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Fiscal Policy Innovations in Advanced Economies

Kwabena Meneabe Ackon

ABSTRACT

Unprecedented 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 thesis 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 and wages. 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 thesis 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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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[1] 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 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[2] (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

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[1] 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.

[2] 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 discourage 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 these 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.

the reduced form model[3], 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[4] found large differences in the size of spending multipliers in recessions and expansions with fiscal policy being more effective in slumps than 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[5] 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 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

[3] 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.

[4] 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 can capture more complex dynamic patterns.

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

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[6] 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 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).

Models with deep habits[7] 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 thesis, 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 several 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

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[6] 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.)

[7] Deep habits assumptions alter the supply side of the economy in fundamental ways as firms consider the fact that the demand they will face in the future depends on their current sales. This is because higher consumption of a 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.

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).

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 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 thesis fills the gaps in knowledge by going through several 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 thesis proposes a new econometric approach to studying effect of fiscal policy on key macroeconomic variables in economic downturns. Furthermore, this thesis 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.

1 EFFECTS OF FISCAL POLICY SHOCK IN USA

1.1 DATA

Quarterly USA data from 1955Q1 to 2014Q4 is used giving $\eta = 244$ 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*', 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 thesis 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[8]. 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.

TABLE 1 PEAK MULTIPLIER FOR DIFFERENT SAMPLE PERIODS; EXPENDITURE SHOCK TO OUTPUT - USA

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

- Indicates peak multiplier for each period

1.2 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.

Apart from 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[9] 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.

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

TABLE 2 VAR LAG ORDER SELECTION CRITERIA - USA

Lag	AIC	SC	HQC
0	19.87	20.02	19.93
1	14.99	16.69*	15.68*
2	14.91	18.16	16.22

[8] 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.

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

3	14.48	19.28	16.41
4	14.08*	20.42	16.63

*indicates optimal lag selection by the multivariate information criterion.

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[10] 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 thesis.

1.4 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 thesis 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.

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

1.5 BENCHMARK REDUCED FORM VECTOR AUTOREGRESSION

Consistent with Caldara and Kamps (2008), the standard or reduced form[11] model of VAR collecting the endogenous variables in the *k*- dimensional vector X_t can be expressed as

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

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[12]. Thus pre-multiplying the above equation by the ($\kappa\chi\kappa$) matrix A_0 gives the structural form

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

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[13]. 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 variables included in this thesis as Z_t , the vector X_t can be partitioned as

$$Z_t = \begin{bmatrix} X1t \\ gt \\ X2t \end{bmatrix}$$

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.

1.6 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 $\sum_u = A_0^{-1}\sum_e(A_0^{-1})'$

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[11] 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.

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

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

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 said 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[14] 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

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

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:

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

1.7 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

[14] 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.

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.

1.8 RESULTS

BASELINE VECTOR AUTOREGRESSION

TABLE 3 EXPENDITURE MULTIPLIERS FOR USA, UK AND GERMANY

	Variables	Impact	1 year	5 years	Peak
USA	GDP	-0.01	0.05*	0.00	0.05*(4)
	Inflation	-0.03	-0.01*	-001	-0.01*(4)
	Interest rate	-0.02	-0.04*	-0.04	-0.04*(4)
UK	GDP	-0.04	-0.10	-0.00	0.02*(4)
	Inflation	-0.03	0.05	0.00	0.13*(3)
	Interest rate	-0.01	0.01*	0.00	0.01*(4)
Germany	GDP	0.17	0.22	0.02	0.22*(4)
	Inflation	0.22	0.02	-0.02	0.22*(3)
	Interest rate	-0.01	0.01	0.00	0.03*(6)

*() refers to peak multiplier and quarter of peak multiplier respectively.

FIGURE 1 IMPULSE RESPONSE[15] GRAPHS FOR POSITIVE GOVERNMENT EXPENDITURE AND REVENUE SHOCKS FOR USA[16]

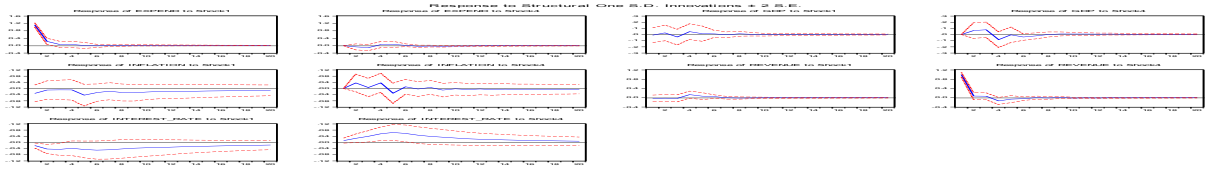
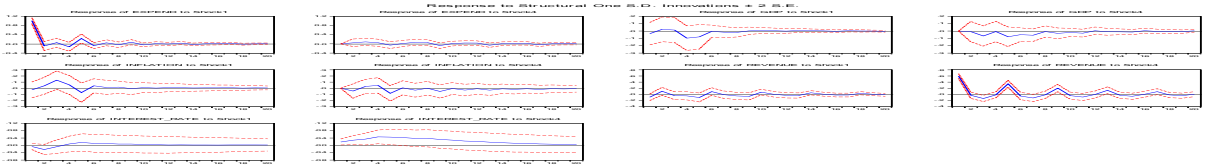


FIGURE 2 TAX AND EXPENDITURE MULTIPLIERS FOR UK



[15] 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.

[16] 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 can 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.

FIGURE 3 TAX AND EXPENDITURE MULTIPLIERS FOR GERMANY

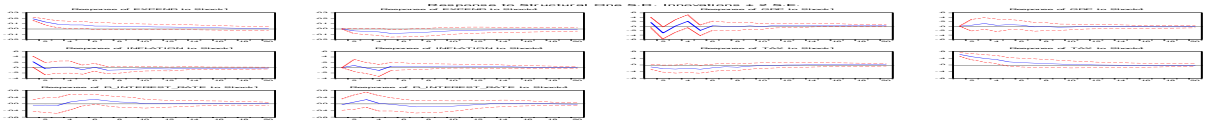


TABLE 4 TAX MULTIPLIERS FOR USA, UK AND GERMANY

	Variables	Impact	1 year	5 years	Peak
USA	GDP	0.00	0.06	-0.00	0.06(4)
	Inflation	0.00	0.04	0.00	0.04(4)
	Interest rate	0.01	0.06	0.01	0.06(4)
UK	GDP	0.00	0.05	0.01	0.05(4)
	Inflation	0.00	-0.01	0.00	0.00(12)
	Interest rate	0.02	0.05	0.00	0.05(4)
Germany	GDP	0.00	0.04	-0.03	0.12(3)
	Inflation	0.00	-0.12	0.01	0.06(9)
	Interest rate	-0.01	0.00	-0.00	0.02(3)

INFERENCE

It can be seen from estimates of the baseline vector autoregression for USA, UK and Germany, 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 then 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, for all three countries 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.

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.

RESULTS FOR BASELINE SVAR USING LEVELS OF US DATA

The data used in this thesis 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.

TABLE 5 EXPENDITURE MULTIPLIERS FOR USA

Variable	Impact	First year	Five years	Peak
GDP	1.85	1.28	2.01*	2.01*
Interest	-0.00	-0.02	0.12*	0.12*
Inflation	-0.01	-0.06	-0.02	-0.11*(3)

FIGURE 4 TAX AND EXPENDITURE IMPULSE RESPONSE

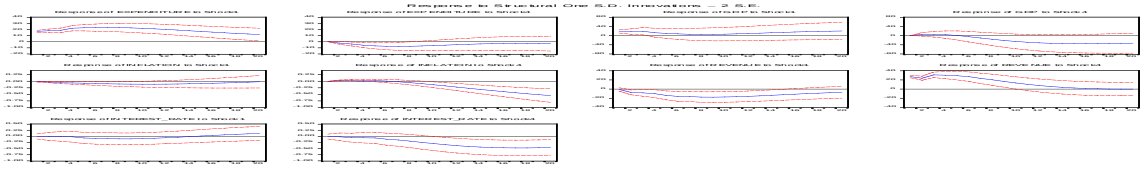


TABLE 6 TAX MULTIPLIERS

Variable	Impact	First year	Five years	Peak Multiplier
GDP	0.00	2.04	-1.10	-1.46*(16)
Inflation	0.00	0.03	-0.55	0.00*(1)
Interest rate	-0.01	-0.06	-0.46	-0.47*(17)

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 overall 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.

RESULTS FOR AUGMENTED VECTOR AUTOREGRESSION FOR USA

PRIVATE CONSUMPTION

TABLE 7 MULTIPLIERS FOR EXPENDITURE SHOCK - USA

Variable	Impact	First year	Five years	Peak
Private Cons	-0.00	0.05	-0.00	0.05*(4)

FIGURE 5 TAX AND EXPENDITURE IMPULSE RESPONSE - USA

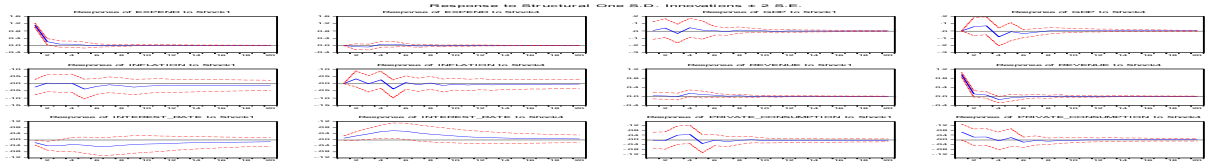


TABLE 8 TAX MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak multiplier
Private Cons	0.06*	-0.00	0.00	-0.02*

INFERENCE

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).

INVESTMENT

TABLE 9 EXPENDITURE MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak multiplier
Investment	-0.04	0.08	-0.00	0.08*(4)

FIGURE 6 TAX AND EXPENDITURE IMPULSE RESPONSE - USA

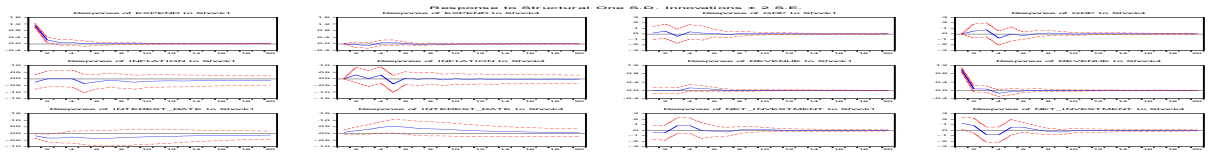


TABLE 10 TAX MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak multiplier
Investment	0.12	-0.08	-0.00	0.05*(5)

INFERENCE

The table above 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 because 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 thesis 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 because 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.

WEALTH

TABLE 11 EXPENDITURE MULTIPLIERS -USA

Variable	Impact	First year	Five years	Peak
Wealth	-0.10	-0.06	-0.00	0.08*(2)

FIGURE 7 TAX AND EXPENDITURE IMPULSE RESPONSE -USA

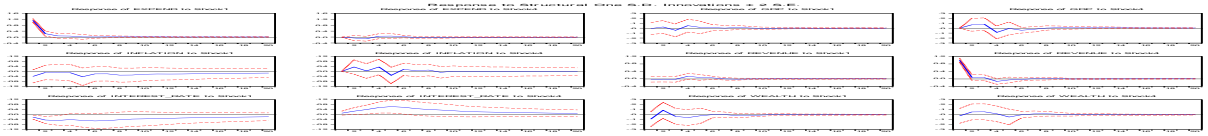


TABLE 12 TAX MULTIPLIERS -USA

Variable	Impact	First year	Five years	Peak
Wealth	-0.02	0.02	-0.00	0.06*(3)

INFERENCE

At the time of writing this thesis, 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 thesis 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*'.

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 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[17] 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).

[17] 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.

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 does not cause an increase in wealth but wealth increases when government expenditure causes key macroeconomic variables like GDP to increase.

TABLE 13 P-VALUES: GRANGER CAUSALITY χ -SQUARE STATISTIC - USA

Variable	χ- square statistic
Wealth	0.84

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.

TABLE 14 MULTIPLIERS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2007Q4 - USA

Variable	Impact	First year	Five years	Peak
GDP	-0.00	0.00	-0.01	0.07*(5)

FIGURE 8 IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2007Q4 - USA

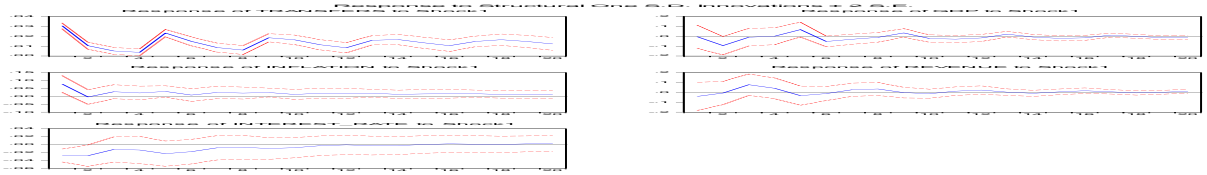
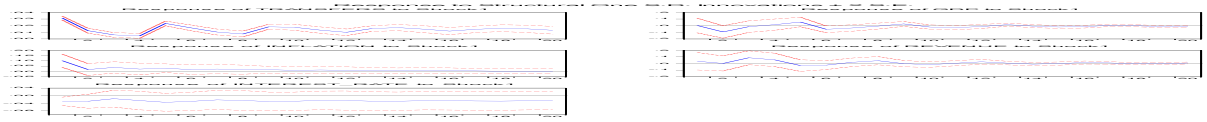


TABLE 15 MULTIPLIERS FOR AUTOMATIC STABILISERS FOR – SAMPLE PERIOD 1955Q1 TO 2014Q4 -USA

Variable	Impact	First year	Five years	Peak
GDP	0.00	0.01	-0.01	0.05*(5)

FIGURE 9 IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS FOR SAMPLE PERIOD 1955Q1 TO 2014Q4 - USA



INFERENCE

The table and figure above 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 way 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, 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 increment in unemployment insurance, Medicaid and other welfare programs.

TESTS FOR STRUCTURAL BREAKS IN BASELINE VARIABLES

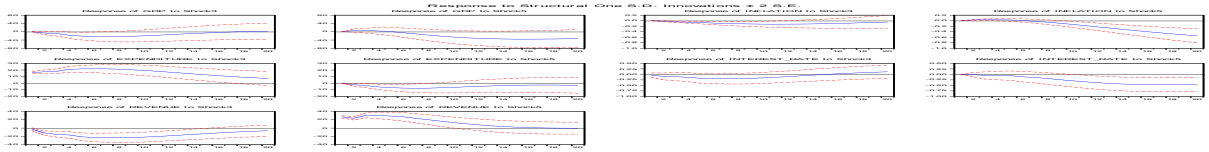
The stability of the coefficients of the baseline vector autoregression was assessed by performing a full sample stability test. Specifically, three test were performed: Quandt-Andrew test in Wald form, Mean Wald and Exponential Wald Statistic. The null hypothesis is no structural breakpoint within 30% 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.

TABLE 16 TESTS FOR STRUCTURAL CHANGE IN BASELINE EQUATION'S VARIABLES – 30% TRIMMING - USA

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.

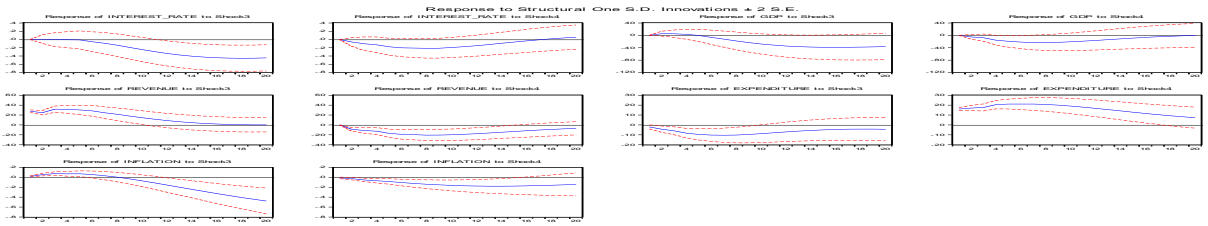
I also considered different sets of orderings. For the first instance, I ordered GDP first, inflation second, expenditure third then followed by interest rate and taxes. In the second instance, I order interest rate first, GDP second, taxes (revenue) third then followed by expenditure and inflation.



in the first set of improvised orderings, GDP falls on impact of the positive government expenditure shock and only returns to the steady state after 18 quarters. Interestingly, GDP rises on impact of a tax shock and falls below the steady state only after 6 quarters. This is neither consistent with economic theory or the existing academic literature on fiscal policy.

Inflation falls in response to expansionary fiscal policy and approaches the steady state at 20 quarters while it rises briefly on impact of a tax rise but falls below the steady state at 8 quarters. Interest rates do fall upon impact of expansionary fiscal policy and rise above the steady state after 15 quarters while it falls and remains below the steady state after a positive government revenue shock.

In the second set of orderings, the impulse responses for the series on GDP, interest rates and inflation show a similar pattern to that of the series in the first set of orderings. In both set of orderings the estimations are significant.



2 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 purposes of standardisation and being able to compare estimates of the different identification approaches used in this thesis, I chose a five-variable baseline equation.

Using a five variable for the baseline equation as set out in Caldara and Kamps 2008, the relationship between the reduced form disturbances u_t and structural disturbances e_t is given as

$$u_t^g = \boldsymbol{\alpha}_{gy} u_t^y + \boldsymbol{\alpha}_{g\pi} u_t^{\pi} + \boldsymbol{\alpha}_{gr} u_t^r + \boldsymbol{\beta}_{g\tau} e_t^{\tau} + e_t^g \quad (4)$$

$$u_t^{\tau} = \boldsymbol{\alpha}_{\tau y} u_t^y + \boldsymbol{\alpha}_{\tau\pi} u_t^{\pi} + \boldsymbol{\alpha}_{\tau r} u_t^r + \boldsymbol{\beta}_{\tau g} e_t^{\tau} + e_t^{\tau} \quad (5)$$

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

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

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

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 $\boldsymbol{\alpha}_{ry}$ = 1.85, inflation to revenue $\boldsymbol{\alpha}_{\tau\pi}$ = 1.25, Perroti sets output elasticity to government spending $\boldsymbol{\alpha}_{gy}$ to 0 as data used is net of total government transfers. That said, the government expenditure used in this thesis is inclusive of transfers so I set the elasticity to 1[18] as

[18] 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.

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

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

2.1 RESULTS

TABLE 17 BASELINE RESULTS FOR BLANCHARD AND PERROTI IDENTIFICATION FOR USA, UK AND GERMANY - EXPENDITURE SHOCKS

	Variable	Impact	First	Five	Peak
USA	GDP	-0.01	0.13	-0.00	0.13(4)
	Inflation	-0.03	-0.05	-0.00	-0.00(7)
	Interest rates	-0.03	-0.10	-0.02	-0.10(4)
UK	GDP	-0.04	-0.10	-0.01	0.10(3)
	Inflation	-0.02	0.01	0.03	0.10(2)
	Interest rates	-0.04	-0.00	-0.00	0.01(3)
Germany	GDP	0.17	0.22	0.02	0.22(4)
	Inflation	0.22	0.02	-0.02	0.22(4)
	Interest rates	-0.01	0.01	0.00	0.03(3)

FIGURE 10 TAX AND EXPENDITURE IMPULSE RESPONSE FOR USA

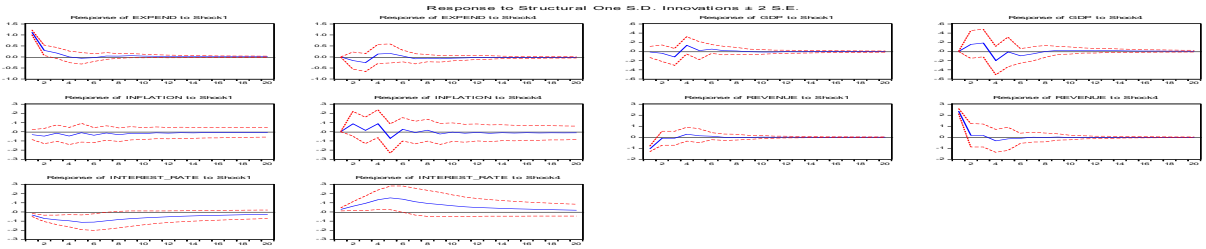


FIGURE 11 TAX AND EXPENDITURE IMPULSE RESPONSE FOR UK

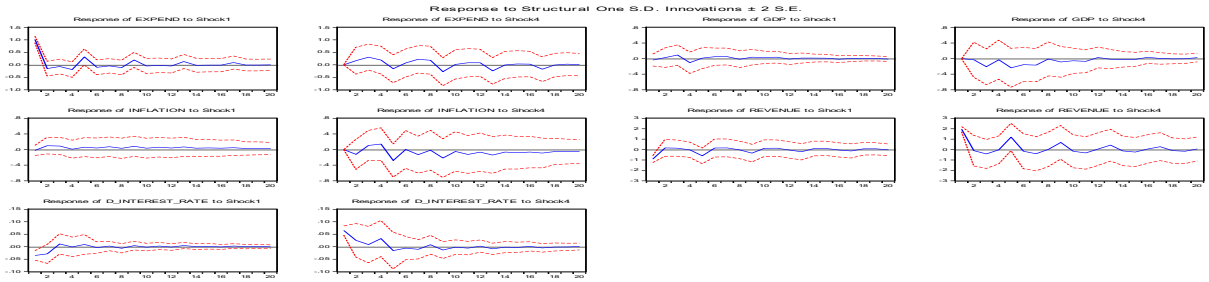


TABLE 18 TAX MULTIPLIERS FOR USA, UK AND GERMANY

	Variable	Impact	First	Five	Peak
USA	GDP	0.00	-0.12	0.00	0.18(3)
	Inflation	-0.01	0.02	-0.01	0.02(4)
	Interest rate	0.03	0.13	0.02	0.15(5)
UK	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)
Germany	GDP	0.00	-0.12	0.00	0.18(3)
	Inflation	0.01	0.02	-0.01	0.02(4)
	Interest rate	0.03	0.13	0.02	0.15(5)

INFERENCE

From the table and figure above, there is no difference in the response of baseline variables to a unit rise in government expenditure and a unit rise in net 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.

AUGMENTED BLANCHARD AND PERROTI INDENTIFICATION

PRIVATE CONSUMPTION

TABLE 19 EXPENDITURE MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak
Private cons	-0.92	0.26*	-0.03	0.26*(4)

FIGURE 12 TAX AND EXPENDITURE IMPULSE RESPONSE - USA

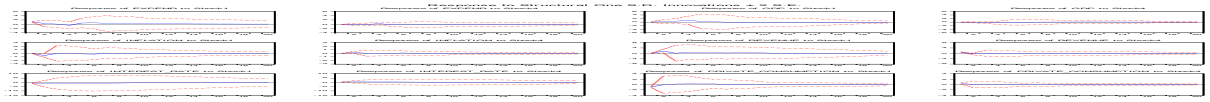


TABLE 20 TAX MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak
Private cons	0.39	-0.09	0.01	0.02*(7)

INFERENCE

From figure 19 and tables 19 and 20, expansionary fiscal policy has a positive effect on private consumption with a peak multiplier of 0.26. 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.

NET INVESTMENT

TABLE 21 EXPENDITURE MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak
Investment	0.01	1.00*	-0.02	0.93*(4)

FIGURE 13 TAX AND EXPENDITURE IMPULSE RESPONSE -USA

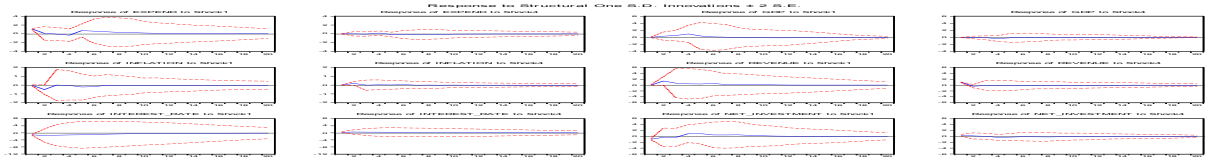


TABLE 22 TAX MULTIPLIERS -USA

Variable	Impact	First year	Five years	Peak
Investment	0.42	-0.35	-0.01	0.04*(3)

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 like those from the recursive identification.

WEALTH

TABLE 23 EXPENDITURE MULTIPLIERS -USA

Variable	Impact	First year	Five years	Peak
Wealth	0.88	-0.70	0.01	0.88*(1)

FIGURE 14 TAX AND EXPENDITURE IMPULSE RESPONSE - USA

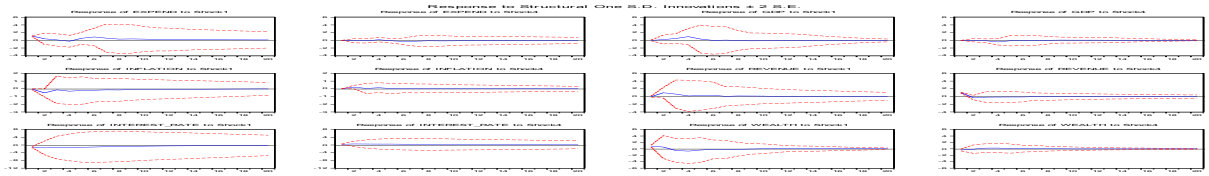


TABLE 24 TAX MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak
Wealth	-0.37	0.24*	-0.01	0.24*(4)

INFERENCE

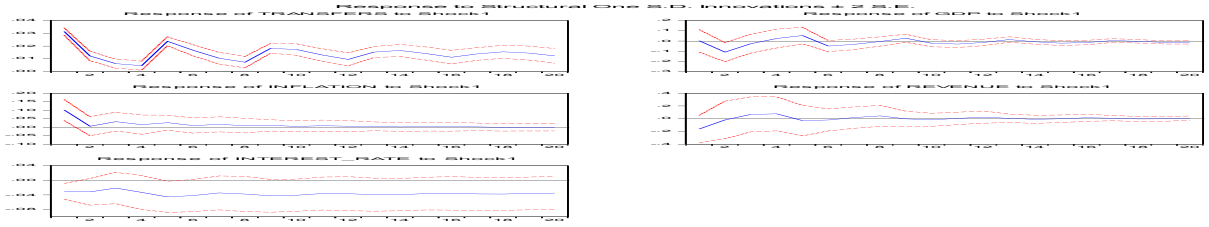
When the US federal government conducts expansionary fiscal policy, it increases the net worth of households. The impact of a unit rise in government purchases plus transfers increases the wealth of US households by 0.88% while a 1% rise in taxes has almost no effect on the wealth of households.

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

TABLE 25 EXPENDITURE MULTIPLIERS FOR AUTOMATIC STABILISERS -USA

Variable	Impact	First year	Five years	Peak
GDP	0.00	0.02	-0.01	0.05*(5)
Inflation	0.10	0.01	0.00	0.03(3)
Interest rate	-0.03	-0.03	-0.03	-0.02(3)

FIGURE 15 IMPULSE RESPONSE FOR AUTOMATIC STABILISERS -USA



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 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

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

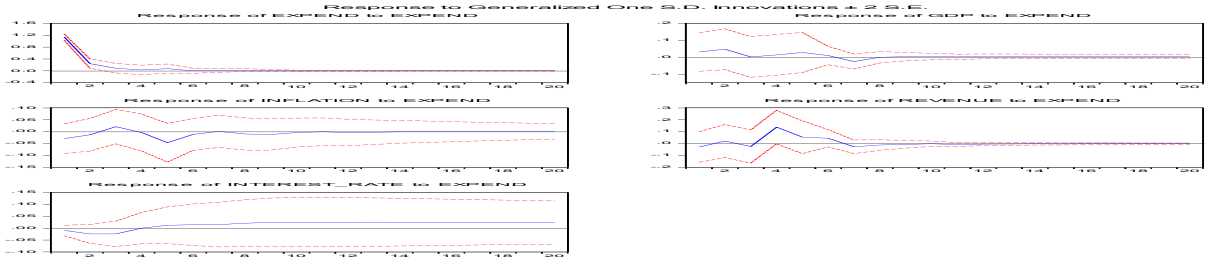
where $\mathbf{\Phi}\,(L)$ is the 4^{th} order lag polynomial associated with the dummy variable which captures the above mentioned fiscal episodes.

3.1 RESULTS

TABLE 26 TAX AND EXPENDITURE MULTIPLIERS FOR USA, UK AND GERMANY - USA

	Variable	Impact	First year	Five years	Peak
USA	GDP	0.03	0.01	0.00	0.05(2)
	Inflation	-0.03	-0.03	0.00	0.02(3)
	Interest rates	0.00	-1.08	0.02	0.03(10)
UK	GDP	-0.04	-0.13	-0.00	0.01(2)
	Inflation	-0.02	0.07	0.01	0.13(3)
	Interest rates	-0.01	0.01	-1.73	-1.73(20)
Germany	GDP	0.03	0.00	0.01	0.04(2)
	Inflation	-0.02	-0.03	0.08	0.04(19)
	Interest rates	-0.01	-0.16	-0.00	-0.16(4)

FIGURE 16 IMPULSE RESPONSE GRAPHS FOR USA



INFERENCE

Using the event study identification, gross domestic product rises with a peak multiplier of 0.05 for USA. 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.

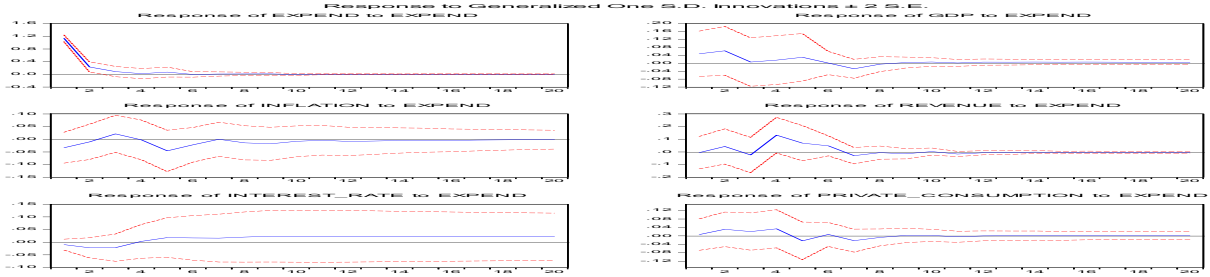
AUGMENTED EVENT STUDY IDENTIFICATION

PRIVATE CONSUMPTION

TABLE 27 EXPENDITURE MULTIPLIERS -USA

Variable	Impact	First year	Five years	Peak
Private Cons	0.01	0.03	0.00	2.78*(12)

FIGURE 17 IMPULSE RESPONSE GRAPHS FOR EXPENDITURE SHOCK -USA



INFERENCE

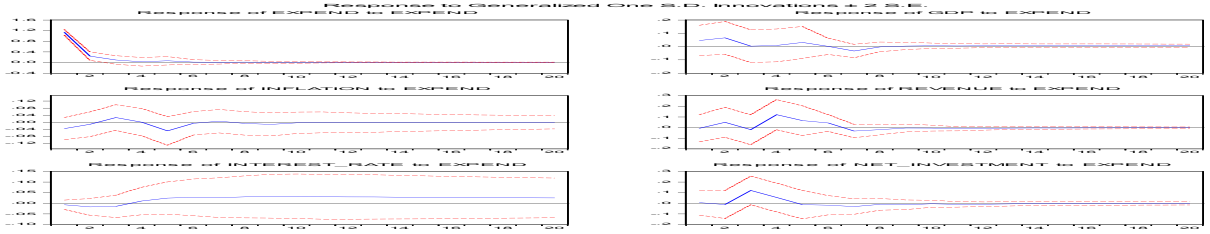
The table and figure above shows that private consumption reacts positively to an unexpected increase in government purchases. It falls below the steady state but returns to equilibrium after 2 years as the impact of the shock wears off.

NET INVESTMENT

TABLE 28 EXPENDITURE MULTIPLIERS - USA

Variable	Impact	First year	Five years	Peak
Investment	0.01	0.05	-0.00	0.12*(3)

FIGURE 18 IMPULSE RESPONSE GRAPHS FOR EXPENDITURE SHOCK



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 thesis 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.

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 affects most 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 because, 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.

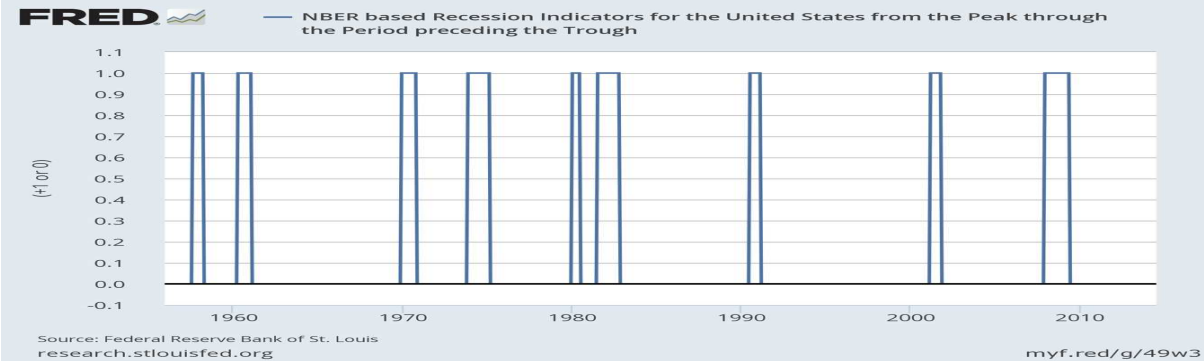
Overall, private consumption and net investment increases when the US federal government tinkers with aggregate demand. Moreover, the wealth of households increases when government carries out expansionary fiscal policy. Interestingly, the results gained for the USA suggests strongly that automatic stabilisers 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.

BUSINESS CYCLE STATE FISCAL MULTIPLIERS

Recessions are endogenous events that arise because 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.

FIGURE 19 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:

$$A_0 X_t = A_0\mu_o + A_0\mu_1 t + A_0\, A(L) X_{t-1} + \mathbf{\Phi}\,(L)\, D_t + B e_t \qquad (10)^{19}$$

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

TABLE 29 TABLE EXPENDITURE MULTIPLIERS IN A RECESSION - USA

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

FIGURE 20 IMPULSE RESPONSE GRAPHS[20] FOR FISCAL MULTIPLIERS IN A RECESSION - USA

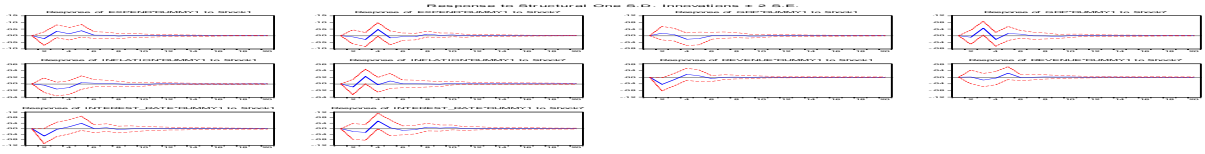


TABLE 30 TAX MULTIPLIERS IN A RECESSION - USA

Variable	Impact	First year	Five years	Peak
GDP	0.00	-0.02	-0.00	0.02*(2)

[19] 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.

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

Inflation	0.00	-0.00	0.00	0.02*(3)
Interest rate	0.00	0.06	0.00	0.06*(4)

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.

EFFECT OF AUTOMATIC STABILISERS IN A RECESSION

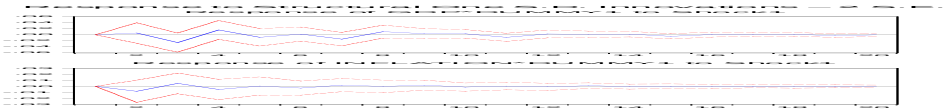
Automatic stabilisers such as unemployment insurance increase during recessions. Sometimes politicians cut this benefit in a bid to reduce the government spending bill and there is normally debates amongst economists about the growth inducing or reducing effect of this policy action. This thesis separates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

TABLE 31 MULTIPLIERS FOR AUTOMATIC STABILISERS –USA

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

FIGURE 21 IMPULSE RESPONSE -AUTOMATIC STABILISERS IN A RECESSION[21] -USA

[21] Shock 1 implies net government transfers to households which serves as automatic stabilisers.



INFERENCE

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.

TABLE 32 P-VALUES GRANGER CAUSALITY χ – SQUARE STATISTICS

Variable	χ-square
GDP	0.02
Inflation	0.00

Another approach to estimating automatic stabilisers is considered and presented as below

Automatic Stabilisers

As directed in the upgrade report, I estimate a smoothing model in the form

$$\Delta \log y_t^d = \alpha + \beta \Delta \log y_t + \varepsilon_t \quad (1)$$

. where y_t, and y_t^d are GDP (or income) and disposable income.

The estimated coefficient $1 - \hat{\beta}$ is interpreted as the percentage of volatility in GDP that is smoothed by taxes and transfers. From the eviews output, the estimated coefficient of β is given as 0.236589. This implies that the percentage change of volatility in GDP that is smoothed by taxes and transfers is 24%.

4 EFFECT OF FISCAL POLICY INNOVATIONS IN THE UNITED KINGDOM

4.1 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.

4.2 PRE-ESTIMATION DATA PREPARATION

Apart from 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 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 RESULTS

AUGMENTED RECURSIVE SVAR FOR UNITED KINGDOM

EMPLOYMENT

TABLE 33 EXPENDITURE MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Employment	-0.00	-0.00	0.01	1.01*(18)

FIGURE 22 IMPULSE RESPONSE GRAPHS -UK

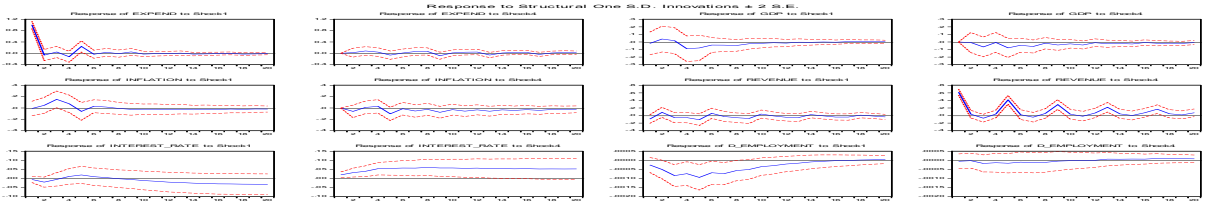


TABLE 34 TAX MULTIPLIERS -UK

Variable	Impact	First year	Five years	Peak
Employment	-5.01	-0.01	0.01	0.01*(5)

INFERENCE

Employment responds to a unit rise in government expenditure positively with a peak multiplier 1.01 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

WAGES

TABLE 35 EXPENDITURE MULTIPLIERS -UK

Variable	Impact	First year	Five years	Peak
Wages	0.10	0.03	0.00	0.10*

FIGURE 23 EXPENDITURE AND TAX IMPULSE RESPONSE GRAPHS- UK

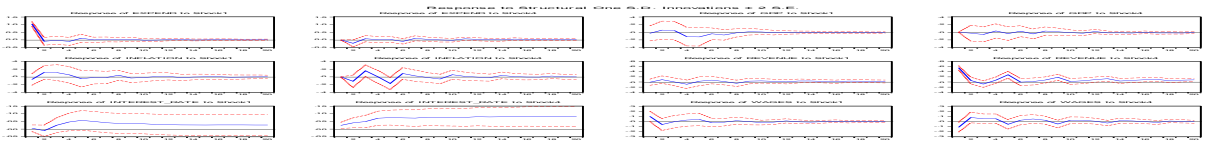


TABLE 36 TAX MULTIPLIERS -UK

Variable	Impact quarter	First year	Five years	Peak
Wages	-0.11	0.05	-0.00	0.08*(2)

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 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.

NET INVESTMENT

TABLE 37 EXPENDITURE MULTIPLIERS - UK

Variable	Impact quarter	First year	Five years	Peak
Investment	0.30*	0.03	-0.09	0.30*(1)

FIGURE 24 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS -UK

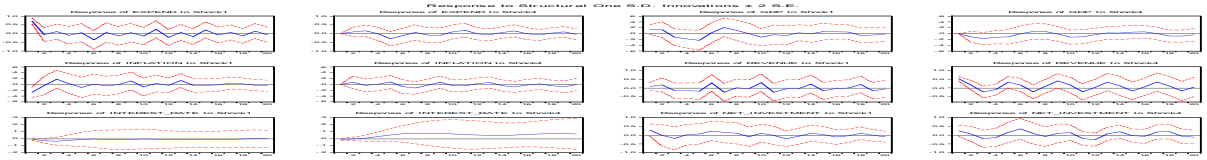


TABLE 38 TAX MULTIPLIERS -UK

Variable	Impact	First year	Five years	Peak
Investment	0.25	-0.12	-0.11	0.25*(6)

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 most of the forecast horizon.

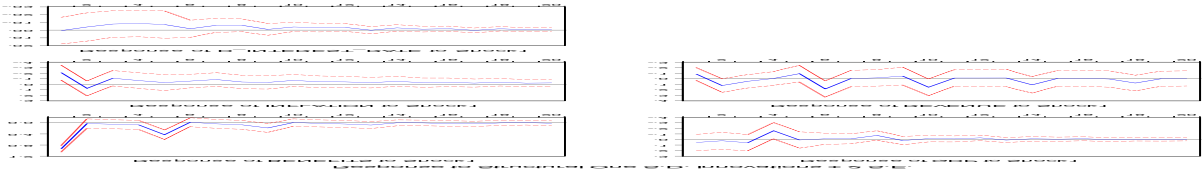
EFFECT OF AUTOMATIC STABILISERS[22] ON KEY UK MACROECONOMIC VARIABLES

TABLE 39 MULTIPLIERS FOR AUTOMATIC STABILISERS - UK

Variable	Impact	First year	Five years	Peak
GDP	0.05	-0.16	-0.01	0.06*(3)
Inflation	-0.21	-0.07	-0.03	0.07*(2)
Interest rate	0.00	-0.01	-0.00	0.29*(13)

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

FIGURE 25 IMPULSE RESPONSE GRAPHS FOR AUTOMATIC STABILISERS -UK



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.

TABLE 40 TAX MULTIPLIERS -UK

Variable	Impact	First year	Five years	Peak
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)

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.

AUGMENTED BLANCHARD AND PERROTI IDENTIFICATION

EMPLOYMENT

TABLE 41 EXPENDITURE MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Employment	0.00	0.01*	-0.00	0.01*(4)

FIGURE 26 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS -UK

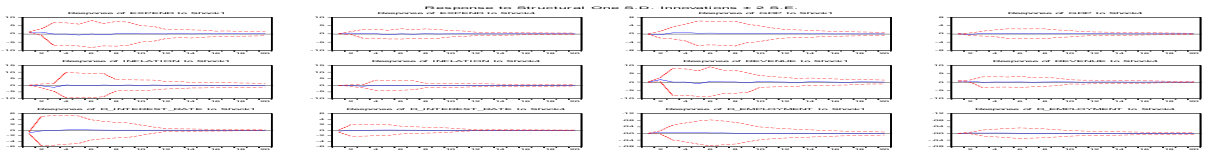


TABLE 42 TAX MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Employment	0.00	0.00	0.00	0.01*(2)

INFERENCE

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.

WAGES

TABLE 43 EXPENDITURE MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Wages	-0.48	-0.39	-0.03	0.03*(3)

FIGURE 27 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS

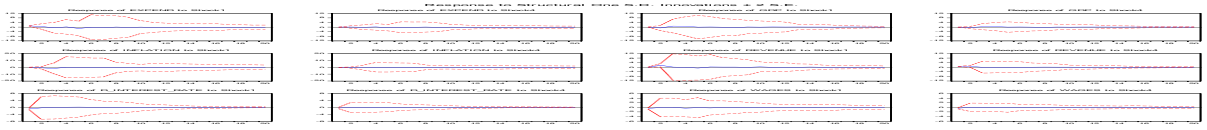


TABLE 44 TAX MULTIPLIERS - UK

Variables	Impact	First year	Five years	Peak
Wages	-0.40	-0.20	-0.02	0.05*(3)

INFERENCE

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.

NET INVESTMENT

TABLE 45 TABLE EXPENDITURE MULTIPLIERS -UK

Variable	Impact	First year	Five years	Peak
Investment	0.44	-0.05	-1.09	2.86*(7)

FIGURE 28 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS -UK

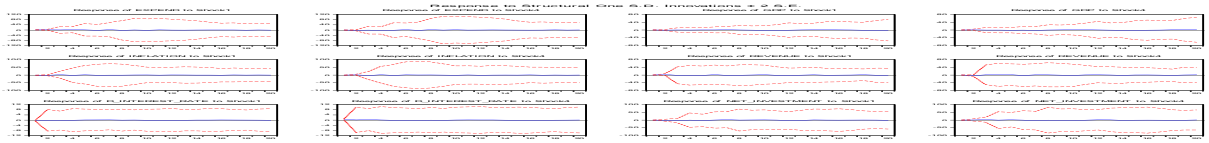


TABLE 45 TAX MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Investment	0.20	-0.04	0.02	0.20*(1)

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.

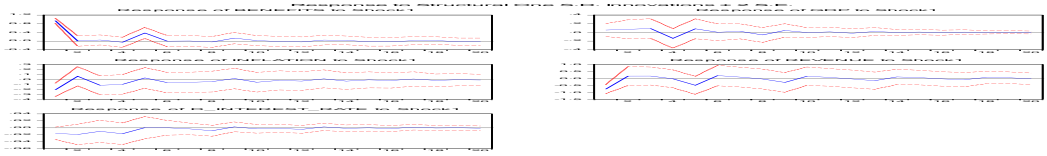
IMPACT OF AUTOMATIC STABILISERS IN THE UNITED KINGDOM

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.

TABLE 46 EXPENDITURE MULTIPLIERS - UK

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

FIGURE 29 IMPULSE RESPONSE GRAPHS - UK



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.

5 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[23]. Adding the dummy variable to the baseline reduced form equation gives

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

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

5.1 Results

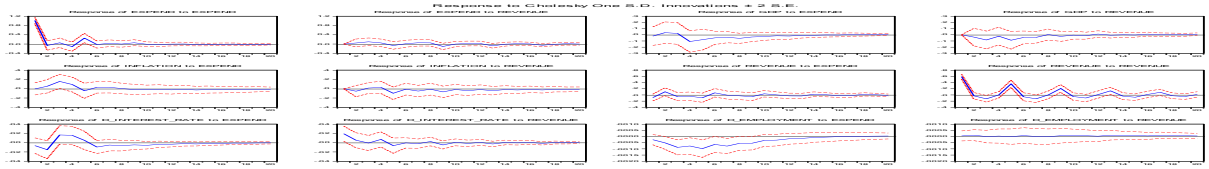
AUGMENTED EVENT STUDY IDENTIFICATION

EMPLOYMENT

TABLE 47 EXPENDITURE MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Employment	-0.00	-0.00	0.00	0.00*(15)

FIGURE 30 FIGURE EXPENDITURE AND TAX IMPULSE RESPONSE GRAPHS - UK



[23] 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 having involved a significant military build-up within the sample period.

INFERENCE

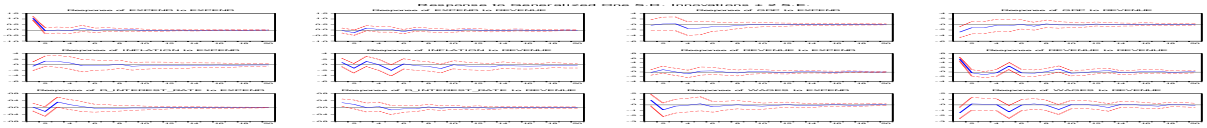
Employment falls but rises significantly to go slightly above the steady state with a peak multiplier of 0.00 at 15 quarters after an expenditure shock resulting from a military build-up.

WAGES

TABLE 48 EXPENDITURE MULTIPLIERS - UK

Variable	Impact	First year	Five years	Peak
Wages	0.08	-0.01	0.00	0.02*(5)

FIGURE 31 IMPULSE RESPONSE GRAPHS - UK



INFERENCE

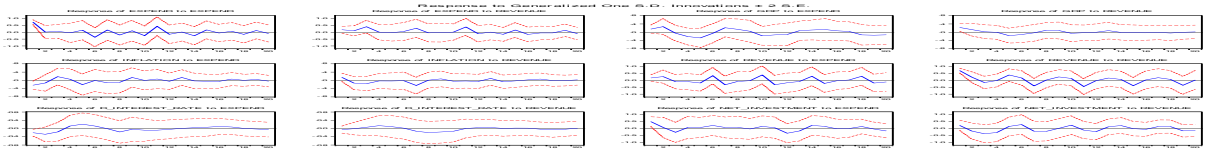
Wages rise upon impact of an expenditure shock resulting from a military build-up. It however falls below the steady state in the second quarter but returns and remains at the steady afterwards for the remainder of the forecast horizon.

NET INVESTMENT

TABLE 49 EXPENDITURE MULTIPLIERS – UK

Variable	Impact	First	Five years	Peak
Investment	0.50	0.07	-0.18	0.20*

FIGURE 32 IMPULSE RESPONSE GRAPHS



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.

5.2 TESTS FOR STRUCTURAL BREAKS

TABLE 50 TESTS FOR STRUCTURAL BREAK -30% TRIMMING - UK

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

INFERENCE

From table 54, there are structural breaks in the data which may have affected the coefficients gained.

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.

6 EFFECT OF FISCAL POLICY SHOCKS IN GERMANY

6.1 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. Apart from 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.

PRE-ESTIMATION DATA PREPARATION

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.

ECONOMETRIC SPECIFICATION

BENCHMARK REDUCED FORM VECTOR AUTOREGRESSION

Consistent with Caldara and Kamps (2008), the standard or reduced form[24] model of VAR collecting the endogenous variables in the *k*- dimensional vector X_t can be expressed as

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

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[25]. Thus pre-multiplying the above equation by the ($\kappa\chi\kappa$) matrix A_0 gives the structural form

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

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[26]. 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 thesis as Z_t , the vector X_t can be partitioned as

$$Z_t = \begin{bmatrix} X1t \\ gt \\ X2t \end{bmatrix}$$

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.

AUGMENTED RECURSIVE IDENTIFICATION

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[24] 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.

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

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

WAGES

TABLE 51 EXPENDITURE MULTIPLIERS - GERMANY

Variables	Impact	First year	First years	Peak
Wages	0.05*	0.02	-0.04	0.05*

FIGURE 33 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS - GERMANY

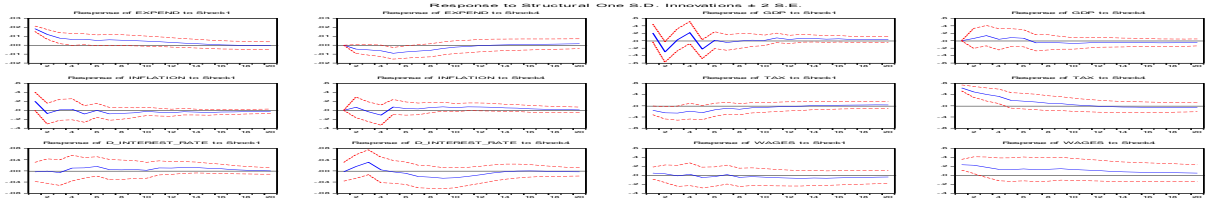

TABLE 52 TAX MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Wage	0.24	0.12	0.05	0.24*

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.

INVESTMENT

TABLE 53 EXPENDITURE MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Investment	0.11	0.13	0.01	0.16*(2)

FIGURE 34 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS - GERMANY

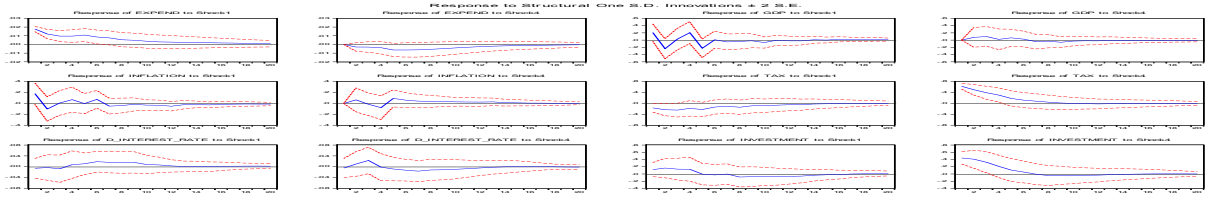

TABLE 54 TAX MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Investment	0.44	0.21	0.00	0.44*(1)

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.

6.2 RESULTS

AUGMENTED BLANCHARD PERTOI IDENTIFICATION

WAGES

TABLE 55 EXPENDITURE MULTIPLIERS -GERMANY

Variable	Impact	First year	Five years	Peak
Wages	-0.22	-0.30	-0.15	-0.20*(12)

FIGURE 35 TAX AND EXPENDITURE IMPULSE RESPONSE GRAPHS -GERMANY

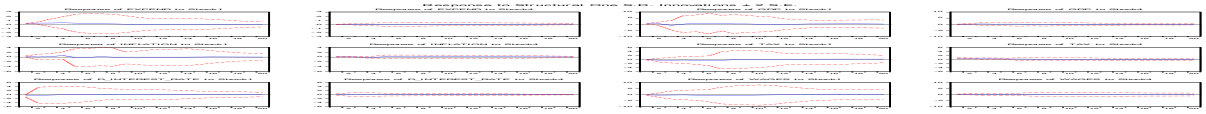

TABLE 56 TAX MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Wages	0.25	0.14	0.05	0.25*

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.

INVESTMENT

TABLE 57 EXPENDITURE MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Investment	0.30	0.60*	0.06	0.60*(4)

FIGURE 35 TAX AND EXPENDITURE IMPULSE RESPONSES - GERMANY

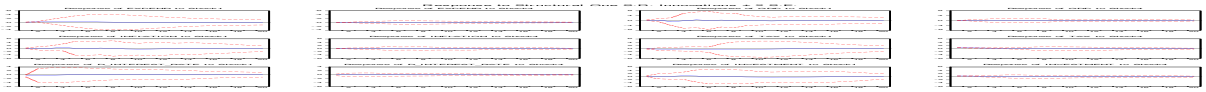

TABLE 58 TAX MULTIPLIERS - GERMANY

Variable	Impact	First year	Five years	Peak
Investment	0.50	0.30	0.01	0.20*(5)

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 were 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.

TEST FOR STRUCTURAL BREAK

TABLE 59 TESTS FOR STRUCTURAL CHANGE -15% TRIMMING - GERMANY

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

SUMMARY OF RESULTS FOR GERMANY

Consistent with the results gained in this thesis 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.

7 DISCUSSION

This thesis 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[27].

Another original contribution made by this thesis 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.

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 because of 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 thesis, 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 thesis, automatic stabilisers improved the path of output suggesting that benefits paid to

[27] 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 (Thesis 2) of this thesis.

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.

7.1 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 thesis, 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 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 apart from Greece.

Moreover, theoretical hypotheses against expansionary fiscal policy such as 'crowding out' was not supported by the findings of this thesis. 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.[28]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. These support the new Keynesian theoretical framework for fiscal policy used by (Fatás and Mihov, 2001) and (Gali, 1994)

7.2 HOW ARE THE ANALYSES/RESULTS DIFFERENT FROM EXISTING LITERATURE

The analyses in this thesis is different from that of the existing literature in that it separates the government spending shock into two components. Specifically,

[28] 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.

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 act 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 can 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 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 can be used as a positive shock to the economy.

Another important note that is central to this thesis is the choice of variables. Apart from the series on government social benefits, this thesis 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 thesis helps the understanding of fiscal policy in that together with key macroeconomic variables studied in this thesis, 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 increase interest's rates, supplants business investment and crowds out private spending. That said, the findings in this thesis has refuted all of this and goes further to show that unlike monetary policy, the effects of fiscal policy benefit all economic agents and presents a solution to the low growth-low-inflation environment in advanced economies. Of course, several 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 thesis 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.

7.3 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 thesis, 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.

7.4 ECONOMIC POLICY PRESCRIPTION AND ANALYSES

Empirical and theoretical evidence from the existing literature and that gained in this thesis shows that fiscal policy works and expands the economy despite the finding in this thesis 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 thesis 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.

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