	-5.805180***		
LCS1	-2.001353	-20.55438***	
TOTC	-0.909630	-22.28565***	
LUSXUK	-2.243627	-5.865940***	
LUSMUK	-3.555911***		
USTAUK	-3.150286**		
LUKGDP	-0.193334	-19.70102***	
LUKCPI	-4.177993***		
LUKS	-2.595632*		
TOTUK	-2.768019*		
LUSXSW1	-0.473440	-21.59019***	
LUSMSW	-0.067195	-8.564824***	
USTASW	-0.052968	-8.949051***	
LSWGDP	-2.553187	-4.847784***	
LSWCPI	-1.973128	-2.481234	-15.55943***
LSWS1	-2.461943	-18.79962***	
TOTSW	-2.867018*		
LUSXJ	-2.472834	-6.908138***	
LUSMJ	-4.129341***		
USTAJ	-3.926427***		
LJGDP1	-4.526552***		
LJCPI	-4.305581***		
LJS1	-2.137365	-17.69212***	
TOTJ	-1.499921	-14.12346***	
LUSXA	-2.791847*		
LUSMA	-1.653819	-13.85459***	
USTAA	-5.031164***		
LAGDP	-3.569385***		
LACPI	-1.853885	-4.057147***	
LAS	-1950877	-17.77384***	
TOTA	-2.239219	-13.78797***	

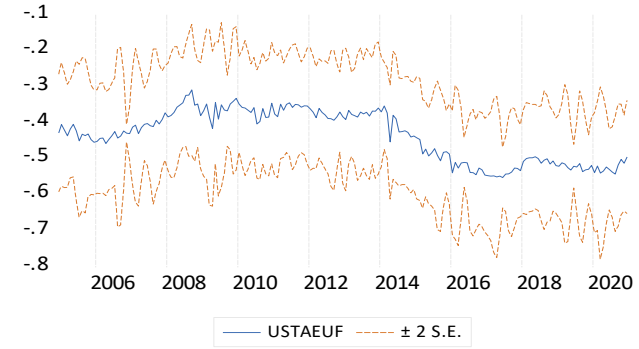
Table 3: Unit Root Tests Augmented Dickey-Fuller

Note: See Tables 1, 2a, and 2b. Source: See, Table 1.

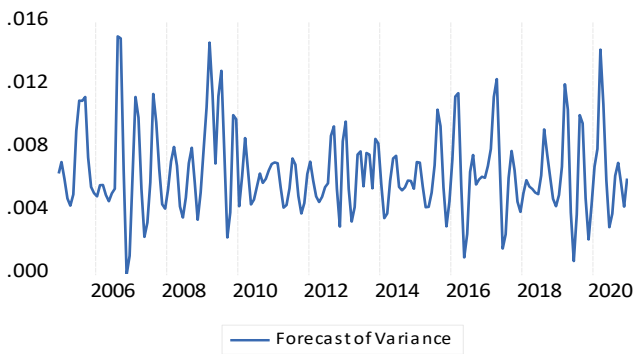
Hypothesized No. of CEs	Eigenvalue	Trace Statistic	5% Critical Value	Maximum Eigenvalue	Max-Eig Statistic	5% Critical Value
Series: LUSXEU and LUSMEU						
$r \leq 0$	0.265	66.682	15.495	0.265	57.936	14.265
$r \leq 1$	0.045	8.746	3.841	0.045	8.746	3.841
Series: LUSXM and LUSMM						
$r \leq 0$	0.210	98.721	15.495	0.210	75.391	14.265
$r \leq 1$	0.071	23.330	3.841	0.071	23.330	3.841
Series: LUSXC and LUSMC						
$r \leq 0$	0.124	83.541	15.495	0.124	63.315	14.265
$r \leq 1$	0.041	20.226	3.841	0.041	20.226	3.841
Series: LUSXUK and LUSMUK						
$r \leq 0$	0.076	48.669	15.495	0.076	26.932	14.265
$r \leq 1$	0.062	21.738	3.841	0.062	21.738	3.841
Series: LUSXSW1 and LUSMSW						
$r \leq 0$	0.139	48.938	15.495	0.139	33.245	14.265
$r \leq 1$	0.068	15.694	3.841	0.068	15.694	3.841
Series: LUSXJ and LUSMJ						
$r \leq 0$	0.127	72.793	15.495	0.127	49.465	14.265
$r \leq 1$	0.062	23.328	3.841	0.062	23.328	3.841
Series: LUSXA and LUSMA						
$r \leq 0$	0.114	72.273	15.495	0.114	48.853	14.265
$r \leq 1$	0.056	23.420	3.841	0.056	23.420	3.841

Table 4: Johansen Cointegration Test for the VAR Estimates of Eq. (13): Effects of Terms of Trade on Exports and Imports

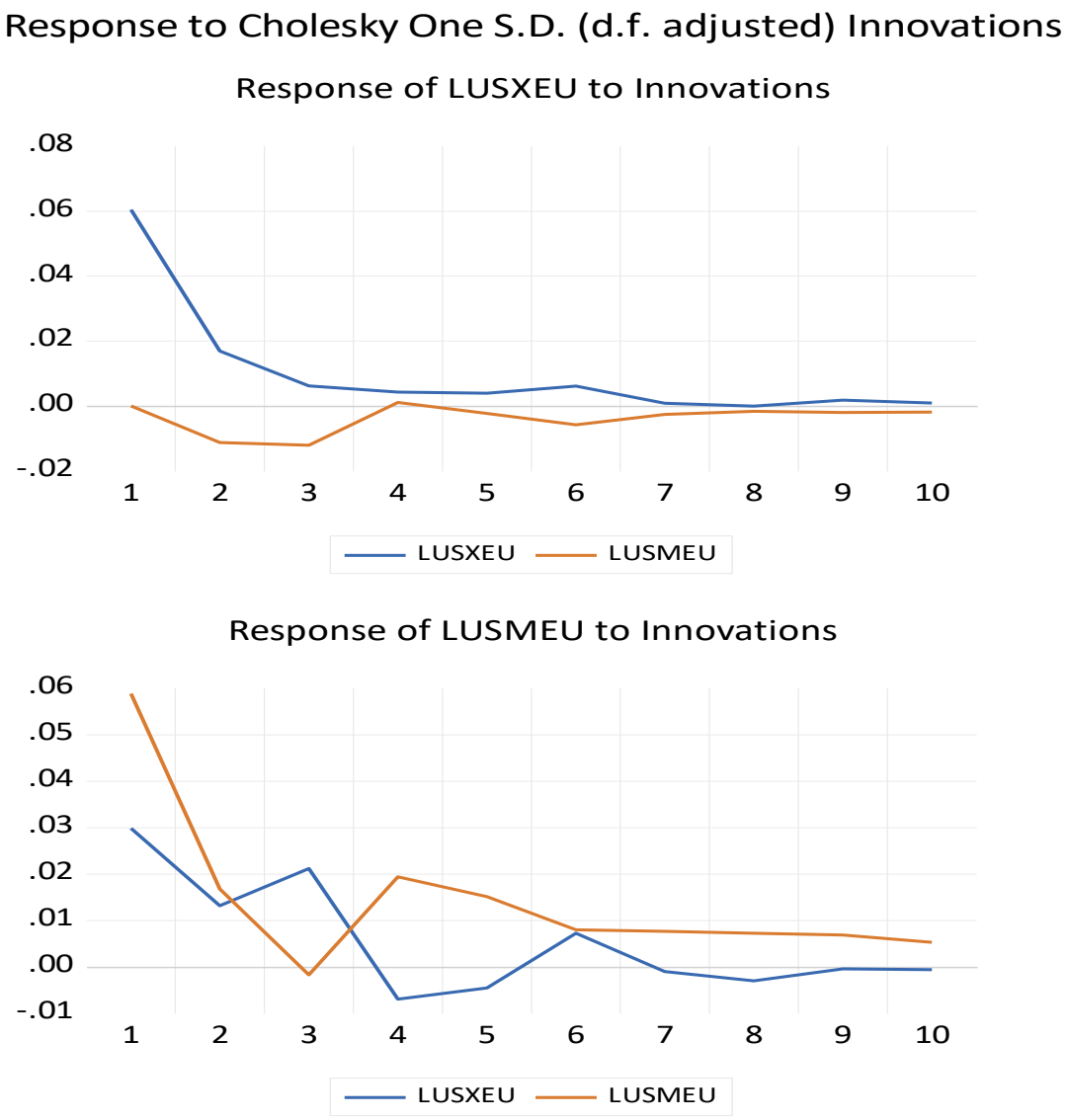
Note: Trace tests indicate 2 cointegrating eigenvalues at the 1% level. Max-Eigenvalue tests indicate 2 cointegrating eigenvalues at the 1% level. Source: See, Table 1.



Forecast: USTAEUF	
Actual: USTAEU	
Forecast sample: 1970M01 2021M12	
Adjusted sample: 2004M12 2020M12	
Included observations: 193	
Root Mean Squared Error	0.079504
Mean Absolute Error	0.063818
Mean Abs. Percent Error	16.66371
Theil Inequality Coef.	0.089520
Bias Proportion	0.000042
Variance Proportion	0.182043
Covariance Proportion	0.817915
Theil U2 Coefficient	0.959980
Symmetric MAPE	15.44461

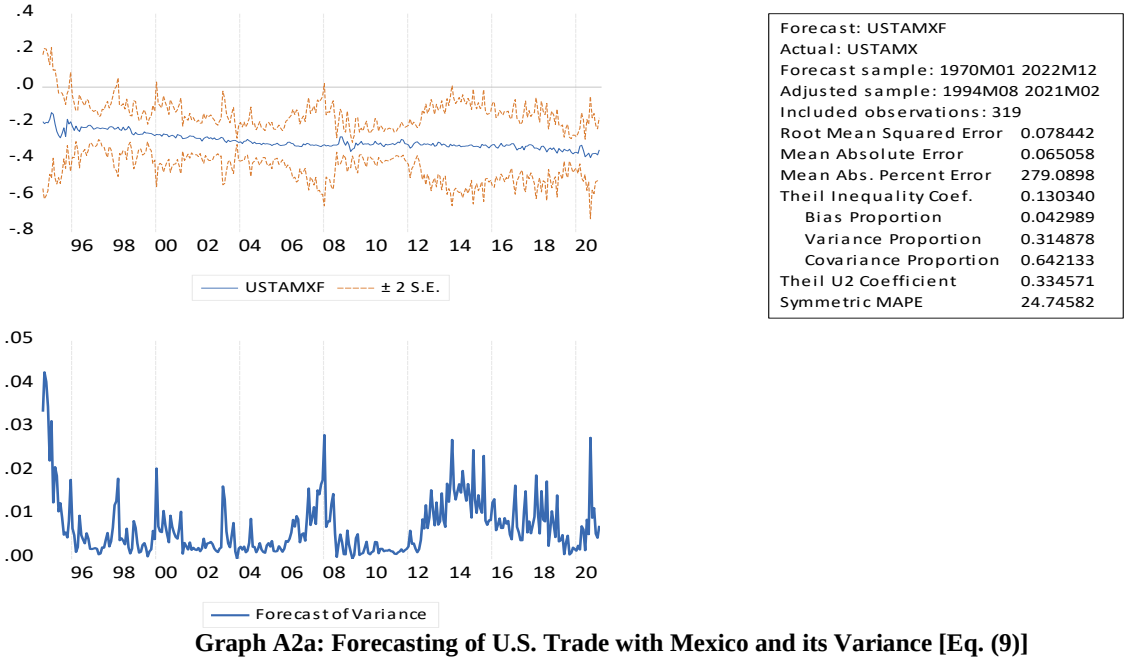


Graph A1a: Forecasting of U.S. Trade with EU and its Variance [Eq. (9)]



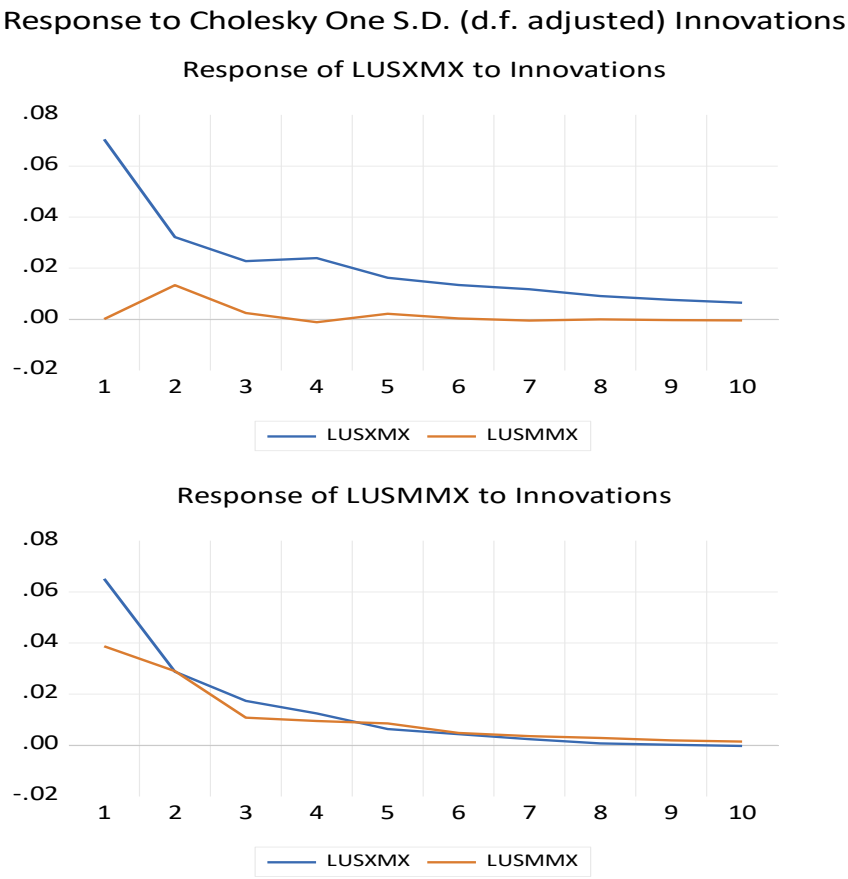
Graph A1b: Response of Trade with EU to Cholesky Innovations Eq. (13)

Note: Imports are increasing until the 4th month and exports are falling; then, TA↓↓ in the S-R and it improved TA↑ after the 5th month.



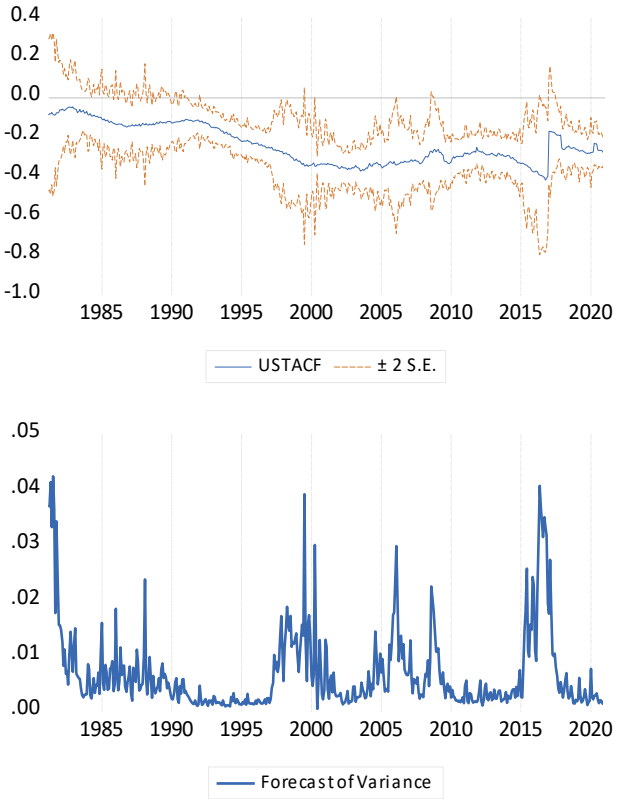
Forecast: USTAMXF	
Actual: USTAMX	
Forecast sample: 1970M01 2022M12	
Adjusted sample: 1994M08 2021M02	
Included observations: 319	
Root Mean Squared Error	0.078442
Mean Absolute Error	0.065058
Mean Abs. Percent Error	279.0898
Theil Inequality Coef.	0.130340
Bias Proportion	0.042989
Variance Proportion	0.314878
Covariance Proportion	0.642133
Theil U2 Coefficient	0.334571
Symmetric MAPE	24.74582

Graph A2a: Forecasting of U.S. Trade with Mexico and its Variance [Eq. (9)]



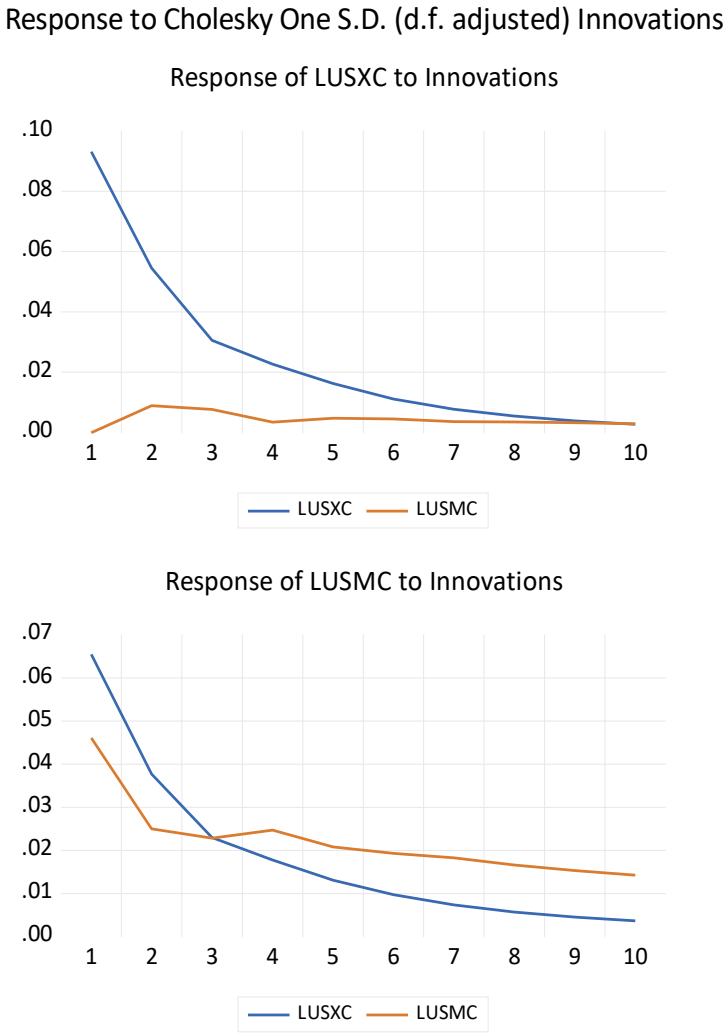
Graph A2b: Response of Trade with Mexico to Cholesky Innovations Eq. (13)

Note: Imports are increasing until the 2th month and exports are falling; then, TA↓↓ in the S-R and it improved TA↑ after the 4th month.



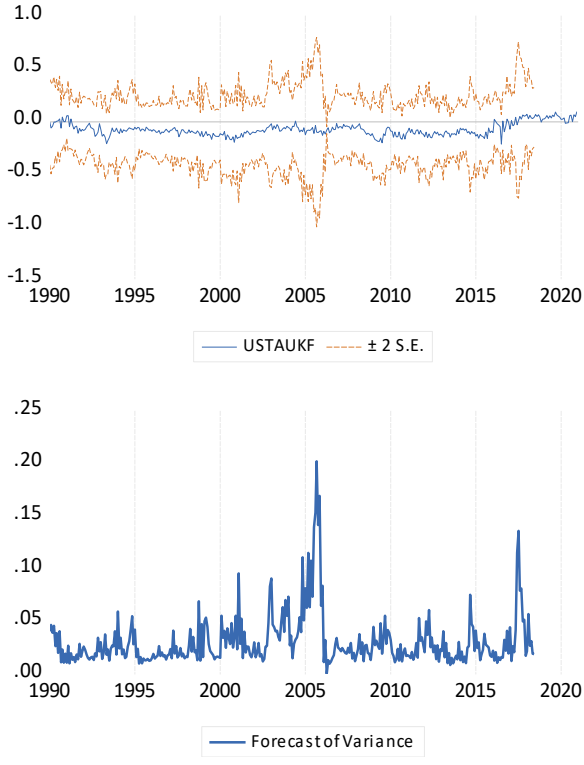
Forecast: USTACF	
Actual: USTAC	
Forecast sample: 1970M01 2021M12	
Adjusted sample: 1981M03 2020M12	
Included observations: 478	
Root Mean Squared Error	0.081895
Mean Absolute Error	0.063303
Mean Abs. Percent Error	76.89202
Theil Inequality Coef.	0.156415
Bias Proportion	0.013396
Variance Proportion	0.112070
Covariance Proportion	0.874534
Theil U2 Coefficient	2.312241
Symmetric MAPE	34.87563

Graph A3a: Forecasting of U.S. Trade with Canada and its Variance [Eq. (9)]



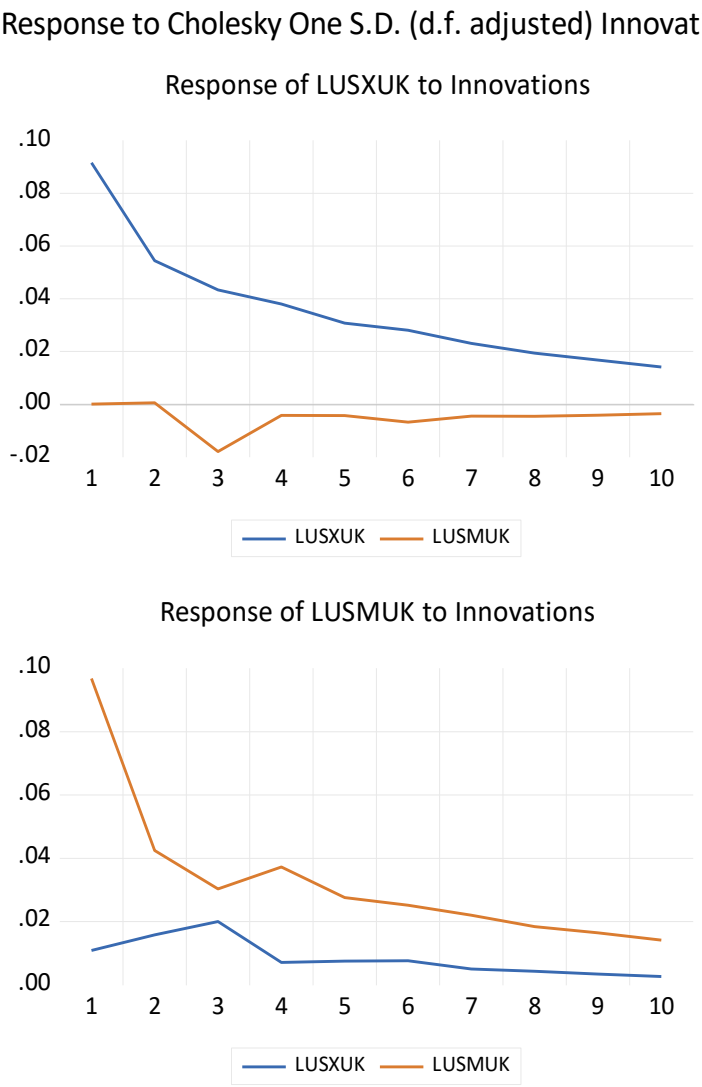
Graph A3b: Response of Trade with Canada to Cholesky Innovations Eq. (13)

Note: Imports are increasing until the 4th month and exports are falling; then, TA↓↓ and it improved TA↑ after the 5th month.



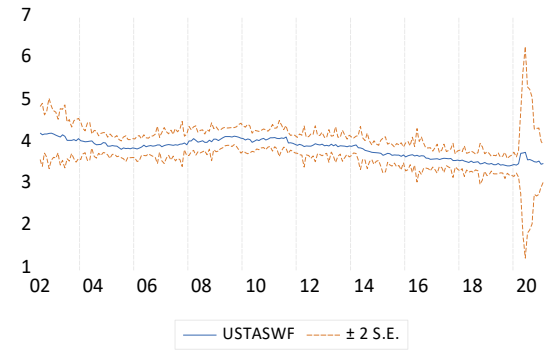
Forecast: USTAUKF	
Actual: USTAUK	
Forecast sample: 1970M01 2021M12	
Adjusted sample: 1990M01 2020M12	
Included observations: 372	
Root Mean Squared Error	0.178658
Mean Absolute Error	0.142901
Mean Abs. Percent Error	400.0042
Theil Inequality Coef.	0.568043
Bias Proportion	0.003260
Variance Proportion	0.562733
Covariance Proportion	0.434007
Theil U2 Coefficient	0.389606
Symmetric MAPE	113.3731

Graph A4a: Forecasting of U.S. Trade with U.K. and its Variance [Eq. (9)]

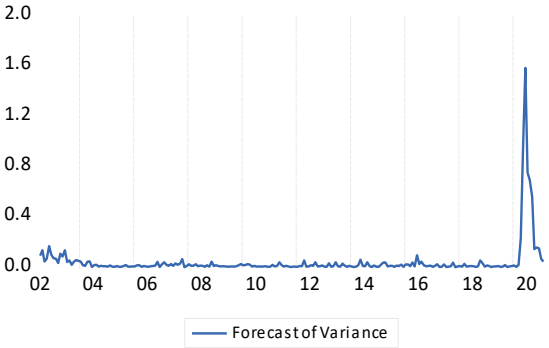


Graph A4b: Response of Trade with U.K. to Cholesky Innovations Eq. (13)

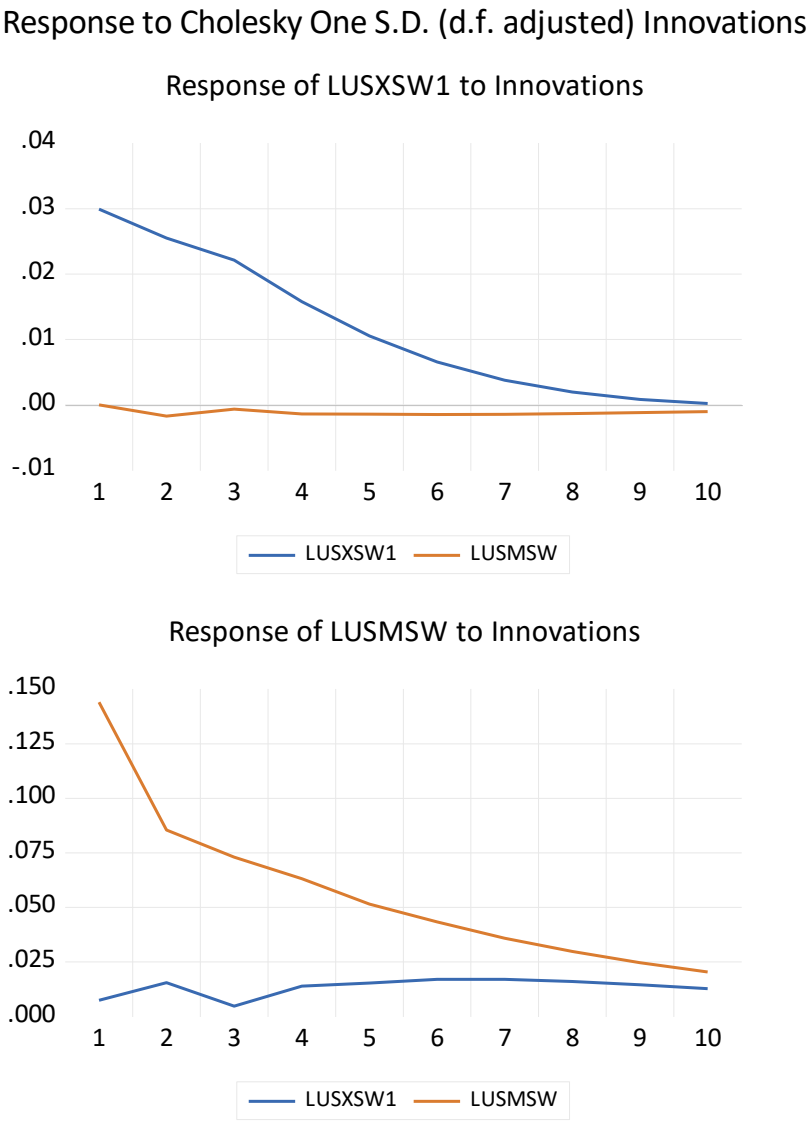
Note: Imports are increasing until the 4th month and exports are falling; then, TA↓↓ and it improved TA↑ after the 5th month.



Forecast: USTASWF	
Actual: USTASW	
Forecast sample: 1970M01 2021M12	
Adjusted sample: 2002M07 2021M02	
Included observations: 224	
Root Mean Squared Error	0.229648
Mean Absolute Error	0.138710
Mean Abs. Percent Error	3.981089
Theil Inequality Coef.	0.029612
Bias Proportion	0.052476
Variance Proportion	0.195942
Covariance Proportion	0.751582
Theil U2 Coefficient	1.741872
Symmetric MAPE	3.744889

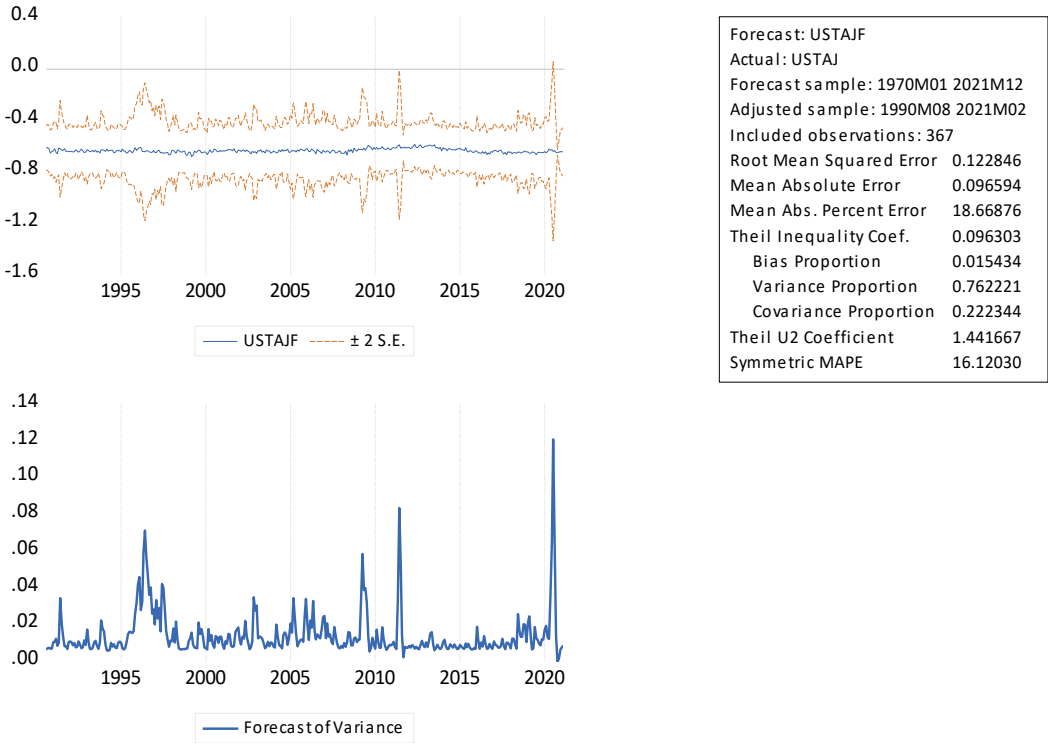


Graph A5a: Forecasting of U.S. Trade with Switzerland and its Variance [Eq. (9)]

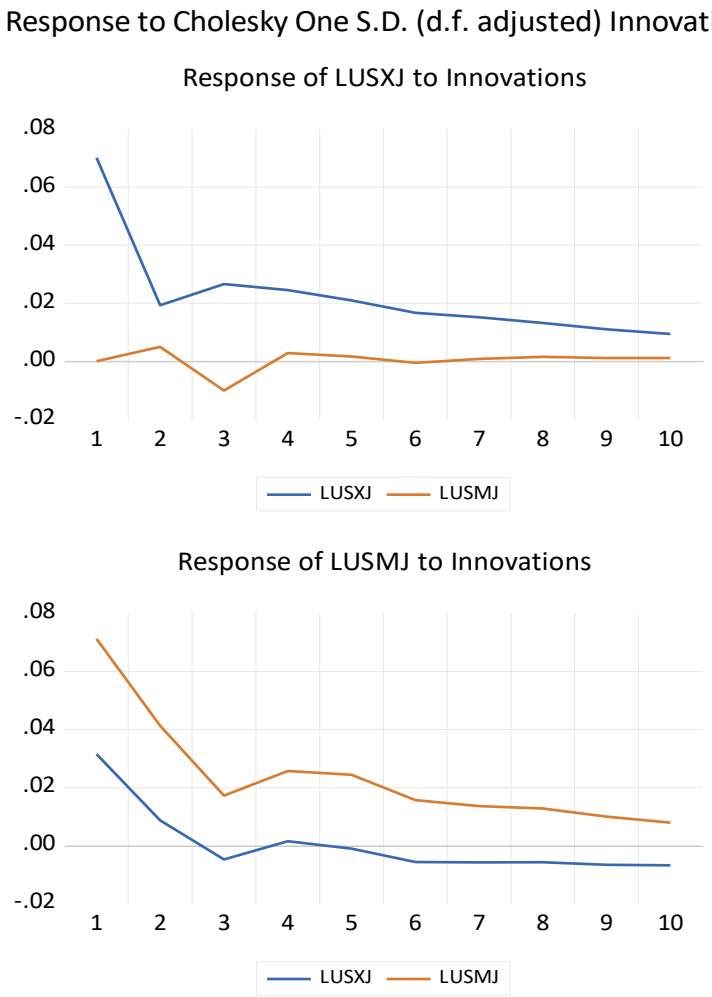


Graph A5b: Response of Trade with Switzerland to Cholesky Innovations Eq. (13)

Note: Imports are flat and exports are falling; then, TA↓↓ and it improved TA↑ after the 9th month.

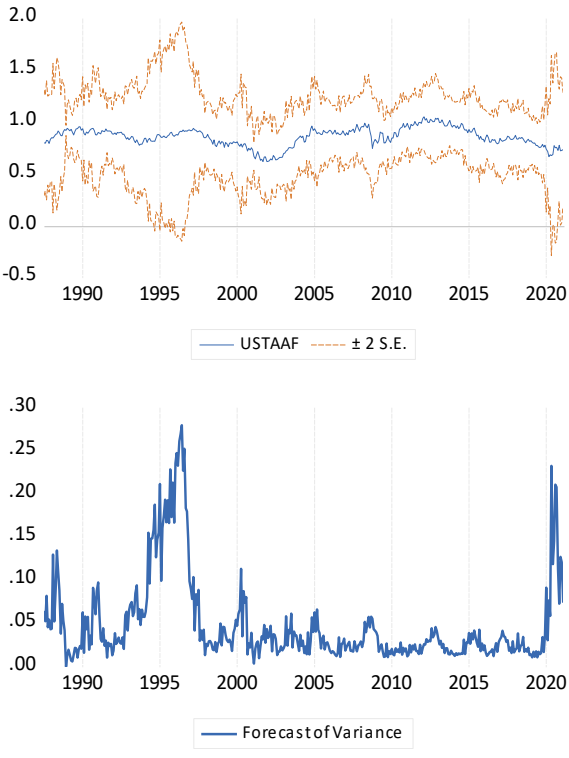


Graph A6a: Forecasting of U.S. Trade with Japan and its Variance [Eq. (9)]



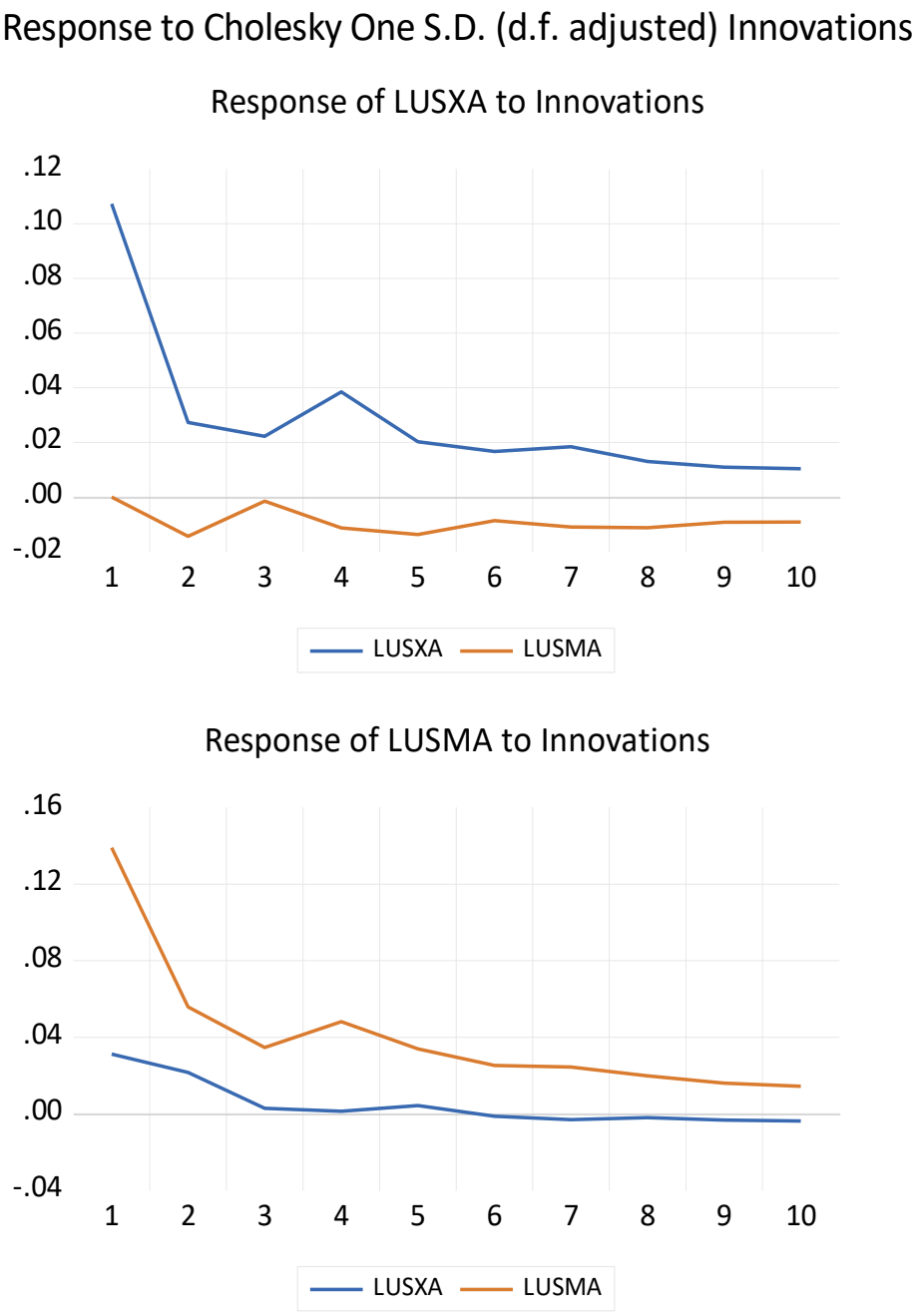
Graph A6b: Response of Trade with Japan to Cholesky Innovations Eq. (13)

Note: Imports are increasing until the 4th month and exports are falling; then, TA↓↓ and it improved TA↑ after the 5th month.



Forecast: USTAAF	
Actual: USTAA	
Forecast sample: 1970M01 2021M12	
Adjusted sample: 1987M07 2021M02	
Included observations: 404	
Root Mean Squared Error	0.223410
Mean Absolute Error	0.167498
Mean Abs. Percent Error	24.93902
Theil Inequality Coef.	0.124275
Bias Proportion	0.038833
Variance Proportion	0.450409
Covariance Proportion	0.510758
Theil U2 Coefficient	0.427426
Symmetric MAPE	19.40256

Graph A7a: Forecasting of U.S. Trade with Australia and its Variance [Eq. (9)]



Graph A7b: Response of Trade with Australia to Cholesky Innovations Eq. (13)
Note: Imports are increasing until the 4th month and exports are falling; then, TA↓↓ and it improved TA↑ after the 5th month.