Examining the Effects of the Recent Global Recession on the Fiscal Multipliers of the G7 Countries.

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Abstract

Since 2007, governments around the world have used expansionary fiscal policies to limit the impact of the recession. However, the full economic implications of this stimulus have yet to be fully analysed. This thesis addresses the impact of the recent recession on the fiscal multipliers of the G7 countries and answers the following research question: '*to what extent has the recent recession influenced the fiscal multipliers of the G7 countries?'* Both literature and quantitative analyses are conducted in order to provide an answer. In the latter, OLS regression analysis is used. The conclusions show that fiscal multipliers have been affected by the recession. Interestingly, the presence of non-Keynesian effects have been identified. The full extent of this remains country specific, e.g. the multipliers for Japan and the UK have reacted differently. The statistical significance of the results does come into question when interpreting the conclusions. In the future, more research should be conducted to gain a clearer understanding about this topic. Only then will this analysis have more complete answer.

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1. Introduction

1.1 Structure of the thesis

This thesis composes eight chapters. The first chapter, containing the introduction, research question and problem statement, introduces the issue and informs the reader about the problem that needs to be addressed: '*what is the effect of the recent recession on the fiscal multipliers of the G7 countries?'* The second chapter discusses the limitations of this analysis. The third chapter delves into the economic principles concerning the theory behind fiscal polcy. Demand side effects of fiscal policy such as Keynesianism, non-Keynesian effects, rational expectations and uncertainty are discussed. The influence of supply side policies are also explained. The fourth chapter covers recent acedemic literature written on the subject. It explores different approaches towards measuring the fiscal multiplier and the economic conditions that may influence it. Chapter five presents the econometric model that will be used in order to answer the main research question of this thesis. In chapter six, the results are presented and chapter seven provides a critical examination and evaluation of these results. This thesis is brought to a conclusion in chapter 8. Additional theory and tables are presented as supportive material in the appendix.

1.2 Problem statement

The financial crisis and recent global recession have been profound in magnitude and duration. Governments have been quick to embrace extensive fiscal policies aimed at limiting the impact of recession and stimulating economic growth.

The International Monetary Fund (IMF) has suggested that all countries implement expansionary fiscal policies consisting of roughly 2% of GDP. This was considered necessary in order to reduce the impact of a global recession (IMF, 2009). An example of a practical application of such a policy can be seen in the United States. Former President George W. Bush signed the Economic Stimulus Act (2008) into law. This was a $152 billion stimulus plan aimed at reducing the impact of a recession. The bill provided roughly $600 tax rebates to middle and low-income earners within the US. In 2009, President Obama signed the American Recovery and Reinvestment Act into law (ARRA). This consisted of $787 billion designed to

provide further tax rebates and induce government funding programs. Roughly $500 billion has already been spent. The remaining $287 will be used over the coming decade (Elmendorf, 2009).

European countries also adopted expansionary fiscal polices designed at reducing the impacts of recession. The European Commission (EC) suggested that EU countries adopt a 1.2% baseline, which is less than the 2% suggested by the IMF. Germany passed a €50 billion package in the form of tax rebates and investment regarding education and infrastructure in 2009, despite initially showing reluctance towards implementing such fiscal measures (BBC, 2009). The UK has been an enthusiastic advocate of using expansionary fiscal policies to stimulate economic output. In 2008, the British introduced tax cuts to those earning less than £34.800 pounds per year. Investment spending was also enlarged. However, the UK will probably not implement any more substantial fiscal policy measures. This is because the bailouts provided to the financial sector had increased the national debt to a high of roughly 80% of GDP in 2009. In addition to this, the UK has made use of extensive automatic stabilizers. Examples of such stabilizers are the welfare benefits provided to the unemployed. These have played a smaller role in other EU countries (BBC, 2009).

Since 2007, deficits and national debts have increased substantially. According to Christine Lagarde - managing director of the IMF - one of the few countries to have implemented fiscal austerity measures correctly is New Zealand (Young, 2013). The problem facing the EU and the IMF is: '*to what extent should countries implement fiscal consolidation in light of the recent recession?'* It is this that has provided the motivation for this thesis.

1.3 Research question

The above leads to the research question stated earlier: '*to what extent has the recent recession influenced the fiscal multipliers of the G7 countries?'* In order to answer to this question, the following sub-questions shall be addressed:

1. How does past economic theory explain the workings of the fiscal multiplier?

2. What does previous academic literature conclude about the fiscal multiplier under different economic conditions?
3. To what extent can the fiscal multiplier be modeled using OLS regression analysis?
4. What does this analysis say about the effects of the recent recession on different fiscal multipliers?

2. Limitations

There are certain limitations regarding the analysis below. It is important to address these before the results are discussed in detail.

OLS regression analysis is used for estimating the coefficients. The estimates, regarding the coefficients, are based on the growth rates of the variables used. These provide an indication regarding the reaction of the fiscal multipliers to different fiscal policies.

Even though the results and conclusions are based on data from the OECD databank, certain assumptions regarding the data have been made. This has been done to enable the econometric model to work. These are discussed in the relevant sections below.

Fiscal policy, notably, has both a economic and political dimension. This paper covers the economic, and not the political, dimension. This should be taken into account when interpreting the conclusions.

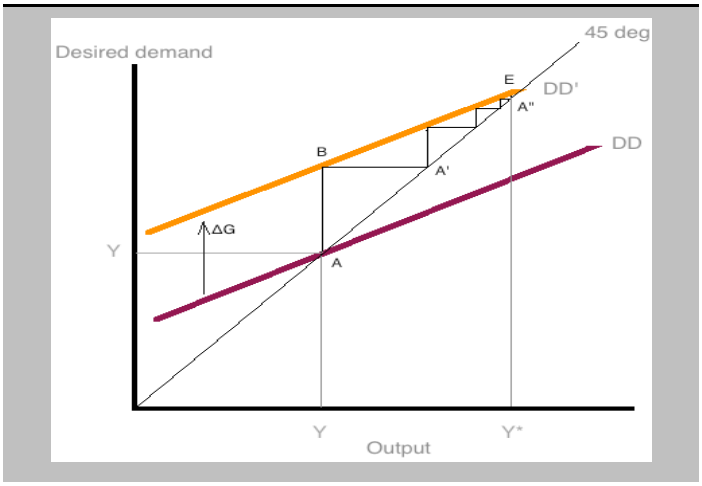
It has been my intention to provide the reader with an informative and precise evaluation of the workings and effects of the fiscal multiplier that govern the effectiveness of fiscal policy.

3. Theory

3.1 The fiscal multiplier

The following example will be used in order to illustrate the concept of the Keynesian multiplier. See figure one. Consider an exogenous increase in government spending, shifting the demand schedule from DD to DD'. The distance between the two schedules is $\Delta\bar{G}$. The new equilibrium output in the economy has increased from Y to Y^*. The multiplier effect is the transition from A to A''. The increase in demand and output increases GDP to A' – the direct effect. However, the DD' line is still above the 45 degree line, so demand and output increase yet again and reach the state of equilibrium. At this point, more is produced in order to match higher demand. The agents' income in the economy also rises. The government buys more from firms distributing the income. GDP increases by a multiple of the initial increase in government expenditure – the Keynesian demand, fiscal multiplier (Wyplosz, 2005). A similar analysis can be used when examining the effects of a tax reduction.

Figure 1: Keynesian demand multiplier



Source: Wypolsz (2005) page 235.

The fiscal multiplier is a ratio of the rate of change in a country's output, ΔY, to an exogenous change in government expenditure[1], ΔG, or net taxes[2], –ΔT, with respect to their initial values (Spilimbergo, Symansky, & Schindler, 2009).

[1] Government expenditure is defined as government consumption plus government
[2] Net taxes are defined as total tax revenue minus transfers and interest payments.

Fiscal multipliers
The impact multiplier $\left(\equiv \frac{\Delta Y(t)}{\Delta G(t)}\right)$
The multiplier at some horizon N $\left(\equiv \frac{\Delta Y(t+N)}{\Delta G(t)}\right)$
The peak multiplier: largest $\left(\equiv \max_{N} \frac{\Delta Y(t+N)}{\Delta G(t)}\right)$ over any horizon N
The cumulative multiplier: the cumulative change in output over the cumulative change in fiscal expenditure at some horizon **N** $\left(\equiv \frac{\sum_{J=0}^{N} \Delta Y(t+J)}{\sum_{J=0}^{N} \Delta G(t+J)}\right)$
Table 1. Note: in the above, ΔG is used as an example to simplify the table. However, one can interchange this variable with –ΔT. Source: Spilimbergo et al. (2009) page 2.

A commonly used measure for economic analysis is the cumulative multiplier. The impact multiplier fails to account for the fact that fiscal stimulus is implemented over a period of time, i.e. the economy reacts gradually. The cumulative multiplier is therefore larger than both the impact and peak multipliers (Spilimbergo et. al. 2009).

The Keynesian multiplier is finite and becomes smaller as time progresses. Eventually agents[3] in the economy will use an ever-decreasing amount of income for consumption. The reason for this is leakages. Leakages in the economic system occur as a result of taxation, savings and the importation of goods from abroad (Wyplosz, 2005).

There are three factors that can be used in order to explain the size of a fiscal multiplier. The size of the fiscal multiplier is increased if the leakages are minimized, the monetary conditions remain favourable e.g. interest rates remain steady after a fiscal expansion, and the countries fiscal state of affairs remains stable after the stimulus in the long run. These are discussed in more detail below (Spilimbergo et. al. 2009):

[3] Agents are referred to as members of the population.

- Leakages in the economy can be reduced by the following:

  i. The stimulus package incorporates a comparatively large governmental component in relation to a tax cut. Note that governmental components refer to expenditure on goods and services. The initial effects on demand will be immediate. People will be inclined to save a larger portion of their income after a tax cut;
  ii. There is a high marginal propensity to consume amongst agents in the economy;
  iii. Stimulus measures are intended for consumers who face liquidity constraints;
  iv. Agents are considered myopic in their attitude regarding future taxation;
  v. The propensity to import goods from abroad is low.

- Monetary conditions remain favourable if:

  i. Nominal interest rates do not rise as a result of fiscal expansion. This mechanism should limit the effects of crowding out when considering domestic investment and consumption;
  ii. The country in question maintains a fixed exchange rate, as explained by the Mundell-Fleming model (Wyplosz, 2005).

- Ensuring fiscal sustainability in the long run will reduce the extent to which the higher debt burden influences the interest rates (Spilimbergo et. al. 2009).

3.2 Demand-side effects of fiscal policy

3.2.1 Keynesian theory

Keynesian theory regarding fiscal policy provides us with a valuable approach towards analysing the demand side effects. The theory assumes price rigidity and excess capacity, i.e. firms maintain a flexible inventory. Also, output is determined through aggregate demand. The relationship between fiscal policy, aggregate demand and output is determined through the Keynesian fiscal multiplier explained above.

A fiscal expansion can result in "crowding out"[4]. This is incorporated in the basic Keynesian model by including assumptions regarding interest and exchange rates. Crowding out has an effect on the size of the multiplier, but does not alter the sign. The Mundell-Fleming, IS-LM, model shows that private investment and interest rates are negatively correlated. As a result, fiscal expansion, financed through increased debt burden, can increase the interest rate and reduce investment in the economy. The Mundell-Fleming model also caters for crowding out through exchange rates. A higher interest rate automatically increases foreign direct investment (FDI) leading to an exchange rate appreciation. This appreciation causes a deterioration of the current account, which counteracts the increase in domestic demand because of the fiscal expansion (Hemming, Kell, & Mahfouz, 2002).

The sensitivity of crowding out via interest and exchange rates is determined by the following factors of the Mundell-Fleming model (Hemming et. al. 2002):

1. The sensitivity of private sector investment to changes in the interest rates. The larger the private sectors sensitivity, the greater the crowding out;
2. Since the demand for money is determined through interest rates and income, if the demand for money is less sensitive to interest rates, it will be more sensitive to income. This will result in greater crowding out. However, monetary policy can be used in order to counteract this rise of interest rates due to the period of fiscal expansion;
3. The openness of the economy and exchange rate regime itself. In the case of flexible exchange rates and perfect capital mobility, fiscal policy will have no effect on output. There is complete crowding out. However, under a fixed exchange rate regime and perfect capital mobility, fiscal policy does have a significant impact on a countries economic output. This is because the money supply is used in order to maintain lower interest rates.

The level of price flexibility within the economy also affects crowding out. Further adaptations to the simple Keynesian model allow for a certain degree of price flexibility within the model itself. This is known as neo-Keynesianism. Allowing prices to adjust in the short run limits the range of values the fiscal multiplier may

[4] Fiscal expansion replaces private sector spending. Governments finance the expansion through tax increases or deficit spending leaving private sector firms with less money.

assume. In particular, price flexibility will limit the influence of the exchange rate regime on the fiscal multiplier, as explained above. This is also the case when considering the long run. If the price adjustment fails to clear the markets, price rigidity is still considered present (Hemming et. al. 2002).

Interest rates, exchange rates and price flexibility also have certain Pigou effects[5] on aggregate demand. This is especially the case when the current level of consumption is dependent on current wealth. Interest rates are negatively correlated with financial assets: an increase of the interest rates will decrease the nominal value of financial assets. Similarly, an appreciation of the domestic currency will reduce the nominal value of foreign currency assets. These wealth effects will increase crowding out, as long as households and firms are net creditors, and the fiscal multiplier will decreases in size. The full effect of flexible prices on crowding out is debateable, since they will have opposing effects on nominal and real wealth (Hemming et. al. 2002).

There is also the possibility that crowding out takes longer to manifest than the direct effects of fiscal expansion. In other words, the crowding out process takes a certain amount of time and only becomes apparent in the long run. In this case, one would expect the fiscal multipliers to be larger in the short run, and gradually decrease over time. The wage-price spiral[6] and the responsiveness of trade to changes in the domestic price levels of imports and exports will also affect the size of the fiscal multiplier in the short run (Hemming et. al. 2002).

3.2.2 Non-Keynesian effects

According to the simplest of Keynesian theories regarding fiscal policy, a fiscal contraction should have a negative impact on aggregate demand and hence reduce output. In fact, a comparatively small improvement in the fiscal balance will result in a significantly larger deterioration in aggregate demand. The reduced aggregate demand can be attributed to the following facts:

[5] This effect refers to the stimulation of output and employment by increasing consumption due to an increase in the real balance of wealth within the economy. This effect is particularly strong during periods of deflation.
[6] A loop in terms of wage hikes because of inflation and companies raising prices. These price increases lead to inflation and so on (Wyplosz, 2005).

- Reduction of public expenditure and/or increased tax revenue;
- Secondary reduction in private consumption[7].

However, the Keynesian models used in the above have microeconomic flaws. In recent literature, new classical models have attempted to address these limitations with demand side properties. Non-Keynesian effects of fiscal policy are implicated as a result of these new classical models (Hemming et. al. 2002).

The definition of non-Keynesian effects is as follows. Improvements in the fiscal balance lead to an increase in aggregate demand and hence economic output. The Samuelson model can be used to demonstrate how a fiscal contraction can increase aggregate demand. According to this model, non-Keynesian effects can be attributed to tax, transfer and public expenditure multipliers. A fiscal balance improvement can be achieved by setting higher taxes, provided that consumers are compensated by adequate public expenditure on goods and services. Learning about the mechanisms behind a fiscal contraction is essential when trying to understand the full extent of these effects (Ciżkowicz & Rzońca, 2005).

Expectations play a significant role in determining non-Keynesian effects. This is more formally known as the expectation channel. This works through an improvement in economic agents' expectations regarding net taxation. In the periods following fiscal contraction, agents may feel that they have been pessimistic regarding future government spending and net taxes. These are both important factors that we assume to determine the agents' income distribution between both consumption and saving. As one would expect, reducing the uncertainty amongst agents will entice them to reduce their savings and increase consumption. It is therefore important that the bout of fiscal consolidation is credible, so that agents do not have to fear further, more draconian, measures in the near future (Benk & Jakab, 2012).

The expectation effect depends on two factors. The first is the size/duration of the measures. The second focuses on the credibility of the government itself. When

[7] This refers to the decrease in the flow of income from firms to households and the assumption that each household spends a fixed percentage of additional income on consumption.

considering non-Keynesian effects, it is assumed that economic agents believe that fiscal adjustments will be carried out when announced, i.e. they need to be credible (Benk & Jakab, 2012).

Knowing when the expectations channel will lead to positive effects on the economic output of a country remains uncertain. However, the literature has identified certain circumstances whereby the probability and magnitude of the positive effects are increased. These are summarized below (Benk & Jakab, 2012):

- The consolidation measures are perceived to drastically improve the fiscal sustainability. It is assumed the country is, initially, facing profound problems from a fiscal point of view;
- The fiscal measures are extensive yet achievable and perhaps part of a greater structural reform plan;
- The measures focus on reducing the agent's disincentives to both work and save. They should proactively promote growth expenditure in order to improve supply conditions in the economy.

3.2.3 Rational expectations

A significant amount of Keynesian theory relies on adaptive expectations[8]. Only a small amount of this theory relies on the role of rational expectations[9]. Juxtaposing the two concepts: rational expectations leads to larger, less progressive, changes in the forward adjustment of variables, as opposed to adaptive expectations. When considering the former, long run effects can transform themselves into short run effects. This means that a clear distinction has to be made between permanent and temporary changes in fiscal policy. A permanent fiscal expansion leads people to believe that interest rates will rise at some point in the future, the long run. This leads to an exchange rate appreciation and intensifies crowding out. This can happen to the extent that the fiscal multipliers assume negative values (Hemming et. al. 2002).

[8] Expectations of future values of economic variables are based on past values.
[9] An agents' prediction of future values of an economic variable based on past values is correct since all errors are random.

3.2.4 Ricardian equivalence

Table 3: Ricardian equivalence is based on the following assumptions:
Rational agents have an infinite time horizon – either immortal or leave bequests
Current budget deficit means higher future taxes
Lump sum taxation
Deficit spending has no political consequences
Households are homogenous
Capital markets function perfectly – no liquidity constraints
Source: taken from Wypolz (2005), page 115.

According to Keynesian theory, consumption and current income are both related. Consumers are considered Ricardian if they are forward-looking and internalize the governments budget constraint[10]. Absolute Ricardian equivalence results in a fiscal multiplier of zero. This is because a government tax reduction is entirely offset by an increase in the private sectors saving. Aggregate demand remains unaffected (Hemming et. al. 2002).

Consider the following scenario: a tax cut today financed by an increase in the government deficit. Since families are assumed to live forever in the infinite horizons model[11], agents will anticipate a higher tax rate in the future to finance the debt burden. From this point of view, permanent income[12] and consumption will remain unchanged. However, this is based on the assumption that there are no liquidity constraints and that capital markets function perfectly. The full extent of a fiscal expansion on permanent income due to increased government spending depends on how the deficit is financed in the future. Permanent income will remain unchanged if current government spending increases are met with future spending cuts. However, if the increased spending is met with future tax increases, permanent income and consumption will both decrease. This can result in a negative fiscal multiplier in the long run, i.e. non-Keynesian effects. The productivity of the government-spending program will determine the fall in output (Hemming et. al. 2002).

[10] $G_1 + \frac{G_2}{1+r_G} = T_1 + \frac{T_2}{1+r_G}$ See the Appendix section A for a detailed explanation.
[11] See appendix for assumptions.
[12] People will spend money at a level consistent with their average long run income.

It is wrong to expect the changes in taxation and/or government spending to have a one-for-one effect on the aggregate demand in the economy. From the literature, it would seem that only sustained changes in income taxation - taxation that induces significant changes in inter-temporal substitution and temporary changes in spending - should be used to alter aggregate demand (Blanchard & Perotti, 2002).

The Ricardian equivalence assumptions are strong if implemented literally. As a result, Ricardian equivalence has yet to be proven empirically. Thus far the extent of its influence within economic reality seems to be circumstantial. Changes in the inter-temporal value of taxation will have little effects on the value of the assets themselves, therefore not having a large impact on private spending (Wyplosz, 2005). Even so, in some cases there may be certain situations whereby the agents' response is likely to have certain Ricardian characteristics. For example, a simple fiscal rule dictates that at some point in the future every government must reverse a fiscal expansion. It is impossible and would be irresponsible to endlessly increase government expenditure or reduce the level of taxation in an economy. Even if an agent has a relatively short time horizon, they will inevitably adjust their savings behaviour and prepare for future tax increases (Hemming et. al. 2002).

3.2.6 Uncertainty

If there is increased uncertainty amongst agents regarding the economy amidst a fiscal expansion, households and firms will become more cautious. This cautious behaviour can cause the fiscal multipliers to turn negative. The uncertainty lingering between the agents can also influence the confidence level within the economy. Despite the fact that the relationship between confidence effects, investment spending and consumption are unclear, it is plausible to assume that they are linked. Namely, the amount both households and firms consume and invest is dependent on the economic climate. In this respect consumer confidence is dictated by the credibility of the governments and its fiscal policies (Hemming et. al. 2002).

3.2.7 Interest rate premiums and credibility

Debt accumulation can affect the fiscal multiplier through interest rates and the associated risk premium[13]. This risk premium will drive up the interest rates and therefore stimulate crowding out. In this case, a permanent fiscal expansion is less effective than a temporary one because agents will worry that the risks of the government default will increase. Policy credibility is therefore important. Risk premiums will inevitably be incorporated into interest rates if agents fear that a temporary government fiscal expansion may become permanent. Large risk premiums are perhaps one of the main reasons why fiscal multipliers assume negative values. The relationship between private spending, a commitment to debt reduction and lowered risk premium is a positive one. In the Giavazzi and Pagano (1990) paper, this is used as a main explanation for non-Keynesian effects. This paper discussed in greater detail in section 4. below.

3.3 Supply-side effects of fiscal policy

Demand and supply-side policies are both important when considering the short and long run effects of fiscal policy. The difference between the two policies and the time it takes for implementation is often hard to distinguish. Fiscal expansion will be crowded out if an economy is already operating at full capacity and if productive capacity is constrained in the short-run. Policies that promote supply-side responses deal with these capacity constraints in the long run. On the other hand, implementation of supply-side policies can have short run effects, since these will increase the agents' expectation of economic growth in the long run. Tax reductions and spending increases are beneficial for the supply-side in the economy. As a result, expansionary fiscal policies that assume the form of tax cuts and government spending increases will enlarge the fiscal multipliers (Hemming et. al. 2002).

Fully evaluating the short run effects of fiscal policies means that one should consider the way in which labour income taxes affect the supply of labour and how capital taxes affect the between saving and investment. Government spending on public goods with positive externalities often leads to an enhanced economic output.

[13] Risk premiums reflects the likelihood of a default and the risk of inflation.

This is measured empirically by Murphy, Shleifer and Vischny (1989). Azariadis and Drazen (1990) have demonstrated that likewise fiscal policies help to nudge the economy from between a 'good' and 'bad' equilibrium (Hemming et. al. 2002).

Analysing the influence of labour markets on the non-Keynesian effects resulting from a change in net taxes or government spending is also important in understanding the supply side effects of fiscal policy. Increasing labour income taxes can have a negative supply side effect if the labour market under consideration is imperfect, e.g. strong unions, forcing the labour costs to rise. The fiscal multiplier could be reduced and hence result in non-Keynesian effects by reducing inflationary pressure in the labour market. This could be achieved by negotiating with the labour unions in order to limit the before tax wages. Alesina and Perotti (1996) examine this in greater detail (Hemming et. al. 2002).

3.4 Institutional factors

In the literature, a distinction is made between 'inside' and an 'outside' lag. An inside lag is defined as the time between realising that a change in fiscal policy is needed and actually implementing it. Outside lags are defined as the time needed for the fiscal policy changes to fully affect aggregate demand. This is notably a function of the political system employed by the country itself. Inside lags are highly dependent on the level of 'red-tape' within the government. Automatic stabilizers such as a progressive income tax system suffer from shorter inside lags. Outside lags are hard to determine, but are generally shorter for transfers and tax reductions for people who in the past have suffered from liquidity constraints. Shorter inside and outside time lags result in larger fiscal multipliers in the short run (Hemming et. al. 2002).

The following political economy issues should to be taken into account when analysing the institutional factors. Governments run the risk of shifting the current fiscal imbalances onto the next time period, i.e. a future generation. Accumulating debt can also be used in order to limit the abilities of a future government to increase government spending programs for example. The ability of voters and governments to maintain an educated view of the government's inter-temporal budget constraint may

be questioned. This could affect the government's stance on favouring a fiscal deficit over a surplus (Hemming et. al. 2002).

4. Literature review

The non-Keynesian effects of fiscal consolidation have been extensively investigated during the past 20 years. The literature ranges from case studies to in-depth analyses into the experience of many countries. Initially, a considerable amount of focus was paid to descriptive statistics, e.g. the Alesina & Perotti (1996) paper. The literature has progressed into cross-country models that have focused on the persistence of the fiscal adjustment within different economies, e.g. McDermott & Wescott (1996). In order to determine the channels through which the fiscal adjustments lead to non-Keynesian effects, attention has been paid towards developing private consumption functions and investment equations, e.g. Giavazzi et al. (1999).

4.1 Non-Keynesian effects

One of the fundamental questions regarding fiscal policy is: '*to what extent do fiscal policy measures affect the economic output of a country?'* This has been investigated at length in a report conducted by Giavazzi and Pagano (1990). It was one of the first papers to suggest that a fiscal contraction could have expansionary effects, i.e. non-Keynesian effects. During the 1980's, EU countries tightened their fiscal policies. Keynesians viewed this as irresponsible, claiming that fiscal contractions would have significant negative effect on employment and economic output. Others argued that this new approach would have expansionary effects. They highlighted the importance of expectations regarding public debt. This view was referred to as the 'German view' by Giavazzi and Pagano (1990) and emphasises the direct and indirect effects of fiscal policy. The former refers to the level and composition of aggregate demand. The latter refers to expectations throughout the economy, i.e. indication of future fiscal policy (Giavazzi & Pagano, 1990).

Giavazzi and Pagano (1990) examine the economic data for a number of European countries and conclude that fiscal policy can result in negative fiscal

multipliers. This is especially the case in countries whereby the spending cuts were perceived as long-term policies. The paper pays special attention to Denmark and Ireland that both witnessed a significant improvement in economic conditions. This improvement resulted from fiscal consolidation programs in 1983 and 1987-9 respectively. The consequently low interest rates fuelled a housing bubble in Ireland between 1990 and 2008 (Malzubris, 2008). The importance of monetary and exchange rate policies in the stabilization process is emphasized. The announcement of budget cuts coincided with the announcement that the Irish Pound and Danish Krone were to be pegged to the Deutschmark. This led to a rise in asset prices and decreased interest rates. The report concludes that in many cases, the German view is a relevant one. When considering Denmark, fiscal consolidation was associated with increased private consumption despite controlling for wealth, income and increases in taxes. The results from Ireland demonstrate the importance of liquidity constraints in the effectiveness of this mechanism (Giavazzi & Pagano, 1990).

Giavazzi and Pagano later went on to continue their research into non-Keynesian effects in 1995. In this paper, the question of when these fiscal policy changes lead to non-Keynesian effects is addressed. The evidence from the cross-country analysis into private consumption confirms the presence of non-Keynesian effects, as long as the fiscal policy measures are both significantly large and persistent. The analysis also shows that these effects can result from changes in private consumption, taxes and transfers. The second part investigates the Swedish fiscal expansion of the 1990's. This expansion consisted of a decrease in net taxes and no alterations in the composition of government expenditure. This fiscal expansion was linked to a significant reduction in private domestic demand. This result contains a large negative error. It is decided that wealth effects and after tax real interest rates are not sufficient in explaining this error. The paper concludes by suggesting that the reduction in permanent disposable income is attributed to the period of fiscal expansion (Giavazzi & Pagano, 1995).

Building on the work done by Giavazzi and Pagano, McDrermott and Wescott (1996) conduct research behind the interplay of fiscal adjustrments and economic performance. Their findings are in accordance with Giavazzi and Pagano: periods of fiscal consolidaiton can lead to non-Keynesian effetcs, especially over the medium

term. McDermott and Wescott (1996) also find that consolidation measures that concentrate on the expenditure side, in particular transfers and government wages, stand a higher chance of reducing the public debt ratio than tax based consolidation measures. This finding is also in accordance with Alesina and Perotti (1996) report, since dramatic fiscal contractions can reduce interest rate premiums and stimulate investment spending. The anticipation of lower taxes in the future also works to encourage consumption and investment. Another important finding is that large consolidaiton measures are more likely to reduce the government debt ratio. The reason for this could be because large fiscal consolidations could be interpreted as more credible by agents in the economy. This would work to build confidence and improve expectations. However, the opposite conclusion was reached in the paper by Alesina & Perotti (1996).

A study conducted by Hemming et al. (2002) also supports the finding of non-Keynesian effects. However, the paper concludes that even though the multipliers are indeed small and subject to change, in general fiscal policies do have Keynesian effects on the economy (Hemming et. al. 2002).

A paper by Giudice et al. (2003) examines all periods of fiscal consolidation in Europe between 1970 and 2002. A total of forty-nine episodes are found and roughly half of the episodes show that the output effect is not clearly negative. The main conclusions state that non-Keynesian effects are more prominent when the initial debt level of a given country is already high (McDermott & Wescott, 1996). Also, the consolidations should take on the form of expenditure cuts. It is concluded that tax increases do not stimulate aggregate demand (Guidice , Turrini, & in 't Veld, 2003).

In a more recent report by Erceg and Lindé (2012), the effects of a tax based versus an expenditure based fiscal consolidation is investigated. This analsyis is based on a currency union. The paper concludes that in the short run, tax based consolidation measures have smaller adverse effects on economic output and visa versa in the long run. Another conclusion is that expenditure based consolidation measures can be counterproductive in the short run if the zero lower bound is binding. This reflects the fact that there will be output losses at the margin. Finally, the paper concludes that mixing a strategy by introducing harsh temporary tax increases

combined with gradual government spending cuts will yield the most desirable outcome regarding minimizing output costs from fiscal consolidaiton (Erceg & Lindé, 2012).

Rzońca and Ciżkowicz (2005) show that periods of fiscal consolidation boost growth rates in the short run. However, the details of the effects on consumption and investment remain ambiguous. The results do show that exports behave in a non-Keynesian manner, i.e. exports increase significantly as a result of the consolidaiton measures. The paper also dives deeper and carries out a quantitative analysis of episodes of strong fiscal adjustment in the NMS[14]. In the case of NMS countries periods of strong fiscal adjustment are met with accelerated output growth, i.e. it was found that non-Keynesian effects are more common than in developed countries (Rzońca & Ciżkowicz, 2005).

4.2 Fiscal multiplier

The relationship between fiscal policy and output is expressed in terms of a multiplier – the percentage change in a countries output as a result of a percentage change in government expenditure or the level of taxation. Certain models estimate relatively large multipliers, such as the Romer and Bernstein (2009). This report laid the foundations of the American Recovery and Reinvestment Act, ARRA. It predicted a combined fiscal multiplier of 1.6. Studies since then have shown this multiplier to be considerably smaller. In some cases nearly zero, e.g. Drautzburg and Uhlig (2011). Importantly, increasing government expenditure can crowd out consumption and investment in the private sector if the output is dominated by supply side factors. This reduces the multipliers' size (Nakamura & Steinsson, 2011).

The literature employs two main approaches when estimating the fiscal multiplier. The first method incorporates changes in government spending in terms of military budgets associated with wars. Inevitably, government expenditure in terms of military spending does not depend on the economic conditions at the specific time of the decision, e.g. Fisher and Peters (2010) and Barro and Redlick (2011). However, there are two caveats in using this technique for the estimation of fiscal multipliers.

[14] New member states

One being that large wars are relatively infrequent, and the other variation associated with macro-economic shocks, e.g. such as tax increases (Nakamura & Steinsson, 2011). Studies conducted by Hall (2009) and Barro and Redlick (2011) argue that it is unwise to use aggregate data on U.S. military spending after 1955 in order to calculate accurate multipliers. This is because there has been insufficient variation in the military spending since the Second World War and the Korean War. In other words, the U.S. government's military spending was at its most significant, as a fraction of output, during these two wars. Basing fiscal multipliers on more recent data will prove less conclusive since the current fraction of military spending on output is significantly smaller. The second method for calculating the fiscal multiplier concerns the vector auto-regression (VAR) approach, as investigated by Blanchard and Perotti (2002), Perotti (2007) and Ilzetzki, Mendoza and Vegh (2011). Using this technique, fiscal multipliers are estimated on the basis of various structural assumptions regarding output and the dynamics of fiscal policy.

One of the studies following the ARRA report is the Drautzburg and Uhlig (2011) paper. The Smets-Wouters new-Keynesian model is extended in the following way: some households are allowed to be credit-constrained, a zero lower bound is introduced, there is government capital and also distortionary taxation. The multiplier assumes a positive value of 0.52 in the short run and negative values in the long run, -0.42. The report concludes that the fiscal multiplier is sensitve to the number of transfers given to the credit-constrained households, the duration of the zero lower bound and capital. Constrained agents in the economy should benefit the most as long as they discount the future sufficiently (Drautzburg & Uhlig, 2011).

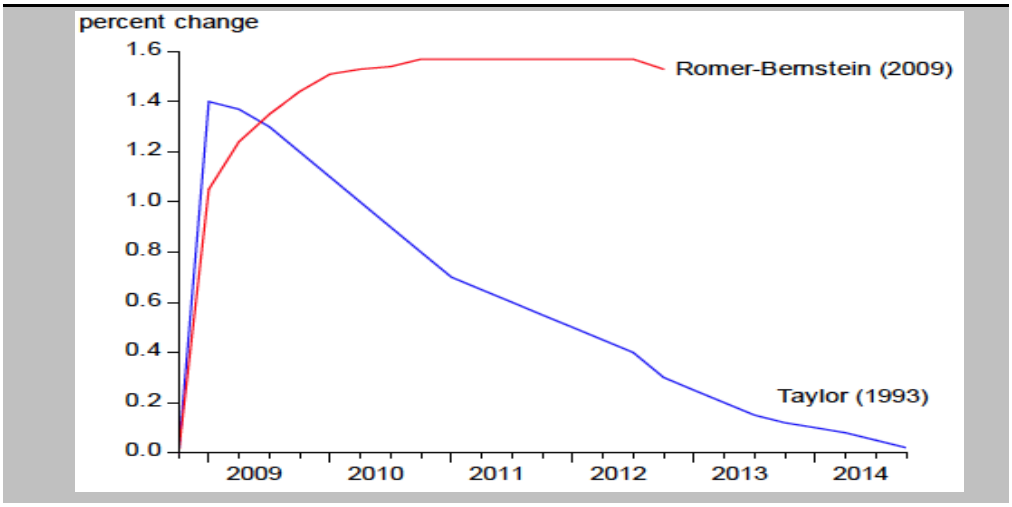
Perotti (2007) discusses the use of alternative time series methodologies in order to identify the effects of different government spending shocks and the delayed effects of a tax cut on output. More precisely, the paper seeks evidence in support of either the neoclassical or indeed the neo-Keynesian approach towards fiscal policy. The former predicting a fall in general consumption and the real wages due to an increase in government spending and taxation. The latter visa versa. These models are applied to the United States and to three OECD countries: Australia, Canada and the United Kingdom. It is concluded that there is little evidence to suggest that neo classical models are correct in their predictions (Perotti, 2007).

Ilzetzki et. al. (2011) contributes to the debate by showing that the effects of fiscal stimulus are country dependent: level of development within the economy, type of exchange rate regime employed, size of public debt and the countries openness to trade. The fiscal multipliers are caclulated for 44 countries. Some of the main conclusions are that the output effect due to government spending is larger in industrial as opposed to developing countries. The fiscal multiplier is practically zero for countries who employ a flexible exchage rate system and larger for those who operate a predetermined one. Fiscal multipliers are larger in closed as opposed to open economies and smaller in countries with higher public debts (Ilzetzki et. al. (2011).

In 2009, Christina Romer, former Chair of the President's Council of Economic Advisors, and Jared Bernstein, Chief Economist of the Office of the Vice-President, estimated the impact of a proposed government stimulus package on GDP and employment in the United States. The Romer-Bernstein paper was based on two quantitative macroeconomic models. The first being the Federal Reserve Board and the other from a forecasting firm, which has chosen to remain unnamed. The models both estimate the effects of an increase in government spending on the real GDP of the US and a net reduction in the level of taxation. These fiscal changes are assumed to be permanent. Romer-Bernstein averages the estimates from both models in order to obtain results for the total effect on real GDP (Cogan, Cwik, Taylor, & Wieland, 2009).

Figure 2 shows this effect. The figure also describes the estimates of the Taylor model due to the same increase in government purchases and reduction in net taxation. The Taylor model is based on rational expectations consisting of staggered wage and price setting and is labelled as a new-Keynesian model. This term is used to denote the fact that models have rational expectations by individual firms and also have a certain degree of price rigidity. This is in contrast with the old-Keynesian approach, such as the Romer-Bernstein method, which fails to incorporate the rational expectations assumption (Cogan et. al. 2009).

Figure 2: Projected impact on real GDP of a 1 percentage increase in government purchases.



Source: Cogan et al. 2009, page 3.

The report by Cogan et al. (2009) finds the assumptions made in the Romer-Bernstein model dubious in comparison to other new-Keynesian models. Especially the assumption regarding monetary policy. Here the FED embraces an interest rate peg[15]. The report concludes that the alternative model predictions are somewhat lower than the original Romer-Bernstein model. Interestingly, the Smets-Wouters model used by Cogan et al. (2009) estimates a fiscal multiplier smaller than one. This means that increased government spending leads to a smaller increase real GDP. As investment and consumption are crowded out, the multipliers shrink to a value smaller than one. The impact in the first year is generally fairly small. However, as the US government decreases its purchases in the years to come, the multipliers do infact turn negative (Cogan et. al. 2009).

An important point to note is that the results of the Romer-Bernstein report do not coincide with the conclusions of Cogan et al. (2009). The impacts of government spending on real GDP can be up to six times larger than those estimated by new Keynesian models. The calculations in the Cogan et al. (2009) also include the impact of tax rebates and transfers on GDP.

In a fairly recent paper conducted by Blanchard and Leigh (2013), doubt is cast on the method of calculating the macroeconomic effects of fiscal multipliers in

[15] Cogan et al. (2009), page 5, for explanation.

times of economic crisis. Other papers support this view by arguing that fiscal multipliers depend on the economic conditions at the time of measurment. This is supported by Barro & Redlick (2011), Blanchard & Leigh (2013) and Auerbach & Gorodnichenko (2012).

The conclusions based on empirical literature are not unanimous regarding the size of fiscal multipliers. Different assumptions and prefereces of the various models mean that the size of the multiplier change. This is because we are dealing with models built for use in specific situations. Multipliers based on the calculations from neo-classical models tend to be smaller than 0.5, e.g. Drautzburg and Uhlig (2011). Research has shown that multiplers are smaller if they are financed by distortionary taxes than in the case of lump sum taxation. New-Keynesian models predict a multiplier that is also dependent on the monetary policy in quesiton, e.g. the degree of leaning against the wind. Relatively small multipliers are generated from counter-cyclical monetary policy[16], similar to the multipliers predicted by the neo-classical models. On the other hand, when a much less responsive monetary policy is employed, the mutliplier can even exceed two. One of the main factors behind the variation between fiscal multipliers is that there are so many different government spending and taxation multipliers. Different models assume different weights on different periods which employ varying fiscal policy regimes (Nakamura & Steinsson, 2011).

5. Methodology

The literature section has discussed some of the main effects of fiscal policy on the economic output for a range of countries. One of the main conclusions is that the values of the fiscal multipliers are country specific. The eventual (non) Keynesian effects of fiscal policy also depend on the model and the variables employed in the analysis.

In this paper, the effects of the recent recession on the fiscal multipliers of the G7 member countries will be investigated using a standard OLS regression.

[16] e.g. the Volcker-Greenspan period in the US.

5.1 The model

The OLS regression model that will be employed in this paper is shown below:

$$(5.1.1)\quad \Delta\mathrm{Ln}(Y_t) = \alpha + \beta\Delta Ln\left(\frac{G_t}{Y_t}\right) + \gamma\Delta Ln\left(\frac{T_t}{Y_t}\right) + \varepsilon_t$$

Whereby:

$Ln(Y_t)$: $Natural\ logarithm$[17] $of\ real\ GDP.$

$Ln(G_t)$: $Natural\ logarithm\ of\ real\ government\ expenditure.$

$Ln(T_t)$: $Natual\ logarithm\ of\ real\ taxes.$

We shall consider the impact of two variables on the growth of the economic output of the G7 countries: the growth of government expenditure and the growth of net tax revenues. It is assumed that both government expenditure and net tax revenue have a significant impact on a countries' economic output. We also assume that the two concepts are not strictly independent. It is therefore essential to include both of these variables in the regression. The expenditure variable is defined as the total government purchases of goods and services, or simply government consumption plus government investment. The tax variable is defined as total tax revenues minus transfers[18].

The regression outputs will provide an indication of the fiscal multipliers for the time periods under consideration. The coefficients from the regression may also be displayed in the following format:

$$(5.1.2)\quad \widehat{\beta_t} = \frac{\Delta\mathrm{Ln}\,(Y_t)}{\Delta\mathrm{Ln}\left(\frac{G_t}{Y_t}\right)}$$

$$(5.1.3)\quad \widehat{\gamma_t} = \frac{\Delta\mathrm{Ln}(Y_t)}{\Delta\mathrm{Ln}\left(\frac{T_t}{Y_t}\right)}$$

[17] The natural logarithm will be taken of the data. This is because OLS assumes that the errors are distributed normally. The Ln will ensure that any possible skewness will be (partially) normalized. The data in log form will also allow for easier interpretation.

[18] Including interest payments.

The equations above provide an indication of the change in the growth rate of real GDP as a result of a change in the growth rate of government expenditure or net tax revenue in the economy. For example, negative values mean the fiscal policy under consideration (expenditure or tax) has a negative effect on the growth rate of the economic output of the economy.

5.2 Data

Data for the G7 countries has been taken from the OECD ilibrary, online databank. It has been decided to analyze the G7 countries because they represent seven of the wealthiest countries at this moment in time[19]. This is measured in terms of global net wealth (EC, 2012). It is important to note that not all of the data regarding tax revenue, less transfers and interest payments, was available on a quarterly bases. Having been in touch with the OECD[20], it has been decided to use YRGT, government receipts less interest payments, since this was unavailable on a quarterly basis for Canada, US, UK and Japan. Unfortunately, this data was not available for the EU members of the G7 group, France, Germany and Italy. Tax revenue, less transfers and interest payments, was available on an annual basis for the EU members. This data has been used for these countries. In short, the dataset for non-EU members contains data of quarterly frequency and the dataset for EU members contains data of annual frequency.

The quarterly data ranges from between 1970 Q1[21] and 2013 Q1 and is divided into three different sub-periods. The annual data ranges from between 1970 – 2012 and is also divided into three different sub-periods. This information is shown in the table below[22].

[19] Excluding China.
[20] The author of this paper has been in touch with the OECD, World Bank, IMF, the Dutch CPB and used the LSE database in search of the quarterly tax revenue less transfers and interest payments for all members of the G7 group. Unfortunately, it has not been possible to attain this data.
[21] Q1 refers to the first quarter of a year (January - March).
[22] It has been chosen not to include data prior to 1970. This is because there is significant risk that it has been interpolated from annual figures, increasing its unreliability (OECD, 2012).

G7 members		
Period	**Non-European members**	**European members**
I	1970 Q1 – 2013 Q1	1970 – 2012
II	1970 Q1 – 2006 Q4	1970 – 2006
III	2007 Q1 – 2013 Q1	2007 - 2012

Table 5.

The data has been extracted from the OECD databank in a nominal format. It has therefore been transformed into real terms using the OECD 2005 deflator. All data is expressed in US dollars, USD.

5.2.3 Unit root and co-integration tests

Unit root and co-integration tests will be carried out before carrying out the OLS regression analysis (equation 5.1.1).

Unit root tests

We shall first determine whether the following variables are covariance stationary, I(0)[23]: $Ln(Y_t)$, $Ln\left(\frac{G_t}{Y_t}\right)$ and $Ln\left(\frac{T_t}{Y_t}\right)$.

Two tests are used to determine stationarity. The first is the Augmented Dickey Fuller (ADF), and the second is the Kwiatkowski *et. al.* (KPSS). The KPSS test will be used to reinforce the conclusions of the ADF test. Both of these tests follow a asymptotic distribution that have normalized bias statistics.

The null hypothesis of both tests can be displayed as follows:

ADF test	**KPSS test**
$H_0: \alpha = 0\ i.e. unit\ root\ is\ present$ (not stationary)	$H_0: \sigma^2 = 0\ i.e. no\ unit\ root\ is\ present$ (stationary)
$H_a: \alpha < 0\ \ i.e. no\ unit\ root\ is\ present$ (stationary)	$H_a: \sigma^2 \neq 0\ \ i.e. unit\ root\ is\ present$ (non stationary)

Table 6. Source: taken and adapted from Verbeek, 2012.

[23] I(0) = the process is integrated of order zero, i.e. stationary.

Unit root test results

The individual sample tests for each of the three periods show that all of the variables $Ln(Y_t)$, $Ln\left(\frac{G_t}{Y_t}\right)$ and $Ln\left(\frac{T_t}{Y_t}\right)$ contain a unit root, save for the UK $Ln\left(\frac{G_t}{Y_t}\right)$ in period I. Because the ADF test has been unable to correctly identify the presence of a unit root for the UK period I, the KPSS test has also been used to double check. The result from the KPSS test shows that this series does contain a unit root. It has therefore been decided that the first differences of all three variables may be taken.

Co-integration test

The Engle and Granger test is used to test a leveled regression for co-integration. This test carries out a unit root test on the estimated residuals. The test assumes the following form:

$$(5.2.4) \quad X_t = \beta Y_t + \omega_t$$

$$(5.2.5.) \quad \Delta\hat{\omega}_t = \pi\hat{\omega}_{t-1} + \varepsilon_t$$

The null hypothesis states that there is no co-integrating relationship present ($\pi = 0$). The null is rejected if ω_t is integrated of order zero. The dependent and independent variables used in the regressions are integrated of the same order. In other words, we are testing to see whether there is a co-integrating relationship, i.e. the variables are associated in the long run:

$$(5.2.6.) \quad Ln(Y_t) = \alpha + \beta Ln\left(\frac{G_t}{Y_t}\right) + \gamma Ln\left(\frac{T_t}{Y_t}\right) + \epsilon_t$$

The Engle and Granger co-integration test will only be carried out for period I on leveled data.

Co-integration test results

The Engle and Granger test[24] shows that no co-integration is present over period I for both the EU members and the non-EU members of the G7 group. We may now proceed with the OLS regression analysis based on equation 5.1.1.

[24] One cannot use the p-value provided in the Eviews output since this is not standardized. We have used the Davidson and Mackinnon (1993) t-values. These values are shown in the Appendix under section *E. Tables*.

6. Results of the OLS regression analysis

The results tables from the OLS regression analysis are presented below. Sub-section 6.1 shows the results for the non-European members of the G7 group: Canada, Japan, UK and the US. Sub-section 6.2 shows the results for the European members of the G7 group: France, Germany and Italy.

A detailed discussion of both the statistical and economic significance of the results is presented below.

6.1 OLS regression tables: non-European members of the G7 group

Table 7. Period I: 1970Q1 – 2013Q1								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficient**	**Std. error**	**t-stat**	**P-value**
Canada	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	23.7	1.70	-0.24 0.00	0.03 0.03	-7.20 0.06	0.00 0.96
Japan	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	17.0	1.20	-0.16 -0.27	0.04 0.06	-4.14 -4.39	0.00 0.00
UK	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	17.2	1.74	-0.16 -0.10	0.04 0.04	-4.18 -2.60	0.00 0.01
US	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	44.1	1.69	-0.48 -0.02	0.04 0.02	-11.26 0.71	0.00 0.48

Table 8. Period II: 1970Q1 – 2006Q4								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficient**	**Std. error**	**t-stat**	**P-value**
Canada	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	23.4	1.15	-0.20 -0.00	0.04 0.03	-5.54 -0.04	0.00 0.97
Japan	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	23.4	1.15	-0.10 -0.35	0.03 0.06	-2.97 -6.06	0.00 0.00
UK	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	22.4	2.00	-0.15 -0.14	0.04 0.04	-3.61 -3.53	0.00 0.01
US	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	48.6	1.93	-0.50 0.02	0.04 0.03	-11.4 0.73	0.00 0.47

Table 9. Period III: 2007Q1 – 2013Q1								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficient**	**Std. error**	**t-stat**	**P-value**
Canada	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	67.9	2.27	-0.38 -0.02	0.06 0.05	-6.56 -0.41	0.00 0.69
Japan	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	74.6	1.79	-1.03 -0.01	0.13 0.12	-8.04 -0.08	0.00 0.93
UK	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	15.7%	1.25	-0.13 0.14	0.08 0.12	-1.62 1.19	0.12 0.25
US	$\Delta\text{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	26.7	1.18	-0.30 0.01	0.12 0.06	-2.50 0.15	0.02 0.88

Notes: Var. = variable, DW-test = Durbin Watson test, Std. Error = standard error and t-stat = t-statistic.

6.2 OLS regression tables: European members of the G7 group

Table 10. Period I: 1970 - 2012								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficient**	**Std. Error**	**t-stat**	**P-value**
France	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	2.0	1.96	-0.35 -0.46	0.65 0.53	-0.54 -0.86	0.60 0.39
Germany	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	2.7	2.14	-0.44 -0.27	0.50 0.46	-0.80 -0.59	0.38 0.56
Italy	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	11.3	2.14	-0.53 -0.42	0.43 0.22	-1.23 -1.89	0.23 0.07

Table 11. Period II: 1970 - 2006								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficient**	**Std. Error**	**t-stat**	**P-value**
France	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	2.84	1.90	-0.36 -0.58	0.76 0.60	-0.47 -0.96	0.64 0.35
Germany	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	1.64	2.09	-0.39 -0.23	0.64 0.54	-0.61 -0.43	0.54 0.67
Italy	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	12.6	2.20	-0.68 -0.40	0.49 0.24	-1.37 -1.72	0.20 0.10

Table 12. Period III: 2007 - 2012								
Country	**Dependent var.**	**Independent var.**	R^2**(%)**	**DW-test**	**Coefficients**	**Std. Error**	**t-stat**	**P-value**
France	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	24.2	1.17	-0.30 -0.01	1.02 0.92	0.00 0.24	0.10 0.83
Germany	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	25.2	2.48	-0.56 -0.46	0.59 0.83	-0.96 -0.56	0.41 0.62
Italy	$\Delta \mathrm{Ln}(Y_t)$	$\Delta Ln(G_t/Y_t)$ $\Delta Ln(T_t/Y_t)$	93.4	1.86	-0.09 -1.78	0.17 0.27	-0.54 -6.51	0.63 0.01

Notes: Var. = variable, DW-test = Durbin Watson test, Std. Error = standard error and t-stat = t-statistic.

6.3 Statistical interpretation

The non-EU member tables show that the R^2 increases between periods I, II and III, save for the US and UK. For example, the R^2 for the US decreases from 48.6% to 26.7% between periods II and III.
The R^2 for the EU members increase between the periods I, II and III, save for Germany. The German R^2 decreases between period I and II. There is a large increase in R^2 in period III. For example, Italy increases from 11.3% to 93.4% between periods I and III. This trend highlights the limitations of using R^2 as a measure of the statistical significance of a regression. For example, the R^2 has increased despite the statistical significance having decreased between period I and III.

The DW-test results for the non-EU members are below the threshold of 2.0, save for the UK (2.0) in period II and Canada (2.27) period III. Values significantly below 2.0 suggest the presence of positive autocorrelation. Values significantly greater than 2.0 indicate the presence of negative autocorrelation.
The EU member countries show DW-test results close to 2.0 throughout periods I, II and III. The main exception is France in period III, which has a DW value of 1.02.

The standard errors of the non-EU members increase between periods I, II and III. Japan is the only exception when considering periods I and II. The standard error for the β_t coefficient decreases from 0.04 to 0.03. However, this is opposed by an increase to 0.13 in period III.
The standard errors of the EU members do not share the same trend. These values fluctuate more between periods I, II and III. For example, the French standard error for the β_t coefficient increases from 0.65 to 1.17 between periods I and III. The same can be said for γ_t, because the coefficients increase from 0.53 to 0.95 between the same periods. The standard errors of the EU members are much larger as a proportion of the coefficients than the standard errors of the non-EU members.

Considering the non-EU members of the G7 group, the significance[25] of the coefficients decrease between the periods, i.e. the coefficients are more significant in period I as opposed to periods II and III. The difference in the significance between

[25] Throughout this thesis we will employ a p-value threshold of 0.05.

periods I and II is minimal. For example, the US coefficient for the tax multiplier, γ_t, increases from 0.480 to 0.468. However, this result is still not statistically significant. The coefficients of the EU members are less significant than the non-EU members. For example, the only significant result is Italy in period III for γ_t. This period also contains the smallest dataset.

6.4 Economic interpretation

An economic interpretation of the coefficients is provided below. Note that despite some of the results not being statistically significant, a full economic interpretation of the coefficients β_t and γ_t will be given nonetheless. These limitations will be discussed in section 7.

Examining the non-EU members, the values for the coefficients β_t and γ_t vary between the periods I, II and III. In period I, the Canadian coefficient for β_t = -0.24 and γ_t = 0.00. This means that an increase in the growth rate of government expenditure by 1.0% will decrease the growth rate of the economy by 0.24%. An increase in the growth rate of net tax revenue by 1.0% will have no not affect the growth rate of the economy. This result suggests the presence of non-Keynesian effects for the β_t coefficient. Government intervention does not increase the growth rate of the output of the Canadian economy. In period III, the coefficients increase in magnitude to β_t = -0.34 and γ_t = -0.02. The interpretation remains the same for β_t. But, an increase in the growth rate of the net tax revenues by 1.0% will lead to a reduction of the growth rate of the economy by 0.02%. The coefficients for period II are smaller than in both periods I and III: β_t = -0.20 and γ_t = 0.00, and largest in period III. This suggests that a recession enlarges the effect of the growth rate of government spending and net tax revenue on the growth rate of the Canadian economy. It would seem that crowding out is an issue when considering government expenditure.

In the case of Japan, the β_t coefficient increases from -0.16 to -1.03 between periods I and III. The value for β_t increases to a value larger than unity. An increase in the growth rate of government expenditure by 1.0% will decrease the growth rate of the Japanese economy by 1.03%. The multiplier for the net tax revenue growth rate

differs in comparison to the Canadian one. In period III, the γ_t coefficient decreases in magnitude. For example, γ_t = -0.27 in period I and γ_t = -0.01 in period III. We also see that in period II, the γ_t = -0.35. We may conclude that in times of recession, the effects of the growth rate of net tax revenues on the growth rate of the Japanese economy becomes smaller.

For the UK, the β_t and γ_t also change between periods I, II and III. Period II has the following coefficients β_t = -0.15 and γ_t = -0.14, whilst period III has β_t = -0.13 and γ_t = 0.14. The recession has had a minimal impact on the effects of the growth rate of government expenditure on the growth rate of the British economy. However, the growth rate of the net tax revenue coefficient indicates that the recession has turned the multiplier positive. An increase in the growth rate of the net tax revenue by 1.0%, increases the growth rate of the UK economy by 0.14%.

The coefficients for the US hint point to a different conclusion. The magnitude of the β_t coefficient decreases as a result of the recession. In period II, β_t = -0.50 and in period III β_t = -0.30. Again, an increase in the growth rate of government expenditure by 1.0% will lead to a decrease in the growth rate of the US economy by 0.30% in period III. This means that despite the ongoing presence of non-Keynesian effects regarding government expenditure, they are less severe during a recession. The γ_t coefficients range from -0.02, 0.02 and 0.01 between periods I, II and III respectively. Here the difference between period II and III and the effect of the recession on period I is not so clear. During a recession, the coefficient is positive. However, this is also the case if we do not include the recession in period II. This has to do with the significance of the results.

When considering the EU member results, the coefficients also fluctuate between the three periods. The French β_t ranges from -0.35, -0.36 and -0.30 between periods I, II and III respectively. A recession reduces the impact of the growth rate of government expenditure on the growth rate of the economy. Again, this result indicates the presence of non-Keynesian effects. However, they are less severe during a recession. The γ_t net tax revenue coefficient decreases from -0.58 in period II, to -0.01 in period III. In a recession, the effect of the growth rate of net tax revenue on

the growth rate of the economy is reduced. However, the growth rate of the net tax revenue still has a negative effect on the growth rate on the economy.

The results are different for Germany. The recession has actually enlarged the magnitude of the coefficients. In period II β_t = -0.39 γ_t = -0.23 and in period III β_t = -0.56 γ_t = -0.46. The growth rate of government expenditure still has a negative effect on the growth rate of the economy. The same is true for the growth rate of the net tax revenue coefficient. In times of recession, these effects are enlarged.

Out of the EU members, the β_t and γ_t coefficients fluctuate the most for Italy between the sub periods. The coefficients assume values of β_t = -0.68 and γ_t= -0.40 in period II and β_t = -0.09 and γ_t= -1.78 in period III. Again, we still see the presence of non-Keynesian effects when considering the effect of the growth rate of government expenditure on the growth rate of economic output. However, the non-Keynesian effects are smaller during a recession. It is also clear that increasing the growth rate of net tax revenues will have a larger, negative, impact on the growth rate of the economy during a recession.

The results show that the effects of a recession can be limited by treating each country separately when considering which fiscal consolidation measures to implement. Some of the results conclude that the non-Keynesian effects for government expenditure are enlarged by the recession, i.e. the value of β_t becomes larger in magnitude. This is the case for Germany, Canada and Japan. In other cases, the effects become smaller in magnitude e.g. the US, France and Italy. The results for the net tax revenue multiplier conclude that for most countries, the multiplier is negative, i.e. reducing the growth rate of the net tax revenues will have a positive effect on the growth rate of the economy. This is the case for Canada, Germany and Italy. However, there are also cases whereby the recession has caused the net tax revenue multiplier to assume positive values i.e. γ_t values larger than zero. This is the case for the US and UK.

As a side note, the theory presented in section 3. has raised the issue of leakages in the economy. This theory suggests that when deciding upon which fiscal consolidation measure to implement, one should consider the use of increasing

government expenditure over a reduction of net taxation. This reduces leakages in the economy. Reducing the net tax revenue eventually presents economic agents with more money. Agents may view a tax reduction as temporary and save. Hence there is a leak. In certain cases, this thesis suggests the reduction of both the net tax revenues and government expenditure, despite the risk of leakages slowing the growth rate. This is because an increase in the growth rate of government expenditure may reduce the growth rate of the economy to a larger extent. However, this effect should be investigated in greater detail.

7. Critical examination and evaluation

A number coefficients, in particular the EU members, are not significant. Because of this, the significance of the conclusions presented in the economic interpretation should be read with caution.

There are a number of important factors to consider when evaluating the different reasons for the lack of statistical significance regarding the coefficients. The first is based on the frequency of the data used within the datasets. Annual data has been used instead of quarterly data. For example, when looking at the dataset for the EU members, period III only contains six data points. It is therefore of little surprise that the results for the EU members have proven less significant than the non-EU members.

Other structural breaks in the data have not been considered. For example, the oil crisis of 1973 and economic recessions of 1981-1982 and 1990-1991. This will also influence the significance of the results.

There are a host of factors that influence the way in which fiscal policy influences the growth effects of economic output. These have not been included in this thesis. A country specific example will be used to explain: Japan. The supply side of the Japanese economy may be a limiting factor. This is because of structural barriers. This means that fiscal policy is generally considered largely ineffective when stimulating the Japanese economy. These supply-side limitations have been discussed in the literature section.

There are various institutional factors that should be taken into consideration when implementing fiscal policy. There are time lags involved when implementing fiscal policy measures. These are the "inside" and "outside" lags discussed in the theory section. Also, political economy affects the success of fiscal policy. For example, governments run the risk of shifting the current fiscal imbalance to the next time period, i.e. a future generation.

Fiscal policy measures are difficult to implement directly as intended due to institutional factors. An example of this is the Asian crisis. Government spending failed to reach the financial sector aimed at supporting banks and financial institutions. This prolonged the Asian crisis by a number of months and illustrated the difficulty of implementing fiscal measures on time and above all, effectively (Hemming et. al. 2002).

EU countries do not have full control over monetary policy decisions. Non-EU member countries use monetary policy as a tool to regulate the output of the economy. The size of the fiscal multiplier is enlarged if agents believe that the interest rates will remain low as a result of the fiscal expansion, despite the increased deficit. The fact that EU members no longer have full control over monetary policy decisions, will contribute to uncertainty in Europe regarding the reaction of interest rates to a change in country specific fiscal policy.

8. Conclusions

This thesis has evaluated the effects of the recent recession on the fiscal multipliers of the G7 countries. An OLS regression analysis has been used in order to accomplish this.

Firstly, the presence of non-Keynesian effects have been identified as a result of this analysis. Increasing the growth rate of government expenditure will not necessarily increase the growth rate of an economy. Having said this, the full extent of this mechanism remains country specific. For example, the expenditure multipliers behave differently depending on the country under consideration - the recession has

significantly increased the Japanese coefficient in magnitude, whereas hardly affected the UK's. Based upon the results, governments should not necessarily increase government expenditure when limiting the impact of a recession. This is contrary some findings of the papers discussed in the literature review, e.g. Hemming et. al. (2002) and Guidice et. al. (2003).

Secondly, the effect of the growth rate of net tax revenue on the growth rate of economic output has mostly remained negative. Again, the extent by which a net tax revenue reduction will translate into positive growth effects also remains country specific. For example, the recession has had little effect on the UK's net tax revenue multiplier, whilst dramatically increasing the Italian coefficient in magnitude. Generally speaking, governments are advised to reduce the net tax revenue in order to stimulate output. Note that the net tax revenue multiplier assumes positive values for the US and UK, however, these are not statistically significant.

As already discussed, some of the results are not statistically significant. This is due to the frequency of the data within the datasets (in particular the EU member dataset). The fact that other periods of economic turmoil, recessions, institutional factors and political economy factors have been ignored will also undoubtedly affected the results.

Despite certain flaws, this thesis does provide a basis upon which a future analysis should be conducted. This analysis should be carried out again in the future in order re-evaluate the effects of the recent recession on the fiscal multipliers of the G7 countries.

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Appendix

A. Keynesian theory

One of the main questions regarding macroeconomic theory is: '*why do countries go through periods of alternating growth and unemployment?*' Keynesian theory provides an explanation for a government's use of monetary and fiscal policy when dealing with these macroeconomic fluctuations. More specifically, the question can be answered with the help of the Keynesian assumption. This assumption is based on the fact that prices are constant over the short run - price rigidity. Here we assume the short run to entail a few months and up to a year. This assumption provides an explanation for short-run fluctuations of real GDP around the long-run growth trend. It implies that aggregate demand determines output and that production adjusts to changes in aggregate demand. In its simplest form, Keynesian theory assumes a closed economy. However, the theory can be extended to represent an open economy. The openness of a country refers to the trade of goods, services and assets. The open-economy version of the Keynesian model is known as the Mundell – Fleming model (Wyplosz, 2005).

The simplest Keynesian model mainly focuses on two markets: the market for both goods and services and the financial market. Since we are dealing with the Mundell-Flemming model, there is also a third one, the foreign exchange market that is a part of the international financial market (Wyplosz, 2005).

Keynesian definition of demand:

$$(A.1)\ Y = C + I + G + PCA$$

Whereby:

Y = national income

C = consumption

I = investment

G = government expenditure

PCA = primary current account

The above equation is an accounting identity. It is an *ex post* measurement of GDP, whereby demand equals output. Besides this fact, the equation represents consumer, firm and government behaviour. This information can be represented along the DD function. The 45-degree line represents market equilibrium. In the diagram below, equilibrium is represented by point A. The desired aggregate demand equals the output in the economy such that there is market equilibrium. The corresponding output level is referred to as the equilibrium GDP. This is represented in the equation below, whereby the components of demand have been replaced by the corresponding function describing its behaviour (Wyplosz, 2005):

$$(A.2)\ DD = C(\bar{\Omega}, Y - \bar{T}) + I(i, \bar{q}) + \bar{G} + PCA(Y, Y^*, \sigma)$$

Whereby:

Consumption function:

$+ \bar{\Omega}: Exogenous\ wealth\ function$

$+ Y - \bar{T}: Disposable\ income$ (Δ GDP Y and exogenous tax payements $\bar{T}$)

Investment function:

$- i: interest\ rate$

$+ \bar{q}: Tobins\ q$

Public sectors own demand:

$\bar{G}: government\ expenditure$

Primary current account function:

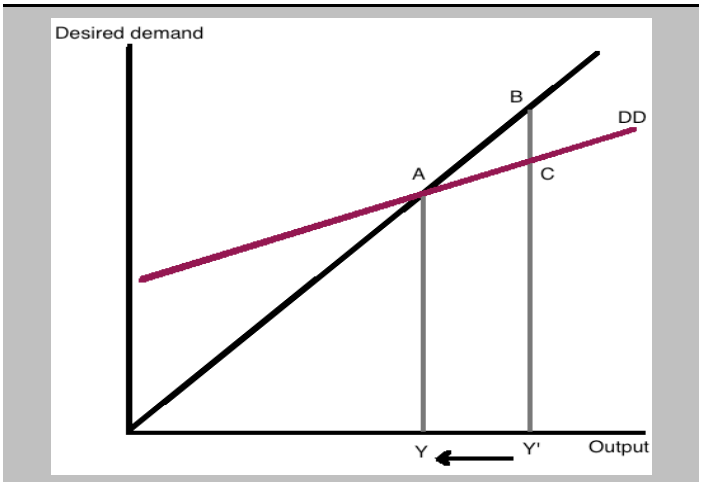
$- Y: GDP\ Y$

$+ Y^*: Foreign\ income$

$- \sigma: Real\ exchange\ rate$

Now assume that the equilibrium point in the goods market is represented at Y'. This is a position above the equilibrium level of Y. Since the demand in the economy is lower than the total amount of goods and services produced in the economy. Eventually firms will reduce production, since they are unwilling to produce goods that they cannot sell (Wyplosz, 2005).

Figure 3: The 45 degree diagram



Source: Wypolsz (2005) page 234.

There are a number of lessons one can draw from the above analysis. First, adjustments to the level of production return the GDP to equilibrium. Firms only adjust their level of production once they realize that the change in the market equilibrium is fixed, long term. Lastly, changes regarding the inventory are treated as demand, positive when inventories rise and visa versa when they decline. This is why sales may differ from output meaning that the accounting identity remains verified off equilibrium (Wyplosz, 2005).

B. Ricardian equivalence proposition

The budget constraints below represent both the private and public sector. The existence of firms is ignored and the initial debt to set to zero (Wyplosz, 2005).

$$(B.1)\ C_1 + \frac{C_2}{1+r} = Y_1 - T_1 + \frac{Y_2 - T_2}{1+r}$$

$$(B.2)\ G_1 + \frac{G_2}{1+r_G} = T_1 + \frac{T_2}{1+r_G}$$

Whereby:

C = Consumption

G = Government expenditure

T = Taxation

r & r_G = interest rate private section & government

In the first equation, the private citizens pay taxes. The second equation illustrates that the government receives them. The private citizens and government both face different interest rates, r and r_G. At this point, we will assume these rates to both be the same, $r = r_G$ (Wyplosz, 2005).

This assumption enables us to merge equations B.1 and B.2:

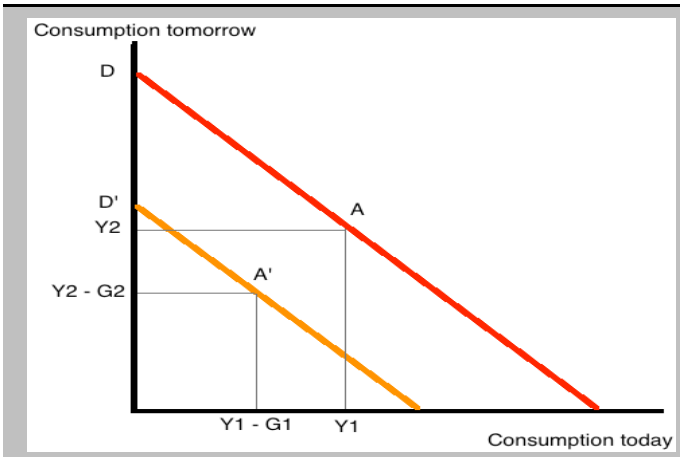
$$(B.3)\ C_1 + \frac{C_2}{1+r} = (Y_1 - G_1) + \frac{Y_2 - G_2}{1+r}$$

Whereby:

Y = Economic output

Equations B.1 and B.2 are similar. However, the taxes have been replaced by government expenditure. Now that the taxes no longer appear in the budget constraint, the private sector has fully internalized the public sector. This is the Ricardian equivalence proposition (Wyplosz, 2005).

Figure 4: Ricardian equivalence



Source: Wypolsz (2005) page 116.

In the above graph, point A represents a persons initial, pre tax, endowment. A' shows the point after government spending has been taken account of. The distance BB' illustrates the reduction in the persons wealth because of public spending. The distance may be called the present value of taxes or public spending, see equation 2.1. Public spending is either financed through taxation or expenditure increases. Increased expenditure without a change in the level of taxation will warrant

a tax increase in the next time period. Assuming that the private and public sectors are able to borrow at the same rate, the inter-temporal shifts are equal. The public borrowing shares a one for one relationship with private saving with the same equal budget-line (Wyplosz, 2005).

One may interpret this result in the following three ways. Firstly, the sum of private and public spending, i.e. national spending, may not exceed a countries wealth. Despite the fact that the country is able to borrow and lend, it must always respect its budget constraint (Wyplosz, 2005):

$$(B.4)\ \ (C_1 + G_1) + \frac{C_2 + G_2}{1 + r} = Y_1 + \frac{Y_2}{1 + r}$$

The difference between private endowments and public spending on both goods and services, defines private sector wealth. Taxes can either be levied today or tomorrow. However, this pattern has no effect on private wealth. Public spending does matter, because it represents the resources taken away from the private sector and must be financed through taxation eventually. The last interpretation of equation B.3 concerns private wealth. Upon the issuance of government bonds, the purchaser is promised the repayment of interest and a principle. However, given the above interpretation households do not consider government indebtedness as part private wealth. Private consumers are aware of the fact that the interest and principle are matched by higher taxation in order to service the government debt. This will be done either today or tomorrow. Households consider public bonds as assets that are offset by the value of tax liabilities. An important fact to note is that Ricardian equivalence implies that government debt does not represent the net wealth to the aggregate private sector (Wyplosz, 2005).

There is a vast array of research that has been devoted to determining the validity of Ricardian equivalence. The main question is whether there are significant departures from it (Wyplosz, 2005).

There are limitations to the Ricardian equivalence proposition. When considering the amount of taxes paid per individual, there is a difference between the citizens of a country. The government's debt burden is not shared equally between all

individuals. However, the situation is different when considering the aggregate household sector that cannot escape the implications of equations B.2 and B.3. In the aggregate, the future tax burdens are the same (Wyplosz, 2005).

Citizens are also mortal. Citizens who are not alive in the second period will certainly not incorporate the government's budget constraint into their own. If the private sector does not incorporate these future tax liabilities, there is a possibility that government debt represents private wealth to some agents (Wyplosz, 2005).

The assumption that the public and private sector pay the same interest rate, $r = r_G$, is fairly unrealistic. In most cases, private sector rates exceed the public borrowing rate. This is because the government is considered less likely to default.. The equation below shows the combination of the private and public budget constraints for different interest rates, r and r_G[26] (Wyplosz, 2005).

$$(B.5)\ C_1 + \frac{C_2}{1+r} = Y_1 - G_1 + \frac{Y_2 - G_2}{1+r} + \left[\frac{r - r_G}{1+r}\right](G_1 - T_1)$$

This result is clearly different from equation 2.3. The left hand side of the equation represents the private sector and is the present value of consumption. The left hand side is discounted by a rate of r, which is the rate by which private citizens engage in trade inter-temporally. The right hand side represents the present discounted value of net private income, i.e. private wealth. When $r > r_G$ a fraction of the deficit $G_1 - T_1$increases the private sectors wealth in the economy. A tax cut that holds current and future spending constant increases private wealth because the government indirectly allows the private sector to borrow on its own terms, which are more favourable (Wyplosz, 2005).

Taxation can lead to certain distortions and create unemployed resources. People alter their behaviour as a result of taxation. In this case, the tax is considered to be distortionary. A fiscal deficit is considered to have increased wealth in the

[26] Multiply equation 2.2 by $(1 + r_G)/(1 + r)$ in order to derive:
$G_1 + \frac{G_2}{1+r} + \frac{r_G - r}{1+r}G_1 = T_1 + \frac{T_2}{1+r} + \frac{r_G - r}{1+r}T_1$

economy if the tax cut increases the level of economic activity and creates additional income (Wyplosz, 2005).

C. Davidson & Mackinnon table

Critical p-value (rejection region)	Test statistic
0.01	-4.29
0.05	-3.74
0.10	-3.45

Table 13. Source: Davidson & Mackinnon (1993).