

Chen, David Y.; Li, Tongzhe

## Article

# International trade imbalance: A comparison of the U.S. and the U.K.

Global Business & Finance Review (GBFR)

## Provided in Cooperation with:

People & Global Business Association (P&GBA), Seoul

*Suggested Citation:* Chen, David Y.; Li, Tongzhe (2015) : International trade imbalance: A comparison of the U.S. and the U.K., Global Business & Finance Review (GBFR), ISSN 2384-1648, People & Global Business Association (P&GBA), Seoul, Vol. 20, Iss. 2, pp. 1-14,  
<https://doi.org/10.17549/gbfr.2015.20.2.1>

This Version is available at:

<https://hdl.handle.net/10419/224329>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by-nc/4.0/>



## International Trade Imbalance: A Comparison of the U.S. and the U.K.

David Y. Chen<sup>a</sup> and Tongzhe Li<sup>b</sup>

<sup>a</sup>Associate Professor of Department of Economics, North Carolina A&T State University, Greensboro, NC, USA

<sup>b</sup>Postdoctoral Research Associate Center for Experimental and Applied Economics, University of Delaware, Newark, DE, USA

### ABSTRACT

This paper investigates macroeconomic determinants of the trade imbalance in the U.S. and the U.K. It is based on a simple DSGE model under perfect capital mobility and flexible exchange rates assumptions of the Mundell-Fleming international trade model. Results suggest both lagged by one period money component and lagged by one period first-order differenced government budget deficit were destabilizers for contemporaneous first-order differenced current account deficit in both countries for 1990-2012. The effect of government budget deficit was weaker. Lagged by one period first-order differenced personal consumption expenditure became a medium level destabilizer for U.S. and an insignificant stabilizer for U.K. for the same current account deficit variable. The Judd-Gaspar test suggests that this model is robust in accuracy for both nations.

*Keywords: Trade Imbalance; Budget Deficit; Consumption; DSGE Model; Judd-Gaspar Test*

## 1. Introduction

International trade imbalance occurs in many countries every year, but long-term sustained trade deficit may pose a problem for the nation. From 1990 to 2014, U.S. current account had been in a deficit position (Cooper, 2008) all these years. Annual trade deficit averaged -3.23 percent of GDP (FRB-St.Louis, 2014, more on this in table 1 later), and -0.16 percent in the U.K. (UK Office of National Statistics, 2014). According to Cooper, international trade imbalance resulted from growing excessive imports over exports and investment over savings. Trade imbalance affects national income identity. Positive net exports

increase GDP; a negative value does the opposite. An extended area in trade imbalance research is the twin deficits theory that covers both government budget deficit and trade imbalance. Twin deficits exist in several countries including the U.S. (Bartolini & Lahiri, 2006; Tang, 2013), the U.K. (Corry, Valero & van Reenen, 2011), Greece (Panagiotidis, 2011), Portugal (Kosteletou, 2013), Italy (Weisenthal, 2013), Serbia (Urosëvić, Nedeljković & Zildžović, 2012), Thailand (Lau, Mansor & Puah, 2010) and others.

There are two approaches to look into trade imbalance and budget deficit relationship: one claims that they are linked by causation from one deficit to the other; but the other approach does not believe so. The former is the twin deficit theory (Bluedorn & Leigh, 2010), and the latter is the Ricardian equivalence proposition (Taylor, 2004, Kim & Roubini, 2008). Empirical evidence on this debate is inconclusive. Bluedorn and Leigh, using a single

† David Y. Chen

Associate Professor of Economics Department of Economics,  
North Carolina A&T State University, Greensboro, NC 27411, USA  
Tel: 336-285-3326, E-mail: [chend@ncat.edu](mailto:chend@ncat.edu)

equation approach on lagged variables, suggest a link exists between the twin deficits. Cooper (2008), based on a global GDP model, states that trade imbalance is sufficiently explained by business globalization and demographic change, therefore, current account deficit is not explicitly related to fiscal policy. New evidence is needed from a different method, the dynamic stochastic general equilibrium (DSGE) model for understanding of this extended trade imbalance issue and its policy implication.

In recent years the DSGE methodology has gained significant acceptance in economic and financial research (more on this in methodology section) due to advancement in theory and breakthrough in computational technology. The purpose of this paper is to investigate trade imbalance and government budget deficit by a DSGE model in two nations, the U.S. and the U.K. Because both countries fit in the assumptions of the Mundell-Fleming international trade model, flexible exchange rates, fully developed financial markets and complete global capital mobility (Mundell, 1960, 1961; Fleming, 1962). The trade deficit in proportion of GDP is significant in size in both countries (Cooper, 2008). Both are developed countries with similar history in budget surplus from 1998 to 2001 and deficit in other 1900s and 2000s years. In the general equilibrium framework with full employment in the labor sector, we may consider household consumption (Lord, 2002; Deaton, 2005) and national debt as the driving forces for trade balance. This study originates from the twin deficits theory and provides parameter estimates for selected macroeconomic variables in the twin deficits model. Our results may provide a basis for comparison with other studies in this research area.

For policy implication purpose we select the first-order difference method in variable transformation instead of the trend adjustment method based on long-term trend. This transformation will allow the variable to satisfy the long-run stationarity requirement. As policymakers look for major factors causing trade imbalance, our study may provide a short list of macroeconomic variables for them to act upon. When a change in the value of the variable is about to occur or already in action such as floating exchange rate changes, then degree of change becomes relevant. The first difference of a variable of real exchange rate indicates how much change there is, also whether the change stays in the upper and lower bounds allowed by the monetary authority. This flexibility is essential to the managed float system. For policymakers, this study

can be a valuable reference to (1) decide what to do, and (2) when to do it based on macroeconomic determinants in international trade imbalance. In this regard, results of this study may also be useful for market practitioners.

This paper is organized in the following order: section two presents methodology and data, section three reports on results, analysis of results is given in section four, applications are formulated in section five and section six concludes.

## II. Methodology and data

### A. Methodology

The DSGE approach for economic and financial studies has been developed on three foundations, dynamic economics, system of equations, and forward looking rational expectations. The Walrasian tradition of general equilibrium economic system adopted both static and dynamic analyses in pursuing equilibria of all components in the economy. Utility maximization by individuals and profit maximization of business firms are used in model building. Large macroeconomic systems using simultaneous equations had been utilized to handle economic forecasts based on a backward looking mechanism. Within the system some variables took a random walk equation with an error term to accommodate innovations and to induce responses from target variables. The rational expectations component was added later by Muth's seminal paper (1961). One advantage of rational expectations is its forward looking nature in forecasting.

Kydland & Prescott (1982) point out the need of total information for policymakers facing uncertainty in the economy. A hybrid strand of blending general equilibrium system of equations, dynamic programming, and rational expectations components has gradually become the DSGE representation (Bellman, 1957; Sargent, 1987). This approach has been facilitated by advances in computational technology (Sims, 2001; Miranda & Fackler, 2002; Lim & McNelis, 2008). But not all recent studies on macroeconomic fundamentals are based on general equilibrium feature. For instance, Sin (2015) relies on SVAR approach to study the impact of a large economy (Mainland China)'s economic policy uncertainty on its

neighboring small economies (Taiwan and Hong Kong). In this paper we specify a simple DSGE representation following Sims' canonical representation model (2001). It is of one lag and one-step-ahead expectations of personal consumption expenditure and national debt as policy variables. The two state variables are the federal budget surplus/deficit and the current account balance. Multiple-step-ahead expectations method is more complicated and impractical for this study.

In this paper a simple DSGE model consists of four sectors of an open economy, the households, the firms, government, and financial assets market. The households depend on their personal consumption expenditures to fulfill inter-temporal utility maximization subject to budget constraints (Obstfeld & Rogoff, 1996). This is specified by the first-order condition Euler equation (equation 4 below). Associated with consumption are a real interest rate component (5) and a rational expectations component (17). We treat consumption tax implicitly in the household sector. An aggregate production function and capital stock and other components are specified in (6) to (9) to represent the business sector and total income of the nation. GDP is included to see whether a country's GDP affects the size of its trade imbalance (Cooper, 2008).

We specify the government sector by functions which include management of national debt, national defense and homeland security, health care, pension, and deficit spending. Those external components are formed as random walk process in equations (9), (10), (13), (14), and (15) in order to uphold the simplicity of the whole model. The importance of national debt in government spending requires no further explanation. However, we include a rational expectations component of national debt in equation (15). Financial assets sector includes government bonds (8) and money stock (9), and international trade deficit as stipulated in the Mundell-Fleming tradition as random walk processes. Current account balance (16) has consumption, other international trade related components, and interaction with fiscal policy. A unique specification in (16) that makes it different from other research is the inclusion of a consumption expenditures of one-lag and of one-period forward expectations term. This system of equations then is converted to Sims' canonical representation in (2).

According to Sims (2001), a canonical representation of a system of equations in general can be formed in an implicit non-linear form

$$1. \Gamma(E_t y_{t+1}, y_t, \eta_{t+1}) = 0 \quad (1)$$

where  $y$  is a 15 by 1 vector of variables including  $\ln C$ ,  $\ln r$ , GDP, A, K, N, DEBT, B, M, NDHS, HEAL, GBS, BCA, W1 and W2. Each variable will be explained later. Rational expectations variables,  $E_t y_{t+1}$ , will be discussed later.  $\eta$  is a rational expectations error vector.

In a linear or log-linear representation it becomes

$$2. G_0 y_{t+1} = G_1 y_t + Q + Dv_{t+1} + F \eta_{t+1} \quad (2)$$

where  $G_0$ ,  $G_1$  are 15 by 15 parameter matrices.  $Q$  is a 15 by 1 vector,  $D$  is a 15 by 12 matrix, and  $v$  is a 12 by 1 vector and  $\eta$  is a 2 by 1 expectations error vector.  $F$  is a matrix. Details of these matrices are available from the authors upon request. Solutions to this representation are obtained from the following reduced form (DeJong & Dave, 2011)

$$3. Y_t = T_1 Y_{t-1} + Q + T_0 v_t \quad (3)$$

where  $Y$  stands for variable vector,  $T_0$ , and  $T_1$  are estimate matrices.

Specifically, the system of equations of this study is listed in the following. Individual equation may be over simplified, however, it serves as a beginning and further research may build upon this foundation.

4. The Euler equation of an aggregate consumption function in logarithmic form:

$$E_t(\ln PCE)_{t+1} = \delta \ln(\ln PCE)_t + \ln(1+r)_t \quad (4)$$

where  $\ln PCE$  is the natural log of aggregate personal consumption expenditures, an exogenous variable.  $\ln(1+r)$  deals with transformed real interest rate. The Euler error is defined as the difference between the values of the left hand side and the right hand side.

5. An interest rate equation:  $r$  is the real short-term interest rate

$$(\ln(1+r))_t = \alpha_0 + \alpha_1(\ln(1+r))_{t-1} + \varepsilon_{1t} \quad (5)$$

6. An aggregate production function based on a Solow growth model:

$$\ln(\text{GDP})_t = \ln(A)_t + \alpha_k \ln(K)_t + \alpha_n \ln(N)_t + \varepsilon_{2t} \quad (6)$$

7. A total factor productivity equation as input of the Solow model above:

$$(A)_t = \psi_0 + \psi_1 (A)_{t-1} + \varepsilon_{3t} \quad (7)$$

8. A capital stock equation as input for the growth model:

$$(K)_t = \gamma_0 + \gamma_1 (K)_{t-1} + \gamma_2 (\ln(1+r))_{t-1} + \varepsilon_{4t} \quad (8)$$

9. A labor equation as input for the growth model:

$$(N)_t = \delta_0 + \delta_1 (N)_{t-1} + \varepsilon_{5t} \quad (9)$$

10. A national debt equation with a one-step-ahead expectations component:

$$(DEBT)_t = \sigma_0 + \sigma_1 (DEBT)_{t-1} + \sigma_2 E_t (DEBT)_{t+1} + \varepsilon_{6t} \quad (10)$$

11. A simplified bond asset equation representing the financial market:

$$(B)_t = \theta_0 + \theta_1 (B)_{t-1} + \varepsilon_{7t} \quad (11)$$

12. A money stock equation representing the currency market:

$$(M)_t = \tau_0 + \tau_1 (M)_{t-1} + \varepsilon_{8t} \quad (12)$$

13. A national defense and homeland security spending equation:

$$(NDHS)_t = \lambda_0 + \lambda_1 (NDHS)_{t-1} + \varepsilon_{9t} \quad (13)$$

14. A health care spending equation:

$$(HEAL)_t = \mu_0 + \mu_1 (HEAL)_{t-1} + \varepsilon_{10t} \quad (14)$$

15. A government budget surplus/deficit approximation equation:

$$(GBS)_t = \xi_1 (GBS)_{t-1} + \xi_2 E_t (DEBT)_{t+1} + \xi_3 (DEBT)_{t-1} + \xi_4 (GDP)_{t-1} + \xi_5 (NDHS)_{t-1} + \xi_6 (HEAL)_{t-1} + \xi_7 (BCA)_{t-1} + \xi_8 (M)_{t-1} + \varepsilon_{11t} \quad (15)$$

Annual government spending does not include payment on national debt. For concern on the multi-collinearity issue in using one-lag component of government budget spending as an explanatory variable, the reader is referred to Sims' canonical representation (2001). This arrangement specifies the relative significance of spending on national defense, homeland security, health care, and trade imbalance in these two countries.

16. A current account balance approximation equation:

$$(BCA)_t = \varphi_1 (BCA)_{t-1} + \varphi_2 E_t (\ln PCE)_{t+1} + \varphi_3 (\ln PCE)_{t-1} + \varphi_4 (GDP)_{t-1} + \varphi_5 (GBS)_{t-1} + \varphi_6 (K)_{t-1} + \varphi_7 (B)_{t-1} + \varphi_8 (M)_{t-1} + \varepsilon_{12t} \quad (16)$$

Cooper (2008) claims that size of the international trade

of a nation is related to its aggregate production. In addition, level of consumption, rational expectation on future consumption spending, capital stock and financial markets represented by bond and money supply are included. Government spending is included to test correlation of the twin deficits. The error term does allow for fluctuations in exchange rate which is implicit to the system. A further study may build a new set of variables.

17. The first rational expectations component of consumption (Sims, 2001):

$$W_{1,t-1} = (\ln PCE)_t - \eta_{1t} \quad (17)$$

18. The second rational expectations component of national debt:

$$W_{2,t-1} = (DEBT)_t - \eta_{2t} \quad (18)$$

For more empirical approach of this specification the reader is referred to Chen & Li's Asian financial crises study (2014).

## B. Data

The study period is selected to be from 1990 to 2012, based on more recent data while these countries were crossing from a period of prosperity to the Great Recession in 2008 and 2009 in business cycles. The sources of annual data are given in the following: For the U.S., the real GDP, personal consumption expenditures, federal funds rate, capital stock, federal debt, money stock (M2), Treasury securities outstanding, and consumer price index were obtained from the FRED database of the Federal Reserve Bank of St. Louis ([www.stlouisfed.org](http://www.stlouisfed.org)).

Capital stock is the real net stock of fixed private nonresidential capital in billions of dollars. U.S. government budget surplus/deficit and balance of current account (BCA) were obtained from the Department of Commerce, Bureau of Economic Analysis. Labor figure as civilian employment in millions of workers was obtained from the Bureau of Labor Statistics. Total factor productivity was taken from Abel, Bernanke & Croushore's table 3.1 (2013). National health expenditures were obtained from the National Health Expenditure Accounts released by the U.S. Department of Health and Human Services. Defense and national security expenditure was estimated by the U.S. Government Spending Company (2013).

For the U.K., annual real GDP, employed workers,

national debt, healthcare expenditure, government surplus/deficit and current account balance were obtained online from the Office for National Statistics, and HM Treasury. Bilateral currency exchange rate of U.S. and U.K. for value conversions was taken from the U.S. Board of Governors of the Federal Reserve System. Personal consumption expenditure was estimated from U.K. population and per capita consumption each year online at website ([www.Ukpublicspending.co.uk](http://www.Ukpublicspending.co.uk)). U.K. LIBOR interest rate was available from the website [www.fedprimerate.com/libor/libor\\_rate\\_history.htm](http://www.fedprimerate.com/libor/libor_rate_history.htm). Total factor productivity, outstanding government bonds were sought from [www.OECD.stat.export](http://www.OECD.stat.export). Capital formation was taken from the World Bank. Money supply was obtained from the Bank of England. Defense expenditure was obtained from [www.UKpublicspending.co.uk](http://www.UKpublicspending.co.uk) and [webarchive.nationalarchives.gov.uk](http://webarchive.nationalarchives.gov.uk). Consumer price index and inflation rate were taken from [www.rateinflation.com](http://www.rateinflation.com).

### III. Results

#### A. Summary statistics of selected time series

To illustrate the significance of twin deficits in the

U.S. and the U.K., table 1 presents the summary statistics of selected macroeconomic variables in the past two decades.

Average annual current account deficit in proportion to real GDP was 3.2 percent in the U.S. but sixteenth of a hundred of one percent in the U.K. Average annual U.S. current account deficit -348.7 billion dollars which is 125 times more than -2.78 billion dollars of the U.K.

Average annual U.S. government deficit -323.3 billion dollars reaches a multiple of 48 than the -6.72 billion dollars (-4.1 billion pounds) of the U.K. Average annual government budget deficit accounted for 2.99 percent of real GDP in the U.S. but only 0.39 percent in the U.K. The problem of government budget deficit was more severe in the U.S. than the U.K.

Average personal consumption expenditures accounted for 64.9 percent in U.S. GDP but only 41.9 percent in the U.K. Consumption behaviors in these two nations are significantly different in some areas but similar in others. Based on the OECD statistics of 2010 and 2014, 66 percent of household consumption expenditures in the U.S. went to services but 56 percent for the U.K. (OECD, 2015). Expenditures on health-based items took up 21 percent in aggregate consumption in the U.S. but only 2 percent in the U.K. For insurance expenditures, the percentage distributions are similar, 2.8 percent for the U.S. and 2.3 percent for the U.K. The percentages for home-related

**Table 1.** Summary Statistics of Selected Macroeconomic Variables, 1990-2012

Variable	U.S.		U.K.	
	Mean	Range	Mean	Range
Real GDP (trillion)	\$10.79	7.88 ~ 13.29	£1.06	£0.78 ~1.34
In USD			(\$1.74)	(\$1.28~2.19)
Current account (billion)	-\$348.7	-800.6 ~ 2.9	- £1.7	-£3.5 ~ -0.1
In USD			(-\$2.78)	(-\$5.74~ -\$0.16)
% of GDP	-3.23%		-16%	
Deficits (billion)	-\$323.3	-1412.7 ~ 236.2	- £4.1	- £11.5 ~ 1.3
In USD			(-\$6.72)	(-\$18.84~ \$2.13)
% of GDP	-2.99%		-39%	
Consumption(% GDP)	64.9%	46.7 ~ 80.8	41.9%	38.9 ~ 45.1
Health exp. (% GDP)	14.9%	12.5 ~ 17.9	6.0%	4.86 ~ 8.09
Defense exp.(% GDP)	4.7%	3.6 ~ 6.2	3.1%	2.6 ~ 4.2
Nat'l Debt (% of GDP)	66.3 %	55.3 ~ 97.6	47.7%	35 ~ 85.5

Sources: US Federal Reserve Bank of St. Louis, and UK Office of National Statistics.

expenses including housing, utilities, furnishing, and maintenance expenditure, are similar 24 for the U.S. and 28 for the U.K.

Such difference raises one question: what the possible role of expected consumption expenditure plays in international trade imbalance. It may shed light on the future demand for import goods and services by means of rational expectations of consumption. If strong link exists then consumption may contribute significantly to trade deficit. National health expenditures made up 14.9 percent of U.S. GDP, but only 6 percent in U.K. Substantial difference 18.6 percent is found in national debt in proportion of GDP in two countries.

### B. The Unit Root Test

To check the stationarity requirement that each time series is confirming to its long term trend, or roots are out of the unit circle in series generating process, we used four unit root tests, the Augmented Dickey-Fuller, the Phillip-Perron, the Dickey-Fuller Generalized Least Squares, and the Kwiatkowski-Phillips-Schmidt-Shin test. When a series failed two or more tests then the first-order or second-order difference transformation was applied. Results of selected transformed series are reported in table 2. The U.S. information is listed on the upper half, the U.K. in the lower half.

For demonstration, U.S. series DLNPCE1 stands for

the first-order differenced log value of personal consumption expenditures in proportion of real GDP is stationary and passed all four tests.

### C. The Cointegration test

The cointegration test of series in both countries is based on the Johansen cointegration test (1991). The purpose of this test is to see whether in the long horizon (long-run) the tested variables are moving collectively as stationary. Each variable under test may be non-stationary or I(1), but tested together they are I(0). When both government budget deficit and current account deficit variables were used, result of the trace test indicated there were two co-integrating equations. This result fulfills the group stationarity requirement of this model. The test on four variables, two deficit variables, national debt, and national defense expenditures, shows only one cointegrating equation. Test on the entire set of variables was not feasible due to limited sample size in each country.

### D. Calibration in simulation

We calibrate the initial values of parameter estimates of the DSGE model by using ordinary least squares (OLS) regression on equations 4 to 16. The OLS estimates plus/minus three standard errors covers ninety-six percent

**Table 2.** Unit-root Test for Selected Macroeconomic Variables

Variable	Augmented Dickey-Fuller	DF-GLS	Phillips-Perron	Kwiatkowski-Phillips Schmidt-Shin
U.S.				
DLNGDP	-2.897 (NS)	-2.638 (S)	-2.941 (S)	0.304 (S)
DLNPCE1	-4.050 (S)	-3.636 (S)	-4.045 (S)	0.063 (S)
DDDEBT	-3.718 (S)	-4.011(S)	-4.524 (S)	0.252 (S)
DDDEFENSE	-4.748 (S)	-4.344 (S)	-5.212 (S)	0.337 (S)
U.K.				
DLNPCE1	-4.669 (S)	-4.703 (S)	-4.783 (S)	0.201 (S)
DDDEBT	-3.441 (S)	-3.683 (S)	-3.777 (S)	-0.094 (S)
DHEAL1	-4.148 (S)	-4.217 (S)	-4.147 (S)	0.314 (S)
DDEFENSE1	-3.154 (S)	-3.217 (S)	-3.196 (S)	0.378 (S)

Note: (S) means stationary. The critical value of the ADF is -3.45 at p=0.01 probability level. Dickey-Fuller GLS regression  $\tau_{\beta}$  test with a critical value -1.616 at p=0.1 or -1.94 at p=0.05. Phillips Perron's rho test has a critical value -3.448 at p=0.01 level. The Kwiatkowski-Phillips-Schmidt-Shin test is based on the null hypothesis that the series is stationary. The asymptotic critical value at p=0.01 is 0.739. Test results are based on absolute values.

**Table 3.** Calibration of Selected Parameters

Symbol	U.S.		U.K.	
	OLS+/- 3s.e.	Simulation	OLS+/-3s.e.	Simulation
Government deficit equation:				
$\xi_1$ (GBS)	0.46 ~ -3.46	-0.17 ~ -3.5	0.69 ~ -1.72	2.13 ~ -4.85
$\xi_3$ (DEBT)	0.46 ~ -0.63	1.0 ~ -2.71	0.24 ~ -0.86	0.78 ~ -4.67
$\xi_7$ (BCA)	1.79 ~ -1.1	2.0 ~ -1.3	0.46 ~ -3.27	0.62 ~ -0.51
Current account deficit equation:				
$\varphi_1$ (BCA)	0.44 ~ -1.2	1.82 ~ -1.6	0.94 ~ -1.45	4.22 ~ -3.01
$\varphi_3$ (lnPEC)	47.28 ~ -60.28	48.0 ~ -61.0	25.56 ~ -80.62	25.73 ~ -58.27
$\varphi_5$ (GBS)	1.38 ~ 0.53	1.7 ~ 0.32	0.42 ~ -0.70	0.83 ~ -0.09

Source: Authors' calculations based on actual data and the model, in high to low values.

of all possible estimates for each parameter in a normal distribution. Based on this range we selected other initial values for parameter simulations. Calibrations of selected variables are reported in table 3.

Our simulation ranges not only were consistent with but also exceeded the ordinary least squares estimates value ranges.

### E. Optimal parameter set

We performed one hundred and twenty simulations for the US. and the U.K. Each simulation is drawn up to 1000 runs to generate a solution. The criterion used

in selecting the best parameter estimate set is the minimum sum of variances of two state variables (Ball, 1999). The minimum sum of variances of government budget deficit (GBS) and current account balance deficit (BCA) is 8.239 for the U.S., and 9.972 for the U.K. as compared to maximum value 300,000 in other simulations. The set of the optimal parameter estimates for each country is presented in table 4.

### F. Optimal parameter estimates

The upper half of Table 4 reports the current account balance equation optimal parameter estimates, and the

**Table 4.** Optimal equation and selected parameter estimates by country

Parameter/variable	U.S.	Function	U.K.	Function
Balance of current account equation: Current BCA				
$\varphi_1$ (lagged BCA)	1.149	strong destabilizer	-.247	weak stabilizer
$\varphi_3$ (lagged lnPCE)	.504	medium destabilizer	-.137	weak stabilizer
$\varphi_4$ (lagged GDP)	1.931	strong destabilizer	.001	near zero destabilizer
$\varphi_5$ (lagged GBS)	.384	weak destabilizer	.398	weak destabilizer
$\varphi_6$ (lagged K)	-1.013	strong stabilizer	1.219	strong destabilizer
$\varphi_7$ (lagged B)	.184	weak destabilizer	-.017	weak stabilizer
$\varphi_8$ (log M)	.514	medium destabilizer	-.571	medium stabilizer
Government budget deficit equation: Current GBS				
$\xi_3$ (lagged DEBT)	-.515	medium stabilizer	-.928	medium stabilizer
$\xi_7$ (lagged BCA)	-.051	very weak stabilizer	.01	very weak destabilizer

Source: Authors' calculations of the DSGE model based on data from U.S. FRB-St. Louis, the U.K. Office for National Statistics.



lower half for selected parameter estimates of the government budget deficit equation. These estimates are considered as the best solution for the Sims' canonical approximation equation for this study. Full discussion of the government budget deficit is beyond the scope of this paper.

The function column defines the effect of a variable on current account deficit or government budget deficit. A stabilizer (negative value) in this study is construed to be one unit increase of the variable tends to decrease fluctuations of another variable. A destabilizer (positive value) means the opposite. We consider, in an absolute value, range 0 to 0.5 to be insignificant or minor level of contribution, 0.501 to 1.0 as medium level of contribution, and 1 or more as significant level contribution. The rationale behind this classification is that if zero stands for no contribution, 1 for whole contribution, the midpoint 0.5 will be substantial contribution. Parameter estimate for lagged by one period DEBT  $\xi_3$  was -.515 in the U.S, but -.928 in the U.K, both fell in the medium influence category. Estimate of national defense and homeland security not shown in the government budget deficit equation in table 4 was .819 in the U.S. but .475 in the U.K. nearly half the size. Parameter estimate for  $\phi_3$  personal consumption expenditures was .504 in the U.S. and -.137 in U.K or insignificant, respectively.

### G. Judd-Gaspar accuracy test statistics

This study adopts the Judd and Gaspar test on the accuracy of the DSGE approximation model (Gaspar & Judd, 1997; Lim & McNelis, 2008). This test is useful for models involving rational expectations variable movements. Since the test aims at balancing the tradeoffs in accuracy, space, and speed of solving approximation models between perturbation and projection methods. It is not based on a specific asymptotic distribution of variables. When rational expectations component is used for personal consumption expenditure, the test value is reported in  $10^{-2}$ . If the test statistic is less than the critical value 1 (originally one dollar), the model is considered to be a "good" approximation of the true parameters (Lim & McNelis, 2008; Lan, 2014). The test formula is specified as

$$E(a) = \| R(.,., \hat{C}(. , a)) / \hat{C}(k, \Theta, a) \| \quad (19)$$

where  $E(a)$  is the test statistic in absolute value,  $R(.)$  is the residual of rational expectations of consumption expenditure or national debt.  $\hat{C}(k, \Theta, a)$  is the approximation of equilibrium policy function lying in some finite-dimensional space.

Results of the Judd-Gaspar test are presented in table 5. The -.311 test statistic for U.S. consumption expenditure indicates that for one percentage point change in personal consumption expenditure over real GDP, there is three tenth of one percent change in Euler error which is relatively small. The .0035 test statistic for U.S. national debt is much smaller in size suggesting the error term is very small. Similar results are found for the U.K. data. The approximation model of two policy variables, consumption expenditures and national debt are robust for the U.S. and the U.K.

**Table 5.** Judd-Gaspar Test ( $\times 10^{-2}$ )

Country	Consumption		National Debt	
	Mean	S.E.	Mean	S.E.
U.S.	-0.311	1.453	0.0035	0.082
U.K.	0.752	8.432	-0.012	0.041

*Source:* Applying data generated from the optimal coefficient estimates in Table 4 to the formula in Gaspar & Judd (1997), also in Lim & McNelis (2008).

An alternative test is the den Haan-Marcet accuracy test (den Haan & Marcet, 1994) which is based on a chi-squares distribution. It is not performed here since it is complicated and beyond the limited scope of this study.

## IV. Analysis

### A. Current account balance deficit and consumption expenditure

In the U.S., estimate of .504 for lagged by one year first-order differenced log personal consumption expenditures over GDP was a destabilizer of medium level significance for contemporaneous first-order differenced current account balance deficit over GDP. This result suggests when consumption expenditure increased its change by one unit, the change in current account balance

increased. It had mild influence on the change in current account balance from a rational expectations perspective. Current account variable was 0.2 in 1995 and -.09 in 1997 indicating change in percentage had been 0.29 (0.2+.09). This magnitude was partially caused by lagged by one period change in consumption expenditures variable -.011 in 1994, and -.015 in 1996, a magnitude 0.004. This piece of information is relevant for the policymakers and market practitioners, as consumers increase spending on goods and services, domestic or foreign made, there will be greater change in international trade imbalance. Policy of stimulating exports should be given higher priority.

In the U.K., parameter estimate of -.137 for consumption expenditures variable was an insignificant stabilizer. Lagged by one year first-order differenced log personal consumption expenditures over GDP were -0.005 in 1996, and -0.001 in 1997, respectively. Magnitude of change from 1996 to 1997 was 0.004. Contemporaneous first-order differenced current account balance was -.2 in 1997 and 0.3 in 1998, a net change of 0.1. A steady consumption level would help reduce fluctuations in current account deficit in the U.K. To the policymakers, more attention can be given to variables other than consumption.

#### B. Current account balance deficit and government budget deficit

The effect of lagged government budget deficit on current account balance deficit in the U.S. is represented by parameter estimate of 0.384. It suggests that one percentage point change in lagged by one year first-order differenced U.S. government budget deficit over GDP exerted minor destabilizing influence on contemporaneous first-order differenced current account balance deficit over GDP. This estimate of 0.384 is greater than the parameter estimate of -.051 reported in section 4.5 below when the causation relationship is reversed. It suggests that lagged by one year first-order differenced government budget deficit affected more strongly on contemporaneous first-order differenced current account deficit. For policymakers, it suggests federal government budget deficit does affect current account deficit. The fiscal policymakers should carefully evaluate the effect of fiscal policy on international trade, both in terms of commodities and financial assets.

A compatible result is found for the U.K. The parameter estimate of 0.398 indicated the effect of government budget deficit on current account balance to be of minor importance, but a destabilizing one. When this relationship was reversed, estimate of .01 representing the effect of current account balance variable on government budget deficit variable was insignificant, listed at the bottom of Table 4. The policy implication is the same as in the U.S.

#### C. Current account balance deficit and other factors

In the U.S. there are two other significant influencers on trade imbalance: GDP and capital stock. Parameter estimate of 1.931 for lagged by one year first-order differenced log value of real GDP and estimate -1.013 of lagged by one year first-order differenced log value of capital stock were of opposing significance. The former was a destabilizer and the latter a stabilizer. The former implies changes in GDP tend to enlarge changes in trade imbalance, so the two variables are positively correlated. The opposite is suggested for capital stock. These results confirm the claim by Obstfeld (2012) that GDP of a country affects significantly its current account balance. In a large open economy, policymaker should realize any change in policy mix would induce different levels of trade imbalance.

For the U.K., parameter estimate of .001 for lagged by one year GDP indicated insignificant influence on contemporaneous first-order differenced current account in proportion of GDP. However, capital stock parameter estimate of 1.219 was a significant destabilizer. Therefore, changes in capital stock can induce significant effect on trade imbalance. This finding is consistent with Corry and others' (2011) claim that the U.K. trade deficit situation at the turn of the millennium was mainly caused by a decrease in machine exports.

For U.S. Treasury bond variable, parameter estimate of .184 served as a destabilizing variable of insignificant of influence. In the U.K., estimate of -.017 became a stabilizer of insignificant influence. From policy point of view change in Treasury bond impacts little in change in current account deficit. For U.S. money stock variable, estimate of 0.514 of lagged by one year first-order differenced money stock was a destabilizer of modest influence on contemporaneous current account variable.

However, parameter estimate of  $-.571$  for contemporaneous log value of money stock variable over GDP was a stabilizer of medium significance. Results suggest that this variable would work differently in two countries.

#### D. Government budget deficit and national debt

Parameter estimate of  $-.515$  for lagged by one year second-order differenced U.S. national debt over GDP exerted negative but moderate influence on contemporaneous first-order differenced federal government budget deficit over GDP. The former not only played a stabilizing but also made the latter a fast adjustment because the measure was twice differenced. The former reached  $-2.9$  percentage points in 1992 and  $-2.8$  in 1994 reflecting a slowdown in adjustment speed. The first-order differenced federal budget was  $0.76$  in 1993 and  $0.69$  in 1995 being relatively smaller than other years. This reduction coincided with the Clinton administration actions prior to budget surplus occurred in 1997. During the 2008-2009 global financial crisis the first-order differenced budget deficit reached  $-2.1$  percent in 2008 and  $-6.99$  percent in 2009, indicating faster expansion of federal budget deficit from  $160.7$  billion dollars in 2007 to  $458.9$  billion in 2008, a  $185$  percent increase. By 2009, it registered another  $208$  percent increase to  $1.413$  trillion dollars. Adjustment speed of national debt reached  $5.43$  in 2008, but  $9.85$  in 2009, respectively.

The estimate of  $-.928$  for lagged by one period second-order differenced U.K. national debt also served as a stabilizer with significant influence on contemporaneous first-order differenced government budget deficit. A second-order differenced variable acts as acceleration in speed of changes. A policy implication is that when national debt is already high in the U.S. more budget deficit would have an adverse effect in popularity to citizens. The adjustment would be very fast. Influence of this variable in the U.K. was comparatively stronger than that in the U.S. The U.K. national debt had increased in the 1980s and reached  $38$  percent of annual GDP by 1990. It reduced to  $35$  percent in 1992 then rose to  $50$  percent in 1995 as the toll of recession became significant. The number one item in government expenditure was pension outlay (Chen, 2012). The U.K. government was able to cut this ratio to  $38$  percent in 2001 at the end of the Margaret Thatcher years and the beginning of John Major government's expansionary fiscal

policy. The proportion of national debt over GDP during the global financial crisis doubling from  $38$  percent in 2007 to  $77$  percent in 2011 (McCann, 2013) helped explain the larger U.K. estimate than the U.S. estimate.

#### E. Government budget deficit and current account balance deficit

In table 4, a very weak estimate of  $-0.051$  for the lagged by one period first-order differenced U.S. current account balance deficit over GDP registered as a very weak stabilizer for contemporaneous first-order differenced federal budget deficit. A policy implication is that change in current account balance did not help much in the change in budget deficit. Policy in reducing trade imbalance would not help the shrinkage in budget deficit. The former reached  $1.4$  percentage points in 2002 and  $-2.2$  points a year later. The latter was  $-1.9$  in 2003 and  $-0.1$  in 2004, respectively. During the global financial crisis, the former was  $0.3$  in 2007 and  $0.32$  in 2008. The latter was  $-2.1$  in 2008 and  $-6.9$  a year later. Change of such magnitude might be induced by interaction with other factors such as GDP.

Policy implication suggests that the lagged by one period government budget deficit tended to increase fluctuations in contemporaneous current account deficit, but not vice versa.

In the U.K. estimate of  $.01$  for the lagged by one year first-order differenced current account balance deficit over GDP was a very weak destabilizer to contemporaneous first-order differenced government budget deficit over GDP. The former had large values in 1991 and 1999. The latter was  $-2$  percentage points in 1992 and  $0.2$  in 2000, respectively. The direction of flow in the twin deficits relationship suggests the causation is not originated from current account deficit to government budget deficit. This result can be a strong reference point for policymakers.

### V. Applications

We look into applications of the optimal parameter estimates in two areas: first, to identify relative contribution of each macroeconomic factor to international trade imbalance, and second, for forecasting when a shock is

detected. By so doing, the reader is able to detect the top three variables that cause trade imbalance, and consider their policy implication.

### A. Parameter evaluation

Using optimal parameter estimates in table 4, the percentage contributions of variables to current account deficit are listed in table 6.

Table 6 includes all variables in equation 16 except the rational expectations term. We present distribution of variables on current account deficit variable for three years. In 2008, the top three contributing variables for contemporary first-order differenced U.S. trade imbalances were, in descending order, 39 percent from lagged by one year first-order differenced government budget deficit, 34 percent from lagged by one year first-order differenced money supply in proportion of GDP, and 28 percent from lagged by one year self-variable. In 2009, the impact of government budget deficit was way out of proportion 514

percent in 2009, and 234 percent in 2010. This phenomenon is not surprising due to the 2008-2009 global financial crisis originated in the U.S. The close association between changes in lagged by one period in the U.S. government budget deficit and the contemporaneous first-order differenced current account deficit was obvious in all three years. In this inference, U.S. personal consumption expenditures failed to exert a significant impact in all three years.

For the U.K., two main contributors were money stock, and capital stock. Government budget deficit was a balancing contributor of -56 percent only in 2010. Money stock in 2009 contributed 85 percent to 2010 trade imbalance. Therefore, money stock and government budget spending of the same year were correlated. This finding supports Sims' (2013) claim that the monetary and fiscal policies are inseparable in business cycle recessions. A policy implication is that it is worthwhile for the U.K. to pay more attention in changes in money stock and in capital stock, and rate of capital export to other countries. Improvement in credit flows and capital hardware export

**Table 6.** Selected Variable contributions to Balance of Current Account deficit

Variable	U.S.			U.K.		
	2008	2009	2010	2008	2009	2010
$\phi_1$ (bca) <sub>t-1</sub>	.942	.369	2.276	-.148	-.321	.074
Percent	28%	-48%	-39%	-2%	-5.6%	1.6%
$\phi_3$ (lnPCE) <sub>t-1</sub>	.009	.013	-.0001	.0001	.006	-.009
Percent	.3%	-1.7%	.002%	.001%	.1%	-.2%
$\phi_4$ (GDP) <sub>t-1</sub>	.037	-.007	-.06	.007	.007	.007
Percent	1%	.8%	1%	.02%	-1%	-2.6%
$\phi_5$ (GBS) <sub>t-1</sub>	1.31	-3.99	-13.49	0.02	-.96	-2.55
Percent	39%	514%	234%	.3%	-16.8%	-56%
$\phi_6$ (K) <sub>t-1</sub>	-.03	-.02	-.004	3.54	3.46	3.23
Percent	-9%	2.6%	-.07%	49%	61%	71%
$\phi_7$ (B) <sub>t-1</sub>	-.046	.992	1.7	.003	-.32	.07
Percent	-1.4%	-127.8%	-30%	.04%	-5.6%	1.5%
$\phi_8$ (M) <sub>t-1</sub>	1.16	1.86	3.82	3.79	3.85	3.86
Percent	34%	-239%	-66%	53%	67%	85%
Total*	100%	100%	100%	100%	100%	100%
Estimated (bca) <sub>t</sub>	3.382	-.776	-5.758	7.206	5.722	4.542
Actual (bca) <sub>t</sub>	.322	1.981	-.297	1.3	-.3	-1.2
Actual/estimated	9.5%	-255%	5%	18%	-5%	-26%

Note: All variables are in transformed form. Authors' calculations from model results and Data set.\* With small rounding discrepancy.

would help reverse current account balance deficit. The U.K. has substantial weight in the global credit flows and it should enhance such advantage and avoid high risk wrong doings such as the LIBOR manipulation scandal in London (Wall Street Journal, 2013).

Table 6 reports both the estimated values and actual values of lagged by one period first-order differenced current account deficit for three years. In the U.S. the ratio of actual over estimated value was 9.5 percent in 2008. It suggests the estimated value is approximately ten times larger than the actual value. All percentages of contribution by macroeconomic factor, if downsized properly, can be used for inference making for the actual value of current account balance. The overall percentage distribution of contributing components would not change. This finding is useful for policymakers.

### B. Model forecast

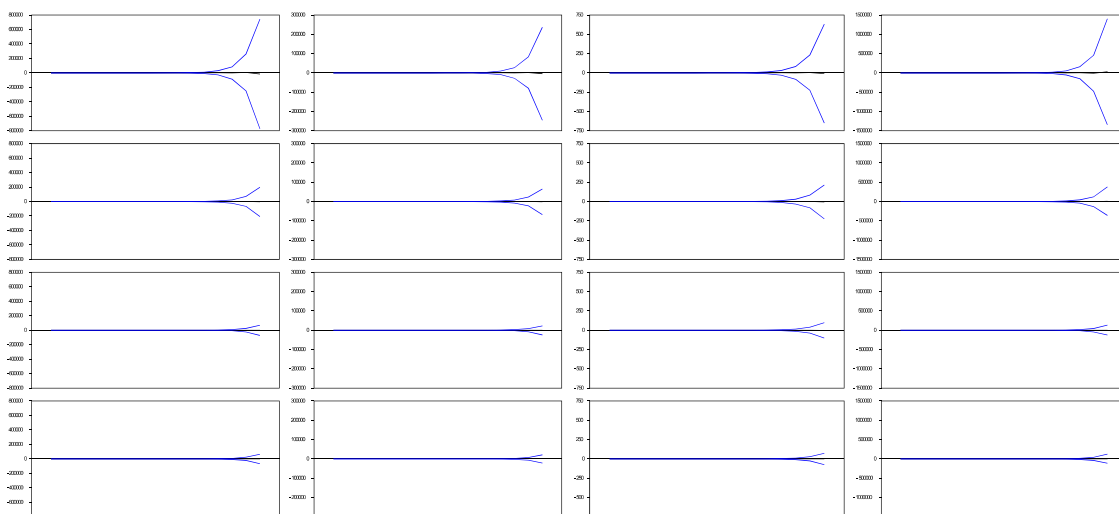
Impulse responses of the current account deficits to a shock originated from personal consumption expenditure were calculated for both countries. For the U.S. there were no visible responses for the first twelve periods of a sixteen-period horizon. For the last period the standard errors increased from zero to 230, an indication of relative stability. For the U.K. standard error was only 20, as

a matter of fact, about one tenth of the size in the U.S.

The panel at the first row in the fourth column represents the response time path of U.S. federal budget deficit to a shock originated from national debt for 16 periods. There are no visible responses from this shock in the first three quarters of the forecasting periods. Fluctuations appear in the last quarter and initially standard error has a range within plus/minus zero, and turns to plus/minus 1.5 million, an unusually large number. It suggests the forecasted values are not reliable even though the impact of national debt on government budget is significant. The panel at the second row in the third column indicates responses of current account balance to an impulse from personal consumption expenditures. The standard error moves from a range of zero to a range of plus/minus 230, an indication of relative stability.

Figure 2 forecasts the U.K. impulse response due to shocks in state variables. The arrangement of panels follows that of Figure 1. When an innovation originates from national debt, the U.K. government budget deficit standard error starts from zero point to a range of plus/minus 0.3 million, which is much milder than the U.S. Responses by U.K. current account balance to a shock from personal consumption expenditures move from zero to a range of 20 in standard errors. This is much smaller than the U.S. responses.

*Shocks from USGBS,USBCA,PCE,DEBT for panels from left to right, responses from top to bottom*



**Figure 1.** Impulse Responses

Shocks from UKDEFICIT, UKBCA, PCE, DEBT for panels from left to right, responses from top to bottom

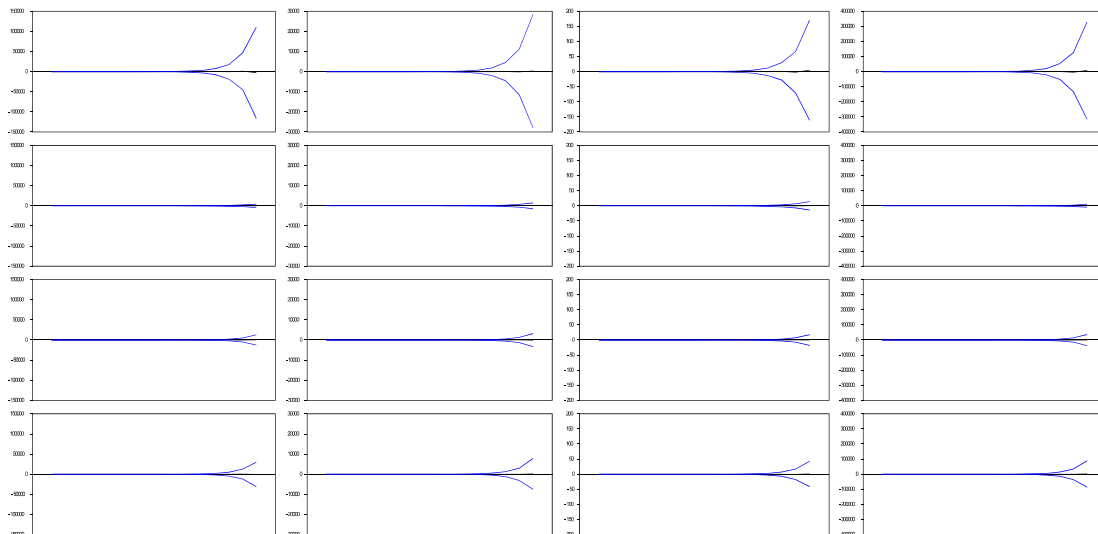


Figure 2. Impulse Responses

## VI. Conclusion

This paper investigates the major determinants of the trade imbalance measured by current account deficit in the U.S. and the U.K. Results from a simple DSGE model suggest that to contemporaneous first-order differenced current account deficit, lagged by one year first-order differenced personal consumption expenditure was a minor destabilizer for U.S. and a stabilizer for U.K. However, lagged by one year first-order differenced government budget deficit had a minor destabilizing effect in both countries. Using the U.S. data, it suggests the lagged by one period first-order differenced government budget deficit tended to increase fluctuations in contemporaneous current account deficit, but not vice versa. This result confirms the twin deficit theory.

For the U.K., same results indicated the causation is from the government budget deficit to the current account deficit. Money stock variable exerts different effect on trade imbalance. The money stock component in the Mundell-Fleming model was a medium level destabilizer to trade imbalance in the U.S. but a medium stabilizer in the U.K. We suggest future work to be done in two areas; first, to be on the effect of shocks of important variables obtained from this study. Second research is to focus on aggregate U.S. consumer disposable income

(Hall, 1982) but pension expenditures in the U.K. Further studies may include the issue of structural breaks in several variables such as GDP and money stock and impact on trade imbalance.

## References

- Abel, A., Bernanke, B. & Croushore, D. (2013). *Macroeconomics*. 8e, Boston: Pearson Publishers.
- Ball, L. (1999). Policy rules for open economies. In J. Taylor, (Ed.), *Monetary Policy Rule* (pp.127-144). University of Chicago Press.
- Bartolini, L. & Lahiri, A. (2006). Twin deficits, twenty years later. *Current Issues in Economics and Finance*. Federal Reserve Bank-New York, New York, 12(7), 1-7.
- Bellman, R. (1957). *Dynamic Programming*. Princeton, NJ: Princeton University Press.
- Blanchard, O. (2007). Current account deficits in rich countries. *International Monetary Fund Staff Papers*, 54, 191-219.
- Bludorn, J. & Leigh, D. (2010). Revisiting the twin deficits hypothesis: the effects of fiscal consolidation on the current account. unpublished. IMF, Washington, D.C.
- Chen, D. (2012). Effect of size on return of sovereign wealth funds: U.K. pension and Temasek of Singapore. *Journal of International Finance and Economics*, 12(1), 34-45.
- Chen, D. & Li, T. (2014). Financial crises, Asian stock indices, and current account: An Asian-U.S. comparative study. *Journal*

- of *Asian Economics*, 34(October), 66-78.
- Cooper, R. (2008). Global imbalances: globalization, demography, and sustainability. *Journal of Economic Perspectives*, 22(3), 93-112.
- Corry, D., Valero, A. & Van Reenen, J. (2011). U.K. economic performance since 1997: growth, productivity and jobs. *Economic paper*, Center for Economic Performance, London School of Economics and Political Science.
- Deaton, A. (2005). *Franco Modigliani and the Life Cycle Theory of Consumption*. Research Program in Development Studies and Center for Health and Wellbeing, Princeton University.
- DeJong, D. & Dave, C. (2011). *Structural Macroeconometrics*. 2e, Princeton: Princeton University Press.
- Den Haan, W. & Marcet, A. (1994). Accuracy in simulations. *Review of Economic Studies*, 61, 3-17.
- FRB-St.Louis. (2013). *FRED Databank*, Federal Reserve Bank of St. Louis, Missouri.
- Fleming, J. (1962). Domestic financial policies under fixed and floating exchange rates. *IMF Staff Papers*, 9(November), 369-379.
- Gaspar, J. & Judd, K. (1997). Solving large-scale rational expectations models. *Macroeconomic Dynamics*, 1(1), 45-75. Also published as NBER Technical Paper 207, 1997, Cambridge, MA.
- Hall, R. & Mishkin, R. (1982). The sensitivity of consumption to transitory income: estimates from panel data on households. *Econometrica*, 50, 461-481.
- Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, 59, 1551-1580.
- Kim, S. & Roubini, N. (2008). Twin deficits or twin divergence? Fiscal policy, current account, and real exchange rate in the US. *Journal of International Economics*, 74, 362-383.
- Kosteletou, N. (2013). Financial integration, Euro and the twin deficits of southern Eurozone countries, *Panaeconomicus*, 2, special issue, 161-178.
- Kydland, F. & Prescott, E. (1982). Time to build and aggregate fluctuations. *Econometrica*, 50, 1345- 1370.
- Lan, H. (2014). Comparing solution methods for DSGE models with labor market search. Memo. Institut für Wirtschaftstheorie, Humboldt-Universität, Berlin, Germany.
- Lau, E., Mansor, S. & Puah, C. (2010). Revival of the twin deficits in Asian crisis-affected Countries. *Economic Issues*, 15, part 1, 29-52.
- Lim, G. & McNelis, P. (2008). *Computational Economics for the Open Economy*. Boston, MA: MIT Press.
- Lord, W. (2002). *Household Dynamics: Economic Growth and Policy*. Oxford University Press.
- McCann, J. (2013). Can the UK inflate away its debt problems?. RBS Co. U.K. Retrieved from <http://rbs.com/content/dam/rbs/documents> accessed 2/21/2014.
- McKinnon, R. (2013). The U.S. saving deficiency, current account deficits, and deindustrialization: Implications for China. *Journal of Policy Modeling*, 35(3), 449-458.
- Miranda, M. & Fackler, P. (2002). *Applied Computational Economics and Finance*. Cambridge, MA, MIT Press.
- Mundell, R. (1960). The monetary dynamics of international adjustment under fixed and flexible exchange rates. *Quarterly Journal of Economics*, 84(May), 227-257.
- Mundell, R. (1961). The international disequilibrium system. *Kyklos*, 14(2), 154-172.
- Muth, J. (1961). Rational expectations and the theory of price movements. *Econometrica*, 29(July), 315-335.
- Obstfeld, M. (2012). Does the current account still matter? *American Economic Review: Papers and Proceedings*, 102, 1-23.
- Obstfeld, M. & Rogoff, K. (1996). *Foundations of International Economics*. Cambridge, MA, MIT Press.
- OECD, Statistics online, (2015). <http://Stats.oecd.org/Index.aspx?DataSetCode=SNA-TABLES>. As of 11/10/2015.
- Panagiotidis, T., (2011). Twin deficits in Greece, *European Institute*. Hellenic Observatory, Greece.
- Sargent, T. (1987). *Dynamic Macroeconomic Theory*. Cambridge, MA, Harvard University Press.
- Sims, C. (2001). Solving linear rational expectations models. *Computational Economics*, 20, 1-20.
- Sims, C. (2013). Paper money. *American Economic Review*, 103, 563-584.
- Sin, C.Y. (2015). The economic fundamental and economic policy uncertainty of Mainland China and their impacts on Taiwan and Hong Kong. *International Review of Economics and Finance*, forthcoming.
- Tang, T. (2013). Twin deficits: An alternative framework from general equilibrium perspective with U.S. results. Discussion paper 41/13. Monash University, Australia.
- Taylor, J., (2004). The U.S. current account: recent trends and policies. JS2084, Office of Public Affairs, US Department of Treasury. Retrieved [www.treas.gov/press/releases/js2084.htm](http://www.treas.gov/press/releases/js2084.htm).
- U.K. Office of National Statistics. (2013). Various publications. London.
- Urosëvić, B., Nedeljković, M. & Zildžović, E. (2012). Jackknife model averaging of the current account determinants. *Panaeconomicus*, 59, 267-281.
- U.S. Bureau of Economic Analysis, (2015). PCECCA, not seasonally adjusted annual series. Retrieved from [www.stlouisfed.org/research](http://www.stlouisfed.org/research).
- U.S. Government Spending Company. (2013). Data & charts posted online ([www.USgovernmentspending.com/downchart\\_gs.php?Year=1990\\_2015](http://www.USgovernmentspending.com/downchart_gs.php?Year=1990_2015))
- Wall Street Journal. (2013). February 6 issue.
- Weisenthal, J. (2013). Why Italy's election has caused global markets to crater? Retrieved from *Yahoo Finance/blogs*
- [www.fedprimerate.com/](http://www.fedprimerate.com/)
- [www.UKpublicspending.co.uk](http://www.UKpublicspending.co.uk)