

# **Quantitative Assessment of Fiscal Contraction Shocks using the G-Cubed Model**

*Chi-Sheng Lo*

**Australian National University**

## **Abstract**

This paper analyse the impact of fiscal contraction policy shock on macroeconomy under three different scenarios by using G-Cubed model. The first two simulate permanent and phase-in policy in the US only and finally, the third simulation is under assumption that both the rest of world and the US implement permanent policy. Following the shock of budget deficit reduction, phase-in policy will be more expansionary than other two kinds of permanent policies. There are two main reasons: First, reduction in spending outweighs increases in consumption under permanent policy. Second, nominal rigidity of gradual increase in spending reduction will prevent GDP from falling. Overall, fiscal contraction policy is highly effective in raising consumption and export in the US. The former will be encouraged by expectation of lower future interest rate and higher future income and the later will be boosted by depreciation in USD.

**JEL Classifications:** C50, D58, H30

**Keywords:** G-Cubed Model, Fiscal Policy Shocks

## **Introduction**

In the past three decades, the US has run large budget deficit which happens when government spending exceeds revenue. Until recently, the US fiscal deficit has greatly reduced especially since the collapse of global financial crisis in 2008. From fiscal year 2009 to 2015, the percentage of fiscal deficit in GDP has reduced from 12.1 percent to 2.5 percent. During the same period, the US GDP had also bottomed out since the third quarter of 2009. Although Bohn (1998) discovers that US government has historically responded to increases in the debt-GDP ratio by reducing primary deficit which is arrived by deducting interest payment by fiscal deficit (p. 962), the US government debt-GDP ratio has continued to rise in the last nine years. As of 2015, the latest figure is at 104.17 percent versus the historical average at 61.94 percent (US Bureau of Public Debt).

Other researchers have concentrated on the effectiveness of fiscal policy. For instance, the theory of Ricardian equivalence is known to against the thought of using tax cut or spending increase as means of boosting aggregate demand for goods and services. Barro (1974) concludes that fiscal effects involving changes in tax and debt finance for a given amount of public expenditure have no influence on aggregate demand and interest rate (p. 1116). There is also theory on the role of expectation in which initial fiscal deficit reduction could be the signal for further reduction and raises the overall demand for goods and services. Romer (2015) argues that fiscal contraction can be expansionary through two channels. The first channel is expectation of lower interest rate as a result of spending cut. The second channel is through the supply side in which people expects higher future income because of lower future taxes (p. 604). In addition, the shock of fiscal policy on consumption and investment may not be in the same direction. Blanchard and Perotti (2002) conclude that either tax increase or government spending increase can crowd out investment; however, consumption will still increase (p. 1364). Also, the outcome from either changing tax or spending alone could be different. Bertola and Drazen (1991) state that fiscal deficit reduction by tax increase while spending remains constant will result in output decrease and consumption unchanged at most but fiscal deficit reduction by spending cut will boost consumption (p. 15).

On the other hand, Bernheim (1987) uses cross country data and found that results are strongly anti-Ricardian in which government deficit can stimulate private consumption (p. 73). Fatas and Mihov (1998) argue that increases in government spending are expansionary which means that output will increase driven by private consumption but growth in

investment does not react significantly to increase in government spending (p. 18). Moreover, unlike the theory of Keynesian who believes that budget reduction will increase unemployment and drag GDP, McDermott and Wescott (1996) note that Neoclassical model has argued reduction in budget deficit might lead to lower interest rate, depreciation in home currency, and positive expectation effect on aggregate demand. Also, the public will feel eased on the default risk of the government (p.2).

For international trade, Erceg, et al (2005) concludes that US fiscal deficit has little effect on its trade balance regardless of whether either increase in spending or reduction in tax (p.32). Bussi`ere, et al (2005) mention that reduction in the US budget deficit may not lower current account deficit and argue that government deficit has no causal relationship with current account (p. 22). Furthermore, when financial markets cast doubt about the fiscal policy, they will increase risk premia in response to higher possibility of government debt default. Mckibbin and Stoeckel (2012) mention that the primary reason government cuts fiscal deficit and reduce debt is that financial market begin to question the sustainability of fiscal policy (p. 14). Others have studied the relation between budget deficit and bond yield. Laubach (2007) discovers that forward yield rate with five and more years into the future will rise by 20 to 30 basis points in response to a percentage point increase in the projected deficit-to-GDP ratio (p. 18).

In this paper, I am going to use the G-Cubed model to provide quantitative assessment of the national and global impacts of permanent reduction in the US fiscal deficit caused by a cut in US government spending. Pezzy and Lambie (2001) mention G-Cubed assumes that economic agents use a combination of rational expectations and short-term behavior (p. 59). Mckibbin and Wilcoxen (1998) emphasize that G-Cubed model is designed to incorporates the best features of econometric general equilibrium modeling, international trade theory, and modern macroeconomics (p. 1). By using G-Cubed model, I will analyze the shock to fiscal deficit reduction on US economy with the baseline set at year 2012 under three cases. The first case assumes a permanent policy in which there will be perpetual US fiscal deficit reduction of one percent of GDP since the first year. The second case simulates phase-in policy which implements cut in the fiscal deficit of 0.2 percent of GDP in year one, then subsequently, 0.4 percent of GDP in year two, 0.6 percent in year three, 0.8 percent in year four and finally one percent of GDP from year five forever. Lastly, the third case assumes both the rest of the world (ROW) and the US apply fiscal deficit reduction of one percent of their GDP together permanently.

### **Case I: Permanent fiscal contraction shock**

Following the one percent permanent shock of expansionary fiscal contraction policy, GDP growth will be in negative zone for four years. Then GDP stably grows at less than 0.2 percent per year compare to baseline in 2012. Mckibbin and Stoeckel (2012) explain that earlier fall in GDP is attributed to decline in government spending. However, the reduction in private spending will be crowded-in as government will borrow less and less that eventually lead to excess of savings (p. 11). Therefore, stock of debt will fall as government reduce borrowing. The actual policy rate will dive and has direct impact on treasury yield as well. From the trend of changes in the real ten-year interest rate, we can see the yield rate will be at least ten basis points below baseline. Also, foreign central banks and institutional investors will gradually reduce holdings in US treasuries as yield rate goes down and bond price goes up. Meanwhile, the U.S. Dollar (USD) will experience large depreciation especially in the first two years. Just in 2013, USD will depreciate 2.22 percent versus the baseline. The permanent fiscal deficit reduction could also result in negative effect on equity investment. For example, stock market value will drop nearly three percent in the first year and later on will not come back to above baseline until after 50 years. However, the impact of fiscal policy on stock market value is still very minimal. Looking at the financial market as a whole, we can also see that fiscal policy has much more impact on bond market and exchange rate market than on equity market. Back to macroeconomic data, demand for capital goods will decline sharply in the first four years. However, household consumption will jump despite decline in GDP and demand for capital goods. Finally, trade balance will jump as a result of sharp US dollar depreciation that makes US export much more competitive.

### **Case II: Phase-in fiscal contraction shock**

The second case simulates the shock of fiscal contraction policy under phase-in approach. Romer (2012) points out that households will respond to tax increase by raising consumption because they expect a small tax increase today is a signal of large reduction in government spending and therefore large tax cut in the future (p. 603). Unlike the permanent fiscal contractions policy, GDP will jump in the first two years, then dive sharply, and eventually bounce back to the level of baseline ten years later. The trend of GDP deviation under phase-in policy is also more volatile than that under permanent policy. Eventually, both GDP of case I and II will converge to same level at around 15 years later. Capital goods demanded

will be reduced in the first two years and then rebounded to above baseline two years earlier than case I. However, in this simulation, consumption in case II will increase less than case I due to the fact that interest rate is effectively lower in case I. Moreover, actual policy rate under case II will jump in the first four years. Thus, household consumption will be less encouraged by phase-in fiscal reduction. The actual policy rate will rise by 38 and 19 basis points in 2014 and 2015 respectively, then followed by further diminishing growth and dive. Also, the volatility of actual policy rate may wreak havoc in the financial market because the long term annual change has only been around three basis points. Stock of debt will fall initially but less than that under case I. However, the ten-year yield will not increase with actual policy rate and the decline is also much less severe than that in case I. Although GDP appears to be more volatile in case II, the stock market value of case II actually reacts more calmly than case I. Real exchange rate will also depreciate but the magnitude is less than under the permanent policy. Furthermore, trade balance will also increase but smaller than that under case I.

After comparing cases I and II, we can see that phase-in policy has higher GDP than that in permanent policy in the first two years. McKibbin and Vines (2000) also point out that permanent reduction is more contractionary than phased-in fiscal contraction because by the time the gradual increase in spending cuts actually happens in case II, there will be enough stimulus induced by the forward looking and inter-temporal budget constraints that the adjustment costs and wage stickiness do not cause GDP slowdown in case II simulated by G-Cubed model (p. 115).

### **Case III: Permanent reduction shock from both the US and the ROW**

If both the US and the ROW cut deficit reduction of one percent of their GDPs every year, both GDPs will still fall but less steeper than if US cuts deficit alone in case I during the first two years. Looking at the US GDP only, although previously, both case I and case III will go down in the first two years, but in case III, the US GDP will bounce back to baseline one year earlier. For ROW's GDP, the change is almost identical to the change in US GDP. Moreover, stock of debt will decline and has about the same magnitude as case I. However, surprisingly, the slopes of ten-year yield decline in both ROW and the US are much steeper than those in previous cases. As for actual policy rate of both the ROW and the US, case III has the largest decline. Botman, et al (2006) also conclude that decrease (increase) in government debt under

larger open economy will lower (raise) the world interest rate (p. 23). The consumption will increase much more than that in previous cases owing to largest decline in expected interest rate. In demand for capital goods, both the US and the ROW will enjoy high growth and then peaked in the seventh year. Besides, case III also has the highest demand for capital goods among all cases. Although capital goods in case I falls, the interest rate in case III is very low enough to trigger investment and borrowing. However, trade balance and real exchange rate will remain nearly constant as both the ROW and the US cut deficit together. Having said that, the US will still enjoy slightly more increase in trade balance and current account than those in the ROW because USD will depreciate while ROW currency will appreciate.

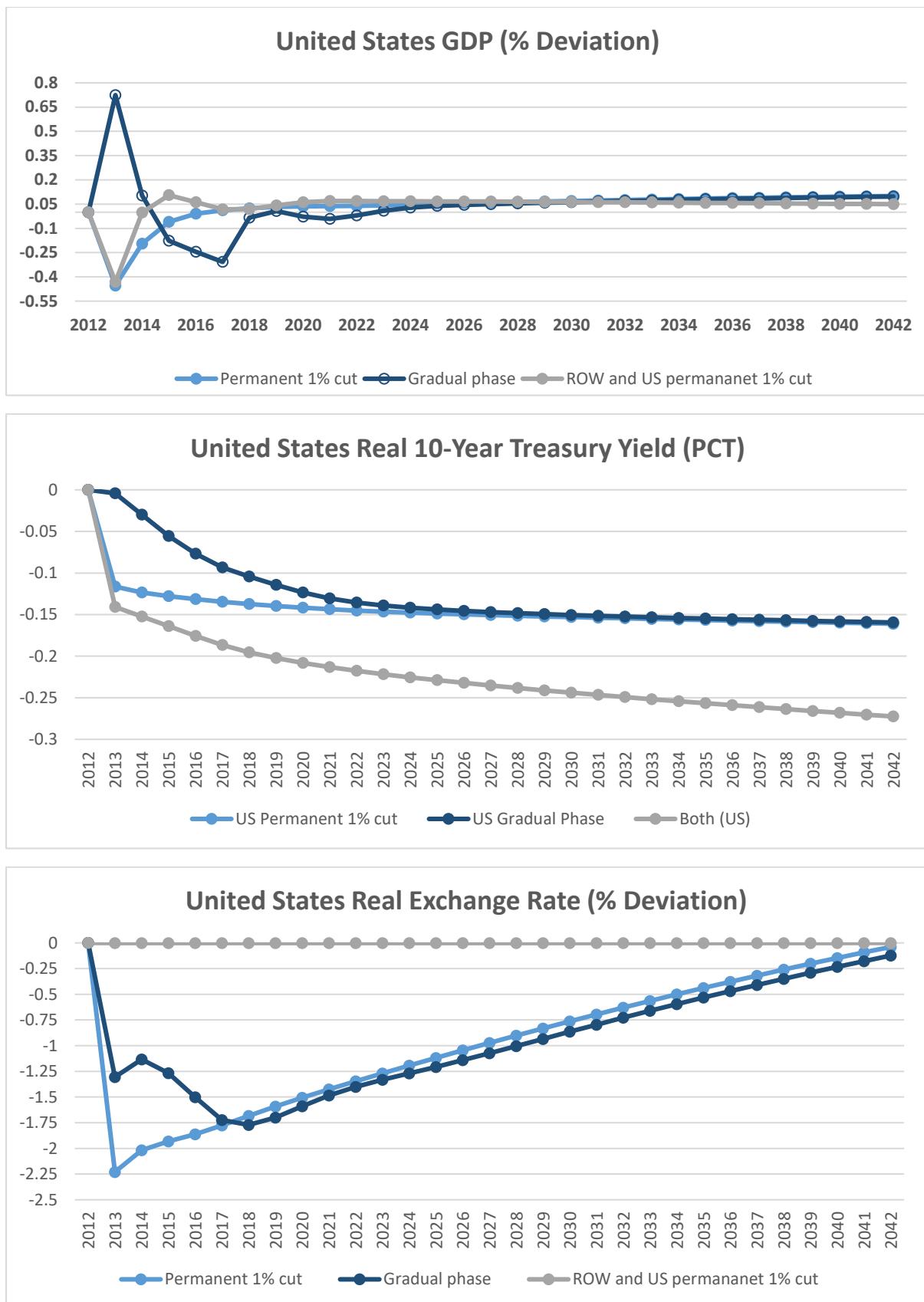
## **Summary and Conclusion**

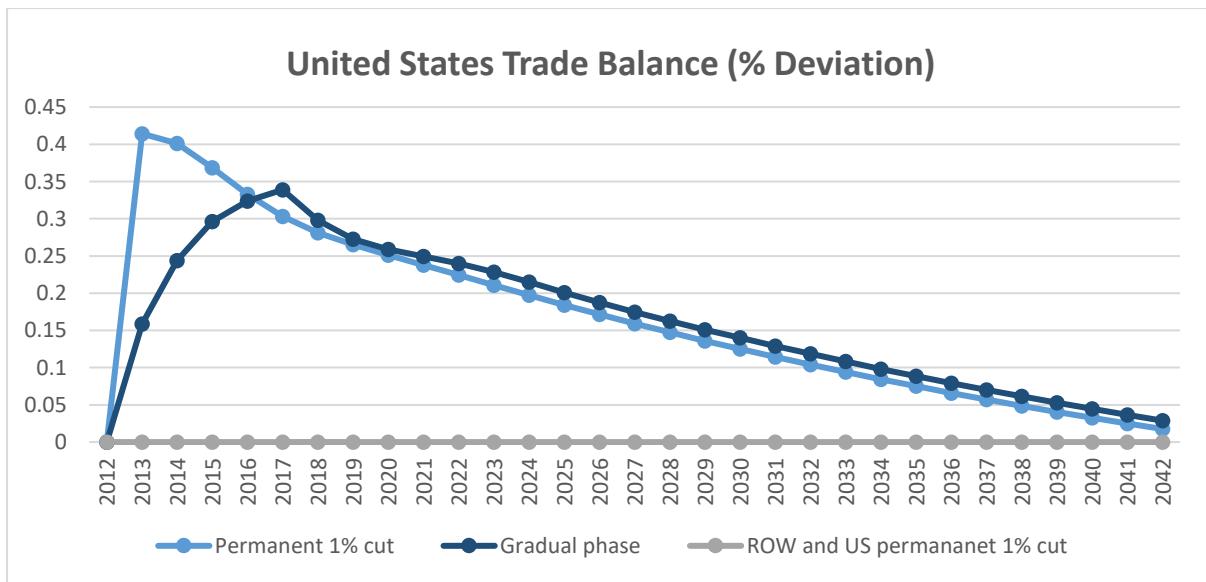
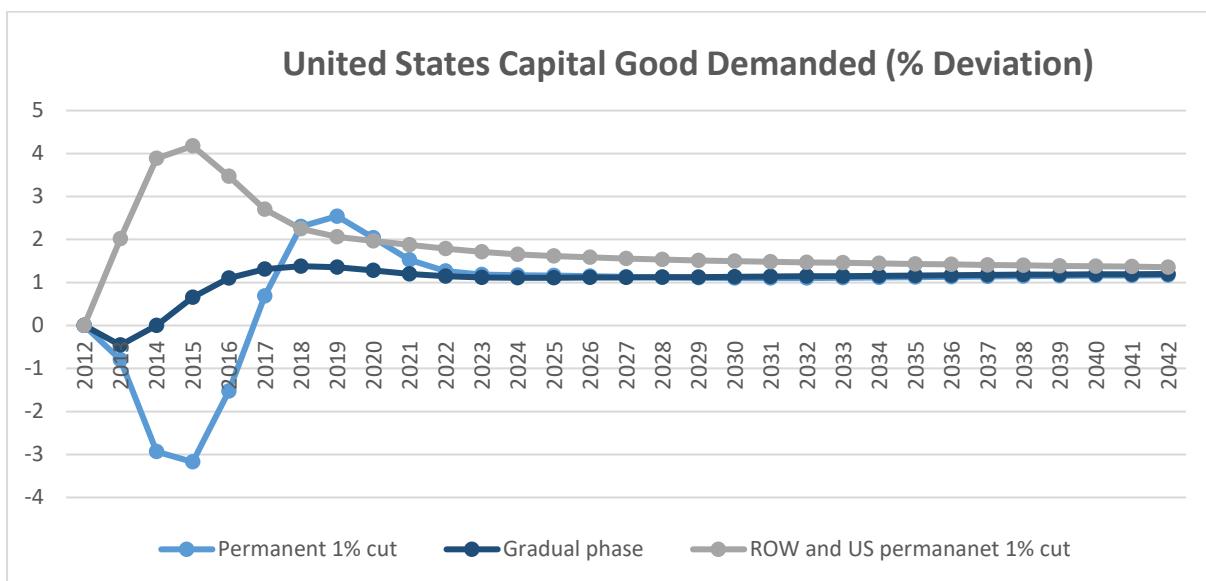
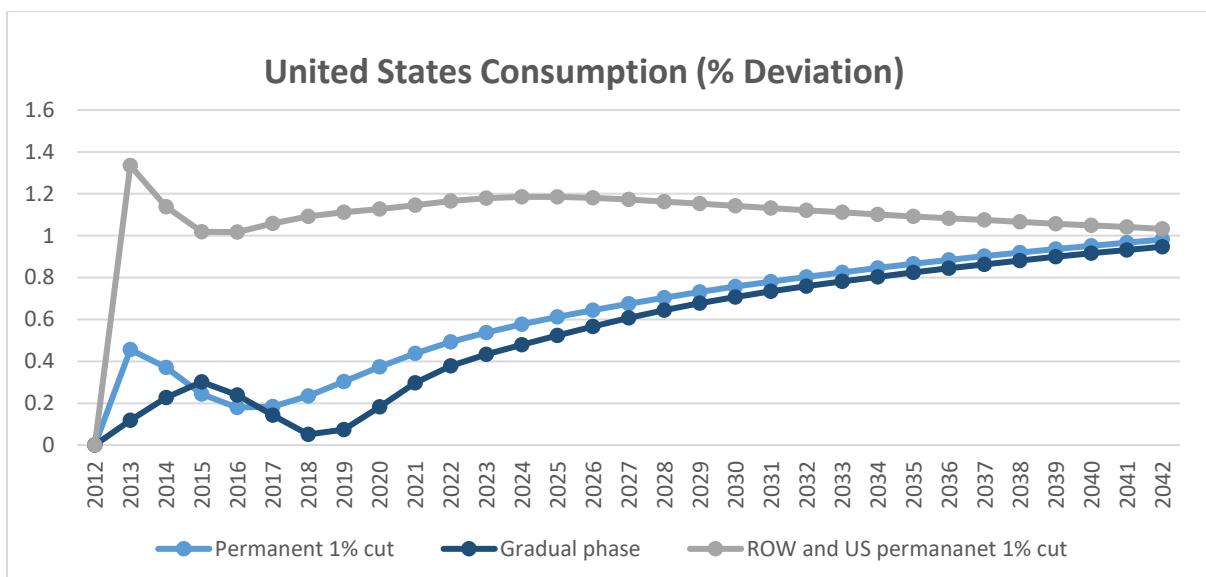
Immediately following the shock of fiscal contraction, GDP will jump the highest in case II, followed by cases I and III. However, consumption and capital goods demanded will jump the most in case III. Furthermore, actual policy rate will jump in case II but only in the first four years, while the actual policy rate under cases III and I will dive immediately. Trade surplus and current account jump the most in case I followed by case II, while the increase in trade surplus and current account in case III will be the smallest. Thus, fiscal contractions is only significantly effective in driving up trade surplus only when the US applies it alone. For fixed income market, the ten-year bond yield will have the steepest decline in case III, followed by cases I and II. For equity market, stock market value will retreat the least in case III, followed by cases II and I. For exchange rate market, USD will depreciate the least in case III, followed by cases II and I.

To conclude, from the simulation of G-Cubed model, permanent reduction of fiscal contraction benefits the most on export because of the sharpest depreciation in USD. However, US is not an export led economy because export only represents 13 percent of GDP and US is known for running the largest current account deficit in the world. Thus, the strongest jump in export does not help the US GDP much in case I. On the other hand, GDP in phase-in approach will jump among the highest in the first two years despite the fact that its long-term financing is the same as in permanent approach. Finally, if both the ROW and the US apply the same percentage of fiscal deficit reduction, the trend of GDP is similar to permanent policy done by US alone but will recover faster due to sharpest decline in interest rate and highest jump in consumption. We can also see that regardless of which fiscal

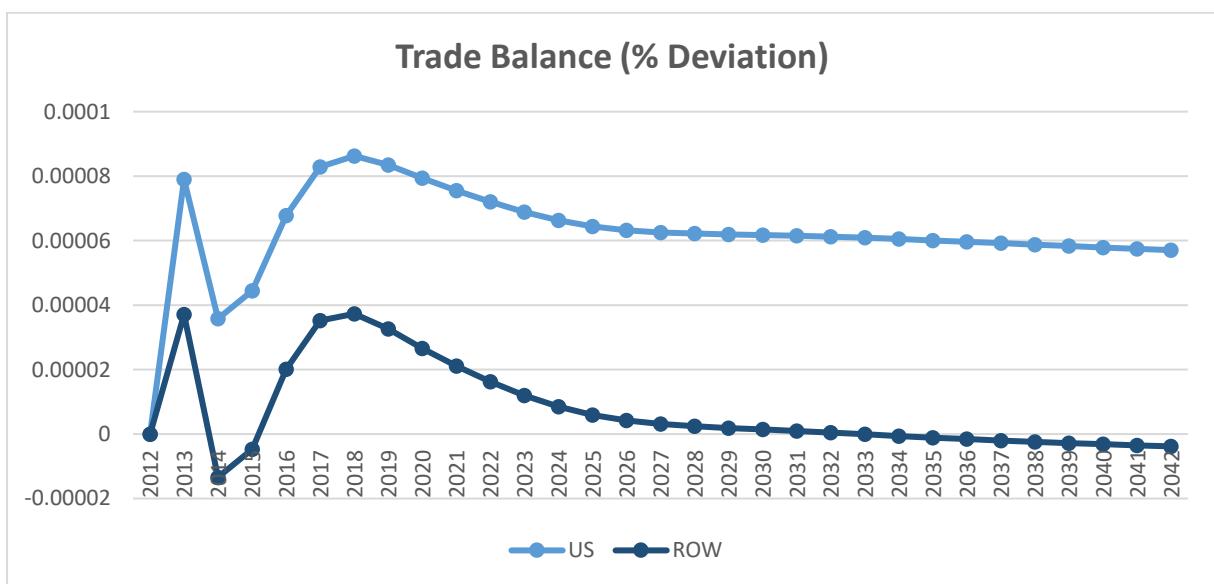
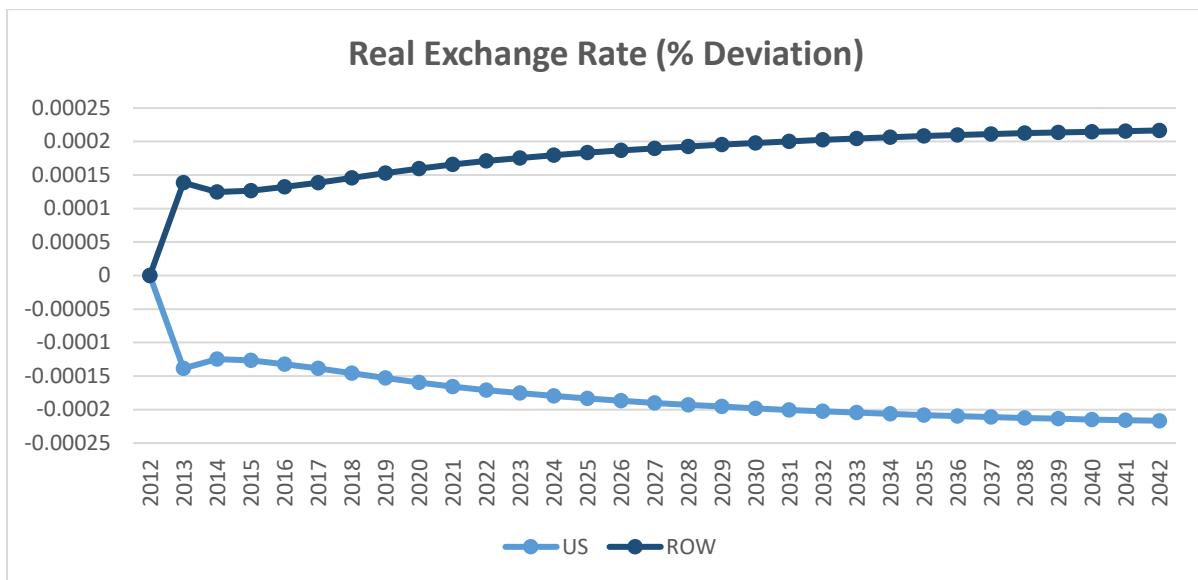
contraction scheme, consumption will be encouraged by decrease in interest rate and lower tax expectation. Mankiw and Weinzierl (2011) suggest that fiscal policy should aim at incentivizing interest-sensitive components of spending, such as investment (p. 246). Perotti (1999) had also concluded that if a fiscal policy shock causes a temporary fall in interest rates, consumers would try to take advantage of the temporarily low intertemporal price of consumption (p. 1432). However, GDP under permanent approach will still be mainly affected by the fall in demand for capital goods and investment as results of spending reduction. Although in the US, private consumption explains nearly 70 percent of the US GDP, the total value of positive response of consumption to fiscal deficit reduction will still be less than the fall in government spending which explains about 20 percent of the US GDP. On the other hand, nominal rigidity under phase-in policy helps prevent GDP from falling. Therefore, in the early stage following the fiscal reduction shock, GDP under phase-in policy is expansionary while the other two under permanent policies are contractionary. Overall, fiscal contractions is highly effective in raising private consumption and export in the US. Export will increase as a result of depreciation in USD. Consumption will be encouraged by lower interest rate and higher future income.

**Figure I:** this section shows all three cases but on US data only:





**Figure II:** this section shows impact of case III on ROW and the US data:



## References

- Barro, RJ 1974, ‘Are government bonds net wealth?’, *Journal of Political Economy*, Vol. 82, No. 6 (Nov. - Dec., 1974), pp. 1095-1117.
- Bernheim, BD 1987, ‘Ricardian equivalence: An evaluation of theory and evidence’, NBER Working Paper No. 2330 (Also Reprint No. r1008) Issued in July 1987.
- Bertola, G & Drazen A 1991, ‘Trigger points and budget cuts: explaining the effects of Fiscal austerity’, NBER Working Paper No. 3844, Issued in September 1991.
- Blanchard, O & Perotti, R 2002, ‘An empirical characterization of the dynamic effects of changes in government spending and taxes on output’, *The Quarterly Journal of Economics*, November 2002.
- Bohn, H 1998, ‘The behaviour of U. S. public debt and deficits’, *The Quarterly Journal of Economics*, August 1998.
- Botman, D, Laxton, D, Muir, D & Romanov, A 2006, ‘A new-open-economy-macro model for Fiscal Policy Evaluation’, International Monetary Fund, viewed 22 August 2016,  
[http://www.douglaslaxton.org/sitebuildercontent/sitebuilderfiles/botman\\_laxton\\_muir\\_2006\\_wp0645.pdf](http://www.douglaslaxton.org/sitebuildercontent/sitebuilderfiles/botman_laxton_muir_2006_wp0645.pdf).
- Bussi`ere, M, Fratzscher, M, M\"uller, G, 2004, ‘Productivity shocks, budget deficits and the current Account’, European Central Bank, viewed 22 August 2016,  
<https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp509.pdf>.
- Erceg, CJ, Guerrieri, L & Gust, C 2005, ‘Expansionary fiscal shocks and the US trade deficit’, *International Finance* 8:3, 2005: pp. 363-397.
- Fatas, A & Mihov I 1998, ‘The effects of fiscal policy on consumption and employment: theory and evidence’, viewed 20 August 2016,  
<http://faculty.insead.edu/fatas/fiscal.pdf>.

Laubach, T 2007, 'New evidence on the interest rate effects of budget deficits and debt', US Federal Reserve Government, viewed 5 September 2016,  
<<https://www.federalreserve.gov/pubs/feds/2003/200312/revision/200312pap.pdf>>.

Mankiw, NG & Weinzierl M 2011, 'An exploration of optimal stabilization policy', *Brookings Papers on Economic Activity*, Spring 2011.

McDermott, CJ & Wescott, RF 1996, 'Fiscal reforms that work', IMF, viewed 20 August 2016,  
<<http://www.imf.org/external/pubs/ft/issues4/issue4.pdf>>.

Mckibbin, WJ & Wilcoxen PJ 1998, 'The theoretical and empirical structure of the G-Cubed model', viewed 20 August 2016,  
<<http://www.insightworks.com/models/gcubed/struct32.pdf>>.

Mckibbin, WJ & Stoeckel, AB 2012, 'Global fiscal consolidation', *Asian Economic Papers*, Vol 11, No 1, pp. 124-146.

Mckibbin, WJ & Vines, D 2000, 'Modelling reality: The need for both intertemporal optimization and stickiness in models for policymaking', *Oxford Review of Economic Policy*, vol. 16, no. 4, pp. 106-137.

Perotti, R 1999, 'Fiscal policy in good times and bad', *The Quarterly Journal of Economics*, November 1999.

Pezzy, J & Lambie, R 2001, 'Computable general equilibrium models for evaluating domestic greenhouse policies in Australia: A comparative analysis', Report to the Productivity Commission. , AusInfo, Canberra.

Romer, D 2012, *Advanced Macroeconomics*, Fourth Edition, McGraw-Hill Irwin.