US Trade Deficit, a Reality Check: New Evidence Incorporating Asymmetric and Nonlinear Effects of Exchange Rate Dynamics

Muhammad Ali Nasir¹, Mary Lueng
Leeds Business School, Leeds Beckett University, United Kingdom

Abstract: In the context of the debate on the global imbalances, this study investigates the determinants of US trade balance in a Non-linear ARDL framework which accounts for the asymmetric and nonlinear effects of real exchange rate dynamics. Drawing on the data from 1994Q1 to 2018Q1, our key empirical findings suggest significant evidence of short and long run asymmetries between the real effective exchange rate, US trade balance and its determinants. An asymmetric cumulative dynamic multiplier analysis showed evidence of an asymmetric J-curve. Furthermore, our empirical results showed that price stability, productivity, domestic savings and fiscal discipline are crucial for determining the US trade balance in the short to long term. Empirical findings of this study contribute to the contemporary debate on the US trade deficit and have profound policy implications for the competitiveness of the US economy and its external balance.

Keywords: Global Imbalances, Competitive Devaluation, Savings, Price Stability, Productivity, Fiscal Deficit, Asymmetric J-Curve, NARDL

JEL Codes: E2, F13, F14, F31, F32, F41.

¹ Corresponding author: Economics, Analytics and International Business subject group, Leeds Business School, Leeds Beckett University, United Kingdom. Email: m.a.nasir@leedsbeckett.ac.uk Tel: 00447508457981.
1. Introduction

The “global imbalances” a term often synonymously used for “current account imbalances” are central to the policy debates on the global political and economic forums (Borio, 2016). In this regard, the dynamics of the world largest economy the US with its gigantic trade volume has significant economic and political implications for the rest of the world. The US trade imbalance with its major trade partners has been a prolonged issue for the last few decades. Though the downturn of the economy in aftermath of the global financial crisis (GFC) accompanied some improvements in the trade balance, further elimination of trade deficit has not been witnessed since then and in fact, there has been deterioration. A prima facie manifestation of US trade balance dynamics is depicted in Fig 1 which shows persistent and widening deficit since the early 1990s. This has caused heated debate and most recently, a trade war. Since 2002, the U.S. has experienced twin deficits i.e. a growing budget deficit along with growing trade deficit. A United Nation’s report proposed to tackle U.S. massive trade deficit in a cautious process which shall involve a reduction in domestic demand as well increase in demand from its trading partners (see, Hong, 2001). However, there is also a misperception that the rise of export from emerging economies was to blame for widening deficit in recent years. An aggressive approach to solve the trade deficit has been adopted by the new administration. For example, a tariff on steel and alumina imposed to Canada, Mexico and the European Union and a 25 per cent tariff on $ 200 billion imports from China. The countries running large trade surpluses, particularly Japan, China and Germany have been accused of competitive devaluation, though similar to the US these countries had been focused on the provision of liquidity to the real economy in the post GFC era which may have led to depreciation as a by-product of monetary policy actions (Hoffmann, 2013, Briscoe, 2015). Yet, post-global financial crisis, there has been the politisisation of issues around global imbalances, particularly, competitive devaluation and unfair trade distortions (Variar, 2011: Nasir and Jackson, 2019). On this aspect, Čerović et al (2014) argued that the crisis has reignited and fuelled the debate between liberalism versus protectionism and the protectionist measures have been taken to protect national interests. Shelburne (2010) echoed these concerns and argued that these measures have a beggar-thy-neighbour component. The recent act of putting China, Japan and Germany on the potential exchange rate manipulators observation list by the
US and stance by the current administrations reinvigorated the debate on the competitive devaluation and unfair practices by the US trade partners.

[United States’ Current Account Balance: % of GDP from Mar 1960 to Dec 2018, Source: CEIC]

Economists have generally agreed exchange rates have potential implications for external balance of an open economy (Narayan, 2006; Lee and Chinn, 2006; Bahmani-Oskooee and Kutan, 2009; Bahmani-Oskooee and Baek 2016, Bahmani-Oskooee and Shah 2017, Bahmani-Oskooee et al 2019), however, with reference to the US case, some scholars, for instance, Lee et al (2006), Reinhart (2017), Sachs (2017), Eichengreen (2017) and Fratzscher (2017) suggested that it is an imbalance in the investment and saving than the issue of competitive devaluations. While to some scholars the trade disequilibria are associated with the financial liberalisation which began in the 1980s (see e.g. Dooley et al., 2003; Caballero et al., 2008; Chakraborty and Dekle, 2009). Steiner (2014) empirical showed that the demand for dollars as a reserve currency has led to US current account deficit and global imbalances. Sinn (2017) argued that the appreciation in the UK and US could be associated with their attractive and developed financial sector which attract investments from foreigners and weigh on their export sector. Whereas, Altuzarra et al (2010) that the trade imbalances are due to structural changes in the current national and international supply and demand patterns and in fact the US trade deficit was financed by the capital flows from some of the large oil exporters as well as emerging (surplus) economies (Ito, 2008; Altuzarra et al, 2010). Low international interest rate as a result of the large supply of saving in Far-East, e.g. China, is responsible for the massive U.S. trade deficits (Bernanke, 2005). Nevertheless,

---

2 Under the US Trade Facilitation and Enforcement Act (2015), China, Germany, Japan, Taiwan and Korea on has been put on watch list for the potential currency manipulator countries.
there are a number of factors, for instance, structural changes, trade policy technological progress and/or monetary and fiscal policies (see Lee et al 2006; Saadaoui et al, 2013; Loeffler, 2015; Yue et al, 2016). Reduction in values of money through inflation can influence trade balance (Hume, 1742, Stockman, 1985). On the other hand, a rise in government spending may encourage more import but less export (Bahmani-Oskooee and Payesteh, 1993). In terms of dealing with trade imbalances, Sinn (2017) suggested that the US and Eurozone should have a well-disciplined fiscal stance.

To reiterate, the global imbalances are often exploited for political gains and therefore have significant political implications. Reinhart (2017) argued that since the 1980s, Japan, China and lately Germany have been accused by the US for its trade deficits. Similarly, criticising current US administration stance on Germany and China, Sachs (2017) declared it to be the lack of US savings rather than the unfair trade policy by Germany and China. Similarly, Zhang and Sato argued that Chinese Renminbi should not be blamed for US deficit. However, earlier studies suggest that the changes in US productivity were the main determinants of the US trade position (Kollmann, 1998)\(^3\). Putting the political debate aside, one shall look at the empirical evidence to see which are the actual critical factors deriving trade balance in the US. Concomitantly, the main objectives of this study are to contextualise the debate on the US trade balance and look at the effects of the key macroeconomic factors on the US trade balance while accounting for the short long term differences as well as asymmetries and nonlinearities. In so doing, we employed a *Nonlinear Autoregressive Distributed Lag (N-ARDL)* model on the US quarterly data from 1994 Q1 to 2018 Q1. The aim of the study is to determine whether the crucial domestic macroeconomic factors such as personal saving, effective real exchange rate, domestic inflation(GDP deflator), fiscal discipline and productivity also influencing the US trade balance and to what extent. Our key findings suggest significant evidence of short and long run asymmetries between the exchange rate, US trade balance and its determinants. We found significant evidence of an asymmetric *J-curve*. Furthermore, our empirical results showed that the price deflator, productivity, domestic savings and fiscal discipline are crucial for US trade balance in the short to long term. The subject study contributes

---

3 Productivity can also have implications for the exchange rate, though empirical evidence in inconclusive (Chinn, 2000).
to the debate on the US trade deficit and has profound policy implications for the competitiveness of the US economy and its external balance.

The rest of the paper is organised as follows. Section 2 briefly reviews the existing evidence on the determinants of the trade balance to contextualise the debate on global imbalances. A Nonlinear Autoregressive Distributed Lag model is set out in Section 3. The empirical findings and discussion are found in Section 4. Finally, Section 5 concludes and discuss policy implication.

2. Determinants of the Trade Balance

In this treatise, the potential determinants of the trade balance we are focusing on are exchange rate, domestic savings, domestic price levels, fiscal discipline and productivity. Starting with the exchange rate which is perhaps the most debated determinant of the global imbalances. For year’s exchange rate has been viewed as an effective tool in adjusting trade imbalance. The logic of exchange rate and the trade balance nexus is embedded in the notion that the exchange rate appreciation makes tradeable domestic goods and services become more expensive for overseas markets while import goods and services become more affordable and vice versa. If such a scenario prevails, Government interventions, analogous to those made by the US (discussed in the introduction) through tariff may be required to correct the issue. Yet, there is often a delay in the materialisation of exchange rate impact, manifested in the fact that the prices of previous purchase orders or contracts that have already been agreed do not change contemporaneously. A phenomenon known as J-curve where the correction of the trade balance should be observed in the long run. For the adjustment of trade balance through appreciation and depreciation, one can go as far back as Hume’s (1742) price–specie flow mechanism argument. The empirical studies since then often support a significant relationship between exchange rate and trade balance (Stučka, 2004; Baharumshah, 2001, Bahmani-Oskooee and Ratha, 2004, and Bahmani-Oskooee and Saha, 2017, Bahmani-Oskooee et al 2019). However, the net benefit of depreciation (appreciation) can only be positive (negative) if the elasticities of export and import sum up to a value greater than unity i.e. Marshall- Learner condition (See Devereux, 2000; Bahmani-Oskooee Ratha, 2004).

Electronic copy available at: https://ssrn.com/abstract=3439302

---

4 Initial deterioration but after that improvement in the trade balance due to exchange rate depreciation forming a J-curve response (Bahmani-Oskooee and Ratha (2004) and Bahmani-Oskooee et al (2017).
or most recently Bahmani-Oskooee and Shah 2017 and Bahmani-Oskooee et al 2017). Hence, on the
depreciation, there is mixed evidence supporting the role of depreciation in improvements in trade
balances (See Himarios, 1989, Bahmani-Oskooee, 1991; Bahmani-Oskooee and Wang (2004);
Bahmani-Oskooee and Ratha, 2004; Lee and Chinn, 2006; Bahmani-Oskooee and Hegerty, 2010;
Zhang and Sato, 2012; Bahmani-Oskooee et al., 2013b; Bahmani-Oskooee,2016; Yildirim and Ivrendi,
2016, Hassan et al., 2017 Bahmani-Oskooee and Shah 2017, Bahmani-Oskooee et al 2019) and also
indicating a lack of evidence on such a nexus, for instance, seminal work by Rose and Yellen (1989)
and Rose (1991) or more lately, Wang et al. (2010), Liew et al (2000) and Shahbaz et al. (2012).
However, the empirical evidence on such an impact is also mixed and contrasting, for instance, after
analysing 87 countries, Bleaney and Tian (2014) reported that the industrial countries are slower in the
adjustment of trade balance after a fall of the exchange rate. Similarly, Narayan (2006), Bahmani-
Oskooee and Kutan’s (2009) and Bahmani-Oskooee et al (2017) also reported mixed results on the
presence of the J-Curve in various economies.

There is a notion that the exchange rate flexibility significantly affects the adjustment of trade balance
(Ghosh et al., 2013). Though the empirical evidence, do not always support the idea that a flexible
exchange rate regime would facilitate current account adjustment (Chinn and Wei, 2013). In fact,
studies, for instance, Falk (2008) further suggest that the depreciation of effective exchange rate become
less efficient in trade balance improvement to countries which have already with trade balance deficit.
As it is prima facie evident that the US has a persistent trade deficit, so can the depreciation help? In
fact, a recent study Begović and Kreso, (2017) shows small open (European transition) economies may
experience an adverse effect of the effective exchange rate on the trade balance. They argued that this
is due to the reason that while the depreciation of currency encourages export, small economies that do
not have substitutes for imports or unable to increase export capacity will not see the effect of the
exchange rate change on the trade balance. However, the wider evidence from developed and
developing economies also suggest that it is not always the case the depreciation helps to improve the
trade balance (Wang et al., 2010; Liew et al 2000; Rose 1991; and Shahbaz et al., 2012). Employing
nonlinear approaches, Arize (2017) found evidence of significant trade balance improvements in eight
countries (excluding US) after depreciation of their currencies. However, in specific to the US, Chiu et al. (2010) analysed the bilateral trade balance with a number of countries and reported mixed results. While Devereux and Genberg (2007) argued that the appreciation by Asian economies can do very little to US current account reduce. Concomitantly, it would be intuitive to look at the holistic picture and incorporate the overall trade balance of the US while accounting for the nonlinearities and asymmetries and additional indicators such as saving rate (Bahmani-Oskooee and Fariditavana 2015, 2016, Chiu and Sun, 2016).

Saving rate increase the supply of loanable funds which leads to a fall of interest rates. This result in an increase in both domestic investment and net capital outflow. Therefore, improving the saving rate may facilitate the elimination of trade imbalance (Arize et al. 2000; Chiu and Sun, 2016). Furthermore, as the export revenue increase, the reliance on foreign capital decrease, resulting in even higher domestic savings. A pattern that found commonly in strong export developing countries (Kandil, 2009).

Ben Bernanke (2005) and Lee et al (2006) have very strongly argued that the huge saving in East Asia, particularly in China has distorted global interest rate had led to a drastic decline in interest rates in the US. Savers find themselves worse-off after falling of interest rate, on the other hand, capital becomes cheaper to borrow this encourage more inflow of capital to finance import consumption and a low level of domestic saving. Some subsequent empirical studies rendered support to Bernanke’s view (for example, Caballero et al., 2008; Mendoza et al., 2009 and Steinberg, 2018). Further, on this channel, Blanchard and Milesi-Ferretti (2011) argued that the export-led countries through macroeconomic policy interventions achieve high saving rate and low domestic demand. This encourages firms at home to seek export opportunities for expansion. Home currency depreciates under low-interest rate make the products more competitive in the global market, trade figure of import countries worse-off. On the other hand, intuitively, some studies have rather focused on the saving as a domestic issue and argued that the low domestic net savings are blamed to the U.S. massive trade deficits (e.g. Feldstein, 2008; Chinn and Ito, 2008; Laibson and Mollerstrom, 2010). A remarkable study on the global savings glut by Chinn and Ito’s (2007) employed data of 19 industrial and 70 developing countries for the period of 1970-2004. Their empirical result did not provide strong support to the claims of Bernanke that high saving
in East Asia has caused the deterioration of US trade balance, rather it is budget deficit causing a decrease of personal saving partly contribute trade deficit. Hence, it cogent to include the domestic savings into the analysis as well as the budgetary stance.

Fiscal policy is an important tool for the adjustment of trade balance. Faced with a trade deficit, a contractionary stance would see a reduction in consumption of both imported and domestic goods and services. As the domestic market shrinks, domestic firms focus on foreign markets and successful ventures may lead to improvements in the trade balance. On the other hand, increased public spending drives up wages and prices and reduce personal saving. Imports increase after increase in income and leading to an increase in the budget deficit. An undesirable potential outcome of the budget deficit is that fall in public saving below domestic investment imply more money borrow from aboard. The empirical evidence shows that government budgetary stance plays a significant role in inflicting current account balance (Baxter, 1995) i.e. Twin Deficits Hypothesis. A twin deficit that U.S. experience since the early 2000s where it has seen an increasing budget deficit and deterioration in trade balance (Cavallo, 2005; Corsetti and Müller, 2006). There had been concerns raised the expansionary fiscal policy employed by U.S. administration would worsen what had been already a wide trade deficit in the Pre Global Financial Crisis era (Chinn, 2005). These concern were disagreed by Ferguson (2004); Greenspan (2005a, b) arguing that at least in short-run, the twin deficit does not exist (also see, Kim and Roubini (2004). Denying the twin deficit, it is argued that an increase of budget deficit, private saving increases expecting a future tax increase, increase government borrowing push up interest rate decrease demand of imports, current account improves. On this aspect, Erceg, et al., (2005) found low responsiveness of prices and switching cost between domestic and imported goods have eliminated the effects of budget deficit on the trade deficit. However, with the benefit hindsight, this seems not the case, the US trade deficit reached a record all-time in 2006. Nonetheless, some of the studies, for instance, Bernheim (1988), Chinn and Prasad (2003) and Chinn and Ito (2008) argued that the budget deficit partly contributes to the massive trade deficit. In this regard evidence from EU countries, Beetsma et al (2008) also reported significant dual deficit hypothesis in EU economies as their North
American counterpart. Hence, it is cogent to include the budget deficit into our analysis to see how much it contributes to the US trade deficit.

The domestic price levels are important factors in determining the price competitiveness of open economies. This aspect was at forefront of the Hume’s (1942) argument that the increased supply of the gold (accumulated through trade surplus) will lead to increase in the domestic prices which will discourage exports and encourage imports and in so doing will lead to adjust of the trade balance. Concomitantly, inflation can have dramatic effects on the direction as well as the volume of international trade (Stockman, 1985). In specific to the trade deficits EMU peripheral states, Sinn (2014) argued that the high rates of domestic inflation had deteriorated the competitiveness of these economies which led to high trade deficits. However, the evidence is contrasting as a recent study by Yiheyis and Musila (2018) reported a very little effect of inflation on the trade balance. Hence, in this study, we are considering the impact of domestic inflation (GDP deflator) on US trade balance to see if the cause of huge trade deficit is due to increase in domestic price levels which may erode the international competitiveness of US economy.

Improved productivity shall play a role in determining trade balance. Ghosh et al., (2014) suggested that the dynamic relationship between productivity and trade balance may offer an alternative tool to adjust trade deficit to countries with less flexible or fixed exchange rate regime. A study by Bussière et al (2010) reported that the productivity and budget deficit are key determinants of current account balances in OECD countries, though there are country-wise differences. Batra and Beladi (1999) argued that the exporting countries which have a large manufacturing base are able to absorb new inventions and materialise them into production. This leads to high productivity and can explain the trade balance. However, this line of reasoning explaining nexus between productivity and trade balance is at odds with some of the examples in the real world, for instance, it does not explain the impressive trade surplus that China currently enjoys which as compared to the US has unimpressive productivity. As the neoclassical growth model suggests, productivity growth affects both investment and consumption and overarchingly aggregate output. The demand for foreign goods and services increases as the wealth increase. This puts pressure on the trade balance. However, the results may vary among countries
depending on various factors, for example, productivity in trade and non-tradeable sectors and/or home-bias. On this aspect, some empirical studies support the notion that there is a negative link between productivity and trade deficit (Engel and Rogers, 2006; Chen et al., 2009). Kollmann (1998) focusing on the US and G-6 argued that US productivity shocks were the most dominating factor for the US trade balance. In a later study, Ferrero (2010) argued that productivity growth differentials significantly influence the US trade balance and all of its dynamics. Specifically, the attractiveness of the US for foreign resources and increased consumption leads to the trade deficit. However, it was also argued that as the consumption is decreased and savings are increased to repay the foreign liabilities, the trade deficit decreases. This fuel the rationale for the subject study where we are intending to analyse the implication of productivity, savings as well as the exchange rate, domestic inflation and fiscal discipline for the US trade balance in a framework which accounts for the potential nonlinearities and asymmetries.

3.1 Methodology

A Nonlinear Auto-Regressive Distributed Lag (N-ARDL) framework is employed to estimate and analyse the shocks to the US trade balance caused by its potential determinants, namely real effective exchange rate, saving, budget deficit/surplus, productivity and GDP deflator. This relationship can be specified in the following form:

\[ TB_t = \beta_{TB}TB_{t-i} + \beta_{EX}Ex_{t-i} + \beta_{PD}PD_{t-i} + \beta_{SAV}SAV_{t-i} + \beta_{BUD}BUD_{t-i} + \beta_{PROD}Prod_{t-i} + e_t \]  

(1)

Where the Trade Balance (TB) is determined by its past values (persistence element, \(TB_{t-i}\)), determinants i.e. Real Exchange rates (\(EX\)), Price Deflator (\(PD\)) a proxy for domestic inflation and price stability, Savings (\(SAV\)), Budget Deficit/Surplus (\(BUD\)) for fiscal discipline and Productivity (\(Prod\)).

Given that these factors are theoretically perceived to be the crucial determinants of external balance.

The novelty of the employed N-ARDL approach is that it takes into account the asymmetries and nonlinearities in the association between trade balance and it’s their determinants. As we are interested in investigating these asymmetries and nonlinearities in the context of US trade balance, N-ARDL is the logically appropriate framework of analysis. The N-ARDL Cointegration approach is based on the

Electronic copy available at: https://ssrn.com/abstract=3439302
seminal work by Shin et al (2011) which found its roots in the contributions by Pesaran and Shin (1999) and Pesaran et al. (2001). To start with, we can specify the Eq. 1 in the following long-run model of the Trade balance:

\[ TB_t = a_0 + a_1 E^{X+} + a_2 E^{X-} + a_3 PD_t + a_4 SAV_t + a_5 BUD_t + a_6 PROD_t + e_t \]  

(2)

Where \( TB_t \) is trade balance and its determinants are as specified in equation (1), \( a = (a_0 - a_6) \) is a co-integrating vector of long-run parameters. In Eq. 3 and Eq. 4) the \( EX^{X+}_t \) and \( EX^{X-}_t \) are partial sums of positive and negative changes in the Exchange rate (\( EX_t \)) and, it can be specified as:

\[ EX^{X+}_t = \sum_{i=1}^{T} \Delta EX^{X+}_i = \sum_{i=1}^{T} \max(\Delta EX_i, 0) \]  

(3)

and

\[ EX^{X-}_t = \sum_{i=1}^{T} \Delta EX^{X-}_i = \sum_{i=1}^{T} \min(\Delta EX_i, 0) \]  

(4)

In the light formulation presented above (Eq.2), the relationship between Trade Balance (\( TB_t \)) and Exchange Rate (\( EX_t \)) is expected to be negative (\( a_1 \)). However, \( a_2 \) captures the association between trade balance and exchange rate while there is reductions or depreciation in the real effective exchange rate. Due to negative association estimates of \( a_2 \) are expected to have positive signs.

Furthermore, we also posit that the exchange rate fluctuations have effects with some lags and follow J-curve behaviour. Nonetheless in the case of asymmetric association between exchange rate and trade balance the effects of appreciation would be different in magnitude from the depreciation. In simple words, the positive shocks will have a greater or smaller impact than the negative shocks i.e. \( a_1 \neq a_2 \). Concomitantly, the long run relationship presented in the Eq. 2 is expected to reflect an asymmetric exchange rate pass through. At this juncture, we can frame the Eq. 2 and Eq.3 into a NARDL setting (see, Shin et al. (2011) Pesaran and Shin (1999) and Pesaran et al. (2001) as follows:

\[
\Delta TB_t = a + \beta_1 TB_{t-1} + \beta_2 EX^{X+}_{t-1} + \beta_3 EX^{X-}_{t-1} + \beta_4 PD_{t-1} + \beta_5 SAV_{t-1} + \beta_6 BUD_{t-1} \\
+ \beta_7 PROD_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta TB_{t-i} + \sum_{i=0}^{q} (\theta_{i}^{+} \Delta EX^{X+}_{t-i} + \theta_{i}^{-} \Delta EX^{X-}_{t-i}) \\
+ \sum_{i=0}^{s} \gamma_i \Delta PD_{t-i} + \sum_{i=0}^{\delta} \delta_i \Delta SAV_{t-i} + \sum_{i=0}^{\Omega} \omega_i \Delta BUD_{t-i} + \sum_{i=0}^{\varphi} \phi_i \Delta PROD_{t-i} \\
+ e_t
\]  

(5)
Where we have defined all the variables earlier and $p, q, s, v, w$ & $x$ are lag orders and $a_1 = -\beta_2/\beta_1$ $a_2 = -\beta_3/\beta_1$ are the earlier mentioned long run impacts of increase(appreciation)/decrease(depreciation) in the exchange rate on trade balance (Eq. 5). In Eq. 5, the $\sum_{i=0}^{q} \theta^+_i$ measures the short-run impacts of an increase in exchange rate on the trade balance whereas $\sum_{i=0}^{q} \theta^-_i$ measures the short run impacts of a decrease in exchange rate on the trade balance.

Concomitantly, in this setting, we capture the asymmetric long-run as well as the asymmetric short run relationship between trade balance and exchange rate dynamics. The implementation of the employed NARDL framework will be entailed on the following steps. At first, we will perform the unit root test to determine the order integration of underlying data series. It is worth acknowledging that the ARDL approach to cointegration is valid whether the series are $I(0)$ or $I(1)$, however, it is still important to perform to unit root test to confirm that there is no $I(2)$ variable. This is an important aspect to consider as $I(2)$ invalidates the computation of $F$-statistics to test the cointegration (Ibrahim, 2015). We would perform the ADF unit root test with a structural break to find the order of integration. Thereafter we would estimate the Equation 5 using the OLS method. After estimation of our NARDL model, we would be applying the bound testing approach proposed by Pesaran et al. (2001) and Shin et al. (2011) to test cointegration among underlying data series. In so doing, we would perform the Wald $F$-test with the null hypothesis, $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$. In the last and final step of analysis we would examine the long and short run asymmetries in the relationship between Trade balance and exchange rate dynamics, we would also discuss the impact of other explanatory variables in the model.

With specific to the US Trade balance and exchange rate, we would derive the asymmetric cumulative dynamic multiplier effects of a 1% change in the exchange rate i.e. $EX^+_t$ and $EX^-_t$ respectively as:

$$m^+_h = \sum_{j=0}^{h} \frac{dy^{+}_j}{E^{+}_t}, m^-_h = \sum_{j=0}^{h} \frac{dy^{-}_j}{E^{-}_t}, h = 0,1,2,\ldots$$

(6)

A point to note here is that as $h \to \infty, m^+_h \to a_1$ and $m^-_h \to a_2$.

3.2 Dataset

The employed NARDL framework on the quarterly data from 1994: Q1 to 2018: Q1. The choice of time horizon is informed by the viability of data, particularly on the real effective exchange rate measure. The details of each variable and proxy are as follows:
Trade Balance: We used the current account balance as a percentage of GDP to represent the trade balance of the United States. The data was extracted from the Federal Reserve Bank of St. Louis.

Real Effective Exchange Rate: To present the exchange rate, we used the Real Effective Exchange Rate as a proxy. The data was obtained from the Bank for the International Settlement (BIS). We employed the board measure of the real effective exchange rate.

Domestic Inflation: For the domestic inflation we employed the data on GDP Implicit Price Deflator. It accounts for the changes in the price levels of domestically produced goods and services and hence a better and most suitable measure to gauge the price competitiveness of the domestically produced goods and services. The Source of data is the U.S. Bureau of Economic Analysis and the data is extracted from the Federal Reserve Bank of St. Louis.

Fiscal Stance: To present the fiscal outlook we employed the data on the federal surplus/deficit as Percent of GDP. The source of data is Federal Reserve Bank of St. Louis and U.S. Office of Management and Budget.

Savings: For savings, we used the data on the Personal Saving Ratios as a percentage of disposable personal income. The data was seasonally adjusted and obtained from the U.S. Bureau of Economic Analysis.

Productivity: To represent the productivity we employed the data on Labour productivity refers to per hour output of all the workers engaged in the production. The data was obtained from The Organisation for Economic Co-operation and Development’s (OECD) database.

4.1 Analysis & Findings
Prior to estimation, a unit root test is performed to determine the order of integration of underlying data series. For this purpose, the ADF Unit root test with the structural break is employed. Accounting for the structural break is vital to avoid the risk of bias towards null of random walk (see Perron (1989) Hansen, (2001) and Perron (2006) Ranganathan and Ananthakumar (2010). We let the data speak and instead of exogenously determining the date of the break, it was left to be determined endogenously. In so doing, we choose the alternative minimize and maximise options to allow for evaluation of one-
sided alternatives, this produces different critical values for the final Dickey-Fuller test statistic and tests with greater power than the non-directional alternatives\(^5\). The ADF is applied to test for the unit root in the presence of break with both Innovative Outliers (IO) and Additive Outliers (AO)\(^6\). In order to choose the optimal number of lags for the ADF test, we used the Schwarz Information Criteria (SIC) which is particularly appropriate in the presence of structural break (Asghar and Abid 2007). The results are presented in Table 1 as follows:

| Variables                | Level          | 1st Difference |
|--------------------------|----------------|----------------|
|                          | ADF Test Statistic (IO) | P-Values | ADF Test Statistic (AO) | P-Values |
| Trade Balance            | -3.801          | 0.648         | -3.895          | 0.591    |
| Real Effective Exchange Rate | -2.753          | 0.985         | -2.759          | 0.958    |
| Price Deflator           | -5.418**        | 0.026         | -4.767          | 0.134    |
| Savings                  | -5.176**        | 0.049         | -5.839*         | < 0.01   |
| Budget Deficit/Surplus   | -6.922*         | < 0.01        | -7.076*         | < 0.01   |
| Productivity             | -11.218*        | < 0.01        | -11.450*        | < 0.01   |
| Trade Balance            | -12.210*        | < 0.01        | -12.337*        | < 0.01   |
| Real Effective Exchange Rate | -8.386*         | < 0.01        | -8.495*         | < 0.01   |
| Price Deflator           | -7.934*         | < 0.01        | -8.084*         | < 0.01   |
| Savings                  | -15.727*        | < 0.01        | -15.989*        | < 0.01   |
| Budget Deficit/Surplus   | -14.816*        | < 0.01        | -22.131*        | < 0.01   |
| Productivity             | -18.556*        | < 0.01        | -19.299*        | <0.01    |

*1% level of significance ** 5% level of significance ***Vogelsang (1993) asymptotic one-sided p-values.

The results unit root test with structural break and including innovation and additive outliers presented above suggest that for some of the series (trade balance and real effective exchange rate) the null of no unit root could not be rejected at a statistical level of significance. Although, budget deficit/surplus was found to be stationary at the level indicating the long-term economic and budgetary stability of the United States. However at the first difference, all the serious were found to be stationary i.e. I(1). For the visual presentation of the structural break in the Trade balance, we have reported the Dickey-Fuller t-stats and the Dickey-Fuller Autoregressive coefficients for US Trade balance using Additive and innovation outliers in the following figure 2.

---

\(^5\) For a detailed discussion and support of this practise please see, Banerjee et al., (1992), Vogelsang and Perron (1998) and Zivot and Andrews (1992).

\(^6\) See Fox (1972) and Tsay (1988) for a detailed discussion and classification of "Additive Outliers (AO)" and "Innovative Outliers (IO)".
The results in Figure 2 indicates the presence of a structural break around the global financial crisis (GFC). This is intuitive if we consider the major disruption for international trade due to the GFC 2007-08. After unit root testing, we come to the estimation of N-ARDL model (Eq. 5).

4.2 Bound testing for Nonlinear Co-integration

Table 2 presents the results of Bounds testing for the nonlinear Cointegration: -
Table 2: Bounds test for the Nonlinear Cointegration

| Dependent variable | F-statistics | K | Lower-Bound (95%) | Upper-Bound (95%) | Conclusion |
|--------------------|-------------|---|-------------------|-------------------|------------|
| Trade Balance (TB) | 4.211*      | 6 | 2.27              | 3.28              | Cointegration |

*1% level of significance ** 5% level of significance ***10% level of significance

The bound testing showed that the critical values of the F-statistics were greater than upper bound at 95% level of confidence. In fact, the results were even significant at 99% indicating strong evidence of Cointegration in the model models (Eq. 5). This implied that there is a long-run relationship between the under analysis variables and hence, we can proceed with the estimation and further analysis. The results of Nonlinear ARDL are presented in Table 3:

Table 3 Nonlinear- ARDL Estimation US Trade Balance

| Variables | Coefficient | Prob. |
|-----------|-------------|-------|
| Panel A: Short Run Estimates |
| \(TB_{t-1}\) | -0.192 | 0.000* |
| \(EX^+_{t-1}\) | -1.156 | 0.037** |
| \(EX^-_{t-1}\) | -0.936 | 0.112 |
| \(PD_{t-1}\) | -0.260 | 0.014* |
| \(Productivity_{t-1}\) | -0.109 | 0.011* |
| \(Savings_{t-1}\) | 0.011 | 0.362 |
| \(Budget_{t-1}\) | 0.04 | 0.377 |
| \(\Delta EX^+\) | -0.594 | 0.809 |
| \(\Delta EX^-_{t-1}\) | 5.952 | 0.024* |
| \(\Delta PD_t\) | -0.109 | 0.417 |
| \(\Delta PD_{t-1}\) | 0.071 | 0.612 |
| \(\Delta PD_{t-2}\) | 0.385 | 0.003* |
| \(\Delta Productivity_t\) | 0.034 | 0.011* |
| \(\Delta Productivity_{t-1}\) | 0.115 | 0.000* |
| \(\Delta Productivity_{t-2}\) | 0.089 | 0.001* |
| \(\Delta Productivity_{t-3}\) | 0.069 | 0.001* |
| \(\Delta Productivity_{t-4}\) | 0.036 | 0.008* |
| \(\Delta Savings_t\) | -0.012 | 0.333 |
| \(\Delta Budget_t\) | -0.015 | 0.578 |
| \(\Delta Budget_{t-1}\) | -0.043 | 0.126 |
| Constant | 0.012 | 0.974 |
| ECT | -0.192 | 0.000* |

Panel B: Long-run Estimates

| \(EX^+\) | -6.007 | 0.033** |
| \(EX^-\) | -4.866 | 0.103 |
| Price Deflator | -1.351 | 0.001* |
| Productivity | -0.570 | 0.002* |
| Savings | 0.062 | 0.337 |
| Budget | 0.208 | 0.291 |

Panel C: Diagnostic Testing

| R² | 0.969 |
| F-test | 111.174 | 0.000* |
| Jarque-Bera (JB) residuals normality test | 0.968 | 0.616 |
| Breusch-Godfrey (BG)LM test | 0.069 | 0.965 |
| Durbin Watson test | 1.985 |

Electronic copy available at: https://ssrn.com/abstract=3439302
Breusch-Pagan-Godfrey (BPG) test | 27.701 | 0.116
White-test | 28.493 | 0.098
Ramsey REST Test | 1.191 | 0.237

*1% level of significance ** 5% level of significance ***10% level of significance, BG LM test with two lags for auto-correlation. Note: Huber-White Hinkley heteroskedasticity-consistent standard errors & covariance.

The estimation results of NARDL model presents the evidence of asymmetries and nonlinearities in the relationship between US trade balance and exchange and other determinants of the trade balance in both short and long short run. To start with we can witness the evidence of the self-correcting mechanism in the trade balance as the lagged value of Trade balance ($TB_{t-1}$) showed a negative and significant impact. On the other hand, the exchange rate showed evidence of asymmetry as the lagged positive exchange rate ($EX^+_{t-1}$) shocks had a negative and significant while the negative ($EX^-_{t-1}$) shock also had a negative but insignificant impact. The price deflator and productivity showed negative and significant impact with one lag implying that the increase in the price level or inflation decreases the competitiveness of US and deteriorates the trade balance. The lagged savings and budget (surplus/deficit) had a positive impact which implied that the increased savings and fiscal discipline can lead to the improvements in the trade balance, though the results were not highly significant. The short-run estimates of the positive shocks to the exchange rate ($\Delta EX^+_t$) showed a negative while the negative shocks or depreciation ($\Delta EX^-_{t-1}$) had strong positive and significant effects on the trade balance, suggesting the short-term asymmetries and nonlinearities. The price deflator had a contemporaneous negative effects, though they were not very significant and varied with lags. Interestingly, the productivity showed short-term positive effects on the trade balance which were also high significant. This implied that the productivity improvements can lead to short-term trade balance improvements. The savings and budget surplus/deficit showed short term negative but insignificant effects on the trade balance. The Error Correction Term (ECT) is found to be negative (-0.192) and high significant suggesting the stability of the model and pace of adjustment. The long run estimates of our NARDL model presented in the Panel (B) suggests that the positive exchange rate shocks or appreciation ($EX^+$) has strong negative and highly significant effects on the trade balance. On the other hand the negative shocks or depreciation ($EX^-_t$) had also a negative but insignificant impact. This indicates the asymmetry the nexus between exchange rate trade balances but also suggests that the long-run improvements of trade balance may not be possible by mere exchange rate depreciation. The price deflator showed very
strong negative and significant impact on the trade balance which implied that the inflation significantly reduces the competitiveness of the US economy and worsens the trade balance. The productivity also showed negative and significant impact on the trade balance in the long run, this implies that the increase in the productivity which may lead to higher income increase the demand for the foreign goods and hence, reduces the US trade balance in the long run. The savings and budget (surplus/deficit) showed a positive impact, indicating the importance of savings and fiscal discipline for the US trade balance. Lastly, we performed the dialogistic test to check the robustness of our model and estimates. It showed that the estimates are very robustness. The $R^2$ and F-test showed high and significant values which implied the overall significance of model. Nonetheless, the Jarque-Bera (JB) residuals normality test showed that the null of normality was not rejected at the 5% level of significance (p-value 0.616 > 0.05). Similarly, the Breusch-Godfrey (BG) LM test and Durbin Watson test suggest that the null of no-auto correlation was not rejected at 5% level of significance. The Breusch-Pagan-Godfrey (BPG) test and White test were performed to check for the heteroskedasticity. The results showed that the null of no heteroskedasticity was not rejected at the 5% level of significance. Lastly, we performed the Ramsey REST Test to check for the mis-specification and the null of no-misspecification was not rejected. Concomitantly, in nutshell, we can conclude that our estimates are robust against all the diagnostic tests including non-normality, Auto-correlation, heteroskedasticity and mis-specification. However, in order to test the stability of our model, we performed the CUSUM and CUSUMSQR parameter stability test. The results are presented in the Figure 3:
The parameter stability test for the US trade balance showed that our estimates are stable. After the stability test, we estimate the multiplier effects of real effective exchange rate dynamics on the US trade balance. The results of the N-ARDL cumulative multiplier impact analysis of real effective exchange rate are presented in Figure 4:

Figure 3. CUSUM and CUSUMSQ Parameter Stability Test for the US Trade Balance

Figure 4: NARDL Multiplier of real effective exchange rate and response of US trade balance
The N-ARDL multiplier effects of real effective exchange rate dynamics for the US trade balance showed very interesting results. The positive shock to the real effective exchange rate or an appreciation (1%) showed an initial improvement but then deterioration of the trade balance. A clear evidence of the J-curve behaviour, however, the negative shock to the real effective exchange rate led to a consistently positive response from the trade balance. Collectively, there is prima facie evidence of an Asymmetric J-curve behaviour of the trade balance in response to the real effective exchange rate dynamics.

5. Conclusion

The global trade imbalances is a topic which never lost its significance in international economics and political economy. This holds true today where the world largest economy is also the largest deficit nation. Concomitantly, it has led to a heated debate and calls for the “trade wars” and accusations of competitive devaluations. However, the impact macroeconomics factors which influence the trade balance adjustment is complicated and interrelated. Keeping this debate in context, we investigated the determinants of US trade balance in a framework which does account for the asymmetric and nonlinear effects of exchange rate dynamics for the US trade balance. Our empirical findings and facts on the ground lead us to conclude that there is significant evidence of short and long run asymmetries between the exchange rate, US trade balance and its determinants. We found the evidence of an asymmetric J-curve. The depreciation can be beneficial to the US trade balance which implies that it is the US trade deficit is related to the exchange rate pass-through to which the US has more influence. Furthermore, our empirical results lead us to conclude that the domestic inflation (GDP deflator), productivity, domestic savings and fiscal discipline are crucial for US trade balance in the short to long term. Specifically, domestic inflation (GDP deflator) and price stability is an important factor which erodes the US international competitiveness trade balance. There could be some short-term gains through improvements in the productivity, however, in the long run, it also leads to negative effects which are in line with the literature. The fiscal discipline and private savings are also found to be important factors which can facilitate the correction of the US trade deficit. The findings of this study contribute to the debate on the US trade deficit and have profound policy implications for the competitiveness of the US economy and its external balance. Specifically, it shows that the trade balance improvement is cannot
be attributed to one single macroeconomics factors. Stabilization policies which can facilitate an increase in savings, fiscal discipline, and domestic price stability can act as critical facilitators within a plan of correcting US trade imbalance over the long run. Such a stabilisation should be gradual as sharp stance can have unattended consequences for the global economy. Putting the politics of trade wars aside, the policymakers should be aware of the inter-relationship between these factors and their individual and collective impact on the trade balance.
References

Arize, A. C., Malindretos, J. Igwe, E. U. 2017, ‘Do exchange rate changes improve the trade balance: An asymmetric nonlinear cointegration approach’, International Review of Economics and Finance, 49, pp.313-326.

Arize, A. C., Bonitsis, T. M., Kallianiotis, I. N., Kasibhatla, K. M., Malindretos, J. 2000, Balance of payment adjustments. Macro facets of international finance revisited. Westport, CT: Greenwood Press.

Baharumshah, A. Z. 2001, The Effect of Exchange Rate on Bilateral Trade Balance: New Evidence from Malaysia and Thailand’, Asian Economic Journal, 15, (3): 291-311

Bahmani-Oskooee, M., Baek, J. 2016, Do exchange rate changes have symmetric or asymmetric effects on the trade balance? Evidence from U.S.–Korea commodity trade', Journal of Asian Economics, 45, pp.15-30.

Bahmani-Oskooee, M., Fariditavana, H. 2016, ‘Nonlinear ARDL approach and the J-curve phenomenon’, Open Economies Review, 27, pp.51–70.

Bahmani-Oskooee, M., Fariditavana, H. 2015, ‘Nonlinear ARDL approach, asymmetric effects and the J-curve’, Journal of Economic Studies, 42, pp.519–530.

Bahmani-Oskooee, M., Kutan, AM 2009, The J-curve in the emerging economies of Eastern Europe’, Applied Economics, 41 (20): 2523-2532.

Bahmani-Oskooee, M., Ratha, A. 2004, “The J-curve: a literature review”, Applied Economics, 36, 13, pp. 1377-1398.

Bahmani-Oskooee, M., Payesteh, S. 1993, ‘Budget Deficits and the Value of the Dollar: An Application of Cointegration and Error-Correction Modeling’, Journal of Macroeconomics, 15, pp.661-677.

Bahmani-Oskooee, M., Saha, S. 2017 ” Asymmetric response of the US–India trade balance to exchange rate changes: Evidence from 68 industries. The World Economy. 2017; 40: 2226–2254.

Bahmani-Oskooee, M., Bose, N. and Zhang, Y. 2019, An Asymmetric Analysis of the J-curve Effect in the Commodity Trade between China and the U.S, The World Economy, doi:10.1111/twec.12829

Batra, R., Beladi, H. 1999, ‘Manufacturing and the trade balance’, Pacific Economic Review, 3: 2 pp.121–131

Baxter, M. 1995. “International Trade and Business Cycles.” In Handbook of International Economics Vol. 3, eds. Gene M. Grossman and Kenneth Rogoff, pp. 1801-1864. Amsterdam: North-Holland.

Beetsma, R. Klaassen, F. Giuliodori, M. 2008, ‘The Effects of Public Spending Shocks on Trade Balances and Budget Deficits in the European Union’, Journal of the European Economic Association, no. 2/3, p. 414.

Begović, S, Kreso, S. 2017, ‘The adverse effect of real effective exchange rate change on trade balance in European transition countries; Nepovoljan efekt promjena realnog efektivnog tečaja na trgovinsku bilancu u Europskim tranzicijskim zemljama’, Zb. rad. Ekon. fak. Rij. 35: 2, pp.277-299.

Bernanke, B.S. 2005. The Global Saving Glut and the U.S. Current Account Deficit. Speech. Board of Governors of the Federal Reserve System.

Bernheim, D. B. 1988. Budget Deficits and the Balance of Trade in Tax Policy and the Economy: Vol. 2. Summers, L. H. (Ed.), MIT, pp. 1-32. URL: http://www.nber.org/chapters/c10935. [Access on 23 Aug. 18 2018]
Blanchard, O. J., Milesi-Ferretti, G.M. 2012, ‘(Why) Should current account balances be reduced?’ IMF Econ. Rev., 60, pp.139-150.

Bleaney, M. Tian, M. 2014, ‘Exchange rates and trade balance adjustment: a multi-country empirical analysis’, Open Economics Review, 25: (4): 655–675.

Borio, C. 2016, On the centrality of the current account in international economics, Journal of International Money and Finance, 68: pp. 266-274.

Bussière, M. Fratzscher, M. Müller, G. J. 2010, Productivity shocks, budget deficits and the current account, Journal of International Money and Finance, 29 (8): 1562-1579.

Caballero, R. Fahri, E., Gourinchas, P.O. 2008, ‘An equilibrium model of “global imbalances” and low interest rates’, American Economic Review, 98, pp.358-393.

Cavallo, M. 2005 Understanding the Twin Deficits: New Approaches, New Results, Economic Letters, 2005-16, July 22, 2005. https://www.frbsf.org/economic-research/publications/economic-letter/2005/july/understanding-the-twin-deficits-new-approaches-new-results/ [accessed on 23 August 2018]

Chen, K. İmrohoroğlu, A. İmrohoroğlu. S.2009, A quantitative assessment of the decline in the U.S. current account balance. Journal of Monetary Economics, 56, pp. 1135-1147

Chinn, M. D. 2000. "The Usual Suspects? Productivity and Demand Shocks and Asia-Pacific Real Exchange Rates,” Review of International Economics 8(1): 20 – 43.

Chinn, M. D. Prasad, E.S. 2003, Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration, Journal of International Economics, 59 (1): 47-76.

Chinn, M. D. 2005. Getting serious about the twin deficits. Council on Foreign Relations, Special Report No. 10.

Chinn, M.D., Wei, S. J., 2013, 'A Faith-Based Initiative meets the evidence: Does a flexible exchange rate regime really facilitate current account adjustment? Review Economics and Statistics, 95 (1): 168-184.

Chinn, M.D., Ito, H., 2008, ‘Global current account imbalances: American Fiscal Policy versus East Asian Savings’, Review of International Economics, 16 (3): 479–498.

Chinn, M.D. Ito, H., 2007, ‘Current account balances, financial development and institutions: assaying the world ‘saving glut’, Journal of International Money and Finance, 26 (4): 546–569.

Chiu, Y. B. Sun, C., 2016, 'The role of savings rate in exchange rate and trade imbalance nexus: Cross-countries evidence', Economic Modelling, 52, pp.1017-1025.

Chiu, Y.-B., Lee, C.-C., and Sun, C.-H., 2010, ‘The U.S. trade imbalance and real exchange rate: an application of the heterogeneous panel cointegration method, Econ. Model., 27, pp.705-716.

Devereux, M. B. Genberg, H.2007 Currency appreciation and current account adjustment, Journal of International Money and Finance, 26, 4, pp. 570-586.

Devereux, M. B. 2000, How does a devaluation affect the current account?, Journal of International Money and Finance,19 (6): pp. 833-851.

Eichengreen, B.2017, Is Germany Unbalanced or Unhinged? Available at [https://www.project-syndicate.org/commentary/german-external-surplus-requires-public-investment-by-barry-eichengreen-2017-05] accessed on 11th September 2017.

Electronic copy available at: https://ssrn.com/abstract=3439302
Engel, C., Rogers, J. 2006, The U.S. current account deficit and the expected share of world output. Journal of Monetary Economics, 53, pp. 1063-1093

Erceg, Christopher J., Luca Guerrieri, Christopher Gust. 2005. “Expansionary Fiscal Shocks and the Trade Deficit.” International Finance Discussion Paper 825, Federal Reserve Board.

Ernesto, R., G, Marcelo, P., D., 2017, 'Does trade openness influence the real effective exchange rate? New evidence from panel time-series', SERIEs: Journal of the Spanish Economic Association, 19, 1, pp 91-113.

Falk, M. 2008, ‘Determinants of the Trade Balance in Industrialized Countries’, FIW Research Report, No. 013.

Feldstein M., 2008, ’Resolving the global imbalance: the dollar and the U.S. saving rate’, Journal Economic Perspectives, Vol. 22, No. 3, pp.113-125.

Ferguson, R. W., “Global Imbalances,” speech at European Institute Roundtable on Financial and Monetary Affairs, Washington, DC, 23 April (2004).

Ferrero, A 2010, 'A structural decomposition of the U.S. trade balance: Productivity, demographics and fiscal policy', Journal of Monetary Economics, vol. 57, pp. 478-490. Available from: 10.1016/j.jmoneco.2010.04.004. [18 August 2018].

Fratzscher, M. 2017, Germany’s Misunderstood Trade Surplus, available at [https://www.project-syndicate.org/commentary/germany-trade-surplus-by-marcel-fratzscher-2017-03?barrier=accessreg] accessed on 12th September 2017.

Ghosh, A., Qureshi, M., Tsangarides, C. 2014, “The Cost of Tying One’s Hands”, Finance & Development, 51, 2: pp. 42–46.

Ghosh, A., Qureshi, M., Tsangarides, C.2013 “Is the Exchange Rate Regime Really Irrelevant for External Adjustment?”, Economics Letters, 118,1, pp. 104–109,

Greenspan, A.2005a, “Current Account,” speech at Advancing Enterprise 2005 Conference, London, 4 February.

Greenspan, A.2005b,“Mortgage Banking,” speech at American Bankers Association Annual Convention, Palm Desert, California, 26 September.

Hassan, M. S. Wajid, A. Kalim, R. 2017. Factors affecting trade deficit in Pakistan, India and Bangladesh. Economia Politca, 34(2): 283 – 304.

Hoffmann, M. 2013, What drives China's current account? Journal of International Money and Finance, 32, pp. 856-883.

Himarios, D.1989, Do devaluations improve the trade balance? The evidence revisited. Econ Inq 27(1):143–168

Hong, P. 2001, Global implications of the United States Trade Deficit Adjustment, Discussion Paper of the United Nations Department of Economic and Social Affairs, No. 17, ST/ESA/2001/DP.17.

Hume, D.1742, Essays, Moral, Political, and Literary, Of the Balance of Trade, Printed by R. Fleming and A. Alison, for A. Kincaid Bookseller, Edinburgh.

Kandil, M. 2009, On the relation between financial flows and the trade balance in developing countries, J. Int. Trade Econ. Dev., 18: 373-393
Kim, S. Roubini, N. 2004. “Twin Deficits or Twin Divergence? Fiscal Policy, Current Account and Real Exchange Rate in the U.S.” Mimeo, Korea University and New York University.

Kollmann, R 1998, 'US trade balance dynamics: the role of fiscal policy and productivity shocks and of financial market linkages', Journal of International Money and Finance, no. 4, p. 637.

Laibson, D., Mollerstrom, J., 2010. Capital flows, consumption booms and asset bubbles: a behavioural alternative to the savings glut hypothesis. Economic Journal, 120 (544), 354–374.

Lee, J, Chinn, MD 2006, 'Current account and real exchange rate dynamics in the G7 countries', Journal of International Money and Finance, 25, 257-274.

Lee, J., McKibbin, W. J. and Park, Y. C. 2006, Transpacific Trade Imbalances: Causes and Cures, the World Economy, 29: 281-303

Lee, J., Chinn, M.D., 1998. The current account and the real exchange rate: a structural VAR analysis of major currencies. NBER Working Paper No. 6495. National Bureau of Economic Research, Cambridge, MA.

Liew, K.S. Lim, K.P. Hussain, H. 2000, Exchange rate and trade balance: The experience of ASEAN countries, Journal of Management Sciences, 3, 15-18

Mendoza, E, Quadirini, V. Rios-Rull, V. 2009 Financial integration, financial development and global imbalances Journal of Political Economy, 117, 371-416

Narayan P.2006, Examining the relationship between trade balance and exchange rate: the case of China’s Trade with the USA. Appl Econ Lett 13(8):507–510

Nasir, M. A. Jackson, K. 2019, An Inquiry into Exchanges Rate Misalignments as a Cause of the Major Global Trade Imbalances, Journal of Economic Studies, forthcoming.

Pesaran M.H. Shin Y. 1999, An autoregressive distributed lag modelling approach to cointegration analysis. In: Storm S (ed) Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Chapter 11. Cambridge University Press, Cambridge.

Pesaran MH, Shin Y, Smith RJ, 2001, Bounds testing approaches to the analysis of level relationship. Journal of Applied Econometrics, 16:289–326.

Reinhart, C. 2017, The Persistence of Global Imbalances, available at [https://www.project-syndicate.org/commentary/unbalanced-america-external-deficit-by-carmen-reinhart-2017-08] accessed on 12th September 2017.

Rose A.K. 1991, The role of exchange rates in a popular model of international trade: does the ‘Marshall–Lerner’ condition hold? J Int Econ 30(3):301–316

Sachs, J.D. 2017, Will Economic Illiteracy Trigger a Trade War? Available at [ https://www.project-syndicate.org/commentary/trump-economic-illiteracy-trade-war-by-jeffrey-d-sachs-2017-04] accessed on 11th September 2017.

Shin Y, Yu B, Greenwood-Nimmo M (2011) Modelling Asymmetric Cointegration and Dynamic Multiplier in a Nonlinear ARDL Framework, Mimeo.

Shahbaz M, Jalil A, Islam F.2012. Real exchange rate changes and the trade balance: the evidence from Pakistan. Int Trade J 26(2):139–153

Steinberg, J.B. 2018, On the source of U.S. trade deficits: Global saving glut or domestic saving drought? Review of Economic Dynamics,
Steiner, A. 2014, Current account balance and dollar standard: Exploring the linkages, Journal of International Money and Finance, 41, 65-94.

Shelburne, R.C. 2010, The Global Financial Crisis and Its impact on Trade: The World and The European Emerging Economies, United Nations Economics Commission For Europe, Geneva, Switzerland, Discussion Paper Series, No. 2010.2.

Sinn, H.W. 2014, The Euro Trap: On Bursting Bubbles, Budgets, and Beliefs, OUP Oxford.

Sinn, H-W. 2017b, President Trump’s Necessary German Lessons, Available at [https://www.project-syndicate.org/commentary/trump-germany-currency-manipulation-charge-by-hans-werner-sinn-2017-03?barrier=accessreg] accessed on 12th September 2017.

Stockman, A. C. 1985 "Effects of Inflation on the Pattern of International Trade," Canadian Journal of Economics, XVIII, 3, 587-601.

Stucka, A Tihomir 2004, 'The Effects of Exchange Rate Change on the Trade Balance in Croatia', IMF Working Papers, no. 65. Available from: 10.5089/9781451848717.001. [20 August 2018].

Wang, C. H. Lin, H. A. Yang, C. H. 2012Short-run and long-run effects of exchange rate change on trade balance: evidence from China and its trading partners. Japan World Economic, 24, 266-273

Yiheyis, Z. Musila, J.2018 "The dynamics of inflation, exchange rates and the trade balance in a small economy: The case of Uganda", International Journal of Development Issues, 17 (2): 246-264.

Zhang, Z. and Sato, K. (2012), Should Chinese Renminbi be Blamed for Its Trade Surplus? A Structural VAR Approach. The World Economy, 35: 632-650.

Zivot, E. Andrews, K.1992 ‘Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis’, Journal of Business and Economic Statistics, 10 (10): 251–270.