Essays In Fiscal Policy And State Dependence Fiscal Policy Innovations Using A New Econometric Approach

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Abstract

Unparrelleled is a word that best describes the current state of advanced economies. Interest rates are low in many advanced countries and negative in a few others suggesting that monetary policy has lost its effectiveness. The economic policy tool that has not been implemented yet by many advanced economies is fiscal policy. This research studies the effect of fiscal policy in USA, UK and Germany and find positive effects of extra government purchases on output, inflation, private consumption, business investment, wages and hours worked. As a contribution to the academic literature on fiscal policy, this thesis estimates the impact of automatic stabilisers on economic activity and finds it holds predictive content for the path of output and inflation with both showing a positive response. Furthermore, this research adds to the literature on state-dependence fiscal policy by using a novel econometric approach to study the effect of expansionary fiscal policy during recessions.

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CHAPTER 1

1.1 MOTIVATION FOR RESEARCH

Economists have always had a keen interest in the role of government in an economy. This interest normally revolves around the regulatory and or expenditure (public goods) role of government. And the latter, since the great recession, has generated a lot of academic and general interest literature regarding the optimal level of government expenditure required to effectively ameliorate the effect of economic downturns.

There are two main school of thoughts: Keynesian economics (Keynes, 1936, Keynes, 1930) and Neoclassical or Real Business Cycle theorists (Kydland and Prescott, 1982). Keynes explained that in an economic slump, prices and wages are not perfectly flexible as they are sticky and adjust slowly. Workers are likely to resist attempts by employers to cut wages allowing the onset of unemployment, inefficient business cycle fluctuations and the non-neutrality of money. This, subsequently, means that fiscal and monetary policy has a role in minimising economic welfare distortions caused by these rigidities and imperfections. Real Business Cycle or neoclassical theorists posit that labour and product markets have no rigidities and are able to perfectly clear without intervention by a fiscal or monetary authority (perfect competition). Indeed, neoclassical theorists believed that fiscal deficits undermined market confidence by threatening to crowd out[1] private spending with concomitant increases in the short term interest rates.

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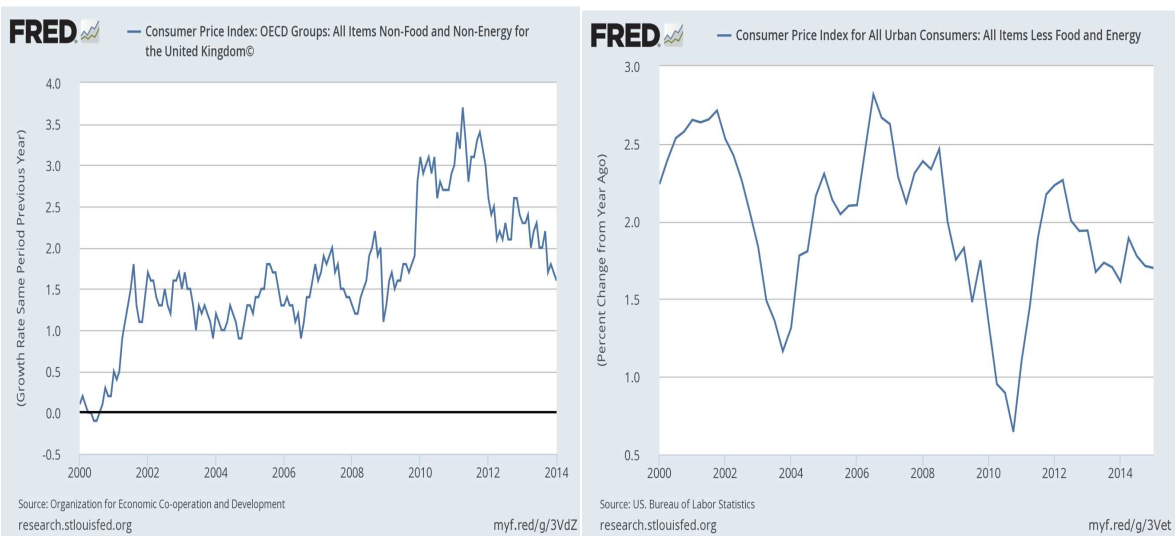
[1] The idea of expansionary fiscal policy crowding out private spending or investment is inaccurate and mostly based on the assumption that resources in a given economy are always employed thus the aggregate income earned is always a fixed sum. However, we know that during recessions there is unemployment of resources which means that income is always below its potential level. In addition, crowding out private investment spending may occur only if the economy is operating near full potential which means that increased government borrowing on the domestic market decreases loanable funds and raises interest rates and can crowd out private investment spending. Moreover, where the fiscal expansion involves running a deficit, it is unlikely that economic agents will save (marginal propensity to consume) all their money gained from a tax cut or increased government transfers in anticipation of higher taxes (*Ricardian equivalence*) in the future. In this instance expansionary fiscal policy will still have an effect as most people do not behave with much foresight and budget discipline.

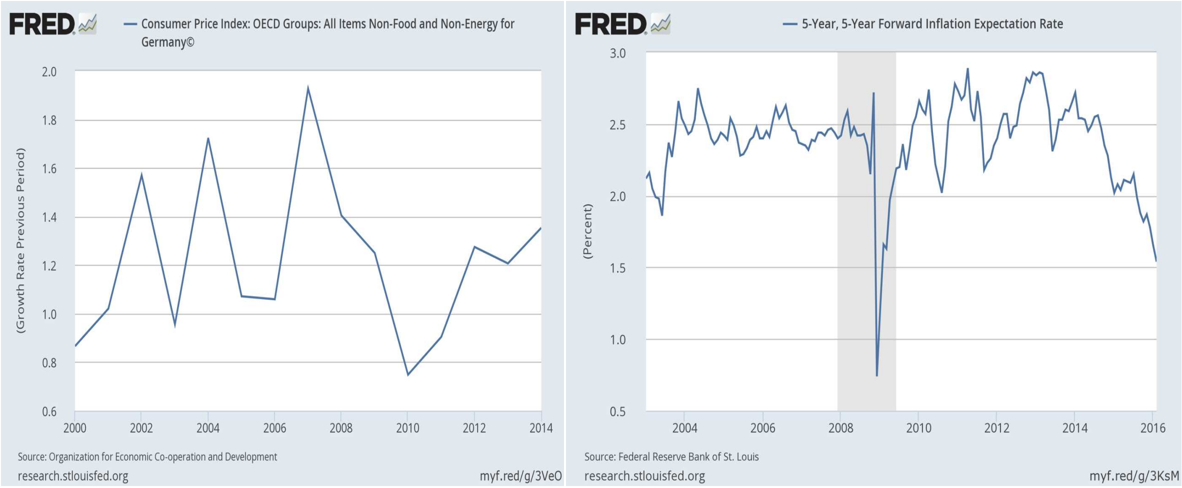
In fact, Keynes theory on employment, interest and money became the main economic policy prescription for dealing with economic recessions until the Real Business Cycle models provided a major methodological shift to dealing with economic slumps. That said, it soon became clear that the contribution of the RBC models to fiscal and monetary policy making by central governments and central banks respectively was of limited impact or usefulness.

As a good example, just as Keynes did in his paper titled: The Great Slump of 1930, I will focus on the prevailing economic conditions in the three main advanced economies; USA, UK and Germany. In the immediate aftermath of the great recession, there was monetary policy coordination between the central banks of USA and UK (Bernanke, 2013). Base short term interest rates were cut to 0.25% in USA, 0.50% in UK and 1.2% in Germany. Indeed, this low rates have persisted for over seven years which based on the predictive properties of the Phillips curve, inflation should rise but this has not happened as can be seen from the chart below. Indeed, the environment is disinflationary if one includes volatile additions like food and energy prices. Moreover, inflation expectations for the USA as deduced from the 5-year, 5-year forward inflation expectation rate[2] is on a downtrend implying that in the long run, low inflation is likely to persist.



1.2 FIGURE 1: INFLATION DYNAMICS FOR THE UK AND USA RESPECTIVELY

[2] This series is a measure of expected inflation (on average) over the five-year period that begins five years from today.

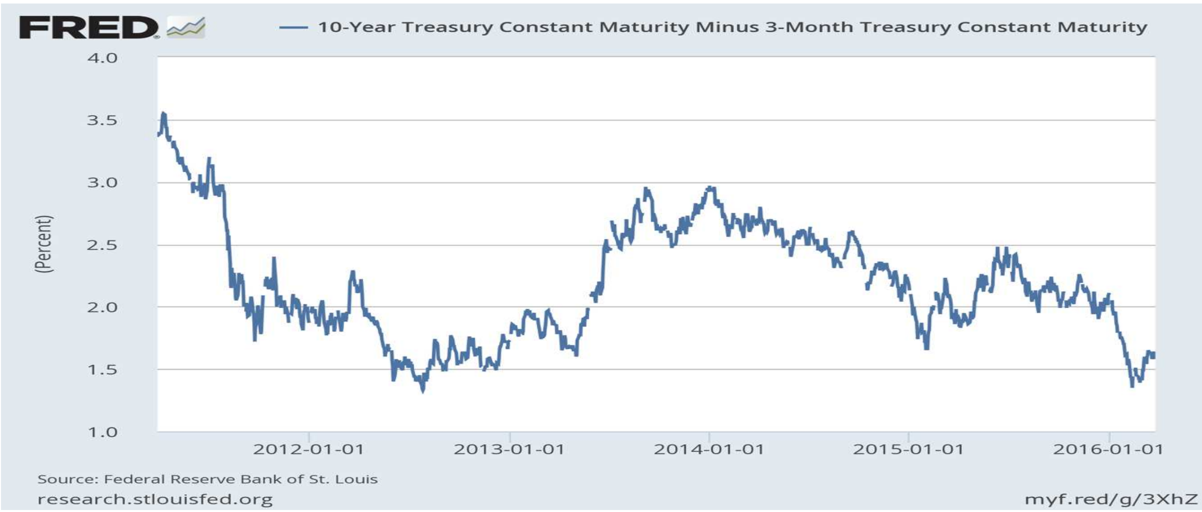


1.3 FIGURE 2: INFLATION DYNAMICS FOR GERMANY AND EXPECTED INFLATION FOR USA RESPECTIVELY.

The persistently low inflation has occurred notwithstanding the Federal Reserve and the Bank of England expanding its balance sheet by an estimated $4 trillion and £375 billion respectively while the European Central Bank has begun asset purchases worth €60 billion a month with the aim of raising inflation to its 2% target. In fact, current research (Falagiarda et al., 2015, Nkrumah, 2015) shows that cross border banking flows and yield-seeking could explain why quantitative easing has had little impact on inflation. Moreover, research (Martin, 2016b) has shown that in the USA for example, interests on bank reserves incentivised banks to keep proceeds from asset sales on their balance sheet thereby restricting credit to economic agents such as households and business. It is not surprising that after an estimated $4 trillion in asset purchases, inflation is still below the 2% target and inflation expectations offer little hope.

Interest rates are now negative in Germany for example and Euro Area inflation being -0.1% as of March 2016 (1% core inflation). In fact, by February 2016, over $7 trillion worth of government bonds offered yields below zero meaning that investors buying bonds and holding them to maturity will not get all of their money back. Before then, it was widely believed that there was a zero lower bound for interest rates. Households can find safe-deposit boxes for their money therefore making it unlikely that banks will charge depositors for their money which means banks are more likely to engage in risky commercial activities to make profit. Indeed, in countries where negative interest rates have gone farthest, bank distress is evident (*see* (Reuters, 2016)). That said, low interest rates and quantitative easing albeit successfully preventing deflation had not only been ineffective at raising inflation but also appears to have had limited impact on economic output (Hall, 2011). Specifically, the fact that central banks have experimented with both conventional and unconventional monetary policies and have even toyed with negative interest rates should indicate that economic growth is not at the expected pace and that there is a real threat of economic stagnation.

Indeed extensive research has shown that yield spreads dominate other economic indicators in predicting negative output (Estrella and Hardouvelis, 1991, Estrella and Mishkin, 1996). Specifically, negative yield spreads – difference between 10-year and 3-month bond rates – have successfully predicted the last three recessions due to assumed risk and lower expectations about future economic activity. US yield spreads are positive but only 1.4% as of 10th February, 2016 and is headed downwards based on trend analysis. And if this trend persists then it could be a harbinger for negative or extremely low output. The only 'known' macroeconomic policy that has not been tried yet – albeit limited in USA – is fiscal policy.

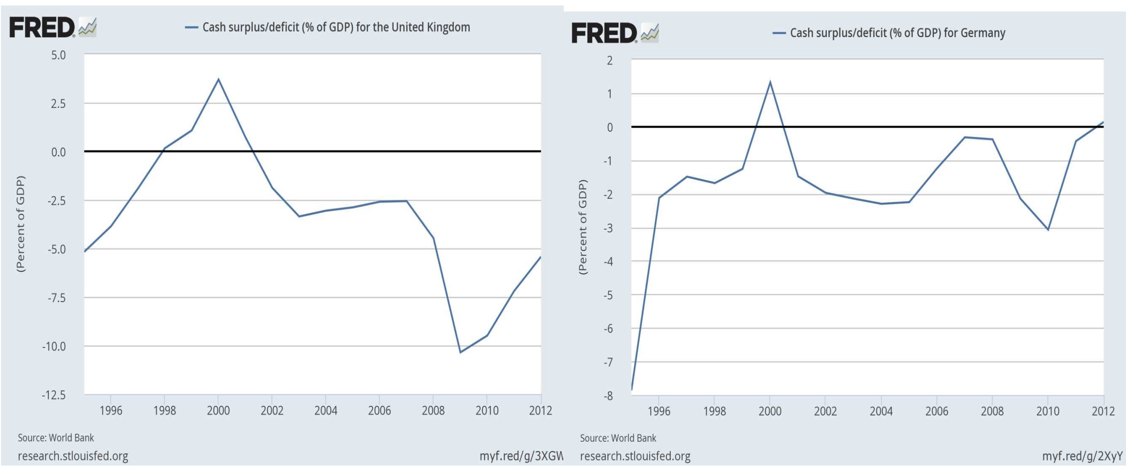


1.4 FIGURE 3: YIELD CURVE FOR US 10 YEAR TREASURIES MINUS 3-MONTH TREASURIES

1.2 THE DEFICIT

As a response to the great recession, USA passed the American Recovery and Reinvestment Act of 2009 (Romer and Bernstein, 2009). UK and Germany opted for fiscal consolidation. In UK for example, prior to the great recession, the budget deficit was not a key concern for economic policy makers. However, the budget deficit became a focal point for the government after the recession that seemed to have been caused by the private sector. In fact, from figure 4 below, it can be seen that the UK budget deficit was just over 4% of GDP in 2008. This deficit more than doubles to over 10% of GDP within one year which is due to loss of revenue and effect of automatic stabilisers as the economy contracted and not due to excessive expenditure prior to the recession.

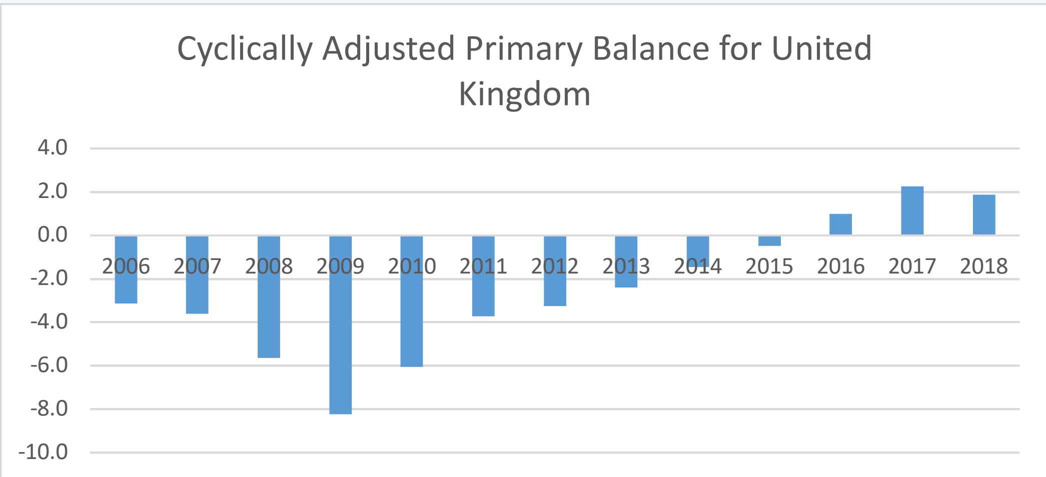
Similarly, Germany's fiscal position worsened by 1% of GDP in the aftermath of the great recession due to loss of revenue from the economic contraction. In fact, in the 12 months leading to the recession, Germany was running something very close to a balanced budget therefore fiscal consolidation – like in the UK - appear to be motivated by politics rather than analytical economics.



1.2.1 FIGURE 4: CASH DEFICIT AS A PERCENTAGE OF GDP FOR UK AND GERMANY

In the United Kingdom for example, austerity measures impacted negatively on gross domestic product. In fact, gross domestic product started increasing only when the government eased the austerity measures from 2012 as can be seen from figure 5 which shows the cyclically adjusted primary balance[3] for the United Kingdom. There is a big spending cut and large tax rise from 2009 to 2011. Indeed, economic growth figures for the UK was a paltry 0.6% for the last three months of 2015 and for the whole year fell to 2.2% from 2.9 in 2014 because there was almost no austerity in 2014. It is clear that the role of government expenditure in an economy is crucial for economic growth and welfare especially when both conventional and unconventional monetary policy tools have a reduced impact on the economy and aggregate demand is low (Portes and Wren-Lewis, 2015).

1.2.2 FIGURE 5: CYCLICALLY ADJUSTED PRIMARY BALANCE FOR UK FROM 2006 TO 2018.



Data Source: International Monetary Fund's Fiscal Monitor Database

[3] Cyclically adjusted primary balance is the budget balance net of the cyclical component and gives the underlying trend in the budget balance. Cyclically adjusted primary balance is an estimate of what the budget balance will be if real GDP were equal to potential output i.e. in the absence of an output gap.

1.3 INEQUALITY

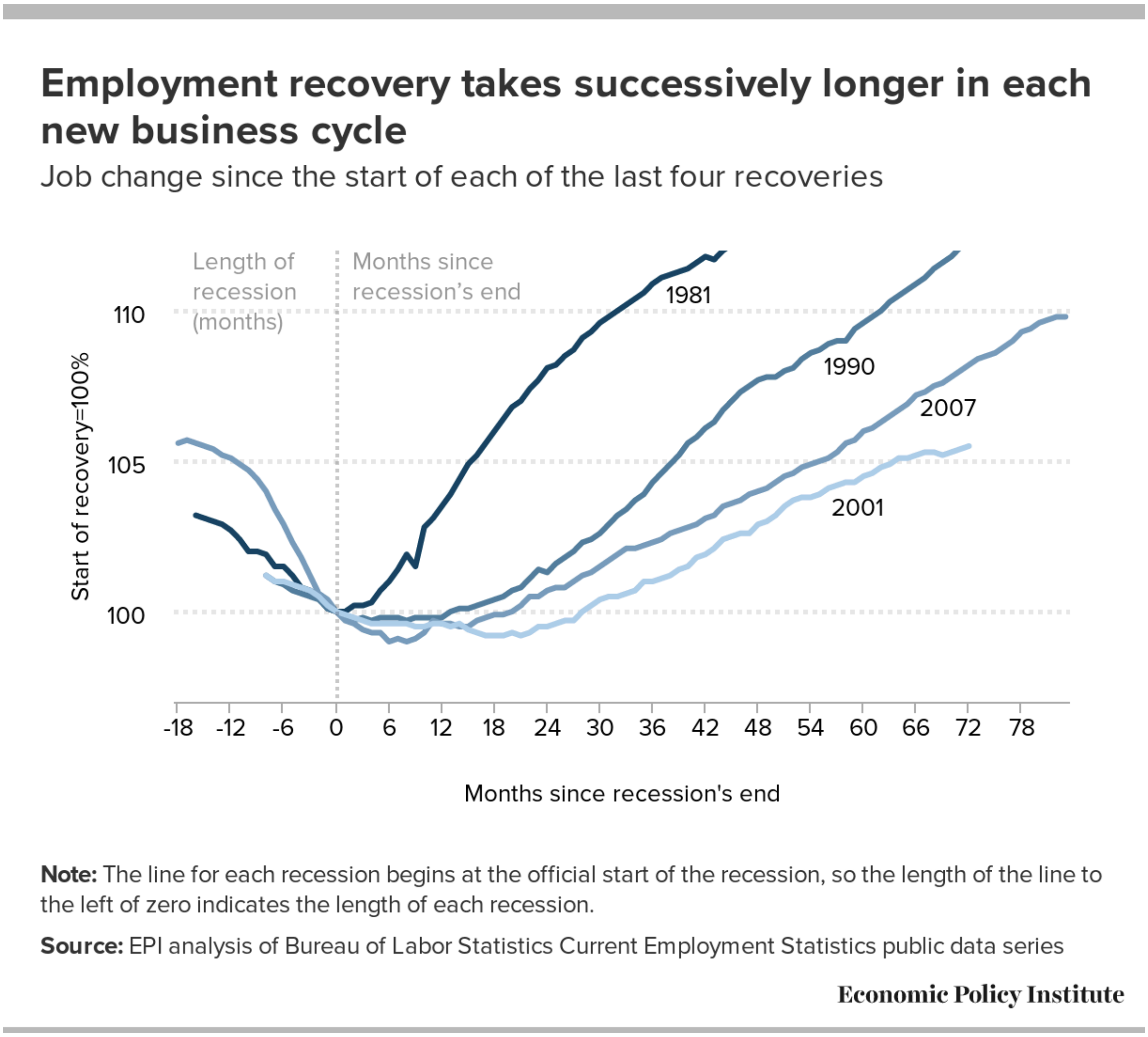
1.3.1 UNITED STATES OF AMERICA

It has been almost a decade since the onset of the great recession. Unemployment in the USA is down to 5% in March 2016 from a high of 10% in December 2009. However, there are 500,000 fewer people working in the public sector than before the great recession. And with normal expansion in government employment since the onset of the great recession, there would have been 2 million more in the public sector (*see* (Kalecki, 1943)). Indeed, the proportion of Americans who were part of the labour force is still substantially low as compared to what it was before the onset of the great recession. This in itself is an indication that the official unemployment figure disguises the true nature of the unemployment problem and slack in the US economy.

Gross domestic product and gross domestic product per capita have significantly deviated from their prerecession trend. Specifically, GDP and GDP per capita are 19% and 16% respectively, below the 1955-2007 trends. This output gap is forecast to widen over the next decade – 2016 to 2026. Between 1955 and 2007, the average annual growth rate was 3.3% and is forecast to grow by a paltry 2.3% in the next decade (Martin, 2016a). It is not surprising that incomes have stagnated. In fact, the incomes of those at the middle and bottom of the income distribution keeps shrinking and even though some states have raised the minimum wage to $15 per hour this year - 2016, this is still inadequate. Specifically, the 400 wealthiest Americans took home an hourly wage of $97,000 in 2009 (IRS, 2010) while median wealth – the wealth of those at the middle of the income scale – fell by almost 40% (Mishel and Bivens, 2011). Interestingly enough, it is estimated that the wealth of Americans at the bottom of the income distribution would have gone up by 75% if they had shared equally in the increase in national wealth between 1992 and 2012

(Stiglitz, 2012). Moreover, after the great recession, wage gains for middle and low income earners have been modest and still below pre great recession trend.

1.3.1.1 FIGURE 6: EMPLOYMENT RECOVERY DYNAMICS FOR THE LAST FOUR US RECESSIONS.



1.3.2 UNITED KINGDOM

Inequality in the United Kingdom follows a similar pattern to that in the United States of America. Specifically, the poorest tenth of the population have on average a net income just over £8,000 while the richest tenth have net income of almost £80,000. In fact, the poorest fifth of society have only 8% of total national income while the top fifth have 40% (Tonkin, 2015). In terms of wealth, the richest 10% of households hold 45% of total wealth while only a paltry 8.7% of national wealth is held by the poorest 50% (ibid).

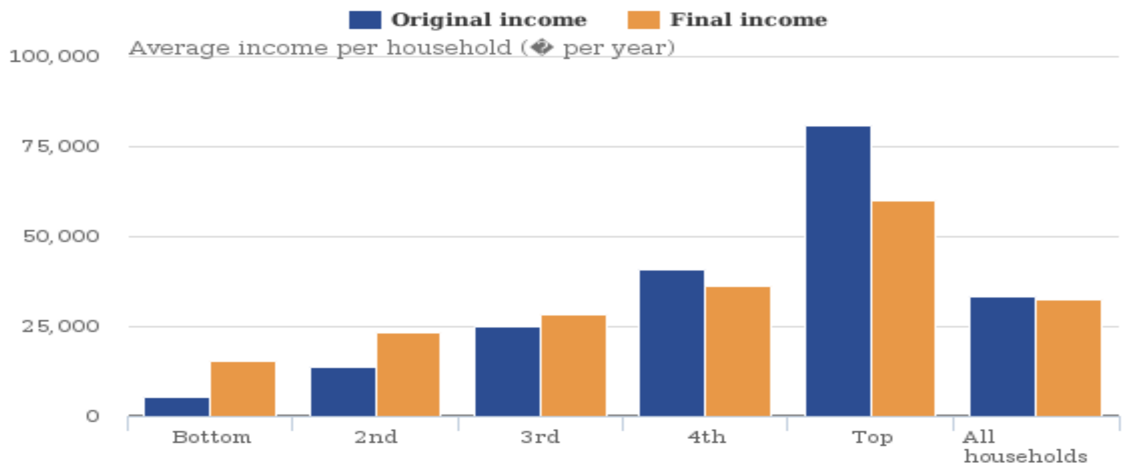
Both income and wealth disparity has worsened in the aftermath of the 2009 recession as the United Kingdom has resorted to aggressive fiscal consolidation by reducing government departmental budgets by 20% between 2010 and 2015. At the moment average incomes are slowly increasing but it still below prerecession trend. Although the magnitude of the loss of income for the poor after the great recession is less than the rich, the disposable incomes for the poor is slightly below prerecession levels and at best stable if housing costs are accounted for.

Furthermore, median household income adjusted for inflation grew by 0.8% in 2013-2014 after the economy grew by a paltry 0.4% in 2012-2013 in response to fiscal consolidation. During this period, average earnings of the employed remained stagnant. This was partly due to cuts to working age benefits and tax credits. In fact the Institute of Fiscal Studies report clearly shows that the United Kingdom is an unequal country when measured by wealth and income (Belfield et al., 2015).

1.4 FIRMS/PRIVATE SECTOR

One of the main arguments against expansionary fiscal policy is the 'crowding out' of private investment by firms and corporations. In fact, the assumption made is that every pound or dollar spent by the central government supplants a dollar of private spending/investment. While this assumption has been proven to be generally wrong as the validity of those arguments depends on the stage of the economic business cycle the current investment climate in US lends support to arguments refuting the 'crowding out' hypothesis.

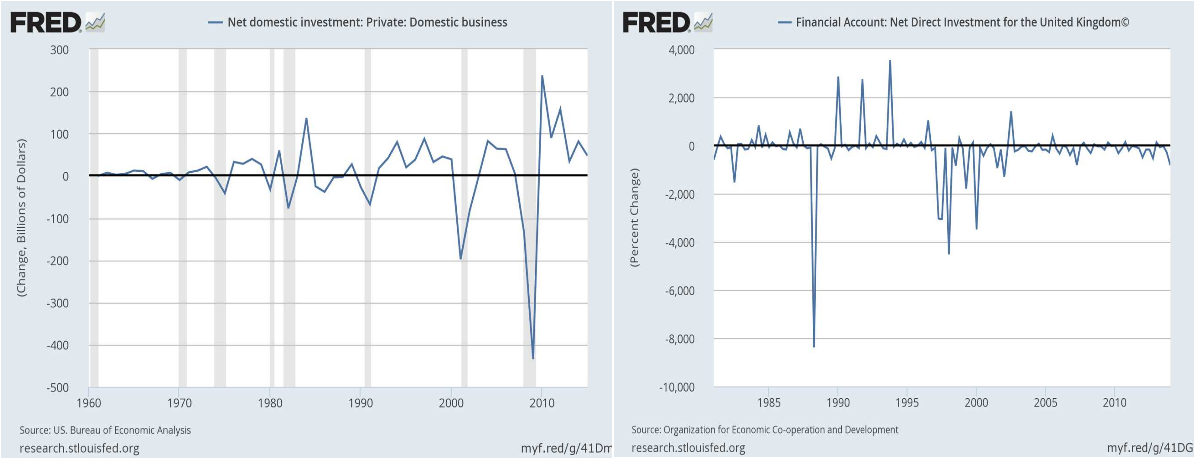
1.3.2.1 FIGURE 7: ORIGINAL INCOME AND FINAL INCOME BY QUINTILE GROUPS FOR ALL HOUSEHOLDS FINANCIAL YEAR ENDING 2014[4].



Source: Office for National Statistics, United Kingdom.

Specifically figure 7 shows the private sector/business investment climate for both US and UK. Despite the fiscal consolidation in the UK, private investment by firms is falling and is actually negative. Similarly, private sector investment is weak in the US as well but still positive. If crowding out theory were right, then private investment in UK should at least be positive and negative for the USA that carried out a brief and very limited fiscal expansion in response to the great recession.

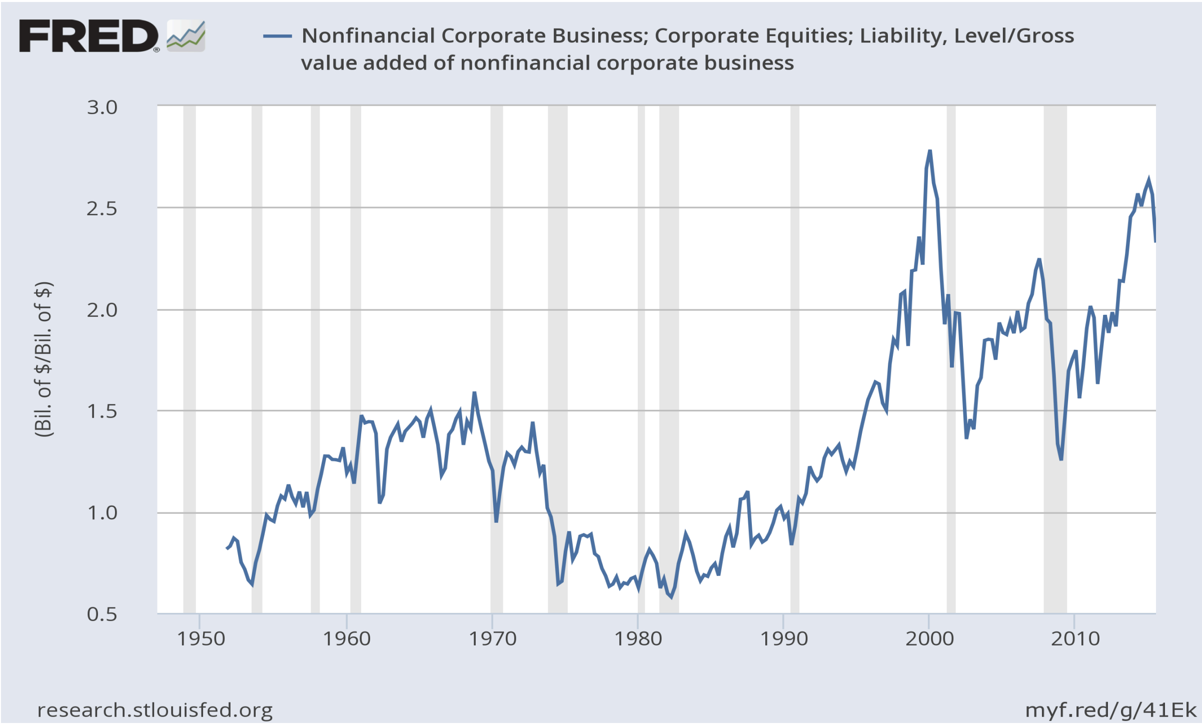
[4] Households are ranked by their equivalised disposable incomes using the modified OECD scale



1.4.1 FIGURE 8: PRIVATE SECTOR/BUSINESS INVESTMENT IN USA AND UK RESPECTIVELY

Moreover, this low investment climate is persisting despite the record rise in profits for US firms (The Economist, 2016) and the S&P 500 being valued at historic highs while the ratio of the value of corporate equities to its GDP is very high as can be seen in figure 8. This could imply a high return on new investment as profits normally reflect marginal productivity of capital. Indeed, a high market capitalisation of firms suggest existing capital is highly valued therefore producing higher interests and payoffs in new capital investments. But US firms seem to 'sit' on this capital rather than invest it which in the absence of expansionary fiscal policy – based on the provisions of 'crowding out' theory - firms should be investing to grow the economy faster and smooth-out the business cycle. Of course, the lack of investment could mean that riskiness is high as businesses could be concerned about the level of demand in the US economy and the long-run growth prospects of the economy.

Similarly, in the UK, the Office for Budget Responsibility downgraded growth forecasts in March 2016 partly due to the weakening investment climate in the economy. In fact, this could be a virtual cycle as the lack of investment by private firms can contribute to persistent loss of aggregate demand in the economy. This observed evidence lends support against the proponents of the crowding out hypothesis as fiscal consolidation in the UK since 2010 has not provided the right environment (space) for private firms in UK to invest and grow UK's economy.



1.4.2 FIGURE 9: RATIO OF MARKET VALUE OF EQUITIES IN CORPORATE SECTOR TO ITS GDP

CHAPTER 2

2.1 LITERATURE REVIEW

In spite of the overwhelming observed effects of extra government purchases, there is lack of a general consensus (Cogan et al., 2010) in the academic literature on its effects on the economy. This could be due to differences in econometric methods employed, range of data used and the stage of the business cycle investigated. Indeed, the differences mentioned has also led to differences in the size of the fiscal multiplier[5] estimated. Specifically, there are two main models of fiscal policy. These are the traditional Keynesian models and New Keynesian models. In the former, any increases in government expenditure increases output whereas in the latter the type of government expenditure matters. In fact a review of the existing academic literature on fiscal policy found that multipliers in traditional Keynesian models were larger than new Keynesian models with the size of the multiplier increasing in recessions (Cogan et al., 2010).

Using a combination of mixed structural vector autoregression and event study approach, Blanchard and Perotti (2002) achieve identification by using institutional information about US tax and government transfer systems to identify the automatic response of taxes and government spending to fiscal policy. They found that expansionary fiscal policy has positive effect on output while tax increases negatively affected output. However, perhaps in an empirical support for adherents of the 'crowding out' hypotheses, they found that both increases in government spending and taxes had a negative effect on private investment spending (Blanchard and Perotti, 2002). These finding, with the exception of the negative impact on investment were supported by Ramey (2011) who, in using the

[5] The fiscal multiplier is the ratio of the change in real GDP caused by an autonomous change in total spending to the size of that autonomous change.

narrative approach which takes into account the timing of the shocks, found that government spending did produce multiplier between 0.6 and 1.2 (Ramey, 2011).

Furthermore, research using the event study approach also found that accounting for the composition of government spending is crucial in understanding the aggregate effects of changes in government spending. Specifically, consistent with IS-LM[6] (Hicks, 1937, Krugman, 2000) theory, the researchers found that an important part of the aggregate effect of changes in government expenditure is through shifts in demand across sector of the economy (Ramey and Shapiro, 1998).

The stated effects of expansionary fiscal policy were confirmed in a study employing the main econometric approaches i.e. the Blanchard and Perroti (2002), the Recursive (Sims, 1980) and event study (Ramey and Shapiro, 1998) approaches. Specifically, Caldara and Kamps (2008) found that controlling for the specification of the reduced form model[7], the Blanchard and Perroti, Recursive and event study approaches yielded qualitative and quantitatively similar results: expansionary fiscal policy significantly increases real gdp, real private consumption and real wages (Caldara and Kamps, 2008).

Research (Auerbach and Gorodnichenko, 2012) on fiscal policy using regime-switching models[8] found large differences in the size of spending multipliers in recessions and expansions with fiscal policy being more effective in slumps than

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[6] Invest-Savings – Liquidity Preference-Money supply: real interest rate driving the level of investment which in turn drives the equilibrium level of output. High real interest rates discourages investment and causes equilibrium output to fall. If output increases savings increases and there are more loanable funds which drives interest rates low and vice versa: interest rates driving GDP and GDP driving interest rates. LM: at higher economic growth people prefer to hold money and this drives interest rates and vice versa. The intersection between IS and LM curve is equilibrium output. For any given level of output, monetary expansion drives down interest rate by shifting the LM curve down and increases the level of output. IS-LM model assumes price stickiness (*see* HICKS, J. R. 1937. Mr Keynes and the "Classics"; A Suggested Interpretation. *Econometrica,* 5**,** 149-159.

[7] Reduced form models in simultaneous ordinary least squares equations allows for re-arranging the equations (usually structural equations) in a manner that allows for estimating unbiased and consistent estimators due to the presence of the same exogenous components. This is required as the dependent variables could be correlated with error terms in different linear equations of the simultaneous equation. This potential correlation produces biased and inconsistent estimators so by substituting the dependent variable of each equation into the other equation, the new error term is then a function of both error terms in the original equation (structural). Of course there is a loss of the underlying economic situation and that is why they are called 'reduced form' models. Usually, the coefficients of interest are also unable to be estimated in the reduced form model due to the transformation of the independent side of the OLS equation.

[8] Regime switching model is a non-linear time series model that involves multiple equations that characterise the random behaviour of time series. By permitting switching between these equations, the model is able to capture more complex dynamic patterns.

expansions. The effectiveness of expansionary fiscal policy in recessions was confirmed by other researchers (Bachmann and Sims, 2012) while others (Tagkalakis, 2008), using a yearly panel of 19 OECD countries, go further to explain that this positive effect of expansionary fiscal policy in recessions is even more pronounced in countries with less developed consumer credit markets.

In fact, using a Dynamic Stochastic General Equilibrium model (DSGE), researchers at National Bureau of Economic Research found that the government spending multiplier can be larger than one in a zero lower bound environment (Christiano et al., 2009). This supports the findings of Auerbach and Gorodnichencko (2012). Furthermore, irrespective of the presence of a zero lower bound constraint, extra government consumption in a recession has been shown to have a peak multiplier effect of about 1.6 (Christiano et al., 2015) with the size of the extra government expenditure being a determinant of the size of the multiplier. For example, Christiano, et al 2015 argue that even though the American Recovery and Reinvestment Act of 2009 produced a peak multiplier of 1.6, it was not enough to deal with the overall weak demand in the US economy at the time.

Moreover, other research documenting the state contingency of fiscal policy has found that extra government expenditure produces multipliers of more than 2 in a recession while similar expansions during boom times produces multipliers less than 1. This was achieved by augmenting a banking model as described in Curdia and Woodford (2010) with a countercyclical variation in bank intermediation costs. This variation causes the spread between bank deposit rate and loan rate to fluctuate countercyclically, creating a financial accelerator[9] that is much robust in recessions than in boom times allowing for the generation of strong multipliers in slumps and weak multipliers in boom times (Curdia and Woodford, 2010, Canzoneri et al., 2016). Basically, as happened in the immediate aftermath of the great recession, there was financial friction which was worsened by the drying of credit lines to economic

[9] This is the idea that endogenous developments in credit markets work to amplify and propagate shocks through an economy.

agents but when central government carries out a fiscal stimulus like the American Recovery and Reinvestment Act, the economy grows which decreases the interest rate spread; encourages more borrowing and private consumption; the economy grows even further which reduces the interest rate spread further and the process repeats itself. This process enables the model to produce state-dependent multipliers (Canzoneri et al., 2016).

It is noteworthy at this point that if the cyclical variation is insufficient in a model, then having a financial accelerator might not necessarily generate large multipliers. Indeed, Cogan, et. al, (2010) reviewed several models based on traditional Keynesian and new Keynesian models and used the Smets and Wouters model (2007) (*see (Smets and Wouters, 2007))* to estimate output and consumption multipliers using transitory versus permanent increases in government expenditure. They find the peak multiplier to be one and discredit the reliability of the traditional Keynesian model used by Romer and Bernstein (2009). Preceding them, was similar research[10] that produced similar results in terms of small multipliers and the lack of cyclical variation over the business cycle (Collard and Dellas, 2008).

These could also explain the source of the disagreement in the quantitative effects of countercyclical extra government expenditure in the academic literature. In fact, research using another identification method i.e Jorda's (2005) local projection method and a longer time time series covering periods of deep recessions and expansions find no evidence of state dependant fiscal multiplier (Ramey and Zubairy, 2014). Jorda's local projection method allows the estimation of local projections at each period of interest instead of forecasts looking at distant horizons from a standard vector autoregression model (Jordà, 2005).

[10] Collard & Dellas (2008) estimate fiscal multipliers using the DSGE model of Bernanke, et al., (1999) with money and price stickiness that allows for the study of how credit market frictions influence transmission of monetary policy (BERNANKE, B. S., GERTLER, M. & GILCHRIST, S. 1999. The financial accelerator in a quantitative business cycle framework. *Handbook of macroeconomics,* 1**,** 1341-1393.)

Models with deep habits[11] have also been shown to produce large multipliers. Based on a model with deep habits, using a panel structural vector autoregression and data from four industrialised countries, an increase in government expenditure raised output and private consumption. Deep habits generate a transmission mechanism for extra government expenditure through countercyclical movements in equilibrium mark-ups of prices over marginal cost. When government expenditure increases, mark-ups decline in the domestic market making it inexpensive in relation to the foreign economy (Ravn et al., 2012).

More importantly for the aims of this research, new Keynesian models with a lower bound constraint on nominal interest rates although shown to generate large fiscal multipliers, still has some disagreements in the size of the multipliers. Specifically, it has been shown that the size of multipliers at zero lower bound grows when prices are stickier causing mark-ups to fall more rapidly when aggregate demand rises, the central bank keeps interest rates low in the presence of a fiscal expansion which is short-lived (Haltom and Sarte, 2011). That said, other researchers have argued that the size of the output multiplier at the zero lower bound is contingent on a number of factors such a low interest rate environment combined with low output volatility, large resource cost of price adjustment which are difficult to reconcile with the empirical requirement that menu costs are small and households expect the period of zero interest rates to be long. The said assumptions make the net effect of the extra government expenditure to to be theoretically ambiguous (Braun and Körber, 2011, Braun et al., 2016).

[11] Deep habits assumptions alter the supply side of the economy in fundamental ways as firms take into account the fact that the demand they will face in the future depends on their current sales. This is because higher consumption of a particular good in the current period makes consumers, all other things equal, more willing to buy that good in the future through the 'force' of habit. For governments, deep habits occur when for example the provision of public goods in one community implies that other communities request the provision of those goods. Alternatively, it can be assumed that government forms procurement relationships that create a tendency to for it to prefer transactions with sellers that supplied the public goods in the past.

2.2 CONTRIBUTION TO THE ACADEMIC LITERATURE AND ECONOMIC POLICY PRESCRIPTION

In the academic literature there is evidence that expansionary fiscal policy aids economic growth and well-known economic theory confirms this even though there is not a general consensus. However, the fact that there was policy divergence between the USA and Europe for example shows that policy makers are not settled as to the optimal policy response to economic downturns. And the strong political opposition to the American Recovery and Reinvestment Act lends support to this.

Thus, this research fills the gaps in knowledge by going through a number of the arguments against fiscal policy and uses both theoretical and empirical evidence to show how most of these arguments are neither supported by theory nor empirical evidence using econometric methods. In addition, this research proposes a new econometric approach to studying effect of fiscal policy on key macroeconomic variables in economic downturns. Furthermore, this research provides estimates of the impact of automatic stabilisers on key macroeconomic variables for the first time and fills the gap in knowledge on this topic as the widely held belief in non-academic settings is that increments in automatic stabilisers impact negatively on economic growth.

The rest of the research proceeds as follows. Chapter 3 elucidates the effects of fiscal policy shocks in the USA. This includes a description of the data and pre-estimation preparation of data, econometric specifications, presentation and explanation of results. Chapter 4 elucidates the effects of fiscal policy in UK and the subsequent sub-headings are the same as for USA. Chapter 5 expounds the effect of fiscal policy shocks in Germany with subsequent sub-headings being the same as USA and UK. Chapter 6 contains a general comment on the results gained for USA, UK and Germany and a discussion section for all three countries. Chapter 7 contains the references for the three countries. Chapter 8 is a data appendix for USA, UK and

Germany and Chapter 9 is an estimation output appendix for USA, UK and Germany.

CHAPTER 3

3.1 FIRST PAPER

3.2 EFFECTS OF FISCAL POLICY SHOCK IN USA

3.3 DATA

Quarterly USA data from 1955Q1 to 2014Q4 is used giving η = 244 observations. The variables of interest are Real Government Consumption Expenditures, *'expend'* (government purchases + gross investment), Government Social Benefits, *'transfers'*, Federal Government Current Tax Receipts, '*revenue*', Real Gross Domestic Product, '*gdp*', Gross Domestic Product Deflator, '*inflation*', Effective Federal Funds Rate, *'interest rate'*, Gross Fixed Capital Formation, '*net investment*', Hours Worked, '*hours*', Households Net Worth, '*wealth*', and Private Final Consumption Expenditure, *'consumption'*. Unless stated otherwise, data used is in growth rates.

The data used in the first set of estimations are restricted to 2007Q4 as the global financial crises and the resultant market mayhem can have an impact on the estimates of fiscal policy shocks and induce large multipliers (Blanchard and Leigh, 2013). In fact, preliminary analyses carried out for this research shows that when the estimation is unrestricted to 2007Q, there is a peak multiplier of 2.72 after 8 quarters for the USA while the calculated peak multiplier is 0.05 when the estimation is restricted to 2007Q4[12]. For clarification purposes, help fill the gaps and help settle the debate on effect of fiscal policy shocks, I also estimate a large sample from 1955Q1 to 2015Q4.

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[12] Please see appendix for the estimates for the two sample period and BLANCHARD, O. & LEIGH, D. 2013. Growth Forecast Errors and Fiscal Multipliers. *IMF Working Paper Series,* 13/1. For a detailed explanation of the rationale for this approach to understanding the data generation process.

3.3.1 TABLE 1: PEAK MULTIPLIER FOR DIFFERENT SAMPLE PERIODS; EXPENDITURE SHOCK TO OUTPUT

Quarters	1955Q1-2014Q4	1955Q1-2007Q4
4	0.01	0.05*
8	2.72*	0.01

*indicates peak multiplier for each period.

3.4 PRE-ESTIMATION DATA PREPARATION

All data series are in real terms at source. In addition, the data series were transformed into their natural logarithms to stabilise the variance and reduce heteroscedasticity (Lütkepohl and Krätzig, 2004, Lütkepohl, 2006). In addition, using the log of variables helps convert elasticities of the response of output to expenditure and tax policies to multipliers by using an *ex post* conversion factor based on the sample average of the ratio of output to government expenditure.

With the exception of the series on Government Social Benefits and interest rate, the remaining time series are found to be stationary. The non-stationary series were first differenced to achieve stationarity. Tests[13] for cointegration showed that the non-stationary series were integrated of order 1 i.e. *I (1)*. First differenced data is used for the estimation and for those series that are stationary, the stationary series are used in the estimation.

3.5 LAG SELECTION

A review of the econometric literature on vector autoregression highlights three multivariate information criteria used in the selection of optimal lags. Specifically, these are Akaike Information Criterion (AIC), Hannan-Quinn Criteria

[13] The outputs for tests of unit roots, first differencing and cointegration can be found in the appendix of this thesis.

(HQC) and Schwarz Criterion (SC). Based on the data used in this research, I have provided the values for AIC, SC and HQC

3.5.1 TABLE 2: VAR LAG ORDER SELECTION CRITERIA

Lag	Akaike Information Criterion	Schwarz Criterion	Hannan-Quinn Criterion
0	19.87	20.02	19.93
1	14.99	16.69*	15.68*
2	14.91	18.16	16.22
3	14.48	19.28	16.41
4	14.08*	20.42	16.63

*indicates optimal lag selection by the multivariate information criterion.

It can be seen that the Schwarz and Hannan-Quinn criterion shows an optimal lag of 1 while the Akaike Information Criterion points to an optimal lag of 4. Usually a choice of lag would have been made based on the SC and HQ due to the two indicating the same number of lags -2. In addition, adding more lags improves the fit but reduces the degrees of freedom while increasing the danger of over-fitting. And this is how the Akaike Information and Schwarz criterion works as they are the measures of the trade-off between fit and loss of freedom in such a way that the chosen lag length should minimise both AIC and SC.

However, in ensuring that my vector autoregression is well specified, I checked for serial correlation of the residuals and found them to be serially correlated. I then added to number of lags, from 1 to 4[14] to until there was no serial correlation amongst the residuals (Toda and Yamamoto, 1995, Lütkepohl, 2006, Lütkepohl and Krätzig, 2004). Moreover, a review of the vector autoregression literature on the impact of fiscal policy shocks also point to 4 as the optimal number of lags. I therefore chose 4 lags as the optimal number of lags for the econometric specification in this research.

[14] The output for these tests can be found in the appendix of this thesis.

3.6 ECONOMETRIC METHODOLOGY

A review of the literature on vector autoregression and its application to estimating the impact of fiscal policy shocks shows three main econometric approaches. Specifically, these are the Recursive approach which was developed by Christopher Sims, Blanchard and Perroti approach which was developed by Olivier Blanchard and Roberto Perroti and the Event study approach developed by Valerie Ramey and Mathew Shapiro. I used the three approaches in this research to estimate the effect of fiscal policy shocks in USA, UK and Germany. A univariate autoregression is a single equation, single variable linear model with the current value of that variable explained by the lagged values of that variable. This means that a vector autoregression is an *n*-equation, *n*-variable linear model wherein each variable is explained (dependent variable) by its lagged values including current and past values of the remaining *n*-1 variables (Sims, 1980). Vector autoregression have become widely accepted as good empirical approach for data description, forecasting, structural inference and economic policy analyses.

3.7 BENCHMARK REDUCED FORM VECTOR AUTOREGRESSION

Consistent with Caldara and Kamps (2008), the standard or reduced form[15] model of VAR collecting the endogenous variables in the *k*- dimensional vector X_t can be expressed as

$$X_t = \mu_o + \mu_1 t + A(L)X_{t-1} + u_t, \qquad (1)$$

[15] Equation 1 is in reduced form because all right hand side variables are lagged or predetermined. The instantaneous relationship among the variables are summarised and contained in the variance-covariance matrix and this is not enough if one wants to use the results of a VAR for economic policy prescription and analyses.

where μ_o is a constant, t is a linear time trend, $A(L)$ is a 4[th] order lag polynomial and u_t is a k- dimensional vector of reduced form disturbances where $E[u_t] = 0$, $E[u_t u'_t] = \sum_u$ and $E[u_t u'_s] = 0$, for $s \neq t$.

The disturbances in the reduced form vector autoregression model will be correlated thus it is important to transform the reduced form model into a structural model[16]. Thus pre-multiplying the above equation by the $(\kappa\chi\kappa)$ matrix A_0 gives the structural form

$$A_0X_t = A_0\mu_o + A_0\mu_1 t + A_0\, A(L)X_{t-1} + Be_t \quad (2)$$

where $Be_t = A_0\mu_t$ describes the relationship between the structural disturbances e_t and the reduced form disturbances u_t. In equation 2, it is assumed that the structural disturbances e_t are uncorrelated with each other i.e. the variance-covariance matrix of the structural disturbances $\sum_e$ is diagonal. The matrix A_0 describes the contemporaneous relationships among the variables collected in the vector X_t[17]. Specifically, in the matrix, X_{1t} will denote variables that do not respond at the same time (contemporaneous) with the onset of the fiscal policy shock and X_{2t} will denote variables that respond at the same time to the fiscal policy shock and another subset of variable g_t (for example) which is the fiscal policy shock itself. Without restrictions A_0 and B, the structural model is not identified. Denoting the the variables included in this research as Z_t , the vector X_t can be partitioned as

$$Z_t = \begin{bmatrix} X_{1t} \\ g_t \\ X_{2t} \end{bmatrix}$$

Where the top represents slow moving variables and the bottom represents fast moving variables such as the immediate response of the stock market to news of a dividend tax cut for example.

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[16] Structural VAR models have contemporaneous variables that appear as independent or explanatory variables. This is valid description of the data generation process.

[17] See LÜTKEPOHL, H. 2005. *New introduction to multiple time series analysis*, Springer Science & Business Media. for further explanation of the AB model

3.8 RECURSIVE IDENTIFICATION

In this type of vector autoregression, *B* is restricted to a *k*- dimensional identity matrix while A_0 is restricted to a lower triangular matrix with unit diagonal which implies the decomposition of the variance-covariance matrix $\sum_u = A_0^{-1}\sum_e(A_0^{-1})'$ and is taken from the Cholesky decomposition $\sum_u = PP'$ by defining a diagonal matrix *D* that has the same main diagonal as *P* and by specifying $A_0^{-1} = PD^{-1}$ and $\sum_e = DD^1$. This means that the elements on the main diagonal of *D* and *P* are equal to the standard deviation of the respective structural shock.

The recursive approach also requires contemporaneous assumptions due to that fact there are '*k*' possible orderings and changing the order affects the result. Thus the order is government expenditure, output, inflation, tax revenue and interest rate respectively in the baseline vector autoregression equation. The sequence is based on theoretical assumptions that movements in government expenditure unlike movement in government revenue are largely unrelated to the real business cycle. This implies that output and inflation are ordered before taxes as the aforementioned affects taxes. Interest rates are then ordered last and ordering interest rate last is then justified on the grounds of a central bank's stackelberg reaction function where fiscal authority is the stackelberg leader[18] meaning that interest rate is set as a function of output gap and inflation. Ordering the variables in this manner helps the benchmark vector autoregression equation to capture the effect of automatic stabilisers.

The variables are ordered as *expend* → *gdp*, → *inflation*, → *revenue*, → *interest_rate* meaning that the baseline Vector Autoregression can be written in notation form as

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[18] See KIRSANOVA, T., STEHN, S. J. & VINES, D. 2005. The Interactions between Fiscal Policy and Monetary Policy. *Oxford Review of Economic Policy,* 21**,** 532-564. for a full explanation of the stackelberg reaction function between a fiscal authority and monetary authority.

$expend_t = \boldsymbol{\alpha} + \sum_{i=1}^{4} \boldsymbol{\Phi}_i \, expend_{t-1} + \sum_{i=1}^{4} \beta_i \, gdp_{t-1} + \sum_{i=1}^{4} \boldsymbol{\lambda}_i \, inflation_{t-1} + \sum_{i=1}^{4} \boldsymbol{\delta}_i \, revenue_{t-1} + \sum_{i=1}^{4} \boldsymbol{\gamma}_i \, interest\_rate_{t-1}$ (3)

the remaining variables are added to the baseline Vector autoregression one after the other to obtain an 'augmented' VAR model that provide estimates for the effect of fiscal policy shocks on private consumption, net investment, hours worked, households net worth. The relationship between the reduced form disturbances u_t and the structural form disturbances e_t takes the form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha yg & 1 & 0 & 0 & 0 \\ \alpha\pi g & \alpha\pi y & 1 & 0 & 0 \\ \alpha\tau g & \alpha\tau y & \alpha\tau\pi & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}$$

3.9 EQUATION FOR AUTOMATIC STABILISERS

To estimate the effect of automatic stabilisers on output and private consumption, I treat the series on transfers as both a shock and as an independent variable. This is because in the standard form, total government expenditure is inclusive of federal government social benefits which includes items such as welfare payments, unemployment insurance and Medicaid. Indeed, contemporaneous ordering of variables allows for the capture of the effect of automatic stabilisers but the observed effect is inclusive of the other aspects of the fiscal policy shock in general.

3.1.0 RESULTS

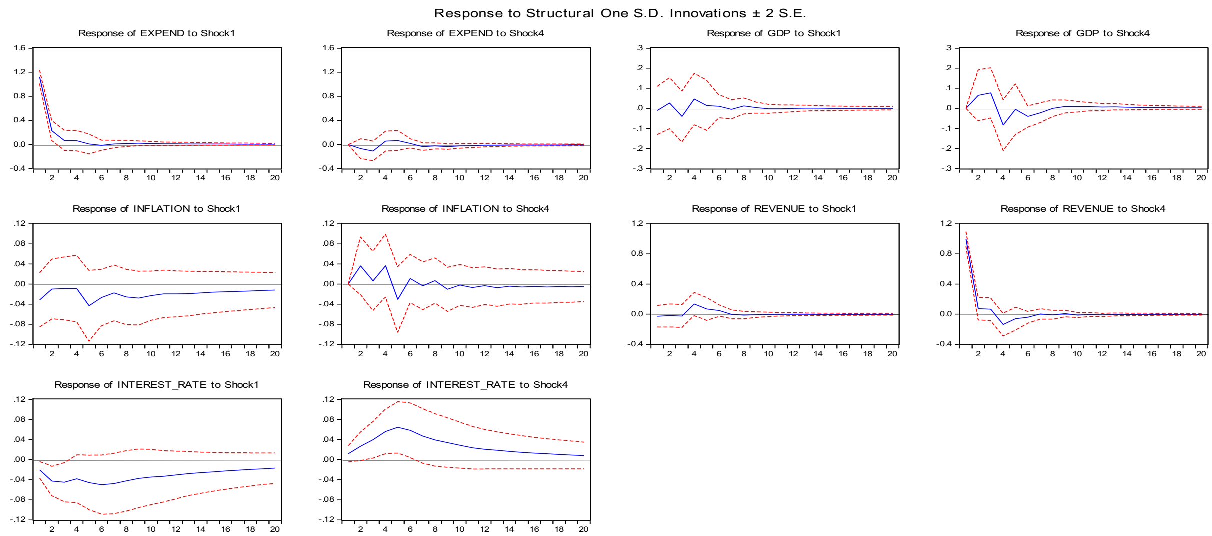
3.11 BASELINE VECTOR AUTOREGRESSION FOR USA

3.1.1.1 TABLE 3: EXPENDITURE MULTIPLIERS

Variables	Impact quarter	First year	5 years	Peak multiplier
Real GDP	- 0.01	0.05*	0.00	0.05*(4)
GDP deflator	- 0.03	- 0.01*	- 0.01*	- 0.01*(4)
Revenue	- 0.02	0.13*	- 0.00	0.13*(4)
Interest rate	- 0.02*	- 0.04*	- 0.02	-0.04*(4)

*indicates peak multiplier

3.1.1.2 FIGURE 10: IMPULSE RESPONSE[19] GRAPHS FOR POSITIVE GOVERNMENT EXPENDITURE AND REVENUE SHOCKS[20]



[19] I chose a forecast horizon of 20 quarters equivalent to five years as while there are disagreements over the number of years that constitute a short run and a medium run, there seems to be a consensus that a long run horizon is beyond five years; see CARNOT, N., KOEN, V. & TISSOT, B. 2005. *Economic Forecasting,* United Kingdom, Palgrave, Macmillan.

[20] Unless otherwise stated, shock 1 implies a positive government spending shock while shock 2 implies a positive government revenue shock i.e. tax increases. In addition, I chose short-run restrictions in the estimation because of the contemporaneous assumptions and the fact that it is able to prevent some variables from reacting to the shock on impact. See COLLARD, F. & MATHERON, J. 2006. Short–Run Restrictions: An Identification Device? *University of Toulouse*. for a detailed discussion.

3.1.1.3 TABLE 4: TAX MULTIPLIERS

Variables	Impact quarter	First year	Five years	Peak multiplier
Expenditure	0.00	0.06	- 0.00	0.06*(4)
Real GDP	0.00	- 0.08*	0.00	-0.08*(4)
GDP Deflator	0.00	0.04*	-0.01	0.04*(4)
Interest rate	0.01	0.06	0.01	0.06*(4)

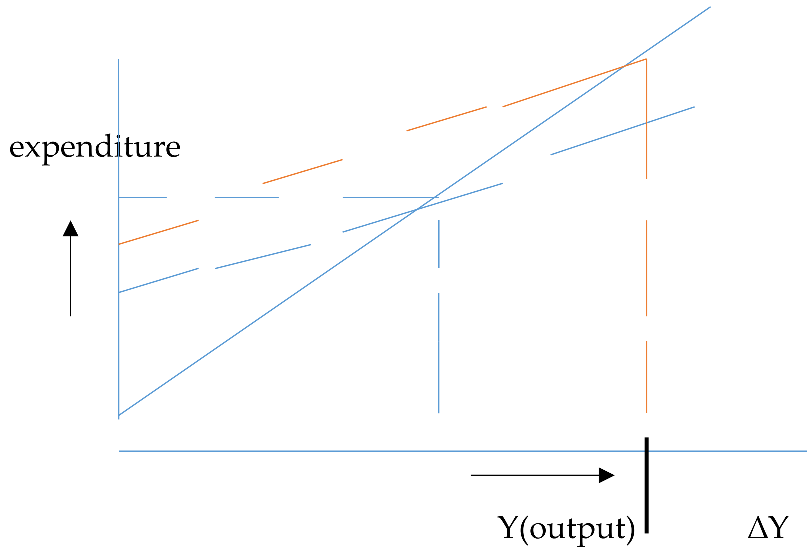
*indicates peak fiscal multiplier.

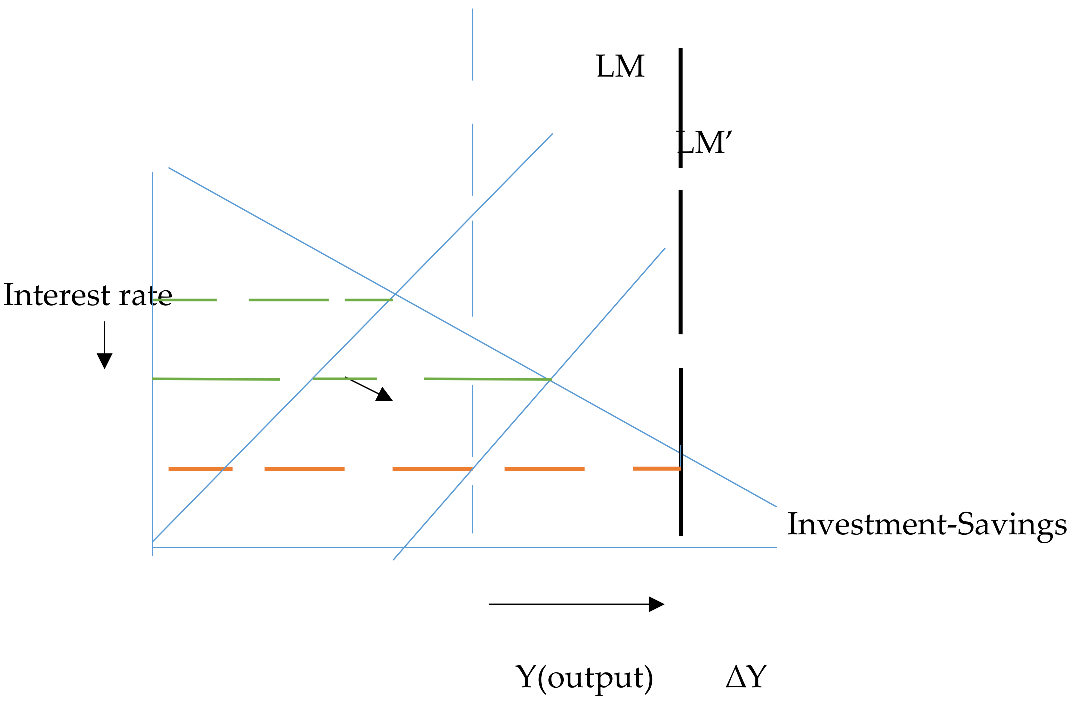
3.1.1.4 INFERENCE

It can be seen from estimates of the baseline vector autoregression, that expansionary fiscal policy has a positive effect on gross domestic product. Specifically, when the federal government increases spending by 1% the US economy will grow by 0.05% after 4 quarters. This is consistent with the findings of other research on the macroeconomic impact of fiscal policy shocks. That said, output rises in response to a positive revenue shock i.e. net tax increases but this rises falls and remains below the steady state after 4 quarters. This brief rise in output could be due to consumers reacting to the announcement of future tax increases by spending more in the current period to avoid consumption taxes in the future.

Inflation, falls below the steady state and remains there over the forecast horizon but this fall is not far from equilibrium suggesting that perhaps larger and sustained increases in government expenditure could bring inflation above steady state in the short run. This observation is consistent with the current disinflationary environment in the USA where despite the American Recovery and Investment Act – which was short-lived – inflation is very low with expected inflation offering little hope.

Interestingly enough, interest rates fall below the steady state equilibrium in response to expansionary fiscal policy. This defies adherents of the 'crowding out' hypothesis while lending strong support to the IS-LM framework. Specifically, when the economy grows, savings increases thereby increasing loanable funds which in turn increase the supply of money which assuming demand remains constant, then the price of money will fall and real interest rates will fall.





3.1.1.5 FIGURE 11: LOANABLE FUNDS APPROACH TO EXPLAINING HOW IS-LM MODEL PREDICTS LOW INTEREST RATES TO EXPANSIONARY FISCAL POLICY IN A LIQUIDITY TRAP.

Figure 10 is the loanable funds approach to the IS-LM explanation of the interaction between GDP and interest rates. Specifically, it explains how the demand and supply for savings affects interest rate. This is because

$$Y- C(Y-T) =I$$

where the left hand side represents savings and I is investment. Budget deficits shift IS curve to the right.

The other aspect of this model is the liquidity preference and money supply which basically posits that interest rates are the trade-off between bonds which pay interest money (cash) which does not but which can be used for transactions and therefore valuable due to its liquidity. However, in a liquidity trap, as pertains in the USA at the moment, monetary expansion is unlikely to have any effect thus leaving the IS curve to determine interest rate through loanable funds.

3.1.2.1 TABLE 5: EXPENDITURE MULTIPLIERS FOR 1955Q1 TO 2014Q4 SAMPLE PERIOD

Variables	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.03	0.01	0.00	2.72*(8)
GDP Deflator	0.02	- 0.00	0.00	-0.05*(5)
Revenue	-0.03	0.12*	-0.00	0.12*(4)
Interest rate	-0.01	-0.00	0.02	0.05*(6)

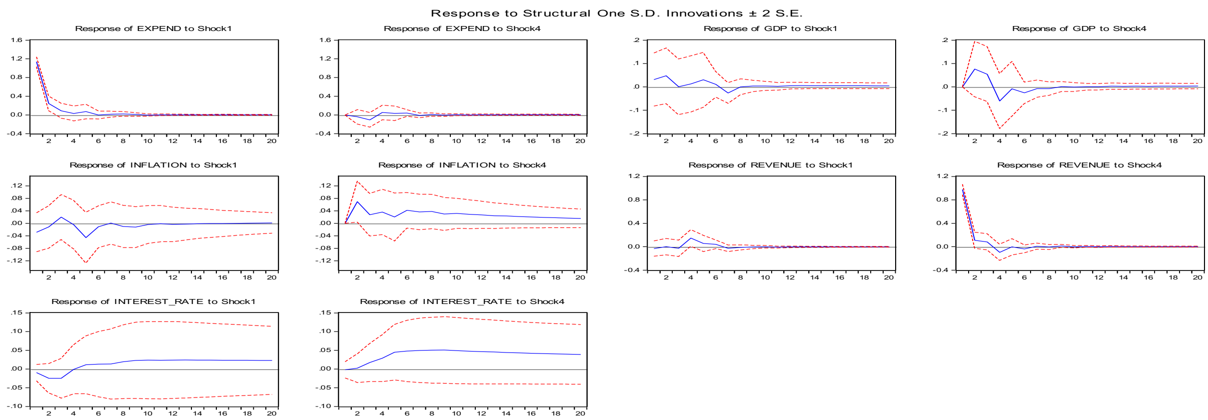
*() indicates peak multiplier and quarter of peak multiplier

3.1.2.2 TABLE 6: TAX MULTIPLIERS FOR 1955Q1 TO 2014Q4				
Variables	Impact quarter	First year	Five years	Peak multiplier
Expenditure	0.00	0.05*	0.00	0.05*(4)
Real GDP	0.00	- 0.06	0.00	- 0.06*(4)
GDP Deflator	0.00	0.04	0.02	0.07*(4)
Interest rate	-0.00	0.03	0.04	0.05*(8)

3.1.2.3 INFERENCE

From table 5 and 6, it can be seen that the fiscal multipliers are large for the sample period 1955 to 2014 than for the sample period 1955 to 2007; the former which includes the period of the great recession. Indeed, there were a number of recessions in the US between the period of 1955 and 2007 but the great recession is widely believed by economists to be the deepest and most protracted of all recessions since the great depressions of 1930. Based on the differences in the size of the multipliers between the two sample periods and consistent with state-dependent investigations into the effect of fiscal policy shocks, it is

3.1.2.4 FIGURE 12: FISCAL MULTIPLIERS FOR SAMPLE PERIOD 1955Q1 TO 2014Q4



suggestible that the optimal response to an economic downturn is extra government purchases rather than tax cuts. This is because the nature of tax cuts determines whether it acts an expansionary shock or not. For example, a dividend tax cut may affect the financial sector of the economy and cause an increase in stock index levels but will not affect the real economy while an income tax cut for middle and lower income earners could serve as significant shock to the real economy.

3.1.2.5 RESULTS FOR BASELINE SVAR USING LEVELS OF US DATA

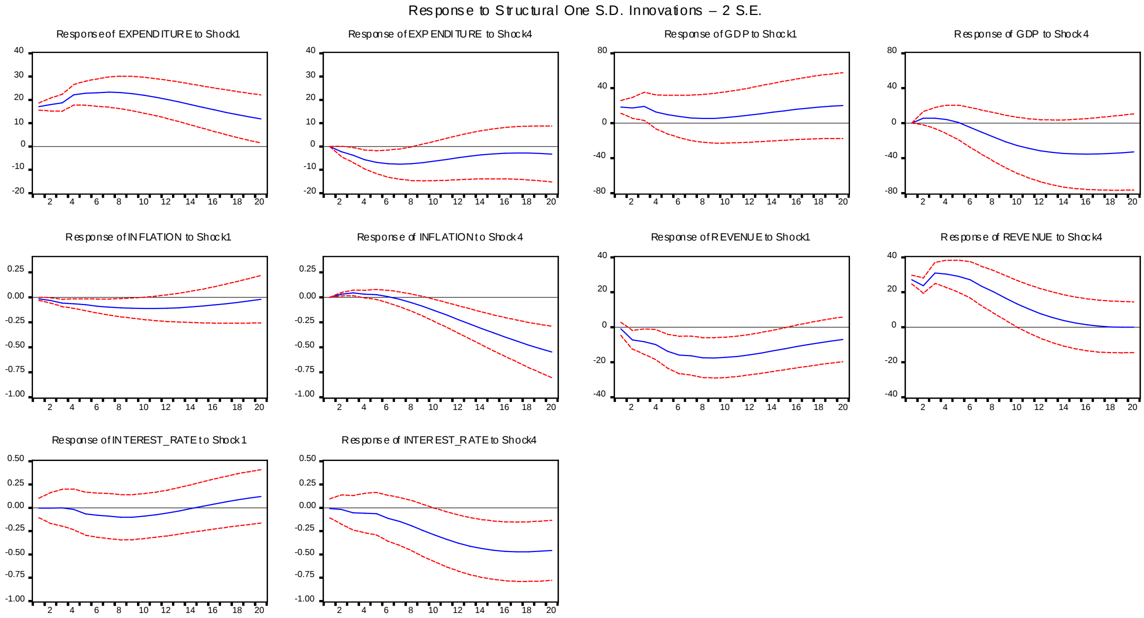
The data used in this research to estimate the effect of fiscal policy shock on key macroeconomic variables is in growth rates and their natural logs is used the estimates as is consistent with the literature but a common critique of this approach is that there is the potential loss of information. I therefore used the levels of data for the baseline variables to estimate the impact of extra government purchases on the macro economy and the results are presented below.

3.1.2.6 TABLE 7 EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five Years	Peak multiplier
GDP	18.49	12.77	20.05*	20.05*(4)
Interest rate	-0.00	-0.02	0.12*	-0.10*(8)
Inflation	-0.01	-0.06	-0.02	-0.11*(9)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.1.2.7 FIGURE 13 TAX AND EXPENDITURE IMPULSE RESPONSE



3.1.2.8 TABLE 8 TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.00	4.04	-32.10	-35.46*(16)
Inflation	0.00*	0.03	-0.55	0.00*(1)
Interest rate	-0.01	-0.06	-0.46	-0.47*(17)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.1.2.9 INFERENCE

The expenditure and tax multipliers are large when the levels of the data are used and the shape of the impulse response graphs are more stable on the whole compared with those resulting from the use of growth rates of the data. That said, the behaviour of key variables such as gross domestic product, inflation and interest rate are the same. Indeed, the growth multipliers are extremely large but that could be due to the inclusion of series from 2008 which is the onset of the great recession and the market mayhem at the time could produce large multipliers.

In addition, although inflation falls with a peak multiplier of -0.11 at 17 quarters, this quickly rises back to the steady state at 20 quarters and is likely to remain above the steady state beyond the forecast horizon. This suggests that expansionary fiscal policy could play an important role in the current low-inflation and low growth environment by exerting an upward pressure on the price level.

3.1.3 RESULTS FOR AUGMENTED VECTOR AUTOREGRESSION

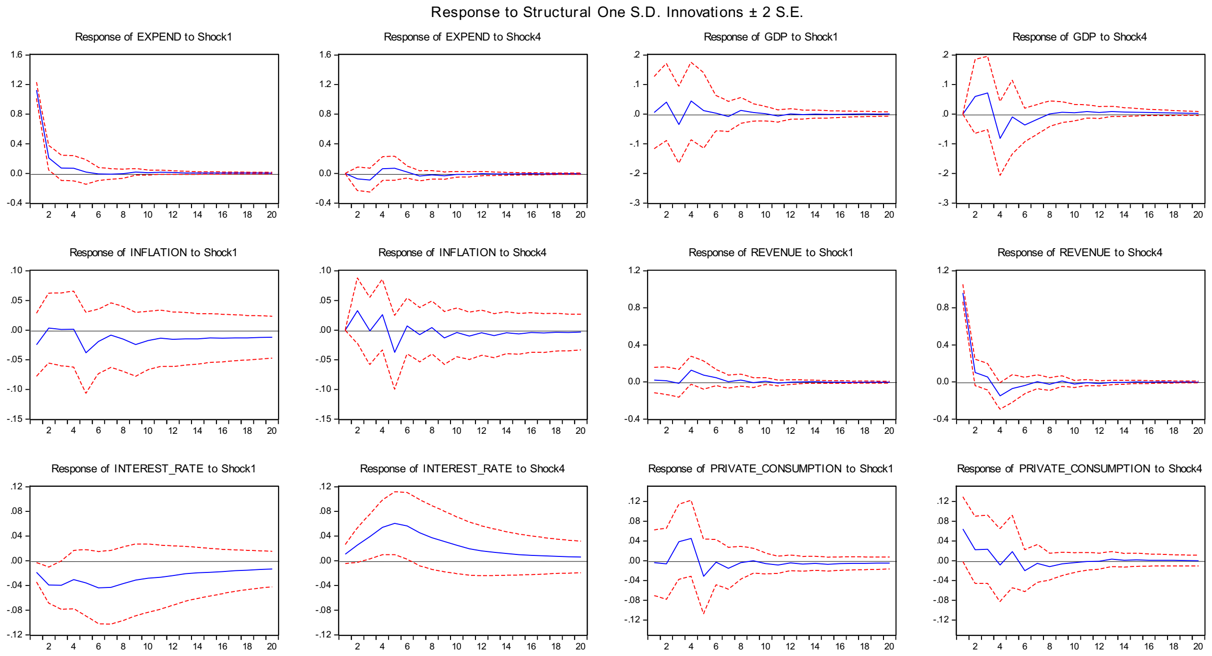
3.1.4 PRIVATE CONSUMPTION

3.1.4.1 TABLE 9: MULTIPLIERS FOR EXPENDITURE SHOCK

Variables	Impact quarter	First year	Five years	Peak multiplier
Private consumption	- 0.00	0.05*	- 0.00	0.05*(4)
Real GDP	0.00	0.04*	0.00	0.04*(4)
GDP Deflator	- 0.02	0.00*	-0.01	0.00*(4)
Revenue	0.02	0.13	-0.00	0.13*(4)
Interest rate	- 0.02	- 0.03	-0.01*	- 0.01*

*()indicates peak multiplier and quarter of peak multiplier respectively

3.1.4.2 FIGURE 14: TAX AND EXPENDITURE IMPULSE RESPONSE



3.1.4.3 TABLE 10: TAX MULTIPLIERS

Variables	Impact year	First year	Five years	Peak multiplier
Private consumption	0.06*	- 0.00	0.00	-0.02*(6)
Real GDP	0.00	- 0.08	0.00	-0.08*(4)
GDP Deflator	0.00	0.03	- 0.00	0.03*(4)
Expenditure	0.00	0.06	- 0.00	0.07*(5)
Interest rate	0.01	- 0.15	- 0.00	0.06*(5)

*indicates peak multiplier.

3.1.4.4 INFERENCE

From table 7 and 8 it can be seen that a unit increase in government expenditure leads to a 0.05% increase in private consumption in the first year. This increase however, falls and remains below the steady state after the 4th quarter for the forecast horizon. This observation supports the arguments against Ricardian equivalence where consumers postpone current consumption with the aim of saving for tax increases in the future. However, everyday people are unlikely to behave with such foresight and careful planning when making spending decisions and economic research confirms this. Specifically, when asked about how much of a unexpected transitory income people will consume, Jappelli and Pistafferi (2014) found substantial heterogeneity in the distribution as households with low-cash-on-hand exhibited a higher marginal propensity to consume than affluent households (Jappelli and Pistaferri, 2014).

Consistent with economic theory, consumption falls and remains below the steady state after 6 quarters in response to a unit rise in government tax receipts. The impact multiplier which is also the peak multiplier is 0.06 but becomes negative after 6 quarters as the disposable income of consumers is reduced. Private consumption remains below the steady state for the whole forecast horizon of 20 quarters (5 years).

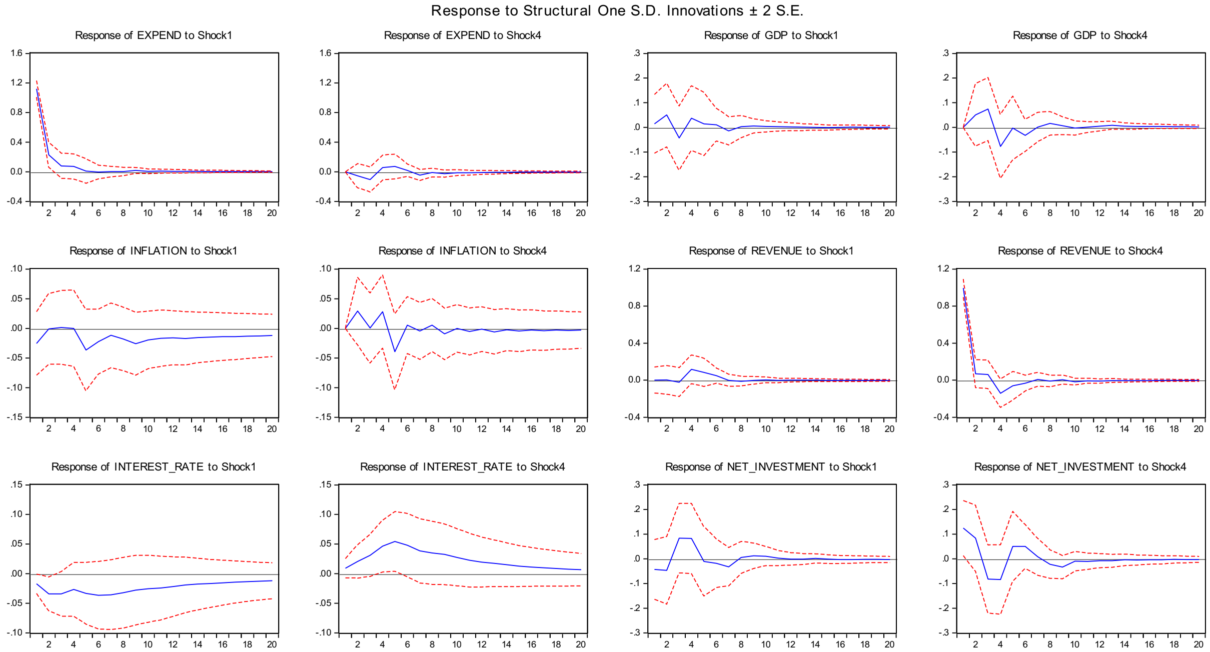
3.1.5 INVESTMENT

3.1.5.1 TABLE 11: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	5 years	Peak multiplier.
Net Investment	- 0.04	0.08*	- 0.00	0.08*(4)
Real GDP	0.01	0.04	0.00	0.04*(4)
GDP Deflator	- 0.03	- 4.24	- 0.01	0.00*(3)
Revenue	0.00	0.12	- 0.00	0.12*(4)
Interest rate	- 0.02	- 0.03	- 0.01	- 0.01*(5)

*()indicates peak multiplier and quarter of peak multiplier respectively

3.1.5.2 FIGURE 15: TAX AND EXPENDITURE IMPULSE RESPONSE



3.1.5.3 TABLE 12: TAX MULTIPLIERS

Variable	Impact year	First year	five years	Peak multiplier
Net Investment	0.12	- 0.08	- 0.00	0.05(5)*
Real GDP	0.00	0.08*	0.00	0.08*(4)
GDP Deflator	0.00	0.03	- 0.00	0.03*(4)
Interest rate	0.00	0.05	0.00	0.05*(4)
Expenditure	0.00	0.06	- 0.00	0.07*(5)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.1.5.4 INFERENCE

Tables 9 and 10 contain the results of the impact of a unit rise in government expenditure on net investment. Specifically, private/business investment rises in response to a 1% rise in government purchases. This could be due to the fact that business entities see expansionary fiscal policy as improving aggregate demand in the economy and with its concomitant effects, then businesses can expect demand for their goods and services which leads them to invest in capital and other projects. That said, the result gained in this research does not support the 'crowding out' hypothesis from real business cycle theorists who posit that every dollar spent by the government will displace a dollar of private/business investment. This is a weak argument especially if one considers that in an output gap environment the level of income in an economy is not fixed as resources both human and capital are not fully employed. Extra government purchases or social transfers puts unemployed resources to use generating higher output and income.

Similarly, in response to a unit rise in taxes, business investment falls steadily over 4 quarters and remains below the steady state after that for the whole forecast horizon of 20 quarters. This could be due to the fact that a tax rise is always seen as an inhibitor. Specifically, since businesses thrive on the demand for their products, tax increases are likely to reduce this demand as consumers postpone or forego consumption entirely. Businesses are then unlikely to invest in new capital or projects that grow their businesses in response to current or expected aggregate demand environment. This also imply the absence of deep habit formation on the part of businesses and consumers as the presence of deep habits would mean that businesses will still invest despite a soft demand environment as higher sales in the previous period means that sales will be higher in the next period as consumers are likely to 'habitually' make purchases.

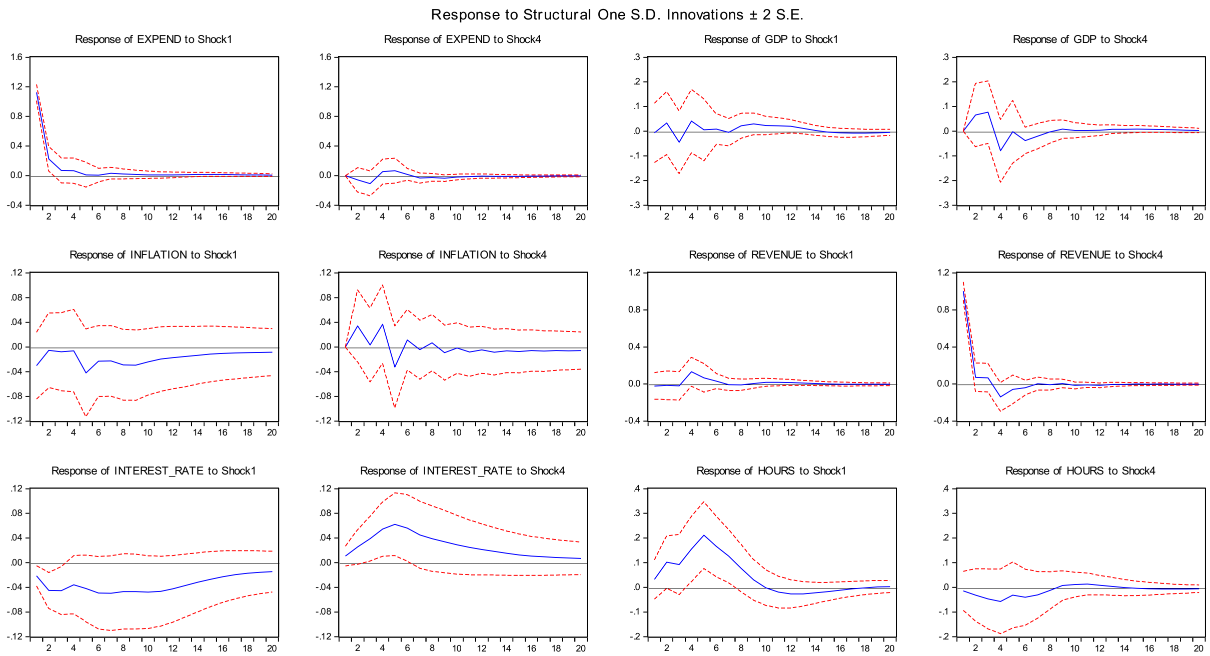
3.1.6 HOURS WORKED

3.1.6.1 TABLE 13: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Hours	0.03	0.16	0.00	0.21*(5)
Real GDP	- 0.00	0.04*	- 0.00	0.04*(4)
GDP Deflator	- 0.03	- 0.00	- 0.00	- 0.00*(4)
Revenue	- 0.02	0.13	- 0.00	0.13*(4)
Interest rate	- 0.02	- 0.04	- 0.01	- 0.04(4)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.1.6.2 FIGURE 16: TAX AND EXPENDITURE IMPULSE RESPONSE



3.1.6.3 TABLE 14: TAX MULTIPLIERS

Variable	Impact year	First year	Five years	Peak multiplier
Hours worked	- 0.01	- 0.06	- 0.01	-0.03*(5)
Real GDP	0.00	- 0.08	0.00	0.08*(3)
GDP Deflator	0.00	0.04*	- 0.00	0.04*(4)
Interest rate	0.01	0.05	0.00	0.06*(5)
Expenditure	0.00	0.05	- 0.00	0.05*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.1.6.4 INFERENCE

From tables 11 and 12 and impulse response graph 14, it can be seen that the number of hours worked rises in response to a 1% increase in government expenditure. This rise remains above the steady state and only falls after 12 quarters and remains close to the steady state for the forecast horizon. Indeed this observation is consistent with existing literature (Burnside et al., 2004, Mertens and Ravn, 2011).

Similarly, when taxes are increased Americans work less. For example, overtime work is attractive when the worker believes they will keep a larger proportion of the hourly wage therefore by increasing taxes, overtime work become less attractive and people actually work less after the announcement of an increase in income tax. Support for this can be seen from an International Monetary Fund working paper (Thomas, 1998) which elucidates that a 1% increase in payroll taxes and indeed total tax rates causes hours worked to fall by 0.5% while unemployment rises by 0.3%. It is noteworthy that the positive revenue shock is persistent throughout the forecast horizon as hours worked returns just slightly above the steady state equilibrium. These observations strongly suggest a high effectiveness of expansionary fiscal policy that includes both government spending increases and tax cuts for middle and low income workers at the same time.

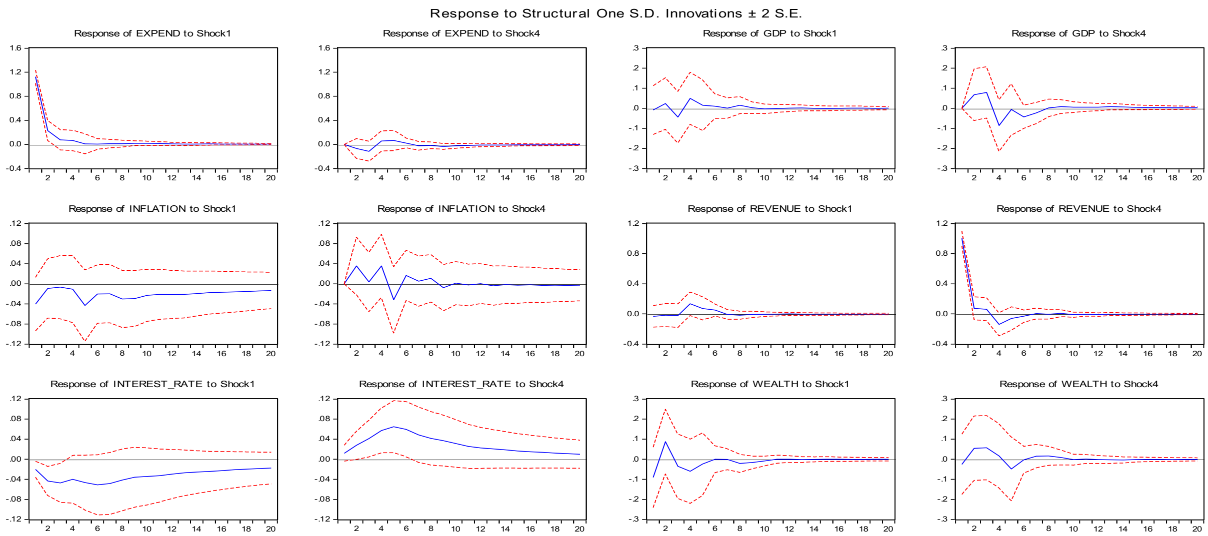
3.1.7 WEALTH

3.1.7.1 TABLE 15: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wealth	- 0.10	- 0.06	- 0.00	0.08*(2)
Real GDP	- 0.00	0.05*	0.00	0.05*(4)
GDP Deflator	- 0.05	- 0.01	-0.01	-0.01*(4)
Revenue	- 0.03	0.13*	-0.00	0.13*(4)
Interest rate	- 0.02	-0.04	-0.02	-0.04*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.1.7.2 FIGURE 17: TAX AND EXPENDITURE IMPULSE RESPONSE



3.1.7.3 TABLE 16: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wealth	- 0.02	0.02	- 0.00	0.06*(3)
Real GDP	0.00	- 0.09	0.00	0.08*(3)
GDP Deflator	0.00	0.04*	- 0.00	0.04*(4)
Interest rate	-0.01	0.06	0.01	0.06*(4)
Expenditure	0.01	0.06	- 0.01	0.07*(5)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.1.7.4 INFERENCE

At the time of writing this research, a detailed search of the existing literature on the impact of fiscal policy on the wealth of households yielded very few results. Thus, it is imperative for this research to consider the effects of fiscal policy on wealth in general as an attempt to fill the gaps in knowledge. The data on wealth is defined as '*Households and Non-profit Organisations; Net Worth as a percentage of Disposable Personal Income*'.

From tables 13 and 14 and figure 15, it can be seen that the level of wealth of households generally improve in response to expansionary fiscal policy i.e. extra government purchases with a peak multiplier of 0.08. Indeed, the wealth levels fall briefly in the 4th quarter but moves back to lie on steady state equilibrium for the remainder of the forecast horizon. In the same vein, a unit increase in overall taxes affect the wealth of households. Specifically, households level of wealth increases briefly upon impact of the contractionary fiscal policy but this falls sharply below the steady state within two quarters. It then remains on the steady state equilibrium for the remainder of the forecast horizon. This could be due to the possibility that tax increases induce households to postpone their consumption in the current period thus having no detriment to their wealth in the current period but income taxes usually only change upon a change in government which happens every 4 years or more. But households hardly act with such foresight and careful planning so might still consume in the future despite no change in policy in the very short run.

These results support the call for fiscal policy to deal with current concerns about increasing inequality and poverty in many advanced economies especially the USA and UK. Fiscal policy greatly affects the distribution of income and the ultimate aim of economic policy should be *economic welfare* for the great mass of people. Therefore, monetary policy should aim to target a certain level of unemployment rather than 2% inflation[21] as the section of society that suffers the most when the economy is in a recession are middle and lower income earners. Furthermore, governments should be more proactive in job creation and job creation should not be left alone to the private sector since the evidence suggests that the only reason the private sector is concerned about a central government led job growth is the former loss of 'clout' in the political economy (Kalecki, 1943, Stiglitz, 2012, Piketty, 2014, Piketty, 2016).

It is important to note that tests of granger non-causality showed that government expenditure does not granger cause wealth. However, a test of granger non-causality between the series on gross domestic product and wealth using 4 lags showed that GDP granger causes wealth with a χ - square statistical probability of 0.02 which is significant. This could indicate that government expenditure in itself does not cause an increase in wealth but wealth increases when government expenditure causes key macroeconomic variables like GDP to increase.

3.1.7.5 TABLE 17 P-VALUES: GRANGER CAUSALITY χ -SQUARE STATISTIC

Variable	χ- square statistic
Wealth	0.84

[21] Higher employment all things being equal, means above 2% inflation which affects bondholders more than lower and middle income employees who are less likely to hold bonds.

3.1.8 EFFECT OF AUTOMATIC STABILISERS ON KEY MACROECONOMIC VARIABLES

Automatic stabilisers are government expenditure and taxation rules that cause fiscal policy to be automatically expansionary when the economy is in a slump and automatically contractionary when the economy grows. For example, the government's unemployment insurance bill increases when the economy is in a recession and the government's tax receipts increases when the economy grows. Such rules are said to 'automatically stabilise' the economy. However, even though ordering of variables based on contemporaneous assumptions help capture the effects of automatic stabilisers, these actual effect is 'clothed' in the total effect of government's discretionary fiscal policy.

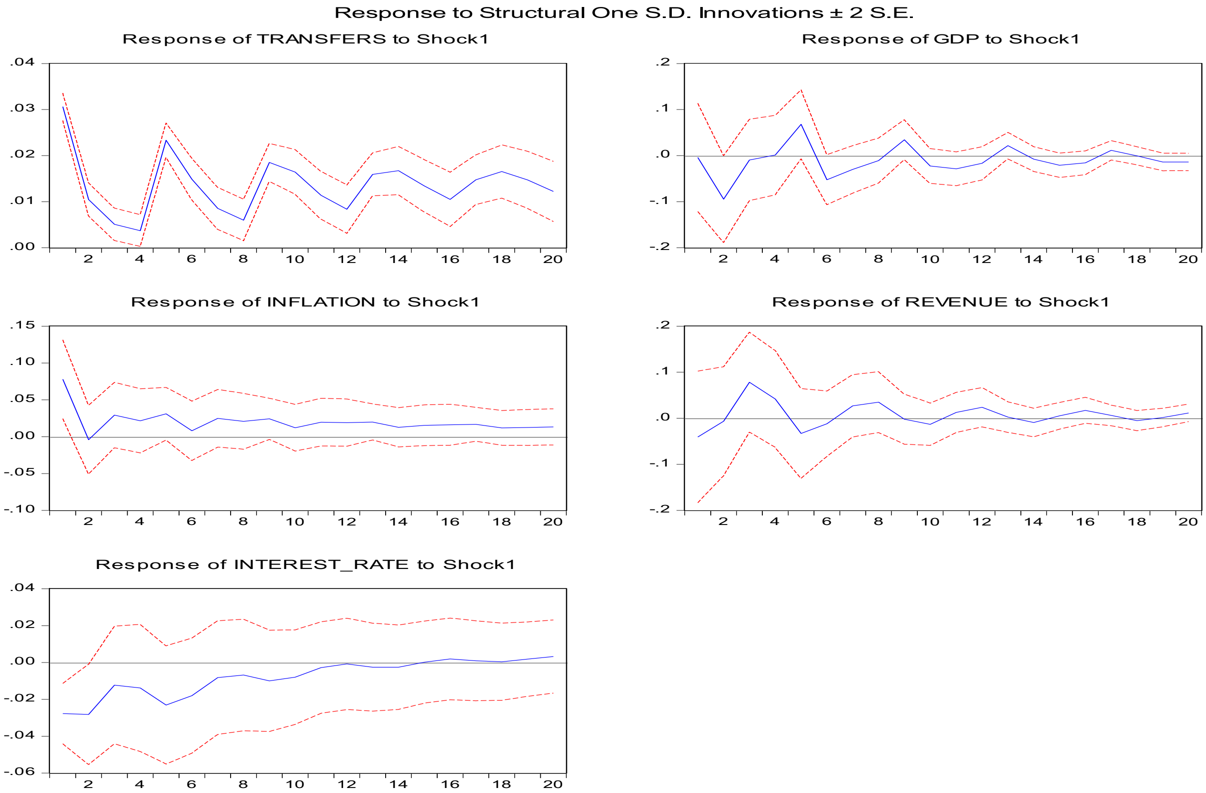
As a contribution to the existing literature I separate effect of automatic stabilisers from the total effect of discretionary expenditure by replacing government expenditure in the baseline vector autoregression equation with 'Government Social Benefits, '*transfers*'. For example, government social benefits include unemployment insurance, Medicaid and food-stamps and these payments or expenditure increase when the economy is in a recession. The contemporaneous assumptions still hold so the ordering of baseline variables remain the same.

3.1.8.1 TABLE 18: MULTIPLIERS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2007Q4

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	- 0.00	0.00	- 0.01	0.07*(5)
GDP Deflator	0.08*	0.02	0.01	0.08*
Revenue	- 0.04	0.04	0.01	0.08*
Interest rate	- 0.03	-0.01	0.00*	0.00*

*indicates peak multipliers. () indicates quarter of peak multiplier.

3.1.8.2 FIGURE 18: IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2007Q4

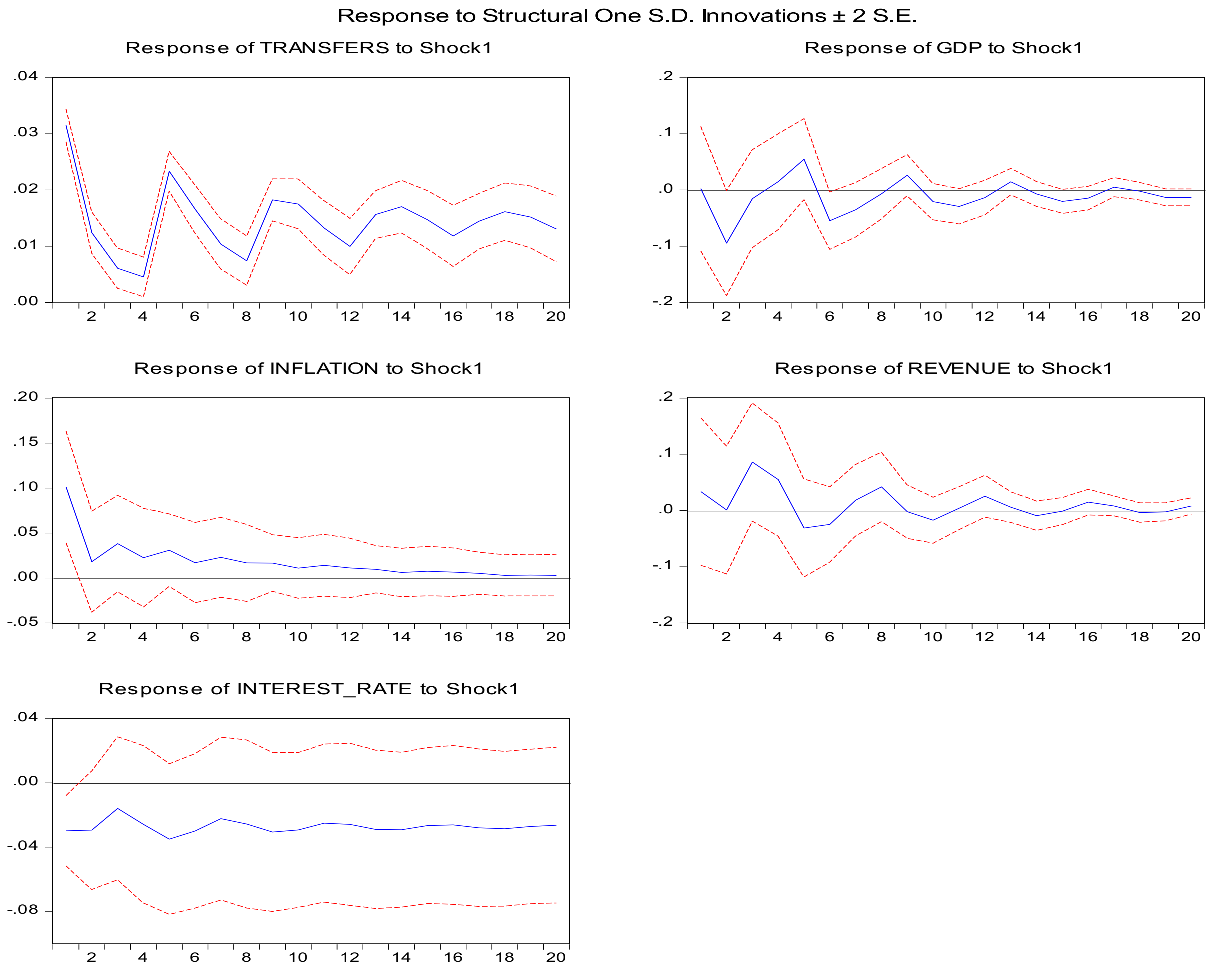


3.1.8.3 TABLE 19: MULTIPLIERS FOR AUTOMATIC STABILISERS FOR – SAMPLE PERIOD 1955Q1 TO 2014Q4

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.00	0.01	- 0.013	0.05*(5)
GDP Deflator	0.10	0.02	0.00	0.03*(3)
Revenue	0.03	0.05	0.00	0.08*(3)
Interest rate	- 0.03	- 0.03	- 0.03	- 0.02*(3)

*indicates peak multiplier while () indicates quarter of peak multiplier.

3.1.8.4 FIGURE 19: IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2014Q4



3.1.8.5 INFERENCE

Table 14 and 15 and figure 16 and 17 shows that gross domestic product increases in response to a 1% increase in government social benefits with a peak multiplier of 0.07 in the sample period ending 2007 while there is a peak multiplier of 0.05 in the sample period ending 2014. The most striking fact is the manner in which inflation responds to automatic stabilisers. Specifically, in response to a unit rise in automatic stabilisers, inflation rises in the USA and remains well above the steady state in both samples. This is interesting as a higher inflation all things being equal translate into a higher GDP. Moreover, the transmission mechanism between automatic stabilisers and inflation is via the increase in aggregate demand channel. Specifically, it is well known that people on lower incomes or unemployed are more likely to spend a higher proportion of their money while those in affluent households spend less of their income (Jappelli and Pistaferri, 2014). This means that by putting money into the hands of people who are more likely to spend it in shops, restaurants etc., the government increase aggregate demand while improving economic welfare at the same time.

The results gained is interesting in terms of economic policy prescription and analyses especially if one considers the persistently ultra-low inflation environment in the USA at the moment with the Federal Reserve considering negative interest rates to ward off potential widespread deflation. Perhaps it is time policy makers considered expansionary fiscal policy with particular increases in unemployment insurance, Medicaid and other welfare programs.

3.1.9 TESTS FOR STRUCTURAL BREAKS IN BASELINE VARIABLES

The stability of the coefficients of the baseline vector autoregression was assessed by performing a full sample stability test. Specifically, three test were performed: Quandt-Andrew test in Wald form, Mean Wald and Exponential Wald Statistic. The null hypothesis is no structural breakpoint within 30% trimmed data from 1973Q2 to 1997Q3. A structural break is a point in time where the underlying data generating process producing the time series changes or there is a change in the mean. Testing for structural breaks helps establish whether there have been any significant changes in the data. The results displayed in table 16 shows that the null hypothesis of no structural change is rejected. This implies there are changes to the data that affect the coefficients gained in the estimations.

3.19.1 TABLE 20: TESTS FOR STRUCTURAL CHANGE IN BASELINE EQUATION'S VARIABLES – 30% TRIMMING

Wald test statistic	Value	Probability
Sup	25.43*	0.00
Mean	19.13*	0.00
Exp	10.28*	0.00

*indicates tests are significant at 5% level using Hansen's (1997) *p* values.

3.2.0 BLANCHARD AND PERROTI IDENTIFICATION

The Blanchard and Perroti approach to identifying fiscal policy shocks depend on the use of institutional information on transfer, tax systems and the timing of tax collections. These institutional information is then used to identify the automatic response of taxes and government spending to fiscal policy. There are two steps involved wherein the first step involves using institutional information to estimate cyclically adjusted taxes and government expenditure. The second step then involves estimating fiscal policy shocks. It is noteworthy that Blanchard and Perroti (2000) used a three variable baseline equation while Perrotti (2005) used a five variable baseline equation. For the purpose of standardisation and being able to compare estimates of the different identification approaches used in this research, I chose a five variable baseline equation.

Using a five variable for the baseline equation, the relationship between the reduced form disturbances u_t and structural disturbances e_t is given as

$$u_t^g = \alpha_{gy} u_t^y + \alpha_{g\pi} u_t^{\pi} + \alpha_{gr} u_t^r + \beta_{g\tau} e_t^{\tau} + e_t^g \quad (4)$$

$$u_t^{\tau} = \alpha_{\tau y} u_t^y + \alpha_{\tau\pi} u_t^{\pi} + \alpha_{\tau r} u_t^r + \beta_{\tau g} e_t^{\tau} + e_t^{\tau} \quad (5)$$

$$u_t^y = \alpha_{yg} u_t^g + \alpha_{yr} u_t^{\tau} + e_t^y \quad (6)$$

$$u_t^{\pi} = \alpha_{\pi g} u_t^g + \alpha_{\pi y} u_t^y + \alpha_{\pi r} u_t^r + e_t^{\pi} \quad (7)$$

$$u_t^r = \alpha_{rg} u_t^r + \alpha_{ry} u_t^y + \alpha_{r\pi} u_t^{\pi} + \alpha_{rr} u_t^{\tau} + e_t^r \quad (8)$$

equations 4 to 8 is in reduced form thus not identified. To achieve identification Perroti (2005) regresses individual revenue items on their tax base obtaining an aggregate value for the elasticity of output to revenue α_{ry} = 1.85, inflation to revenue $\alpha_{\tau\pi}$ = 1.25, Perroti sets output elasticity to government spending α_{gy} to 0 as data used is net of total government transfers. That said, the government expenditure used in this research is inclusive of transfers so I set the elasticity to 1[22] as discussed in Arpaia & Turrini (2008). Consistent with Perroti (2005), inflation elasticity to government spending $\alpha_{g\pi}$ is set to -0.5 while interest rate elasticities to government spending α_{gi} and taxes $\alpha_{\tau i}$ are both set to zero. The parameter $\beta_{g\tau}$ is set to 0 meaning that decisions on government spending are taken before those on government revenue. When these restrictions are imposed on the parameters then the relationship between the reduced form and structural disturbances is written as

[22] ARPAIA, A. & TURRINI, A. 2008. Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment. *European Union Economic and Financial Affairs Economic Papers,* 300. This paper shows that over a sample of 15 EU countries over 1970-2003, there is a long run elasticity of output to cyclically adjusted primary government expenditure that is close to unity.

$$
\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ \alpha yg & 1 & 0 & \alpha y\tau & 0 \\ \alpha\pi g & \alpha\pi y & 1 & \alpha\pi\tau & 0 \\ 1 & 1.85 & 1.25 & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{g\tau} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}
$$

3.2.1 RESULTS

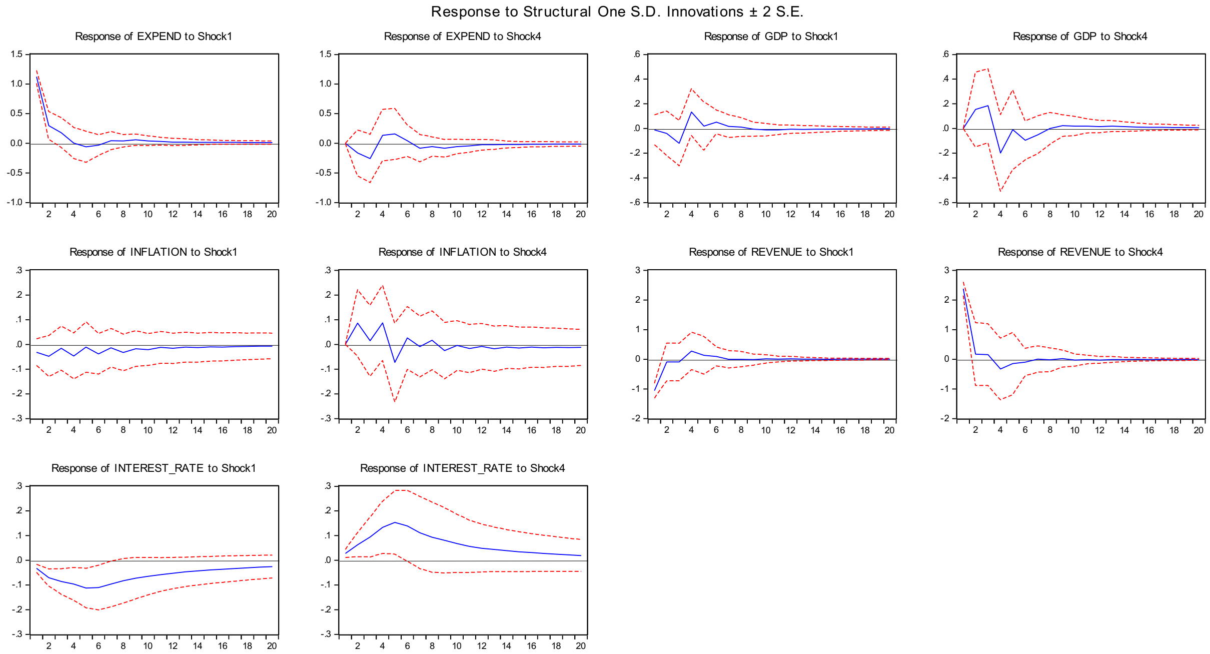
3.2.2 BASELINE RESULTS FOR BLANCHARD AND PERROTI IDENTIFICATION

3.2.2.1 TABLE 21: MULTIPLIERS FOR BASELINE – EXPENDITURE SHOCK

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	-0.01	0.13*	-0.00	0.13*(4)
GDP Deflator	-0.03	-0.05	-0.00*	-0.00*(7)
Revenue	-1.06	0.28*	0.00	0.28*(4)
Interest rate	-0.03	-0.10	-0.02*	-0.10*(4)

*() indicates peak multiplier and quarter of peak multiplier.

3.2.2.2 FIGURE 20: TAX AND EXPENDITURE IMPULSE RESPONSE



3.2.2.3 TABLE 22: TAX MULTIPLIERS

Variables	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.00	-0.12	0.00	0.18*(3)
GDP Deflator	-8.24	0.09*	-0.01	0.09*(4)
Interest rate	0.03	0.13	0.02	0.15*(5)
Expenditure	0.00	0.14	-0.01	0.16*(5)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.2.4 *INFERENCE*

From tables 17 and 18 and figure 18, it can be seen that there is no difference in the response of baseline variables to a unit rise in government expenditure and a unit rise in next tax receipts. Specifically, in both identifications, expansionary fiscal policy has a positive impact on gross domestic product while a 1% increase in taxes affects output negatively. Although output increases in the impact quarter in response to a tax shock, there is an acute fall in gross domestic product by the end of the year which is consistent with both theoretical and empirical economics. That said, in response to an expenditure shock gross domestic product falls briefly but rise and remains above the steady for the whole forecast horizon.

In addition, interest rates fall in response to a unit rise in government expenditure while it increases well above the steady state and indeed remains above the whole period of the forecast horizon in response to a positive tax shock. This is evidence against the 'crowding out' hypothesis and the recursive approach also provided similar results.

Moreover, the response of inflation to an expenditure shock describes the current disinflationary environment in the USA; it falls and remains below the steady state equilibrium for the whole of the forecast horizon but in response to a tax shock, inflation rises and falls briefly below the steady state after 6 quarters, returns and remains just above the steady equilibrium for the whole of the forecast horizon. Speculatively, this could be an indication that perhaps the size of the fiscal expansion is key to ensure that growth multipliers are large and able to cause inflation to rise as inflation returns just slightly below the steady state for the remainder of the forecast horizon.

3.2.3 AUGMENTED BLANCHARD AND PERROTI INDENTIFICATION

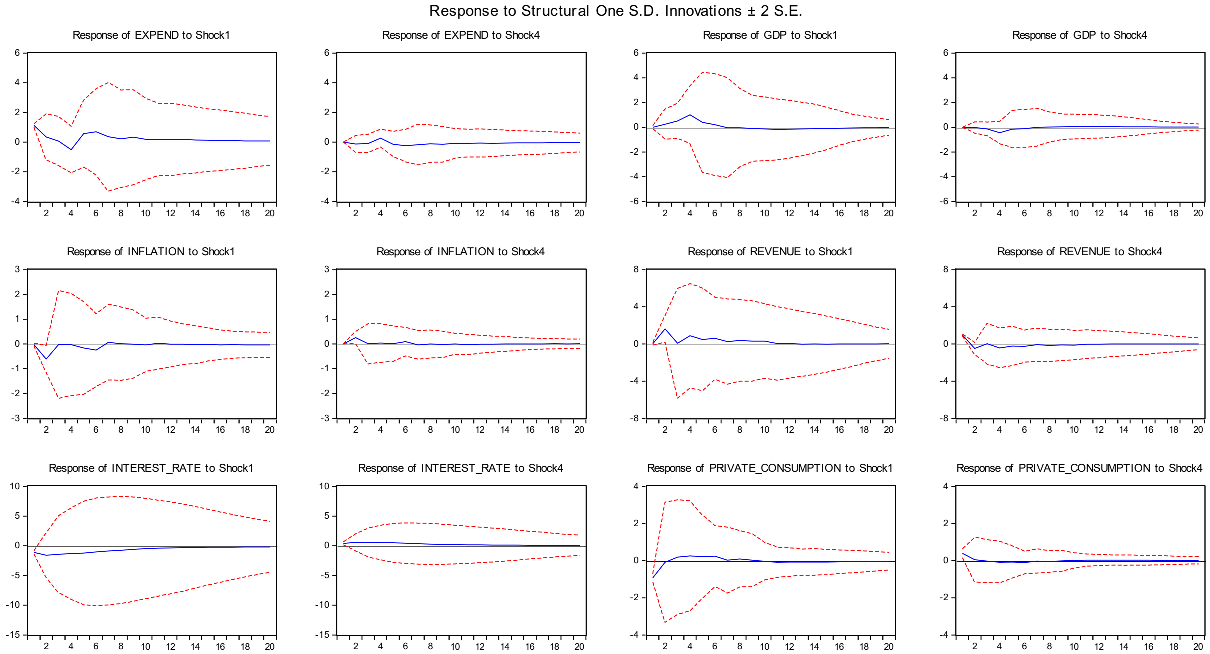
3.2.4 PRIVATE CONSUMPTION

3.2.4.1 TABLE 23: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Private consumption	-0.92	0.26*	-0.03	0.26*(4)
Real GDP	0.01	1.01*	-0.02	1.01*(4)
GDP Deflator	-0.02	-0.03	-0.04	0.02*(7)
Revenue	0.02	0.88	0.01	1.63*(2)
Interest rate	-1.09	-1.32	-0.18*	-0.18*(12)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.4.2 FIGURE 21: TAX AND EXPENDITURE IMPULSE RESPONSE



3.2.4.3 TABLE 24: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Private consumption	0.39	-0.09	0.01	0.02*(7)
Real GDP	0.00	-0.43	0.01	-0.43*(4)
GDP Deflator	0.00	0.04	0.01	0.25*(2)
Interest rate	0.40	0.52	0.07	0.56*(5)
Expenditure	0.00	0.27*	-0.03	0.27*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.2.4.4 INFERENCE

From figure 19 and tables 19 and 20, it can be seen that expansionary fiscal policy has a positive effect on private consumption with a peak multiplier of 0.05. The effect of a tax rise on private consumption is muted generally. However, upon impact of the tax shock, private consumption reduces marginally and lies on the steady state for the remainder of the forecast horizon. That said, these results are not different from the pattern observed in the recursive identification.

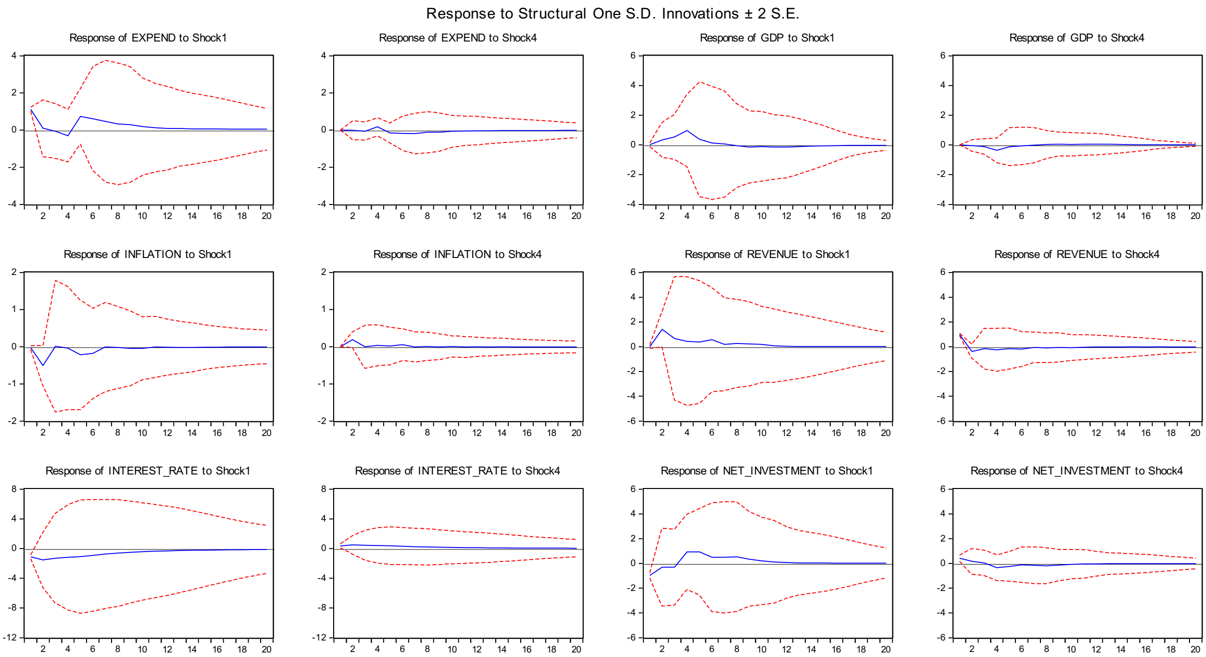
3.2.5 NET INVESTMENT

3.2.5.1 TABLE 25: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	-0.97	0.93*	0.02	0.93*(4)
Real GDP	0.01	1.00*	-0.02	1.00*(4)
GDP Deflator	-0.03	- 0.03	-0.00	0.00*(3)
Revenue	0.00	0.45	0.02	1.40*(2)
Interest rate	-1.12	-1.18	-0.13*	-1.52*(2)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.5.2 FIGURE 22: TAX AND EXPENDITURE IMPULSE RESPONSE



3.2.5.3 TABLE 26: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net Investment	0.42	- 0.35	-0.01	0.04*(3)
Real GDP	0.00	- 0.37	0.01	0.05*(11)
GDP Deflator	- 1.73	0.04	-0.01	0.20*(2)
Interest rate	0.35	0.41	0.04	0.50*(2)
Expenditure	0.00	0.17*	-0.01	0.17*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.5.4 Inference

Net investment increases with a peak multiplier of 0.04 in response to a 1% increase in government purchases while it falls and returns to steady state equilibrium after 4 quarters after a 1% tax shock. The results gained is similar to those from the recursive identification.

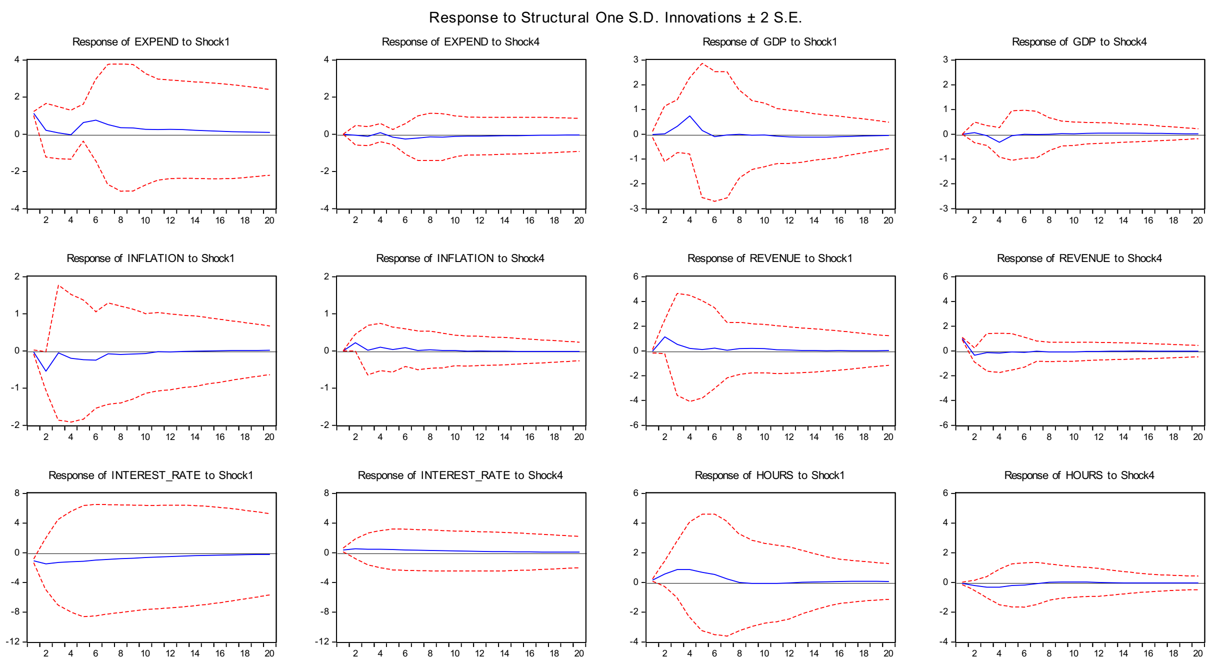
3.2.6 HOURS WORKED

3.2.6.1 TABLE 27: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Hours worked	0.16	0.87*	0.07	0.87*(4)
Real GDP	-0.00	0.74*	-0.05	0.74*(4)
GDP Deflator	- 0.03	- 0.20	0.02	0.00*(3)
Revenue	- 0.02	0.20	0.03	1.14*(2)
Interest rate	- 1.08	- 1.20	-0.21	0.00*(13)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.6.2 FIGURE 23: TAX AND EXPENDITURE IMPULSE RESPONSE



3.2.6.3 TABLE 28: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Hours worked	-0.06	-0.30	-0.02	0.01*(4)
Real GDP	0.00	-0.33	0.02	0.00*(6)
GDP Deflator	0.00	0.10	-0.02	0.02*(2)
Interest rate	0.39	0.47	0.08	0.53*(5)
Expenditure	0.00	0.09*	-0.03	0.09*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.6.4 INFERENCE

Consistent with theoretical economics, hours worked increases in response to expansionary fiscal policy. Specifically, an increase in aggregate demand means all things being equal an increase in the employment of resources both human and capital. In addition, people already in work are likely to work more hours as the demand for goods and services increase. A unit rise in taxes causes people to work less as tax increases are a disincentive since it reduces disposable incomes with a concomitant effect on the marginal propensity to consume. The result gained is similar to those using the recursive identification.

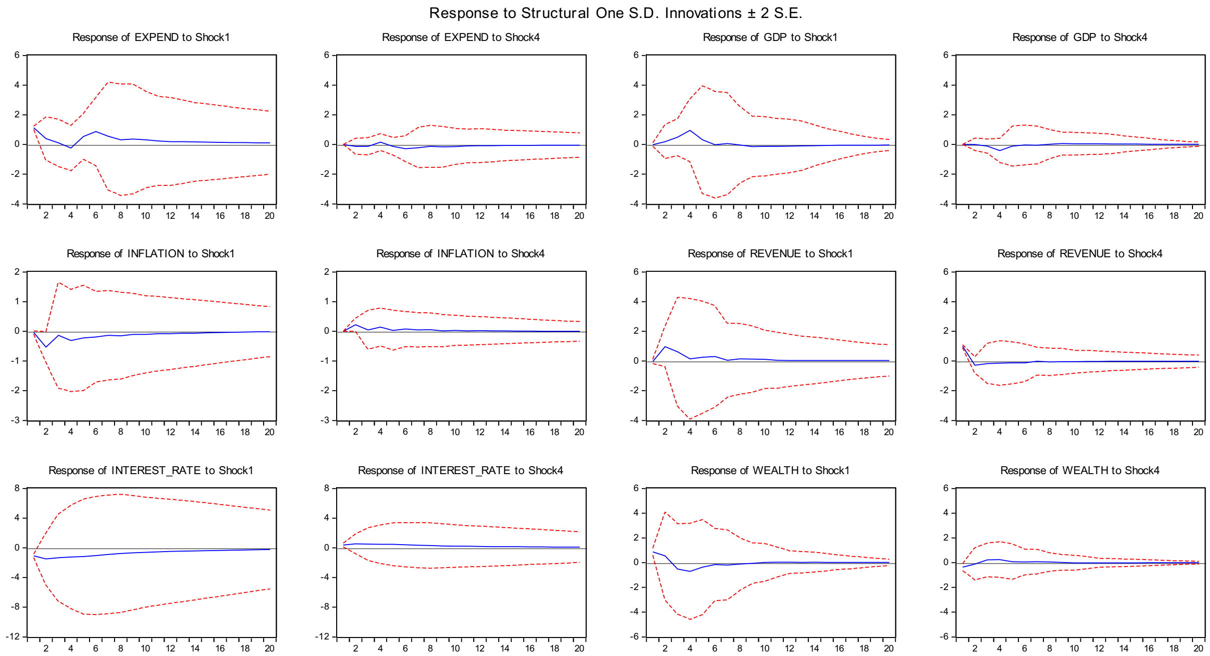
3.2.7 WEALTH

3.2.7.1 TABLE 29: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wealth	0.88*	-0.70	0.01	0.88*(1)
Real GDP	-0.01	0.95*	-0.04	0.95*(4)
GDP Deflator	-0.04	-0.31	-0.01	-0.01*(3)
Revenue	-0.03	0.14	0.03	0.10*(2)
Interest rate	-1.07	-1.23	-0.23*	-0.23*(20)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.7.2 FIGURE 24: TAX AND EXPENDITURE IMPULSE RESPONSE



3.2.7.3 TABLE 30: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wealth	-0.37	0.24*	-0.01	0.24*(4)
Real GDP	0.00*	-0.40	0.02	0.00*(5)
GDP Deflator	1.74*	0.14	-0.00	1.74*(1)
Interest rate	1.00*	-0.14	-0.02	1.00*(1)
Expenditure	0.00	0.16*	-0.04	0.16*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.2.7.4 INFERENCE

When the US federal government conducts expansionary fiscal policy, it increases the net worth of households. The impact of a unit rise in government purchases plus transfers increases the wealth of US households by 0.88% while a 1% rise in taxes has almost no effect on the wealth of households.

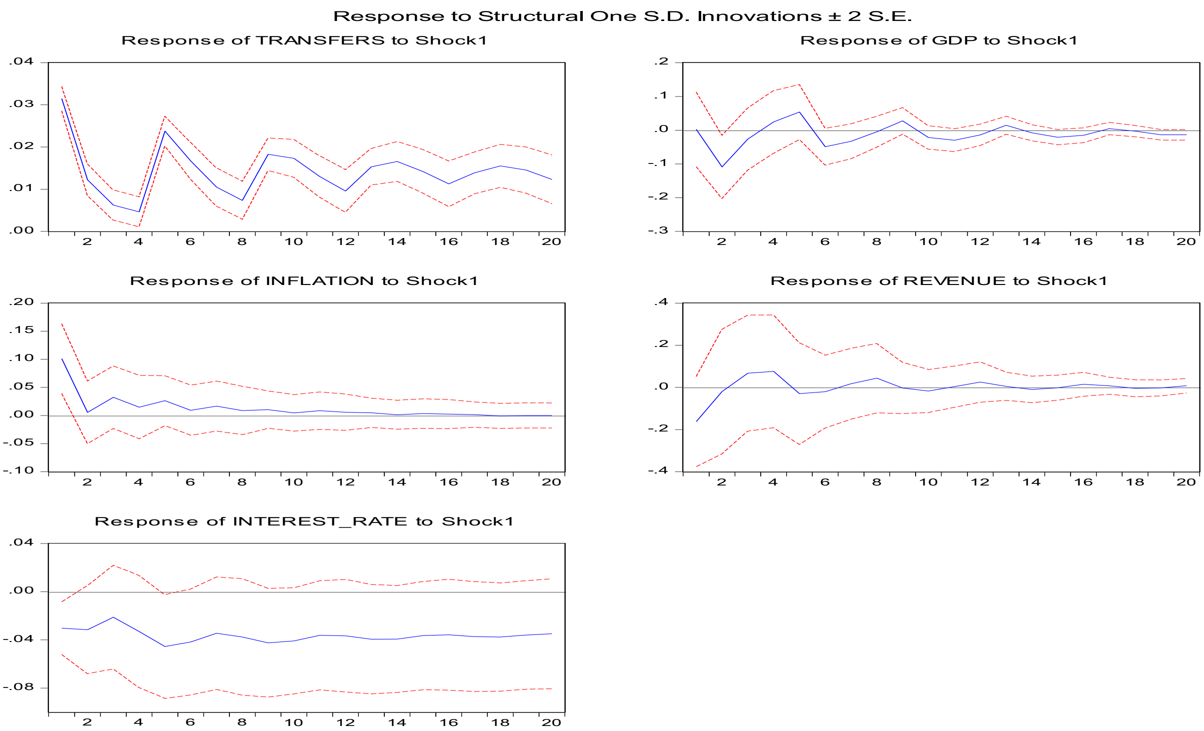
3.28 EFFECT OF AUTOMATIC STABILISERS USING BLANCHARD AND PERROTI IDENTIFICATION - SAMPLE ENDING 2014Q4.

3.2.8.1 TABLE 31: EXPENDITURE MULTIPLIERS FOR AUTOMATIC STABILISERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.00	0.02	-0.01	0.05*(5)
GDP Deflator	0.10	0.01	0.00	0.03*(3)
Revenue	-0.16	0.08*	0.00	0.08*(4)
Interest rate	-0.03	-0.03	-0.03	-0.02*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively.

3.2.8.2 FIGURE 25: IMPULSE RESPONSE FOR AUTOMATIC STABILISERS



3.2.8.3 INFERENCE

Automatic stabilisers have a positive impact of US gross domestic product but the most striking result is the response of inflation. Specifically, in response to a 1% rise in federal government social benefits, inflation rises and stays above the steady state equilibrium for the whole forecast horizon. This suggests a potential role for automatic stabilisers in dealing with the current disinflationary environment in the USA. It is noteworthy that both recursive and Blanchard Perroti identifications suggest a very strong positive influence of automatic stabilisers on output and inflation.

3.2.9 EVENT STUDY IDENTIFICATION

The event study identification of fiscal shocks is predicated on the reduced form vector autoregression. This identification looks for fiscal episodes that can be treated as exogenous with respect to the state of the economy so that there is an estimation of an autoregressive model where current and lagged values of the military build-up dummy variable are included as exogenous regressors (Ramey and Shapiro, 1998). These extra government purchase resulting from military build-up are not in response to the stage of the business cycle or are unrelated to events from the domestic (endogenous) US economy so require no contemporaneous assumption about the structure of the economy and are thus exogenous. This approach helps in identifying the effects of unexpected or unanticipated fiscal policy shocks especially if one knows the timing of the military build-ups or fiscal episodes in general.

Consistent with the literature, a dummy variable D_t is defined and takes a value of 1 in 1965Q1 for the onset of the Vietnam war, 1980Q1 for the onset of Reagan-Carter military build-up, 2001Q3 for the onset of the war against terrorism and 0 for anything else. Adding the dummy variable to the baseline reduced form equation gives

$$X_t = \mu_o + \mu_1 t + A(L)X_{t-1} + \mathbf{\Phi}\,(L)\,D_t + u_t \tag{9}$$

where $\mathbf{\Phi}\,(L)$ is the 4th order lag polynomial associated with the dummy variable which captures the above mentioned fiscal episodes.

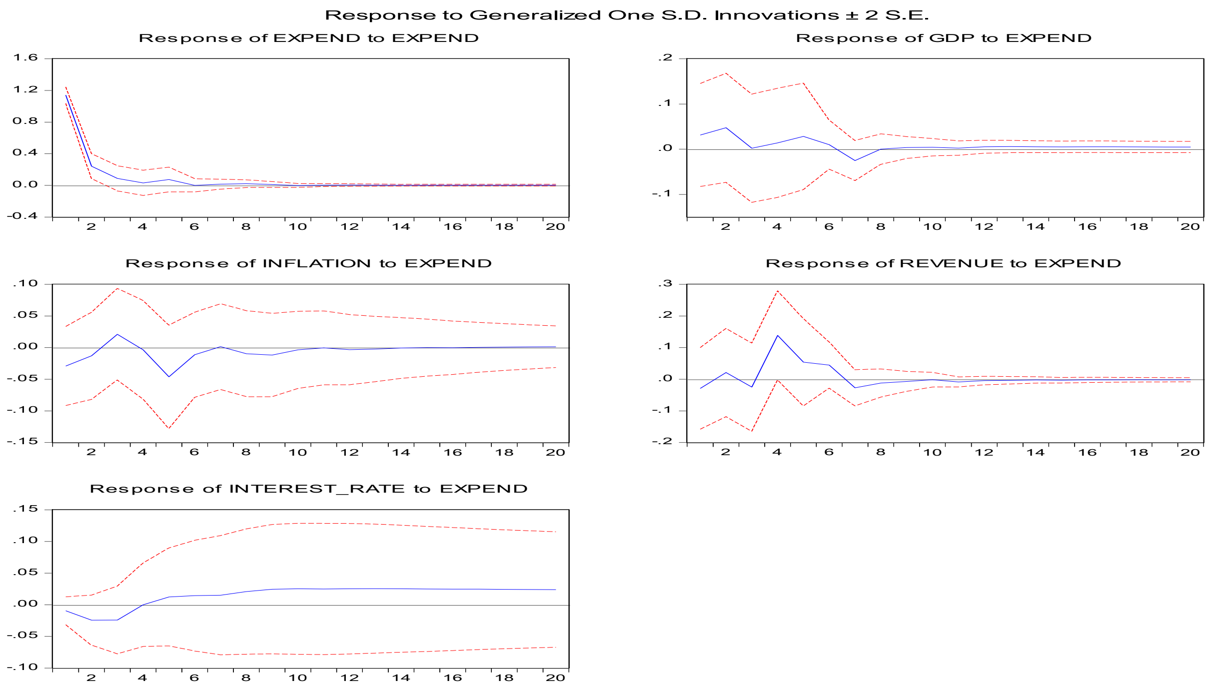
3.3.0 RESULTS

3.3.0.1 TABLE 32: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.03	0.01	0.00	0.05*(2)
Inflation	-0.03	-0.03	0.00	0.02*(3)
Revenue	-0.03	0.14*	-0.00	0.14*(4)
Interest rate	-0.00	-1.08	0.02	0.03*(10)

*indicates peak multiplier () indicates quarter of peak multiplier

3.3.0.2 FIGURE 26: IMPULSE RESPONSE GRAPHS



3.3.0.4 INFERENCE

Using the event study identification, gross domestic product rises with a peak multiplier of 0.05. Output falls briefly below the steady state in the 7th quarter and returns above the steady state for the remainder of the forecast horizon as the effect of the spending shock wears off. Inflation also rises and falls below the steady state in the 5th quarter. It however returns to the steady after the same quarter. Interest rate falls briefly and returns well above the steady state after 4 quarters. The observed behaviour of output, inflation and interest rate is consistent with economic theory and findings based on recursive and Blanchard and Perroti identifications.

3.3.1 AUGMENTED EVENT STUDY IDENTIFICATION

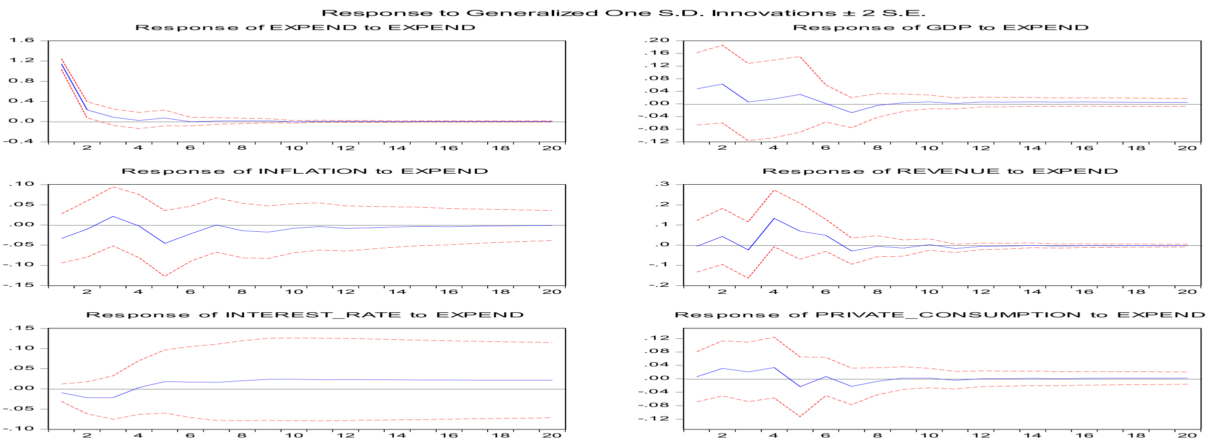
3.3.2 PRIVATE CONSUMPTION

3.3.2.1 TABLE 29: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Private consumption	0.01	0.03	0.00	3.78*(12)
Real GDP	0.05	0.02	0.01	0.06*(2)
Inflation	-0.03	-0.00	-0.00	8.69*(7)
Revenue	-0.01	0.13*	-0.00	0.13*(4)
Interest rate	-0.01	0.00	0.02*	0.04*(9)

*indicates peak multiplier while () indicates quarter of peak multiplier.

3.3.2.2 FIGURE 27: IMPULSE RESPONSE GRAPHS FOR EXPENDITURE SHOCK



3.3.2.3 *INFERENCE*

Table 29 and figure 25 shows that private consumption reacts positively to an unexpected increase in government purchases. It falls below the steady state but returns to equilibrium after 2 years as the impact of the shock wears off.

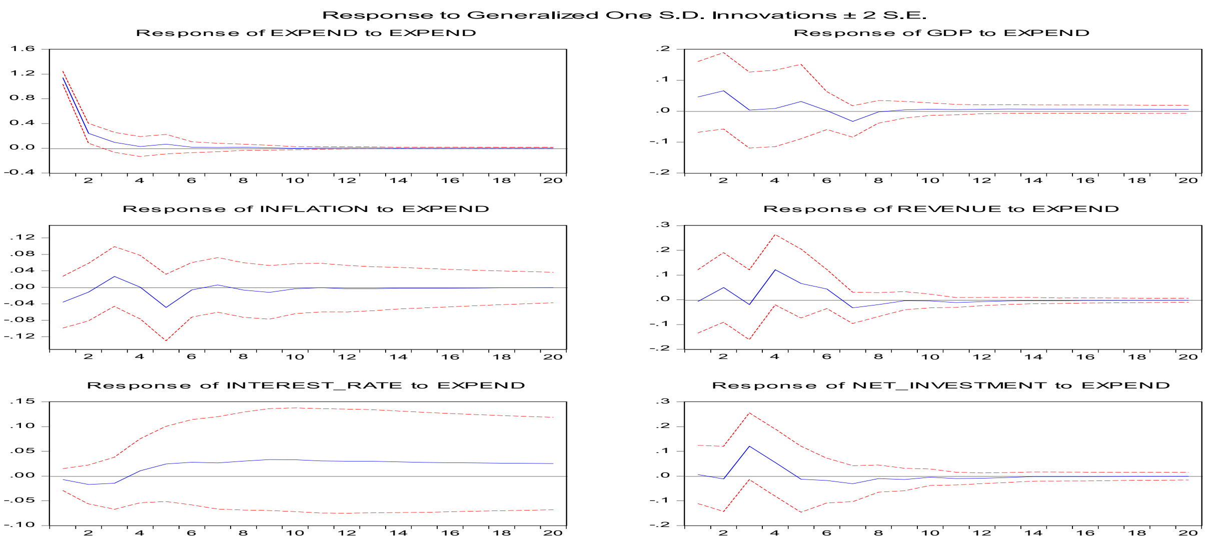
3.3.3 NET INVESTMENT

3.3.3.1 TABLE 33: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multipliers
Net investment	0.01	0.05	-0.00	0.12*(3)
Real GDP	0.05	0.01	0.01	0.07*(2)
Inflation	-0.04	0.00	-0.00	0.03*(3)
Revenue	-0.01	0.12	-0.00	0.12*
Interest rate	-0.01	0.01	0.03*	0.03*

*indicates peak multiplier while () indicates quarter of peak multiplier.

3.3.3.2 FIGURE 28: IMPULSE RESPONSE GRAPHS FOR EXPENDITURE SHOCK



3.3.3.3 *INFERENCE*

Consistent with theoretical economics and the findings of existing literature, net investment increases with a peak multiplier of 0.12 in the third quarter, in response a unit rise in extra government purchases. This finding does not lend support to the ‘crowding out hypothesis even though the military build-up is an exogenous event and the US economy could be in expansion at the time. The caveat in support of the crowding out hypothesis is that when the economy is in expansion then income is fixed and an extra government expenditure could supplant net investment which is supported by the findings of the event study investigation into effect of fiscal episodes. However, it is noteworthy that the US economy was in recession around two of the fiscal episodes used in this research i.e. 1980 and 2001 although these recessions were slight and in fact, the military build-ups were not in response to the recessions thus extra government purchases would still be unexpected or unanticipated.

3.3.4 SUMMARY OF RESULTS FOR EFFECTS OF FISCAL POLICY SHOCK FOR USA

Irrespective of the identification used, output responded positively to extra government purchases. Private consumption increases in response to expansionary fiscal policy. Inflation reacts positively to both expansionary and contractionary fiscal policy but seems to be more sensitive to tax increment irrespective of the identification used. This could be due the effect of consumption taxes on prices of goods and services. These affect the majority of the population and thus have a strong direct transmission mechanism to the consumer price index.

Interest rates generally fell in response to expansionary fiscal policy and rose to contractionary fiscal policy. This could be due to the fact that a growing economy improves the level of savings in the economy which increases loanable funds. An increase in loanable funds imply an increase in the availability of credit which is likely to drive down the cost of capital.

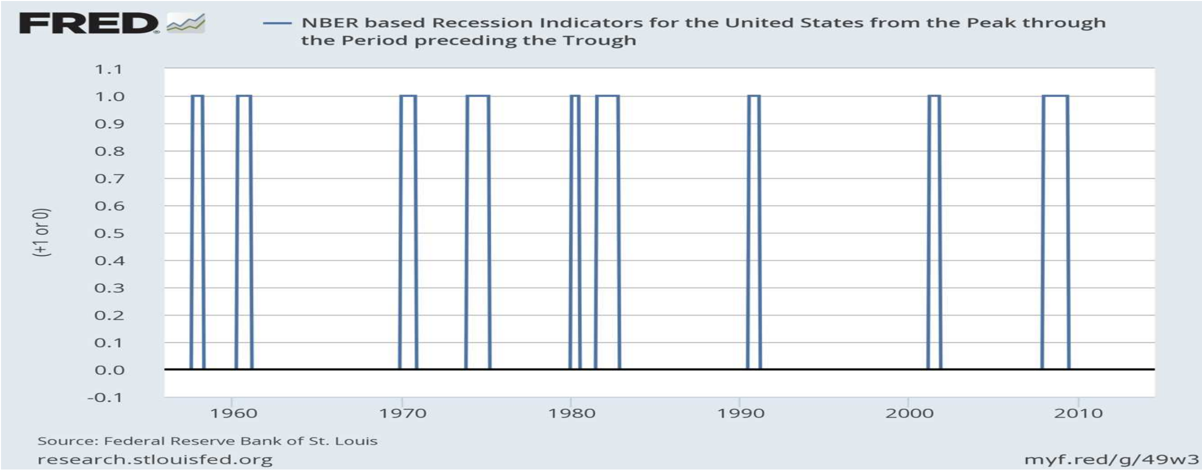
Overall, private consumption and net investment increases when the US federal government tinkers with aggregate demand. Moreover, the wealth of households increases when government carries out expansionary fiscal policy. Interestingly, the results gained for the USA suggests strongly that automatic stabilisers have an expansionary effect on the US economy while aiding an increase in the aggregate price level through an increase in aggregate demand in the economy. This may have policy relevance for the current disinflationary environment in the United States of America.

3.3.5 BUSINESS CYCLE STATE FISCAL MULTIPLIERS

Recessions are endogenous events that arise as a result of some shocks to the domestic economy and researchers have used non-linear models and local projection methods to estimate the effects of fiscal policy in a recession. However, there has been little agreement as to the efficacy of the econometric methods and some have even argued that the size of the fiscal multiplier is irrespective of the stage of the business cycle (Ramey and Zubairy (2014).

I extend the event study identification to allow for the estimation of fiscal multipliers in a recession. Specifically, I create a dummy variable D_t which is defined and takes a value of 1 in 1957Q3, 1960Q2, 1969Q3,1973Q3, 1980Q1, 1981Q3, 1990Q3, 2001Q3, and 2007Q4 which are the official dates of the onset on US recessions for the sample period 1955 to 2014 as given by the National Bureau of Economic Research.

3.3.6 FIGURE 29: OFFICIAL RECESSION DATES FOR THE USA AS GIVEN BY NATIONAL BUREAU OF ECONOMIC RESEARCH.



Now, unlike the standard event study approach, the dummy variable is added to the baseline structural equation since recessions are endogenous events and requires contemporaneous assumptions regarding the real nature of the economy. The dummy variable is also treated as an endogenous variable. Adding the dummy variable to the baseline structural equation gives:

$$A_0X_t = A_0\mu_o + A_0\mu_1 t + A_0\, A(L)X_{t-1} + \mathbf{\Phi}\,(L)\, D_t + Be_t \qquad (10)$$[23]

where $\mathbf{\Phi}\,(L)$ is the 4th order lag polynomial associated with the dummy variable which captures the above mentioned recessions.

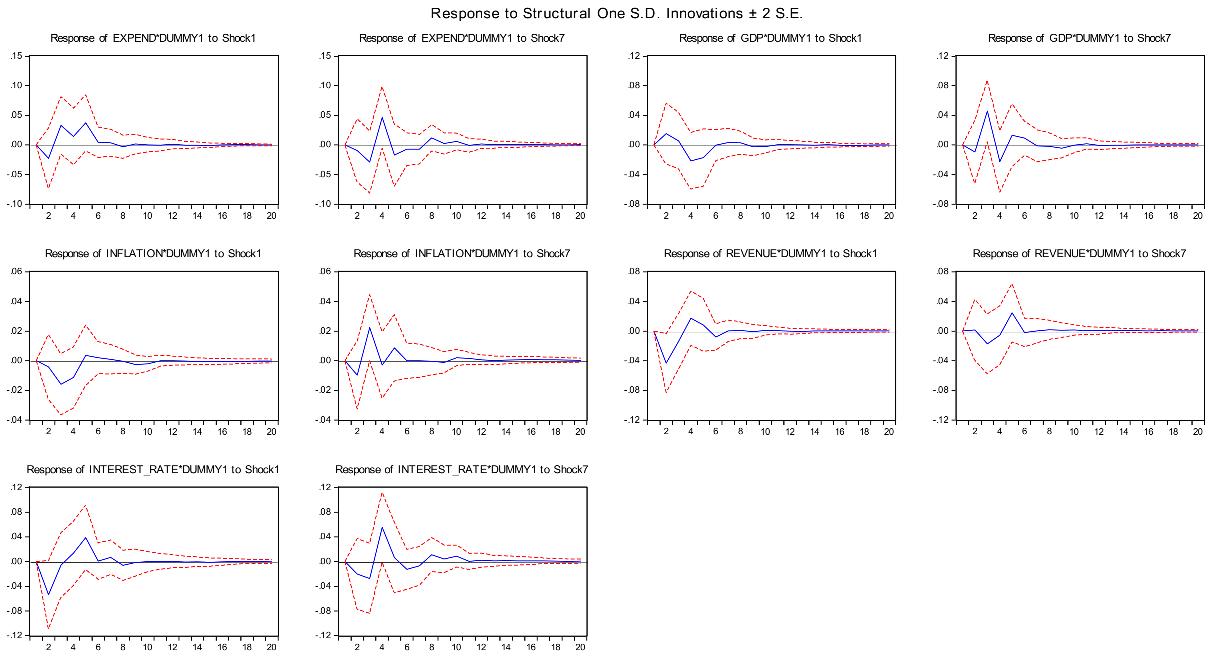
3.3.7 TABLE 34: EXPENDITURE MULTIPLIERS IN A RECESSION

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.00	-0.02	-5.50	0.02*(2)
Inflation	0.00	-0.01	-0.00	0.00*(1)
Revenue	0.00	0.02	1.23	0.02*(2)
Interest rate	0.00	0.01	-0.02	0.04*(2)

[23] In carrying out the estimation, each endogenous variable is included in the estimation plus the endogenous variables multiplied by a dummy variable that takes a value of 1 for the onset of US recessions and 0 for expansions.

*() indicate peak multiplier and quarter of peak multiplier respectively.

3.3.8 FIGURE 30: IMPULSE RESPONSE GRAPHS[24] FOR FISCAL MULTIPLIERS IN A RECESSION



3.3.9 TABLE 35: TAX MULTIPLIERS IN A RECESSION

[24] For this analysis, shock 1 refers to to a positive expenditure shock and shock 7 refers to a positive tax shock

Variable	Impact quarter	First year	Five years	Peak multiplier
Real GDP	0.00	-0.02	-0.00	0.02*(2)
Inflation	0.00	-0.00	0.00	0.02*(3)
Interest rate	0.00	0.06*	0.00	0.06*
Expenditure	0.00	0.05*	0.00	0.05*

*() indicate peak multiplier and quarter of peak multiplier respectively.

3.4.0 INFERENCE

The findings do not reveal any marked differences between fiscal multipliers in a recession and fiscal multipliers in expansions. This finding is consistent with other novel approaches that aims to study the state dependence of fiscal policy such the local projection method. That said, during a recession, government revenues increase with a peak multiplier of 0.02 at 2 quarters after extra government purchases. This finding is significant in that much of the academic and political opposition to expansionary fiscal policy as a policy response to economic recessions normally centres on the deficit and how it affects business. However, if government revenues respond positively to expansionary policy, then this provides strong empirical evidence against adherents of expansionary fiscal consolidation. Indeed, this is not significant enough but it could be an indication that higher and sustained expansionary fiscal policy can produce significant multipliers. An increase in government revenues imply that the Treasury can find the money required to close the deficit and pay down debt resulting from a loss of revenue from a recession.

A revenue shock during a recession also produces interesting output multipliers. Specifically, there is a peak multiplier of output of about 0.02 at 2 quarters but this could be due to the nature of the tax rise. If the tax rise is for high income earners and corporations, then this can be used to offset tax cuts for middle and lower income earners which can serve as a positive shock to the real economy.

3.4.0.1 EFFECT OF AUTOMATIC STABILISERS IN A RECESSION

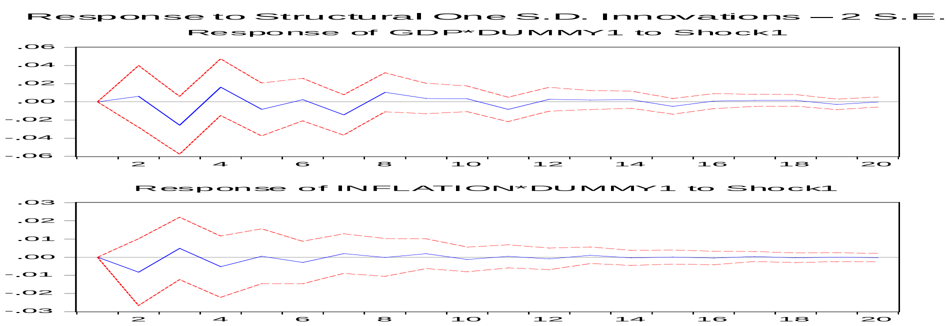
Automatic stabilisers such as unemployment insurance increase during recessions. Sometimes politicians cut this benefit in a bid to reduce the government spending bill and there is normally debates amongst economists about the growth inducing or reducing effect of this policy action. This research separates the series on government social benefits from total government expenditure and treats this as a shock in itself to determine the impact on gross domestic product and inflation in a recession. The results are presented below.

3.4.0.2 TABLE 36 MULTIPLIERS FOR AUTOMATIC STABILISERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.00	0.02*	-0.00	0.02*
Inflation	0.00	-0.01	0.01*	0.01*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively

3.4.0.3 FIGURE 31: IMPULSE RESPONSE -AUTOMATIC STABILISERS IN A RECESSION[25]



INFERENCE

[25] shock 1 implies net government transfers to households which serves as automatic stabilisers.

A unit rise or one standard deviation shock to automatic stabilisers impacts positively on GDP with a peak multiplier 0.02 in the fourth quarter. This result is slightly significant. That said the series fluctuate around the steady for the whole forecast horizon and remains mostly above the steady state for the whole forecast horizon. Inflation on the other hand responds to the same shock positively but with a peak multiplier of 0.01 at 3 quarters.

These results are interesting in that governments are tempted to cut welfare programs during periods of recessions as part of deficit reduction strategies. In addition, this finding has policy implications for the current low inflation environment of most advanced economies including the USA. Specifically, tests for Granger non causality showed that a unit increase in net government transfers households causes output and inflation to rise.

3.4.0.4 TABLE 37 P-VALUES GRANGER CAUSALITY χ – SQUARE STATISTICS

Variable	χ-square
GDP	0.02
Inflation	0.00

CHAPTER 4

4.1 SECOND PAPER

4.2 EFFECT OF FISCAL POLICY INNOVATIONS IN THE UNITED KINGDOM

4.3 DATA

Data used for the United Kingdom spans the period 1955Q1 to 2007Q4 giving η = 212 observations. The variables of interest are Central Government Current expenditure, '*Expend'*, Central Government Total Current Receipts, '*Tax'*, Private Sector Employment, '*Employment'*, Central Government Net Social Benefits Payable, '*Benefits'*, Gross Capital Fixed Formation: Business Investment, '*Net Investment*', Average Weekly Earnings, *Wages*, Quarterly Average of Official Bank Rate, '*Interest rate'*, GDP Deflator, '*Inflation*', Gross Domestic Product, '*GDP*'. The data used is restricted to 2007Q4. This is because including time series covering the great recession produces large multipliers skews the results gained (Blanchard and Leigh, 2013). Unless otherwise stated, data used in the estimations are in the growth rate.

4.3.1 PRE-ESTIMATION DATA PREPARATION

With the exception of Gross domestic product all-time series are in real terms at source. GDP is transformed into Real GDP by dividing nominal GDP by the GDP deflator. All time series are then transformed into their natural logarithms with the aim of stabilising the variance and reducing heteroscedasticity (Lütkepohl and Krätzig, 2004, Lütkepohl, 2006). Using the natural logarithm version of the time series also helps in converting the elasticities of the response of output to increases in expenditure and taxes to multipliers by using an *ex post* conversion factor based on the sample average of the ratio of output to government expenditure.

Apart from the interest rate and employment, all series were found to be stationary. Interest rate and employment were then first differenced to achieve stationarity. After tests of cointegration, interest rate and employment were found to be cointegrated of order 1. i.e. $I(1)$.

4.3.2 LAG LENGTH SELECTION

Akaike information criterion points to 4 lags while Schwarz and Hannan-Quinn points to 1 lag. That said the residuals produced a Durbin Watson statistic above 2 which means they are not autocorrelated. Indeed, adding to the lags produces a much higher Durbin Watson statistic ensuring the model is well specified. And this is consistent with the literature and a survey reveals a preference for 4 lags.

4.4 ECONOMETRIC SPECIFICATION

4.5 BENCHMARK REDUCED FORM VECTOR AUTOREGRESSION

Consistent with Caldara and Kamps (2008), the standard or reduced form[26] model of VAR collecting the endogenous variables in the *k*- dimensional vector X_t can be expressed as

$$X_t = \mu_o + \mu_1 t + A(L)X_{t-1} + u_t, \qquad (1)$$

[26] Equation 1 is in reduced form because all right hand side variables are lagged or predetermined. The instantaneous relationship among the variables are summarised and contained in the variance-covariance matrix and this is not enough is one wants to use the results of a VAR for economic policy prescription and analyses.

where μ_o is a constant, t is a linear time trend, $A(L)$ is a 4th order lag polynomial and u_t is a k- dimensional vector of reduced form disturbances where $E[u_t] = 0$, $E[u_t u'_t] = \sum_u$ and $E[u_t u'_s] = 0$, for $s \neq t$.

The disturbances in the reduced form vector autoregression model will be correlated thus it is important to transform the reduced form model into a structural model[27]. Thus pre-multiplying the above equation by the ($\kappa\chi\kappa$) matrix A_0 gives the structural form

$$A_0 X_t = A_0 \mu_o + A_0 \mu_1 t + A_0 A(L) X_{t-1} + B e_t \quad (2)$$

where $Be_t = A_0 \mu_t$ describes the relationship between the structural disturbances e_t and the reduced form disturbances u_t. In equation 2, it is assumed that the structural disturbances e_t are uncorrelated with each other i.e. the variance-covariance matrix of the structural disturbances $\sum_e$ is diagonal. The matrix A_0 describes the contemporaneous relationships among the variables collected in the vector X_t[28]. Specifically, in the matrix, X_{1t} will denote variables that do not respond at the same time (contemporaneous) with the onset of the fiscal policy shock and X_{2t} will denote variables that respond at the same time to the fiscal policy shock and another subset of variable g_t (for example) which is the fiscal policy shock itself. Without restrictions A_0 and B, the structural model is not identified. On Denoting the the variables included in this research as Z_t, the vector X_t can be partitioned as

$$Z_t = \begin{bmatrix} X_{1t} \\ g_t \\ X_{2t} \end{bmatrix}$$

[27] Structural VAR models have contemporaneous variables that appear as independent or explanatory variables. This is valid description of the data generation process.

[28] See LÜTKEPOHL, H. 2005. *New introduction to multiple time series analysis*, Springer Science & Business Media. for further explanation of the AB model

Where the top represents slow moving variables and the bottom represents fast moving variables such as the immediate response of the stock market to news of extra government purchases from the private sector.

4.6 RECURSIVE IDENTIFICATION

In the recursive identification scheme, *B* is restricted to a *k*- dimensional identity matrix while A_0 is restricted to a lower triangular matrix with unit diagonal which implies the decomposition of the variance-covariance matrix $\sum_u = A_0^{-1}\sum_e(A_0^{-1})'$ and is taken from the Cholesky decomposition $\sum_u = PP'$ by defining a diagonal matrix *D* that has the same main diagonal as *P* and by specifying $A_0^{-1} = PD^{-1}$ and $\sum_e = DD^1$. This means that the elements on the main diagonal of *D* and *P* are equal to the standard deviation of the respective structural shock.

The recursive identification also requires contemporaneous assumptions due to that fact there are '*k*' possible orderings and changing the order affects the result. Thus the order is government expenditure, output, inflation, tax revenue and interest rate respectively in the baseline vector autoregression equation. The sequence is based on theoretical assumptions that movements in government expenditure unlike movement in government revenue are largely unrelated to the real business cycle. This implies that output and inflation are ordered before taxes as the aforementioned affects taxes. Interest rates are then ordered last and ordering interest rate last is then justified on the grounds of a central bank's stackelberg reaction function where fiscal authority is the stackelberg leader[29] meaning that interest rate is set as a function of output gap and inflation. Ordering the variables in

[29] See KIRSANOVA, T., STEHN, S. J. & VINES, D. 2005. The Interactions between Fiscal Policy and Monetary Policy. *Oxford Review of Economic Policy,* 21**,** 532-564. for a full explanation of the stackelberg reaction function between a fiscal authority and monetary authority.

this manner helps the benchmark vector autoregression equation to capture the effect of automatic stabilisers.

The variables are ordered as *expend* → *gdp,* → *inflation,* → *revenue,* → *interest_rate* meaning that the baseline Vector Autoregression can be written in notation form as

$$expend_t = \boldsymbol{\alpha} + \sum_{i=1}^{4} \boldsymbol{\Phi}_i \, expend_{t-1} + \sum_{i=1}^{4} \beta_i \, gdp_{t-1} + \sum_{i=1}^{4} \boldsymbol{\lambda}_i \, inflation_{t-1} + \sum_{i=1}^{4} \boldsymbol{\delta}_i \, revenue_{t-1} + \sum_{i=1}^{4} \boldsymbol{\gamma}_i \, interest\_rate_{t-1} \qquad (3)$$

the remaining variables are added to the baseline Vector autoregression one after the other to obtain an 'augmented' VAR model that provide estimates for the effect of fiscal policy shocks on output, private consumption, net investment, hours worked, households net worth. The relationship between the reduced form disturbances u_t and the structural form disturbances e_t then takes the form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha yg & 1 & 0 & 0 & 0 \\ \alpha \pi g & \alpha \pi y & 1 & 0 & 0 \\ \alpha \tau g & \alpha \tau y & \alpha \tau \pi & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}$$

4.8 RESULTS

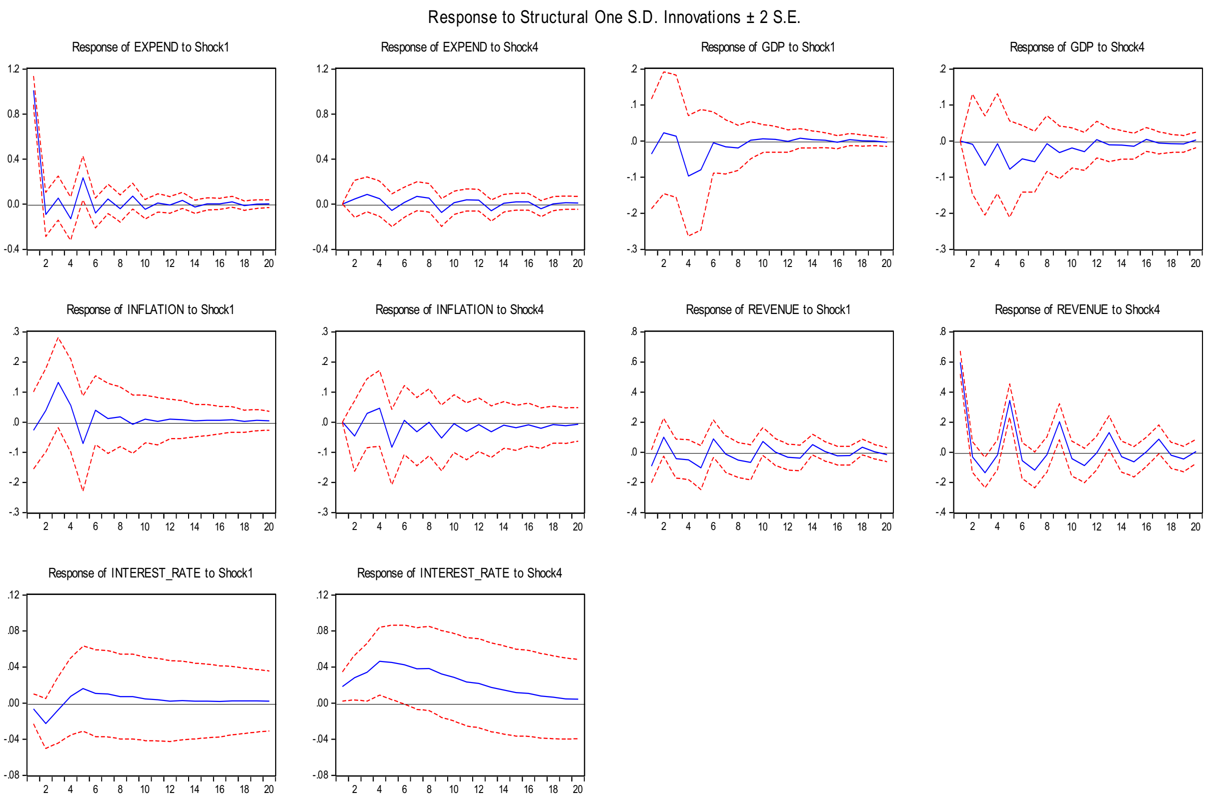
4.9 BASELINE RECURSIVE IDENTIFICATION

4.9.1 TABLE 32: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	-0.04	-0.10	-0.00	0.02*(2)
Inflation	-0.03	0.05	0.00	0.13*(3)
Tax	-0.09	-0.05	-0.02	0.10*(2)
Interest rate	-0.01	0.01*	0.00	0.01*

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.9.2 FIGURE 32: TAX AND EXPENDITURE IMPULSE RESPONSE



4.9.3 TABLE 33: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Expenditure	0.00	0.05	0.01	0.07*(7)
GDP	0.00*	-0.01	0.00*	0.00*(12)
Inflation	0.00	0.05*	-0.01	0.05*(4)
Interest rate	0.02	0.05*	0.00	0.05*(4)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.9.4 INFERENCE

The quantitative effect on an increase in government expenditure is positive for output with a peak multiplier of 0.02 within the first year. That said consistent with theoretical economics, a 1% increase in tax causes economic contraction with the economic remaining below the steady state for most of the forecast horizon. Indeed, it is not surprising that inflation responds positively to expansionary fiscal policy suggesting that policy-wise the UK government could look at implementing expansionary fiscal policy to deal with the current disinflationary environment. Tax increment also have a positive effect on inflation but this effect is short-lived as inflation falls and remain below the steady state for the remainder of the forecast horizon.

4.1.0 AUGMENTED RECURSIVE SVAR

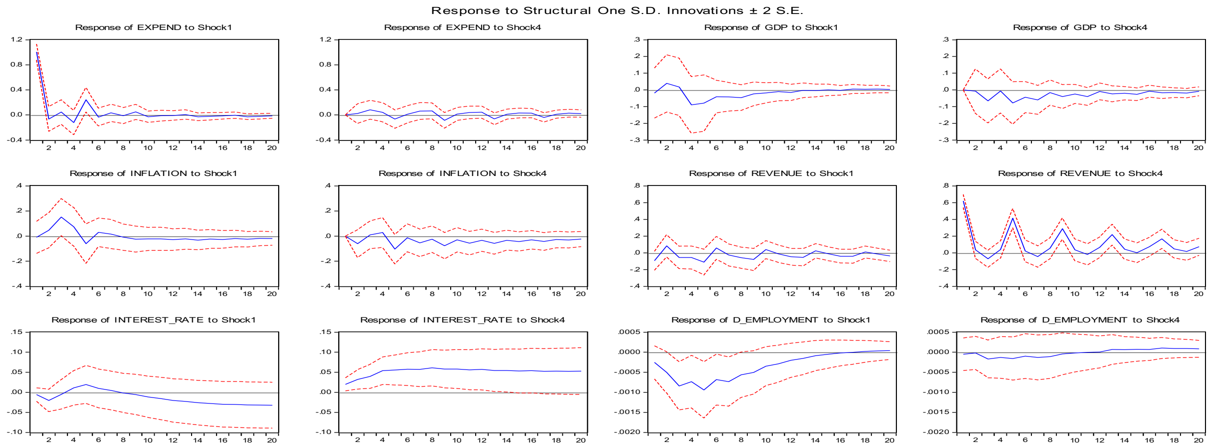
4.1.1 EMPLOYMENT

4.1.1.2 TABLE 34: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Employment	-0.00	-0.00	0.01	0.01*(18)
GDP	-0.02	-0.09	0.00	0.04*(4)
Inflation	-0.01	0.07	-0.02	0.15*(3)
Revenue	-0.10	-0.06	-0.04	0.08*(2)
Interest rate	-0.01	0.01	-0.03	0.02*(5)

*() indicate peak multiplier and quarter of peak multiplier respectively

4.1.1.3 FIGURE 33: IMPULSE RESPONSE GRAPHS



4.1.1.4 TABLE 35: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Employment	-5.01	-0.00	0.01	0.01*(15)
GDP	0.00*	-0.01	-0.00	0.00*(12)
Inflation	0.00	0.03*	-0.02	-0.03*(4)
Expenditure	0.00	0.04	0.02	0.08*(8)
Interest rate	0.02	0.05	0.05	0.06*(8)

*() indicate peak multiplier and quarter of peak multiplier respectively

4.1.1.5 INFERENCE

Employment responds to a unit rise in government expenditure positively with a peak multiplier 3.94 in the fifth year. The increase in employment starts after the first year and rises above the steady state equilibrium at the end of the forecast horizon. Similarly, upon impact, a 1% rise in government revenue causes a dip in employment and rises slowly to lie above the steady state at the end of the forecast horizon. This is consistent with economic theory and the existing literature on outcome of fiscal policy shocks to key macroeconomic variables

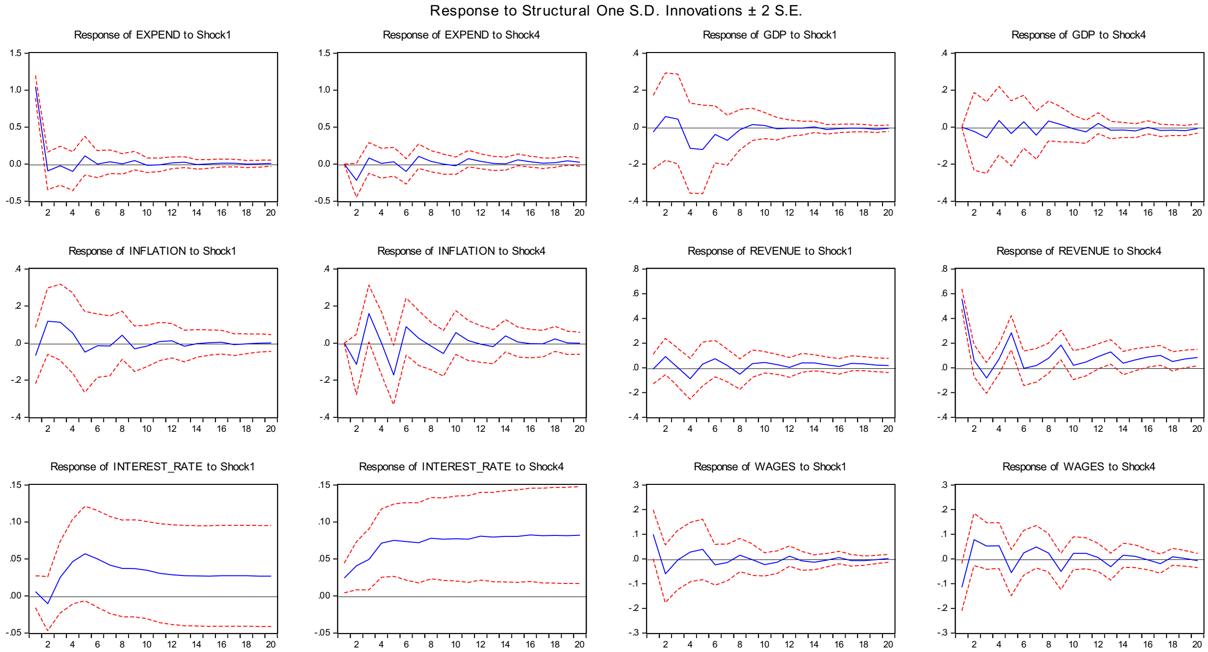
4.1.2 WAGES

4.1.2.1 TABLE 36: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	0.10*	0.03	0.00	0.10*
GDP	-0.03	-0.11	-0.01	0.06*
Inflation	-0.07	0.05*	0.00	0.05*
Revenue	-0.01	-0.09	0.02	0.07*(7)
Interest rate	0.00	0.05	0.03	0.06*(5)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.1.2.3. FIGURE 34: EXPENDITURE AND TAX IMPULSE RESPONSE GRAPHS



4.1.2.4 TABLE 37: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	-0.11	0.05	-0.00	0.08*(2)
GDP	0.00	0.04*	-0.01	0.04*
Inflation	0.00	0.00	-0.00	0.16*(3)
Interest rate	0.02	0.07	0.08*	0.08*
Expenditure	0.00	0.01	0.03	0.10*(7)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.1.2.5 INFERENCE

When the UK government shifts aggregate demand to the right, the average weekly wage of employees in the United Kingdom improves significantly and the impact is immediate. This finding underscores the usefulness of expansionary fiscal policy in improving economic welfare and standards of living. Indeed, wages fall in the second quarter but returns back to the steady state for the remainder of the forecast horizon. Similarly, general increment in taxes causes a sharp dip in wages on impact but fluctuates around the steady state for the remainder of the forecast horizon.

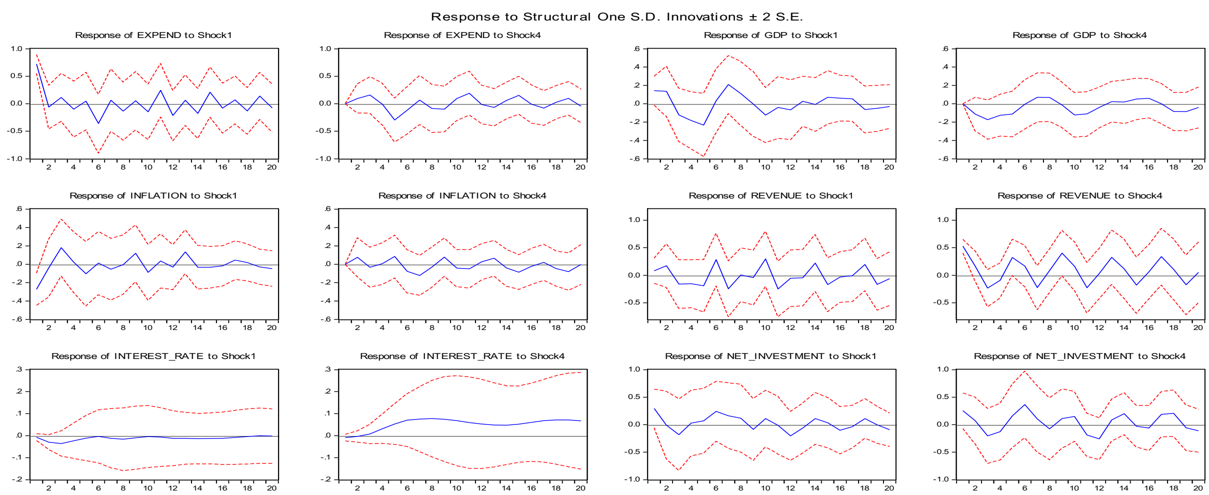
4.1.3 NET INVESTMENT

4.1.3.1 TABLE 38: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	0.30*	0.03	-0.09	0.30*
GDP	0.14	-0.13	-0.03	0.21*(7)
Inflation	-0.27	0.02	-0.05	0.18*(3)
Revenue	0.08	-0.15	-0.06	0.30*(6)
Interest rate	-0.00	-0.02	-0.00*	-0.00*

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.1.3.2 FIGURE 35: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



4.1.3.3 TABLE 39: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	0.25	-0.12	-0.11	0.25*(6)
GDP	0.00	-0.13	-0.04	0.07*(7)
Inflation	0.00	0.01	-0.00	0.08*(2)
Interest rate	-0.01	0.03	0.07	0.08*(7)
Expenditure	0.00	-0.01	-0.04	0.20*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.1.3.4. Inference

Business investment reacts positively to a 1% increase in government purchases with a peak multiplier of 0.30 in the first quarter. Tax increments does not affect business investment although it fluctuates around the steady state for the majority of the forecast horizon.

4.1.4 EFFECT OF AUTOMATIC STABILISERS[30] ON KEY UK MACROECONOMIC VARIABLES

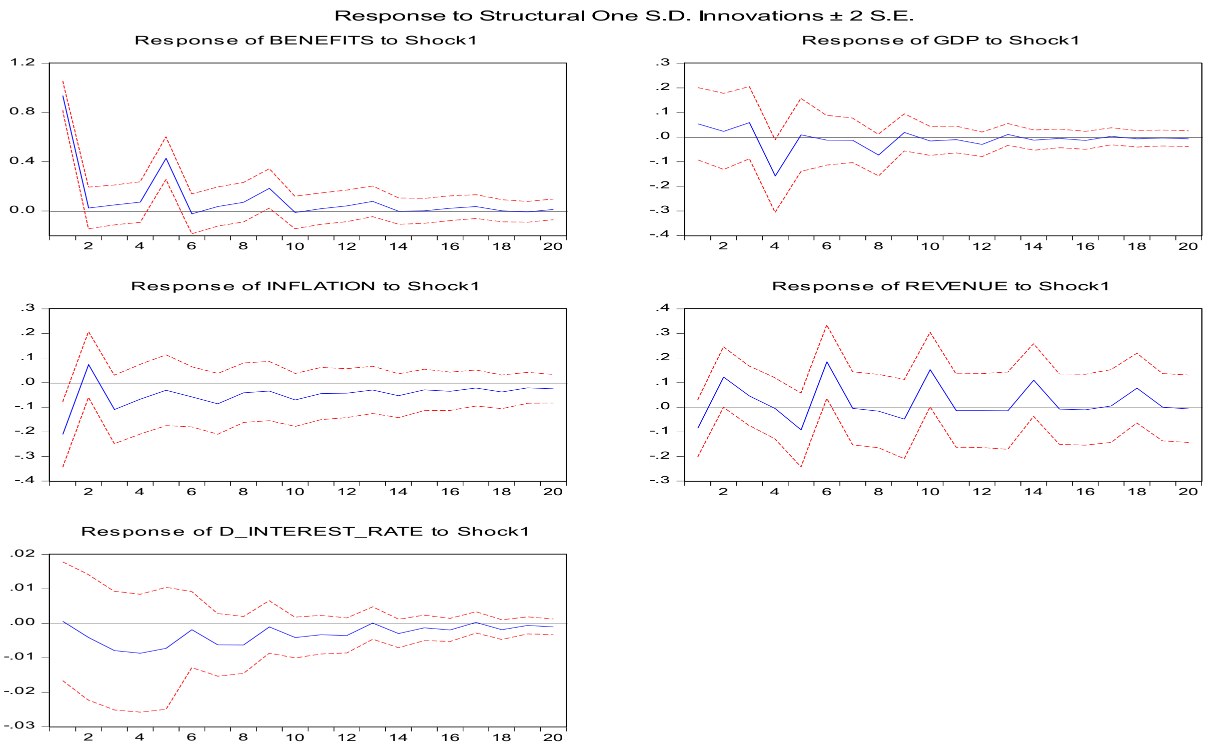
4.1.4.1 TABLE 40: MULTIPLIERS FOR AUTOMATIC STABILISERS

Variables	Impact quarter	First year	Five years	Peak multiplier
GDP	0.05	-0.16	-0.01	0.06*(3)
Inflation	-0.21	-0.07	-0.03	0.07*(2)
Revenue	-0.09	-0.01	-0.01	0.20*(6)
Interest rate	0.00	-0.01	-0.00	6.29*(13)

*() indicate peak multiplier and quarter of peak multiplier respectively.

[30] I substituted total social benefits paid by the UK government in place of total expenditure in the baseline recursive equation.

4.1.4.2 FIGURE 36: IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS



4.1.4.3 INFERENCE

Output stays above the steady state, drops sharply in the 4th quarter and returns to the steady state after the same quarter in response to a unit rise in benefits paid to households and individuals. But most importantly, is the effect this has on the aggregate price level in the UK economy. Specifically, inflation rises sharply from below to above the steady state upon impact of the benefits shock. This finding is interesting and supports the widely believed premise that individuals on low incomes tend to spend a higher proportion of their income and by doing so increase aggregate demand with its concomitant benefits to the real economy. It is noteworthy that inflation falls back below the steady state as the effect of the shock wears off.

4.1.5 BLANCHARD AND PERROTI IDENTIFICATION

This identification scheme used in estimating fiscal policy shocks depend on the use of institutional information on transfer, tax systems and the timing of tax collections. The institutional information is then used to identify the automatic response of taxes and government spending to fiscal policy. There are two steps involved wherein the first step involves using institutional information to estimate cyclically adjusted taxes and government expenditure. The second step then involves estimating fiscal policy shocks. It is noteworthy that Blanchard and Perroti (2000) used a three variable baseline equation while Perrotti (2005) used a five variable baseline equation. For the purpose of standardisation and being able to compare estimates of the different identification approaches used in this research, I chose a five variable baseline equation.

Using a five variable for the baseline equation, the relationship between the reduced form disturbances u_t and structural disturbances e_t is given as

$$u_t^g = \alpha_{gy} u_t^y + \alpha_{g\pi} u_t^\pi + \alpha_{gr} u_t^r + \beta_{g\tau} e_t^\tau + e_t^g \quad (4)$$

$$u_t^\tau = \alpha_{\tau y} u_t^y + \alpha_{\tau\pi} u_t^\pi + \alpha_{\tau r} u_t^r + \beta_{\tau g} e_t^\tau + e_t^\tau \quad (5)$$

$$u_t^y = \alpha_{yg} u_t^g + \alpha_{yr} u_t^\tau + e_t^y \quad (6)$$

$$u_t^\pi = \alpha_{\pi g} u_t^g + \alpha_{\pi y} u_t^y + \alpha_{\pi r} u_t^r + e_t^\pi \quad (7)$$

$$u_t^r = \alpha_{rg} u_t^r + \alpha_{ry} u_t^y + \alpha_{r\pi} u_t^\pi + \alpha_{rr} u_t^\tau + e_t^r \quad (8)$$

equations 4 to 8 is in reduced form thus not identified. To achieve identification Perroti (2005) regresses individual revenue items on their tax base obtaining an aggregate value for the elasticity of output to revenue α_{ry} = 1.85, inflation to revenue $\alpha_{\tau\pi}$ = 1.25, Perroti sets output elasticity to government spending α_{gy} to 0 as data used is net of total government transfers. That said, the government expenditure used in this research is inclusive of transfers so I set the elasticity to 1[31] as discussed in Arpaia & Turrini (2008). Consistent with Perroti (2005), inflation elasticity to government spending $\boldsymbol{\alpha}_{g\pi}$ is set to -0.5 while interest rate elasticities to government spending $\boldsymbol{\alpha}_{gi}$ and taxes $\boldsymbol{\alpha}_{\tau i}$ are both set to zero. The parameter $\boldsymbol{\beta}_{g\tau}$ is set to 0 meaning that decisions on government spending are taken before those on government revenue. When these restrictions are imposed on the parameters then the relationship between the reduced form and structural disturbances is written as

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ \alpha yg & 1 & 0 & \alpha y\tau & 0 \\ \alpha\pi g & \alpha\pi y & 1 & \alpha\pi\tau & 0 \\ 1 & 1.85 & 1.25 & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{g\tau} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}$$

4.1.6 RESULTS

4.1.7 BASELINE BLANCHARD AND PERROTI INDENTIFICATION

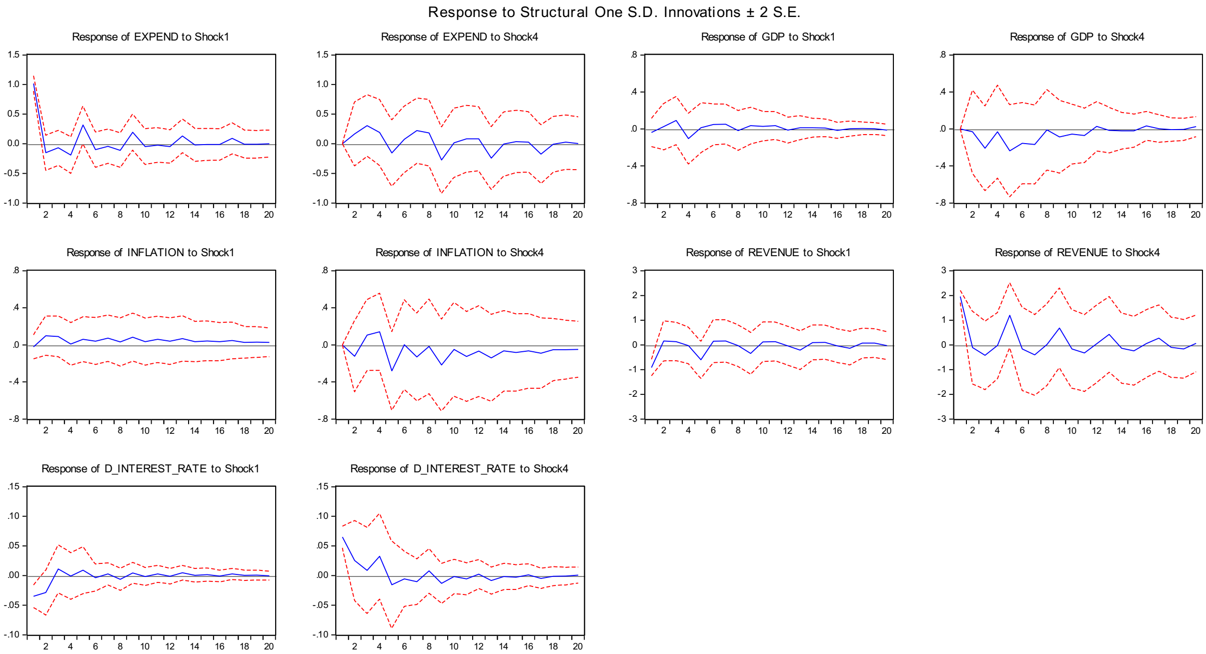
31 ARPAIA, A. & TURRINI, A. 2008. Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment. *European Union Economic and Financial Affairs Economic Papers,* 300. This paper shows that over a sample of 15 EU countries over 1970-2003, there is a long run elasticity of output to cyclically adjusted primary government expenditure that is close to unity.

4.1.7.1 TABLE 41: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multipliers
GDP	-0.04	-0.10	-0.01	0.10*(3)
Inflation	-0.02	0.01	0.03	0.10*(2)
Revenue	-0.92	-0.03	-0.04	0.20*(2)
Interest rate	-0.04	-0.00	-0.00	0.01*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.1.7.2 FIGURE 37: IMPULSE RESPONSE GRAPHS FOR BASELINE



4.1.7.3 TABLE 42: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.00	-0.03	0.02	0.03*(3)
Inflation	-1.36	0.14*	-0.05	0.14*(4)
Interest rate	0.07	0.03*	0.00	0.03*(4)
Expenditure	0.00	0.20	0.00	0.31*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.1.7.4 INFERENCE

Output responds positively to increments in government purchases. Output falls and remains below the steady state equilibrium when government increases overall taxes. This finding is consistent with the existing academic literature and economic theory.

4.1.8 AUGMENTED BLANCHARD AND PERROTI IDENTIFICATION

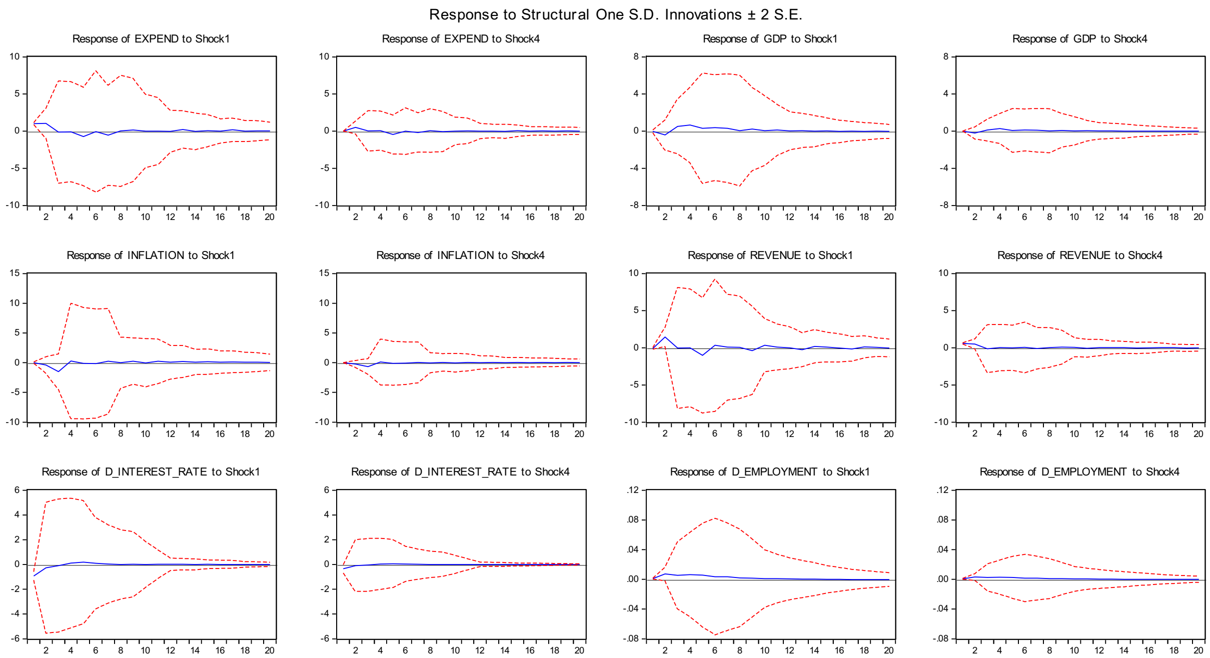
4.1.9 EMPLOYMENT

4.1.9.1 TABLE 43: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five year	Peak multiplier
GDP	-0.02	0.70	-0.03	0.50*(3)
Employment	0.00	0.01*	-0.00	0.01*(4)
Inflation	-0.00	0.30*	0.06	0.30*(4)
Revenue	-0.09	0.00*	-0.04	2.00*(2)
Interest rate	-0.92	0.11*	0.00	0.11(4)*

*() indicate peak multiplier and quarter of peak multiplier respectively

4.1.9.2 FIGURE 38: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



4.1.9.3 TABLE 44: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Employment	0.00	0.00	0.00	0.01*(2)
GDP	0.00	0.30	-0.01	0.30*(4)
Inflation	0.00	0.11*	0.02	0.11*(4)
Interest rate	-0.34	0.05	0.00	0.07*(5)
Expenditure	0.00	0.06	0.01	0.50*(2)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.1.9.4 INFERENCE

It can be seen that employment rises significantly in the United Kingdom in response to extra government spending. This extra government purchases produces a peak multiplier of 0.01 at 4 quarters. Interestingly, employment also grows significantly in response to an increase in government revenue. That said, this could be the response of employment to a unit rise in the general level of taxes and perhaps the response of employment could be different for 2% rise or more in tax increment.

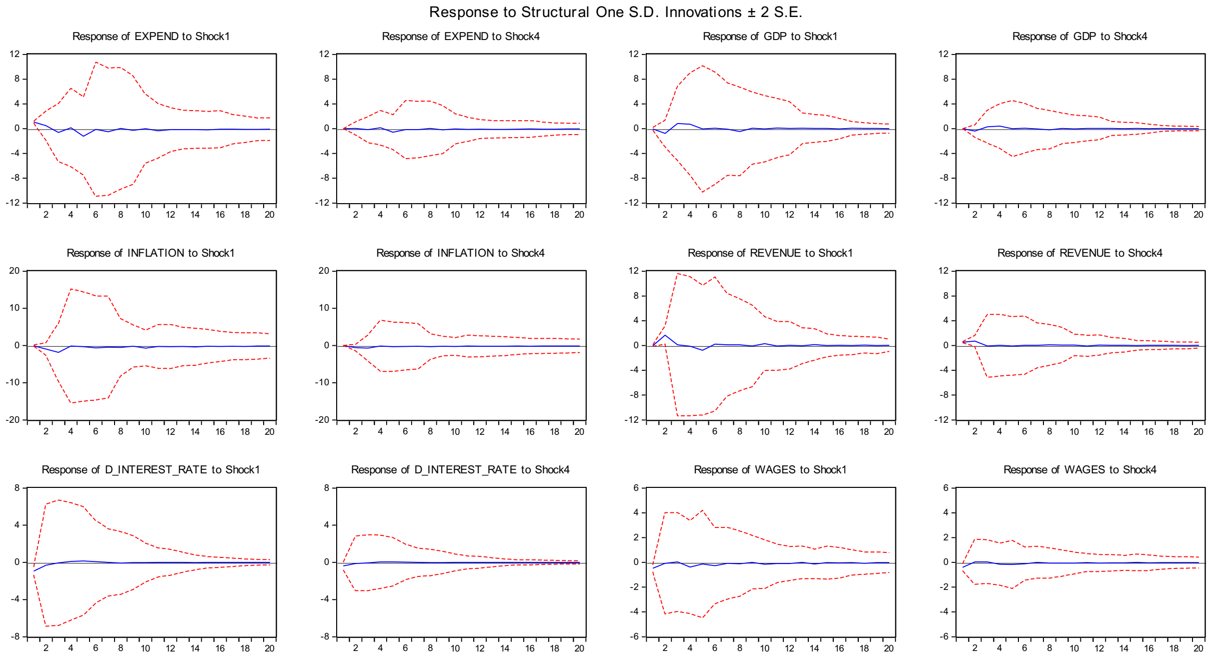
4.2.0 WAGES

4.2.0.1 TABLE 45: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	-0.48	-0.39	-0.03	0.03*(3)
GDP	-0.03	0.74	0.01	0.85*(3)
Inflation	-0.06*	-0.11	-0.12	-0.06*
Revenue	-0.02	-0.12	0.02	1.70*
Interest rate	-0.93	0.10	-0.01	0.15*(5)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.2.0.2 FIGURE 39: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



4.2.0.3 TABLE 46: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	-0.40	-0.20	-0.02	0.05*(3)
GDP	0.00	0.42*	0.01	0.42*
Inflation	-3.74	-0.11*	-0.11	-0.11*
Expenditure	0.00	0.14*	-0.01	0.14*
Interest rate	-0.40	0.05	-0.00	0.06*(5)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.2.0.4 INFERENCE

It can be seen that wages respond positively to both expansionary and contractionary fiscal policy. That said the response of output in a wage rise environment is very strong indicating that increments in minimum wage or living wage has a positive effect of economic activity with its concomitant effects on standard of living and economic welfare.

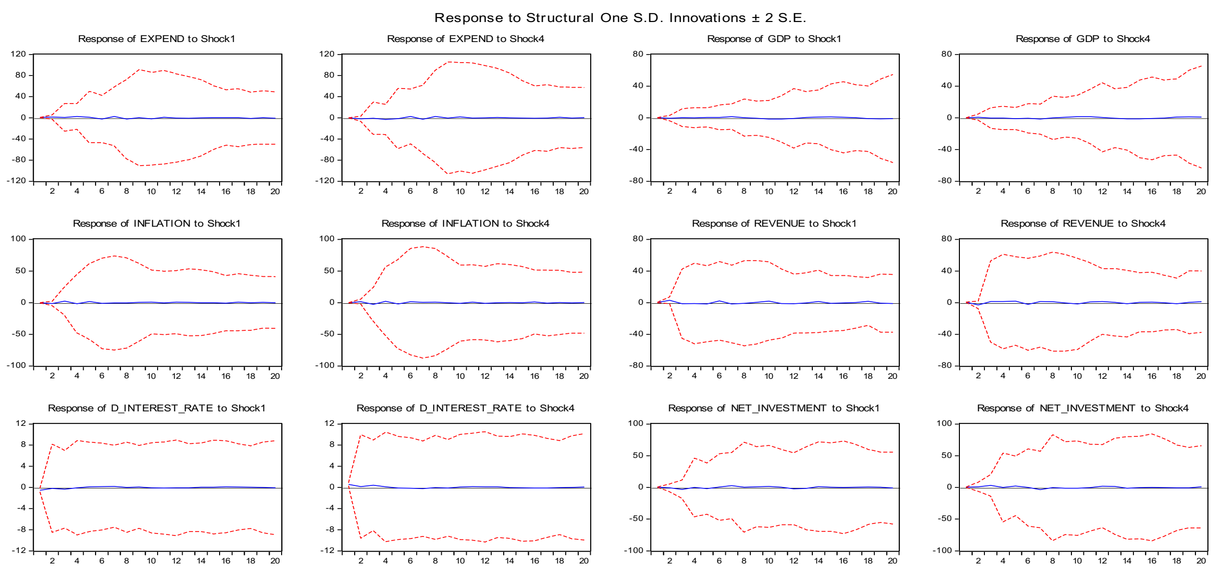
4.2.1 NET INVESTMENT

4.2.1.1 TABLE 47: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	0.44	-0.05	-1.09	2.86*(7)
GDP	0.16	0.05	-0.93	1.53*(7)
Inflation	-0.22	-1.70	-0.14	2.27*(3)
Tax	0.17	-1.15	-1.02	2.81*(2)
Interest rate	-0.52	-0.08	-0.08	0.20*(7)

*() indicate peak multiplier and quarter of peak multiplier.

4.2.1.2 FIGURE 40: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



4.2.1.3 TABLE 48: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	0.20	-0.04	0.02	3.16*(3)
GDP	0.00	-0.20	1.00	1.64*(11)
Inflation	1.64	2.12*	0.15	2.12*(4)
Interest rate	0.52	1.30	1.14	2.00*(5)
Expenditure	0.00	-3.10	0.50	2.60*(8)

*() indicates peak multiplier and quarter of peak multiplier.

4.2.1.4 INFERENCE

Net investment by business and private individuals rises in response to a 1% increase in government purchases. This finding suggests that expansionary fiscal policy does not detriment businesses and private individuals in the United Kingdom. It also does not lend support to the crowding out hypothesis from real business cycle theorists. That said, a unit rise in overall taxes does not affect business investment upon impact as a multiplier effect of 0.20.

4.2.2 IMPACT OF AUTOMATIC STABILISERS IN THE UNITED KINGDOM

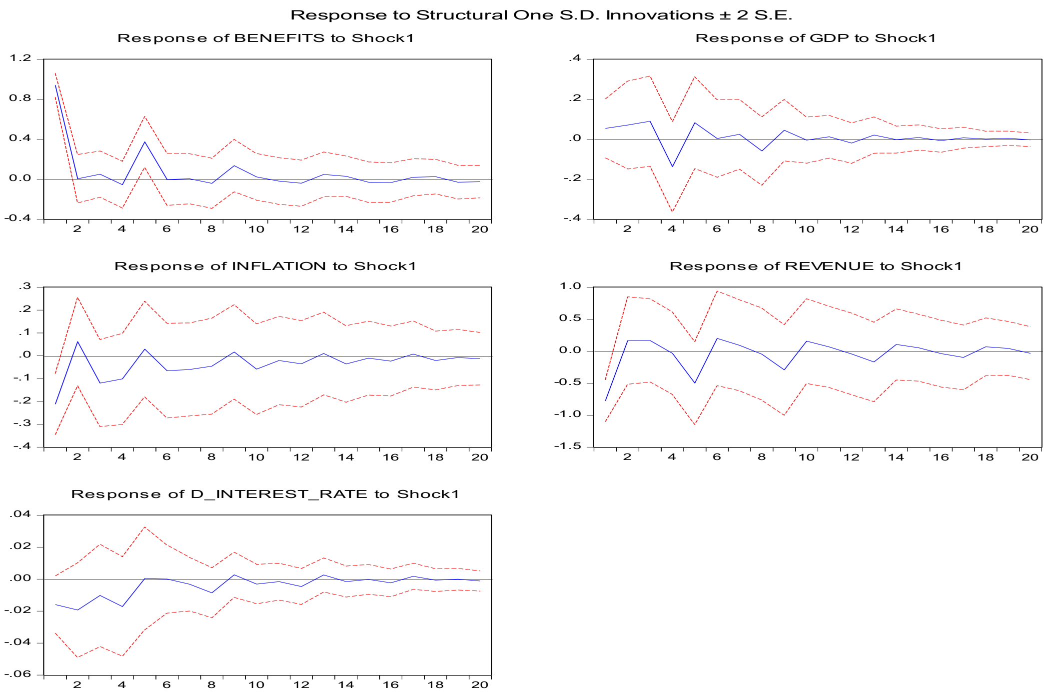
Total government benefits paid is substituted into the place of total government expenditure in the baseline recursive equation for the UK. This helps to estimate the impact of a unit rise in benefits paid to low and middle income on economic activity.

4.2.2.1 TABLE 49: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.05	-0.13	-0.00	0.09*(3)
Inflation	-0.21	-0.10	-0.01	0.06*(2)
Revenue	-0.78	-0.03	-0.03	0.20*(2)
Interest rate	-0.02	-0.02	-0.00	0.02*(4)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.2.2.3 FIGURE 41: IMPULSE RESPONSE GRAPHS



4.2.2.4 INFERENCE

Output responds positively to an increase in automatic stabilisers such as jobseekers allowance and housing benefit. This is primarily due to the fact people on low and middle incomes have a higher marginal propensity to consume. Therefore, putting money into the hands of people who are more likely to spend it in the shops aids expansionary economic activity by increasing aggregate demand. Inflation responds positively to an increase in benefits paid and gets above the steady state in the second quarter suggesting that perhaps UK economic policy makers should look at increasing benefits paid to deal with the current low inflation environment.

4.2.2 EVENT STUDY IDENTIFICATION

This identification scheme is based on the reduced form vector autoregression model. This identification looks for fiscal episodes that can be treated as exogenous with respect to the state of the economy so that there is an estimation of a univariate autoregressive model where current and lagged values of the military build-up dummy variable are included as exogenous regressors (Ramey and Shapiro, 1998). These extra government purchase resulting from military build-up are not in response to the stage of the business cycle or are unrelated to events from the domestic (endogenous) United Kingdom economy so require no contemporaneous assumption about the structure of the economy and are thus exogenous. This approach helps in identifying the effects of unexpected or unanticipated fiscal policy shocks especially if one knows the timing of the military build-ups or fiscal episodes in general.

Consistent with the literature, a dummy variable D_t is defined and takes a value of 1 in 1982Q2 for the onset of the Falklands war, and 2001Q3 for the onset of the war against terrorism[32]. Adding the dummy variable to the baseline reduced form equation gives

[32] The United Kingdom partook in other wars during the sample period but the ones included in this thesis are the ones the UK National Army Museum considers to have involved a significant military build-up within the sample period.

$$X_t = \mu_o + \mu_1 t + A(L)X_{t-1} + \mathbf{\Phi}\ (L)\ D_t +\ u_t \quad (9)$$

where **Φ** (L) is the 4th order lag polynomial associated with the dummy variable which captures the above mentioned fiscal episodes.

4.2.4 RESULTS

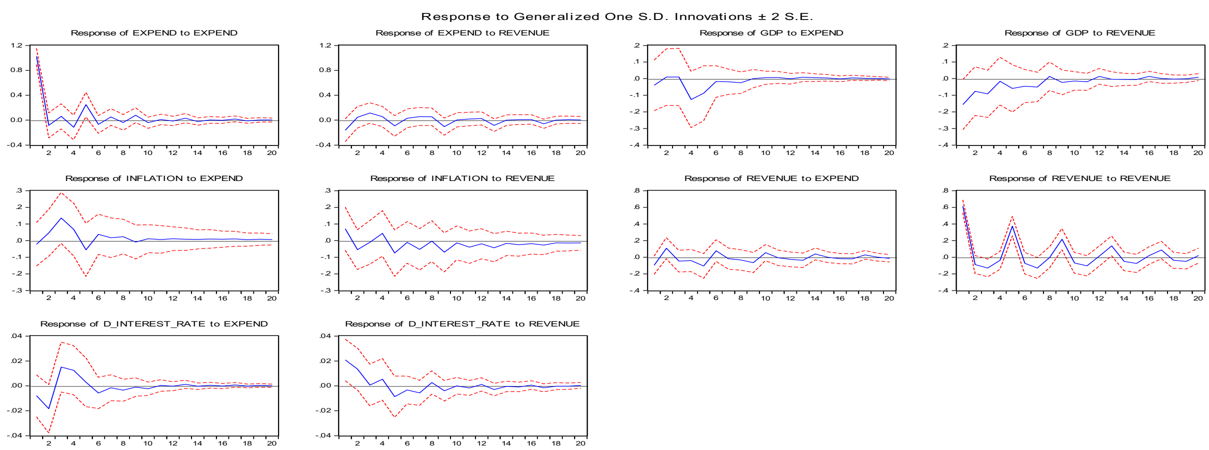
4.2.4 BASELINE EVENT STUDY IDENTIFICATION

4.2.4.1 TABLE 50: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	-0.04	-0.13	-0.00	0.01*(2)
Inflation	-0.02	0.07	0.01	0.13*(3)
Tax	-0.10	-0.04	-0.01	0.08*(8)
Interest rate	-0.01	0.01	-1.73	0.02*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.2.4.2 FIGURE 42: TAX AND EXPENDITURE SHOCKS IMPULSE RESPONSE GRAPHS



4.2.4.3 *INFERENCE*

Output increases in response to a military build-up where government purchases increases. This increase is short-lived output return to the steady state and remains there for the remainder of the forecast horizon.

4.2.5 AUGMENTED EVENT STUDY IDENTIFICATION

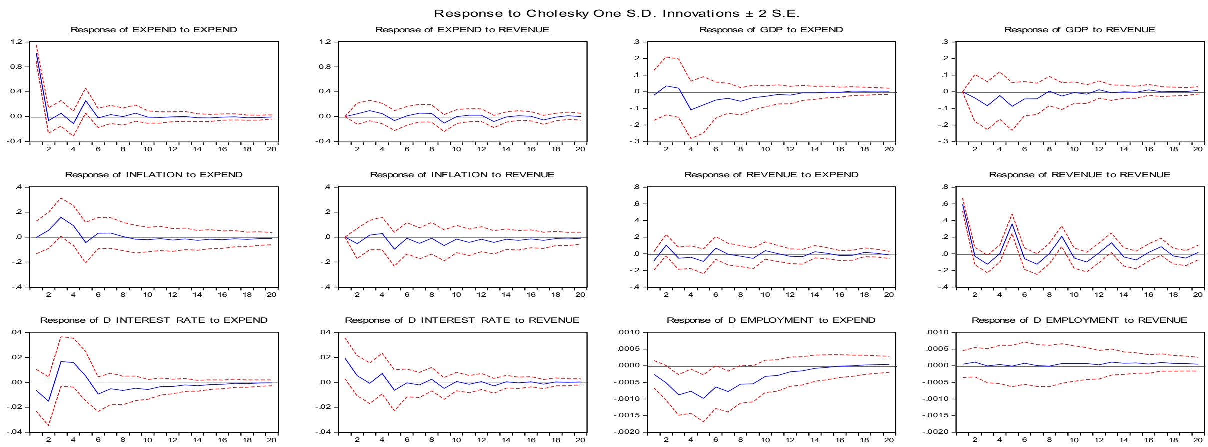
4.2.6 EMPLOYMENT

4.2.6.1 TABLE 51: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Employment	-0.00	-0.00	0.00	0.00*(15)
GDP	-0.02	-0.11	0.00	0.04*(2)
Inflation	-0.00	0.10	-0.01	0.20*(3)
Tax	-0.09	-0.04	-0.02	0.10*(2)
Interest rate	-0.01	0.02*	-0.00	0.02*(4)

*() indicate peak multiplier and quarter of peak multiplier respectively

4.2.6.2 FIGURE 43: EXPENDITURE AND TAX IMPULSE RESPONSE GRAPHS



4.2.6.3 INFERENCE

Employment falls but rises significantly to go slightly above the steady state with a peak multiplier of 0.00 at 15 quarters after an expenditure shock resulting from a military build-up.

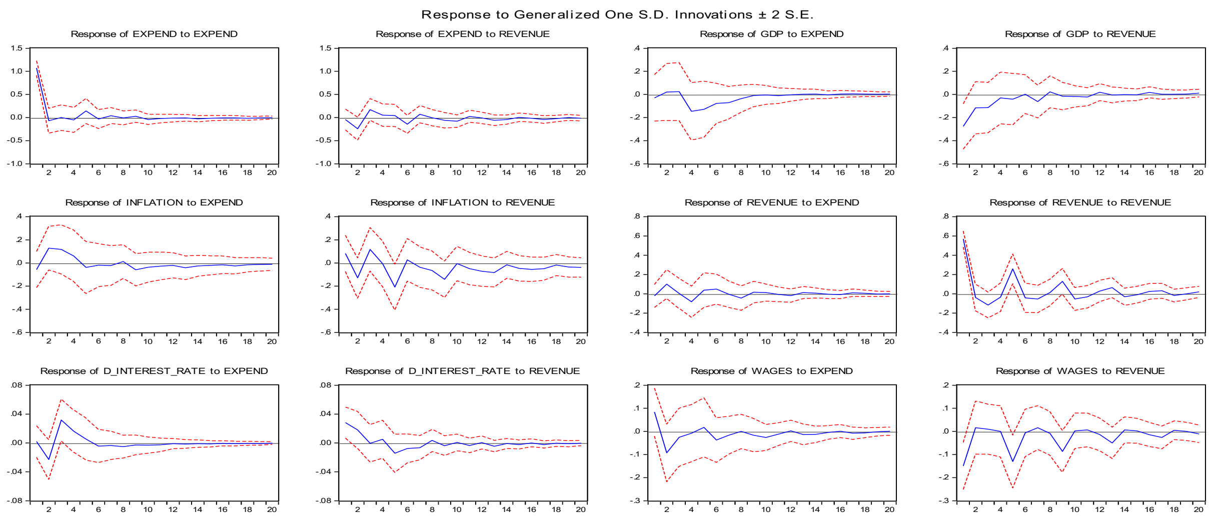
4.2.7 WAGES

4.2.7.1 TABLE 52: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	0.08	-0.01	0.00	0.02*(5)
GDP	-0.03	-0.15	0.00	0.02*(2)
Inflation	-0.10	0.10	-0.01	0.12*(3)
Revenue	-0.02	-0.10	-0.00	0.10*(2)
Interest rate	0.00	0.02	-0.00	0.03*(3)

*() indicate peak multiplier and quarter of peak multiplier respectively.

4.2.7.2 FIGURE 44: IMPULSE RESPONSE GRAPHS



4.2.7.3 *INFERENCE*

Wages rise upon impact of an expenditure shock resulting from a military build-up. It however falls below the steady state in the second quarter but returns and remains at the steady afterwards for the remainder of the forecast horizon.

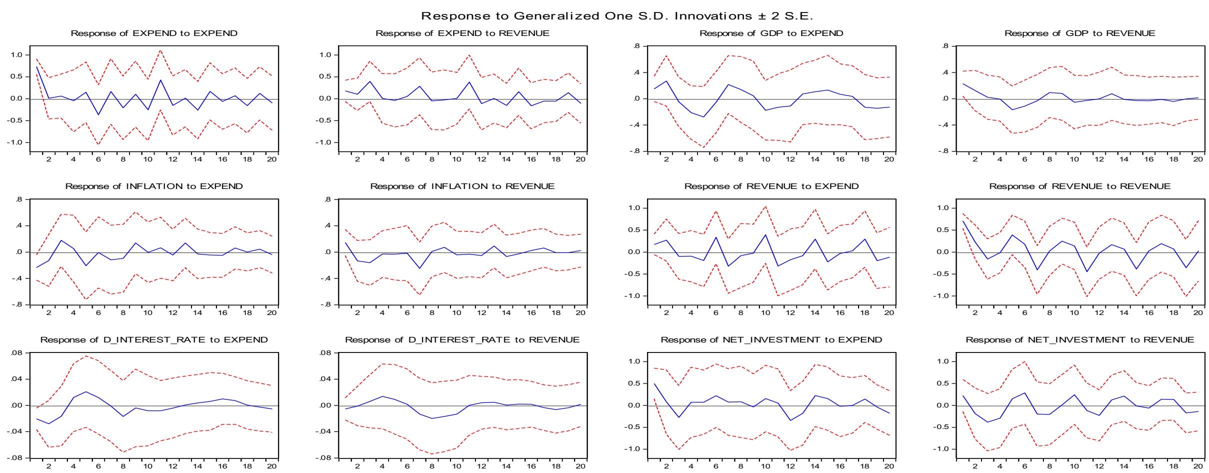
4.2.8 NET INVESTMENT

4.2.8.1 TABLE 53: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Net investment	0.50	0.07	-0.18	0.20*(14)
GDP	0.15	-0.21	-0.13	0.30*(7)
Inflation	-0.23	0.05	-0.04	0.20*(3)
Revenue	0.20	-0.09	-0.12	0.34*(6)
Interest rate	-0.20	0.01	-0.01	0.02*(5)

*() indicates peak multiplier and quarter of peak multiplier respectively.

4.2.8.2 FIGURE 45: IMPULSE RESPONSE GRAPHS



4.2.8.3 INFERENCE

Net investment rises upon impact of an expenditure shock resulting from a military build-up. This finding is consistent with the findings of the recursive and Blanchard Perroti identification.

4.2.9 TESTS FOR STRUCTURAL BREAKS

4.2.9.1 TABLE 54: TESTS FOR STRUCTURAL BREAK -30% TRIMMING

Wald Statistic	Value	Probability
Sup	16.16	0.06
Mean	7.30	0.10
Exp	4.95	0.10

Probabilities calculated using Hansen (1997) method.

4.2.9.2 INFERENCE

From table 54, it can be seen that there are structural breaks in the data which may have affected the coefficients gained.

4.3.0 SUMMARY OF RESULTS FOR UNITED KINGDOM

Output, employment, wages and net investment all increase in response to a unit rise in government purchases and social transfers. This suggests strongly that UK economic policy makers should perhaps consider expansionary fiscal policy including increasing the size of automatic stabilisers to deal with the current low growth and disinflationary environment.

CHAPTER 5

5.1 THIRD PAPER

5.2 EFFECT OF FISCAL POLICY SHOCKS IN GERMANY

5.3 DATA

Time series used in the third paper which looks at effect fiscal policy shocks in Germany spans the period 1970Q1 to 2014Q4 giving η = 180 observations. The variables of interest are Gross Domestic Product, *GDP,* GDP Deflator, '*Inflation'*, Total Government Spending, *'Expend'*, Investment *'Investment'*, Short Term Interest Rates, '*Interest rates*', Tax Revenue, '*Tax'* and Average Wages, '*Wage*'. The estimation is not restricted to 2007Q4 as the great recession was not prolonged in Germany although it has not grown much in the aftermath of the great recession partly due to cuts in public expenditure. With the exception of the series of interest rate, all series satisfied stationary properties but interest rate achieved stationarity after first differencing and first differenced data is used in the estimations. Unless otherwise stated, the data used is in the growth rates.

5.3.1 PRE-ESTIMATION DATA PREPARATION

5.3.2 LAG LENGTH SELECTION

Akaike Information, Schwarrz and Hannan Quinn information criteria pointed to a lag of 1 but the residuals were found to be autocorrelated. Adding to the lags ensured that there was no serial correlation and the baseline vector autoregression is well specified. I therefore chose 4 lags.

5.4 ECONOMETRIC SPECIFICATION

5.5 BENCHMARK REDUCED FORM VECTOR AUTOREGRESSION

Consistent with Caldara and Kamps (2008), the standard or reduced form[33] model of VAR collecting the endogenous variables in the *k*- dimensional vector X_t can be expressed as

$$X_t = \mu_o + \mu_1 t + A(L)X_{t-1} + u_t, \tag{1}$$

where μ_o is a constant, t is a linear time trend, $A(L)$ is a 4th order lag polynomial and u_t is a *k*- dimensional vector of reduced form disturbances where $E[u_t] = 0$, $E[u_t u'_t] = \sum_u$ and $E[u_t u'_s] = 0$, for $s \neq t$.

The disturbances in the reduced form vector autoregression model will be correlated thus it is important to transform the reduced form model into a structural model[34]. Thus pre-multiplying the above equation by the $(\kappa\chi\kappa)$ matrix A_0 gives the structural form

$$A_0 X_t = A_0\mu_o + A_0\mu_1 t + A_0\, A(L)X_{t-1} + Be_t \tag{2}$$

[33] Equation 1 is in reduced form because all right hand side variables are lagged or predetermined. The instantaneous relationship among the variables are summarised and contained in the variance-covariance matrix and this is not enough if one wants to use the results of a VAR for economic policy prescription and analyses.

[34] Structural VAR models have contemporaneous variables that appear as independent or explanatory variables. This is valid description of the data generation process.

where $Be_t = A_0\mu_t$ describes the relationship between the structural disturbances e_t and the reduced form disturbances u_t. In equation 2, it is assumed that the structural disturbances e_t are uncorrelated with each other i.e. the variance-covariance matrix of the structural disturbances $\sum_e$ is diagonal. The matrix A_0 describes the contemporaneous relationships among the variables collected in the vector X_t[35]. Specifically, in the matrix, X_{1t} will denote variables that do not respond at the same time (contemporaneous) with the onset of the fiscal policy shock and X_{2t} will denote variables that respond at the same time to the fiscal policy shock and another subset of variable g_t (for example) which is the fiscal policy shock itself. Without restrictions A_0 and B, the structural model is not identified. on Denoting the the variables included in this research as Z_t , the vector X_t can be partitioned as

$$Z_t = \begin{bmatrix} X_{1t} \\ g_t \\ X_{2t} \end{bmatrix}$$

Where the top represents slow moving variables and the bottom represents fast moving variables such as the immediate response of the stock market to news of extra government purchases from the private sector.

5.6 RECURSIVE IDENTIFICATION

In the recursive identification scheme, B is restricted to a k- dimensional identity matrix while A_0 is restricted to a lower triangular matrix with unit diagonal which implies the decomposition of the variance-covariance matrix $\sum_u = A_0^{-1}\sum_e(A_0^{-1})'$ and is taken from the Cholesky decomposition $\sum_u = PP'$ by defining a diagonal matrix D that has the same main diagonal as P and by specifying $A_0^{-1} = PD^{-1}$ and $\sum_e =$

[35] See LÜTKEPOHL, H. 2005. *New introduction to multiple time series analysis*, Springer Science & Business Media. for further explanation of the AB model

DD^1. This means that the elements on the main diagonal of D and P are equal to the standard deviation of the respective structural shock.

The recursive identification also requires contemporaneous assumptions due to that fact there are '*k*' possible orderings and changing the order affects the result. Thus the order is government expenditure, output, inflation, tax revenue and interest rate respectively in the baseline vector autoregression equation. The sequence is based on theoretical assumptions that movements in government expenditure unlike movement in government revenue are largely unrelated to the real business cycle. This implies that output and inflation are ordered before taxes as the aforementioned affects taxes. Interest rates are then ordered last and ordering interest rate last is then justified on the grounds of a central bank's stackelberg reaction function where fiscal authority is the stackelberg leader[36] meaning that interest rate is set as a function of output gap and inflation. Ordering the variables in this manner helps the benchmark vector autoregression equation to capture the effect of automatic stabilisers.

The variables are ordered as *expend* → *gdp*, → *inflation*, → *revenue*, → *interest_rate* meaning that the baseline Vector Autoregression can be written in notation form as

$$expend_t = \boldsymbol{\alpha} + \sum_{i=1}^{4} \boldsymbol{\Phi}_i\, expend_{t-1} + \sum_{i=1}^{4} \beta_i\, gdp_{t-1} + \sum_{i=1}^{4} \boldsymbol{\lambda}_i\, inflation_{t-1} + \sum_{i=1}^{4} \boldsymbol{\delta}_i\, revenue_{t-1} + \sum_{i=1}^{4} \boldsymbol{\gamma}_i\, interest\_rate_{t-1} \qquad (3)$$

the remaining variables are added to the baseline Vector autoregression one after the other to obtain an 'augmented' VAR model that provide estimates for the effect of

36 See KIRSANOVA, T., STEHN, S. J. & VINES, D. 2005. The Interactions between Fiscal Policy and Monetary Policy. *Oxford Review of Economic Policy,* 21**,** 532-564. for a full explanation of the stackelberg reaction function between a fiscal authority and monetary authority.

fiscal policy shocks on output, private consumption, net investment, hours worked, households net worth. The relationship between the reduced form disturbances u_t and the structural form disturbances e_t then takes the form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha yg & 1 & 0 & 0 & 0 \\ \alpha\pi g & \alpha\pi y & 1 & 0 & 0 \\ \alpha\tau g & \alpha\tau y & \alpha\tau\pi & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}$$

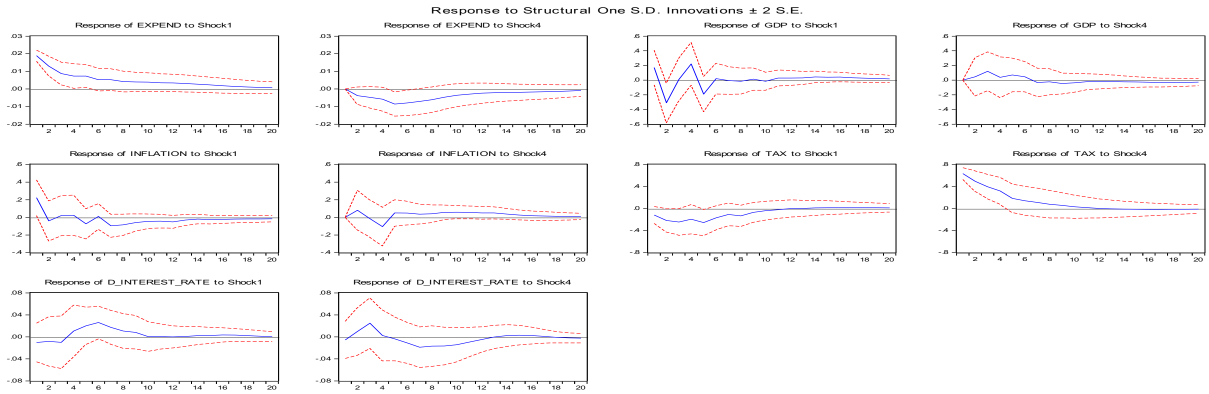
5.7 RESULTS FOR BASELINE SVAR

5.7.1 TABLE 55: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.17	0.22*	0.02	0.22*
Inflation	0.22*	0.02	-0.02	0.22*
Tax	-0.12	-0.20	0.01	0.00*(13)
Interest rate	-0.01	0.01	0.00	0.03*(6)

*() indicate peak multiplier and quarter of peak multiplier

5.7.2 FIGURE 46: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



5.7.3 TABLE 56: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.00	0.04	-0.03	0.12*(3)
Inflation	0.00	-0.12	0.01	0.06*(9)
Expenditure	0.00*	-0.01	-0.00	0.00*
Interest rate	- 0.01	0.00	-0.00	0.02*(3)

*() indicates peak multiplier and quarter of peak multiplier

5.7.4 INFERENCE

Output responds positively to expansionary fiscal policy on impact of the shock but falls below the steady state in the second quarter, falls below the steady state again in the third quarter and moves to lie above the steady state for the remainder of the forecast horizon. This suggests a strong positive effect of extra government purchases on output. Inflation also responds positively upon impact of the expenditure shock but falls and remains below the steady state after 6 quarters. This finding is consistent with the those of the USA and UK using the recursive identification scheme.

5.8 AUGMENTED RECURSIVE IDENTIFICATION

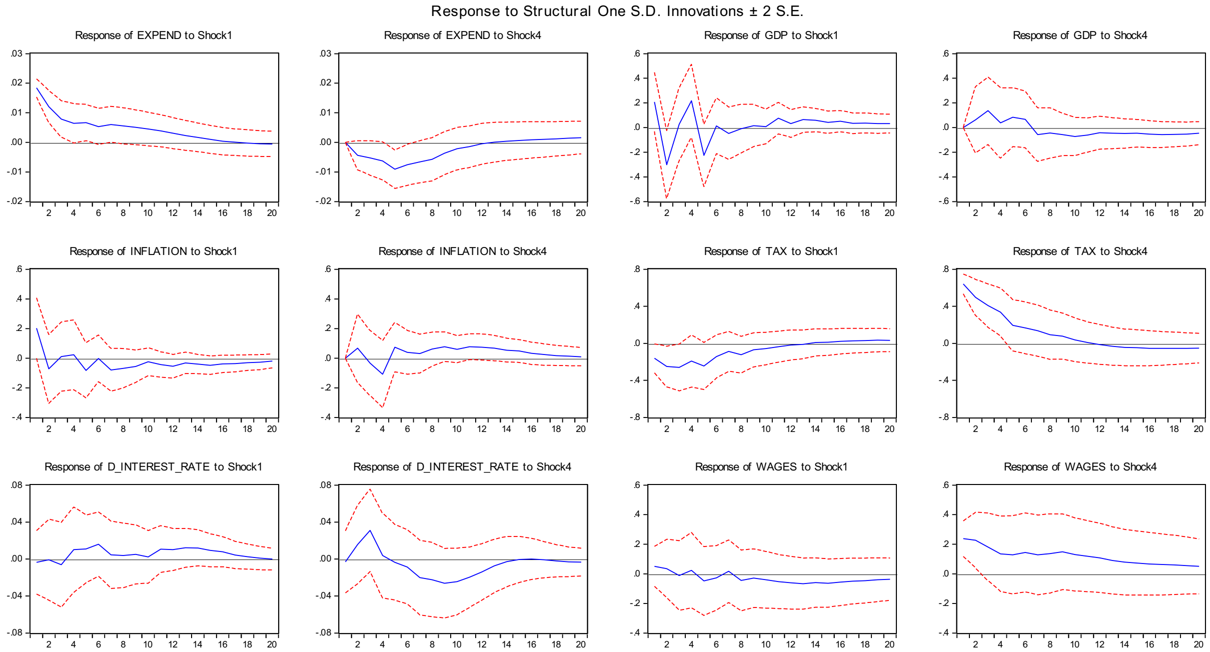
5.9 WAGES

5.9.1 TABLE 57: EXPENDITURE MULTIPLIERS

Variables	Impact quarter	First year	Five years	Peak multiplier
Wages	0.05*	0.02	-0.04	0.05*
GDP	0.21	0.22*	-0.05	0.22*
Inflation	0.20*	0.02	-0.02	0.20*
Tax	-0.16	-0.19	0.03*	0.03*
Interest rate	-0.00	0.01*	-8.00	0.01*

*() indicate peak multiplier and quarter of peak multiplier

5.9.2 FIGURE 47: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



5.9.3 TABLE 58: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wage	0.24*	0.12	0.05	0.24*
GDP	0.00	0.04	-0.05	0.14*(3)
Inflation	0.00	-0.19	0.01	0.10*(2)
Expenditure	0.00	-0.01	0.00	3.37*(13)
Interest rate	0.00	0.00	-0.00	0.03*(3)

*() indicate peak multiplier and quarter of peak multiplier respectively.

5.9.4 INFERENCE

Wages respond positively to extra government purchases but falls below the steady state after 5 quarters and remains there for the remainder of the forecast horizon. Wages also increase in response to a unit rise in overall taxes. The rise in wages could be due to workers and trade unions demanding higher wage as taxes on consumables rise.

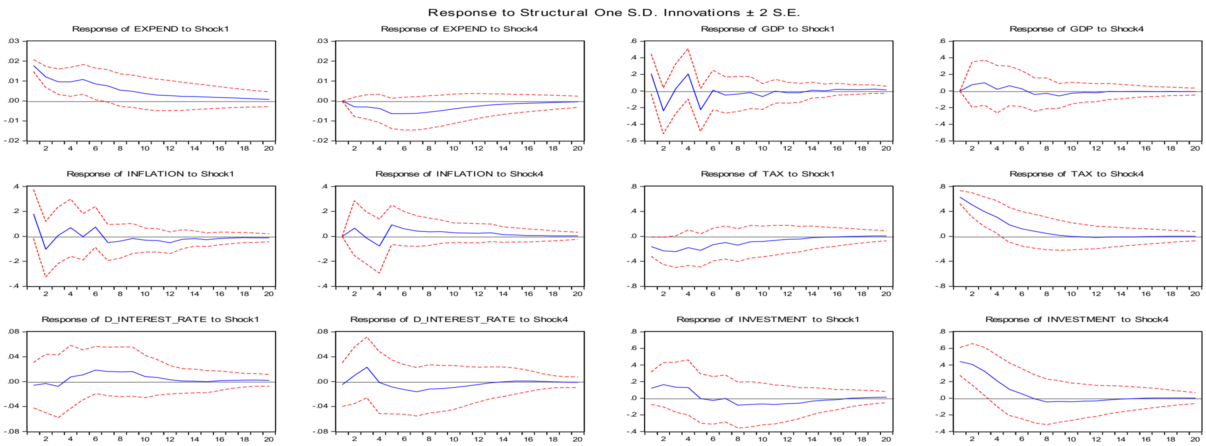
5.1.0 INVESTMENT

5.1.0.1 TABLE 59: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Investment	0.11	0.13	0.01	0.16*(2)
GDP	0.21*	0.21*	0.01	0.21*
Inflation	0.20*	0.07	-0.01	0.20*
Tax	-0.20	-0.20	0.01*	0.01*
Interest rate	-0.01	0.01	0.00	0.02*(6)

*() indicate multiplier and peak multiplier respectively.

5.1.0.2 FIGURE 48: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



5.1.0.3 TABLE 60: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Investment	0.44*	0.21	0.00	0.44*
GDP	1.40*	0.02	-0.01	1.40*
Inflation	1.40*	-0.10	0.04	1.40*
Interest rate	0.63*	0.31	0.00	0.63*
Expenditure	0.00*	-0.00	-0.00	0.00*

*() indicate peak multiplier and quarter of peak multiplier respectively.

5.1.0.4 INFERENCE

Investment responds positively to a 1% rise in government expenditure but this rise falls below the steady state after 2 years as the effect of the shock wears off. Business investment also respond positively to a rise in taxes. This could be possible if the tax increment is on consumption products and not on business.

5.1.1 BLANCHARD AND PERROTI IDENTIFICATION.

Under the Blanchard and Perroti identification scheme used in estimating fiscal policy shocks, institutional information on transfer, tax systems and the timing of tax collections are used. The institutional information is then used to identify the automatic response of taxes and government spending to fiscal policy.

There are two steps involved wherein the first step involves using institutional information to estimate cyclically adjusted taxes and government expenditure. The second step then involves estimating fiscal policy shocks. It is noteworthy that Blanchard and Perroti (2000) used a three variable baseline equation while Perrotti (2005) used a five variable baseline equation. For the purpose of standardisation and being able to compare estimates of the different identification approaches used in this research, I chose a five variable baseline equation.

Using a five variable for the baseline equation, the relationship between the reduced form disturbances u_t and structural disturbances e_t is given as

$$u_t^g = \alpha_{gy} u_t^y + \alpha_{g\pi} u_t^{\pi} + \alpha_{gr} u_t^r + \beta_{g\tau} e_t^{\tau} + e_t^g \quad (4)$$

$$u_t^{\tau} = \alpha_{\tau y} u_t^y + \alpha_{\tau\pi} u_t^{\pi} + \alpha_{\tau r} u_t^r + \beta_{\tau g} e_t^{\tau} + e_t^{\tau} \quad (5)$$

$$u_t^y = \alpha_{yg} u_t^g + \alpha_{yr} u_t^{\tau} + e_t^y \quad (6)$$

$$u_t^{\pi} = \alpha_{\pi g} u_t^g + \alpha_{\pi y} u_t^y + \alpha_{\pi r} u_t^r + e_t^{\pi} \quad (7)$$

$$u_t^r = \alpha_{rg} u_t^r + \alpha_{ry} u_t^y + \alpha_{r\pi} u_t^{\pi} + \alpha_{rr} u_t^{\tau} + e_t^r \quad (8)$$

equations 4 to 8 is in reduced form thus not identified. To achieve identification Perroti (2005) regresses individual revenue items on their tax base obtaining an aggregate value for the elasticity of output to revenue α_{ry} = 1.85, inflation to revenue $\alpha_{\tau\pi}$ = 1.25, Perroti sets output elasticity to government spending α_{gy} to 0 as data used is net of total government transfers. That said, the government expenditure used in this research is inclusive of transfers so I set the elasticity to 1[37] as discussed in Arpaia & Turrini (2008). Consistent with Perroti (2005), inflation elasticity to government spending $\alpha_{g\pi}$ is set to -0.5 while interest rate elasticities to government spending α_{gi} and taxes $\alpha_{\tau i}$ are both set to zero. The parameter $\beta_{g\tau}$ is set to 0 meaning that decisions on government spending are taken before those on government revenue. When these restrictions are imposed on the parameters then the relationship between the reduced form and structural disturbances is written as

[37] ARPAIA, A. & TURRINI, A. 2008. Government expenditure and economic growth in the EU: long-run tendencies and short-term adjustment. *European Union Economic and Financial Affairs Economic Papers,* 300. This paper shows that over a sample of 15 EU countries over 1970-2003, there is a long run elasticity of output to cyclically adjusted primary government expenditure that is close to unity.

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ \alpha yg & 1 & 0 & \alpha y\tau & 0 \\ \alpha\pi g & \alpha\pi y & 1 & \alpha\pi\tau & 0 \\ 1 & 1.85 & 1.25 & 1 & 0 \\ \alpha rg & \alpha ry & \alpha r\pi & \alpha r\tau & 1 \end{bmatrix} \begin{bmatrix} \mu_t g \\ \mu_t y \\ \mu_t \pi \\ \mu_t \tau \\ \mu_t r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{g\tau} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t g \\ e_t y \\ e_t \pi \\ e_t \tau \\ e_t r \end{bmatrix}$$

5.1.2 RESULTS

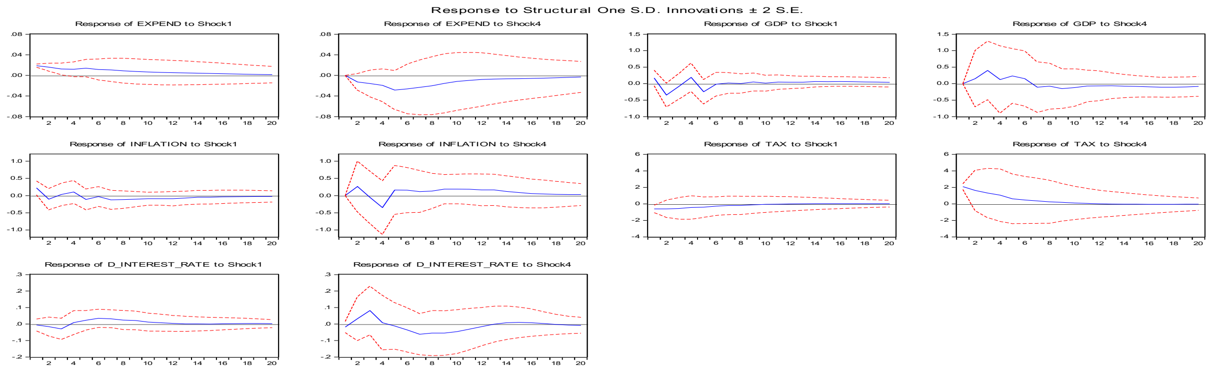
5.1.3 BASELINE BLANCHARD AND PERROTI IDENTIFICATION

5.1.3.1 TABLE 61: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	0.20*	0.20	0.04	0.20*
Inflation	0.22*	0.11	-0.02	0.22*
Tax	-0.61	-0.44	0.02	0.03*(15)
Interest rate	-0.01	0.01	0.00	0.03*(3)

*() indicates peak multiplier and quarter of peak multiplier respectively

5.1.3.2 FIGURE 49: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



5.1.3.3 TABLE 62: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
GDP	-5.80	0.12	-0.10	0.15*(2)
Inflation	-2.90	-0.35	0.03	0.30*(2)
Interest rate	-0.02	0.01	-0.01	0.10*(3)
Expenditure	0.00*	-0.02	-0.02	0.00*

*() indicate peak multiplier and quarter of peak multiplier

5.1.3.4 Inference

Output responds positively to an expenditure and remains above the steady state for much of the forecast horizon.

5.1.4 AUGMENTED BLANCHARD PERTOI IDENTIFICATION

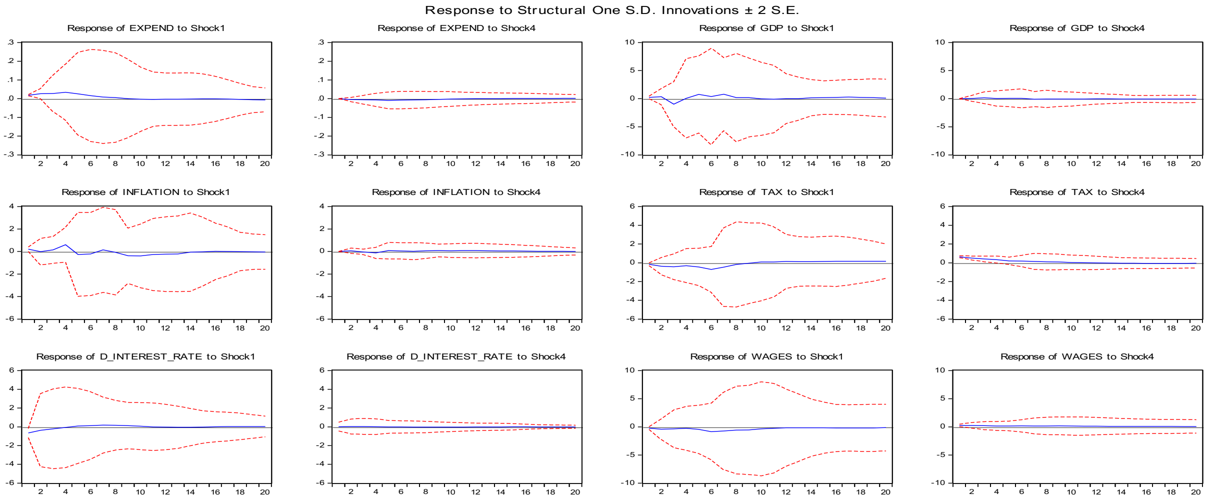
5.1.5 WAGES

5.1.5.1 TABLE 63: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	-0.22	-0.30	-0.15	-0.20*(12)
GDP	0.21	0.10	0.10	0.80*(5)
Inflation	0.20*	0.60	-0.04	0.20*
Tax	-0.16	-0.30	0.20*	0.20*
Interest rate	-0.70	-0.06	0.03*	0.03*

*() indicates peak multiplier and quarter of peak multiplier respectively.

5.1.5.2 FIGURE 50: TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS



5.1.5.3 TABLE 64: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Wages	0.25*	0.14	0.05	0.25*
GDP	1.0	0.04	-0.05	1.0*(5)
Inflation	0.00	-0.12	0.00	0.10*(5)
Expenditure	0.01	-0.00	0.01	0.01*(7)
Interest rate	0.02	0.00	-0.00	0.02*

*() indicate peak multiplier and quarter of peak multiplier respectively

5.1.5.4 Inference

Wages respond negatively albeit not large to a unit rise in extra government expenditure. This could be due to structural breaks that affect the co-efficient of the parameters. However formal stability tests indicated that there was no structural change in the data generation process.

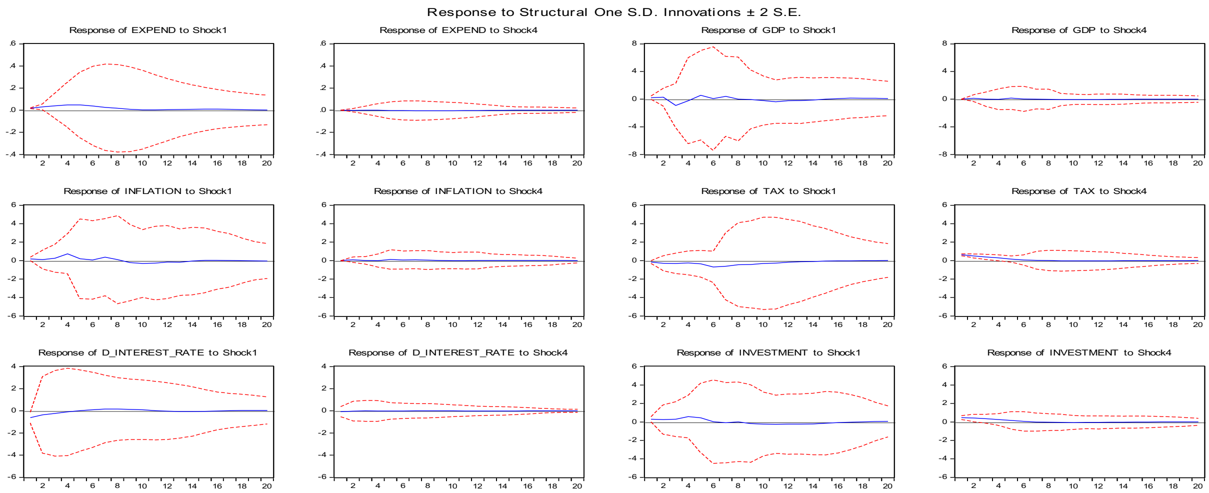
5.1.6 INVESTMENT

5.1.6.1 TABLE 65: EXPENDITURE MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Investment	0.30	0.60*	0.06	0.60*(4)
GDP	0.20	-0.22	0.08*	1.00*(5)
Inflation	0.01	-0.00	-0.00	1.00*(5)
Interest rate	-0.60	-0.09	0.03	0.03*(5)
Tax	-0.17	-0.30	0.00	0.00*(13)

*() indicates peak multiplier and quarter of peak multiplier respectively.

5.1.6.2 FIGURE 51: TAX AND EXPENDITURE IMPULSE RESPONSES



5.1.6.3 TABLE 66: TAX MULTIPLIERS

Variable	Impact quarter	First year	Five years	Peak multiplier
Investment	0.50	0.30	0.01	0.20*(5)
GDP	0.00	-0.03	0.01	0.15*(5)
Inflation	0.00	-0.00	-0.00	0.11*(5)
Expenditure	0.00	0.00	-0.00	0.01*(3)
Interest rate	-0.07	-0.01	0.00	0.01*(5)

*() indicates peak multiplier and quarter of peak multiplier respectively

5.1.6.4 INFERENCE

Investment rises in response to a unit rise in extra government purchases while a tax rise affects business investment slightly. These results are not significant. That said the loss of significance could be due to loss of information due to the pre-estimation data preparations. In fact, when the levels of data was used for the USA for example, the impulse responses appear to have the same shape even though the shape of the impulse responses showed a significant effect.

5.1.7 TEST FOR STRUCTURAL BREAK

5.1.7.1 TABLE 67: TESTS FOR STRUCTURAL CHANGE -15% TRIMMING

Wald Statistic	Value	Probability
Sup	126.35	0.00
Exp	60.32	0.00
Mean	65.23	0.00

Probabilities are from Hansen (1997) *p* values.

5.1.8 SUMMARY OF RESULTS FOR GERMANY

Consistent with the results gained in this research for United states of America and United Kingdom, extra government purchases on the whole increases output, business investment and wages. A tax rise provides a mixed bag of results.

In addition, the event study identification was not carried out for Germany as Germany has not been to war anytime in the sample period.

CHAPTER 6

6.1 DISCUSSION

This research studies the effect of fiscal policy shocks in three main advanced economies: United States of America, United Kingdom and Germany. I used the three main econometric approaches. Specifically, these are the Recursive, Blanchard and Perroti and Event Study identifications. As a contribution to the academic literature on fiscal policy, I used a novel approach to estimate the effect of extra government purchases on key macroeconomic variables during a recession. Specifically, I used the insight from the event study approach by specifying official periods of US recession as given by National Bureau of Economic Research and then treating these periods as endogenous events by incorporating them in the structural vector autoregression equation as a dummy variable: there appeared to be no marked difference in the size of the fiscal multipliers in a recession[38].

Another original contribution made by this research to the academic literature on fiscal policy shock is studying the impact of automatic stabilisers on key macroeconomic variables. This is achieved by substituting total expenditure with net government transfers in the structural vector autoregression baseline equation. This produced interesting results: automatic stabilisers improved the path of inflation and contributed significantly to output suggesting that in the current low inflation-low growth economy perhaps economic policy makers should look at increasing unemployment insurance and Medicaid for example rather than cutting those benefits.

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[38] Ramey and Zubairy (2014) using Jorda's local projection method did not find any difference in the size of the fiscal multipliers in a recession or expansion but research such as Auerbach and Gorodnichenko (2012) in using regime switching models found fiscal multipliers in a recession was higher than in expansions. The former provides a critique of the latter which is also discussed in the literature review section (Chapter 2) of this thesis.

In general, the main results are that irrespective of the econometric approach used or the sample of data employed, extra government purchases had a significant positive effect on economic activity. Specifically, economic output rose in response to a unit rise in government total expenditure albeit muted in some circumstances suggesting that the size and length of the shock matters in achieving significant improvements in economic activity.

Private consumption and business investment responded positively to attempts by central governments to reach full employment of resources both human and capital. This was irrespective of the identification employed. These findings provide counterarguments to the 'crowding out' hypothesis that has often been used in persuading market oriented central governments from enacting fiscal policy to achieve full employment.

Wages and the wealth of households increase in response to increment in government expenditure. It is noteworthy that wages fell after a unit rise in government expenditure but this fall was slightly below the steady state equilibrium indicating that perhaps large and sustained increases in government expenditure could lift wages up. For the United States and United Kingdom, the wealth of households increased upon a unit rise in government expenditure. This finding is interesting in terms of its relevance to the economic situation in many advanced economies. Specifically, the great mass of people is concerned about rising levels of poverty and inequality partly due to fiscal consolidation and partly due to the fact that efforts to deal with the fall-out from the great recession has centred on the financial sector of the economy that only benefits financiers and bond-holders and not the real economy that benefits the great mass of people.

For all three countries studied in this research, the effect of automatic stabilisers on output was very significant. Automatic stabilisers also had a significant and positive effect on the path of inflation. Specifically, it contributed to a rise in inflation. These findings also have economic policy implications for the USA, UK and Germany as there is currently, a real threat of widespread deflation due to quantitative easing and low interest rate losing their effectiveness on the real economy. In addition, consistent with existing research and the finding in this research, automatic stabilisers improved the path of output suggesting that benefits paid to individuals and households such as unemployment insurance, jobseekers allowance and housing benefit does not detriment the economy of either the USA, UK or Germany and perhaps could be an antidote to the 'disinflation-deflation' environment that persists in many advanced economies.

6.2 ARGUMENTS AGAINST FISCAL POLICY

One of the main arguments for fiscal consolidation in the aftermath of the great recession was that central governments had engaged in fiscal profligacy. Spain for example was running a surplus prior to the great recession but engaged in massive public sector spending cuts in response to the great recession deepening and prolonging the recession in the process.

Most importantly for the aims of this research, Germany was running something close to a balanced budget prior to the recession but opted for fiscal consolidation. And the deficit in the UK budget was year on year 16% higher in October 2015 amid very weak economic growth figures while it was revealed that public debts has actually risen despite fiscal consolidation. Not surprisingly, the budget deficit in the USA is a paltry 3% of GDP from a high of 9.8% in 2009 (Federal Reserve Bank of St. Louis and US., 2016) and if arguments against expansionary fiscal policy were right then UK should have a reduced budget deficit while the US deficits grow from the effect of American Recovery and Reinvestment Act.

What is undisputed though is that the great recession was caused by the financial sector in advanced economies notably USA where financiers engaged in fraud and took massive risks with what at times appeared to be public money. Thus the monetary policy response can best be termed as '*private sector gain, public sector pain*' for a crisis that was caused by the private sector with the exception of Greece.

Moreover, theoretical hypotheses against expansionary fiscal policy such as 'crowding out' was not supported by the findings of this research. Specifically, private consumption and business investment all increased in response to extra government purchases and this was irrespective of the stage of the business cycle. Strong adherents of the crowding out hypotheses are normally from the private sector and one of their motivations could be to fight-off attempts by the public sector to reach full employment.[39]However, the ultimate aim of economic policy should be about economic welfare for the great mass of people so proponents of expansionary austerity in a recession cannot be deemed well-intentioned not least when the empirical evidence suggest that expansionary fiscal policy aids economic growth and welfare.

6.3 HOW ARE THE ANALYSES/RESULTS DIFFERENT FROM EXISTING LITERATURE

The analyses in this research is different from that of the existing literature in that it separates the government spending shock into two components. Specifically, there is an estimation of effect of fiscal policy shock where the shock is general government expenditure including government investment. This general government expenditure is inclusive of government social benefits. These social benefits acts as an automatic stabiliser in a recession as more people are likely to access welfare programs like unemployment insurance and housing benefits. Therefore, by separating the automatic stabilisers from pure government spending shock, I am able to estimate the effect of a pure government spending shock on economic activity and effect of automatic stabilisers on economic activity. Of course contemporaneous assumption and ordering enables the structural equation to capture the effect of automatic stabilisers. However, the shape of the impulse

[39] KALECKI, M. 1943. POLITICAL ASPECTS OF FULL EMPLOYMENT1. The Political Quarterly, 14, 322-330 treats this topic very well and gives reasons why Captains of Industry are usually the opponents of expansionary fiscal policy.

response observed is affected by automatic stabilisers so separating the two allows for the estimation of their effects.

To be sure that an increase in automatic stabilisers cause GDP and inflation to increase, I carried out tests of Granger causality which produced significant χ -square statistics. These results are significant as there is a real threat of deflation in advanced economies especially USA. It also shows that increase in welfare payments by governments does not detriment the economy and actually can be used as a positive shock to the economy.

Another important note that is central to this research is the choice of variables. Apart from the series on government social benefits, this research estimates the impact of positive government spending shock on key but often ignored macroeconomic variables such as wealth of households. This increases significantly in response to a unit rise in government expenditure with movements in gross domestic product holding predictive content for the rise in households' wealth in USA for example.

The choice of variables in this research helps the understanding of fiscal policy in that together with key macroeconomic variables studied in this research, it underscores the importance of fiscal policy in improving the economic situation of almost every economic agent i.e. individuals, households, firms and government accounts. This is important especially if one considers both the ideological and political opposition to the conduct expansionary fiscal policy by governments. Normally the arguments raised is that extra government purchases increases interest's rates, supplants business investment and crowds out private spending. That said, the findings in this research has refuted all of this and goes further to show that unlike monetary policy, the effects of fiscal policy benefits all economic agents and presents a solution to the low growth-low-inflation environment in advanced economies. Of course a number of the impulse responses were not significant but this is mainly to due to loss of information resulting from the pre-estimation data preparation. Using the levels of data for the USA for example showed the impulse responses have the same trajectory but with a higher significance.

Econometric-wise, this research ensures that the vector autoregressions are well-specified by checking for serial correlation in the residuals. And where residuals are found to serially correlated, lags are added to the variables until there is no serial correlation in the residuals. This approach addresses any potential issues of misspecification.

6.4 OTHER METHODOLOGICAL CONSIDERATIONS

There exist in the literature other identification of fiscal policy shocks such as the sign restrictions approach (Mountford and Uhlig, 2009) and local projection identification (Jordà, 2005) and both have consistently and unequivocally shown that output, employment private consumption and business investment rise in response to extra government purchases. Indeed, a recent application of the local projection method elucidated that local multipliers alone were an inadequate basis for inferring the aggregate effects of extra government purchases (Dupor, 2016). However, the disagreement has centred on the size of the fiscal multiplier in general and the size of the multiplier when the economy is in a recession. This research, in treating periods of recession as endogenous events extended the event study approach and found that the size of the multiplier seemed to be irrespective of the stage of the business cycle.

6.5 ECONOMIC POLICY PRESCRIPTION AND ANALYSES

Empirical and theoretical evidence from the existing literature and that gained in this research shows that fiscal policy works and expands the economy despite the finding in this research that perhaps the size and duration of the fiscal expansion matters. The debate on the size of the fiscal multiplier is not settled either but what is incontrovertible is the effect expansionary fiscal policy has on output and inflation. And this finding is informative for economic policy makers in the United States of America, United Kingdom and Germany even as low growth-low inflation threatens to turn into widespread deflation.

In conclusion, the findings in this research indicate that the effect of extra government purchases with the aim of stimulating the economy is positive for key macroeconomic variables: gross domestic product, inflation, private consumption, wealth of households, wages and business investment. In addition, the findings also highlighted the weakness in the arguments against expansionary fiscal policy including the fact that much of the time, these arguments were motivated more by political economics rather that evidenced-based economic policy making. As a consequence, expansionary fiscal policy is an economic policy worth considering especially when one considers the low growth-low inflation (*see* (Stiglitz, 2016)) environment in many advanced economies including public concern about rising levels of poverty and inequality.

CHAPTER 7

7.1 REFERENCE

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CHAPTER 8

8.1 DATA APPENDIX FOR USA

Federal Reserve Economic Data, Federal Reserve Bank of St Louis, *Effective Federal Funds Rate,* Percent, Quarterly, Not Seasonally Adjusted; *Federal Government Current Tax Receipts*, Percent Change, Quarterly, Seasonally Adjusted Annual Rate; *Gross Domestic Product*: *Implicit Price Deflator*, Percent Change, Quarterly, Seasonally Adjusted; *Real federal government consumption expenditures: Defense consumption expenditures: Gross output of general government: Intermediate goods and services purchased: Services (chain-type quantity index)*, Percent Change, Quarterly, Seasonally Adjusted; *Gross Fixed Capital Formation*, Quarterly; *Households and Non-profit Organizations; Net Worth as a Percentage of Disposable Personal Income*, Percent Change, Quarterly, Not Seasonally Adjusted; *Average Annual Hours Worked by Persons Engaged for United States*, Percent Change, Annual, Not Seasonally Adjusted; *Private Final Consumption Expenditure in United States*, Quarterly, Seasonally Adjusted; *Real Gross Domestic Product*, Percent Change, Quarterly, Seasonally Adjusted Annual Rate.

Bureau of Economic Analysis, *Table 3.12. Government Social Benefits*, Annual, Billions of dollars.

8.2 DATA APPENDIX FOR UK

Office for National Statistics, United Kingdom, National Statistic, *Gross Domestic Product – CP*, Quarterly, Millions of Pounds; *Central Government: Current Expenditure: Total Payable,* Millions, Quarterly, Not Seasonally Adjusted; *GDP Deflator*, Quarterly, Seasonally Adjusted; *Central Government: Total Current Receipts Receivable,* Millions, Quarterly, Not Seasonally Adjusted; *Central Government: Current expenditure: Net Social Benefits payable*, Millions of Pounds, Quarterly, Not Seasonally Adjusted; *Gross Fixed Capital Formation: Business Investment,* Millions of Pounds, Quarterly, Seasonally Adjusted; *Total Employment Rate,* Percent, Annual; *Average Weekly Earnings: Whole Economy Historic,* Levels, Not Seasonally Adjusted.

Bank of England, Quarterly Average of Official Bank Rate, Percent

8.3 DATA APPENDIX FOR GERMANY

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CHAPTER 9

ESTIMATION OUTPUT APPENDIX FOR USA

TESTS FOR STATIONARITY

Null Hypothesis: EXPEND has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.406927	0.0000
Test critical values:	1% level	-3.455193	
	5% level	-2.872370	
	10% level	-2.572615	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPEND)
Method: Least Squares
Date: 04/04/16 Time: 21:15
Sample (adjusted): 1950Q3 2015Q4
Included observations: 262 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPEND(-1)	-0.716652	0.076183	-9.406927	0.0000
D(EXPEND(-1))	-0.063137	0.061384	-1.028557	0.3046
C	1.215049	0.148163	8.200772	0.0000

R-squared	0.385092	Mean dependent var	-0.002297
Adjusted R-squared	0.380344	S.D. dependent var	1.463587
S.E. of regression	1.152110	Akaike info criterion	3.132452
Sum squared resid	343.7858	Schwarz criterion	3.173311
Log likelihood	-407.3512	Hannan-Quinn criter.	3.148874
F-statistic	81.10060	Durbin-Watson stat	2.001235
Prob(F-statistic)	0.000000		

Null Hypothesis: GDP has a unit root

Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.741820	0.0000
Test critical values:	1% level	-3.455193	
	5% level	-2.872370	
	10% level	-2.572615	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 04/04/16 Time: 21:19
Sample (adjusted): 1950Q3 2015Q4
Included observations: 262 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.772169	0.079263	-9.741820	0.0000
D(GDP(-1))	-0.066711	0.061717	-1.080919	0.2807
C	-0.239000	0.059373	-4.025402	0.0001

R-squared	0.415845	Mean dependent var	-0.010931
Adjusted R-squared	0.411334	S.D. dependent var	1.154371
S.E. of regression	0.885686	Akaike info criterion	2.606476
Sum squared resid	203.1698	Schwarz criterion	2.647334
Log likelihood	-338.4483	Hannan-Quinn criter.	2.622898
F-statistic	92.18770	Durbin-Watson stat	2.002208
Prob(F-statistic)	0.000000		

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.741820	0.0000
Test critical values:	1% level	-3.455193	
	5% level	-2.872370	
	10% level	-2.572615	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 04/04/16 Time: 21:19
Sample (adjusted): 1950Q3 2015Q4
Included observations: 262 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.772169	0.079263	-9.741820	0.0000
D(GDP(-1))	-0.066711	0.061717	-1.080919	0.2807
C	-0.239000	0.059373	-4.025402	0.0001

R-squared	0.415845	Mean dependent var	-0.010931
Adjusted R-squared	0.411334	S.D. dependent var	1.154371
S.E. of regression	0.885686	Akaike info criterion	2.606476
Sum squared resid	203.1698	Schwarz criterion	2.647334
Log likelihood	-338.4483	Hannan-Quinn criter.	2.622898
F-statistic	92.18770	Durbin-Watson stat	2.002208
Prob(F-statistic)	0.000000		

Null Hypothesis: HOURS has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.620977	0.0000
Test critical values:	1% level	-3.457286	
	5% level	-2.873289	
	10% level	-2.573106	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HOURS)
Method: Least Squares
Date: 04/04/16 Time: 21:21
Sample (adjusted): 1951Q3 2011Q4
Included observations: 242 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HOURS(-1)	-0.233496	0.041540	-5.620977	0.0000
D(HOURS(-1))	0.116733	0.064240	1.817127	0.0705
C	-0.212783	0.052534	-4.050414	0.0001

R-squared	0.116762	Mean dependent var	-9.61E-05
Adjusted R-squared	0.109371	S.D. dependent var	0.600715
S.E. of regression	0.566914	Akaike info criterion	1.715099
Sum squared resid	76.81243	Schwarz criterion	1.758350
Log likelihood	-204.5270	Hannan-Quinn criter.	1.732522
F-statistic	15.79769	Durbin-Watson stat	2.030864
Prob(F-statistic)	0.000000		

Null Hypothesis: D(INTEREST_RATE) has a unit root
Exogenous: None

Lag Length: 0 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.646797	0.0000
Test critical values:	1% level	-2.574474	
	5% level	-1.942131	
	10% level	-1.615832	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE,2)
Method: Least Squares
Date: 04/04/16 Time: 21:26
Sample (adjusted): 1955Q1 2015Q4
Included observations: 244 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1))	-0.556045	0.057640	-9.646797	0.0000

R-squared	0.276899	Mean dependent var	0.001013
Adjusted R-squared	0.276899	S.D. dependent var	0.207306
S.E. of regression	0.176283	Akaike info criterion	-0.629359
Sum squared resid	7.551418	Schwarz criterion	-0.615026
Log likelihood	77.78180	Hannan-Quinn criter.	-0.623587
Durbin-Watson stat	1.896267		

Null Hypothesis: REVENUE has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.871618	0.0000
Test critical values:	1% level	-3.455289	
	5% level	-2.872413	
	10% level	-2.572638	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REVENUE)
Method: Least Squares
Date: 04/04/16 Time: 21:30
Sample (adjusted): 1950Q3 2015Q3
Included observations: 261 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REVENUE(-1)	-0.777888	0.078800	-9.871618	0.0000
D(REVENUE(-1))	-0.055823	0.061682	-0.905016	0.3663

C	0.510528	0.083378	6.123038	0.0000

R-squared	0.415053	Mean dependent var	-0.010946
Adjusted R-squared	0.410518	S.D. dependent var	1.352600
S.E. of regression	1.038495	Akaike info criterion	2.924850
Sum squared resid	278.2459	Schwarz criterion	2.965822
Log likelihood	-378.6930	Hannan-Quinn criter.	2.941320
F-statistic	91.53279	Durbin-Watson stat	1.993796
Prob(F-statistic)	0.000000		

Null Hypothesis: WEALTH has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.881682	0.0000
Test critical values:	1% level	-3.456093	
	5% level	-2.872765	
	10% level	-2.572826	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WEALTH)
Method: Least Squares
Date: 04/04/16 Time: 21:34
Sample (adjusted): 1952Q3 2015Q3
Included observations: 253 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WEALTH(-1)	-0.837493	0.084752	-9.881682	0.0000
D(WEALTH(-1))	-0.069750	0.063264	-1.102530	0.2713
C	-0.107920	0.067937	-1.588530	0.1134

R-squared	0.451808	Mean dependent var	0.006183
Adjusted R-squared	0.447422	S.D. dependent var	1.433150
S.E. of regression	1.065340	Akaike info criterion	2.976252
Sum squared resid	283.7374	Schwarz criterion	3.018150
Log likelihood	-373.4959	Hannan-Quinn criter.	2.993109
F-statistic	103.0222	Durbin-Watson stat	1.994462
Prob(F-statistic)	0.000000		

Null Hypothesis: D(TRANSFERS) has a unit root
Exogenous: None
Lag Length: 0 (Fixed)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-	5.097563274

		16.0312195418814	228479e-32
Test critical values:	1% level	-2.573955896222506	
	5% level	-1.942059193678831	
	10% level	-1.615878438528205	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TRANSFERS,2)
Method: Least Squares
Date: 04/04/16 Time: 21:33
Sample (adjusted): 1950Q3 2014Q4
Included observations: 258 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TRANSFERS(-1))	-1	0.06237828615518054	16.0312195418814	-1.455628405361255e-40

R-squared	0.5	Mean dependent var	0
Adjusted R-squared	0.5000000000000001	S.D. dependent var	0.07402255315231435
S.E. of regression	0.05234184929474312	Akaike info criterion	-3.058172595958595
Sum squared resid	0.7040949812115555	Schwarz criterion	-3.044401434776729
Log likelihood	395.5042648786588	Hannan-Quinn criter.	-3.052635146003781
Durbin-Watson stat	2		

Null Hypothesis: PRIVATE_CONSUMPTION has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.825053068303145	2.284698381723052e-11
Test critical values:	1% level	-3.457865156985462	

5% level	-2.873543422004348
10% level	-2.573242430637934

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PRIVATE_CONSUMPTION)
Method: Least Squares
Date: 04/04/16 Time: 21:29
Sample (adjusted): 1955Q4 2014Q4
Included observations: 237 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PRIVATE_CONSUMPTION(-1)	-0.6200171284800589	0.07923487841782892	-7.825053068303145	1.741483636539372e-13
D(PRIVATE_CONSUMPTION(-1))	-0.1823745921917638	0.06430165843662822	-2.836234657485562	0.004964805246541566
C	0.2277578511024819	0.05104936391371215	4.461521822043799	1.264596170579882e-05

R-squared	0.3995520943673641	Mean dependent var	-0.002140214219409283
Adjusted R-squared	0.3944200609858886	S.D. dependent var	0.8237121358480038
S.E. of regression	0.641004686142502	Akaike info criterion	1.961017473501199
Sum squared resid	96.14755979165554	Schwarz criterion	2.004916968958606
Log likelihood	-229.3805706098921	Hannan-Quinn criter.	1.978711749894762
F-statistic	77.85453925720338	Durbin-Watson stat	2.082964330613032
Prob(F-statistic)	1.206741137158108e-26		

Null Hypothesis: NET_INVESTMENT has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.636273426969455	6.330700546573605e-11

Test critical values:	1% level	-3.457747321035438
	5% level	-2.873491705286623
	10% level	-2.573214772431566

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NET_INVESTMENT)
Method: Least Squares
Date: 04/04/16 Time: 21:28
Sample (adjusted): 1955Q4 2015Q1
Included observations: 238 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NET_INVESTMENT(-1)	-0.5488124275455195	0.07186914308322799	-7.636273426969455	5.607029134486765e-13
D(NET_INVESTMENT(-1))	-0.1073305829735082	0.06476350580282928	-1.657269501442267	0.09879937197295419
C	0.1875650280965748	0.06359753625789451	2.949249910184878	0.003507108186558465

R-squared	0.3148333498011117	Mean dependent var	-0.004691367084033612
Adjusted R-squared	0.3090021442675041	S.D. dependent var	1.081879982124692
S.E. of regression	0.899326591709282	Akaike info criterion	2.638183936602027
Sum squared resid	190.0652548605269	Schwarz criterion	2.681952054337382
Log likelihood	-310.9438884556413	Hannan-Quinn criter.	2.655823272172984
F-statistic	53.99112550339748	Durbin-Watson stat	1.992855577003094
Prob(F-statistic)	5.082242400452408e-20		

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-	2.770371707

		5.535303258998428	368601e-06
Test critical values:	1% level	-3.455192545387297	
	5% level	-2.872369943633023	
	10% level	-2.572614743835118	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION)
Method: Least Squares
Date: 04/04/16 Time: 21:23
Sample (adjusted): 1950Q3 2015Q4
Included observations: 262 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.2864935643871174	0.05175751914249343	-5.535303258998428	7.608433040060154e-08
D(INFLATION(-1))	-0.2010103983520687	0.06086787931491306	-3.302405153826671	0.001093598962864272
C	-0.1423548286978241	0.04616161943937338	-3.083835238596571	0.002264626399772097

R-squared	0.2112999214743941	Mean dependent var	-0.00211414469465649
Adjusted R-squared	0.2052095733776713	S.D. dependent var	0.699336090289353
S.E. of regression	0.6234652537668311	Akaike info criterion	1.904336901437585
Sum squared resid	100.6756109675257	Schwarz criterion	1.9451958079692
Log likelihood	-246.4681340883236	Hannan-Quinn criter.	1.920758988304798
F-statistic	34.69422734442605	Durbin-Watson stat	2.093372429760095
Prob(F-statistic)	4.467751265703596e-14		

LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria

Endogenous variables: D_TRANSFERS EXPEND GDP HOURS INFLATION INTEREST_RATE NET_INVESTMENT PRIVATE_CONSUMPTION REVENUE WEALTH
Exogenous variables: C
Date: 04/04/16 Time: 22:57
Sample: 1950Q1 2015Q4
Included observations: 219

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2165.384	NA	0.000201	19.86652	20.02128	19.92902
1	-1531.655	1203.796	1.54e-06	14.99228	16.69456*	15.67978*
2	-1422.508	197.3609	1.42e-06	14.90875	18.15855	16.22125
3	-1275.619	252.1945	9.38e-07	14.48053	19.27785	16.41803
4	-1131.253	234.6761*	6.42e-07*	14.07537*	20.42021	16.63786
5	-1066.566	99.24672	9.25e-07	14.39786	22.29022	17.58535
6	-987.9496	113.4368	1.20e-06	14.59315	24.03303	18.40564
7	-912.0708	102.5576	1.64e-06	14.81343	25.80083	19.25092
8	-851.4561	76.39111	2.66e-06	15.17312	27.70804	20.23560

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

TESTS FOR SERIAL CORRELATION IN RESIDUALS

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/05/16 Time: 10:56
Sample (adjusted): 2007Q3 2012Q1
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.086725	1.290315	-0.067213	0.9479
D_DEFICIT(-1)	0.355222	1.380746	0.257268	0.8028
D_TRANSFERS(-1)	8.499953	14.97847	0.567478	0.5843
INFLATION(-1)	-0.345140	0.434457	-0.794416	0.4474
GDP(-1)	-0.485355	0.666543	-0.728167	0.4850
HOURS(-1)	-0.423370	0.919739	-0.460315	0.6562
INTEREST_RATE(-1)	-0.167684	0.463707	-0.361616	0.7260
NET_INVESTMENT(-1)	-0.437755	0.415717	-1.053013	0.3198
PRIVATE_CONSUMPTION(-1)	-0.175472	0.368291	-0.476450	0.6451
WEALTH(-1)	-0.056334	0.285323	-0.197438	0.8479

R-squared	0.366639	Mean dependent var	1.139971
Adjusted R-squared	-0.266722	S.D. dependent var	1.165369
S.E. of regression	1.311608	Akaike info criterion	3.685803
Sum squared resid	15.48285	Schwarz criterion	4.182876
Log likelihood	-25.01513	Hannan-Quinn criter.	3.769927
F-statistic	0.578878	Durbin-Watson stat	1.724397
Prob(F-statistic)	0.786063		

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/05/16 Time: 11:02
Sample (adjusted): 2008Q2 2012Q4
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.355299	0.816260	4.110576	0.0026
D_DEFICIT(-4)	-2.571083	0.873467	-2.943537	0.0164
D_TRANSFERS(-4)	10.56379	9.475459	1.114858	0.2938
INFLATION(-4)	0.704477	0.274840	2.563226	0.0305
GDP(-4)	0.563358	0.421658	1.336052	0.2143
HOURS(-4)	0.692999	0.581832	1.191063	0.2641
INTEREST_RATE(-4)	0.826592	0.293343	2.817830	0.0201
NET_INVESTMENT(-4)	0.576171	0.262984	2.190895	0.0562
PRIVATE_CONSUMPTION(-4)	-0.135281	0.232983	-0.580647	0.5757
WEALTH(-4)	-0.198098	0.180497	-1.097514	0.3009

R-squared	0.777998	Mean dependent var	0.984592
Adjusted R-squared	0.555996	S.D. dependent var	1.245213
S.E. of regression	0.829730	Akaike info criterion	2.769985
Sum squared resid	6.196073	Schwarz criterion	3.267058
Log likelihood	-16.31486	Hannan-Quinn criter.	2.854110
F-statistic	3.504467	Durbin-Watson stat	2.399925
Prob(F-statistic)	0.037861		

RECURSIVE IDENTIFICATION BASELINE VAR

Structural VAR Estimates
Date: 04/06/16 Time: 14:26
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
A =

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	C(8)	1	0
C(4)	C(7)	C(9)	C(10)	1

B =

C(11)	0	0	0	0
0	C(12)	0	0	0
0	0	C(13)	0	0
0	0	0	C(14)	0
0	0	0	0	C(15)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.027548	0.049915	-0.551891	0.5810

C(2)	0.024350	0.027345	0.890453	0.3732
C(3)	0.031187	0.055840	0.558499	0.5765
C(4)	0.007360	0.009561	0.769781	0.4414
C(5)	0.035212	0.035488	0.992218	0.3211
C(6)	-0.262477	0.072497	-3.620508	0.0003
C(7)	-0.010752	0.012741	-0.843901	0.3987
C(8)	-0.194813	0.132146	-1.474226	0.1404
C(9)	-0.056523	0.022713	-2.488525	0.0128
C(10)	0.002188	0.011091	0.197320	0.8436
C(11)	1.137788	0.052150	21.81742	0.0000
C(12)	0.876154	0.040158	21.81742	0.0000
C(13)	0.479681	0.021986	21.81742	0.0000
C(14)	0.977899	0.044822	21.81742	0.0000
C(15)	0.167320	0.007669	21.81742	0.0000

Log likelihood -1082.123

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-0.027548	1.000000	0.000000	0.000000	0.000000
0.024350	0.035212	1.000000	0.000000	0.000000
0.031187	-0.262477	-0.194813	1.000000	0.000000
0.007360	-0.010752	-0.056523	0.002188	1.000000

Estimated B matrix:

1.137788	0.000000	0.000000	0.000000	0.000000
0.000000	0.876154	0.000000	0.000000	0.000000
0.000000	0.000000	0.479681	0.000000	0.000000
0.000000	0.000000	0.000000	0.977899	0.000000
0.000000	0.000000	0.000000	0.000000	0.167320

AUTOMATIC STABILISERS UNDER RECURSIVE INDENTIFICATION

Structural VAR Estimates
Date: 04/08/16 Time: 20:29
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix

A =

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	C(8)	1	0
C(4)	C(7)	C(9)	C(10)	1

B =

C(11)	0	0	0	0
0	C(12)	0	0	0
0	0	C(13)	0	0
0	0	0	C(14)	0
0	0	0	0	C(15)

	Coefficient	Std. Error	z-Statistic	Prob.

C(1)	-0.074514	1.757185	-0.042406	0.9662
C(2)	-3.217115	0.973744	-3.303862	0.0010
C(3)	-0.493380	2.066420	-0.238761	0.8113
C(4)	1.181881	0.345549	3.420297	0.0006
C(5)	0.041102	0.035920	1.144264	0.2525
C(6)	-0.283781	0.074742	-3.796812	0.0001
C(7)	-0.010186	0.012870	-0.791461	0.4287
C(8)	-0.172538	0.134508	-1.282736	0.1996
C(9)	-0.071782	0.022567	-3.180760	0.0015
C(10)	-0.002457	0.010838	-0.226716	0.8206
C(11)	0.031483	0.001443	21.81742	0.0000
C(12)	0.853453	0.039118	21.81742	0.0000
C(13)	0.472939	0.021677	21.81742	0.0000
C(14)	0.981390	0.044982	21.81742	0.0000
C(15)	0.164090	0.007521	21.81742	0.0000

Log likelihood -214.9138

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-0.074514	1.000000	0.000000	0.000000	0.000000
-3.217115	0.041102	1.000000	0.000000	0.000000
-0.493380	-0.283781	-0.172538	1.000000	0.000000
1.181881	-0.010186	-0.071782	-0.002457	1.000000

Estimated B matrix:

0.031483	0.000000	0.000000	0.000000	0.000000
0.000000	0.853453	0.000000	0.000000	0.000000
0.000000	0.000000	0.472939	0.000000	0.000000
0.000000	0.000000	0.000000	0.981390	0.000000
0.000000	0.000000	0.000000	0.000000	0.164090

BLANCHARD AND PERROTI IDENTIFICATION – BASELINE SVAR

Structural VAR Estimates
Date: 04/08/16 Time: 20:29
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
A =

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	C(8)	1	0
C(4)	C(7)	C(9)	C(10)	1

B =

C(11)	0	0	0	0
0	C(12)	0	0	0
0	0	C(13)	0	0
0	0	0	C(14)	0

0	0	0	0	C(15)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.074514	1.757185	-0.042406	0.9662
C(2)	-3.217115	0.973744	-3.303862	0.0010
C(3)	-0.493380	2.066420	-0.238761	0.8113
C(4)	1.181881	0.345549	3.420297	0.0006
C(5)	0.041102	0.035920	1.144264	0.2525
C(6)	-0.283781	0.074742	-3.796812	0.0001
C(7)	-0.010186	0.012870	-0.791461	0.4287
C(8)	-0.172538	0.134508	-1.282736	0.1996
C(9)	-0.071782	0.022567	-3.180760	0.0015
C(10)	-0.002457	0.010838	-0.226716	0.8206
C(11)	0.031483	0.001443	21.81742	0.0000
C(12)	0.853453	0.039118	21.81742	0.0000
C(13)	0.472939	0.021677	21.81742	0.0000
C(14)	0.981390	0.044982	21.81742	0.0000
C(15)	0.164090	0.007521	21.81742	0.0000
Log likelihood	-214.9138			

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-0.074514	1.000000	0.000000	0.000000	0.000000
-3.217115	0.041102	1.000000	0.000000	0.000000
-0.493380	-0.283781	-0.172538	1.000000	0.000000
1.181881	-0.010186	-0.071782	-0.002457	1.000000

Estimated B matrix:

0.031483	0.000000	0.000000	0.000000	0.000000
0.000000	0.853453	0.000000	0.000000	0.000000
0.000000	0.000000	0.472939	0.000000	0.000000
0.000000	0.000000	0.000000	0.981390	0.000000
0.000000	0.000000	0.000000	0.000000	0.164090

AUGMENTED BLANCHARD AND PERROTI – WEALTH

Structural VAR Estimates
Date: 04/10/16 Time: 17:44
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 6 iterations
Structural VAR is over-identified (3 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
A =

1	0	0	0	0	0
C(1)	1	0	0	0	0
C(2)	C(5)	1	0	0	0
C(3)	C(6)	C(8)	1	0	0
1	1.85	1.25	C(10)	1	0
C(4)	C(7)	C(9)	C(11)	C(12)	1

B =

C(13)	0	0	0	0	0
0	C(14)	0	0	0	0

0	0	C(15)	0	0	0
0	0	0	C(16)	0	0
0	0	0	0	C(17)	0
0	0	0	0	0	C(18)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.008038	0.053857	0.149243	0.8814
C(2)	0.036418	0.023427	1.554513	0.1201
C(3)	0.017108	0.061846	0.276619	0.7821
C(4)	0.092444	0.077435	1.193819	0.2325
C(5)	0.050287	0.030015	1.675382	0.0939
C(6)	-0.291152	0.079311	-3.671010	0.0002
C(7)	-0.100298	0.114226	-0.878063	0.3799
C(8)	-0.268471	0.181135	-1.482156	0.1383
C(9)	-0.116921	0.202723	-0.576750	0.5641
C(10)	-0.382999	0.127181	-3.011457	0.0026
C(11)	0.014284	0.076053	0.187822	0.8510
C(12)	0.925317	0.039099	23.66575	0.0000
C(13)	1.125269	0.054908	20.49390	0.0000
C(14)	0.878236	0.042854	20.49390	0.0000
C(15)	0.381996	0.018640	20.49390	0.0000
C(16)	1.002702	0.048927	20.49390	0.0000
C(17)	1.912185	0.093305	20.49390	0.0000
C(18)	1.083452	0.052867	20.49390	0.0000

Log likelihood	-1736.819		
LR test for over-identification:			
Chi-square(3)	1186.395	Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.008038	1.000000	0.000000	0.000000	0.000000	0.000000
0.036418	0.050287	1.000000	0.000000	0.000000	0.000000
0.017108	-0.291152	-0.268471	1.000000	0.000000	0.000000
1.000000	1.850000	1.250000	-0.382999	1.000000	0.000000
0.092444	-0.100298	-0.116921	0.014284	0.925317	1.000000

Estimated B matrix:

1.125269	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.878236	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.381996	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	1.002702	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	1.912185	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	1.083452

AUTOMATIC STABILISERS UNDER BLANCHARD AND PERROTI INDENTIFICATION

Structural VAR Estimates
Date: 04/10/16 Time: 19:46
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 5 iterations
Structural VAR is over-identified (3 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
A =

	1	0	0	0	0
	C(1)	1	0	0	0
	C(2)	C(4)	1	0	0
	1	1.85	1.25	1	0
	C(3)	C(5)	C(6)	C(7)	1
B =					
	C(8)	0	0	0	0
	0	C(9)	0	0	0
	0	0	C(10)	0	0
	0	0	0	C(11)	0
	0	0	0	0	C(12)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.074514	1.757185	-0.042406	0.9662
C(2)	-3.217115	0.973744	-3.303862	0.0010
C(3)	1.181882	0.345543	3.420357	0.0006
C(4)	0.041102	0.035920	1.144264	0.2525
C(5)	-0.010184	0.015508	-0.656663	0.5114
C(6)	-0.071780	0.023330	-3.076716	0.0021
C(7)	-0.002456	0.004964	-0.494844	0.6207
C(8)	0.031483	0.001443	21.81742	0.0000
C(9)	0.853453	0.039118	21.81742	0.0000
C(10)	0.472939	0.021677	21.81742	0.0000
C(11)	2.142718	0.098211	21.81742	0.0000
C(12)	0.164090	0.007521	21.81742	0.0000

Log likelihood	-400.7585		
LR test for over-identification:			
Chi-square(3)	371.6894	Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-0.074514	1.000000	0.000000	0.000000	0.000000
-3.217115	0.041102	1.000000	0.000000	0.000000
1.000000	1.850000	1.250000	1.000000	0.000000
1.181882	-0.010184	-0.071780	-0.002456	1.000000

Estimated B matrix:

0.031483	0.000000	0.000000	0.000000	0.000000
0.000000	0.853453	0.000000	0.000000	0.000000
0.000000	0.000000	0.472939	0.000000	0.000000
0.000000	0.000000	0.000000	2.142718	0.000000
0.000000	0.000000	0.000000	0.000000	0.164090

BASELINE EVENT STUDY IDENTIFICATION

Vector Autoregression Estimates
Date: 04/11/16 Time: 15:54
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	INTEREST_RATE

EXPEND(-1)	0.212582	0.042983	-0.001003	0.007602	-0.008917
	(0.06819)	(0.05256)	(0.02886)	(0.05956)	(0.01018)
	[3.11745]	[0.81785]	[-0.03476]	[0.12764]	[-0.87550]
EXPEND(-2)	0.025052	-0.007589	0.032110	-0.035428	0.005901
	(0.06885)	(0.05306)	(0.02914)	(0.06014)	(0.01028)
	[0.36386]	[-0.14302]	[1.10209]	[-0.58911]	[0.57386]
EXPEND(-3)	-0.008435	-0.001203	0.000809	0.131656	0.016457
	(0.06870)	(0.05295)	(0.02907)	(0.06001)	(0.01026)
	[-0.12277]	[-0.02271]	[0.02782]	[2.19384]	[1.60378]
EXPEND(-4)	0.050794	0.002500	-0.050082	0.012574	-0.003038
	(0.06835)	(0.05268)	(0.02893)	(0.05971)	(0.01021)
	[0.74310]	[0.04746]	[-1.73141]	[0.21060]	[-0.29756]
GDP(-1)	0.121769	0.090107	0.005041	0.179584	0.024917
	(0.09065)	(0.06987)	(0.03836)	(0.07918)	(0.01354)
	[1.34328]	[1.28972]	[0.13141]	[2.26803]	[1.84042]
GDP(-2)	0.118019	0.028790	-0.006330	-0.029094	0.027988
	(0.09112)	(0.07023)	(0.03856)	(0.07959)	(0.01361)
	[1.29516]	[0.40994]	[-0.16415]	[-0.36552]	[2.05652]
GDP(-3)	0.071077	0.021121	0.004418	0.072680	0.004460
	(0.09260)	(0.07137)	(0.03918)	(0.08088)	(0.01383)
	[0.76760]	[0.29595]	[0.11276]	[0.89859]	[0.32250]
GDP(-4)	-0.004270	-0.039555	-0.032317	0.083732	0.008284
	(0.09298)	(0.07166)	(0.03935)	(0.08121)	(0.01389)
	[-0.04592]	[-0.55199]	[-0.82137]	[1.03101]	[0.59655]
INFLATION(-1)	0.023201	0.025686	0.262818	-0.066803	0.044021
	(0.17748)	(0.13679)	(0.07510)	(0.15502)	(0.02651)
	[0.13072]	[0.18778]	[3.49938]	[-0.43092]	[1.66074]
INFLATION(-2)	0.098050	0.090447	0.240022	0.265556	0.043791
	(0.17954)	(0.13838)	(0.07598)	(0.15682)	(0.02681)
	[0.54612]	[0.65363]	[3.15915]	[1.69334]	[1.63310]
INFLATION(-3)	-0.240644	-0.221773	0.160773	0.222394	-0.037193
	(0.18143)	(0.13983)	(0.07677)	(0.15847)	(0.02710)
	[-1.32641]	[-1.58604]	[2.09410]	[1.40338]	[-1.37261]
INFLATION(-4)	0.201754	-0.102570	0.127308	-0.131563	-0.036160
	(0.17676)	(0.13623)	(0.07480)	(0.15440)	(0.02640)
	[1.14139]	[-0.75289]	[1.70196]	[-0.85211]	[-1.36969]
REVENUE(-1)	-0.040259	0.078107	0.071371	0.109106	0.005458
	(0.07869)	(0.06065)	(0.03330)	(0.06874)	(0.01175)
	[-0.51161]	[1.28785]	[2.14326]	[1.58734]	[0.46444]
REVENUE(-2)	-0.111111	0.038595	-0.000317	0.078221	0.007290
	(0.07832)	(0.06037)	(0.03314)	(0.06841)	(0.01170)
	[-1.41861]	[0.63935]	[-0.00955]	[1.14336]	[0.62317]
REVENUE(-3)	0.069113	-0.085888	0.004635	-0.141620	-0.003705

	(0.07806)	(0.06016)	(0.03303)	(0.06818)	(0.01166)
	[0.88542]	[-1.42767]	[0.14033]	[-2.07713]	[-0.31783]
REVENUE(-4)	0.032090	0.016686	-0.006689	0.025366	0.015288
	(0.07767)	(0.05986)	(0.03287)	(0.06784)	(0.01160)
	[0.41315]	[0.27874]	[-0.20349]	[0.37389]	[1.31789]
INTEREST_RATE(-1)	0.455688	0.151695	0.246373	-0.836381	1.418409
	(0.45206)	(0.34841)	(0.19130)	(0.39486)	(0.06752)
	[1.00802]	[0.43539]	[1.28789]	[-2.11815]	[21.0083]
INTEREST_RATE(-2)	-0.948853	-0.131062	0.052537	0.789558	-0.605953
	(0.77690)	(0.59877)	(0.32876)	(0.67860)	(0.11603)
	[-1.22134]	[-0.21889]	[0.15980]	[1.16351]	[-5.22231]
INTEREST_RATE(-3)	0.780659	-0.472082	0.060383	-0.247346	0.319666
	(0.77586)	(0.59797)	(0.32832)	(0.67769)	(0.11588)
	[1.00619]	[-0.78948]	[0.18391]	[-0.36498]	[2.75867]
INTEREST_RATE(-4)	-0.278234	0.616323	-0.306203	0.135558	-0.151601
	(0.44774)	(0.34508)	(0.18947)	(0.39109)	(0.06687)
	[-0.62141]	[1.78601]	[-1.61608]	[0.34661]	[-2.26705]
C	1.348025	-0.676902	-0.176811	0.785071	0.010114
	(0.31887)	(0.24576)	(0.13494)	(0.27852)	(0.04762)
	[4.22751]	[-2.75433]	[-1.31032]	[2.81867]	[0.21236]
DUMMY	-0.225091	-0.048243	-0.113970	1.504719	0.021510
	(0.68323)	(0.52658)	(0.28912)	(0.59678)	(0.10204)
	[-0.32945]	[-0.09162]	[-0.39419]	[2.52138]	[0.21079]
R-squared	0.112689	0.100378	0.619613	0.148401	0.983353
Adj. R-squared	0.026423	0.012915	0.582631	0.065607	0.981734
Sum sq. resids	280.7787	166.7857	50.28075	214.2230	6.263121
S.E. equation	1.140132	0.878724	0.482474	0.995878	0.170282
F-statistic	1.306295	1.147659	16.75445	1.792410	607.5689
Log likelihood	-357.3776	-295.3956	-152.7042	-325.1822	95.16608
Akaike AIC	3.188047	2.667190	1.468103	2.917498	-0.614841
Schwarz SC	3.509013	2.988156	1.789069	3.238464	-0.293875
Mean dependent	1.651488	-0.322314	-0.431315	0.642031	1.198785
S.D. dependent	1.155500	0.884454	0.746817	1.030247	1.259932

Determinant resid covariance (dof adj.)	0.006056
Determinant resid covariance	0.003729
Log likelihood	-1023.132
Akaike information criterion	9.522119
Schwarz criterion	11.12695

AUGMENTED PRIVATE CONSUMPTION – EVENT STUDY

Vector Autoregression Estimates
Date: 04/12/16 Time: 13:24
Sample (adjusted): 1956Q2 2007Q4
Included observations: 207 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	INTEREST_RA TE	PRIVATE_CON SUMPTION
EXPEND(-1)	0.189122	0.030380	0.014459	-0.001690	-0.010210	-0.000699
	(0.07495)	(0.05859)	(0.02554)	(0.06471)	(0.00754)	(0.03196)
	[2.52318]	[0.51851]	[0.56615]	[-0.02612]	[-1.35461]	[-0.02186]
EXPEND(-2)	0.029878	-0.052682	0.007002	-0.033991	0.004009	0.030702
	(0.07482)	(0.05849)	(0.02549)	(0.06460)	(0.00752)	(0.03191)
	[0.39932]	[-0.90075]	[0.27467]	[-0.52619]	[0.53283]	[0.96226]
EXPEND(-3)	0.043571	0.018582	-0.007124	0.108830	-0.001701	0.019207
	(0.07433)	(0.05810)	(0.02533)	(0.06417)	(0.00747)	(0.03170)
	[0.58620]	[0.31983]	[-0.28128]	[1.69590]	[-0.22763]	[0.60599]
EXPEND(-4)	0.000960	-0.021201	-0.035593	0.003944	-0.008687	-0.045118
	(0.07299)	(0.05706)	(0.02487)	(0.06302)	(0.00734)	(0.03113)
	[0.01315]	[-0.37158]	[-1.43112]	[0.06258]	[-1.18346]	[-1.44953]
GDP(-1)	0.136105	0.065687	-0.016020	0.217950	0.012118	0.069380
	(0.09891)	(0.07732)	(0.03370)	(0.08540)	(0.00995)	(0.04218)
	[1.37598]	[0.84953]	[-0.47534]	[2.55209]	[1.21823]	[1.64486]
GDP(-2)	0.165135	0.020973	0.024591	-0.006686	0.023441	0.148009
	(0.09944)	(0.07773)	(0.03388)	(0.08586)	(0.01000)	(0.04240)
	[1.66061]	[0.26980]	[0.72577]	[-0.07787]	[2.34400]	[3.49038]
GDP(-3)	0.128522	0.007538	-0.021435	0.069542	-0.004149	0.006435
	(0.10382)	(0.08115)	(0.03537)	(0.08963)	(0.01044)	(0.04427)
	[1.23796]	[0.09289]	[-0.60595]	[0.77586]	[-0.39738]	[0.14536]
GDP(-4)	-0.070356	-0.023050	-0.004153	0.122044	0.012315	0.025209
	(0.10607)	(0.08291)	(0.03614)	(0.09158)	(0.01067)	(0.04523)
	[-0.66331]	[-0.27801]	[-0.11492]	[1.33269]	[1.15453]	[0.55736]
INFLATION(-1)	0.208567	0.050562	0.252557	-0.098771	0.066126	0.248354
	(0.20857)	(0.16304)	(0.07107)	(0.18007)	(0.02097)	(0.08894)
	[0.99999]	[0.31013]	[3.55384]	[-0.54850]	[3.15268]	[2.79239]
INFLATION(-2)	0.314950	0.030660	0.207581	0.364076	0.064005	0.209166
	(0.22267)	(0.17406)	(0.07587)	(0.19225)	(0.02239)	(0.09495)
	[1.41442]	[0.17615]	[2.73600]	[1.89378]	[2.85834]	[2.20284]
INFLATION(-3)	-0.127053	-0.267730	0.080801	0.227121	-0.070647	-0.093385
	(0.22418)	(0.17524)	(0.07638)	(0.19355)	(0.02254)	(0.09560)
	[-0.56675]	[-1.52780]	[1.05782]	[1.17344]	[-3.13369]	[-0.97687]
INFLATION(-4)	-0.045417	-0.072794	0.300891	-0.151694	-0.029757	-0.081163
	(0.22459)	(0.17556)	(0.07652)	(0.19390)	(0.02259)	(0.09577)
	[-0.20222]	[-0.41464]	[3.93201]	[-0.78232]	[-1.31754]	[-0.84748]
REVENUE(-1)	-0.071336	0.050523	0.023419	0.107212	0.005433	0.017680
	(0.08421)	(0.06582)	(0.02869)	(0.07270)	(0.00847)	(0.03591)
	[-0.84714]	[0.76754]	[0.81623]	[1.47465]	[0.64156]	[0.49235]
REVENUE(-2)	-0.083957	0.063739	-0.019783	0.058276	0.009479	0.006036
	(0.08259)	(0.06456)	(0.02814)	(0.07130)	(0.00831)	(0.03522)

	[-1.01659]	[0.98732]	[-0.70303]	[0.81729]	[1.14130]	[0.17138]
REVENUE(-3)	0.077426	-0.092675	0.013463	-0.177817	0.006271	-0.031133
	(0.08214)	(0.06421)	(0.02799)	(0.07092)	(0.00826)	(0.03503)
	[0.94259]	[-1.44333]	[0.48104]	[-2.50733]	[0.75913]	[-0.88882]
REVENUE(-4)	0.064231	0.027079	-0.061009	-0.007957	0.007744	0.025914
	(0.08313)	(0.06498)	(0.02833)	(0.07178)	(0.00836)	(0.03545)
	[0.77263]	[0.41670]	[-2.15382]	[-0.11086]	[0.92625]	[0.73099]
INTEREST_RATE(-1)	-0.057091	-0.399526	0.503157	-1.745730	1.369732	0.012851
	(0.73397)	(0.57374)	(0.25009)	(0.63369)	(0.07381)	(0.31299)
	[-0.07778]	[-0.69635]	[2.01193]	[-2.75485]	[18.5574]	[0.04106]
INTEREST_RATE(-2)	-0.043809	0.011948	-0.838023	2.555621	-0.686213	-0.320908
	(1.24292)	(0.97158)	(0.42350)	(1.07310)	(0.12499)	(0.53001)
	[-0.03525]	[0.01230]	[-1.97882]	[2.38153]	[-5.49008]	[-0.60547]
INTEREST_RATE(-3)	0.542669	-0.265015	0.374961	-1.879318	0.435577	0.147789
	(1.21224)	(0.94760)	(0.41305)	(1.04662)	(0.12191)	(0.51693)
	[0.44766]	[-0.27967]	[0.90779]	[-1.79561]	[3.57303]	[0.28590]
INTEREST_RATE(-4)	-0.619156	0.603338	-0.058392	0.670332	-0.191968	0.142247
	(0.67553)	(0.52806)	(0.23017)	(0.58324)	(0.06793)	(0.28807)
	[-0.91654]	[1.14256]	[-0.25368]	[1.14933]	[-2.82580]	[0.49380]
PRIVATE_CONSUMPTION(-1)	-0.080085	0.241251	0.077408	0.253447	0.084705	0.079188
	(0.17847)	(0.13951)	(0.06081)	(0.15408)	(0.01795)	(0.07610)
	[-0.44873]	[1.72931]	[1.27296]	[1.64485]	[4.71966]	[1.04054]
PRIVATE_CONSUMPTION(-2)	-0.036923	0.106643	0.028865	0.064521	-0.047706	0.068309
	(0.18903)	(0.14776)	(0.06441)	(0.16320)	(0.01901)	(0.08061)
	[-0.19533]	[0.72172]	[0.44815]	[0.39534]	[-2.50963]	[0.84743]
PRIVATE_CONSUMPTION(-3)	-0.105038	0.006381	0.084727	-0.292068	-0.001112	0.073074
	(0.18773)	(0.14675)	(0.06397)	(0.16208)	(0.01888)	(0.08005)
	[-0.55951]	[0.04348]	[1.32456]	[-1.80195]	[-0.05888]	[0.91280]
PRIVATE_CONSUMPTION(-4)	-0.369727	0.067204	0.098367	0.539594	-0.001985	-0.020226
	(0.18888)	(0.14764)	(0.06436)	(0.16307)	(0.01899)	(0.08054)
	[-1.95748]	[0.45517]	[1.52847]	[3.30891]	[-0.10453]	[-0.25113]
C	2.032935	-0.428301	-0.100476	1.073503	0.134289	0.541290
	(0.50915)	(0.39800)	(0.17348)	(0.43958)	(0.05120)	(0.21711)
	[3.99283]	[-1.07615]	[-0.57917]	[2.44209]	[2.62277]	[2.49312]
DUMMY	-0.164080	-0.018147	-0.178128	1.594996	0.041738	-0.039489
	(0.69345)	(0.54206)	(0.23628)	(0.59870)	(0.06974)	(0.29570)
	[-0.23661]	[-0.03348]	[-0.75389]	[2.66408]	[0.59852]	[-0.13354]
R-squared	0.142496	0.111135	0.721156	0.245960	0.968133	0.297769
Adj. R-squared	0.024056	-0.011637	0.682642	0.141811	0.963732	0.200776
Sum sq. resids	229.5079	140.2386	26.64500	171.0785	2.320999	41.73358

S.E. equation	1.126055	0.880227	0.383679	0.972206	0.113240	0.480179
F-statistic	1.203111	0.905218	18.72434	2.361611	219.9574	3.070004
Log likelihood	-304.4034	-253.4201	-81.53314	-273.9935	171.0694	-127.9741
Akaike AIC	3.192303	2.699711	1.038968	2.898488	-1.401636	1.487672
Schwarz SC	3.610906	3.118314	1.457570	3.317091	-0.983034	1.906274
Mean dependent	1.712225	-0.269532	-0.340231	0.616083	1.602128	0.458179
S.D. dependent	1.139849	0.875150	0.681073	1.049462	0.594616	0.537118

Determinant resid covariance (dof adj.)	0.000327
Determinant resid covariance	0.000146
Log likelihood	-848.1750
Akaike information criterion	9.702174
Schwarz criterion	12.21379

AUGMENTED NET INVESTMENT EVENT STUDY

Vector Autoregression Estimates
Date: 04/12/16 Time: 13:24
Sample (adjusted): 1956Q2 2007Q4
Included observations: 207 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	INTEREST_RATE	NET_INVESTMENT
EXPEND(-1)	0.199628	0.050390	0.010910	0.011660	-0.007553	-0.013895
	(0.07546)	(0.05772)	(0.02597)	(0.06698)	(0.00795)	(0.05816)
	[2.64556]	[0.87306]	[0.42012]	[0.17408]	[-0.95040]	[-0.23892]
EXPEND(-2)	0.025092	-0.048209	0.009384	-0.036561	0.004395	0.102857
	(0.07484)	(0.05724)	(0.02575)	(0.06643)	(0.00788)	(0.05768)
	[0.33529]	[-0.84220]	[0.36434]	[-0.55037]	[0.55765]	[1.78331]
EXPEND(-3)	0.039534	0.002180	-0.001962	0.087298	-0.001562	0.000260
	(0.07468)	(0.05712)	(0.02570)	(0.06629)	(0.00786)	(0.05756)
	[0.52938]	[0.03817]	[-0.07635]	[1.31688]	[-0.19860]	[0.00452]
EXPEND(-4)	0.001334	-0.026658	-0.034833	0.019306	-0.011552	-0.076406
	(0.07289)	(0.05575)	(0.02508)	(0.06470)	(0.00768)	(0.05618)
	[0.01830]	[-0.47816]	[-1.38861]	[0.29838]	[-1.50487]	[-1.36010]
GDP(-1)	0.156920	-0.016399	-0.016525	0.149660	-0.000993	0.025217
	(0.10501)	(0.08032)	(0.03614)	(0.09321)	(0.01106)	(0.08093)
	[1.49440]	[-0.20417]	[-0.45730]	[1.60560]	[-0.08975]	[0.31160]
GDP(-2)	0.208959	-0.023584	0.017396	-0.043794	0.017493	0.017020
	(0.10430)	(0.07978)	(0.03589)	(0.09259)	(0.01098)	(0.08039)
	[2.00341]	[-0.29562]	[0.48463]	[-0.47301]	[1.59253]	[0.21173]
GDP(-3)	0.089052	0.023956	-0.001535	0.101194	0.000942	0.106903
	(0.10438)	(0.07984)	(0.03592)	(0.09265)	(0.01099)	(0.08044)
	[0.85317]	[0.30007]	[-0.04274]	[1.09218]	[0.08569]	[1.32890]
GDP(-4)	-0.062827	-0.013063	-0.003549	0.129060	0.003702	0.009547

	(0.10688)	(0.08175)	(0.03678)	(0.09488)	(0.01126)	(0.08238)
	[-0.58780]	[-0.15978]	[-0.09648]	[1.36026]	[0.32887]	[0.11590]
INFLATION(-1)	0.168420	-0.019451	0.274186	-0.113614	0.053702	0.001716
	(0.21184)	(0.16203)	(0.07290)	(0.18804)	(0.02231)	(0.16326)
	[0.79504]	[-0.12005]	[3.76098]	[-0.60419]	[2.40713]	[0.01051]
INFLATION(-2)	0.361684	0.048422	0.211776	0.315035	0.075334	0.241687
	(0.22068)	(0.16879)	(0.07595)	(0.19589)	(0.02324)	(0.17008)
	[1.63896]	[0.28687]	[2.78852]	[1.60821]	[3.24149]	[1.42103]
INFLATION(-3)	-0.244057	-0.240927	0.121055	0.310555	-0.067125	-0.140017
	(0.22351)	(0.17096)	(0.07692)	(0.19840)	(0.02354)	(0.17226)
	[-1.09194]	[-1.40928]	[1.57379]	[1.56528]	[-2.85173]	[-0.81283]
INFLATION(-4)	-0.009344	-0.058718	0.286896	-0.122739	-0.040431	0.134153
	(0.22401)	(0.17134)	(0.07709)	(0.19885)	(0.02359)	(0.17265)
	[-0.04171]	[-0.34270]	[3.72146]	[-0.61725]	[-1.71378]	[0.77703]
REVENUE(-1)	-0.049885	0.027858	0.023983	0.056444	0.005400	0.033729
	(0.08358)	(0.06393)	(0.02877)	(0.07420)	(0.00880)	(0.06442)
	[-0.59682]	[0.43575]	[0.83376]	[0.76074]	[0.61346]	[0.52359]
REVENUE(-2)	-0.082654	0.056283	-0.019259	0.061986	0.003704	-0.124477
	(0.08243)	(0.06305)	(0.02837)	(0.07317)	(0.00868)	(0.06353)
	[-1.00270]	[0.89267]	[-0.67890]	[0.84713]	[0.42665]	[-1.95935]
REVENUE(-3)	0.053507	-0.061216	0.021428	-0.152845	0.010409	-0.055297
	(0.08309)	(0.06356)	(0.02860)	(0.07376)	(0.00875)	(0.06404)
	[0.64393]	[-0.96316]	[0.74933]	[-2.07218]	[1.18948]	[-0.86346]
REVENUE(-4)	0.033396	0.057138	-0.053052	0.026631	0.009552	0.131918
	(0.08377)	(0.06408)	(0.02883)	(0.07436)	(0.00882)	(0.06456)
	[0.39865]	[0.89173]	[-1.84018]	[0.35813]	[1.08265]	[2.04322]
INTEREST_RATE(-1)	0.173170	-0.454462	0.458012	-1.522866	1.332184	-0.150257
	(0.69872)	(0.53444)	(0.24046)	(0.62024)	(0.07358)	(0.53851)
	[0.24784]	[-0.85036]	[1.90473]	[-2.45530]	[18.1041]	[-0.27902]
INTEREST_RATE(-2)	-0.034691	-0.051475	-0.779503	1.399829	-0.690390	0.400457
	(1.14683)	(0.87719)	(0.39468)	(1.01802)	(0.12078)	(0.88387)
	[-0.03025]	[-0.05868]	[-1.97504]	[1.37505]	[-5.71624]	[0.45307]
INTEREST_RATE(-3)	-0.023359	-0.344617	0.458846	-0.528182	0.408792	-1.566704
	(1.11318)	(0.85145)	(0.38310)	(0.98814)	(0.11723)	(0.85794)
	[-0.02098]	[-0.40474]	[1.19773]	[-0.53452]	[3.48701]	[-1.82613]
INTEREST_RATE(-4)	-0.351052	0.866041	-0.125357	0.323646	-0.122439	1.110670
	(0.64780)	(0.49549)	(0.22294)	(0.57504)	(0.06822)	(0.49926)
	[-0.54191]	[1.74784]	[-0.56230]	[0.56283]	[-1.79470]	[2.22461]
NET_INVESTMENT(-1)	-0.048486	0.212615	0.008668	0.204041	0.024948	0.403624
	(0.10382)	(0.07941)	(0.03573)	(0.09216)	(0.01093)	(0.08001)
	[-0.46703]	[2.67752]	[0.24261]	[2.21409]	[2.28181]	[5.04453]
NET_INVESTMENT(-2)	-0.197618	0.123746	0.059404	0.091523	0.016580	0.093961
	(0.10779)	(0.08244)	(0.03709)	(0.09568)	(0.01135)	(0.08307)

	[-1.83343]	[1.50098]	[1.60144]	[0.95656]	[1.46059]	[1.13109]
NET_INVESTMENT(-3)	0.103365	0.036051	-0.024610	-0.011696	0.011353	-0.006436
	(0.10814)	(0.08271)	(0.03721)	(0.09599)	(0.01139)	(0.08334)
	[0.95589]	[0.43587]	[-0.66132]	[-0.12184]	[0.99695]	[-0.07722]
NET_INVESTMENT(-4)	-0.113847	-0.056574	0.034150	0.028161	-0.003400	0.088938
	(0.10410)	(0.07962)	(0.03583)	(0.09241)	(0.01096)	(0.08023)
	[-1.09362]	[-0.71051]	[0.95322]	[0.30475]	[-0.31012]	[1.10852]
C	1.957922	-0.516813	-0.045745	1.077814	0.120561	0.577244
	(0.50674)	(0.38760)	(0.17439)	(0.44982)	(0.05337)	(0.39055)
	[3.86377]	[-1.33338]	[-0.26231]	[2.39610]	[2.25911]	[1.47804]
DUMMY	-0.370965	0.304946	-0.123981	1.921745	0.028187	0.967908
	(0.69230)	(0.52953)	(0.23825)	(0.61454)	(0.07291)	(0.53356)
	[-0.53584]	[0.57588]	[-0.52038]	[3.12713]	[0.38661]	[1.81405]
R-squared	0.145726	0.152156	0.716608	0.205914	0.965183	0.311882
Adj. R-squared	0.027733	0.035051	0.677465	0.096234	0.960374	0.216838
Sum sq. resids	228.6433	133.7666	27.07964	180.1642	2.535868	135.8119
S.E. equation	1.123932	0.859676	0.386796	0.997688	0.118365	0.866223
F-statistic	1.235037	1.299308	18.30761	1.877400	200.7065	3.281454
Log likelihood	-304.0128	-248.5299	-83.20782	-279.3493	161.9056	-250.1004
Akaike AIC	3.188529	2.652462	1.055148	2.950235	-1.313098	2.667637
Schwarz SC	3.607132	3.071065	1.473750	3.368837	-0.894495	3.086239
Mean dependent	1.712225	-0.269532	-0.340231	0.616083	1.602128	0.372475
S.D. dependent	1.139849	0.875150	0.681073	1.049462	0.594616	0.978822

Determinant resid covariance (dof adj.)	0.001093
Determinant resid covariance	0.000489
Log likelihood	-973.2636
Akaike information criterion	10.91076
Schwarz criterion	13.42237

EVENT STUDY HOURS

Vector Autoregression Estimates
Date: 04/12/16 Time: 13:25
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	INTEREST_RATE	HOURS
EXPEND(-1)	0.201603	0.034309	0.010919	-0.007624	-0.011809	0.068889
	(0.07459)	(0.05801)	(0.02605)	(0.06769)	(0.00791)	(0.03819)
	[2.70299]	[0.59147]	[0.41914]	[-0.11264]	[-1.49235]	[1.80371]
EXPEND(-2)	0.015831	-0.045871	0.004774	-0.028234	0.007575	-0.019433
	(0.07457)	(0.05799)	(0.02604)	(0.06767)	(0.00791)	(0.03818)
	[0.21230]	[-0.79098]	[0.18330]	[-0.41722]	[0.95744]	[-0.50894]

EXPEND(-3)	0.019882	0.025163	0.000464	0.127219	0.001232	0.065691
	(0.07402)	(0.05757)	(0.02585)	(0.06718)	(0.00785)	(0.03791)
	[0.26858]	[0.43708]	[0.01796]	[1.89368]	[0.15684]	[1.73302]
EXPEND(-4)	-0.011994	-0.015261	-0.027395	0.027697	-0.007726	0.067228
	(0.07365)	(0.05728)	(0.02572)	(0.06684)	(0.00781)	(0.03771)
	[-0.16286]	[-0.26644]	[-1.06503]	[0.41438]	[-0.98881]	[1.78264]
GDP(-1)	0.130299	0.069319	-0.004304	0.230807	0.012126	0.057990
	(0.09833)	(0.07647)	(0.03434)	(0.08924)	(0.01043)	(0.05035)
	[1.32517]	[0.90648]	[-0.12531]	[2.58649]	[1.16238]	[1.15175]
GDP(-2)	0.158888	0.034962	0.041807	0.006957	0.029536	0.010845
	(0.09860)	(0.07669)	(0.03444)	(0.08949)	(0.01046)	(0.05049)
	[1.61140]	[0.45592]	[1.21396]	[0.07775]	[2.82337]	[0.21479]
GDP(-3)	0.087992	0.033445	0.002660	0.115791	0.007385	0.011464
	(0.10099)	(0.07854)	(0.03527)	(0.09165)	(0.01071)	(0.05171)
	[0.87133]	[0.42584]	[0.07541]	[1.26341]	[0.68921]	[0.22170]
GDP(-4)	-0.089070	-0.009685	0.013011	0.138331	0.004064	-0.039159
	(0.10246)	(0.07969)	(0.03579)	(0.09299)	(0.01087)	(0.05247)
	[-0.86930]	[-0.12154]	[0.36359]	[1.48761]	[0.37382]	[-0.74634]
INFLATION(-1)	0.179923	0.083432	0.298312	-0.077394	0.063216	0.079228
	(0.20422)	(0.15883)	(0.07133)	(0.18534)	(0.02167)	(0.10458)
	[0.88101]	[0.52529]	[4.18222]	[-0.41757]	[2.91752]	[0.75760]
INFLATION(-2)	0.277499	0.078219	0.253220	0.338838	0.083982	0.054452
	(0.21582)	(0.16785)	(0.07538)	(0.19587)	(0.02290)	(0.11052)
	[1.28578]	[0.46600]	[3.35928]	[1.72992]	[3.66764]	[0.49271]
INFLATION(-3)	-0.222344	-0.260405	0.104119	0.354437	-0.057919	0.103628
	(0.22345)	(0.17378)	(0.07804)	(0.20279)	(0.02371)	(0.11442)
	[-0.99505]	[-1.49846]	[1.33412]	[1.74780]	[-2.44307]	[0.90567]
INFLATION(-4)	-0.041328	-0.094138	0.271931	-0.108702	-0.041014	-0.102071
	(0.21828)	(0.16976)	(0.07624)	(0.19810)	(0.02316)	(0.11177)
	[-0.18933]	[-0.55453]	[3.56689]	[-0.54872]	[-1.77097]	[-0.91319]
REVENUE(-1)	-0.058122	0.064031	0.028768	0.081993	0.010407	-0.015953
	(0.08264)	(0.06427)	(0.02886)	(0.07500)	(0.00877)	(0.04232)
	[-0.70329]	[0.99622]	[0.99665]	[1.09320]	[1.18690]	[-0.37698]
REVENUE(-2)	-0.103991	0.068477	-0.013533	0.075811	0.006944	-0.010539
	(0.08163)	(0.06349)	(0.02851)	(0.07408)	(0.00866)	(0.04180)
	[-1.27393]	[1.07861]	[-0.47467]	[1.02333]	[0.80175]	[-0.25213]
REVENUE(-3)	0.065775	-0.089093	0.020191	-0.181703	0.006579	-0.012055
	(0.08171)	(0.06355)	(0.02854)	(0.07416)	(0.00867)	(0.04184)
	[0.80494]	[-1.40190]	[0.70745]	[-2.45015]	[0.75879]	[-0.28810]
REVENUE(-4)	0.052629	0.018959	-0.057381	-0.000870	0.005714	0.019553
	(0.08249)	(0.06415)	(0.02881)	(0.07486)	(0.00875)	(0.04224)
	[0.63802]	[0.29553]	[-1.99172]	[-0.01163]	[0.65291]	[0.46292]
INTEREST_RATE(-1)	0.022047	0.010693	0.515453	-1.189515	1.358657	-0.365917

	(0.67585)	(0.52563)	(0.23605)	(0.61337)	(0.07171)	(0.34608)
	[0.03262]	[0.02034]	[2.18365]	[-1.93932]	[18.9476]	[-1.05731]
INTEREST_RATE(-2)	-0.157589	-0.354105	-0.770661	1.103414	-0.696056	0.051406
	(1.12288)	(0.87329)	(0.39218)	(1.01906)	(0.11913)	(0.57499)
	[-0.14034]	[-0.40548]	[-1.96506]	[1.08277]	[-5.84262]	[0.08940]
INTEREST_RATE(-3)	0.123164	-0.125746	0.481407	-0.271855	0.404849	0.233549
	(1.08118)	(0.84086)	(0.37762)	(0.98122)	(0.11471)	(0.55364)
	[0.11392]	[-0.14954]	[1.27485]	[-0.27706]	[3.52930]	[0.42184]
INTEREST_RATE(-4)	-0.279241	0.543755	-0.236819	0.073095	-0.145786	0.037962
	(0.60839)	(0.47316)	(0.21249)	(0.55214)	(0.06455)	(0.31153)
	[-0.45899]	[1.14921]	[-1.11451]	[0.13238]	[-2.25856]	[0.12186]
HOURS(-1)	-0.014876	-0.065603	0.018002	-0.139725	-0.022406	0.810279
	(0.14104)	(0.10969)	(0.04926)	(0.12800)	(0.01496)	(0.07222)
	[-0.10548]	[-0.59807]	[0.36545]	[-1.09159]	[-1.49728]	[11.2191]
HOURS(-2)	0.259249	0.064013	-0.022093	0.057423	0.016589	0.003401
	(0.18283)	(0.14219)	(0.06385)	(0.16592)	(0.01940)	(0.09362)
	[1.41801]	[0.45020]	[-0.34599]	[0.34608]	[0.85523]	[0.03633]
HOURS(-3)	-0.160077	-0.061765	-0.053621	0.030449	0.010750	-0.029821
	(0.18280)	(0.14216)	(0.06384)	(0.16590)	(0.01939)	(0.09360)
	[-0.87571]	[-0.43446]	[-0.83987]	[0.18354]	[0.55428]	[-0.31859]
HOURS(-4)	-0.053751	0.152226	0.057362	0.003140	-0.028442	-0.153653
	(0.13964)	(0.10860)	(0.04877)	(0.12673)	(0.01481)	(0.07150)
	[-0.38494]	[1.40174]	[1.17619]	[0.02478]	[-1.91979]	[-2.14891]
C	1.996357	-0.367883	0.040920	1.099503	0.135107	-0.530230
	(0.49869)	(0.38785)	(0.17418)	(0.45259)	(0.05291)	(0.25537)
	[4.00317]	[-0.94853]	[0.23493]	[2.42937]	[2.55351]	[-2.07636]
DUMMY	-0.248665	-0.089857	-0.136019	1.625171	-0.001985	0.392110
	(0.68192)	(0.53034)	(0.23817)	(0.61887)	(0.07235)	(0.34919)
	[-0.36466]	[-0.16943]	[-0.57110]	[2.62603]	[-0.02744]	[1.12292]
R-squared	0.146018	0.110037	0.702786	0.175749	0.964846	0.682260
Adj. R-squared	0.029988	-0.010882	0.662404	0.063758	0.960070	0.639088
Sum sq. resids	233.3620	141.1500	28.46691	192.2061	2.626875	61.19054
S.E. equation	1.126176	0.875854	0.393334	1.022056	0.119484	0.576678
F-statistic	1.258448	0.910002	17.40332	1.569316	202.0045	15.80357
Log likelihood	-309.0529	-256.2622	-88.14874	-288.6804	162.0607	-168.5000
Akaike AIC	3.190980	2.688212	1.087131	2.996957	-1.295816	1.852381
Schwarz SC	3.605383	3.102615	1.501535	3.411360	-0.881413	2.266785
Mean dependent	1.727716	-0.271184	-0.337084	0.607128	1.590810	-0.944456
S.D. dependent	1.143451	0.871126	0.676959	1.056284	0.597942	0.959915

Determinant resid covariance (dof adj.)	0.000633
Determinant resid covariance	0.000287
Log likelihood	-931.3337
Akaike information criterion	10.35556
Schwarz criterion	12.84198

AUGMENTED WEALTH

Vector Autoregression Estimates
Date: 04/12/16 Time: 13:26
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	INTEREST_RATE	WEALTH
EXPEND(-1)	0.199219	0.017255	0.007271	-0.009145	-0.014004	0.084512
	(0.07446)	(0.05814)	(0.02557)	(0.06730)	(0.00769)	(0.07249)
	[2.67547]	[0.29679]	[0.28437]	[-0.13588]	[-1.82016]	[1.16587]
EXPEND(-2)	0.021844	-0.045722	0.011721	-0.026490	0.007245	-0.041144
	(0.07451)	(0.05817)	(0.02558)	(0.06734)	(0.00770)	(0.07253)
	[0.29318]	[-0.78596]	[0.45816]	[-0.39336]	[0.94103]	[-0.56727]
EXPEND(-3)	0.045818	0.025420	0.004063	0.123470	-0.000306	-0.039127
	(0.07404)	(0.05781)	(0.02542)	(0.06692)	(0.00765)	(0.07207)
	[0.61886]	[0.43976]	[0.15982]	[1.84508]	[-0.03998]	[-0.54288]
EXPEND(-4)	-0.009506	-0.021325	-0.027850	0.028892	-0.011089	-0.000797
	(0.07272)	(0.05678)	(0.02497)	(0.06573)	(0.00751)	(0.07080)
	[-0.13072]	[-0.37556]	[-1.11523]	[0.43953]	[-1.47562]	[-0.01125]
GDP(-1)	0.118188	0.084794	-0.001879	0.251501	0.014482	-0.179559
	(0.09831)	(0.07676)	(0.03376)	(0.08886)	(0.01016)	(0.09571)
	[1.20217]	[1.10465]	[-0.05565]	[2.83024]	[1.42558]	[-1.87613]
GDP(-2)	0.154903	0.027478	0.048844	-0.000426	0.020599	-0.063151
	(0.09951)	(0.07770)	(0.03417)	(0.08994)	(0.01028)	(0.09687)
	[1.55667]	[0.35367]	[1.42947]	[-0.00474]	[2.00333]	[-0.65189]
GDP(-3)	0.094766	0.040600	0.000864	0.127390	0.004367	-0.047953
	(0.10169)	(0.07940)	(0.03492)	(0.09192)	(0.01051)	(0.09900)
	[0.93190]	[0.51134]	[0.02475]	[1.38593]	[0.41556]	[-0.48439]
GDP(-4)	-0.103756	-0.014200	0.007681	0.129874	0.003800	-0.017928
	(0.10325)	(0.08062)	(0.03545)	(0.09333)	(0.01067)	(0.10051)
	[-1.00490]	[-0.17614]	[0.21665]	[1.39162]	[0.35614]	[-0.17836]
INFLATION(-1)	0.140941	0.087362	0.289819	-0.081617	0.071175	0.151092
	(0.20745)	(0.16197)	(0.07123)	(0.18751)	(0.02144)	(0.20195)
	[0.67940]	[0.53936]	[4.06853]	[-0.43527]	[3.32042]	[0.74816]
INFLATION(-2)	0.315857	0.078126	0.284764	0.334401	0.082039	-0.098879
	(0.21823)	(0.17039)	(0.07494)	(0.19725)	(0.02255)	(0.21245)
	[1.44736]	[0.45851]	[3.80009]	[1.69529]	[3.63819]	[-0.46543]
INFLATION(-3)	-0.162107	-0.224098	0.110855	0.334626	-0.068361	-0.012368
	(0.22401)	(0.17490)	(0.07692)	(0.20248)	(0.02315)	(0.21807)
	[-0.72366]	[-1.28127]	[1.44116]	[1.65266]	[-2.95339]	[-0.05672]
INFLATION(-4)	-0.090560	-0.074128	0.228864	-0.128536	-0.043662	-0.082721
	(0.22063)	(0.17227)	(0.07576)	(0.19942)	(0.02280)	(0.21479)
	[-0.41046]	[-0.43031]	[3.02087]	[-0.64454]	[-1.91520]	[-0.38513]

REVENUE(-1)	-0.065938	0.068255	0.029021	0.084249	0.010498	0.060563
	(0.08268)	(0.06455)	(0.02839)	(0.07473)	(0.00854)	(0.08049)
	[-0.79753]	[1.05733]	[1.02223]	[1.12736]	[1.22883]	[0.75245]
REVENUE(-2)	-0.108953	0.077093	-0.013532	0.071703	0.008285	0.065282
	(0.08183)	(0.06390)	(0.02810)	(0.07397)	(0.00846)	(0.07967)
	[-1.33138]	[1.20654]	[-0.48155]	[0.96937]	[0.97973]	[0.81944]
REVENUE(-3)	0.071483	-0.086694	0.020236	-0.186771	0.009010	0.019867
	(0.08204)	(0.06406)	(0.02817)	(0.07416)	(0.00848)	(0.07987)
	[0.87128]	[-1.35336]	[0.71829]	[-2.51858]	[1.06279]	[0.24874]
REVENUE(-4)	0.056581	0.028198	-0.056224	-0.000938	0.006454	-0.079471
	(0.08306)	(0.06485)	(0.02852)	(0.07508)	(0.00858)	(0.08086)
	[0.68118]	[0.43479]	[-1.97122]	[-0.01249]	[0.75192]	[-0.98280]
INTEREST_RATE(-1)	-0.170140	-0.211187	0.473294	-0.989243	1.365374	-0.401551
	(0.68952)	(0.53837)	(0.23677)	(0.62324)	(0.07125)	(0.67125)
	[-0.24675]	[-0.39227]	[1.99898]	[-1.58726]	[19.1640]	[-0.59822]
INTEREST_RATE(-2)	0.058538	-0.213885	-0.676341	0.871655	-0.714815	1.028940
	(1.14228)	(0.89187)	(0.39224)	(1.03248)	(0.11803)	(1.11201)
	[0.05125]	[-0.23982]	[-1.72432]	[0.84424]	[-6.05623]	[0.92530]
INTEREST_RATE(-3)	0.175805	-0.197747	0.527630	0.060544	0.456232	-0.287233
	(1.09935)	(0.85836)	(0.37750)	(0.99368)	(0.11359)	(1.07022)
	[0.15992]	[-0.23038]	[1.39771]	[0.06093]	[4.01632]	[-0.26839]
INTEREST_RATE(-4)	-0.342430	0.622613	-0.320825	-0.194939	-0.176725	-0.266986
	(0.62051)	(0.48448)	(0.21307)	(0.56086)	(0.06412)	(0.60407)
	[-0.55185]	[1.28511]	[-1.50572]	[-0.34757]	[-2.75632]	[-0.44198]
WEALTH(-1)	-0.012745	-0.059691	-0.025528	-0.010269	-0.030656	0.043317
	(0.07629)	(0.05956)	(0.02619)	(0.06895)	(0.00788)	(0.07426)
	[-0.16707]	[-1.00216]	[-0.97453]	[-0.14892]	[-3.88910]	[0.58329]
WEALTH(-2)	-0.085953	-0.014257	-0.025161	0.057509	0.005083	0.051286
	(0.07846)	(0.06126)	(0.02694)	(0.07091)	(0.00811)	(0.07638)
	[-1.09555]	[-0.23273]	[-0.93393]	[0.81096]	[0.62696]	[0.67148]
WEALTH(-3)	0.003522	-0.026766	0.037316	-0.005417	-0.004102	0.032025
	(0.07909)	(0.06175)	(0.02716)	(0.07149)	(0.00817)	(0.07699)
	[0.04453]	[-0.43344]	[1.37404]	[-0.07577]	[-0.50190]	[0.41594]
WEALTH(-4)	0.106676	-0.034466	0.054329	0.092808	-0.003829	0.042502
	(0.07835)	(0.06117)	(0.02690)	(0.07082)	(0.00810)	(0.07627)
	[1.36157]	[-0.56342]	[2.01945]	[1.31054]	[-0.47298]	[0.55725]
C	1.890190	-0.309984	0.010584	1.114991	0.141586	-0.433645
	(0.49623)	(0.38745)	(0.17040)	(0.44853)	(0.05127)	(0.48308)
	[3.80910]	[-0.80006]	[0.06211]	[2.48587]	[2.76132]	[-0.89767]
DUMMY	-0.272822	-0.088033	-0.152921	1.720445	-0.027976	0.315905
	(0.68928)	(0.53818)	(0.23669)	(0.62302)	(0.07122)	(0.67101)
	[-0.39581]	[-0.16358]	[-0.64609]	[2.76144]	[-0.39280]	[0.47079]

R-squared	0.143488	0.100360	0.711864	0.179975	0.966558	0.067939
Adj. R-squared	0.027114	-0.021874	0.672715	0.068559	0.962014	-0.058699
Sum sq. resids	234.0534	142.6848	27.59748	191.2205	2.498942	221.8136
S.E. equation	1.127843	0.880602	0.387281	1.019432	0.116538	1.097957
F-statistic	1.232991	0.821046	18.18346	1.615339	212.7229	0.536481
Log likelihood	-309.3635	-257.3978	-84.89186	-288.1407	167.3031	-303.7237
Akaike AIC	3.193938	2.699026	1.056113	2.991816	-1.345744	3.140226
Schwarz SC	3.608342	3.113430	1.470517	3.406220	-0.931340	3.554630
Mean dependent	1.727716	-0.271184	-0.337084	0.607128	1.590810	-0.204520
S.D. dependent	1.143451	0.871126	0.676959	1.056284	0.597942	1.067084

Determinant resid covariance (dof adj.)	0.002115
Determinant resid covariance	0.000957
Log likelihood	-1057.955
Akaike information criterion	11.56148
Schwarz criterion	14.04790

Structural VAR Estimates
Date: 04/13/16 Time: 18:46
Sample (adjusted): 1955Q3 2014Q4
Included observations: 238 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is just-identified

EFFECT OF

FISCAL POLICY

IN A RECESSION

Model: Ae = Bu where E[uu']=I

Restriction Type: short-run pattern matrix

A =

1	0	0	0	0	0
C(1)	1	0	0	0	0
C(2)	C(6)	1	0	0	0
C(3)	C(7)	C(10)	1	0	0
C(4)	C(8)	C(11)	C(13)	1	0
C(5)	C(9)	C(12)	C(14)	C(15)	1

B =

C(16)	0	0	0	0	0
0	C(17)	0	0	0	0
0	0	C(18)	0	0	0
0	0	0	C(19)	0	0
0	0	0	0	C(20)	0
0	0	0	0	0	C(21)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-0.025932	0.050002	-0.518610	0.6040
C(2)	0.019993	0.027252	0.733635	0.4632
C(3)	0.033483	0.055423	0.604124	0.5458

C(4)	0.003961	0.009216	0.429743	0.6674
C(5)	0.001369	0.010441	0.131080	0.8957
C(6)	0.036107	0.035308	1.022615	0.3065
C(7)	-0.250447	0.071883	-3.484076	0.0005
C(8)	-0.011745	0.012245	-0.959146	0.3375
C(9)	0.032510	0.013894	2.339929	0.0193
C(10)	-0.182508	0.131677	-1.386026	0.1657
C(11)	-0.053727	0.021967	-2.445751	0.0145
C(12)	0.023748	0.025188	0.942834	0.3458
C(13)	-0.003377	0.010770	-0.313552	0.7539
C(14)	-0.002980	0.012200	-0.244243	0.8070
C(15)	0.006457	0.073406	0.087965	0.9299
C(16)	1.141821	0.052335	21.81742	0.0000
C(17)	0.880800	0.040371	21.81742	0.0000
C(18)	0.479781	0.021991	21.81742	0.0000
C(19)	0.974637	0.044672	21.81742	0.0000
C(20)	0.161944	0.007423	21.81742	0.0000
C(21)	0.183395	0.008406	21.81742	0.0000

Log likelihood	-1009.739

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
-0.025932	1.000000	0.000000	0.000000	0.000000	0.000000
0.019993	0.036107	1.000000	0.000000	0.000000	0.000000
0.033483	-0.250447	-0.182508	1.000000	0.000000	0.000000
0.003961	-0.011745	-0.053727	-0.003377	1.000000	0.000000
0.001369	0.032510	0.023748	-0.002980	0.006457	1.000000

Estimated B matrix:

1.141821	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.880800	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.479781	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.974637	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.161944	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.183395

ESTIMATION OUTPUT APPENDIX FOR UK

RECURSIVE APPROACH

TESTS FOR STATIONARITY

Null Hypothesis: BENEFITS has a unit root

Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.316981	0.0000
Test critical values:	1% level	-3.461478	
	5% level	-2.875128	
	10% level	-2.574090	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BENEFITS)
Method: Least Squares
Date: 04/12/16 Time: 22:33
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BENEFITS(-1)	-0.845351	0.090732	-9.316981	0.0000
D(BENEFITS(-1))	-0.035995	0.068675	-0.524133	0.6007
C	0.895306	0.119485	7.493028	0.0000

R-squared	0.444790	Mean dependent var	-0.007549
Adjusted R-squared	0.439426	S.D. dependent var	1.350425
S.E. of regression	1.011084	Akaike info criterion	2.874106
Sum squared resid	211.6142	Schwarz criterion	2.921922
Log likelihood	-298.7811	Hannan-Quinn criter.	2.893436
F-statistic	82.91594	Durbin-Watson stat	2.029570
Prob(F-statistic)	0.000000		

Null Hypothesis: EXPEND has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.590561	0.0000
Test critical values:	1% level	-3.461478	
	5% level	-2.875128	
	10% level	-2.574090	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPEND)
Method: Least Squares
Date: 04/12/16 Time: 22:34
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

EXPEND(-1)	-0.815946	0.094982	-8.590561	0.0000
D(EXPEND(-1))	-0.155015	0.068612	-2.259310	0.0249
C	0.677735	0.109508	6.188883	0.0000

R-squared	0.497212	Mean dependent var	-0.005937
Adjusted R-squared	0.492354	S.D. dependent var	1.518830
S.E. of regression	1.082156	Akaike info criterion	3.009971
Sum squared resid	242.4098	Schwarz criterion	3.057786
Log likelihood	-313.0469	Hannan-Quinn criter.	3.029301
F-statistic	102.3520	Durbin-Watson stat	2.003258
Prob(F-statistic)	0.000000		

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.903192	0.0000
Test critical values:	1% level	-3.461630	
	5% level	-2.875195	
	10% level	-2.574125	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP)
Method: Least Squares
Date: 04/12/16 Time: 22:37
Sample (adjusted): 1955Q4 2007Q4
Included observations: 209 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.838070	0.094131	-8.903192	0.0000
D(GDP(-1))	-0.093351	0.068318	-1.366411	0.1733
C	-0.351520	0.075558	-4.652300	0.0000

R-squared	0.469420	Mean dependent var	-0.004629
Adjusted R-squared	0.464269	S.D. dependent var	1.271399
S.E. of regression	0.930583	Akaike info criterion	2.708240
Sum squared resid	178.3930	Schwarz criterion	2.756216
Log likelihood	-280.0111	Hannan-Quinn criter.	2.727637
F-statistic	91.12721	Durbin-Watson stat	2.008481
Prob(F-statistic)	0.000000		

Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.156865	0.0000
Test critical values:	1% level	-3.461630	
	5% level	-2.875195	

10% level	-2.574125

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION)
Method: Least Squares
Date: 04/12/16 Time: 22:38
Sample (adjusted): 1955Q4 2007Q4
Included observations: 209 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION(-1)	-0.363899	0.070566	-5.156865	0.0000
D(INFLATION(-1))	-0.399163	0.063659	-6.270294	0.0000
C	0.041610	0.053040	0.784498	0.4336

R-squared	0.414794	Mean dependent var	-0.005257
Adjusted R-squared	0.409112	S.D. dependent var	0.983964
S.E. of regression	0.756366	Akaike info criterion	2.293667
Sum squared resid	117.8504	Schwarz criterion	2.341643
Log likelihood	-236.6882	Hannan-Quinn criter.	2.313064
F-statistic	73.00642	Durbin-Watson stat	2.223216
Prob(F-statistic)	0.000000		

Null Hypothesis: NET_INVESTMENT has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.978683	0.0002
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(NET_INVESTMENT)
Method: Least Squares
Date: 04/12/16 Time: 22:42
Sample (adjusted): 1997Q4 2007Q1
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NET_INVESTMENT(-1)	-0.967228	0.194274	-4.978683	0.0000
D(NET_INVESTMENT(-1))	0.339878	0.165514	2.053472	0.0476
C	0.975281	0.259042	3.764950	0.0006

R-squared	0.430799	Mean dependent var	-0.016997
Adjusted R-squared	0.398273	S.D. dependent var	1.300403
S.E. of regression	1.008736	Akaike info criterion	2.930931
Sum squared resid	35.61423	Schwarz criterion	3.060214

Log likelihood	-52.68769	Hannan-Quinn criter.	2.976929
F-statistic	13.24485	Durbin-Watson stat	1.804587
Prob(F-statistic)	0.000052		

Null Hypothesis: REVENUE has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-17.89800	0.0000
Test critical values:	1% level	-3.461478	
	5% level	-2.875128	
	10% level	-2.574090	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REVENUE)
Method: Least Squares
Date: 04/12/16 Time: 22:43
Sample (adjusted): 1955Q3 2007Q4
Included observations: 210 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
REVENUE(-1)	-1.530861	0.085533	-17.89800	0.0000
D(REVENUE(-1))	0.487011	0.059629	8.167354	0.0000
C	3.346135	0.199097	16.80655	0.0000

R-squared	0.636050	Mean dependent var	-0.014105
Adjusted R-squared	0.632533	S.D. dependent var	1.574102
S.E. of regression	0.954205	Akaike info criterion	2.758307
Sum squared resid	188.4751	Schwarz criterion	2.806123
Log likelihood	-286.6222	Hannan-Quinn criter.	2.777637
F-statistic	180.8796	Durbin-Watson stat	2.077252
Prob(F-statistic)	0.000000		

Null Hypothesis: WAGES has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.644600	0.0000
Test critical values:	1% level	-3.475500	
	5% level	-2.881260	
	10% level	-2.577365	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(WAGES)
Method: Least Squares

Date: 04/12/16 Time: 22:44
Sample (adjusted): 1963Q3 1999Q4
Included observations: 146 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WAGES(-1)	-0.530536	0.093990	-5.644600	0.0000
D(WAGES(-1))	-0.180108	0.083542	-2.155901	0.0328
C	0.029642	0.040535	0.731279	0.4658

R-squared	0.344841	Mean dependent var	-0.000937
Adjusted R-squared	0.335678	S.D. dependent var	0.593958
S.E. of regression	0.484111	Akaike info criterion	1.407327
Sum squared resid	33.51393	Schwarz criterion	1.468634
Log likelihood	-99.73491	Hannan-Quinn criter.	1.432238
F-statistic	37.63387	Durbin-Watson stat	2.089774
Prob(F-statistic)	0.000000		

Null Hypothesis: INTEREST_RATE has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.817435	0.3707
Test critical values:	1% level	-3.482453	
	5% level	-2.884291	
	10% level	-2.578981	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE)
Method: Least Squares
Date: 04/12/16 Time: 22:39
Sample (adjusted): 1976Q2 2007Q4
Included observations: 127 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTEREST_RATE(-1)	-0.036670	0.020177	-1.817435	0.0716
D(INTEREST_RATE(-1))	0.345184	0.084793	4.070892	0.0001
C	0.073371	0.042995	1.706515	0.0904

R-squared	0.127971	Mean dependent var	-0.005084
Adjusted R-squared	0.113906	S.D. dependent var	0.102759
S.E. of regression	0.096730	Akaike info criterion	-1.810453
Sum squared resid	1.160224	Schwarz criterion	-1.743267
Log likelihood	117.9637	Hannan-Quinn criter.	-1.783156
F-statistic	9.098531	Durbin-Watson stat	1.982642
Prob(F-statistic)	0.000206		

Null Hypothesis: EMPLOYMENT has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.896886	0.3331
Test critical values:	1% level	-3.475819	
	5% level	-2.881400	
	10% level	-2.577439	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EMPLOYMENT)
Method: Least Squares
Date: 04/12/16 Time: 22:30
Sample (adjusted): 1971Q4 2007Q4
Included observations: 145 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPLOYMENT(-1)	-0.013448	0.007089	-1.896886	0.0599
D(EMPLOYMENT(-1))	0.760675	0.054413	13.97974	0.0000
C	0.057344	0.030197	1.898967	0.0596

R-squared	0.580000	Mean dependent var	0.000114
Adjusted R-squared	0.574085	S.D. dependent var	0.003914
S.E. of regression	0.002555	Akaike info criterion	-9.081318
Sum squared resid	0.000927	Schwarz criterion	-9.019731
Log likelihood	661.3956	Hannan-Quinn criter.	-9.056293
F-statistic	98.04771	Durbin-Watson stat	2.464741
Prob(F-statistic)	0.000000		

LAG SELECTION

VAR Lag Order Selection Criteria
Endogenous variables: EXPEND GDP INFLATION REVENUE INTEREST_RATE
Exogenous variables: C
Date: 04/13/16 Time: 10:52
Sample: 1955Q1 2007Q4
Included observations: 121

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-685.0058	NA	0.061771	11.40505	11.52058	11.45198
1	-479.5786	390.4814	0.003132	8.422787	9.115959*	8.704311*
2	-444.3384	64.07313	0.002650	8.253528	9.524341	8.769654
3	-417.0120	47.42593	0.002563	8.215075	10.06353	8.965804
4	-379.7487	61.59236*	0.002114*	8.012375*	10.43847	8.997706
5	-368.4765	17.70008	0.002696	8.239281	11.24302	9.459215
6	-354.8276	20.30411	0.003332	8.426903	12.00829	9.881440
7	-339.9572	20.89233	0.004077	8.594334	12.75336	10.28347

8	-315.7738	31.97804	0.004330	8.607832	13.34450	10.53157

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

TESTS FOR SERIAL CORRELATION

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/13/16 Time: 11:04
Sample (adjusted): 1976Q1 2007Q4
Included observations: 128 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.305113	0.569081	-0.536151	0.5928
GDP(-1)	0.082075	0.108369	0.757370	0.4503
INFLATION(-1)	0.150848	0.113397	1.330262	0.1859
REVENUE(-1)	-0.004617	0.113141	-0.040811	0.9675
INTEREST_RATE(-1)	0.506048	0.247353	2.045849	0.0429

R-squared	0.085325	Mean dependent var	0.705717
Adjusted R-squared	0.055579	S.D. dependent var	1.070914
S.E. of regression	1.040729	Akaike info criterion	2.955998
Sum squared resid	133.2233	Schwarz criterion	3.067406
Log likelihood	-184.1839	Hannan-Quinn criter.	3.001264
F-statistic	2.868497	Durbin-Watson stat	2.258236
Prob(F-statistic)	0.025919		

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/13/16 Time: 11:05
Sample (adjusted): 1976Q4 2007Q4
Included observations: 125 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.206946	0.569500	0.363382	0.7170
GDP(-4)	0.070116	0.107305	0.653421	0.5147
INFLATION(-4)	0.142469	0.112456	1.266890	0.2076
REVENUE(-4)	-0.194836	0.112964	-1.724768	0.0871
INTEREST_RATE(-4)	0.425190	0.249303	1.705513	0.0907

R-squared	0.093210	Mean dependent var	0.677858
Adjusted R-squared	0.062984	S.D. dependent var	1.063852
S.E. of regression	1.029805	Akaike info criterion	2.935793
Sum squared resid	127.2597	Schwarz criterion	3.048926

Log likelihood	-178.4871	Hannan-Quinn criter.	2.981753
F-statistic	3.083752	Durbin-Watson stat	2.276299
Prob(F-statistic)	0.018597		

VAR ESTIMATES

EVENT STUDY

Vector Autoregression Estimates
Date: 04/14/16 Time: 16:28
Sample (adjusted): 1998Q2 2007Q1
Included observations: 36 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	EXPEND	GDP	INFLATION	REVENUE	D_INTEREST_RATE	NET_INVESTMENT
EXPEND(-1)	-0.128623	0.244560	-0.307004	0.181694	-0.031183	-0.318838
	(0.31009)	(0.24928)	(0.25342)	(0.30030)	(0.02145)	(0.46569)
	[-0.41479]	[0.98107]	[-1.21145]	[0.60505]	[-1.45357]	[-0.68465]
EXPEND(-2)	0.264331	0.014248	0.155850	-0.545012	-0.001267	-0.187455
	(0.34578)	(0.27797)	(0.28259)	(0.33487)	(0.02392)	(0.51930)
	[0.76444]	[0.05126]	[0.55150]	[-1.62755]	[-0.05294]	[-0.36098]
EXPEND(-3)	-0.704799	-0.164454	0.261791	0.294192	0.024219	0.364301
	(0.26637)	(0.21414)	(0.21769)	(0.25796)	(0.01843)	(0.40004)
	[-2.64590]	[-0.76799]	[1.20257]	[1.14044]	[1.31421]	[0.91066]
EXPEND(-4)	0.095525	0.031938	-0.429271	-0.075774	-0.013841	0.009526
	(0.26355)	(0.21186)	(0.21538)	(0.25523)	(0.01823)	(0.39580)
	[0.36246]	[0.15075]	[-1.99304]	[-0.29689]	[-0.75914]	[0.02407]
GDP(-1)	-0.276454	0.103538	0.360896	0.226038	-0.004107	-0.032731
	(0.41100)	(0.33040)	(0.33589)	(0.39802)	(0.02843)	(0.61724)
	[-0.67264]	[0.31337]	[1.07444]	[0.56790]	[-0.14443]	[-0.05303]
GDP(-2)	0.053383	-0.008640	0.162636	0.579716	0.041753	0.322849
	(0.34255)	(0.27537)	(0.27995)	(0.33173)	(0.02370)	(0.51444)
	[0.15584]	[-0.03138]	[0.58095]	[1.74755]	[1.76184]	[0.62757]
GDP(-3)	0.261797	-0.446280	-0.430564	-0.145007	-0.001196	-0.136649
	(0.44509)	(0.35781)	(0.36375)	(0.43104)	(0.03079)	(0.66844)
	[0.58819]	[-1.24727]	[-1.18367]	[-0.33641]	[-0.03883]	[-0.20443]
GDP(-4)	-0.320031	-0.369133	0.843446	0.228371	-0.022397	0.131037
	(0.52911)	(0.42535)	(0.43242)	(0.51241)	(0.03661)	(0.79463)
	[-0.60484]	[-0.86784]	[1.95053]	[0.44568]	[-0.61184]	[0.16490]
INFLATION(-1)	-0.060278	-0.196965	-0.202853	-0.109272	0.040720	-0.499164
	(0.28296)	(0.22747)	(0.23125)	(0.27403)	(0.01958)	(0.42495)
	[-0.21303]	[-0.86590]	[-0.87721]	[-0.39876]	[2.08009]	[-1.17464]
INFLATION(-2)	0.085550	0.030174	-0.073093	0.379715	0.039843	-0.127443
	(0.42081)	(0.33829)	(0.34391)	(0.40752)	(0.02911)	(0.63198)

	[0.20330]	[0.08920]	[-0.21254]	[0.93176]	[1.36857]	[-0.20166]
INFLATION(-3)	-0.434605	0.158836	0.123817	0.395653	0.026002	-0.151475
	(0.35467)	(0.28511)	(0.28985)	(0.34347)	(0.02454)	(0.53264)
	[-1.22539]	[0.55710]	[0.42717]	[1.15194]	[1.05972]	[-0.28439]
INFLATION(-4)	-0.149931	0.256084	-0.238682	0.199216	0.011458	0.374126
	(0.30698)	(0.24678)	(0.25088)	(0.29729)	(0.02124)	(0.46103)
	[-0.48840]	[1.03769]	[-0.95136]	[0.67010]	[0.53949]	[0.81150]
REVENUE(-1)	0.239679	0.106014	-0.221916	0.233344	-0.005974	-0.229702
	(0.21964)	(0.17657)	(0.17950)	(0.21271)	(0.01520)	(0.32986)
	[1.09124]	[0.60042]	[-1.23629]	[1.09703]	[-0.39314]	[-0.69637]
REVENUE(-2)	0.645037	-0.017957	-0.238792	-0.682667	0.006352	-0.318571
	(0.23806)	(0.19138)	(0.19456)	(0.23055)	(0.01647)	(0.35753)
	[2.70951]	[-0.09383]	[-1.22736]	[-2.96107]	[0.38567]	[-0.89104]
REVENUE(-3)	-0.192311	-0.106237	0.167374	0.280811	0.050072	-0.175909
	(0.29379)	(0.23618)	(0.24010)	(0.28452)	(0.02033)	(0.44122)
	[-0.65458]	[-0.44982]	[0.69710]	[0.98698]	[2.46352]	[-0.39869]
REVENUE(-4)	0.092664	0.000970	-0.362446	0.803686	0.016364	0.178583
	(0.27250)	(0.21906)	(0.22270)	(0.26390)	(0.01885)	(0.40925)
	[0.34005]	[0.00443]	[-1.62749]	[3.04544]	[0.86803]	[0.43637]
D_INTEREST_RATE(-1)	-3.361564	1.134637	2.739612	-5.258649	0.275527	1.533863
	(4.29334)	(3.45138)	(3.50874)	(4.15779)	(0.29703)	(6.44777)
	[-0.78297]	[0.32875]	[0.78080]	[-1.26477]	[0.92762]	[0.23789]
D_INTEREST_RATE(-2)	0.753478	0.776614	-7.348934	6.217819	0.331476	3.645848
	(4.52411)	(3.63689)	(3.69733)	(4.38127)	(0.31299)	(6.79434)
	[0.16655]	[0.21354]	[-1.98763]	[1.41918]	[1.05906]	[0.53660]
D_INTEREST_RATE(-3)	0.212803	-2.246452	1.698917	-3.822127	-0.258972	-9.067799
	(4.04110)	(3.24860)	(3.30259)	(3.91351)	(0.27957)	(6.06895)
	[0.05266]	[-0.69151]	[0.51442]	[-0.97665]	[-0.92631]	[-1.49413]
D_INTEREST_RATE(-4)	-4.373764	-0.367016	3.977192	3.120552	-0.342295	5.958291
	(4.05487)	(3.25967)	(3.31385)	(3.92685)	(0.28053)	(6.08963)
	[-1.07864]	[-0.11259]	[1.20017]	[0.79467]	[-1.22018]	[0.97843]
NET_INVESTMENT(-1)	0.041651	0.066302	0.181223	-0.136515	0.023553	0.542739
	(0.26477)	(0.21285)	(0.21639)	(0.25641)	(0.01832)	(0.39764)
	[0.15731]	[0.31150]	[0.83750]	[-0.53240]	[1.28579]	[1.36490]
NET_INVESTMENT(-2)	-0.624484	-0.175672	-0.164438	0.549593	0.014567	-0.145426
	(0.26364)	(0.21193)	(0.21546)	(0.25531)	(0.01824)	(0.39593)
	[-2.36874]	[-0.82890]	[-0.76321]	[2.15264]	[0.79868]	[-0.36730]
NET_INVESTMENT(-3)	0.481990	0.211062	-0.157176	-0.381938	-0.016792	-0.012033
	(0.25377)	(0.20401)	(0.20740)	(0.24576)	(0.01756)	(0.38112)
	[1.89929]	[1.03458]	[-0.75785]	[-1.55410]	[-0.95642]	[-0.03157]
NET_INVESTMENT(-4)	-0.478200	-0.221906	0.081733	0.134504	0.011982	-0.007049
	(0.18406)	(0.14796)	(0.15042)	(0.17825)	(0.01273)	(0.27642)
	[-2.59807]	[-1.49973]	[0.54335]	[0.75459]	[0.94100]	[-0.02550]

C	-0.796867	-0.500683	1.226146	1.477651	-0.103267	1.768282
	(1.38212)	(1.11107)	(1.12954)	(1.33848)	(0.09562)	(2.07567)
	[-0.57656]	[-0.45063]	[1.08553]	[1.10398]	[-1.07998]	[0.85191]
DUMMY	0.526310	0.634051	-0.091484	0.357659	0.037881	0.060021
	(1.28694)	(1.03456)	(1.05175)	(1.24631)	(0.08903)	(1.93274)
	[0.40896]	[0.61287]	[-0.08698]	[0.28697]	[0.42547]	[0.03105]
R-squared	0.853329	0.665945	0.721404	0.881007	0.826652	0.718715
Adj. R-squared	0.486651	-0.169193	0.024915	0.583526	0.393283	0.015502
Sum sq. resids	5.391959	3.484505	3.601282	5.056859	0.025807	12.16117
S.E. equation	0.734300	0.590297	0.600107	0.711116	0.050801	1.102777
F-statistic	2.327192	0.797407	1.035772	2.961555	1.907503	1.022044
Log likelihood	-16.90681	-9.048315	-9.641663	-15.75186	79.24930	-31.54690
Akaike AIC	2.383711	1.947129	1.980092	2.319548	-2.958294	3.197050
Schwarz SC	3.527364	3.090781	3.123745	3.463201	-1.814642	4.340703
Mean dependent	0.487779	-0.446895	-0.542405	2.093416	-0.008895	0.983348
S.D. dependent	1.024866	0.545918	0.607725	1.101911	0.065220	1.111425

Determinant resid covariance (dof adj.)	1.79E-05
Determinant resid covariance	8.22E-09
Log likelihood	28.60068
Akaike information criterion	7.077740
Schwarz criterion	13.93966

ESTIMATION OUPUT APPENDIX FOR GERMANY

TESTS FOR STATIONARITY

Null Hypothesis: EXPEND has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.341126	0.0165
Test critical values:	1% level	-3.521579	
	5% level	-2.901217	
	10% level	-2.587981	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXPEND)
Method: Least Squares
Date: 04/15/16 Time: 14:04
Sample (adjusted): 1995Q3 2013Q4
Included observations: 74 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

EXPEND(-1)	-0.156668	0.046891	-3.341126	0.0013
D(EXPEND(-1))	0.005320	0.110523	0.048136	0.9617
C	0.598098	0.179899	3.324628	0.0014

R-squared	0.136143	Mean dependent var	-0.002864
Adjusted R-squared	0.111809	S.D. dependent var	0.021543
S.E. of regression	0.020303	Akaike info criterion	-4.916401
Sum squared resid	0.029267	Schwarz criterion	-4.822993
Log likelihood	184.9068	Hannan-Quinn criter.	-4.879139
F-statistic	5.594754	Durbin-Watson stat	2.027024
Prob(F-statistic)	0.005542		

LAG SELECTION CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: EXPEND GDP INFLATION TAX D_INTEREST_RATE
Exogenous variables: C
Date: 04/15/16 Time: 14:20
Sample: 1970Q1 2014Q4
Included observations: 70

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-139.6428	NA	4.29e-05	4.132651	4.293257	4.196446
1	-13.53496	230.5971*	2.39e-06*	1.243856*	2.207497*	1.626626*
2	-1.067661	21.01631	3.46e-06	1.601933	3.368608	2.303678
3	15.32585	25.29285	4.55e-06	1.847833	4.417542	2.868552
4	38.10306	31.88808	5.12e-06	1.911341	5.284084	3.251036
5	57.62292	24.53926	6.56e-06	2.067916	6.243693	3.726586
6	65.88027	9.201044	1.22e-05	2.546278	7.525089	4.523922

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

TESTS FOR SERIAL CORRELATION

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/15/16 Time: 14:23
Sample (adjusted): 1995Q1 2013Q4
Included observations: 76 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.856683	0.013492	285.8396	0.0000
GDP(-1)	0.006272	0.005927	1.058329	0.2935
INFLATION(-1)	0.006520	0.007135	0.913843	0.3639
TAX(-1)	-0.011492	0.005379	-2.136369	0.0361
D_INTEREST_RATE(-1)	-0.037609	0.034927	-1.076780	0.2852

R-squared	0.079728	Mean dependent var	3.837323
Adjusted R-squared	0.027882	S.D. dependent var	0.053809
S.E. of regression	0.053053	Akaike info criterion	-2.971516
Sum squared resid	0.199840	Schwarz criterion	-2.818178
Log likelihood	117.9176	Hannan-Quinn criter.	-2.910234
F-statistic	1.537776	Durbin-Watson stat	0.196836
Prob(F-statistic)	0.200569		

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/15/16 Time: 14:23
Sample (adjusted): 1995Q1 2013Q4
Included observations: 76 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.849593	0.013814	278.6638	0.0000
GDP(-4)	0.004235	0.006028	0.702490	0.4847
INFLATION(-4)	0.004683	0.007318	0.640011	0.5242
TAX(-4)	-0.006626	0.005433	-1.219588	0.2267
D_INTEREST_RATE(-4)	-0.038337	0.035840	-1.069646	0.2884

R-squared	0.038671	Mean dependent var	3.837323
Adjusted R-squared	-0.015488	S.D. dependent var	0.053809
S.E. of regression	0.054224	Akaike info criterion	-2.927868
Sum squared resid	0.208756	Schwarz criterion	-2.774530
Log likelihood	116.2590	Hannan-Quinn criter.	-2.866587
F-statistic	0.714021	Durbin-Watson stat	0.203493
Prob(F-statistic)	0.585090		

BASELINE SVAR

Dependent Variable: EXPEND
Method: Least Squares
Date: 04/15/16 Time: 14:23
Sample (adjusted): 1995Q1 2013Q4
Included observations: 76 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.849593	0.013814	278.6638	0.0000
GDP(-4)	0.004235	0.006028	0.702490	0.4847
INFLATION(-4)	0.004683	0.007318	0.640011	0.5242
TAX(-4)	-0.006626	0.005433	-1.219588	0.2267
D_INTEREST_RATE(-4)	-0.038337	0.035840	-1.069646	0.2884

R-squared	0.038671	Mean dependent var	3.837323
Adjusted R-squared	-0.015488	S.D. dependent var	0.053809
S.E. of regression	0.054224	Akaike info criterion	-2.927868
Sum squared resid	0.208756	Schwarz criterion	-2.774530
Log likelihood	116.2590	Hannan-Quinn criter.	-2.866587
F-statistic	0.714021	Durbin-Watson stat	0.203493
Prob(F-statistic)	0.585090		

BLANCHARD PERROTI

Structural VAR Estimates
Date: 04/15/16 Time: 14:37
Sample (adjusted): 1996Q1 2013Q4
Included observations: 72 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 1 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
A =

1	0	0	0	0
C(1)	1	0	0	0
C(2)	C(5)	1	0	0
C(3)	C(6)	C(8)	1	0
C(4)	C(7)	C(9)	C(10)	1

B =

C(11)	0	0	0	0
0	C(12)	0	0	0
0	0	C(13)	0	0
0	0	0	C(14)	0
0	0	0	0	C(15)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-9.095824	6.226462	-1.460833	0.1441
C(2)	-13.71068	5.182063	-2.645797	0.0081
C(3)	5.881515	4.202258	1.399608	0.1616
C(4)	1.036363	0.962791	1.076416	0.2817
C(5)	0.213117	0.096661	2.204780	0.0275
C(6)	-0.076393	0.077316	-0.988056	0.3231
C(7)	-0.042305	0.017596	-2.404218	0.0162
C(8)	0.085171	0.091236	0.933522	0.3506
C(9)	-0.004908	0.020749	-0.236523	0.8130
C(10)	0.008697	0.026641	0.326459	0.7441
C(11)	0.018890	0.001574	12.00000	0.0000
C(12)	0.998032	0.083169	12.00000	0.0000
C(13)	0.818584	0.068215	12.00000	0.0000
C(14)	0.633717	0.052810	12.00000	0.0000
C(15)	0.143257	0.011938	12.00000	0.0000

Log likelihood -37.73965

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000	0.000000
-9.095824	1.000000	0.000000	0.000000	0.000000
-13.71068	0.213117	1.000000	0.000000	0.000000
5.881515	-0.076393	0.085171	1.000000	0.000000
1.036363	-0.042305	-0.004908	0.008697	1.000000

Estimated B matrix:

0.018890	0.000000	0.000000	0.000000	0.000000
0.000000	0.998032	0.000000	0.000000	0.000000
0.000000	0.000000	0.818584	0.000000	0.000000
0.000000	0.000000	0.000000	0.633717	0.000000
0.000000	0.000000	0.000000	0.000000	0.143257

TEST FOR STRUCTURAL BREAK

Quandt-Andrews unknown breakpoint test
Null Hypothesis: No breakpoints within 15% trimmed data
Varying regressors: All equation variables
Equation Sample: 1995Q1 2013Q4
Test Sample: 1998Q1 2011Q1
Number of breaks compared: 53

Statistic	Value	Prob.
Maximum LR F-statistic (1998Q2)	25.27015	0.0000
Maximum Wald F-statistic (1998Q2)	126.3508	0.0000
Exp LR F-statistic	10.44613	0.0000
Exp Wald F-statistic	60.32633	0.0000
Ave LR F-statistic	13.04680	0.0000
Ave Wald F-statistic	65.23401	0.0000

Note: probabilities calculated using Hansen's (1997) method