Three Essays on the Political Economy of Fiscal Policy

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Abstract

This study focuses on different aspects of fiscal policy. The second and third chapters investigate drivers of fiscal policy whereas the fourth chapter investigates its consequences. The second chapter analyses how changes in demographic structure affects policy variables. Building on Razin, Sadka and Swagel (2002) we propose a U-shape relationship between labor income tax rates and the share of retirees. Using data from 1991-2012 for 13 OECD countries, the results related to income taxes and the size of government are found to reconcile with theory after controlling for possible endogeneity and presence of unit roots.

Borrowing from Meltzer and Richard (1981) the impact of a rise in inequality on tax composition is examined in the third chapter. Based on median voter model we propose that direct (income) taxes monotonically increase with inequality, whilst indirect (expenditure) taxes exhibit a U-shaped relationship with inequality. Moreover, based on voters' myopia, how changes in inequality affect deficits and debt is also examined. Using cross-country data for 129 countries the empirical results are found to be consistent with theory and especially in strong democracies. With panel data estimates, the findings also partially support our theory.

The fourth chapter examines the Armey (1995) curve assessing the relationship between economic growth and the government size. We find strong evidence for presence of the Armey curve across non-OECD countries. Government expenditures are found to be optimized in terms of economic growth at 23.99% of GDP. Employing panel data estimation we use a recent data set for 79 countries from 1981-2010, taking five years averages. The results also hold for weak democracies whereas the OECDs and strongly democracies are found to sustain larger governments as findings related to them are mixed. Empirical analysis is also extended decomposing public expenditures, taking direct transfers and GDP per capita as policy variables.

Table of Contents

Chapter One

Introduction

Chapter Two

Demography and Fiscal Policy

Chapter Three

Inequality and the Composition of Taxes

Chapter Four

Government Size and Economic Growth

Chapter Five

Conclusion and Direction for Future Research

Appendices

List of Tables

List of Figures

List of Graphs

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Declaration

I hereby confirm that this thesis and the work presented in it are my own and has been generated by me as a result of my own original research. Only Chapter 3 of this thesis is co-authored with my supervisor, Dr. Andrew Pickering. The work here in this thesis has not been submitted for any other degree at the University of York or any other institution. All sources are acknowledged as references.

Chapter One

Introduction

1.1) Thesis Statement

This thesis contains three essays on the political economy of fiscal policy. The hypothesis under investigation in each chapter is different. In the second chapter we hypothesize how changes in demographic structure affect policy variables – the labor income tax rates and the government size measured by total taxes as a share of GDP. The third chapter assesses the relationship between inequality and the composition of taxes whilst the fourth chapter addresses how government size affects economic growth.

1.2) Motivation

As the issues investigated in each chapter are different, the motivation is also bound to be different. Aging societies in the European Union have already raised concerns for policy makers. In the instance of chapter two, future increases in relative size of the old are projected. Consequently the chapter addresses how demographic choices regarding policy outcomes such as government size and public debt will change.

According to the projected trends in aging population by Brooks (2003) the ratio of the population aged 60 and older to those between ages 15 and 59 is predicted to rise from 35% in 2000 to 66% in 2050 in the European Union. Germany, Italy and Spain will be amongst the most

aged societies with the dependency ratio projected to increase to 71, 76 and 81% respectively in these countries by 2050. Japan is no exception as the ratio is estimated to rise from 36 to 70% in the same span of time. However, the forecast figures for the US are not as alarming since the dependency ratio is estimated to rise from 27% in 2000 to 47% in 2050.

In welfare economies like the European Union the forecast increases in the aged population have major implications. Since the countries in the EU to varying degrees use PAYG pension systems, taxes will need to increase sharply to finance redistribution to retirees in the form of pension and other social security needs. Bongaarts (2004) predicts that the public expenditures on pensions might increase from 35% to 75% of earnings in Italy from 2000 to 2050.

Another revenue source which can be used to finance redistribution to the current old is public debt. According to estimates reported in the Economist (24th August, 2002, p.21), public debt could reach 100% of national income in the US, 150% in the EU as a whole and over 250% in Germany and France by 2050. The seriousness of these figures can be understood when we take into account the Stability and Growth Pact (1992) agreed upon by all the countries of the EU. This pact puts a constraint that public debt cannot increase beyond 60% of national income.[1]

The academic literature on the impact of aging societies on the policy is quite mixed. For example, Razin, Sadka and Swagel (2002) find a negative relationship between the labor income tax rates and the relative size of the old. On the other hand, Bryant (2003) and Shelton (2007) criticize Razin, Sadka and Swagel (2002) for not decomposing the dependency ratio into separate components for the youth and the aged population. They rather find a positive correlation between labor income tax rates and the share of retirees when they decompose the data. The quite contrasting results make this question worth investigating in more depth.

The motivation for the third chapter is to understand how political processes affect taxation decisions and follows Meltzer and Richard (1981). Their model proposes a positive relationship

[1] For example the debt to GDP ratios of Belgium, Italy and the US were 98.2, 117.5 and 89.9 in 2010 respectively.

between inequality and the size of government. However, the empirical literature is fairly negative on this hypothesis. For example, Perroti (1996), Bassett et al (1999) and Persson and Tabellini (2003) find no support in cross country studies. On the other hand, they themselves find support for theory in Meltzer and Richard (1983) using state-level data from the United States. Similarly Borge and Rattso (2004) using data from Norway find support for the positive association between inequality and the demand for redistribution. They suggest testing the hypothesis of Meltzer and Richard (1981) in a more homogenous setting with comparable institutions and straight forward policy about redistribution. We extend the original model by adding another dimension which is indirect taxes (taxes on goods and services or expenditure taxes or relative taxes).

Moreover, we also analyse how a rise in inequality leads to affect budget deficit and debt. For this, we propose tentative hypotheses for public deficit and debt as shares of GDP. Based on voters' myopia, a rise in inequality leads to higher budget deficits and debt levels.

Theory and tentative hypotheses, relating to public debt and deficit, of this chapter are further empirically assessed employing cross sectional, panel data and panel data in first differences estimations. Besides these estimations, we also split the sample into weaker and stronger democratic samples owing to the fact that the role of median voter is relatively more important in stronger democracies unlike dictatorships or weaker democracies.

The chapter four addresses the question of the optimal size of government. The expansion of government has generated both positive as well as negative effects on the economy. Hence, there are proponents and opponents of public expansion in economic matters who through their research have put forth their cases. Protection of property rights, law and order and incentives to save and invest are few favourable effects that proponents of government expansion propose. Similarly, there are adverse effects of government expansion on the economy as well. For example, rent-seeking activities of government officials, corruption, excessive taxation and

efficiency are few of them. In order to explore the optimum level of government we investigate it further following the Armey curve.

The Armey curve (1995) is a stylized representation of the relationship between economic growth and the size of government. According to Armey, extremes such as no government and complete government control are not the ideal cases. Without any government control problems such as the absence of rule of law, protection of property rights and incentives to either save or invest due to constant threat of expropriation will serve to undermine investment. On the other hand, there are also costs borne with government expansion. Corruption, rent-seeking behaviour, excessive taxation, and inefficiency are all endemic in excessively large states.

Thus the Armey curve (1995) posits an inverted U-shape curve suggesting a positive relation between the economic growth and the size of government up to a certain level but the relationship becomes negative once government expands beyond that threshold. Relatedly there are other empirical studies which argue for an optimal government size; Radwan and Reiffers (2004), Pevcin (2004), Peden (1991), Scully (1994) and Herath (2012) are a few examples.

Since there are mixed findings for optimal government size suggested by the previous literatures, we explore the optimal size of government in an expanded and up-to-date database, measured by public expenditures as a share of GDP.

There are different components of government spending which may have positive as well as negative impact on economic growth. For this, we de-compose public expenditures into government consumption and public investment. Furthermore, we also analyse the impact of how changes in direct transfers are related to the efficient level of government expenditures.

1.3) Objective

There is no single objective wrapping the whole thesis since the issues taken up in each chapter are different. The goal of second chapter is to redefine the argument proposed in Razin, Sadka and Swagel (2002). They propose that the relationship between the labor income tax rates and the retirees share is negative. Only when the retirees make up at least 50% of the voters the relation will change into positive. Their rationale is due to the political power the retirees gain when they form the majority in a median voter model. However, in chapter two the relationship between the labor income tax rates and the relative size of the old changes from negative to positive when the aged population represents only 8.4% of the population due to potential empathy within families with elderly relatives. On the other hand, the empirical findings applying OLS, 2SLS and 2SLS in first difference estimations (2SLS+FD) support the theory and Razin, Sadka and Swagel (2002) to the extent that the correlation is found to be U-shaped.

We also extend the analysis taking youth dependency ratio as dependent variable. With 2SLS estimation, the results indicate a U-shaped correlation to exist between labor income tax rate and the share of youth reconciling with tentative hypothesis and Razin and Sadka (2007).

In addition, the empirical analysis is also extended taking total tax revenue as a share of GDP (measuring the government size) as a policy variable. The findings relating to the government size are in accordance with the results we get with regards to labor income tax rate. Hence, these results also offer some support to the theory.

Even when the sample size is enlarged to 16 countries including Greece, Luxembourg and Switzerland, the findings support the theory, Razin, Sadka and Swagel (2002) and the results that we get with smaller sample.

The aim of third chapter is to analyse and test a simple political-economic model of the composition of taxes. The theory is related to the hypothesis of Meltzer and Richard (1981) that

higher inequality increases the size of government measured by the extent of redistribution. In the theoretical framework we develop, both income and expenditures are taxed to finance redistribution. The power to determine the extent and the composition of taxes lies with the median voter. The theoretical framework proposes that an increase in inequality at any level will lead to higher income taxes. With regards to consumption taxes it is proposed that a rise in inequality is positively associated with consumption taxes at low levels of inequality. Nonetheless, the association between the two variables becomes negative when inequality reaches to a certain threshold. Moreover, relative taxes are argued to be positively related to a rise in inequality. The empirical findings using cross country data for 129 countries are also consistent with our theory across the full sample but are statistically significant for strongly democratic countries.

We also investigate the relation between inequality and budget deficit and inequality and public debt. Based on the assumption that the voters are short-sighted, our hypotheses are supported by empirical results with cross sectional estimation as we find a positive correlation between deficit and inequality as well as public debt and inequality.

In addition the panel data estimation is used to reproduce the cross-sectional analysis. Linear estimation with regards to direct and indirect taxes reconciles with the theory. When we assess the non-linearity after controlling for non-stationarity in the data, the empirical findings relating to both direct and indirect taxes support the theory. Moreover, public deficit and debt are also found to have a positive association with inequality except when we difference the data.

To determine the optimal government size and test for the presence of an Armey Curve (1995) is the goal attached to fourth chapter of the thesis. We find empirical evidence of the presence of Armey Curve (1995) across Non-OECD countries. Using data set as fresh and large as possible and employing panel data estimates are also key objectives of this study. Panel data is rarely used to estimate the optimal government size in the previous literature. Besides these,

the comparisons of how much government expansion is beneficial for the economy between the OECD and non-OECD countries as well as weak and strong democracies are drawn. Strong evidence for the presence of the Armey Curve is found in the non-OECD and less democratic countries. Nonetheless, the OECD and more democratic countries are found to sustain larger government sizes as the results relating to these economies are also found to be both U-shaped and an inverted U-shape.

We extend the empirical analysis using log real GDP per capita. GDP per capita better encapsulates economic welfare than growth, and it is of interest to investigate whether government size affects GDP per capita in levels as well as growth. Applying 2SLS in first differences estimation, we find evidence for the hypothesis of Armey curve. However, the results are U-shaped across non-OECDs and OECDs. Following Cashin (1995) the investigation of changes in the government size, measured by direct transfers, is also made. We find support for the Armey curve in terms of direct transfers.

We also examine the impact of changes in the government size on current government consumption and public investment following Ghosh and Gregoriou (2008). Across the sample distinguished with the OECD countries and strong democracies, there is substantial evidence for the presence of Armey curve with regards to current government consumption. On the other hand, the results with public investment are rather fragile.

1.4) Contribution

Since there are three different issues taken up in this thesis the contributions of each issue are idiosyncratic. Building on Razin, Sadka and Swagel (2002) we develop a theoretical model assuming empathy for the aged population within families with elderly relatives. Unlike Razin, Sadka and Swagel (2002) who argue that thelabor income tax rates increase only when retirees

constitute at least 50% of the total voters, we rather theorize a similar association between the two variables to hold once the aged population makes up 8.4% of the population. Furthermore, besides empirically analysing how income taxes change with demographic structure we also assess whether the government size is affected. In addition, how changes in the share of youth affect both labor income tax rate and the government size is also investigated.Furthermore, the data sample we collect is extended covering 1991-2012. We find empirical results related to labor income tax rate and the share of retirees in harmony with the theory. Similarly, labor income tax rate is found to have a U-shaped correlation with the share of youth when we apply estimations controlling for possible endogeneity.

As far as the findings related to the government size are concerned, these are similar to what we get for labor income tax rate. Thus, there is support found for the theory as well as Razin, Sadka and Swagel (2002). In addition, we also extend the sample size and find no substantial difference between the results of larger and smaller sample.

In the third chapter the argument of Meltzer and Richard (1981) is redefined. Their model is augmented with an additional policy instrument which is expendituretaxes (taxes on goods and services as a share of revenue). The theory is consistent at large with Meltzer and Richard (1981) as it proposes higher redistribution with more inequality in a median voter model. However, novel hypotheses are offered in relation to the composition of taxes and, in particular, expenditure taxes. Income and relative taxes are proposed to be positively related with inequality whereas a U-shape relationship between expenditure taxes and inequality is proposed. For the empirical analysis cross country data for 129 countries are collected. The findings across the full sample support the theory. In addition the theory gathers more support in strong democracies. Cross-sectional estimates to test the non-linearity of expenditure and income taxes are also used. An inverted U-shape association between consumption taxes and inequality as well as income taxes and inequality is found which is also in accordance with the

argument proposed. So we find that higher income inequality will lead to more redistribution in a median voter model, via a shift from expenditure to income taxes. Similarly, the theory is also supported when the empirical estimation is extended to apply panel data estimations applying first difference estimation in order to investigate non-linear relation between policy variables (both direct and indirect taxes) and inequality. With linear estimation, there is support found for the proposed argument related to expenditure taxes across full sample and stronger democracies. Nevertheless, the hypothesis related to income taxes is supported across weaker democracies.

Additionally, extension of empirical analysis to investigate how policy variables such as public deficit and debt respond to changes in income inequality is also a contribution of this chapter. Both cross-sectional estimation and panel data estimation for these policy variables are also offered. The results relating to these also support our tentative hypotheses relating to public debt when we control for unit roots in the data.

The extended range of recent data from 1981-2010 is a significant contribution of the fourth chapter where we investigate the optimal government size for economic growth. Moreover, the use of panel data is another contribution as there is not much literature in the past which have used panel data to analyse the Armey Curve (1995). We find substantive evidence for the presence of the Armey Curve (1995) across Non-OECD countries. With further decomposed samples between weak and strong democracies, there is considerable evidence found for the presence of Armey Curve (1995) in non- weak democratic samples.On the other hand, we find both mixed results, U-shaped and inverted U-shape, for the OECD sample which may imply that these countries can sustain larger governments.

The same methodology is used to determine the optimal government size for real GDP per capita. We again find support for the hypothesis of Armey curve when we apply 2SLS in first

differences estimation for the full sample. However, there is no evidence found for the Armey curve across sub-samples.

Following Ghosh and Gregoriou (2008), how the composition of expenditures affects economic growth is also analysed. The empirical results with regards to current government consumption across the OECDs and strong democracies support the presence of Armey curve. Applying 2SLS estimation, the results consistently fail to confirm the presence of Armey curve for both policy variables. Moreover, direct transfers are also used to examine how the size of government is related to this policy variable. The results relating to this variable also support the Armey curve hypothesis.

1.5) Structure

The remainder of the thesis is structured as follows. Chapter 2 assesses how changes in demographic structure affect policy variables – labor income tax rate, total tax revenue as a share of GDP and public debt as a share of GDP. How income inequality affects the composition of taxes is the issue explored both theoretically and empirically in the third chapter. The fourth chapter analyses the optimal government size, measured by government expenditures as a share of GDP, in terms of economic growth. The fifth chapter concludes.

Chapter 2

Demography and Fiscal Policy

2.1) Introduction

Since the end of World War II, decreases in both fertility and mortality rates in industrial countries have brought about a dramatic rise in the old age population, at least in the OECD countries. Life expectancy rose by an average two-and-a-half years per decade in countries where people already live longest, as estimated by Oeppen and Vaupel (2002). The median age in Europe is estimated to further rise from 37.7 in 2002 to 52.7 in 2050. For Western Europe the ratio of old (defined as persons aged over 65) to working age (defined as persons aged 16-65) is projected to rise from 20% in 2000 to 40% in 2050 (The Economist, 2002, p. 22). The dramatic rise in the relative size of the old has created many challenges for the respective governments because of the increased burden on the working-age population.

Governments that use Pay-As-You-Go finance systems take care of their dependent population through transfers from the young to the old and through the provision of public goods and services in kind paid for by current taxation. Given the rise in the relative size of the old, unmanageable increases in social security, rising budget deficits, tax hikes and public debt both internally and externally or a mix of all are potential outcomes for governments to consider. For example; public debt, in principle, has a ceiling at 60% of National Income in the EU Stability and Growth Pact (1992). Moreover, external debt may potentially harm annual growth.

Reinhart and Rogoff (2010) estimated that growth rates are approximately cut in half if external debts increase beyond 90 percent of GDP[2].

The unprecedented rise in the relative share of the aged population may potentially put constraints on the government's ability to smoothly run its fiscal transactions. A larger number of retirees mean a larger share of expenditures to be allocated to their social security services which, in turn, would have implications over the rest of fiscal policy. Hence, this study focuses on whether and how fiscal policy responds to demographic changes in the population. For this, we have taken the average labor income tax rate, total tax revenue as a share of GDP and public debt to GDP ratio as measures of fiscal policy.

To analyse how governments' policies change in response to a rise in the share of the old as a percentage of the total population, we take inspiration from Razin, Sadka and Swagel (2002). They argued theoretically that a rise in the share of the old can downsize the welfare state as long as the median voter is working. According to their proposition, a rise in the dependency ratio of the old may potentially produce the following effects: First, a higher dependency ratio means a larger support for increase in the labor income taxes because retired people favour it. However, the more numerous working people around the median voter have incentives to support a decrease in income taxes because their incomes will be taxed since they belong to working-age population. The demands of the workers prevail if they are more powerful politically as opposed to the old. As a result, a rise in the relative share of the old decreases labor income tax rates. Their argument contradicts alternative theories of "grey power" wherein a larger elderly vote always leads to increased pension provision.

The theoretical contribution of this chapter is to redefine the theoretical argument of Razin, Sadka and Swagel (2002) where they argue that the welfare state would increase in size in response to a rise in the relative share of the old population only once the median voter is old.

[2] Though, Herndon, Ash and Pollin (2014) cast considerable doubt over these findings.

Following them, we develop a theoretical model though with a different demographic structure. We assume three family types with different preferences depending on their demographic makeup. Additionally, we include another dimension in the theory where we consider possible empathy towards the old besides considering the political power of the median voter like Razin, Sadka and Swagel (2002). The complete rationale of our model is given below.

There are three types of families, type-X families, type-Y families and type-Z families. Type-X families consist of 6 individuals including two children/youth, two workers (parents) and two retirees (population aging 65 and above). Type-Y families consist of 4 individuals including two workers (parents) and two young (non-working individuals). These family types include no old.Type-Z families constitute of 5 individuals including one old individual (retired), two workers (parents) and two young (non-working individuals). Families are assumed to vote collectively, hence type-X and type-Z family members are assumed to be empathetic towards the old whereas type-Y families share no empathy for the old. In addition, we also assume probability of survival of parents to the retirement age. When we assume 30% probability of parents entering the retirement age, both families (type-X and type-Z) which share empathy with the old aggregately constitute majority in the population. Thus, at this probability, we expect preferences of the elderly to dominate.

Given this composition, the theory finds that a rise in the relative size of the old would increase tax on labor income once the retirees constitute 8.4% of the population which is termed as the 'critical mass/threshold/benchmark.' We define the critical mass as the point where the proportion of old in the population can no longer be exploited politically. Below the critical mass (8.4%), the demands of the workers dominate as the old are vulnerable politically. Once the old constitute 8.4% of the population or more, they become powerful politically and their demand for a rise in labor income tax rates prevails.

Briefly, similar to Razin, Sadka and Swagel (2002) we propose a "U-shaped" relationship between the labor income tax rates and the retirees share. This implies a negative association between labor income tax rates and the share of retirees until the old constitute 8.4% of the population but the relationship between these two variables changes and becomes positive once the share of retirees exceeds this threshold.

We criticize Razin, Sadka and Swagel (2002) for using the dependency ratio to denote share of retirees only. In reality the dependency ratio includes both old and youth dependency ratios. The finding may not present the true impact of a rise in the relative size of the old on labor income tax rates if the dependency ratio is not de-composed into young and retired population because it would also absorb the impact of youth dependency ratio. Therefore, de-composition of data and independently controlling for these two variables is important. Bryant (2003) and Shelton (2007) also criticize Razin, Sadka and Swagel (2002) for this reason.

To regress labor income tax rates on the share of retirees in population, we collect annual data for the average labor income tax rates[3] ranging from 1991 to 2012. The sample covers 13 OECD countries. Control variables included are GDP growth per capita, openness to trade (the sum of imports and imports as a share of GDP), income inequality, and the unemployment rate. We apply Ordinary Least Squares, Ordinary Least Squares in first differences, Two Stage Least Squares and Two Stage Least Squares in fist difference methods and employ country and time fixed effects in the analysis. Standard errors are clustered by country.

Despite criticizing Razin, Sadka and Swagel (2002) for not de-composing dependency ratio into young and the old, we estimate the relationship between labor income tax rate and the dependency ratio. There is support found for Razin, Sadka and Swagel (2002) as the relation between the two variables is indicated to be U-shaped. However, the threshold is 32.78% which is less than what they propose.

[3] Its method of calculation and source are described in the data section and the appendix.

Theory proposed in this chapter and the argument of Razin, Sadka and Swagel (2002) are supported by the empirical results. We find a U-shaped association between labor income tax rate and the share of retirees (when we add all control variables). The estimated threshold is 16.43% which is rather closer to what we propose.

Owing to non-stationarity of data and possible endogeneity between the variables, we also replicate the analysis with 2SLS in first difference estimation (2SLS+FD). The estimated relationship is again a U-shaped supporting the theory and Razin, Sadka and Swagel (2002). Again the estimated threshold is attained when retirees constitute 20.82% of the total population. As before the estimated threshold is closer to our theory.

The empirical analysis is also extended for youth dependency ratio. The evidence for a U-shaped association between labor income tax rate and the youth is confirmed with 2SLS estimation. However, the estimated correlation between the two variables is found to be an inverted U-shape when we difference the data. The data seem to lose some information due to differencing.

As the retired population may be more concerned about their gross expenditures as opposed to income taxes only, the empirical analysis is extended taking total tax revenue as a share of GDP, measuring the government size, as policy variable. The results are again found to indicate a U-shaped correlation between the government size and the share of old. These results reconcile with the theory, Razin, Sadka and Swagel (2002) and the findings we get with labor income taxes. When we analyse the relationship between the government size and the youth dependency, the results are similar to what we find with labor income taxes.

In addition, we also extend the sample size from 13 to 16 OECD countries including Greece, Luxembourg and Switzerland. Controlling for possible endogeneity and the presence of unit roots, the results support theory and are consistent with results of smaller sample.

The chapter is outlined as follows. Section 2.2 is a literature survey divided into three sub-sections. We discuss literature investigating the theoretical model of Razin, Sadka and Swagel (2002), the determinants of the average labor income tax rate andgovernment in sub-sections 2.2.1, 2.2.2 and 2.2.3 respectively. Section 2.3 is a theory section. Sub-section 2.3.1 outlines the assumption of the model whereas 2.3.2 presents the complete theoretical model where we develop our model to redefine the argument of Razin, Sadka and Swagel (2002). Section 2.4 of this paper offers a detailed description for the data sample. The empirical findings are presented in section 2.5. The empirical findings of the relationship between the retirees share and labor income tax rate and the government size and the debt are analysed in sub-sections 2.5.1 and 2.52 respectively. In addition, sub-section 2.5.3 tests for structural break in theory and sub-section 2.5.4 highlights the empirical findings with larger sample size. Section 2.6 concludes.

2.2) Literature Review

This section is divided into three sub-sections. First of all, literature related to the determinants of the labor income tax rates is reviewed. After that the determinants of the government size, measured as a share of GDP collected through total taxes, are analysed and in the last we analyse the determinants of the public debt as a share of GDP.

2.2.1) Theoretical Model of Razin, Sadka and Swagel (2002)

Razin, Sadka and Swagel (2002) examine a standard over lapping generations model composed of two generations: young and old.Each generation is assumed to be working in the first period and retired in the second period. A stylized economy is also assumed based on two types of workers, skilled and unskilled, following Saint – Paul (1994) and Razin and Sadka (1995a). The skilled workers are more productive providing one efficiency unit of labor per unit of labor time whereas the unskilled workers provide only q< 1 efficiency units of labor per unit of labor time. In the first period, each worker has one unit of time and an endowment of K units of capital but they are born without skills and hence low productivity. Each worker faces a decision whether to acquire education and become skilled or else remain unskilled. After the first period, workers retire and thereafter their consumption is financed by their savings in the first period and government transfers in the current period.

An innate ability parameter, e, denoting the time needed to acquire education characterizes the continuum of individuals. A worker becomes skilled after making an investment of e units of labor time in education. Once the worker becomes skilled the remaining units of labor time denoted as 1- e provide an equal amount of effective labor in the balance of first period. Education is more costly for less capable individuals in terms of lost income (education is a full

time activity) as they require more time to become skilled as opposed to capable individuals who need relative lesser time. The cost of acquiring education, denoted as r, is not tax deductible. $G(.)$denotes cumulative distribution function of innate ability with an interval $[0,1]$. $g = G'$refers to the density function. It is also assumed that the government levies a flat payroll tax rate, T, to finance a lump-sum grant, b.

Given these assumptions, the equality between the cost of and the returns to education determines a cut-off level corresponding to the individual's education cost parameter.

$$(1-T)\,w\,(1-e^*) = qw(1-T) + r \tag{2.1}$$

$$e^* = 1 - q - \frac{r}{(1-T)w}$$

Individuals acquire education and become skilled if their costs are less than the cut-off level. Those for whom the cost of acquiring education exceeds beyond the cut-off level do not attain education and rather remain unskilled.

A linear production function and a growing population are also assumed. Here, labor income taxes do not distort the individual's decision to supply labor as it is assumed to be fixed though income taxes affect aggregate labor supply because taxes affect innate ability parameter.[4]

The government balances its budget in each period. It uses the labor income tax rate to finance the grant to the current workers and retirees. The total grant is given below:

$$b_t = T_t wl(e_t^*)\frac{1+n}{2+n} \tag{2.2}$$

Here n refers to population. Note that the median voter is a worker in a growing population. Transfers will be driven to zero by the median voter if only the old are beneficiaries. Moreover, any social contract that future young will engage in redistribution to the future old may exist yet

[4]The fixed factor price assumption and the period-by-period budget balancing in thepay-as-you-go tax-transfer system break the links between generations that do not overlap.In this way, our intertemporal model becomes essentially isomorphic to a static atemporalmodel. This enables us to focus in a simple way on the effect of the dependency ratio onthe tax-transfer system.

implementation is not guaranteed. Given this, transfers are shared between workers and retirees.

The retirees favor higher income taxes as long as taxes raise total revenue and transfers. The political equilibrium tax rate is determined by the median voter who is young. Therefore, the workers would support higher taxes if their lifetime income is optimized as a result.

$$W(e, T_t, T_{t+1}, n) =$$

$$(1-T)\, w\, (1-e) - r + b(T_t, n) + \frac{b(T_{t+1},\ n)}{1=r} \qquad for\ e\ \leq e^*\ (T_t)$$

$$(1-T)\, wq + b(T_t, n) + \frac{b(T_{t+1}, n)}{1=r} \qquad for\ e\ \geq e^*\ (T_t) \tag{2.3}$$

Equation (2.3) denotes the lifetime income of labor with innate ability parameter e. Subscript t is suppressed since it is constant over time for a given population growth rate. First order condition and second order condition give us the following:

$$\frac{\partial W\ [e_M(n), T_0\ (n), n}{\partial T} = \mathrm{B}[T_0(n), n] = 0 \tag{2.4}$$

$$\frac{\partial^2 W\ [e_M(n), T_0\ , n}{\partial T^2} = \mathrm{B}[T_0(n), n]\ \leq 0 \tag{2.5}$$

$$B(T, n) =$$

$$-\, w[1 -\ e_M(n)] + \frac{w(1+n)}{2+n}\ l[e^*(T_t)] + \frac{rT(1+n)g[e^*(t)]}{(2+n)(1-T)}\frac{de^*}{dT} \quad if\ e_M(n) < e^*(T)$$

$$-\, wq + \frac{w(1+n)}{2+n}\ l[e^*(T_t)] + \frac{rT(1+n)g[e^*(t)]}{(2+n)(1-T)}\frac{de^*}{dT} \quad if\ 1 > e_M(n) > e^*(T) \tag{2.6}$$

With the help of equation (2.6) it can be seen that the transfers depend on whether the median voter is skilled or unskilled.

$$\frac{dT_0(n)}{dn} = -\frac{B_n[T_0(n), n]}{B_T[T_0(n), n]} \tag{2.7}$$

Total differentiation of equation (2.4) with respect to n gives us equation (2.7) which suggests that the sign of transfers $\mathrm{B}[T_0(n), n] \leq 0$ determines the direction of the effect of changes in the population growth rate on the equilibrium tax rate.With differentiation of equation (2.6) with respect to n we get

$$B_n[T_0(n), n] =$$

$$w\frac{de_M}{dn} + wl\{e^*[T_0(n)]\}\frac{1}{(2+n)^2} + T\frac{r}{1-T}\frac{g\{e^*[T_0(n)]\}}{(2+n)^2}\frac{de^*}{dT} \quad if\ e_M < e^*[T_0(n)]$$

$$wl\{e^*[T_0(n)]\}\frac{1}{(2+n)^2} + T\frac{r}{1-T}\frac{g\{e^*[T_0(n)]\}}{(2+n)^2}\frac{de^*}{dT} \quad if\ 1 > e_M > e^*[T_0(n)] \tag{2.8}$$

If the sign of $\mathrm{B}[T_0(n), n]$ is positive, a rise in the population growth rate raises the labor income tax rate. If this is the case, then there exists a negative relation between retirees as a proportion of the population and labor income tax rate.

A rise in the retirees share is hypothesized to generate two effects. First, it would increase the share of retirees implying a decrease in the share of young population. A higher share of retirees in the population means a rise in their political power and an increase in favour of labor income taxes as they are not workers anymore. Second, a relatively larger size of the retired population puts a higher tax burden on the workers to finance redistribution to the retirees. Therefore, those for whom the cost of raising taxes exceeds the benefits shift to anti-tax coalition. If the median voter is a worker, a rise in the share of the aged population would lead to lower income taxes. Nevertheless, the relationship between a rise in their relative share and income taxes would be positive once the median voter is retired (i. e. if $n < 0$ in the model).

Razin, Sadka and Swagel (2002) estimate their theoretical predictions using regressions in which alternatively the labor income tax rate and real per capita transfers depend on the dependency ratio as well as additional control variables. Control variables include real GDP

growth, openness to trade, government employment as a share of total employment and income inequality. Real GDP growth is taken to control for the cyclical effects of the business cycle. Exposure to external shocks is controlled for using openness to trade as Rodrick (1998) proposes that the provision of social insurance against the adverse external shocks is one of the functions of the welfare state – i. e. a positive association between the larger governments and more open economies is expected. Government employment as a share of total employment is included to show the breadth of government involvement in the economy. Income inequality is taken to test Meltzer and Richard (1981) who argue for more demand for redistribution with an increase in the income inequality. Unemployment as a share of total employment isincluded to control for reverse causality as argued by Daveri and Tabellini (2000) that higher income taxes lead to higher unemployment.

They took data for 13 European countries from 1965 to 1992. Their main finding is that an increase in the relative size of the retirees as a share of total voters decreases the labor income tax rates. Razin, Sadka and Swagel (2002) argue that the finding is consistent with their theoretical argument[5] where they suggested a negative association between the labor income tax rate and the share of retirees.

Bryant (2003) criticizesRazin, Sadka and Swagel (2002) for failing to disaggregate the dependency ratio into population aging between 0-14 and 65 and above as well as for assumptions made in their theory assuming that the benefit payments are the same for everyone. He replicated the empirical work ofRazin, Sadka and Swagel (2002) using the same specifications and the same period of time but disaggregating the dependency ratio. His estimation resultsindicate that a rise in the share of youth dependency leads to a decrease in the labor income tax rates. However, an increase in the relative size of the old as a fraction of total

[5] The findings corresponding to the control variables are as follows: firstly a negative but significant coefficient for the growth of real GDP showing the counter-cyclical pattern of taxes with the business cycle. The estimated coefficient for openness to trade shows a positive correlation with income taxes. This finding supports Rodrick (1998) but does not support Alesina and Wacziarg (1998).

voters increases labor income tax rate in contrast to Razin, Sadka and Swagel (2002). He also challenged the prediction ofRazin, Sadka and Swagel (2002) about the future size of the welfare state. Rather, he finds that the upward pressure on taxes and benefits would increase with a decrease and increase in the young and the old population respectively in the future. Likewise, Shelton (2007) also criticizesRazin, Sadka and Swagel (2002) for not disaggregating the dependency ratio and finds a positive correlation between income taxes andthe share of retirees.

Migration, though clearly a different variable, may be similar to aging in the way it affects government size. Facchini, Razin and Willmann (2004) estimate that the government size, measured as the labor income tax rate, decreases if there is an increase in un-skilled immigration or low-skilled immigration as the immigrants add to the working-class group and strengthens them more politically. On the one hand, domestic un-skilled workers might lobby against the inflow of immigrants because higher share of the immigrant labor means a rise in the labor supply pool of un-skilled labor that may depress wages of the domestic un-skilled labor. On the other hand, high-skilled labors are pro-immigration because large number of immigrants strengthens their political power. The second factor may dominate the first factor implying a negative association between immigration of un-skilled labor force and the size of the welfare state.

In this paper we analyse the impact of the retirees as a fraction of population following Razin, Sadka and Swagel (2002) though we also analyse additional policy variables which are tax revenue as a fraction of GDP and public debt as a share of GDP as opposed to using just the labor income tax rates. The rationale for analysing different policy instruments is that the retired bloc may be more concerned to overall expenditures and accumulating higher public debt accumulation since the future generations are supposed to pay the debt back.

2.2.2) Determinants of the Size of the Government

Government size, usually measured by total spending of the public sector as a percentage of GDP, has been extensively researched. There are a number of determinants that can potentially affect its size. These determinants include demography, immigration, education, globalization, income inequality, income levels, ideology,the level of democracy, institutions, corruption, population, cultural homogeneity and constitutions.

Increases in mean income level also affect the government size through other channels. Pickering and Rockey (2011) estimated that an increase in the mean level of income increases the impact of ideology on the size of the government. The nature of institutions developed in a country should be a reflection of ideology it follows and therefore may also likely affect its government size.

Trade openness is possibly an important factor determining the government size. Alesina and Wacziarg (1998) estimate a positive association between openness to trade and the size of the government. They argue that there exists a link between country size and its need to open to trade where the indirect link between the government size and openness to trade originates from. According to their argument small countries have stronger incentives to be more open to trade. A state of autarky is not economically viable for small countries as compared to large countries since they are not self-sufficient to the extent that they can rely on their domestically produced goods and services. Moreover, small countries cannot exploit the advantage of global trade unless their economies are open to trade. Alesina, Spolaore and Wacziarg (2000) argue that smaller countries can reap the benefits of cultural homogeneity without paying the cost integrated with small markets. In the light of their argument, geographic boundaries form the size of market in a world where trade is restricted using trade barriers. Given this, larger countries lead to larger governments and smaller countries lead to smaller governments whereas the globalization enables the governments of smaller countries to increase their

markets beyond their political boundaries. Resultantly, the size of the government rises due to increase in their role in the overall economy. Rodrik (1998) estimates a positive relation between openness to trade and the government size, measured by the public expenditures as a percentage of GDP. He argues that more open economies are more vulnerable to external economic shocks and, hence, government expenditures work as a social insurance against the external risks.

Ideology also likely determines the size of government. Blais, Blake and Dion (1993) find that parties which subscribe to leftist ideology are found to spend a higher fraction of GDP than parties skewed towards right-wing ideology. The finding relates to the parties forming majority governments whose composition does not change over a number of years.

The constitution of a country is also a potential determinant of the state's involvement in the economy. Lizzeri and Persico (2001) argue for the under-provision of public goods if the benefits of public goods provision are lesser than the benefits of direct transfers for the office-seeking candidates. Because the direct transfers can be made to the selective constituencies easily the politicians prefer them over public goods as the latter cannot easily be restricted to a targeted group of voters. In their model they compared different electoral systems. They suggest the winner-take-all system is less efficient than proportional system if the public good is very desirable. Building on the same point another study Persson, Roland and Tabellini (2000) establishes that more power delegation and fewer incentives for legislative cohesion are found to be associated with presidential – congressional regime than the parliamentary regime. These distinctions cause changes in the size and composition of public expenditures. A large size of government is found under parliamentary systems. In this system the majority is targeted for redistribution purposes. Moreover, this system offers less under-provision of public goods and more rents to politicians. Conversely, the size of government is smaller under presidential

regimes. More under-provision of public goods, less rents for politicians and powerful minority as the target group for redistribution purposes are the features of congressional regimes.

The size of government can also be determined by the extent of democracy. The size of government may differ based on whether autocrats or democratically elected leaders rule the country. As argued in Acemoglu and Robinson (2000) the political transition from dictatorship to democracy may lead to large government size. In order to prevent social unrest and revolution the ruling elite strategically opts for extended franchises. In democracy since it represents the median voter, therefore, the demand for redistribution is high. To cater to the demands of voters for redistribution the representative governments increase taxation which ultimately leads to an extended scope of government in the economy. In Boix (2001), democratic regimes are found to have bigger governments as compared to dictatorial ones.

Institutional quality is also a very important determinant of government size. Stein (1998) finds a positive correlation between decentralized governments and the size of government. In this form of government the fiscal decisions are arguably better approximate reflection of voter's preferences. Decentralized governments are, therefore, awarded more resources as they are more entrusted to provide public goods demanded by the constituents. Nevertheless, Persson and Tabellini (1994) conversely assert that centralization would lead to larger government size.

The size of government is also related to corruption. A corrupt government may allocate a higher share of public expenditures on public goods which require inputs from suppliers who are close allies of the incumbent government. For example, Mauro (1998) finds that more corrupt governments would decrease the share of public expenditures on education. The rationale for such a correlation to exist is that education is a public good which does not require the supply of high-tech inputs from oligopolistic suppliers who either directly or indirectly constitute

government. Thus, the rent-seeking corrupt governments find education less attractive as its provision does not serve their self-interest.

Population and its demographic structure may also determine government size as different aging groups have different preferences.Razin, Sadka and Swagel (2002) propose a negative relationship between the proportion of retirees and the size of government. Their proposed hypothesis is based on the two impacts the aging societies generate. First, a rise in the share of old refers to more power to the group supporting higher labor income tax rates. Second, a rise in the relative share of the aged population increases the burden on current working population as their incomes will be taxed to finance redistribution for the old. Since the median voter in their model is a young worker, the second factor dominates because supporting a rise in income tax rates becomes costly for labor. Contrary to Razin, Sadka and Swagel (2002), Bryant (2003) and Shelton (2007) find that more aging societies lead to larger government size. They criticize the finding of Razin, Sadka and Swagel (2002) as they use the dependency ratio instead of the aged population variable to analyse the impact of aging societies on the size of the welfare state.

Poor voters arguably demand more redistribution whereas rich constituents may demand less knowing that they will be taxed higher for redistribution to be financed. Hence, income inequality may also determine the size of government. Meltzer and Richard (1981) suggest that in democracies, where everyone is granted the right to vote, the median voter is generally poor. A rise in mean income relative to median income would lead to large size of government, measured by total redistribution.

Social homogeneity and heterogeneity may also determine the government size. Peltzman (1980) finds large governments in countries where large groups share homogenous interest as well as articulate them. In his paper the growth of government is mainly attributed to the levelling of income differences across a substantial fragment of population – the growth of the middle class. On the other hand, Supply of a certain public good to one group may raise concerns

for other groups in societies divided on ethnic lines. Hence, this may impact the size of government. More heterogeneous and polarized societies, according to political economy theories, assign less weight to public goods as compared to patronage. These societies are also arguably less careful with regards to fiscal discipline. Alesina, Baqir and Easterly (1999) find that higher ethnic fragmentation leads to less amount of spending on public goods – education, roads, sewers and trash pickups – in the US cities. This may be attributed to differences in preferences of ethnic groups and a reduction in utility derived from the use of public goods if other ethnic groups also use it.

With more communication facilities societies arguably become more aware about their rights and mobilized which result in high demand for public goods and transfers. Deutsch (1961) finds that accelerating impact of modern communications proved instrumental in paving the way to higher demands for government involvement in the economy. Because of widespread dissemination of knowledge the people became more informed about what they can get. At the same time, the higher level of social mobilization exerted more pressure for public services to be effective.

2.3) Theory: Household-Level Utility Maximization

In contrast to Razin, Sadka and Swagel (2002) we posit that individuals work and vote so as to maximize household level utility rather than individual utility.

2.3.1) Key Arguments

The key argument is that voters maximize household utility and not individual utility. Along these lines, different family types are assumed to vote collectively and vote for same candidate. Glaser (1959) provides evidence for similarity in the voting behaviour within households as a result of close family ties or other types of close attachments that may affect the attitude of family members. Niemi, Hedges and Jennings (1977) find the presence of a broad congruence within couples in voting behaviour. The agreement may be attributed to the couple's selection or mutual socialization or the similar experiences that they encounter every day. Huckfeldt and Sprague (1991) find that political discussions of households, people residing near-by or like-minded people exert a considerable social influence on the voting preferences of people. Nickerson (2008) finds in a placebo-controlled experiment that the propensity to vote passed onto other household members is 60% as the preferences of couples become more similar as time goes by.

Based on the empirical evidence that families vote collectively, we argue that families share empathy with each other (within the households). Hence a household with many elderly relatives will be more pre-disposed towards material interests benefitting the elderly.

Note that this argument does not imply that all household members perfectly align their interests with the elderly household member(s). All that is being assumed is collective voting at the level of the household. Hence a household with elderly relatives will be more sympathetic to

the needs of the elderly than those without. The budget constraint applies at the level of the household, and not individuals, so improvements in the income to the old (via redistribution) will benefit all members of the household. Hence the key argument is that working age adults support elderly household members when pension provision is limited. This aligns their interests with those of the elderly.

One could question the argument that self-interested adults will put weight on possible utility when old if the chance of survival is low. But even here the self-interested adult will care about the utility of the elderly when there are elderly relatives currently within the household.[6]

In the analysis the proportion of retired people in society is assumed to grow exogenously over time. Increased aging corresponds to a rise in life expectancy. This means that the proportion of families with elderly relatives grows over time. Oeppen and Vaupel (2002) attribute increases in life expectancy in industrialized countries to medical progress, social improvements and economic development.

[6] An alternative, but certainly not mutually exclusive, argument could be that cultural norms dictate deference to the elderly.

2.3.2) Model

We suppose three family types in the model defined as type-X, type-Y and type-Z. Type-X family consists of six individuals including two workers (parents), two non-working individuals (children/youth) and two retirees (aging 65 and above). Type-Y family constitutes 4 individuals. Of them, two are workers and two are children. This family type thus includes no retirees. Type-Z families consist of 5 individuals including two workers (parents), two non-working individuals (children) and one retiree (old). Children are unable to vote. Hence, there are four voters in type-X households, two voters in type-Y households and three voters in family type-Z. In such a demographic structure, retirees constitute half of the adult population (electorate) in type-X family and one-third in type-Z families whereas type-Y families include no old. The family structure is endogenous to changes in the mortality or "survival" ratio between the second and third generations.

Before discussing the model formally, we first discuss the divergence of interests between workers and the old. The retirees prefer higher income taxes as they no longer work. On the other hand, workers support lower income taxes as their incomes in the form of income taxes are deducted to finance redistribution to the old. Especially when the relative size of the old in the population increases, so does the burden on workers as now the smaller quantity of workers will be taxed to cater to the social security needs of higher proportion of retirees. Nonetheless, in our model, we take interests of households as a whole.

Because of empathy within the households, we argue that families that include older members would vote for higher income taxes in order for higher redistribution to be made to the old. Note also that empathizing with the old also potentially serves in their own self-interest

as workers may themselves survive to be old in the future.[7] Moreover, higher income taxes would ensure more extraction of income from families that do not include retirees to families with elderly relatives.

Increasing life expectancy is modelled as increased probability of surviving into retirement. As is shown in the third column of Table 2.1, where we assume 10% probability of workers to survive into retirement from all three demographic structures in our model, the retirees constitute 3.9% of total population. The method of this calculation is given below:

First consider family types (X and Y) to calculate their proportions. Given a 10% survival rate, the proportion of type-X families is:

$$P^2 = \frac{1}{10} * \frac{1}{10} = 0.01. \tag{2.9}$$

On the other hand the proportion of type-Y families is:

$$(1 - P)^2 = \frac{9}{10} * \frac{9}{10} = 0.81. \tag{2.10}$$

From these proportions, we can calculate the proportion of type-Z family which is 0.18. It is shown below:

$$1 - P^2 - (1 - P)^2 = 1 - 0.01 - 0.81 = 0.18. \tag{2.11}$$

We now analyse which family type holds majority in the given population. Type-Y families, at 10% survival rate, make up 81% of total population when we assume 10% probability of workers to be able to reach retirement age. Since type-Y families share no empathy with the old, they will vote in favor of low taxes. Owing to more political power resting with type-Y families, anti-tax coalition dominates the preferences of pro-tax coalition. Thus, a rise in the share of retirees would lead to lower income taxes.

[7]This mechanism is distinct, but certainly not incompatible with the main argument proposed in the chapter – that voters empathize with current household members. Greater survival rates will potentially induce *all* voters to be more sympathetic to the needs of the elderly if we assume persistence in policy, though a full analysis of this mechanism is beyond the scope of this chapter.

Even when we take 20% and 25% probabilities of workers to reach retirement age, the majority share (64% and 56.25% which are more than 50%) in the population consists of type-Y families. In both cases, the shares of retirees in the population are calculated to be 7.7% and 9.5% respectively. Anti-tax coalition still dominates pro-tax coalition for type-Y families share no empathy with the old. Hence, a negative relation between income taxes and the proportion of retirees in the population would emerge with a rise in the relative size of old.

A negative correlation corresponds to the argument that the preferences of the working class dominate the preferences of retirees. The working population is here more powerful and influential politically than the retirees. Moreover, the allocation of an increasing amount of the budget expenditure for their healthcare and security needs also causes this negative association between the two variables.

Only when we take survival probability to be 30%, type-X and type-Z families (9% and 42%) jointly make up for more than 50% of total population. These both family types are empathetic towards the old. Given that the more political power rests with these families, a positive relation between income taxes and the relative size of old would exist. At what threshold level the relationship between these two variables becomes positive is of utmost importance. In this case, the critical point is 8.4%. The critical point comes at which voters who are empathetic towards the old start to outnumber voters who are not. This threshold is calculated as follows:

$$2(1-P)^2 = 4P^2 + 3(2P(1-P)). \tag{2.12}$$

The term on the left hand side of equation (2.12) is the proportion of type-Y families multiplied by two adult voters. On the right hand side, the first term is the proportion of type-X families multiplied four voters. The second term is the proportion of type-Z families multiplied by three adult voters. The solution to this formula is the root of

$$4P^2 - 10P + 2 \tag{2.13}$$

hence, $P \approx 0.219$. This means that the proportion of old people is calculated as follows:

$$\frac{(0.219)^2}{3} + \frac{2\,(0.219)(1-0.219)}{5} = 0.0159 + 0.0684 = 0.084 = 8.4\%. \tag{2.14}$$

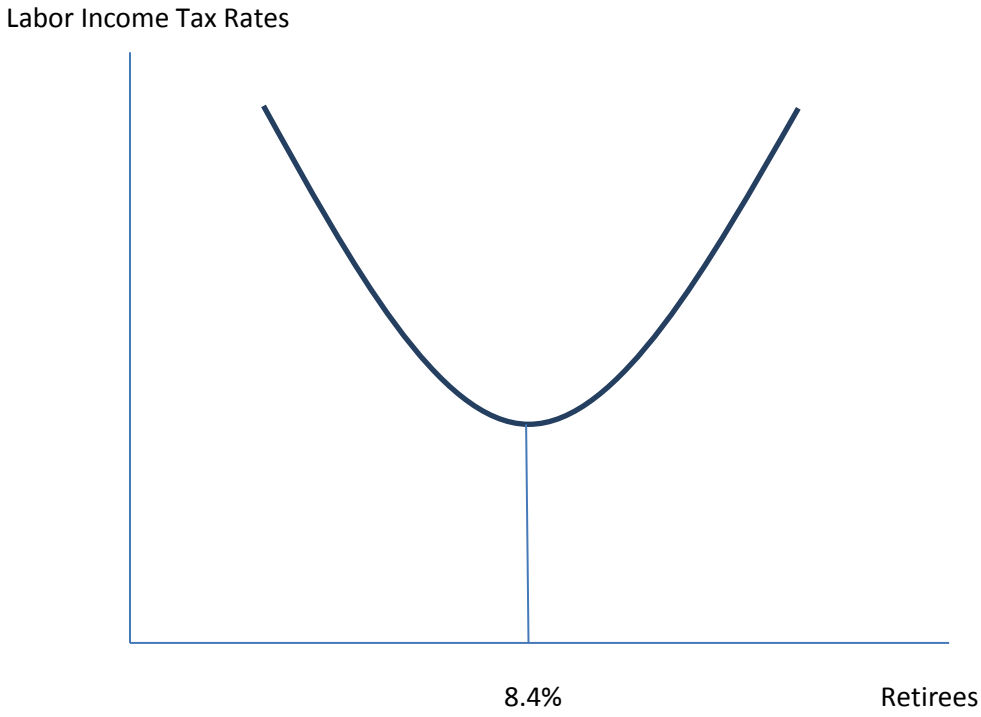
In equation (2.14), $\frac{1}{3}$ refers to the share of youth in type-X families whereas and $\frac{1}{5}$ refers to the share of elderly members in type-Z families.

To sum up, a rise in the share of retirees would lead to a decrease in income taxes but the correlation between the two variables becomes positive once the old constitute 8.4% of the population. Graphical presentation of this argument is illustrated in Graph 2.1.

This argument challenges the theory of Razin, Sadka and Swagel (2002) who argue for a positive relation between income taxes and retirees only once the retirees constitute half the total voters. We propose, on the other hand, that a rise in the relative size of old would decrease income taxes initially. Nonetheless, a further rise in their share would be positively associated with income taxes once proportion of the retirees in population becomes 8.4% due to empathy within households. The empathy factor is crucial to our result that Razin, Sadka and Swagel (2002) fail to acknowledge.

Table 2.1: The effect of increasing longevity on the family structure of the population.

Probability of workers to Survive into retirement		10%	20%	25%	30%
Type-X family	2 Youth 2Workers 2 Retirees	1% (Share of type-X family in the total population)	4% (Share of type-X family in the total population)	6.25% (Share of type-X family in the total population)	9% (Share of type-X family in the total population)
Type-Y family	2 Youth 2Workers 0 Retirees	81% (Share of type-Y family in the total population)	64% (Share of type-Y family in the total population)	56.25% (Share of type-Y family in the total population)	49% (Share of type-Y family in the total population)
Type-Z family	2 Youth 2Workers 1 Retirees	18% (Share of type-Z family in the total population)	32% (Share of type-Z family in the total population)	37.5% (Share of type-Z family in the total population)	42% (Share of type-Z family in the total population)
Share of retirees in the whole population					8.4%



Graph 2.1: A U-shaped relationship between labor income tax rates and the share of retirees.

To conclude, though the theory in this section argues for a U-shape relationship between the labor income tax rates and the share of retired population following Razin, Sadka and Swagel (2002), the critical mass is still far below than what they argue for. The theory suggests that the interests of the retirees prevail well before they account for 50% of the population as opposed to Razin, Sadka and Swagel (2002) who argue for the possibility of such a relationship to hold only once the median voter is the retiree.

2.4) Data

The data for the analysis of labor income tax rates are collected following Razin, Sadka and Swagel (2002). Following their empirical analysis, the data sample covers 13 OECD countries[8]. The data are annual ranging from 1991 to 2012. We also investigate how total government expenditures respond to changes in the demographic structures. Table 2.2 contains descriptive statistics of the dependent and explanatory variables used for the analysis.

Data for the labor income tax rates are calculated as the ratio of taxes on income, and profits to labor income share. The OECD Revenue Statistics is used as a data source. The data span from 1991 to 2012. The mean and the standard deviation values for labor income tax rates are 28.45and 10.72 respectively. Its mean demonstrates widespread reliance on income taxes though the standard deviation demonstrates a considerable variation within the sample. Figure 2.1 exhibits an increasing trend in average labor income tax rates over the years though the trend is negative in late 2000s.

Tax revenue as a share of GDP from 1991 to 2012 is taken from the OECD Revenue Statistics. Its mean value, 40.47%, demonstrates the scale of public sector in these countries though its standard deviation, 6.21%, shows moderate variation across the sample. Figure 2.2 displays an increasing trend for the fraction of GDP collected through taxes from 1991 to 2000 but after this the variable shows a slight decreasing trend.

The dependency ratio data, measured as 1 minus the total population aged 15-64 as a share of the total population, are collected from the World Development Indicators (WDI) Database. The mean and the standard deviation are 33.57 and 1.26 respectively. This variable is included to test the hypothesis of Razin, Sadka and Swagel (2002) where they argue for a clear negative association between the labor income tax rates and the relative share of the retirees.

[8] There are 13 OECD countries included in the sample which are Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, the UK and the US.

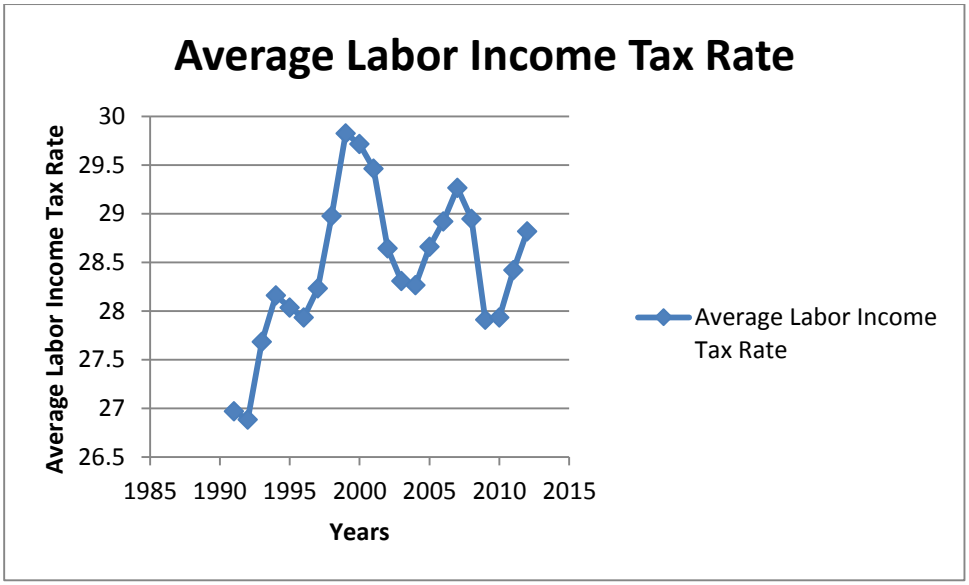
We break up the dependency ratio into the youth and the retirees share since the dependency ratio is composed of the shares of the young and the retired people in the population. The sample mean and standard deviation values are 15.96 and 1.81 respectively for the old. Across the sample, an increasing trend in the relative size of retired population over the years is shown in Figure 2.3.

Globalization is likely to affect the governments' capacity to raise revenue, for example, as more openness could mean less tariff revenue. Hence, governments might resort to other forms of taxation. As a control variable openness to trade is also included to test the hypothesis of Rodrick (1998) who argues for a positive relation between the government size and openness. Openness to trade is measured by summing imports and exports as a fraction of GDP. These data are also from the World Development Indicators database. The mean and standard deviation for openness are 62.89 and 34.65 respectively.

Table 2.2. Summary Statistics of the Variables

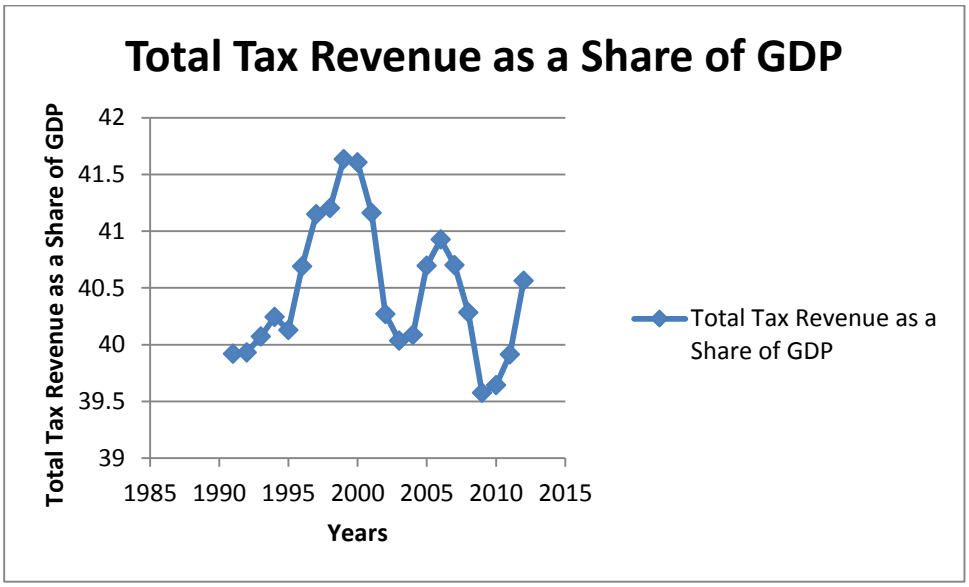
	Obs	Mean	Std Dev	Min	Max
Labor Income Tax Rate	286	28.45	10.72	12.74	44.9
Dependency Ratio	286	33.57	1.26	31.07	36.31
Retirees	286	15.96	1.81	12.28	21.1
Population aging 0-14	286	17.59	1.95	11.39	21.86
Trade Openness	286	62.89	34.65	19.73	58.94
Per capita GDP growth	286	1.37	2.21	-1.97	5.89
Rich/Middle income share	286	31.08	3.4	23.7	40.1
Unemployment Rate	286	7.85	4.02	2.1	15.02
Log Per capita real GDP	286	10.34	0.18	9.92	10.85
Tax revenue as a share of GDP	286	40.47	6.21	23.28	51.43

The data are cross country averages from 1990-2012. Labor income tax rate is collected from OECD Revenue Statistics data base. Tax revenue as a share of GDP, public debt as a share of GDP, Dependency ratio, retirees, 0-14, trade openness, per capita GDP growth, ratio of rich to middle income share and unemployment rate are all taken from World Development Indicators database. Log Real GDP per capita is collected from Penn World Table database.



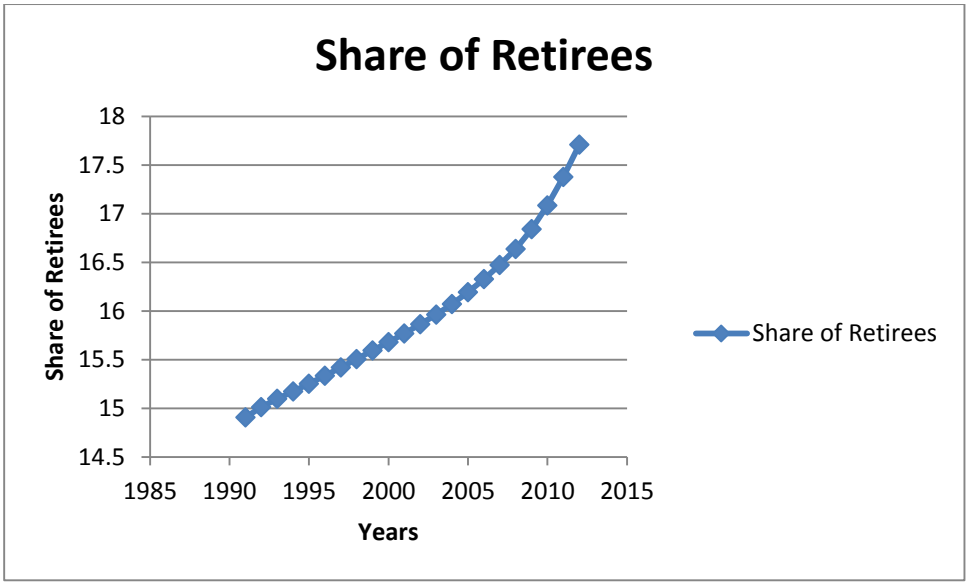
Cross country average of labor income tax rate taken over the period of 1991-2012

Figure: 2.1



Cross country average of Tax revenues to GDP ratio taken over the period of 1991-2012

Figure: 2.2



Cross country average of population aged 65 and above taken over the period of 1991-2012

Figure: 2.3

Controlling for the cyclicality of the business cycle is also important as governments generally find it easier to collect taxes in boom compared to recession. On the other hand, there is a literature that finds fiscal policy in developing countries to be rather pro-cyclical(Talvi and Vegh, 2005 and Ilzetzki and Vegh , 2008). GDP growth per capita is, therefore, included as a control variable for cyclical variation. WDI is the source for this data. The mean and standard deviation are 1.37 and 2.21 respectively.

In times of higher inequality the demand for higher redistribution financed through raising income taxes is increased, in theory. In order to control for inequality a measure of income

inequality is introduced in the model. Meltzer and Richard (1981) argue that under majority rule the size of the government, measured by the share of income redistributed, increases with pre-tax inequality measured as mean level of income of voters compared to the income of median voter. Milanovic (2000) using data comprising of 79 observations from 24 democracies finds that countries with more inequitable distribution of factor income (incomes before taxes and transfers) distribute more. An updated inequality database of Deininger and Squire (1996) is used to derive the data for income inequality. The mean and standard deviations are 31.08 and 3.4 in order.

Daveri and Tabellini (2000) find that a rise in labor income taxes may lead to higher real wages if trade unions play an instrumental role in the determination of wages. Increased real wages lower the demand for labor and, therefore, may lead to higher unemployment rates. They substantiate their hypothesis by estimating data for the EU from 1965 to 1995. They estimated that a 14% rise in labor tax rates increased the unemployment rate by almost 4%. To be precise, they argue and find reverse causality between labor income tax rate and the level of unemployment. Total unemployment rate, taken as total unemployment as a share of labor force, is included to control for the reverse causation between the two variables found in Daveri and Tabellini (2000). The mean and standard deviation of unemployment rates are 7.85 and 4.02 respectively. The data for unemployment rate are taken from the OECD Revenue Statistics.

Countries differ from each other in terms of the level of economic development, which in turn, may affect policy variables. To control for differences in economic development, log GDP per capita is included following Persson and Tabellini (2003). Its mean and standard deviation values are 10.34 and 0.18 respectively. These data are from the World Development Indicators. The data are collected from 1991 to 2012.

2.5) Empirical Analysis

Following the data section, we report the empirical findings related to the labor income tax rates and government size measured by tax revenue as a share of GDP sequentially from 1991-2012. We regresslabor income taxes on the dependency ratio and the share of retirees in the first sub-section. Control variables included are openness to trade, per capita GDP growth, log real GDP per capita and the measure of inequality. There are two points here that are worth mentioning. First, we do not include ratio of civil employment to total employment as a control variable due to unavailability of data which Razin, Sadka and Swagel (2002) use in their paper. Second, we add log real GDP per capita in our model to control for differences in development level across countries which Razin, Sadka and Swagel (2002) do not control for in their model. Besides these differences in our model, a key distinction is the de-composition of the dependency ratio into retirees and children. Regressions in the following sub-section repeat the analysis for total tax revenue as a share of GDP.

2.5.1) Empirical analysis of the Labor Income Tax Rates

We first regressthe labor income tax rates on the dependency ratio and all other control variables. All specifications exhibited includecountry and time fixed effects. Moreover, the errors are clustered by country. We apply Ordinary Least Squares method on panel data for 13 OECD countries following Razin, Sadka and Swagel (2002). The data sample ranges from 1991-2012.

The first column of Table 2.3 replicates Razin, Sadka and Swagel (2002). A 1% percent increase in the dependency ratio leads to 1.42% increase in the labor income tax rates though the coefficient is insignificant. This result neither supports our hypothesis nor the empirical finding

of Razin, Sadka andSwagel (2002) where they argue for a negative relationship between the two variables as long as the median voter is young. A coalition against higher income taxes dominates a coalition supporting a rise in income taxes. All the other estimated coefficients corresponding to control variables in the first column are insignificant unlike Razin, Sadka and Swagel (2002).

Unemployment rate as an additional control variable is included in the second column again followingRazin, Sadka and Swagel (2002). Potential reverse causality between income taxes and unemployment, higher income taxes leading to more unemployment, is explained by the positively estimated coefficient of unemployment rate. The finding supportsRazin, Sadka and Swagel (2002) as well as Daveri and Tabellini (2000) who also find reverse causation between income taxes and unemployment. However, the coefficient does not hold significance.

There are no considerable differences in the findings after we control for unemployment rate except that the magnitude of the estimated coefficient for the dependency ratio decreases. It is still not statistically significant.

Columns 3 and 4 of Table 2.3 repeat columns 1 and 2 respectively with the addition of quadratic terms for the dependency ratio in each column. Razin, Sadka and Swagel (2002) argue that the relation between labor income tax rate and the old would become positiveonly once the old constitute 50% of total voters and more. The theory in this chapter, nevertheless, suggests taxes could go up much earlier. Given this, a “U-shape” relationship between these two variables may be inferred. The estimated coefficients for both the linear and quadratic terms for the dependency ratio in columns 3 and 4 indicate a U-shaped relation between thelabor income tax rates and the dependency ratio. But the coefficients in column 3 are only statistically significant at 10%. A rise in dependency ratio at first decreases labor income tax rate but the correlation between two variables becomes positive after any further rise in the dependency ratio after 32.51% (column 3). For column 4, the estimated threshold is 32.71%. In comparison to

the proposed benchmark with what we argue in the theory and what Razin, Sadka and Swagel (2002) argue in their paper, our estimated benchmark is different.

Regressions of first four columns of Table 2.3 are repeated in the last four columns with an additional control variable, per capita real GDP. It is included following Person and Tabellini (2003)to account for the difference in the level of economic development across the countries. As before the estimated coefficients for the dependency ratio are positive and insignificant in the 5th and 6th columns. This is inconsistent with Razin, Sadka and Swagel (2002). Whilst columns 7 and 8 again suggest a U-shape association between the labor income tax rates and the dependency ratio, the coefficients of only column 7 are statistically significant at 5%. The critical mass estimated from column 7 for the dependency ratio is attained when the retirees represent 32.82% of the total population.[9] Hence, inclusion of GDP per capita does not alter the findings.

We consistently find U-shaped correlation between labor income tax rates and the dependency ratio. All the calculated benchmarks for dependency ratio in Table 2.3 (columns 3, 4, 7 and 8) are within the range of 32% to 33%. These are very consistent throughout the table. These results support our theory and the hypothesis proposed in Razin, Sadka and Swagel (2002). Our theory is supported more than Razin, Sadka and Swagel (2002) to the extent that they claim for such a correlation to exist only when retirees constitute half the total voters.

Bryant (2003) and Shelton (2007) criticizeRazin, Sadka and Swagel (2002) for failing to split the dependency ratio into youth and old age (retirees) dependency shares. Theyfind a negative association betweenlabor tax rates and youth dependency whereas the relation between labor taxes and the relative size of retirees is found positive.

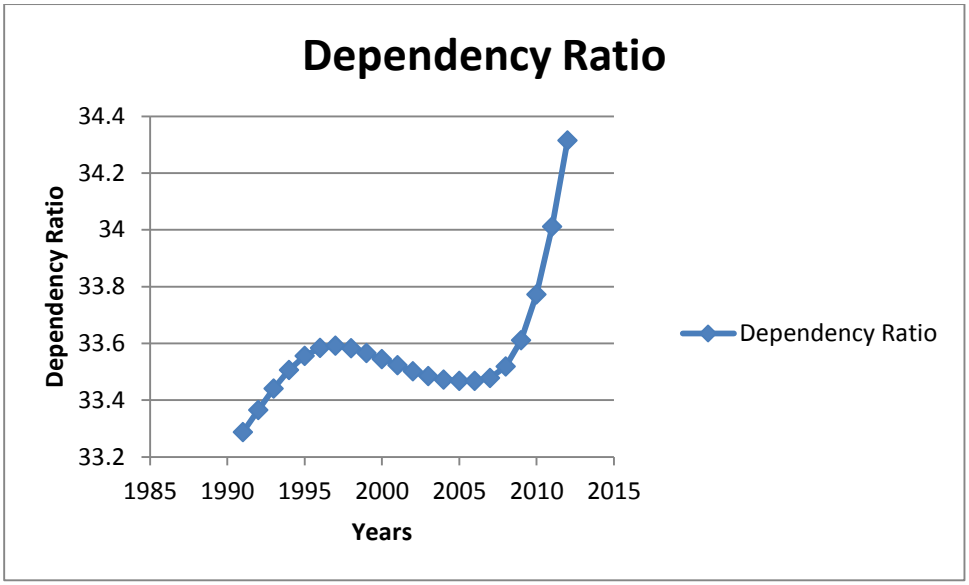
The criticism of Bryant (2003) and Shelton (2007) appears important when the trends of both variables, dependency ratio and the retired population, are compared with each other. The dependent population exhibits a decreasing trend from mid 1990s to late 2000s as can be seen

[9]Detailed method of calculating the critical mass is given below.

in Figure 2.4whereas the retired population is showing a rising trend throughout the time period as indicated by Figure 2.3. An opposite trend exhibited by the two variables is an indication of how important it is to de-compose the dependency ratio into young and retired population. Upon analysing the data, having de-composed the dependency ratio, it becomes easier to understand the decreasing trend of the dependency ratio.

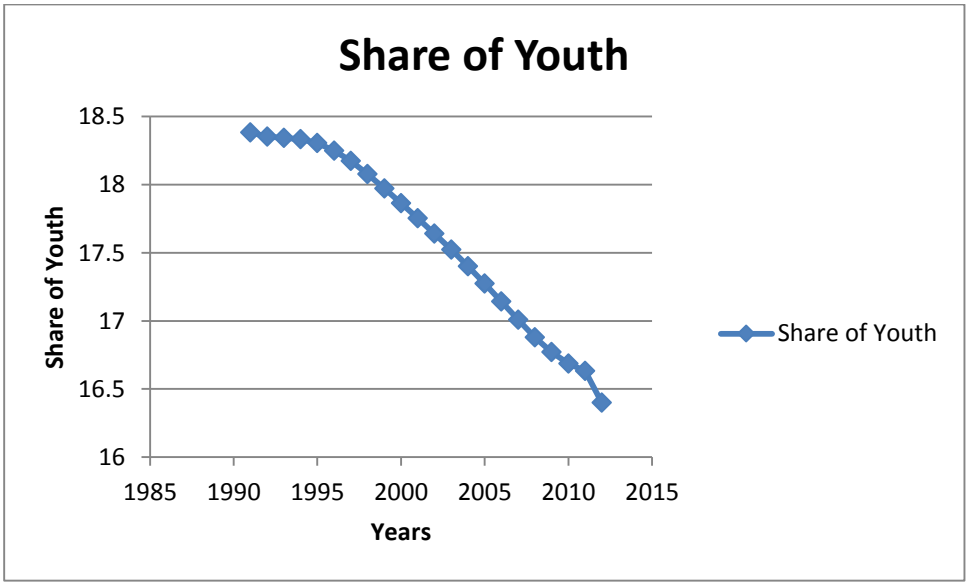
In Figure 2.5 there is a clear indication that the fertility rate measured by, population aged zero to fourteen, have decreased from 1991 to 2012. This declining trend corresponding to young actually dominates the retired population in the given period because of which the overall trend in Figure 2.4 becomes negative. Hence, following Bryant (2003) and Shelton (2007), we also differentiate the dependency ratio between youth (population aging between 0-14) and retired population (population aging 65 and above).

All regressions of Table 2.3 are replicated for Table 2.4 dis-aggregating the dependency ratio into youth and the relative size of the old. The estimated coefficient for the share of retirees is positive thoughstatistically insignificant. This result suggests that a 1% increase in the relative size of the retirees raises the labor income tax rates by 1.54%. This finding is not consistent with both the theory of this chapter and the empirical finding of Razin, Sadka and Swagel (2002) who argue and find a negative association between these two variables. However, it supports Bryant (2003), Shelton (2007) and Disney (2007) who found a positive relationship between the two variables. The retiredpopulation seems to be becoming more powerful politically in an unconditional sense than the working age population when we disaggregate the dependency ratio into youth and old age dependency ratios.



Cross country average of the dependency ratio as a share of the population taken over the period of 1991-2012

Figure: 2.4



Cross country average of the population aging 0-14 taken over the period of 1991-2012

Figure: 2.5

The estimated coefficient for the youth dependency is positive but does not hold statistical significance. It suggests a rise of 0.88% in the labor income tax rates if there is 1% increase in youth dependency as a share of the total population. The finding is not consistent with Bryant (2003) and Shelton (2007) who both finda negative relationship betweenlabor income tax rates and the youth dependency ratio. In support of their finding they argue that a negative correlation unambiguously exists between the income tax rates and youth dependency rate if transfer payments are directly made to children aging 0-14. According to them the direct redistribution made to children will discourage students to get education as well as increase the fiscal leakage. Provided that the children, unlike the retired population, do not have the voting power to balance the effects of fiscal leakage and education, a rise in youth dependency would likely lead to a decrease in the size of the welfare state. Nevertheless the findings are complex if transfers are made to parents directly. In such a case the tax and transfer system will be seen as having less fiscal leakage effects by working age parents than working age non-parents. Thus, a rise in the youth dependency ratio may add or subtract to the pro-tax coalition depending on innate ability and how childbearing is distributed among the workers. How a rise in the relative size of young would affect tax and benefit systems cannot be predicted unconditionally by the framework used without knowing these distributions.

The estimated results in column 2 offer no considerable difference except that the inequality coefficient changes from positive to negative. In next two columns we again test for non-linear relationship between labor income tax rates and the share of retirees.

In column 3 both, linear and quadratic, coefficients of retirees are positive but insignificant. In column 4 we find a U-shaped association between labor income tax rates and the proportion of retirees in total population. This finding supports our theory and Razin, Sadka and Swagel (2002) to the extent that the correlation is U-shaped. The estimated threshold is achieved when the

retirees constitute 15.83% of the population which is more in line with the argument advanced in this chapter.

Columns 5-8 add per capita real GDP as a control variable. We find an inverted U-shape association between labor income tax rates and the share of retirees in column 7. The estimated coefficients are statistically insignificant. This is exactly the opposite of that predicted in the theory of this chapter and Razin, Sadka and Swagel (2002). The estimated coefficients for the retirees suggest that the relationship between labor income tax rates and the share of retirees is positive and increasing and that the labor income tax rates decline once the retirees constitute 34.67% of the population. An inverted U-shape relation indicates that the retired population is increasingly powerful politically as well as perhaps that the empathy for them is high. There are also some other findings worth discussing.

Income inequality is positive in column 7 supporting the hypothesis of Meltzer and Richard (1981) and Milanovic (2000) who propose a positive correlation between the two variables. However, in column 8, it is negative supporting Razin, Sadka and Swagel (2002). Trade as a share of GDP is consistently negative and insignificant throughout the table which contradicts Razin, Sadka and Swagel (2002) who found a positive correlation between globalization and labor income tax rates. Likewise, GDP growth is positive indicating a rise in GDP growth would lead to a rise in taxes.

On the other hand, in column 8, the estimated coefficients of retirees are found to have a U-shaped association though insignificant. This again supports our theory and previous literature. The estimated coefficient is found to be 16.43%, the detailed calculation of which is given below. Its graphical presentation can be seen in Figure 2.2.

$$LTR = -3.057(V1) + 0.093(V1)^2 + 0.020\,(V2) - 0.048(V3) + 0.244(V4) - 0.046(V5) + 0.032(V6) - 11.631(V7) \quad (2.15)$$

Here,

LTR = Labor income tax rate

$V1$ = Population aging 65 or above

$V2$ = Population aging 0-14

$V3$ = Trade (exports and imports as a share of GDP)

$V4$ = GDP growth per capita

$V5$ = Income skewedness

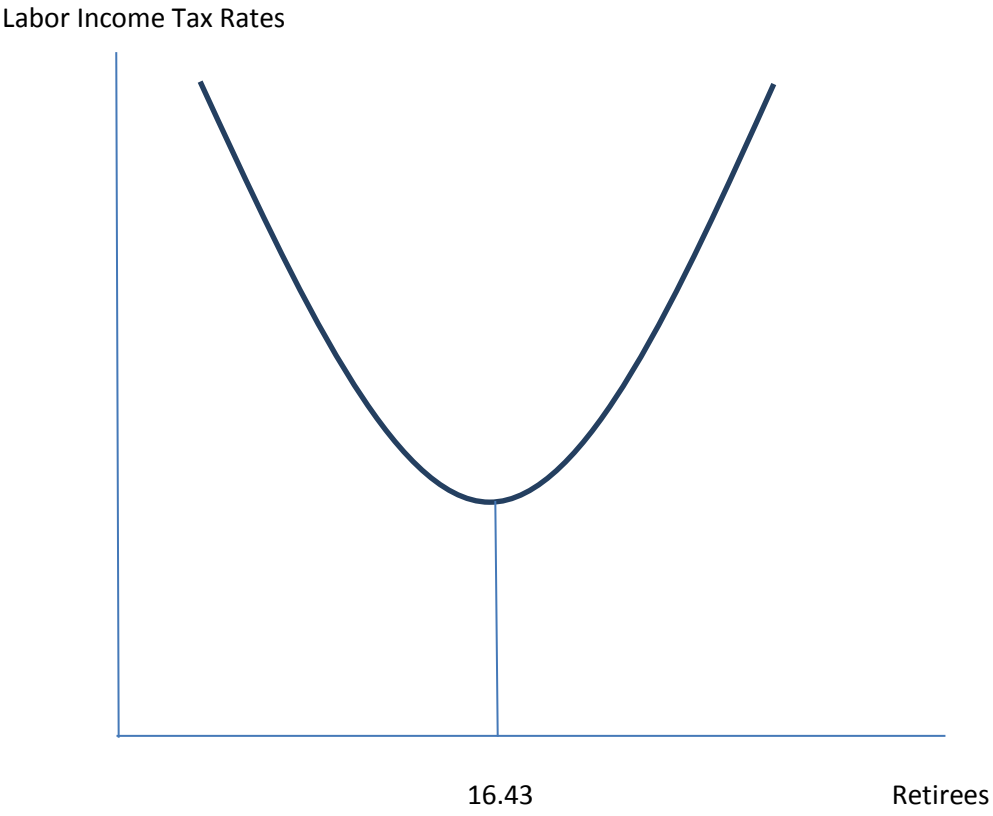
$V6$ = Unemployment force as a share of total labor force

V7 = Log Real GDP per capita

The labor income tax rate in equation (2.15) is differentiated with respect to dependency ratio.

$$\frac{\partial LTR}{\partial V1} = -3.057 + 0.093(V1) = 0$$

$$V1 = \frac{3.057}{0.186} = 16.43\%$$



Graph 2.2: A U-shaped relationship betweenlabor income tax rates and the relative size of the old.

In general, the findings of Table 2.4 regarding labor income tax rates and the share of retirees are mixed. We find both the coefficients (linear and quadratic) positive in column 3 whereas the correlation is found to be inverted U-shape in column 7. These are inconsistent with the hypothesis of this chapter as well as Razin, Sadka and Swagel (2002). However, in columns 4 and 8 (where all control variables are included) we find a U-shaped association consistent with our proposition and Razin, Sadka and Swagel (2002). The inverted U-shape association between labor income tax rate and the share of retirees may be the manifestation of grey power and

diminishing returns. We also test for the structural break at the threshold identified by the theory. It is found that structural break exists in all columns of Table 2.4.

Few of the variables used in the analysis are non-stationary which may cause results to be spurious. For example; both the average income tax and the dependency ratios are bound to contain unit roots. To investigate which variables are stationary and which ones contain unit roots, we apply Im-Pesaran-Shin (IPS) test, following Im, Pesaran and Shin (2003). Applying this test, we fail to reject the hypothesis that all panels contain unit roots except GDP growth per capita. The Im-Pesaran-Shin test rejects the null hypothesis which means that we cannot reject alternate hypothesis which means some panels are stationary. There are problems with inference which can be caused if non-stationarity is not dealt with properly. With the presence of unit roots in the data, the standard assumption of asymptotic analysis becomes invalid. Moreover, the persistence of shocks is infinite if the data are not stationary. To deal with this problem, we difference the data of variables such as labor income tax rate, total tax revenue as a share of GDP, population aging 65 and above, population aging zero to fourteen, trade as a share of GDP, unemployment rate, income inequality and GDP per capita. Whilst differencing the data satisfies stationarity properties, some information is lost in the process. The reason to use the IPS test is that it developed a set of tests that relax the assumption of a common autoregressive parameter across the panel. In addition, it does not require balanced datasets, and data availability varies by country. Having controlled for non-stationarity, we replicate the panel data analysis with first difference estimation.

Table 2.5 reports the estimates in first differences (all variables are differenced but GDP growth per capita). In all columns (3, 4, 7 and 8) where we test for non-linearity, the estimated correlation between labor income tax rates and the share of retirees in all cases found to be insignificant. Differencing loses some information in the data which might account for this.

Furthermore, there are variables such as economic growth, unemployment rate and trade in our model that may be endogenous. For example, higher economic growth may decrease the level of unemployment. On the contrary, reverse causation may also be possible. Higher trade may raise GDP whereas vice versa is also possible. The endogeneity issue needs to be dealt with properly. Therefore, we take two lags of three variables, GDP growth, trade and unemployment, and use them as instrumental variables in empirical analysis to control for endogeneity. The endogeneity problem can arise from many causes such as simultaneity, omitted variable bias and measurement error. For example, that higher GDP growth and unemployment may simultaneously affect each other. Further analysis is extended using 2SLS estimation (taking 2 lags of trade, GDP growth and unemployment rate) to control for endogeneity issue that may arise because of simultaneous determination of the dependent variable and explanatory variables. In the presence of endogeneity, OLS yields inconsistent estimates.

Column 1 of Table 2.6 reports results with 2SLS estimation to control for possible endogeneity whereas column 2 reports results with 2SLS and first difference estimation to control for both possible endogeneity and non-stationarity. We use the specification in column 8 in previous tables as it involves all the control variables. There is some support rendered to the theory and Razin, Sadka and Swagel (2002) by the estimated coefficients of the share of retirees as the correlation between them is found to be U-shaped in both columns. The estimated thresholds for both the columns are 15.91 and 20.82 respectively although statistical significance is again low in this quite demanding specification.

Here, we summarize how changes in the composition of demographic structure affects labor income tax rates. We find U-shaped relation between income tax rates and the share of retirees consistently except in Table 2.5 where the estimated coefficients are statistically insignificant. Even when we difference the data and address the endogeneity issues, the estimated correlation is found to support our theory and Razin, Sadka and Swagel (2002). Throughout the

tables, from Table 2.4 to Table 2.6, the estimated benchmark for U-shaped association is found within the range of 15% to 35%.[10] Moreover, the thresholds are closer to our theory when we control for endogeneity and unit root issues in the data.

Subsequently, we investigate how change in youth dependency ratio affects labor income tax rates. Razin and Sadka (2007) propose that young (working labor) receive higher share of total transfers when the share of children (youth dependency ratio) rises over time. This supplementary rise in transfers towards the children does not affect transfers from the labor to the retirees that aging causes. Besides, payroll tax is not the only source to finance direct transfers and, in practice, by and large the labor income tax rate does not discriminate between young and elderly dependent population. Thus, young families with many children may join the retirees and support anti-tax policies initially. Nevertheless, they may support for larger welfare state once they form half the total voters.

In next Table 2.7, the estimated relationship between labor income tax rate and the share of youth is estimated to be U-shaped when we apply 2SLS estimation. However, the relationship is found to suggest an inverted U-shape when 2SLS in first difference estimation is applied. The later finding is also statistically significant at 10%. The estimated benchmark in column 1 is 13.58% whereas, in the next column, it is 18.69%. In summary, we find a quite contrasting result when the data are differenced. This may again suggest the loss of information while controlling for the presence of unit roots in the data.

2.5.2) Empirical analysis of the Size of the Government

In this subsection we regress total tax revenue as a share of GDP, measuring the size of the government, on the shareof retirees and control variables following Razin, Sadka and Swagel

[10] These estimated thresholds are taken from columns where all the control variables are included along with main variable under investigation.

(2002). The old may be more concerned about the overall expenditures rather than labor income tax rates only. Except taking a different dependent variable, there is no difference from the analysis in the previous subsection.

In column 1 and column 2 of Table 2.8 the estimated coefficient for the share of retirees are positive though statistically insignificant.These implythat a 1% rise in the share of retirees would enlarge the size of the government by 0.12%. This finding is not consistent with Razin, Sadka and Swagel (2002) as a higher share of retired population means an addition in the pro-tax coalition to finance total redistribution. Thus, a positive correlation between the two variables may exist.

Columns 3 and 4 assess the non-linearity in the relationship between the size of government and the share of retirees. The estimated coefficients of the share of retirees suggest a U-shaped relation between tax revenue as a share of GDP and the relative size ofretired population. Both the coefficients hold significance at 1%. These findings substantially support our theory and the hypothesis proposed in Razin, Sadka and Swagel (2002) though with a different dependent variable. Both columns report the threshold at 16.73% and 17.72% respectively.

In columns 5 to 8, log real GDP per capita is included to account for the difference in the level of economic development across the sample as before. Our theory and Razin, Sadka and Swagel (2002) seek considerable support from the estimated coefficients of the share of retirees in column 7 and column 8. A U-shaped association is again found between labor income tax rates and the share of retirees. A rise in the share of retirees leads to decrease the size of government initially, nevertheless, both the variables are found to be associated positively once the retirees constitute 17.5% of the total population. In column 8, the estimated threshold increases to 18.62%. Both linear and quadratic coefficients are strongly significant at 1% in both the columns.

To be precise, the findings in Table 2.8 strongly support the theory proposed in this chapter as well as the hypothesis of Razin, Sadka and Swagel (2002). However, we use a different dependent variable as opposed to labor income tax rates. Throughout the table the benchmark lies within the range of 17% to 19%. There is again strong evidence found for structural break in the data.

As before, Table 2.9 reports our findings applying OLS in first differences. All the columns that investigate the non-linear correlation between the government size and the share of retirees are found to report an inverted U-shape association between the two variables. Nevertheless, the estimated coefficients are not statistically significant in any column.

Table 2.10 reports the results with 2SLS as well as 2SLS in first difference estimation. The estimated relationship between the government size and the share of retirees is U-shaped and strongly significant at 1% in column 1. Controlling for endogeneity bias provides us with better estimated as the coefficients retain statistical significance. Moreover, the estimated threshold is 19.08%. When we apply 2SLS in first differences as reported in the next column, the result does not change. A U-shaped correlation between revenue as a share of GDP and the fraction of old is found though statistically insignificant. The benchmark is found to be 20.46%. These both findings substantially support, though the dependent variable used is different, our theory and Razin, Sadka and Swagel (2002).

Overall, we find notable support for the theory we develop as well as for the argument proposed in Razin, Sadka and Swagel (2002) though the dependent variable is different. The findings with regards to the size of government are found to be consistently U-shaped with all estimation techniques we use except OLS in first difference estimation. It may imply that the retirees are concerned more about overall expenditures as opposed to only labor income tax rates.

Comparing the results relating to labor income tax rate and the government size, it can be safely argued that the findings regarding the government size support the empirical analysis with labor taxes. Moreover, the significance levels improve when we analyse the relation between the government size and the old.

Empirical analysis taking youth dependency ratio is also replicated for the government size. Again, as before, Table 2.11 reports results with 2SLS and 2SLS in first difference estimation. In column 1, the coefficients are found to be U-shaped and are strongly significant. A rise in the share of youth leads to a decrease in labor income tax rate initially. Nonetheless, the association between the two variables changes into positive once the share of youth attains a certain threshold. On the other hand, column 2 finds the relation between the government size and the share of youth to be an inverted U-shape.

2.5.3) Test for the Structural Break

All the variables included in the analysis are found to be non-stationary except GDP growth per capita when we applied the Im-Pesaran-Shin test. The results of the analysis in levels are therefore likely to be spurious. Therefore,we re-estimate the analysis in first differences, and test for structural break for the share of retirees at the threshold identified by the median value of population aging 65 and above which is 15.841. We did not test for the threshold identified by the theory in this chapter since the share of retirees in the population is already beyond that threshold. To test structural break we apply Chow test following Chow (1960). The Chow test is simply a test of whether the coefficients estimated over one group of the data are equal to the coefficients estimated over another. In our case, we aim to reject the null hypothesis of Chow test that there is no structural break.

Table 2.12 reports the results for specifications used to assess structural break. Columns 1-3 report coefficients for labor income tax rate whereas columns 4-6 report results for the government size. We only run specification in column 8 of previous tables applying 2SLS and 2SLS in first differences as it is the preferred specification for it includes all control variables. Applying the Chow test, we reject the null hypothesis – there is no structural break. Thus, there exists a structural break in the coefficients estimated over one group of the data to coefficients over other group of data. In Table 2.12, it can be seen that the coefficient estimates in column 2 (where pop65above<=15.841) indicate a positively linear correlation between labor income tax rates and the share of retirees. On the other hand, the estimated coefficients in column 3 (where pop65above>15.841) are found to indicate a U-shaped association between the two variables. Similarly, column 2 for the size of government is found to suggest an inverted U-shape correlation whereas column 3 is found to be U-shaped.

2.5.4) Extension of the Sample Size

In addition, we also enlarge the sample size to 16 countries by including Greece, Luxembourg and Switzerland. Everything else except addition of countries is unchanged. Moreover, we run our preferred specification (column 8 in previous tables) because it includes all control variables.

In columns 1 and 2 of Table 2.13, we report the results investigating how changes in the demographic structure are associated with labor income tax rates. As before, we apply 2SLS estimation in column 1 and 2SLS in first difference in column 2. The results acquired with larger sample reconcile with the findings of smaller sample, the theory developed in this chapter and Razin, Sadka and Swagel (2002) as we find a U-shaped correlation between labor income tax rates and the share of retirees in population. Furthermore, the thresholds are estimated to be

19.46% (column 1) and 19.97% (column 2) which are closer to the benchmark advanced in the theory.

Column 3 (2sls) and 4 (2SLS+FD) report coefficient estimates related to the size of government, measured by total tax revenue as a share of GDP. In both these columns the estimated coefficients are found to suggest a U-shaped correlation between labor income tax rate and the relative size of retired population. These results again support the theory, Razin, Sadka and Swagel (2002) and findings of smaller sample. The thresholds estimated in column 3 and column 4 (18.99% and 17.33% respectively) are also closer to the theory developed in this chapter than what Razin, Sadka and Swagel (2002) proposed.

Whilst comparing the findings of smaller sample with larger sample, we conclude that there is no substantial change between the two. We find the relation between labor income tax rate and the old as well as the relation between the government size and the old to be U-shaped.

2.6) Conclusion

This chapter explored how changes in demography affect fiscal policy. The dependent variables include the average labor income tax rates and total tax revenue as a share of GDP. Using family-based voting and assuming possible empathy for the old within families we redefine the theoretical argument of Razin, Sadka and Swagel (2002). We argue that a negative relationship between labor income tax rates and the retirees as a fraction of total population would change into positive once the aged population represents 8.4% of the total voters.

The theory is tested empirically using the average labor income tax rates. The empirical findings are fragile unlike in Razin, Sadka and Swagel (2002) who do not distinguish between the young and the old. Our theory and the hypothesis proposed in Razin, Sadka and Swagel (2002) are supported with OLS, 2SLS and 2SLS in first difference estimations to the extent that the relation between labor income tax rate and the share of retirees is found to be U-shaped.[11] The thresholds are estimated to be closer to what our theory predicts.

We also extend the empirical analysis for the share of youth. A u-shaped association is again found with 2SLS estimation. Nonetheless, the relationship is found to be an inverted U-shape when we difference the data.

The old people may be more concerned about their overall expenditures as opposed to labor income tax rates only. Previous empirical analysis is replicated taking total tax revenue, measuring the government size, as dependent variable. As before, the association between labor income tax rate and the old is estimated to be U-shaped with OLS, 2SLS and 2SLS in first difference estimations and statistical significance also improves. With regards to youth, results do not considerably change.

[11]These refer to last column of each table since they include all control variables

The empirical analysis is extended taking a larger sample size that consists of 16 OECD countries. The results still support the theory as well as previous results of smaller sample.

Table 2.3: Labor Income Tax Rate

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Dependency Ratio	1.419	0.620	-47.539	-39.719	0.920	0.193	-59.021	-51.662
	(0.875)	(0.471)	(25.588)*	(29.126)	(0.915)	(0.691)	(25.754)**	(35.45)
Dependency Ratio Square			0.731	0.607			0.899	0.788
			(0.383)*	(0.437)			(0.383)**	(0.535)
Trade/GDP	-0.074	-0.056	-0.079	-0.086	-0.107	-0.060	-0.126	-0.117
	(0.072)	(0.056)	(0.058)	(0.052)	(0.087)	(0.059)	(0.060)*	(0.055)*
GDP Growth	0.068	0.172	0.019	0.153	0.241	0.261	0.190	0.186
	(0.159)	(0.165)	(0.141)	(0.136)	(0.223)	(0.220)	(0.195)	(0.180)
Inequality	0.319	-0.081	0.066	-0.181	0.316	-0.038	-0.029	-0.180
	(0.453)	(0.231)	(0.340)	(0.163)	(0.399)	(0.259)	(0.237)	(0.205)
Unemployment		0.156		0.265		0.020		0.260
		(0.163)		(0.189)		(0.156)		(0.213)
Log(GDP per capita)					-15.767	-13.281	-12.948	-3.583
					(11.096)	(12.207)	(9.444)	(12.44)
Observations	286	255	286	255	260	236	260	236
R-squared	0.946	0.957	0.951	0.960	0.954	0.958	0.962	0.961

NOTES: Cross country regressions of average Labor Income Tax Rate including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 2.4: Labor Income Tax Rate

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Retirees	1.542	0.632	1.081	-4.498	1.186	0.269	2.358	-3.057
	(0.886)	(0.515)	(5.157)	(3.375)	(0.850)	(0.511)	(5.031)	(3.282)
Retirees Square			0.013	0.142			-0.034	0.093
			(0.125)	(0.089)			(0.131)	(0.092)
Children	0.876	0.384	0.861	0.161	0.547	0.156	0.582	0.020
	(0.869)	(0.657)	(0.940)	(0.642)	(1.017)	(0.899)	(1.057)	(0.831)
Trade/GDP	-0.087	-0.060	-0.085	-0.044	-0.125	-0.065	-0.129	-0.048
	(0.071)	(0.071)	(0.080)	(0.070)	(0.088)	(0.070)	(0.095)	(0.076)
GDP Growth	0.022	0.148	0.022	0.167	0.228	0.255	0.233	0.244
	(0.174)	(0.170)	(0.175)	(0.164)	(0.225)	(0.210)	(0.231)	(0.217)
Inequality	0.410	-0.045	0.413	-0.054	0.447	-0.009	0.448	-0.046
	(0.465)	(0.343)	(0.459)	(0.316)	(0.457)	(0.390)	(0.458)	(0.369)
Unemployment		0.162		0.173		0.027		0.032
		(0.174)		(0.158)		(0.158)		(0.152)
Log(GDP per capita)					-14.994	-12.819	-15.450	-11.631
					(11.152)	(11.134)	(12.504)	(11.17)
Threshold			41.57	.015			34.67	16.43
Observations	286	255	286	255	260	236	260	236
R-squared	0.946	0.956	0.946	0.958	0.955	0.958	0.955	0.958

NOTES: Cross country regressions of average Labor Income Tax Rate including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 2.5: Labor Income Tax Rate

	(1) OLS+FD	(2) OLS+FD	(3) OLS+FD	(4) OLS+FD	(5) OLS+FD	(6) OLS+FD	(7) OLS+FD	(8) OLS+FD
Retirees	-0.319	0.289	7.245	11.648	0.227	0.482	12.852	16.078
	(0.866)	(1.148)	(9.373)	(11.003)	(1.359)	(1.365)	(16.696)	(16.986)
Retirees Square			-0.227	-0.340			-0.364	-0.447
			(0.278)	(0.314)			(0.475)	(0.476)
Children	-0.349	-0.389	-0.293	-0.337	-0.335	-0.533	0.424	0.372
	(0.283)	(0.355)	(0.329)	(0.447)	(0.943)	(1.071)	(1.055)	(1.201)
Trade/GDP	0.007	-0.000	0.002	-0.005	-0.003	-0.008	0.001	-0.015
	(0.047)	(0.052)	(0.050)	(0.056)	(0.024)	(0.055)	(0.053)	(0.060)
GDP Growth	0.101	0.078	0.101	0.076	0.130	0.153	0.130	0.165
	(0.070)	(0.093)	(0.071)	(0.094)	(0.086)	(0.120)	(0.082)	(0.127)
Inequality	-0.043	-0.135	-0.094	-0.224	-0.116	-0.180	-0.199	-0.286
	(0.099)	(0.134)	(0.131)	(0.182)	(0.145)	(0.167)	(0.224)	(0.234)
Unemployment		-0.096		-0.105		-0.210		-0.237
		(0.125)		(0.126)		(0.142)		(0.152)
Log(GDP per capita)					-5.502	-14.524	-4.336	-13.643
					(10.780)	(9.343)	(8.350)	(10.078)
Threshold			15.95	17.12			17.65	17.98
Observations	273	243	273	243	247	224	247	224
R-squared	0.152	0.162	0.157	0.173	0.149	0.170	0.156	0.182

NOTES: Cross country regressions of average Labor Income Tax Rate including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test.

Table 2.6: Labor Income Tax Rate

	(1) 2SLS	(2) 2SLS+FD
Retirees	-0.923	-93.052
	(3.494)	(652.868)
Retirees Square	0.029	2.234
	(0.091)	(15.520)
Children	0.531	-0.562
	(0.800)	(12.854)
Trade/GDP	-0.126	3.846
	(0.106)	(25.529)
GDP Growth	1.186	1.023
	(0.519)**	(8.422)
Inequality	-0.063	1.609
	(0.344)	(13.154)
Unemployment	-0.055	-5.099
	(0.165)	(40.715)
Log(GDP per capita)	-15.977	-306.624
	(11.936)	(2,346.136)
Threshold	15.91	20.82
Observations	224	212
R-squared	0.956	0.947

NOTES: Cross country regressions of average Labor Income Tax Rate including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Table 2.7: Labor Income Tax Rate

	(1)	(2)
	2SLS	2SLS+FD
Children	-1.902	118.765
	(5.711)	(522.477)
Children Square	0.070	-3.177
	(0.157)	(14.043)
Retirees	-0.056	-2.128
	(0.798)	(20.088)
Trade/GDP	-0.149	2.771
	(0.077)*	(12.297)
GDP Growth	1.306	0.877
	(0.456)***	(4.706)
Inequality	-0.023	0.446
	(0.296)	(3.434)
Unemployment	-0.045	-4.809
	(0.177)	(25.385)
Log(GDP per capita)	-16.943	-233.074
	(10.797)	(1,206.532)
Observations	224	212
R-squared	0.954	118.765

NOTES: Cross country regressions of average Labor Income Tax Rate including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Table 2.8: Government Size

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Retirees	0.121	0.120	-6.292	-7.126	-0.060	-0.329	-6.825	-7.712
	(0.265)	(0.350)	(1.572)***	(1.957)***	(0.395)	(0.418)	(1.551)***	(1.559)***
Retirees Square			0.182	0.201			0.195	0.207
			(0.042)***	(0.054)***			(0.040)***	(0.042)***
Children	-0.105	-0.135	-0.321	-0.450	-0.278	-0.504	-0.479	-0.807
	(0.484)	(0.433)	(0.428)	(0.400)	(0.662)	(0.563)	(0.547)	(0.470)
Trade/GDP	-0.034	-0.042	-0.021	-0.019	-0.050	-0.043	-0.028	-0.004
	(0.031)	(0.045)	(0.026)	(0.031)	(0.033)	(0.042)	(0.029)	(0.030)
GDP Growth	-0.108	-0.112	-0.101	-0.085	-0.031	-0.004	-0.055	-0.030
	(0.096)	(0.118)	(0.090)	(0.125)	(0.127)	(0.152)	(0.125)	(0.149)
Inequality	0.115	0.108	0.160	0.096	0.186	0.182	0.183	0.100
	(0.228)	(0.282)	(0.203)	(0.224)	(0.272)	(0.304)	(0.237)	(0.240)
Unemployment		-0.165		-0.151		-0.279		-0.267
		(0.113)		(0.096)		(0.080)***		(0.076)***
Log(GDP per capita)					-5.326	-12.688	-2.699	-10.051
					(8.152)	(7.908)	(5.776)	(4.993)*
Threshold			16.73	17.72			17.5	18.62
Observations	285	255	285	255	260	236	260	236
R-squared	0.960	0.963	0.966	0.971	0.963	0.966	0.968	0.971

NOTES: Cross country regressions of Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 2.9: Government Size

	(1) OLS+FD	(2) OLS+FD	(3) OLS+FD	(4) OLS+FD	(5) OLS+FD	(6) OLS+FD	(7) OLS+FD	(8) OLS+FD
Retirees	-0.146	-0.053	1.784	2.394	-0.481	-0.299	0.989	2.588
	(0.357)	(0.475)	(4.903)	(4.599)	(0.719)	(0.599)	(6.394)	(6.600)
Retirees Square			-0.058	-0.073			-0.035	-0.083
			(0.148)	(0.134)			(0.187)	(0.192)
Children	-0.291	-0.305	-0.276	-0.294	-0.553	-0.541	-0.415	-0.373
	(0.143)*	(0.149)*	(0.129)*	(0.159)*	(0.512)	(0.527)	(0.410)	(0.413)
Trade/GDP	0.002	0.017	0.001	0.016	0.013	0.015	0.003	0.014
	(0.018)	(0.027)	(0.017)	(0.027)	(0.013)	(0.028)	(0.020)	(0.028)
GDP Growth	-0.152	-0.182	-0.152	-0.182	-0.183	-0.139	-0.191	-0.137
	(0.047)***	(0.055)***	(0.046)***	(0.054)***	(0.066)**	(0.062)**	(0.068)**	(0.064)*
Inequality	-0.081	-0.080	-0.095	-0.100	-0.088	-0.084	-0.100	-0.103
	(0.038)*	(0.055)	(0.050)*	(0.075)	(0.049)*	(0.067)	(0.079)	(0.096)
Unemployment		-0.193		-0.195		-0.278		-0.283
		(0.086)**		(0.086)**		(0.090)**		(0.087)***
Log(GDP per capita)					2.264	-10.371	4.904	-10.208
					(5.447)	(2.953)***	(5.513)	(3.124)***
Threshold			15.37	16.39			14.12	15.59
Observations	272	243	272	243	247	224	247	224
R-squared	0.276	0.327	0.277	0.329	0.280	0.325	0.276	0.326

NOTES: Cross country regressions of Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test.

Table 2.10: Government Size

	(1)	(2)
	2SLS	2SLS+FD
Retirees	-7.556	-39.907
	(1.455)***	(253.856)
Retirees Square	0.198	0.975
	(0.038)***	(6.047)
Children	-0.583	-0.638
	(0.356)	(4.848)
Trade/GDP	-0.029	1.441
	(0.048)	(9.839)
GDP Growth	0.392	0.091
	(0.363)	(3.190)
Inequality	0.101	0.615
	(0.233)	(5.078)
Unemployment	-0.329	-1.881
	(0.086)***	(15.646)
Log(GDP per capita)	-11.802	-106.371
	(7.264)	(902.097)
Threshold	19.08	20.46
Observations	224	212
R-squared	0.971	0.85

NOTES: Cross country regressions of Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Table 2.11: Government Size

	(1) 2SLS	(2) 2SLS+FD
Children	-9.680	56.043
	(2.746)***	(354.323)
Children Square	0.264	-1.492
	(0.073)***	(9.516)
Retirees	-1.082	-3.108
	(0.351)***	(12.322)
Trade/GDP	-0.132	0.366
	(0.049)***	(2.307)
GDP Growth	0.839	1.689
	(0.353)**	(8.211)
Inequality	0.281	0.280
	(0.187)	(3.097)
Unemployment	-0.279	-2.978
	(0.115)**	(17.149)
Log(GDP per capita)	-16.363	-140.941
	(7.232)**	(812.666)
Observations	224	212
R-squared	0.960	0.927

NOTES: Cross country regressions of Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Table 2.12:	Labor Income Tax Rate	Labor Income Tax Rate	Labor Income Tax Rate	Government Size	Government Size	Government Size
	2SLS+FD	2SLS+FD	2SLS+FD	2SLS+FD	2SLS+FD	2SLS+FD
Retirees	-93.05	9.95	-17.17	-39.90	25.73	-9.41
	(652.86)	(99.12)	(21.57)	(253.85)	(51.55)	(5.10)*
Retirees Square	2.23	0.18	0.46	0.97	-0.98	0.24
	(15.52)	(3.70)	(0.57)	(6.04)	(2.11)	(0.11)**
Children	-0.56	5.43	0.39	-0.63	-2.42	-2.54
	(12.85)	(18.14)	(5.04)	(4.84)	(11.50)	(1.30)*
Trade/GDP	3.84	-0.22	0.61	1.44	0.22	0.04
	(25.52)	(0.38)	(0.24)**	(9.83)	(0.31)	(0.09)
GDP Growth	1.02	0.14	-0.10	0.09	-0.26	-0.26
	(8.42)	(1.25)	(0.25)	(3.18)	(0.53)	(0.11)**
Unemployment	-5.09	2.02	-0.09	-1.88	-0.31	0.02
	(40.71)	(5.73)	(0.88)	(15.64)	(3.62)	(0.14)
Inequality	1.60	-1.04	1.46	0.61	-0.17	-0.08
	(13.15)	(0.71)	(1.12)	(5.07)	(0.53)	(0.35)
Log(GDP per capita)	-306.62	79.01	-0.41	-106.37	-7.46	1.06
	(2,346.14)	(294.13)	(30.24)	(902.09)	(186.31)	(12.54)
Observations	212	114	98	212	114	98
R-squared	0.947	0.43	0.34	0.927	0.209	0.314
Structural Break	Full	pop65above<=15.841	pop65above>15.841	Full	pop65above<=15.841	pop65above>15.841

NOTES: Cross country regressions of average Labor Income Tax Rate and Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

The specification assesses the structural break applying Chow test. 15.841 is the median value for the share of retirees. Moreover, all the specifications involve 2SLS and first difference estimation to control for endogeneity and unit roots.

All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Table 2.13:	Labor Income Tax Rate	Labor Income Tax Rate	Government Size	Government Size
	(1)	(2)	(3)	(4)
	2SLS	2SLS+FD	2SLS	2SLS+FD
Retirees	-3.931	-3.476	-8.282	-7.697
	(2.211)*	(7.438)	(1.512)***	(5.581)
Retirees Square	0.101	0.087	0.218	0.222
	(0.066)	(0.224)	(0.040)***	(0.164)
Children	0.123	-0.413	-0.441	-0.992
	(0.619)	(1.559)	(0.351)	(0.624)
Trade/GDP	0.001	0.163	-0.001	-0.047
	(0.042)	(0.195)	(0.025)	(0.046)
GDP Growth	0.799	0.346	0.434	-0.358
	(0.556)	(0.255)	(0.359)	(0.145)**
Inequality	-0.079	-0.031	0.060	-0.095
	(0.334)	(0.116)	(0.215)	(0.043)**
Unemployment	-0.032	-0.018	-0.295	0.316
	(0.141)	(0.351)	(0.089)***	(0.281)
Log(GDP per capita)	-13.391	-13.638	-8.179	11.193
	(10.538)	(13.990)	(6.317)	(5.383)**
Threshold	19.46	19.97	18.99	17.33
Observations	240	228	240	228
R-squared	0.971	0.27	0.965	0.025

NOTES: Cross country regressions of average Labor Income Tax Rate and Government Size, measured by tax revenue as a share of GDP, including Trade/GDP, GDP Growth, Inequality, Unemployment and log(GDP per capita) as control variables. Robust standard errors are reported in the parenthesis. Regressions control for time and country fixed effects which are not shown though. Errors are clustered by country. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

The sample size is extended to 16 OECD countries including Greece, Luxembourg and Switzerland.

All the variables are differenced due to presence of unit roots applying Im-Pesaran-Shin test. In addition, due to endogeneity between, trade, unemployment rate and GDP growth, two lags of these variables are taken to use as instrumental variables.

Chapter 3

Inequality and the composition of taxes

3.1) Introduction

What determines fiscal policy in democracies? A canonical theoretical result derived by Meltzer and Richard (1981), building on Romer (1975), is that the size of government increases with the degree of inequality in the pre-tax income distribution.

Cross country evidence testing the Meltzer and Richard (1981) hypothesis is predominantly unsupportive. For example Perotti (1996), Bassett et al (1999) and Persson and Tabellini (2003) all find that the size of government is either insignificantly and/or negatively related to measures of inequality. In response, new theories have emerged through which high levels of inequality can coexist with small government under democracy.[12]Benabou and Ok (2001) advanced the possibility that the prospect of upward income mobility may limit the demand for redistribution under rational expectations. Nonetheless, the `Great Gatsby curve' (Krueger, 2012) undermines this argument somewhat as a full reconciliation with the data.

In the cross-country context there are many potential determinants of the total size of government, beyond the income distribution. Socioeconomic, historical and institutional differences may account for observed differences in government size, and indeed undoubtedly

[12]For example Persson (1995) and Benabou (2000).

also co-determine differences in the income distribution. The broader literature on the size of government catalogues income levels (Wagner's law, analyzed in Ram, 1987), ideology (Pickering and Rockey, 2011), demographic change (Razin et al 2002), openness (Rodrik, 1998), country size (Alesina and Wacziarg, 1998) and fragmentation (Alesina et al, 1999). Public choice theory characterizes the size of government as the outcome of the power of a bureaucracy that has the capacity to sustain itself (Niskanen, 1974), which also may differ across institutional settings. Persson and Tabellini (1999) and Persson et al (2000) stress the importance of constitutional rules in determining government size. Shelton (2007) provides an extensive survey and examination of this literature.

Consequently an alternative empirical literature instead focusses on testing the hypothesis within countries. Meltzer and Richard (1983) found some support for their hypothesis using data from the US states, and relatedly Alesina et al (2000) found that public employment was higher in US cities with greater levels of inequality. Borge and Rattsø (2004) found that the tax burden shifts from poll taxes to property taxes with greater income inequality across Norwegian local governments.

This chapter revisits international evidence, but first asks a different, but basic, question: how does inequality affect the composition of taxes? Arguably total expenditure (and therefore total taxation under a balanced budget) is determined institutionally, or more generally by factors other than the income distribution listed above. But the total size of government is not the only policy lever. Even if the size of the public sector is taken as given, governments still face unresolved questions on the appropriate composition of taxes. Perhaps the most basic question here is the extent to which government raise taxes on income as opposed to expenditure. Indeed Crawford et al (2010) write that "(t)he appropriate balance between direct and indirect taxation --- between income taxes and taxes on goods and services --- is one of the oldest issues in public finance, but still imperfectly understood." There is of course an enormous literature

analysing optimal taxation, beginning with Diamond and Mirrlees (1971a & b), but relatively little in the way of a positive analysis of the political economics of the tax composition decision.

A related literature examines the adoption of particular tax instruments, both historically (Aidt and Jensen, 2009a and 2009b) and as an outcome or indeed a driver of the development process (Keen and Lockwood, 2010; Besley and Persson, 2014). However, this literature generally neglects the impact of inequality on the adoption process.

In this chapter the composition of taxes is determined in a simple median voter framework. Taxes may be levied on income, or on expenditure. There are different tax collection costs (or deadweight losses) associated with both, but income taxes are more effective at redistributing than expenditure taxes. Because the median voter's income is less than their expenditure, a given level of additional redistribution costs more to them in consumption terms when financed by expenditure taxes than by income taxes. In the theoretical framework the preferred policy of the median voter is the unique Condorcet winner, despite the fact there are two policy instruments, because across individuals the ideal policy mix is still unidimensional in income.[13] The results relating to income taxes are familiar. As with Meltzer and Richard (1981) greater inequality monotonically leads to higher income taxes. The results relating to expenditure taxes are novel. At low levels of inequality, increases in inequality also lead to higher expenditure tax rates because these are also redistributive (because the rich spend more than the poor hence pay more taxes), and at low tax levels the deadweight losses are relatively small. However, once inequality passes some threshold level, then there is a stronger desire for redistribution, even if this comes at the price of greater deadweight income-tax losses. The median voter now substitutes expenditure taxes for income taxes. Nonetheless, an unambiguous finding is that the composition of taxes, defined as the extent to which taxes are levied on income relative to expenditure, theoretically always rises with inequality.

[13] This is the condition of 'intermediate preferences' identified by Grandmont (1978), also used by Borge and Rattso (2004).

Cross-country data measuring the extent to which taxes are levied on earnings relative to expenditure exhibit a robust positive correlation with inequality. This stands in contrast to the evidence testing the standard Meltzer and Richard (1981) hypothesis related to total government size. Moreover income taxes as a percentage of total taxes increase, whilst taxes on expenditure as a percentage of total taxes fall with increased inequality. The magnitude of the estimated effects is quite large. A one-standard deviation increase in inequality is associated with an increase in the ratio of taxes collected from income to taxes collected from expenditure of around half a standard deviation. These statistical relationships hold most significantly in countries with higher levels of democracy, in support of the mechanism proposed in this paper.

In addition, we find an inverted U-shape correlation between income taxes and inequality though the estimated coefficients are not statistically significant. This supports our theory, Figure 3.1 and the non-linear findings related to indirect taxes. Since income taxes are assumed to be more effective at redistribution, at higher level of inequality more redistribution is financed using income taxes.

We also formulate tentative hypotheses related to budget deficits and public debt as shares of GDP. Based on the voters' myopia a rise in equality may lead to higher deficits and debt as the opportunist politicians may increase redistribution by increasing deficits and debt levels. Empirical findings lend considerable support to tentative hypotheses.

Beside cross sectional data analysis, we also repeat non-linear analysis with panel data. The findings related to income and expenditure taxes support our theory and cross section estimation for weaker democracies. Similarly, non-linear estimation of direct taxes is estimated to conflict with our theory. Nevertheless, we find an inverted U-shape correlation between indirect taxes and income inequality which substantially supports our model and results with cross-sectional analysis for full samples and stronger democracies.

The coefficient estimates related to public debt support our hypothesis whereas budget deficits are found to suggest negative relation with income inequality. A rise in equality increases public debt for the full sample, stronger and weaker democracies.

We do some robustness checks due to non-stationarity of some variables. The empirical estimation is replicated using first difference estimation. Direct and indirect taxes support our theory for weaker democracies. Both indirect and direct taxes are found to have an inverted U-shape correlation with inequality though the coefficients are insignificant. The findings are consistent with theory and other findings we get employing cross sectional estimation.

On the other hand, we also analyse how changes in inequality affect public deficit and debt. The estimated coefficients of budget deficits are negative for each sample. However, we find support for theory as public debt is positively correlated with inequality in stronger democratic sample.

The next section, 3.2, provides a theoretical analysis of the political economics of income and expenditure taxation whereas we discuss regarding budget deficit and public debt in subsection 3.2.1. Section 3.3 contains data and section 3.4 contains the empirical analysis. Its subsections 3.4.1, 3.4.2 and 3.4.3 respectively contain cross-section analysis, panel data analysis and panel data with first difference estimation analysis. The last section 3.5 concludes.

3.2) Model

The model is a simple extension of Meltzer and Richard (1981) to include expenditure taxes as well as income taxes. As in that paper, individual expenditure x_i is set equal to disposable income,

$$x_i = \left(1 - t_y\right) y_i + r \tag{3.1}$$

wheret_y is the income tax rate, $y_i$is income, indexed i across the population and r is per capita redistribution. Consumption(c_i) is less than expenditure, because of the presence of an expenditure/consumption tax (t_c), hence

$$c_i = (1 - t_c)\, x_i \tag{3.2}$$

The budget is assumed to balance so that redistribution in per capita terms is financed from consumption and income tax revenue, requiring

$$r = t_c\overline{x} + t_y\overline{y} \tag{3.3}$$

$\overline{x}$ and$\overline{y}$ refer to average expenditures and average income across the population respectively.Furthermore at the aggregate level income equals expenditure, thus

$$\overline{x} = \overline{y} \tag{3.4}$$

in order to maintain tractability the labor-supply decision is not formally modelled, hence maximization of utility amounts to maximization of consumption (because consumption is the only argument in the utility function). The pivotal voter/policymaker thus chooses the triple $q = \{t_c, t_y, r\}$ in order to maximize their own consumption. Substituting in (3.4), (3.3) and (3.1) into (3.2) gives

$$c_i = (1 - t_c)\left[\left(1 - t_y\right) y_i + \left(t_c + t_y\right)\overline{y}\right] \tag{3.5}$$

hence the policy problem reduces to two dimensions (t_c and t_y). The important point of departure from Meltzer and Richard (1981) is that there are now two tax instruments being set. In general the Condorcet winner does not exist when the policy problem has two (or more) dimensions, but the structure presented can be re-expressed in terms of (unidimensional) intermediate preferences which means that the choice of the median voter will be pivotal.[14]Grandmont (1978) showed that as long as voters only differ along one dimension (here, income), and that the indirect utility function $\left(W(q; y_i)\right)$

can be written as$W(q; y_i) = J\,(q) + K\,(y_i)\,H\,(q)$

then the choice of the median voter is a Condorcet winner. It is clear that equation (5) satisfies this requirement.

A final ingredient of the model is that mean income declines with taxes, capturing tax collection and/or `deadweight' costs. To model this we follow Pickering and Rockey (2011) and posit that

$$\overline{y} = y^* \left(1 - \frac{\delta_y t_y \overline{y}}{y^*} - \frac{\delta_c t_c \overline{y}}{y^*}\right) \tag{3.6}$$

wherey^* is potential income and δ_y and $\delta_c$are parameters defining the sensitivity of actual (taxable) income respectively to income and consumption taxes. The parameters δ_y and δ_c represent deadweight losses, either incurred directly as the tax collection costs, and/or indirectly in terms of their effects on economic activity. In order to generate a meaningful policy tension $0 < \delta_y < 1$and $0 < \delta_c < 1$. Otherwise, even the poorest voter would prefer $t_y = 0$. $\delta_y$in particular may vary across countries. High values could imply high income tax collection costs or a low income tax base. As discussed by Besley and Persson (2014), many countries cannot easily

[14] See Persson and Tabellini (2000) pp. 25. Borge and Rattso (2004) also employ intermediate preferences to solve a two-dimensional policy problem.

collect income taxes. Arguably both δ_y and δ_c may be higher in the presence of a significant informal economy. Whilst the informal economy is not modelled here, it is intuitive that it is more difficult to levy taxes (which would apply by construction to the formal sector) when the economic agents within the formal sector may easily migrate to the informal economy. $\overline{y}$, which here represents the formal economy, would fall more readily with increased taxation.[15] Nonetheless, across groups of countries that are economically and institutionally similar, one might expect that the cost parameters are also similar.

The median voter has incomey_m , and we define $m \equiv \frac{\overline{y}}{y_m} > 1$. Maximization of (3.5) with respect to t_y, given (3.6) yields

$$t_y + t_c = \frac{(m-1)}{\delta_y m} \tag{3.7}$$

This immediately delivers the well-known Meltzer and Richard (1981) that the total size of government (i.e. $t_y + t_c$) is increasing in inequality. Moreover, when choosing t_y for givent_c the two instruments can be understood as perfect substitutes.Hence if δ_c is high, then the median voter chooses lower $t_c$and higher t_y (The expression$t_y + t_c$is independent ofδ_c) . The intuition is; if$\delta_c$increases then$t_y + t_c$are perfect substitutes (a decrease in$t_c$and increase in$t_y$cancels out each other).Higher t_c permits lower t_y . However, t_c is not a given.

Maximization of (3.5) with respect tot_c, and using (3.7), yields

$$t_c = \frac{(m-1)\left[m\left(\delta_y - \delta_c\right) - (m-1)\right]}{m\left[\delta_y(m+1) - \delta_c(m-1)\right]} \tag{3.8}$$

Note that no restrictions are required in order to ensure $t_c < 1$. It is trivially clear from (3.5) that the median voter will will not want to set expenditure taxes in excess of 100% as this will mean negative consumption. $t_c > 0$requires $\delta_y - \delta_c > \frac{m-1}{m}$. For the median voter to desire positive

[15] Porta and Shleifer (2014) also argue that agents choose informality as a means of avoiding tax.

expenditure taxes at all, there has to be a wedge between $\delta_y$andδ_c. Were δ_y and δ_c equal, then income taxes would always (i.e. irrespective of m) be the preferred policy instrument. The reason for this is that when both types of tax are applied with equal cost (i.e. both incur the same output loss) then the only concern left is redistribution. Given the structure of the tax system, income taxes are inherently more redistributive (dollar for dollar) than consumption taxes. The latter always incur a cost to expenditure, which exceed the cost in terms of (own) income when income taxes are applied. However, when$\delta_y > \delta_c$, then the policy decision becomes more complex. Incomes taxes may be more redistributive, but if the costs are prohibitive, then it becomes optimal for the median voter to choose consumption taxes.

Combining equations (3.7) and (3.8) yields

$$t_y = \frac{(m-1)(\delta_y + \delta_c) + (m-1)^2}{\delta_y m\left[\delta_y (m+1) - \delta_c(m-1)\right]} \tag{3.9}$$

As per Meltzer and Richard (1981) any degree of income inequality (m> 1) ensures positive income taxes. $t_y < 1$in fact follows a fortiori from $\delta_y - \delta_c > \frac{m-1}{m}$. The proof of this is in the appendix. The intuition here is that δ_y is high enough such that income taxes will not be maximally set.[16]

The ratio of income to expenditure taxes is given by

$$\frac{t_y}{t_c} \equiv \tau = \frac{(\delta_y + \delta_c) + (m-1)}{\delta_y[m(\delta_y - \delta_c) - (m-1)]} \tag{3.10}$$

The derivative of this expression with respect to $m$is unambiguously positive given$0 < \delta_c < \delta_y < 1$.[17] Increases in inequality lead to increases in income taxes relative to consumption taxes. The reason is that as inequality increases, then greater weight is placed on redistribution through income taxes for given tax collection (or deadweight output losses) costs.

[16] This can also be viewed as shorthand for the plausible general equilibrium result in Meltzer and Richard (1981) that the labor supply will be sufficiently elastic at high income tax rates.
[17] Details are in the appendix.

It is also of interest to consider how income and expenditure taxes separately respond to increases in inequality. The more straightforward case is income taxes. In this instance there is no ambiguity: income taxes increase with inequality ($\frac{dt_y}{dm} > 0$ – as shown in the appendix), with exactly the same underpinning as that provided in Meltzer and Richard (1981) (who only consider income taxes).

On the other hand the response of consumption taxes to increasing inequality is ambiguous. Taking for simplicity the case of$\delta_c = 0$, the derivative of (3.8)with respect to m is positive or negative depending on

$$\left(2\delta_y - 3\right)m^2 + 2m + 1 \gtrless 0$$

Note that the first term is unambiguously negative, hence $\frac{dt_c}{dm} < 0$ for large values of m. The critical threshold is $= \frac{1+\sqrt{4-2\delta_y}}{3-2\delta_y}$. At levels of inequality below this, increases in inequality lead to higher consumption taxes. At levels beyond the threshold, increases in inequality lead to lower consumption taxes. The intuition for this non-monotonicity lies in the fact that income taxes are more redistributive than consumption taxes. Both instruments achieve redistribution, but at low levels of inequality the median voter's income is comparatively close to mean income and the redistributive difference (at least for the median voter) between the two instruments is relatively small. Here increases in inequality result in both types of tax increasing, with the extent depending on the collection costs or deadweight losses associated with each instrument. As inequality increases, a stronger tension between the two instruments arises and the median voter becomes disposed towards income taxes to the extent that they now substitute for consumption taxes. Even if income taxes entail higher deadweight losses, they are still preferred because of their capacity to redistribute.[18]

[18]Vedder (2001) finds that income taxes are more distortionary than sales tax.

Figure 3.1 depicts how taxes change with inequality under the (arbitrary) parameterization δ_y = 0.9 and δ_c= 0.3. The position of these curves change with these parameters, but the key properties always hold given the conditions outlined. Income taxes monotonically increase a la Meltzer and Richard (1981), whilst expenditure taxes first increase and then decrease with inequality. Note also that the gradient of the income tax curve is always higher than that of the expenditure tax curve, hence $\frac{d\tau}{dm} > 0$ at all levels of inequality.

The model in this section is very stylized and omits several key features of any real-world tax system. For example the marginal propensity to consume may fall with income. This particular consideration would render the expenditure tax as regressive rather than proportionate as above. In a median voter model this would potentially lead to a negative relationship between consumption taxes and inequality. Hence the prediction that τ increases with inequality would hold more strongly were this feature incorporated into the model.

Recent literature has highlighted the role that institutions such as the voting rule (Lizzeri and Persico, 2001 and Persson and Tabellini, 1999) or form of government (Persson et al., 2000) may play in determining policy, and in particular the size of government. These mechanisms and mechanisms highlighting the role of inequality (as in the present paper) are not mutually exclusive. For example, one possibility could be that institutions determine the total budget, whilst inequality determines the composition of taxes.

Other generalizations of the model could include a richer (more progressive?) set of income tax instruments and thresholds, and indeed also analyse the tax collection costs (or deadweight losses) more fully.

Despite its simplicity, the model still sheds light on the tax composition decision in a median voter model. The results relating to income taxes are familiar, with income taxes rising as before-tax inequality rises. The results relating to expenditure taxes are more novel. In particular when

inequality is initially at low levels, then increased inequality will also lead to increased demand for expenditure taxes. The rich spend more, and greater taxes will serve to redistribute towards the poor. However, this mechanism is eroded as inequality increases. Tax levels and associated collection costs increase. The median voter now replaces expenditure taxes with income taxes and beyond a certain threshold of inequality further increases in inequality lead to reductions in expenditure taxes. One possibility is that the elasticity of labor supply is higher than the elasticity of demand for goods. The dead-weight loss associated with a particular tax depends importantly on elasticities of demand and supply. Crawford, Keen and Smith (2010) suggest that one reason for the recent increases in VAT stem from low price-elasticity of demand for commodities. This could justify lower (total) collection costs associated with taxes on expenditures.

In the next sub-section we also investigate how changes in income inequality affect budget deficits and public debt. Since the main emphasis of this chapter is to analyse the impact of income inequality on the composition of taxes, we limit ourselves to empirical analysis with regards to deficits and debt.

3.2.1) Discussion related to Budget Deficit and Public Debt

Following Meltzer and Richard (1981) we assume zero budget deficits. Our model implies consumption-smoothing hence long-run debt levels should be zero if income growth is zero, e, g. Barro (1979) argues that average debt through the business cycle should be zero.We do not include budget deficit in the model since including it would require the median voter to deal with two dimensions (current differences in income as well as future implications of deficits as they will have to pay it back in one way or the other) and in general the median voter policy choice is not a Condorcet winner in two-dimensional policy space. Nonetheless, we form a tentative hypothesis with regards to deficits and now report additional empirical work on this.

There are two purposes that the budget deficit may serve. One of them is to redistribute income over time and the second one is to redistribute income across generations. Given this, the median voter may trade-off future for present consumption by supporting higher budget deficits if income inequality rises. This demand from the median voter may be the consequence of his myopia in the sense he discounts the fact it has to be paid back in future. The literature, with regards to whether or not the median voter is myopic, is mixed.

The neoclassical paradigm envisions individuals (voters/consumers) as far-sighted. Under the traditional Keynesian model of consumption, on the other hand, individuals are considered to be myopic.

Relatedly, voters may suffer from fiscally illusion. According to Buchanan and Wagner (1977), voters lack understanding of the inter-temporal budget constraint of the government. Knowing this, opportunist governments with desires to be re-elected respond to voters' demands by increasing deficit-financed spending. Since voters are myopic, they overestimate the benefits of current expenditures and underestimate the cost that would be imposed by raising taxes in future.

Pommerehne and Schneider (1978) take data for revenue structure and public outlays of 110 Swiss cities. Fiscal illusion, in their paper, is measured by systematic misperception by individuals of both the future tax burden borne by them and the amount of benefit they receive from government expenditures. They find strong empirical evidence of fiscal illusion among voters as they under-estimate the cost of future taxes that would be imposed to finance current rise in public expenditures.

The effect on deficits depends to some extent on the degree of myopia in voters. If the median voter sees deficits as a means of expropriating from future (high) income groups, then it

may be conjectured that inequality will increase the budget deficits/debt. Thus, we tentatively propose positive correlation between budget deficits and income inequality.

Public debt is the accumulation of fiscal deficits. To keep the balance between total revenues and total expenditures, generally, is an important target of policy makers responsible for fiscal policy in any country. A fiscal deficit may emerge as a consequence when policy makers cannot achieve their objective of balanced-budget which may lead to bankruptcy and economic depression if debts cannot be repaid. Since public debt is a consequence of fiscal deficits, this paper also empirically investigates the relationship between public debt and income inequality.

We use debt instead because the deficit may not be a good indicator of the extent to which future generations are burdened by increased debts. In particular, under high growth or high inflation, deficits can co-exist with falling debt levels.

3.3) Data

The main agenda here is to ask whether the composition of taxes across countries systematically changes with inequality. Cross-country income and expenditure tax revenue data are available from the World Development Indicators through 1990-2012. Despite over 20 years of data, there is much greater variation in the policy data, as well as in the inequality data discussed below, across countries than within countries.[19]Consequently we report results from cross-country regressions using within-country averages. This at least has the advantage of removing any cyclicality from the data, which could also endogenously vary with inequality.

The main dependent variable is constructed from the ratio of the percentage of tax revenue taken from taxes on income, profits and capital gains and the percentage of tax revenue taken from taxes on goods and services, i.e.

$$\tau = \frac{t_y}{t_c} = \frac{Taxes\ on\ income, profits\ and\ capital\ gains\ (\%\ of\ revenue)}{Taxes\ on\ goods\ and\ services\ (\%\ of\ revenue)} \tag{3.11}$$

where both the numerator and denominator are taken from the World Development Indicators (WDI) database. In practice rates vary with different forms of income (and at different levels of income) and goods within countries, but the aggregate measure here is a means of gauging the overall extent of taxes on income relative to taxes on expenditure. In the regression analysis below we use the natural logarithm of τ because there are a small number of outliers where the denominator in (3.11) is quite small.

As well as examining how $\ln(\tau)$ varies with inequality we also separately analyse how the separate tax measures are respectively affected by inequality. The model above unambiguously predicts a positive impact of inequality on $\ln(\tau)$andt_y, whilst the effect on t_c is ambiguous.

[19] For example, across strong democracies (described below) the standard deviation of cross-country mean inequality is 6.24, whilst the average within-country standard deviation is 1.39. For the main policy variable ($\ln(\tau)$ – described below) the standard deviation of the cross-country mean is 1.02, whilst the average within-country standard deviation is 0.261.

The inequality measure used in the empirical analysis is the University of Texas Inequality Project's estimate of household income inequality (Galbraith and Kum, 2005). These data (denotedas$UTIP$) are constructed using Theil's T statistic to measure pay inequality across sectors in each country.

Government deficit as a share of GDP is collected from World Development Indictors. Its mean, -1.39, shows that on average countries are running deficits whereas the standard deviation, 3.76, indicates considerable variation throughout the sample.

Government debt as a share of GDP is also taken from World Development Indictors. On average the countries constituting the sample are in huge debt as shown by its mean which is 56.61. The standard deviation, 30.32, also shows quite large variation across the sample.

One important determinant of the capacity to tax is the level of development, so a first control variables used in the regression analysis is the natural log of GDP per capita in constant chained PPP US$ $(\ln(\overline{y}))$ from the Penn World Tables. OECD membership ($OECD$) is also used as a further control, also to some extent capturing the level of development and institutional capacity. Because the alternative tax instruments may redistribute across generations to differing extents, demographic variables (the proportion of the population aged 15-64 and the proportion aged 65 and above) are also included in the analysis (denoted $PROP1564\ and\ PROP65$). These data are all taken from the WDI.

Countries raise tax revenue through means beyond taxation on income and goods and services. One important source is revenue from customs and other import duties. For this reason the trade share (exports plus imports as a percentage of GDP - denoted $TRADE$) is also included in the regression analysis. In addition to these controls the log of the total population size

($ln(POP)$, also from the WDI) is also included, to account for any scale (dis-)economies associated with particular types of tax collection.[20]

A final control variable is the quality of democratic institutions. The degree of democracy may affect policy variables directly, through channels other than that analysed above, or indirectly as a proxy for tax capacity. For this reason the $POLITY2$ democracy score is included in the regression analysis as standard. Moreover the median income earner more plausibly drives policy under pure democracy. For this reason the sample is split into countries which score highly on this measure and those that do not. The expectation is that inequality will be more strongly related to the policy variables in the more democratic subsample.

Table 3.1 contains descriptive statistics of the key variables used in the analysis below. Note first that there is considerable dispersion in both the tax variables. Countries differ meaningfully in terms of how they raise tax revenue. Across the whole sample, taxes on goods and services represent a higher fraction of total revenue than taxes on income. This reflects the fact that in low income countries, the capacity to raise income taxes is often limited. Indeed within the $OECD$members, income taxes are around 32% of revenue, whilst in the rest of the World income taxes are just 20% of revenue. These data are also consistent with Besley and Persson (2014).

The $UTIP$ data cover 129 countries, and numerically range from below 30 (the Czech Republic and Sweden) to 58.2 (Angola), with higher numbers representing greater inequality. Notably, these data are negatively correlated with GDP per capita, with a Pearson correlation coefficient of -0.66. Richer countries are measured (on average) to be more equal than poorer countries (see Galbraith, 2008 for a discussion). This highlights the importance of controlling for economic development; else the inequality measure will be proxying for other potential drivers of policy.

[20] Both the trade data and the population data come from the World Development Indicators.

3.4) Empirical Analysis

3.4.1) Cross-Section Analysis

Before presenting the main results we first report regressions, in Table 3.2, where the size of government, as measured by average total tax revenue as a share of GDP, is regressed on inequality. This serves to recapitulate the consensus on the absence of evidence supporting the Meltzer and Richard (1981) hypothesis that the total size of government increases with before-tax income inequality. Column 1 is a simple regression with just inequality ($UTIP$) and GDP per capita used as regressors. In that regression, as well as column 2, in which the full controls are used, the size of government is not significantly correlated with inequality.[21] Significance levels do not improve when the sample is split by the quality of democracy. Column 3 contains results for countries with strong democratic credentials, with an average $POLITY2$ democracy score of 7 or above through the sample period.[22] Column 4 contains results for countries with $POLITY2$ democracies scores of less than 7. In neither instance, there is any statistical relationship found between the size of government and inequality. These finding reflects those found for example in Perotti (1996), Bassett et al (1999) and Persson and Tabellini (2003).[23]

Table 3.3 contains results when $\ln(\tau)$ is used as the dependent variable. When looking at the full sample both excluding (column 1) and including (column 2) control variables there is a statistically significant positive association between the extent to which countries use income taxes relative to expenditure taxes and inequality. When the sample is separated according to $POLITY2 \gtrless 7$ (columns 3 and 4) it becomes clear that the positive relationship holds only under democratic regimes. This is consistent with the theory above, which relies on a complete franchise. If the median voter within a reduced franchise earns more than the median income in

[21] The sample in column 2 is slightly smaller because the $POLITY\ 2$ data do not cover some of the countries included in column 1.
[22] This cut-off was chosen for the simple reason that it results in two equally sized subsamples.
[23] Specifically, in column 6 of Table 3.1 of Persson and Tabellini (2003) pp. 40. This regression uses the Deininger and Squire (1996) measure of Gini coefficient.

the population, their inclination towards redistribution will be much weaker.[24] When the democracy criterion is strengthened further, so that only countries with $POLITY2 \geq 8$ (column 5), the magnitude of the estimated coefficient increases and is statistically significant at the 1% level.[25] The finding supports Acemoglu, Johnson and Robinson (2000). According to their argument the democracies distribute more as compared to dictatorships due to constant threat of social unrest and revolution.

Using the coefficient estimate from column 5 of Table 3.3, a one standard deviation increase in inequality is statistically associated with an increase of 0.46 in the policy variable$\ln(\tau)$, holding all else equal. Given that this is nearly a half of the raw standard deviation in the policy variable, the magnitude of the estimated correlation is sizable.

One possible concern with these results is the presence of outliers. To check sensitivity to these we computed $DFITS$ measures for each observation used in column 5 of Table 3.3 following the procedure detailed in Welsch and Kuh (1977). Four observations exhibit$DFITS$ measures greater than one in magnitude - Bolivia, Brazil, Bulgaria and the US. Omission of any one, or indeed all four of these outliers does not change the results substantively. In all cases the estimated coefficient is positive with comparable magnitude and remains significant at the 1% level.

In Tables 3.4 and 3.5 results are presented respectively for t_y and t_c , the numerator and denominator in (11). In Table 3.4 the findings for income taxes (t_y) are quite similar to the results found for $\ln(\tau)$. Increases in inequality are generally found to be positively related with the extent to which income taxes are used within total taxes, but more so in the stronger democracies. In countries where $POLITY2 \geq 7$, the estimated effect remains positive, though is not statistically significant, whilst in countries where$POLITY2 < 7$, the estimated relationship

[24] For example, if only the richest 50% of the population are allowed to vote, then the median voter's income will be higher than the median income of the population.

[25] The 11 countries that get dropped in column 5 relative to column 3 are Argentine, Botswana, Colombia, Estonia, El Salvador, South Korea, Macedonia, Moldova, Paraguay, Romania and Turkey.

is found to be negative, though at a very weak significance level. When the stronger democratic requirement is applied (i.e. where$POLITY2 \geq 8$), the estimated effect increases and is statistically significant at the 5% level. Using the estimate of column 5, a one standard deviation increase in inequality, is statistically associated with an increase of 6.46 in t_y, holding all else equal. As with $\ln(\tau)$, this represent about half of a standard deviation in the policy variable, so again the magnitude of the estimated correlation is sizable.

In the case of income taxes, some of the results relating to the control variables are of interest. The proportion of the population aged over 65 years is consistently negatively related to income taxes. This is consistent with the findings of Razin, Sadka and Swagel (2002) who found a robust negative relationship between labor tax rates and the dependency ratio. Another regularity in Table 3.4 is the positive relationship with income per capita. As discussed in Besley and Persson (2014) this likely reflects the greater capacity to tax in richer countries. A further result is that the extent of democracy is positively associated with the extent to which income taxes are used. If income taxes (relative to other forms of taxation) are more progressive, then given the plausible assumption that democratization means that the median voter becomes relatively poorer, then this relationship would be expected.

Table 3.5 presents the results relating to t_c, the extent to which taxes raised through expenditure on goods and services as a percentage of total revenue. In contrast to income taxes, increases in inequality are generally found to be negatively related with the extent to which expenditure taxes are used, especially in the stronger democracies. In countries, where$POLITY2 \geq 7$, the estimated relationship is negative and statistically significant at the 10% level, whilst in countries where$POLITY2 \geq 8$, the estimated effect is statistically significant at the 5% level. Arguably this could reflect a compositional effect: greater t_y must mean less taxes raised elsewhere as a percentage of the total, hence correlations may be reversed for t_c. Nonetheless, because there are other meaningful sources of revenue the results for t_c are not

just simply a mirror image for t_y. Indeed the raw correlation between the two data series used is only -0.08 (for the subsample of democracies with $POLITY2 \geq 8$ it is still only -0.18).

Using the estimate of column 5 of Table 3.5, a one standard deviation increase in inequality is statistically associated with an reduction of 5.06 in t_c, holding all else equal. This represents 38% of a standard deviation in t_c, so whilst this is slightly less than that found for t_y this is still a sizable effect.

Again the results relating to the control variables are of worthy of some discussion. In contrast to income taxes there is a negative relationship with income per capita - likely reflecting tax capacity, and the ability to raise taxes through income taxes in particular. However, there are also some interesting differences between the results for $t_y$and t_c. For example, unlike the case of income taxes the demographic variables are not consistently related with t_c. There is also a consistent negative relationship between t_c and trade (though this relationship is not statistically strong). Globalization may constrain countries' capacity to tax goods and services - indeed arguably this puts more pressure on countries without the capacity to tax elsewhere (see Khattry and Rao, 2002, and Baunsgaard and Keen, 2010). Interestingly, and as found with t_y the extent of democracy is positively associated with the extent to which expenditure taxes are used. Essentially revenue sources outside of t_y and t_c are increasingly relied upon, the weaker the level of democracy. Given that both forms of taxes are progressive (in the weak sense that both instruments require the rich to pay more), this finding is consistent with the model presented above.

In relation to income taxes the theory above generates an unambiguous hypothesis. Greater inequality results in greater use of income taxes as a source of revenue. The data are supportive of this hypothesis, at least in strong democracies. However, the hypotheses relating to how taxes on expenditure are related to inequality are more nuanced. Increases in inequality are proposed to increase expenditure tax rates at low levels of inequality, and once some threshold

level of inequality is reached, then the relationship becomes negative. In the empirical analysis the relationship is unambiguously negative. To test for non-monotonicity a quadratic term in $UTIP$ is included in the analysis. Table 3.6 contains the results, in column 1 for the full sample, in column 2 for countries with $POLITY2 \geq 7$ and in column 3 for countries with$POLITY2 \geq 8$. In all three cases the estimated sign on the point estimate for the linear term ($UTIP$) is positive, whilst the sign on the point estimate for the quadratic term ($UTIP^2$) is negative, consistent with the theory above. However, in all three cases the results are statistically insignificant.

Estimating a potential non-linear relationship between income taxes and inequality, in Table 3.7, we find an inverted U-shape correlation though insignificant. This holds across the full sample as well as sub-samples (strongly democratic). At low levels of inequality the median voter opts for higher income taxes as inequality increases but he prefers lower tax once inequality reaches a certain benchmark. Contrasting a distinction between indirect and direct taxes, we argue that at higher level of inequality the median voter votes for redistribution financed more through direct taxes than indirect taxes.

Following the discussion of section 3.2.1, we also investigate how changes in inequality affect government deficit and debt as shares of GDP. In the first and second columns of Table 3.8 the coefficients of inequality are positive but statistically insignificant throughout the full sample. This finding supports our tentative hypothesis that voters would prefer redistribution to be financed by raising higher deficits when the inequality increases. Their preference is based on given the assumption that they are short-sighted. For subsamples distinguished by weak and strong democracies, the deficit is found to increase with a rise in inequality in stronger democracies whereas the association is negative across weak democracies though again the significance levels are low. A possible explanation may be that the role of median voter is more vital in stronger democracies. That may explain why as the inequality rises the median voter opts for more redistribution by voting in favour of higher deficit.

The relation between public debt as a share of GDP and inequality is investigated in Table 3.9. As we explained earlier, the reason to analyse the impact of inequality on public debt is that it is relatively a better measure for analysing how burdened future generations are. A rise in inequality is positively associated with public debt across full samples as well as stronger and weaker democracies. The coefficient estimates are statistically significant at 5% for full sample and weak democracies. This again suggests that the median voter owing to short-sightedness votes for more redistribution when inequality rises.

In a nutshell, our hypotheses regarding budget deficits and public debt are supported across all samples though we find negative correlation between budget deficits and income inequality for weaker democracies.

3.4.2) Panel Data Analysis

This subsection extends the analysis to use panel data estimation. The empirical estimation covers 129 countries from 1990 to 2012 employing time and country fixed effects. We use Ordinary Least Square for the analysis. Using panel data is important because it not only adds time dimension but also enlarges our data sample.

In Table 3.10 the coefficient estimates for income taxes are reported. For the full sample (both with and without control variables) the estimated correlation between income taxes and income inequality is negative though insignificant. Further analysis decomposing the sample into weaker and stronger democracies suggests that the association between income tax and income inequality is also negatively related in stronger democracies whereas the correlation between the two variables is found to be positive across weak democracies. Significance levels do not improve.

The estimated relation between income tax and inequality across full samples and strong democracies does not support the theory in this chapter. Nevertheless, the coefficient estimates are positive across weaker democracies, though insignificant, which is in accordance with what we proposed.

Similarly, results for indirect taxes in Table 3.11 are neither reconciliatory with the theory nor with the findings we get with cross-section estimation. The estimated coefficients are positive, though statistically insignificant, for full samples (column 1 and 2) and across strong democracies. Nonetheless, we find negative coefficient estimates for weaker democracies with no improvement at significance levels.

Comparing the results of Table 3.10 and Table 3.11 with panel data estimation, we can clearly analyse that the results for the full sample and strong democracies are conflicting with the model we propose as well as to some extent with the results for cross sectional estimation. The possible justification for such conflicting results may be the inclusion of time dimension with country and time fixed effects. There are time-invariant characteristics (culture, religion)which are unique to the individual and should not be correlated with other individual characteristics. Using time and country fixed effects estimation allows us to control for the bias in results which otherwise may exist with cross-sectional estimation. Furthermore, there may be presence of the outliers as we confronted while estimating cross-sectional estimation.

To check sensitivity to these we again compute $DFITS$ measures for direct and indirect taxes of Table 3.10 and Table 3.11 following the procedure detailed in Welsch and Kuh (1977). Twenty four observations exhibit$DFITS$ measures greater than one in magnitude –Brazil, Bulgaria, Chile, Guatemala, Indonesia, Jamaica, Lithuania, Luxembourg, Mongolia, Peru, Slovak Republic, Trinidad and Venezuella. Omission of these outliers does not change the results substantively. Nevertheless, the estimated coefficients of column 3 and column 5 in Table 3.10 gain significance at 1% and 10%. Indistinguishably, column 1, column 2, column 3 and column 5 of

Table 3.11 improve significance levels at 10%, 5%, 1% and 1% respectively. These improved results of Table 3.10 and Table 3.11 controlling for outliers presence are now reported in Table 3.12 Table 3.13 respectively. Besides these changes, all other findings do not change. There is no substantial change after controlling for outliers confirms that there is sizeable proportion of similarity between our baseline specification and robust estimations. This reaffirms that the results derived from our baseline specifications employing OLS estimation are not generally affected by outliers.

We also investigate non-linearity between direct taxes and inequality using longitudinal data in Table 3.14. We find a U-shaped relationship, statistically significant, between the two variables in both full and strongly democratic samples. This contrasts the theory proposed in this chapter as well as the findings with cross-sectional estimation. The benchmark (column 1) is estimated to be 44.67.

In order to reconcile these findings with the model we may argue that in egalitarian countries (inequality less than 44.67)[26], increases in inequality implies lower income taxes. It requires further research but is on the face of it a rejection of the model. A possible reverse causation cannot be ignored too. Lower income taxes may be an incentive for rich people to invest more that may translate into higher inequality. Nevertheless, a U-shaped correlation between income taxes and income inequality supports our theory to the extent that income taxes are positive at higher levels of inequality.

As before, Table 3.15 reports results of non-linear estimation for expenditure taxes. The estimated coefficients are found to suggest an inverted U-shape association between indirect taxes and income inequality for the full sample and across strong democracies though statistically significant for full sample only. This result is in accordance with theory as well as with findings related to cross-sectional estimation. A rise in income inequality increases expenditures

[26] Threshold calculated from the full sample.

taxes at first but the correlation between the two variables becomes negative once the income inequality reaches to 46.52% (threshold from column 1 as it is statistically significant).

In Table 3.16 the relation between budget deficit as a share of GDP and income inequality is investigated using panel data. The estimated coefficients are found to be negative in all columns except for last column (where $POLITY2 < 8$) though only column 2 (full sample) holds significance at 10%. These coefficient estimates do not support our hypothesis that voters would demand for a rise in budget deficit to finance redistribution based on their short-sightedness when income inequality rises.

Next, we test relationship between public debt and income inequality the coefficient estimates of which are reported in Table 3.17. Throughout the table the relationship between the two variables is found to be positive and statistically significant for full sample and across weak democracies.[27] These results substantially support our proposition. Based on their myopia, a rise in inequality will lead voters to support higher public debts for redistribution to be financed. Both empirical analysis either with cross-section data or panel data correspond to positive correlation between public debt and income inequality.

Summarising the results with panel data estimation, it can be said that income and expenditure taxes are found to support our theoretical model and cross-sectional findings for weaker democracies only (where $POLITY2 < 7$and $POLITY2 < 8$). As far as no-linear relation is concerned, direct taxes are estimated to suggest a U-shaped association whereas indirect taxes suggest an inverted-U shape correlation. Evidence on indirect taxes substantially reconciles with our theory and results with cross-sectional estimation. On the other hand, no support either for theory or cross-sectional results is found with regards to direct taxes. Our hypothesis relating to public debt as a share of GDP is also

[27] Arguably short-term is a bigger problem in weaker democracies.

supported by empirical findings with statistical significance. However, budget deficit is confirms the hypothesis only when $POLITY2 < 8$.

3.4.3) Panel Data Analysis with First Difference Estimation

Since the variables used for empirical analysis are potentially non-stationary, we apply Im-Pesaran-Shin (IPS) test, following Im, Pesaran and Shin (2003),which fail to reject the hypothesis that all panels contain unit roots. As we know the presence of unit roots can cause few problems with inference. For example, the persistence of shocks will be infinite. Further, the presence of non-stationarity can also render standard assumptions for asymptotic analysis invalid. However, whilst differencing the data converts non-stationary data into stationary, some information is also lost. The reason to prefer the IPS test over other tests is that it developed a set of tests that relax the assumption of a common autoregressive parameter across the panel. Furthermore, data are not necessarily required to be balanced, and data availability varies by country in a penal data setting. After controlling for non-stationarity, the panel data analysis with first difference estimation is re-estimated.

Table 3.18 reports the results for direct taxes. The estimated coefficients relating to full sample and strong democracies are negative but statistically insignificant. Only the coefficient estimates for weaker democracies ($POLITY2 < 7$and $POLITY2 < 8$) are positive though the significance levels do not improve. There is not any substantial difference between the results with and without first difference estimation though the magnitude of coefficients does change. These results do not support the theory we propose. Neither have they supported the findings we derive with cross-sectional estimation.

In the following Table 3.19 we investigate how changes in income inequality affects indirect taxes. The findings contrast with the theory and results with cross-sectional estimation as we

find negative coefficients for inequality across full samples and strong democracies, though the estimates are statistically insignificant. Lack of significance may imply lack of variation in the data. We lose information when we difference the data.

The estimated coefficients in Table 3.20, where we test for non-linear relationship between income taxes and inequality, are found to suggest an inverted U-shape correlation between the two variables. Both the coefficient estimates (linear and quadratic) are negative when we decompose the sample for strong democracies ($POLITY2 \geq 7$). Nevertheless, the relation is again found to be inverted U-shape when we decompose the sample into even stronger democracies ($POLITY2 \geq 8$). These results support the hypothesis proposed as well as previous findings with cross-section estimation of this chapter. Here, applying first difference estimation improves the results with panel data analysis as opposed to results we get without differencing the data in Table 3.14 because we get an inverted U-shape correlation which confirms theory and results with cross-sectional estimates.

All three columns of Table 3.21 (full sample and stronger democracies) suggest an inverted U-shape relationship between indirect taxes and income inequality. The estimated coefficients in column 2 ($POLITY2 \geq 7$) also hold statistical significance. These results support our theory and all previous findings related to expenditure taxes of this chapter. A rise in inequality leads to higher expenditure taxes. However, expenditure taxes decrease once the inequality is 38.71% (threshold from column 2 since it is statistically significant). This corresponds strongly with the theory.

In Table 3.22 examining the effect of inequality on government deficits, the estimated coefficients of inequality are negative for full sample as well as for weak and strong democracies though statistically insignificant. According to results, the deficit decreases with a rise in inequality. This does not support our hypothesis in this chapter which rather argues for a positive association between the two variables, though to repeat, is insignificant.

For public debt, the estimated coefficients in Table 3.23 are negative for full samples and weak democracies. These are not in accordance with the proposed hypothesis. Nevertheless, positive coefficient estimates for inequality in stronger democracies find support for our hypothesis.

To summarize the findings with first difference estimation briefly, the findings for direct taxes do not improve. The estimated coefficients are still negative in all columns except weaker democracies. Nevertheless, the results relating to indirect taxes support the theory and results with cross-sectional estimation for full samples and across stronger democracies. Whilst we assess non-linearity between direct taxes and inequality as well as between indirect taxes and inequality, the results reconcile with theory and findings with cross-sectional analysis. Furthermore, budget deficits still do not support our hypothesis whereas public debt as a share of GDP confirms our hypothesis for stronger democracies only. The results with first difference estimation are preferred for they control as the variables are stationary.

3.5) Conclusion

This chapter analyses how the composition of taxes is determined in a simple median voter framework. Taxes may be levied on income, or on expenditure, as in the case of a sales tax. In the framework analysed the median voter is a Condorcet winner despite the fact there are two policy instruments. The results relating to income taxes are familiar. As with Meltzer and Richard (1981) greater inequality monotonically leads to higher income taxes.

The results relating to expenditure taxes are novel. At low levels of inequality, increases in inequality lead to higher expenditure tax rates. Even though expenditure taxes are not as effective at redistributing as income taxes, there is still a redistributive impetus embodied within an expenditure tax, as the rich spend more than the poor. If expenditure taxes are preferred for separate reasons, perhaps because of smaller deadweight losses or collection costs, then the standard argument - that greater inequality leads to higher taxes - also applies to expenditure taxes.

However, once inequality passes some threshold level, then there is a stronger desire for redistribution, even if this comes at the price of greater deadweight losses. The median voter now substitutes income taxes for expenditure taxes. Nonetheless, an unambiguous finding is that the composition of taxes, defined as the extent to which taxes are levied on income relative to expenditure, will rise with inequality.

Using cross-country data for tax composition from the WDI, and inequality data from the Texas Inequality Project, there is a robust positive correlation between the extent to which taxes are levied on income relative to expenditure and inequality. This contrasts with evidence on total government size testing the original Meltzer and Richard (1981) hypothesis. Moreover income taxes as a proportion of total taxes increase with inequality, whilst expenditure taxes as a proportion of total taxes fall with inequality. Given the nature of cross-country data, and in

particular unobserved heterogeneity across countries, it is not possible to say that these are causal relationships. Nonetheless, the fact that the empirical results hold most strongly for countries with higher levels of democracy, is supportive of the mechanism proposed in this chapter.

Non-linear relationship between direct taxes and inequality is also estimated to be inverted U-shape supporting our hypothesis that income taxes are more effective instrument of redistributing at higher levels of inequality.

Based on the assumption that voters are short-sighted, our hypotheses about budget deficits and public debt are also confirmed across all samples. However, the budget deficits for weaker democracies are negatively correlated with inequality.

The empirical analysis is extended using panel data with and without first difference estimation. With first difference estimation, linear estimation related to direct and indirect taxes finds support for theory and cross-sectional findings for weak democracies. The theory is supported when we test non-linearity between direct taxes and inequality. Similarly, non-linear association between indirect taxes and inequality substantially supports the theory and cross-sectional findings. From budget deficits and public debt, the latter supports our tentative proposition when Polity2 >= 7.

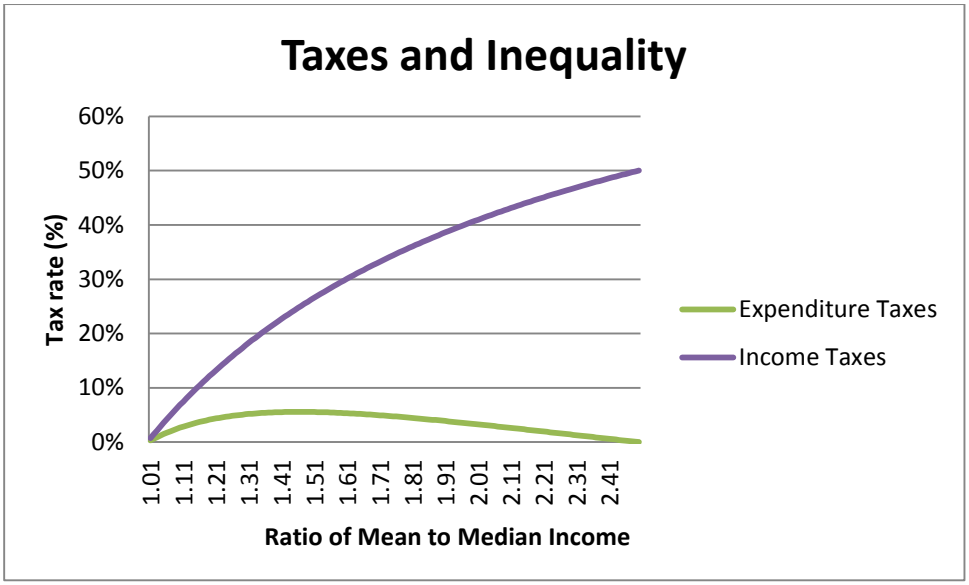


Figure 3.1: How Expenditure and Income Taxes change with Inequality

Table 3.1: Summary Statistics of the Variables	# obs	mean	s.d.	min	max
t_y	125	21.44	7.25	10.14	38.59
t_c	119	28.41	8.15	10.12	40.96
$\ln(\tau)$	157	-0.24	0.98	-2.8	4.57
$\ln(\overline{y})$	166	8.63	1.26	5.6	11.22
Deficit as a share of GDP	158	-1.39	3.76	-11.57	13.82
Debt as a share of GDP	95	56.61	30.20	14.28	141.89
$UTIP$	129	44.03	6.49	29.08	58.25
$PROP1564$	194	61.23	6.57	48.52	76.78
$PROP65$	194	7	4.62	0.81	18.39
$TRADE$	121	45.98	10.63	22.11	60.82
$OECD$	213	0.138	0.333	0	1
$ln(POP)$	213	15.07	2.36	9.16	20.96
$POLITY2$	165	3.03	6.2	-10	10

Notes: The data are within-country averages between 1990-2014. $t_y$denotes taxes on income, profits and capital gains (as a % of revenue) - taken from the World Development Indicators (WDI). $t_c$denotes taxes on goods and services (as a % of revenue) - also taken from the WDI. $\tau = \frac{t_y}{t_c}$. $\overline{y}$is real GDP at chained PPPs in millions of 2005 US dollars per capita - taken from the Penn World Tables. $UTIP$is the University of Texas Inequality Project estimate of household income inequality. $PROP1564$and$PROP65$ are respectively the proportion of the population aged between 15 and 64, and 65 and above. $TRADE$is imports plus exports as a percentage of GDP. $OECD$is a dummy variable denoting $OECD$ membership. $ln(POP)$ is the country population size $POLITY2$ is a measure of democracy provided by the Polity IV project, with 10 denoting the highest level of democracy, and -10 denoting the highest level of autocracy.

Table 3.2: The Size of Government

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy
$UTIP$	-0.177	0.077	0.089	0.19
	(0.147)	(0.198)	(0.209)	(0.301)
$\ln(\overline{y})$	1.155	0.737	3.032*	-1.384
	(0.786)	(1.368)	(1.599)	(1.595)
$OECD$		1.81	1.542	0.225
		(2.803)	(3.242)	(3.577)
$PROP1564$		-0.195	-0.212	-0.023
		(0.174)	(0.219)	(0.292)
$PROP65$		0.183	-0.236	0.516
		(0.204)	(0.298)	(0.367)
$TRADE$		0.019	-0.033	0.047
		(0.022)	(0.024)	(0.039)
$ln(POP)$		-1.46***	2.489***	-1.127*
		(0.432)	(0.683)	(0.578)
$POLITY2$		0.254*	0.987	0.103
		(0.15)	(0.886)	(0.162)
R-Square	0.11	0.29	0.37	0.25
Number of Observations	119	112	56	56
Sample Size	Full	Full	$POLITY2 > 7$	$POLITY2 < 7$

Notes: Cross country regressions of total tax revenue as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.3: The Composition of Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	0.076***	0.027*	0.047*	0.021	0.071***	0.007
	(0.016)	(0.016)	(0.024)	(0.023)	(0.021)	(0.022)
$\ln(\overline{y})$	0.428***	0.733***	0.859***	0.561***	1.014***	0.629***
	(0.259)	(0.138)	(0.286)	(0.193)	(0.299)	(0.163)
$OECD$		0.374	0.038	-1.204***	0.161	-0.736*
		(0.313)	(0.432)	(0.418)	(0.39)	(0.408)
$PROP1564$		-0.06***	-0.031	-0.035	0.019	-0.048*
		(0.022)	(0.041)	(0.028)	(0.047)	(0.025)
$PROP65$		-0.08***	-0.072**	-0.166***	-0.094**	-0.148***
		(0.024)	(0.029)	(0.041)	(0.036)	(0.034)
$TRADE$		0.001	0.000	0.002	0.001	0.001
		(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
$ln(POP)$		0.127**	0.16*	0.119	0.229**	0.088
		(0.058)	(0.093)	(0.087)	(0.1)	(0.08)
$POLITY2$		-0.012	0.122	-0.008	0.115	-0.01
		(0.015)	(0.115)	(0.023)	(0.117)	(0.02)
R-Square	0.19	0.43	0.54	0.48	0.62	0.48
Number of Observations	117	111	56	55	45	66
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Cross country regressions of composition of taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.4: Income Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	0.524*	0.185	0.586	-0.045	0.995**	-0.06
	(0.3)	(0.307)	(0.496)	(0.448)	(0.435)	(0.391)
$\ln(\overline{y})$	4.576***	6.77***	8.078**	5.523*	15.254***	4.53**
	(1.538)	(1.856)	(3.232)	(2.954)	(3.947)	(2.237)
$OECD$		7.277	5.686	-3.33	7.307	-4.244
		(4.703)	(6.861)	(7.19)	(6.833)	(6.516)
$PROP1564$		-0.453	0.146	-0.257	0.403	-0.224
		(0.321)	(0.577)	(0.52)	(0.838)	(0.433)
$PROP65$		-1.35***	-1.36**	-1.952**	-2.067***	-1.728***
		(0.42)	(0.602)	(0.733)	(0.75)	(0.615)
$TRADE$		0.016	-0.037	0.034	-0.055	0.038
		(0.025)	(0.052)	(0.033)	(0.053)	(0.03)
$ln(POP)$		1.921**	1.101	2.006*	1.404	1.885*
		(0.815)	(1.517)	(1.093)	(1.549)	(1.041)
$POLITY2$		0.539**	3.322*	0.733*	0.602	0.485
		(0.266)	(1.724)	(0.387)	(3.46)	(0.319)
R-Square	0.11	0.31	0.43	0.48	0.51	0.27
Number of Observations	118	112	56	56	45	67
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Cross country regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.5: Expenditure Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	-0.892***	-0.317	-0.591*	-0.174	-0.779**	-0.001
	(0.268)	(0.302)	(0.342)	(0.445)	(0.364)	(0.429)
$\ln(\overline{y})$	-4.13***	-7.48***	-9.416***	-5.202	-8.226***	-6.819**
	(1.493)	(2.093)	(3.232)	(3.844)	(3.4)	(2.876)
$OECD$		-1.394	1.508	32.98***	-2.47	15.39
		(4.318)	(4.135)	(8.105)	(3.837)	(9.746)
$PROP1564$		0.891**	0.603	0.517	0.034	0.629
		(0.373)	(0.447)	(0.631)	(0.521)	(0.509)
$PROP65$		0.296	0.212	1.27	0.297	1.277***
		(0.416)	(0.358)	(0.775)	(0.389)	(0.619)
$TRADE$		-0.026	-0.031	-0.034	-0.039	-0.015
		(0.023)	(0.031)	(0.035)	(0.034)	(0.032)
$ln(POP)$		-1.091	-2.172***	-0.541	-2.538**	-0.202
		(0.833)	(0.923)	(1.453)	(0.998)	(1.255)
$POLITY2$		0.464	0.326	0.614	0.22	0.429
		(0.287)	(1.437)	(0.446)	(1.851)	(0.377)
R-Square	0.12	0.24	0.45	0.33	0.47	0.31
Number of Observations	118	111	56	55	45	66
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Cross country regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.6: Expenditure Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	0.032	0.645	0.988
	(1.867)	(2.093)	(1.903)
$UTIP^2$	-0.004	-0.016	-0.022
	(0.022)	(0.027)	(0.025)
$\ln(\overline{y})$	-7.463***	-9.549***	-8.681**
	(2.075)	(2.613)	(3.532)
$OECD$	-1.295	1.631	-1.939
	(4.528)	(4.156)	(3.825)
$PROP1564$	0.881**	0.555	-0.024
	(0.373)	(0.462)	(0.519)
$PROP65$	0.306	0.174	0.239
	(0.406)	(0.362)	(0.4)
$TRADE$	-0.026	-0.031	-0.039
	(0.022)	(0.032)	(0.035)
$ln(POP)$	-1.106	-2.171**	-2.628**
	(0.831)	(0.935)	(1.015)
$POLITY2$	0.457	0.411	0.066
	(0.295)	(1.493)	(1.837)
R-Square	0.24	0.45	0.47
Number of Observations	111	56	45
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Cross country regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.7: Income Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	2.712	3.184	2.599
	(2.280)	(3.501)	(3.330)
$UTIP^2$	-0.029	-0.033	-0.020
	(0.027)	(0.047)	(0.044)
$\ln(\overline{y})$	6.904	7.792	14.817
	(1.872)***	(3.369)**	(4.257)***
$OECD$	8.158	5.950	7.803
	(4.919)	(6.757)	(7.001)
$PROP1564$	-0.510	0.045	0.351
	(0.334)	(0.641)	(0.870)
$PROP65$	-1.287	-1.444	-2.120
	(0.423)***	(0.650)**	(0.775)***
$TRADE$	0.018	-0.037	-0.056
	(0.025)	(0.051)	(0.053)
$ln(POP)$	1.759	1.107	1.323
	(0.833)**	(1.527)	(1.569)
$POLITY2$	0.478	3.501	0.466
	(0.261)*	(1.864)*	(3.522)
R-squared	0.311	0.432	0.510
Observations	111	56	45
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Cross country regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.8: Deficit as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	0.061	0.025	0.209	-0.106	0.147	-0.072
	(0.091)	(0.091)	(0.146)	(0.111)	(0.126)	(0.125)
$\ln(\overline{y})$	0.789	0.922	0.591	1.547	0.970	1.674
	(0.471)*	(0.645)	(0.831)	(0.909)*	(0.707)	(1.514)
$OECD$		0.626	0.859	2.465	0.280	3.612
		(1.378)	(1.819)	(1.798)	(1.852)	(2.529)
$PROP1564$		0.001	0.066	-0.178	0.012	-0.172
		(0.119)	(0.172)	(0.163)	(0.148)	(0.268)
$PROP65$		-0.175	0.046	-0.336	-0.026	-0.386
		(0.123)	(0.256)	(0.119)***	(0.215)	(0.170)**
$TRADE$		0.019	0.034	-0.016	0.033	-0.024
		(0.011)	(0.013)**	(0.014)	(0.011)***	(0.017)
$ln(POP)$		-0.096	0.453	-1.119	0.211	-1.265
		(0.291)	(0.377)	(0.507)**	(0.351)	(0.645)*
$POLITY2$		-0.067	-0.051	-1.172	0.012	-1.891
		(0.074)	(0.087)	(0.515)**	(0.089)	(1.057)*
R-squared	0.045	0.181	0.330	0.296	0.314	0.263
Observations	116	109	53	56	64	45
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Cross country regressions of Government Deficit as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.9: Debt as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	0.107	2.335	0.525	3.699	1.271	3.596
	(0.755)	(1.150)**	(1.939)	(1.538)**	(1.419)	(1.747)**
$\ln(\overline{y})$	-2.752	-1.760	-14.666	0.034	-15.501	4.855
	(4.939)	(9.126)	(13.538)	(11.254)	(9.715)	(20.368)
$OECD$		6.361	-0.815	-7.231	6.016	-16.919
		(20.237)	(26.860)	(23.241)	(18.382)	(34.808)
$PROP1564$		-2.681	-1.277	-0.811	-0.678	-2.493
		(1.560)*	(2.511)	(1.659)	(1.947)	(2.914)
$PROP65$		3.388	0.031	3.682	-0.872	4.098
		(1.599)**	(2.067)	(1.869)*	(1.766)	(2.221)*
$TRADE$		0.163	0.261	-0.067	0.295	-0.020
		(0.144)	(0.149)*	(0.151)	(0.124)**	(0.176)
$ln(POP)$		1.870	-2.800	2.530	1.363	3.092
		(3.065)	(4.821)	(4.120)	(3.623)	(4.699)
$POLITY2$		1.314	1.153	15.687	0.754	21.232
		(1.019)	(1.829)	(5.286)***	(1.424)	(10.772)*
R-squared	0.0118	0.160	0.314	0.386	0.310	0.343
Observations	87	81	35	46	42	39
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Cross country regressions of Government debt as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.10: Income Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	-0.067	-0.108	-0.240	0.252	-0.135	0.180
	(0.148)	(0.166)	(0.211)	(0.252)	(0.245)	(0.234)
$\ln(\overline{y})$	5.288	6.354	16.943	-0.140	18.325	0.241
	(1.824)***	(2.051)***	(3.691)***	(2.482)	(4.017)***	(2.387)
$OECD$		-2.644	0.585	-2.081	0.705	-2.058
		(1.340)**	(1.510)	(2.185)	(1.558)	(2.155)
$PROP1564$		-0.258	-1.229	0.357	-1.208	0.369
		(0.181)	(0.405)***	(0.237)	(0.440)***	(0.229)
$PROP65$		-0.114	-0.216	4.717	-0.076	4.155
		(0.479)	(0.541)	(1.312)***	(0.534)	(1.226)***
$TRADE$		0.045	0.077	0.010	0.087	0.021
		(0.016)***	(0.027)***	(0.027)	(0.028)***	(0.025)
$ln(POP)$		1.178	37.619	-1.305	46.399	-2.397
		(5.267)	(8.522)***	(10.263)	(8.530)***	(9.580)
$POLITY2$		-0.367	0.104	-0.361	0.337	-0.371
		(0.132)***	(1.003)	(0.250)	(1.049)	(0.245)
R-squared	0.889	0.891	0.924	0.886	0.925	0.887
Observations	870	839	540	299	516	323
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.11: Expenditure Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	0.152	0.122	0.220	-0.106	0.204	-0.112
	(0.132)	(0.123)	(0.147)	(0.212)	(0.157)	(0.215)
$\ln(\overline{y})$	-6.194	-9.086	-16.454	-7.183	-18.236	-6.188
	(1.713)***	(1.653)***	(2.559)***	(2.426)***	(2.717)***	(2.406)**
$OECD$		-4.431	-3.718	-0.887	-3.803	-1.115
		(1.511)***	(4.674)	(1.940)	(4.542)	(1.955)
$PROP1564$		0.538	0.902	0.525	0.907	0.383
		(0.178)***	(0.305)***	(0.331)	(0.329)***	(0.320)
$PROP65$		1.194	0.566	3.042	0.514	3.149
		(0.445)***	(0.429)	(1.349)**	(0.431)	(1.290)**
$TRADE$		0.019	0.007	-0.001	0.014	-0.009
		(0.017)	(0.023)	(0.026)	(0.023)	(0.026)
$ln(POP)$		-15.515	-32.845	10.791	-36.902	2.910
		(6.142)**	(7.418)***	(11.322)	(7.610)***	(11.283)
$POLITY2$		-0.146	0.065	-0.289	0.099	-0.244
		(0.114)	(0.954)	(0.188)	(1.027)	(0.183)
R-squared	0.898	0.897	0.896	0.924	0.886	0.923
Observations	840	807	522	285	497	310
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.12: Income Taxes

	(1)	(2)	(3)	(4)	(5)	(6)
			Strong Democracy	Weak Democracy	Strong Democracy	Weak Democracy
$UTIP$	-0.035	-0.050	-0.423	0.252	-0.314	0.180
	(0.139)	(0.171)	(0.155)***	(0.252)	(0.185)*	(0.234)
$\ln(\overline{y})$	3.650	3.830	8.611	-0.140	9.375	0.241
	(1.636)**	(1.816)**	(2.210)***	(2.482)	(2.462)***	(2.387)
$OECD$		-3.325	-1.404	-2.081	-1.307	-2.058
		(1.258)***	(1.476)	(2.185)	(1.439)	(2.155)
$PROP1564$		-0.059	-0.724	0.357	-0.581	0.369
		(0.170)	(0.307)**	(0.237)	(0.373)	(0.229)
$PROP65$		0.017	-0.328	4.717	-0.163	4.155
		(0.418)	(0.404)	(1.312)***	(0.395)	(1.226)***
$TRADE$		0.052	0.072	0.010	0.084	0.021
		(0.015)***	(0.022)***	(0.027)	(0.022)***	(0.025)
$ln(POP)$		-4.318	23.913	-1.305	32.241	-2.397
		(4.946)	(7.094)***	(10.263)	(7.030)***	(9.580)
$POLITY2$		-0.425	-0.999	-0.361	-0.570	-0.371
		(0.139)***	(0.599)*	(0.250)	(0.615)	(0.245)
R-squared	0.912	0.915	0.961	0.886	0.963	0.887
Observations	845	814	515	299	491	323
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions (after omitting outliers) of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.13: Expenditure Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	0.232	0.236	0.508	-0.106	0.521	-0.112
	(0.136)*	(0.123)*	(0.123)***	(0.212)	(0.136)***	(0.215)
$\ln(\overline{y})$	-4.394	-7.393	-10.126	-7.183	-11.804	-6.188
	(1.767)**	(1.688)***	(2.345)***	(2.426)***	(2.528)***	(2.406)**
$OECD$		-3.971	-3.536	-0.887	-3.624	-1.115
		(1.515)***	(4.235)	(1.940)	(4.135)	(1.955)
$PROP1564$		0.585	0.912	0.525	0.956	0.383
		(0.198)***	(0.322)***	(0.331)	(0.387)**	(0.320)
$PROP65$		0.932	0.516	3.042	0.533	3.149
		(0.454)**	(0.423)	(1.349)**	(0.430)	(1.290)**
$TRADE$		0.019	0.023	-0.001	0.030	-0.009
		(0.017)	(0.021)	(0.026)	(0.021)	(0.026)
$ln(POP)$		-15.750	-27.523	10.791	-29.972	2.910
		(6.171)**	(6.918)***	(11.322)	(7.083)***	(11.283)
$POLITY2$		-0.134	1.411	-0.289	1.589	-0.244
		(0.102)	(0.718)**	(0.188)	(0.786)**	(0.183)
R-squared	0.909	0.909	0.917	0.924	0.908	0.923
Observations	815	782	497	285	472	310
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions (after omitting outliers) of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.14: Income Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	-3.663	-2.512	-2.696
	(0.815)***	(1.173)**	(1.262)**
$UTIP^2$	0.041	0.028	0.032
	(0.010)***	(0.015)*	(0.017)*
$\ln(\overline{y})$	6.496	15.600	16.618
	(1.987)***	(3.757)***	(4.090)***
$OECD$	-2.824	0.694	0.827
	(1.298)**	(1.548)	(1.632)
$PROP1564$	-0.354	-1.278	-1.234
	(0.178)**	(0.406)***	(0.448)***
$PROP65$	0.076	-0.204	-0.042
	(0.458)	(0.531)	(0.523)
$TRADE$	0.050	0.081	0.092
	(0.016)***	(0.026)***	(0.027)***
$ln(POP)$	-2.590	33.807	42.524
	(4.912)	(8.485)***	(8.401)***
$POLITY2$	-0.368	0.231	0.485
	(0.124)***	(0.989)	(1.025)
R-squared	0.894	0.925	0.926
Observations	839	540	516
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Panel data regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.15: Expenditure Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	2.14***	0.746	0.4
	(0.772)	(0.967)	(1)
$UTIP^2$	-0.023**	-0.006	-0.002
	(0.009)	(0.012)	(0.012)
$\ln(\overline{y})$	-8.8***	-16.26***	-18.22***
	(1.68)	(2.69)	(2.9)
$OECD$	-4.34***	-4.3	-4.41
	(1.54)	(4.81)	(4.6)
$PROP1564$	0.579***	0.904***	0.886***
	(0.181)	(0.303)	(0.33)
$PROP65$	0.88*	0.423	0.38
	(0.453)	(0.439)	(0.439)
$TRADE$	0.013	0.002	0.01
	(0.017)	(0.023)	(0.023)
$ln(POP)$	-17**	-36.56***	-41.52***
	(6.79)	(8.66)	(8.69)
$POLITY2$	-0.143	0.066	0.14
	(0.109)	(0.945)	(1.01)
R - Squared	0.9	0.9	0.89
Observations	807	522	497
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Panel data regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.16: Deficit as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak democracy	(5) Strong Democracy	(6) Weak democracy
$UTIP$	-0.613	-0.679	-1.593	-0.034	-1.312	0.050
	(0.461)	(0.405)*	(0.967)	(0.098)	(0.853)	(0.093)
$\ln(\overline{y})$	15.435	15.999	25.014	3.284	23.430	4.900
	(11.071)	(9.941)	(14.289)*	(1.430)**	(14.229)	(1.273)***
$OECD$		-3.303	-3.913	-2.518	-3.608	-2.758
		(2.333)	(3.667)	(1.517)*	(3.557)	(1.711)
$PROP1564$		-0.067	-0.435	-0.358	-0.316	-0.383
		(0.191)	(0.598)	(0.171)**	(0.553)	(0.152)**
$PROP65$		-2.003	-4.945	-0.266	-5.144	-0.295
		(1.297)	(3.410)	(0.301)	(3.694)	(0.292)
$TRADE$		-0.103	-0.148	0.003	-0.138	0.001
		(0.061)*	(0.085)*	(0.016)	(0.081)*	(0.016)
$ln(POP)$		-48.955	-77.107	-10.638	-75.238	-7.496
		(25.651)*	(44.143)*	(5.009)**	(43.939)*	(4.583)
$POLITY2$		-0.094	-0.217	0.761	-0.215	0.425
		(0.104)	(0.304)	(0.406)*	(0.286)	(0.412)
R-squared	0.374	0.478	0.557	0.709	0.539	0.717
Observations	835	810	282	528	306	504
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Government Deficit as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.17: Debt as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	1.614	1.874	0.536	2.537	0.346	2.306
	(0.553)***	(0.567)***	(0.857)	(0.712)***	(0.782)	(0.893)**
$\ln(\overline{y})$	-27.023	-31.902	-24.610	-49.962	-27.031	-55.001
	(7.621)***	(7.401)***	(12.346)**	(10.105)***	(11.555)**	(12.959)***
$OECD$		-14.334	-3.524	-28.082	-3.025	-28.510
		(5.178)***	(5.442)	(4.644)***	(5.549)	(4.754)***
$PROP1564$		0.252	-3.707	4.143	-3.816	4.935
		(0.839)	(1.215)***	(1.054)***	(1.224)***	(1.271)***
$PROP65$		1.644	1.268	3.602	0.492	4.322
		(1.825)	(4.191)	(2.198)	(3.782)	(2.205)*
$TRADE$		0.297	0.345	0.178	0.354	0.173
		(0.058)***	(0.078)***	(0.077)**	(0.071)***	(0.076)**
$ln(POP)$		-52.152	-36.809	-99.696	-40.283	-117.770
		(23.184)**	(30.818)	(42.376)**	(30.076)	(41.879)***
$POLITY2$		0.087	-0.754	-5.168	-0.885	-2.571
		(0.685)	(0.812)	(3.039)*	(0.819)	(2.880)
R-squared	0.878	0.875	0.887	0.895	0.889	0.896
Observations	592	576	198	378	214	362
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Government debt as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3.18:Income Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	-0.046	-0.083	-0.222	0.020	-0.270	0.050
	(0.158)	(0.164)	(0.298)	(0.148)	(0.333)	(0.134)
$\ln(\overline{y})$		-1.266	4.405	-1.759	10.793	-3.496
		(4.854)	(8.241)	(5.151)	(8.609)	(5.069)
$OECD$		-1.331	1.861	-2.722	2.239	-2.746
		(1.235)	(0.892)**	(1.058)**	(0.906)**	(1.054)***
$PROP1564$		0.575	-0.161	0.465	-0.676	0.664
		(1.009)	(2.284)	(0.898)	(2.347)	(0.921)
$PROP65$		-0.450	0.684	-7.101	0.505	-4.572
		(2.697)	(2.727)	(7.154)	(2.730)	(6.747)
$TRADE$		0.063	0.110	0.005	0.140	-0.010
		(0.042)	(0.064)*	(0.034)	(0.063)**	(0.034)
$ln(POP)$		0.188	2.371	-0.257	4.592	1.118
		(4.777)	(7.084)	(7.801)	(7.030)	(7.010)
$POLITY2$		-0.125	-0.268	-0.136	-0.215	-0.166
		(0.122)	(0.363)	(0.118)	(0.387)	(0.117)
R-squared	0.152	0.169	0.205	0.217	0.234	0.209
Observations	729	702	463	239	446	256
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Table 3.19: Expenditure Taxes

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	-0.149	-0.121	-0.317	0.061	-0.192	0.017
	(0.138)	(0.134)	(0.187)*	(0.176)	(0.201)	(0.181)
$\ln(\overline{y})$	-0.297	-5.273	-5.874	-9.523	-6.573	-9.136
	(1.336)	(2.885)*	(4.318)	(4.817)**	(4.633)	(4.500)**
$OECD$		-0.697	-0.908	-0.266	-1.079	-0.209
		(1.035)	(0.757)	(0.999)	(0.759)	(1.038)
$PROP1564$		-0.340	-0.707	-0.264	0.582	-0.327
		(0.942)	(1.649)	(0.953)	(1.711)	(0.944)
$PROP65$		0.031	0.675	0.555	0.807	-0.428
		(2.236)	(1.636)	(7.149)	(1.504)	(6.350)
$TRADE$		-0.027	-0.044	-0.024	-0.038	-0.030
		(0.019)	(0.025)*	(0.038)	(0.026)	(0.035)
$ln(POP)$		1.058	-1.556	15.452	-4.362	9.954
		(3.141)	(4.581)	(7.658)**	(4.937)	(7.520)
$POLITY2$		-0.047	-0.143	-0.109	0.032	-0.137
		(0.127)	(0.580)	(0.135)	(0.511)	(0.139)
R-squared	0.161	0.186	0.228	0.235	0.226	0.231
Observations	700	673	446	227	427	246
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Table3.20: Income Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	0.729	-0.178	0.146
	(1.630)	(2.299)	(2.104)
$UTIP^2$	-0.009	-0.001	-0.005
	(0.018)	(0.028)	(0.026)
$\ln(\overline{y})$	-0.204	3.134	11.057
	(1.918)	(4.563)	(8.281)
$OECD$	-1.330	1.743	2.242
	(1.243)	(0.883)**	(0.906)**
$PROP1564$	0.644	0.721	-0.597
	(1.046)	(2.596)	(2.413)
$PROP65$	-0.605	1.100	0.471
	(2.696)	(2.976)	(2.714)
$TRADE$	0.063	0.108	0.140
	(0.043)	(0.065)*	(0.064)**
$ln(POP)$	-0.497	1.806	4.126
	(4.249)	(6.970)	(6.791)
$POLITY2$	-0.117	-0.267	-0.215
	(0.123)	(0.358)	(0.387)
R-squared	0.169	0.208	0.234
Observations	702	463	446
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Panel data regressions of Income Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Table 3.21: Expenditure Taxes

	(1)	(2) Strong Democracy	(3) Strong Democracy
$UTIP$	0.153	2.162	1.813
	(0.896)	(1.113)*	(1.122)
$UTIP^2$	-0.003	-0.028	-0.023
	(0.011)	(0.014)**	(0.014)
$\ln(\overline{y})$	-0.363	-2.127	-5.283
	(1.338)	(2.083)	(4.464)
$OECD$	-0.589	-0.777	-1.063
	(1.049)	(0.793)	(0.780)
$PROP1564$	-0.362	-1.132	0.926
	(0.947)	(1.681)	(1.752)
$PROP65$	-0.101	0.086	0.638
	(2.261)	(1.629)	(1.490)
$TRADE$	-0.026	-0.044	-0.041
	(0.019)	(0.025)*	(0.026)
$ln(POP)$	0.637	-3.688	-6.477
	(3.242)	(4.999)	(5.318)
$POLITY2$	-0.011	-0.157	0.025
	(0.122)	(0.590)	(0.530)
R-squared	0.180	0.242	0.239
Observations	673	446	427
Sample Size	Full	$POLITY2 \geq 7$	$POLITY2 \geq 8$

Notes: Panel data regressions of Expenditure Taxes as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Table 3.22: Deficit as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	-0.420	-0.133	-0.142	-0.110	-0.209	-0.088
	(0.248)*	(0.090)	(0.128)	(0.132)	(0.144)	(0.117)
$\ln(\overline{y})$	19.709	4.595	2.505	5.719	3.958	5.710
	(14.139)	(2.286)**	(3.669)	(3.078)*	(4.294)	(2.909)*
$OECD$		0.770	2.497	0.214	2.617	0.382
		(1.110)	(0.863)***	(0.687)	(0.867)***	(0.667)
$PROP1564$		0.725	0.255	0.651	0.304	0.669
		(0.732)	(1.128)	(0.947)	(1.113)	(0.947)
$PROP65$		0.686	0.071	2.468	0.072	2.654
		(1.170)	(1.265)	(2.691)	(1.280)	(2.424)
$TRADE$		0.006	0.019	-0.005	0.025	-0.008
		(0.018)	(0.026)	(0.025)	(0.029)	(0.023)
$ln(POP)$		-0.931	0.851	-7.238	1.224	-5.433
		(2.732)	(3.645)	(5.062)	(3.445)	(4.533)
$POLITY2$		-0.035	-0.285	-0.044	-0.289	-0.039
		(0.093)	(0.154)*	(0.105)	(0.157)*	(0.106)
R-squared	0.346	0.259	0.377	0.215	0.376	0.252
Observations	703	683	453	230	435	248
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Government Deficit as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Table 3.23: Debt as a share of GDP

	(1)	(2)	(3) Strong Democracy	(4) Weak Democracy	(5) Strong Democracy	(6) Weak Democracy
$UTIP$	-0.268	-0.204	0.077	-0.638	-0.019	-0.663
	(0.430)	(0.441)	(0.709)	(0.465)	(0.836)	(0.461)
$\ln(\overline{y})$	-54.853	-56.254	-4.963	-48.780	-44.712	-47.454
	(12.289)***	(13.289)***	(10.830)	(19.075)**	(21.240)**	(18.647)**
$OECD$		-2.109	-13.374	2.483	-15.616	3.362
		(6.336)	(2.660)***	(3.559)	(2.366)***	(3.264)
$PROP1564$		-3.705	-12.317	-3.666	-0.500	-3.292
		(4.335)	(7.205)*	(6.938)	(5.948)	(6.834)
$PROP65$		-0.420	3.119	-21.623	8.393	-21.337
		(6.770)	(8.645)	(8.907)**	(8.740)	(8.054)***
$TRADE$		0.090	0.051	0.233	0.002	0.202
		(0.055)	(0.091)	(0.082)***	(0.089)	(0.082)**
$ln(POP)$		15.211	45.082	35.050	33.403	40.239
		(19.227)	(48.838)	(29.829)	(47.044)	(28.470)
$POLITY2$		-1.028	1.102	0.187	2.306	0.164
		(1.202)	(2.820)	(0.606)	(3.209)	(0.609)
R-squared	0.278	0.296	0.357	0.388	0.384	0.398
Observations	488	476	319	157	309	167
Sample Size	Full	Full	$POLITY2 \geq 7$	$POLITY2 < 7$	$POLITY2 \geq 8$	$POLITY2 < 8$

Notes: Panel data regressions of Government Debt as a percentage share of GDP including $\ln(\overline{y})$, $OECD$, $PROP1564$, $PROP65$, $TRADE$, $ln(POP)$ and $POLITY2$ as control variables described in the text. Full data sample includes 129 countries and covers time period from 1990-2012. Robust standard errors are reported in parentheses. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.
All the variables are differenced due to presence of unit roots following Im-Pesaran-Shin test).

Chapter 4

Government Size and Economic Growth

4.1) Introduction

Is government intervention in the economy necessary? If yes, what is the optimal level of government intervention that would maximize living standards? These questions are at the heart of economics. There are proponents as well as opponents of government intervention and a continuum of opinions on the optimal size of government.

In this paper we analyse how government intervention/size, measured by government expenditures as a percentage of GDP, affects economic growth, measured by real GDP growth per capita. In order to proceed, we build on Islam (1995). Whilst Islam (1995) focuses on convergence, our hypothesis is based on the work of Armey (1995) where we argue that a rise in government expenditures as a fraction of GDP will increase GDP growth but only prior to a certain point after which further increases in government expenditures would lead to decreased GDP growth. We use panel data taking five years averages of data from 1981-2010 covering 79 countries. Our data sample is different to Armey (1995) covering many more countries and years.

We take government expenditures as a share of GDP to measure government size and other control variables which include log initial real GDP per capita, openness to trade, the population growth rate, secondary school enrolment rate, inflation rates, the level of democracy, rule of law and bank deposits as a share of GDP.

There is substantial evidence for the Armey curve across non-OECDs. The weak democracies are also found to have Armey curve. These results are in accordance with our hypothesis. On the other hand, lack of evidence for the presence of the Armey curve implies that these countries can sustain larger governments supporting Besley and Persson (2011). This argument is justified when we analyse that the share of public expenditure in GDP is 44.69% on average.

Because of possible endogeneity between government consumption and economic growth we apply 2 Stage Least Squares estimation (2SLS) method. The method also employs time and country fixed effects clustering standard errors by country. The evidence relating to full sample does not support presence of the Armey curve.

We also split the data sample depending on the OECD membership. Countries with OECD membership are highly democratic whereas Non-OECDs are relatively weak democracies. Following Besley and Persson (2011), Besley and Persson (2014) and Feng (1997), we also expect larger government size in strong democracies. The relationship between GDP growth and the government size is estimated to be an inverted U-shape across the non-OECD sample supporting our hypothesis, Armey (1995) and previous literature. The benchmark for the efficient government spending is found to be 23.99% of GDP. A rise in the size of government size increases economic growth but the growth is negatively affected with any further public expansion once the size of government reaches 23.99%.

On the other hand, the results regarding full and the OECD sample are rather mixed. We find both a U-shaped and an inverted U-shape association across these samples. Even when an association supporting the Armey curve is found for the OECD sample the estimated coefficients are statistically insignificant. As with the more democratic subsample this may imply that these countries are already have governments at or above the efficient level of government suggested by our empirical analysis.

The evidence for the support of Armey curve is substantial across non-OECD countries when we interact government size with level of democracy. The purpose of interaction is to analyse the robustness of our results considering the possible indirect effects between the two variables. Democracies tend to have larger governments, so this possible indirect relation between these two variables is controlled by using them as interactive variables.

Following Ghosh and Gregoriou (2008) we also break-down government spending into current consumption and public investment as the type of governments also matters. We find evidence for Ghosh and Gregoriou (2008) and Devarajan*et al* (1996) across full sample, non-OECD and OECD and strong democracies. Increase in current government expenditures lead to higher output growth. We also find evidence for positive effect of public investment on GDP growth for full samples, weak democracies and non-OECD countries. These results confirm the previous literature such as Aschauer (1989) and Easterly and Rebelo (1993). However, strong democracies and the OECD countries are estimated to suggest negative correlation between the two avriables lending support to Gregoriou (2008) and Devarajan*et al* (1996).

Further, non-linearity between these variables and economic growth is examined. For current government consumption there is substantial support found for the Armey curve across OECD countries and strongly democratic countries. However, the association between current consumption and economic growth is rather found to be U-shaped.

Contrary to current consumption, public investment is estimated to support the hypothesis of Armey Curve throughout non-OECDs and weak democracies. The nature of correlation between economic growth and public investment is found to be U-shaped across OECD and more democratic countries. These coefficients also do not hold statistical significance.

Following Cashin (1995) we also investigate how changes in direct transfers affect economic growth. For the whole sample, both direct taxes and transfers are found to support the presence of Armey curve.

The empirical analysis is also extended by exploring how changes in the government size affect GDP per capita. In this case the evidence we find using 2SLS in first differences estimation confirms the hypothesis of Armey curve for the full sample though the coefficients are not statistically significant. The results are U-shaped for subsamples.

Section 4.2 reviews the literature whereas section 4.3 reviews the Armey Curve. Data are discussed in section 4.4 in detail. Section 4.5 confirms the empirical analysis and the following section concludes.

4.2) Literature Review

Before the incarnation of the first wave of growth theory, economic (GDP) growth was considered due to factor accumulation which arises from differences in saving rates (Solow), preferences (Cass-Koopmans) and other exogenous variables. However, in recent years, economists have explored the mechanics of growth with different dimensions. For example, the emphasis of Romer (1986) and Lucas (1988) is that the externalities originating from factor accumulation cause steady state growth. The distinctive feature of the models developed by Romer (1990a) and Aghion and Howitt (1992) is that they endogenize steady-state growth and technical progress although their explanation of differences in the level of economic development across countries did not differ from that of the old theories.

Differences in parameters considered essential for growth by both neo-classical and endogenous growth models led research to further avenues. The previous research also proposes other determinants of growth. Among those determinants are – the role of institutions, ideology, human capital, research and development, globalization, finance and growth, short-run and long-run macroeconomics, inequality, social and political factors, government size, investment, supply shocks and population.

Since we aim to empirically test the relationship between the size of government, measured by public expenditures as a share of GDP, and economic growth (Armey Curve) in this chapter, we first review the literature on economic growth followed by the literature on the Armey curve.

4.2.1) Government Size as a Determinant of Economic Growth

The size of government is an important potential determinant of output growth of a country. The evidence for its impact on economic growth has been found to be both positive as well as negative depending on its scope in economic matters and the data sample analysed.

Government size, measured by government expenditures as a share of GDP, may negatively affect economic growth as it potentially can produce distortionary effects for the economy. Dar and AmirKhalkhali (2002) find that a larger government size leads to a lower economic growth indirectly through its adverse impact on factor productivity. They estimate that larger government size in 19 OECD countries from 1971-1999 decreases capital productivity and total factor productivity growth. The efficiency level resulting from larger policy-induced distortions (burden of taxation) is lower in countries where government size is larger. Lack of market mechanisms, likewise, arguably suppresses the efficiency of resource use as well as the presence of crowding-out effects that discourage investment which is pivotal for economic growth. Folster and Henrekson (2001) find a robust negative correlation between public expenditures and economic growth for rich countries. Despite extending the analysis to non-OECD countries, their findings are substantially supported. An analysis of data spanning from 1960-1996 for the US, 23 OECD countries and the larger sample consisting of 60 countries, Gwartney, Holcombe and Lawson (1998) suggest that the government intervention beyond their core functions in the economy reduce investment as a percentage of GDP, labor productivity and real GDP growth. Wildavsky (1975) also argues for a negative relationship between economic growth and expansion of public economy.

The association between GDP growth and government size is also analysed after de-composing government expenditures. Different compositions of government expenditures yield mixed effects, positive and negative, on economic growth. Devarajan, Swaroop and Zou (1996) de-compose government expenditures into current and capital expenditures and analyse their

impact on GDP growth. A rise in economic growth per capita with higher current expenditures and a decrease in GDP growth per capita with more capital expenditures are estimated. Large share of budget allocation for capital expenditures in developing countries implying excessive use of capital expenditures actually turns otherwise productive expenditure into unproductive. Since many components of current expenditures have high rates of return than capital expenditures, the excessive use of capital expenditures results in lower economic growth. To sum up, an excessive use of even the productive, capital, expenditures could become unproductive as is seen in the case of 43 developing countries in their study. Increases in total government outlays, government consumption and government transfers are found to reduce the productivity growth of the private sector by Hansson and Henrekson (1994). Contrarily, government expenditures on education are estimated to have a positive effect whereas government investment has no impact on private productivity growth. Comparing the difference between total and marginal productivity the former is found to affect labor and capital productivity. Using cross-country data of the share of government consumption expenditures in GDP, Landau (1983) finds a negative relation between the fraction of GDP spent as government consumption and real GDP growth per capita.

On the other side of spectrum others have found a positive impact of government involvement. Rubinson (1977) finds that economic growth is promoted by large government size. Using a data set including 115 market economies during 1960 to 1980, Ram (1986) finds a positive impact of government size on economic growth. He also finds a positive externality effect of public expansion on the overall economy and higher factor productivity in the public sector in 1960 at least. Similarly, La Porta, Silances, Shleifer and Vishny (1999) use measures such as government size, government intervention, public sector efficiency, political freedom and supply of public goods to determine the performance of government. Performance of larger governments is concluded to be better. Besides that the performance of poor countries, countries closer to the equator, ethno linguistically heterogeneous and countries using socialist

laws or having more religious population have been found to be inferior. Carr (1989) argues for a positive correlation between the size of government and economic growth[28].

The findings of the literature analysing the impact of the size of government on output growth are not conclusive and, at times, contrary. The difference in the results may largely be attributed to the differences in the data, the sample of countries chosen for the analysis and the difference of the chosen model.

4.2.2) Other Determinants of Economic Growth

The size of government is not the only determinant of economic growth; hence we briefly review a broad variety of literature shedding light on the factors that may potentially have an impact on output growth.

Institutions to some extent are determined by the ideology of statesas they represent the magnitude of government intervention in the economy which makes it an important determinant of economic growth. Policy makers influenced by the idea of free economy might prefer to establish effective and strong institutions for they form the rules of the game by providing economic agents with appropriate incentives. On the contrary, weak institutions and a higher level of government intervention can be found in societies with the objective of a controlled economy. As we already know that government intervention can yield both positive and negative effects - i. e. government existence can be good or bad depending on institutions.

Bjornskov (2005) finds higher economic growth in right-wing societies as compared to left-wing societies as voters in latter might demand inefficient levels of redistribution and government

[28] The findings are suggested to be analysed with caution though. Ignoring the positive externalities generating from goods and services provided by the government and evaluating them at cost value does not perfectly measure government productivity. Further, he suggests, the marking of government intermediate goods as final products also induces a positive bias between the two variables.

intervention whilst paying less heed to the matters of the economy. Haan and Sturm (2000) also suggest that higher economic growth is found in societies which let the economy free.

Economic growth also depends on whether or not the institutions protect property right. Protection of property rights encourages innovation by securing the rights of producers investing for invention/innovation of new technology. Along these lines, the works of Acemoglu, Johnson and Robinson (2005) and Jones (1981) establish institutions as the fundamental cause for long-run economic growth. Furthermore, Keefer and Knack (2002) find any factor negatively affecting institution by decreasing its ability to enforce protection of property rights and the security of contract may hamper economic growth. In their study social polarization negatively affects economic growth by reducing the ability of institutions to enforce property rights.

Investment, undeniably, is among the most important determinants of GDP. De Long and Summers (1990) find a rise in GDP growth by one third of a percentage point per year with a 1% higher investment in machinery and equipment.

Another study by Makki and Somwaru (2004) establishes a positive correlation between GDP growth and foreign direct investment because often the advance technology transfer takes place through foreign direct investment (FDI). Nonetheless, there is an endogeneity problem despite the high returns generated through foreign direct investment as it is attracted by the countries which are either doing well or expected to do well in the future.[29]

According to Solow-Swan (1956) growth model as well as much of the literature that followed, the returns to physical capital are diminishing implying the convergence hypothesis. For example, the work of Benhabib and Spiegel (1994) and King and Levine (1994) support the growth model developed by Solow-Swan (1956)[30].

[29] The argument is owed to Pritchett (1996a).
[30] Although given this, yet the positive externalities ensuing from FDI cannot be ruled out.

The confidence of economic agents, especially investors, heavily depends on the stable political environment of the country. Political instability inevitably causes policy instability with frequent and untimely change of faces in the political office since every political party (dictators if there is a military coup) has a different set of preferences and list of priorities. Alesina, Ozler, Roubini and Swagel (1996) find that higher political instability, measured by the propensity of a government collapse, hampers economic growth. In his work, Fosu (1992) finds a deleterious effect of political instability on economic performance. Likewise, Barro (1991)finds a negative relation between political instability, measured by revolutions, coups and political assassinations, on economic growth and investment. Jong-A-Pin (2009) extending the dimensions of political stability to four, mass civil protest, politically motivated aggression, instability within the political regime and instability of the political regime, also finds lower GDP growth with higher political instability[31].

Incentives of, and constraints on, economic actors are determined by institutions in a country. Acemoglu, Johnson and Robinson (2005) establish arguments about the important role the institutions can play in the economic development of a country as they provide protection of property rights. Similarly, Gould and Gruben (1996) suggest that more protection of intellectual property rights for they provide incentives to innovate would increase GDP growth.

Allocation of a considerable share of the budget for education, health and other human capital investments manifests the importance of human capital for a country. As aptly put by Alderman et al. (1996) developing countries spend more than $100 billion a year on human capital investment. Considering this, its contribution to economic growth requires an in-depth analysis. The significance of human capital in the form of educational attainment is accentuated in many economic growth models, for example; Nelson and Phelps (1966), Lucas (1988), Mulligan and Sala-i-Martin (1993), Rebelo (1991) and Becker, Murphy and Tamura (1990). In an

[31]Campos and Nugent (2002) claimed that there exists neither a causal relationship nor any negative relationship between political instability and economic growth. Nevertheless, they find short-run effect.

empirical study, for example, Barro (2001) finds faster economic growth in those countries which attain higher level of education at their start for a given level of initial per capita GDP and values of policy-related variables. Using the proxies for human capital, some empirical studies of growth (Benhabiband Spiegel (1994) and Barro (1991) also attempt to analyse how higher level of educational attainment affects economic growth though their work suffered due to lack of data availability on education for a large number of countries. The importance of education also implies a positive role for government intervention.

Population is also a significant determinant of GDP. There are two streams of thought. Proponents of higher population argue about the demand-side effects and consider population as a blessing whereas the opponents speak about the supply-side effects the higher population growth generates and consider it a burden on the economy. According to the Malthusian theory of population growth, an arithmetic rise in the resources coupled with a geometric rise in the population growth (unrestricted) would result in famine, disease, misery, starvation, war and a tendency for economies to stagnate at subsistence level. Coale and Hoover (1958)suggest three adverse effects of population growth; capital-shallowing effect, an age dependency effect and an investment-diversion effect. Becker, Glaeser and Murphy (1999) find that an increase in population can decrease productivity as intensive use of land and other natural resources may produce diminishing marginal returns.

On the other hand, Keynes (1936), Hansen (1939) and Reddaway (1939) term slow population growth to be a potential cause of the insufficient aggregate demand that prolonged the 1930's depression.[32] Greater specialization and higher investment in knowledge can also be attributed to high population growth rate that would translate into increased productivity. Likewise, it can also provide with cheap labor and big market.

[32] Though the debate never ended and the view that population growth generates adverse effects dominated from 1960s again and continued thereafter.

Acemoglu, Johnson and Robinson (2005) consider geography also as a potential cause for affecting economic growth. They broke geography into three categories; climate, availability of technology and disease burden. Montesquieu (1748) argues that people in cold climate would be more willing to work whereas the inclination of inhabitants of hot territories towards work would be relatively less due to the heat factor. Sachs (2001) suggests that the productivity of technology in temperate-zone will be less as opposed to the technology in tropical-zone. A reduction of 1.3 percent growth a year due to diseases is found by Sachs (2000).

Culture, since it is composed of the values, beliefs, preferences and attitudes of the society as a whole, is certainly instrumental in any country's economic development. Besides the necessary condition for economic growth such as natural, physical, financial, informational and human resources, the attitude of the society in economic literature is termed as the sufficient condition for economic prosperity. The attitude may include approach towards research and development, equal rights, democracy, honesty, dedication, sincerity, and the willingness to work, learn, participate, innovate and invent as well as the intention and motivation to develop. Mechanism explained in the theory of stages of growth did not always work because Rostow and Harrod-Domarmodels implicitly assume the attitude of under-developed countries similar as that of the developed nations (Todaro 1992). In addition, different cultures based on different beliefs choose a different set of institutions which then determine the rules how the society will work (Greif 1994). Needless to say, free and effective institutions promote growth whereas weak institutions are one of the reasons why GDP growth of developing or under-developed countries is low.

Proponents of "trickle down" economic theory suggest that a rise in income inequality resulting from economic growth has to be swallowed though a hard pill. Their rationale for this advocacy is that the boons of economic development will ultimately be redistributed to the society once the economy becomes better-off as a whole. Kuznets hypothesis re-conciliates with

the idea of trickle-down effect theory. However, there exists a large amount of literature that rather finds a reverse causation. According to the literature, it is the income inequality that reduces growth as opposed to growth causing income inequality. Alesina and Perroti (1996) show that societies with unfair distribution of income and land demand more redistribution through a rise in direct taxes which harm economic growth. Likewise, Persson and Tabellini (1994)find that a higher level of unfair distribution would result in lower growth.

Some government policies increase GDP growth whereas some might bring harmful effects to it. Similarly, taxation policies also receive mixed response as far as their impact on economic growth is concerned. Vedder (2001) finds negative impact of taxes on economic growth elaborating that less taxes mean less government spending. Private sector makes more productive use of resources as compared to public sector as the policies of latter are non-market friendly as well as politically influenced. According to his study, income taxes are more distortionary than sales tax. On the contrary, Helms (1985) finds a positive impact of higher taxation on economic output. Higher taxes may increase economic growth when the revenues generated from them are used to make transfer payments which may lead to improved public services, such as, education, infrastructure and social security needs.

4.3) The Armey Curve

Absence or presence of government in economic matters has always attracted considerable attention and controversy. According to Public Choice literature, corruption, rent seeking activities and excessive taxation causing inefficiency are problems associated with large public sectors. On the other hand, law and order, protection of property rights, confidence in the economy and incentive to save and invest are potential favourable effects that proponents of government expansion put forward. For example, Ram (1986) and Kormendi and Meguire (1986) are studies that find positive effect of government size on the economy whereas Landau (1983), Engen and Skinner (1992), Folster and Henrekson (2001) and Dar and Amirkhalkhali (2002) are studies that find adverse effects of public expansion on the economy. Hence, there arise questions that need to be investigated. Should government exist at all to control and regulate the economy? If yes, what should be the level of its intervention? The research literature is not wholly resolved.

At the limit, a country without government will face significant problems; no rule of law, no protection of property rights, no incentive to either save or invest due to constant fear of expropriation, no confidence on currency and many more issues that can be named. Thus, some government seems essential. Government can promote economic growth by building better legal institutions and administrative as well as economic infrastructure.

On the other hand, the presence of government is not costless. There are many negative effects of government activity that may be the consequence of its rent-seeking behaviour, corruption, excessive taxation and inefficiency.

Given the potentially adverse and favourable consequences of government involvement in the economy, it can be said that government intervention is essential but too much of it is not

desirable. What is the optimum level of government presence then? Is it the government size that causes growth or the other way round?

The Armey curve questions “Wagner’s Law” by reversing the causality between the two variables. Wagner (1892) developed a hypothesis, which later was enshrined in the literature as Wagner’s Law, suggesting an increase in the government size with an increase in income. However, Armey (1995) establishes government size as instead a cause for lower economic growth.

As is suggested by the Armey curve, government involvement in the economy is desirable up to an extent but beyond that point it will damage the economy by decreasing its economic growth. The Armey curve establishes a non-linear, inverted U-shape, relationship between GDP growth and the government size, measured by the government expenditures as a share of GDP. He suggests that the positive implications of government activity on the overall economy may be due to the provision of sub-structures and public goods.The negative effects, however, may result from the crowding-out effect of government monopolistic activities.

The literature investigating the Armey curve is now quite well developed. Vedder and Gallaway (1998) find evidence for the Armey curve. At first, they argue that due to reductions in transaction costs, improved environment for investment, improvement in the rule of law and enforceable property rights the growth of public expansion in the economy leads to higher output growth. However, there is a negative correlation between economic growth and government size if government expands beyond a certain threshold. In their sample including Canada, Denmark, Italy, Sweden, Britain and the US the findings are consistent with the Armey curve.

Tanzi and Zee (1997) also support the Armey curve hypothesis. According to their argument public finance instruments, such as tax, expenditures and overall budgetary policies, could affect

economic growth. These instruments by increasing allocative efficiency, maintaining macroeconomic stability and making income distribution fairerhelp economies to grow more. Nonetheless, their hypothesis is not supported by empirical findings because the findings lack robustness. Contrary to theirs', our findings are robust and consistent with the Armey curve.

Proceeding along the same lines, Grossman (1987) also supports the Armey curve. He develops a simultaneous equations model in order to test the non-linear relationship between the size of government and economic growth. The model is empirically tested using time-series data for the United States and finds substantial support for presence of the Armey curve.

Cashin (1995) develops an endogenous growth framework to study how public investment, public transfers and distortionary taxation affect economic growth. Using time series estimation to support his theory he concludesthat there are trade-offs associated with growth of government. Public investment and transfer payments contribute positively to economic growth as they yield positive externalities by encouraging private investment. Distortionary impact of taxation imposed to fund the supply of public goods, nevertheless, leads to dampen economic growth as they reduce the marginal return to private capital. This chapter also finds strong evidence for the Armey Curve implying both positive and negative effects of government though only for the Non-OECD and weak democratic countries when we decompose the sample.

Using a two – sector model production function employing government and private sector, Ram (1986) analyses the effect of government size on GDP growth. The study supports the Armey curve. Having classified government into three categories, Chen and Lee (2005) conclude that there exists a threshold effect and a non-linear relationship between the size of government and economic growth.

The short and intermediate-run analysis of the Armey curve has also been investigated. Using single and simultaneous equations for less developed and developed countries the study, Lin

(1994), concludes that the growth of government induces economic growth in the short-run but not in the intermediate-run[33].

Besides establishing a non-linear relationship between the size of government and economic growth, some papers also estimate the optimal government size. Handoussa and Reiffers (2003) study the relationship between economic growth and government size having obtained data from 1968 to 1997 for Tunisia. Due to the significant role of the Tunisian government their findings support presence of the Armey curve. According to their findings the government expenditures making up 35% of GDP would induce economic growth beyond which further public expansion will reduce the GDP growth. In another study, (Radwan and Reiffers2004), public consumption constituting 44% of Gross Domestic Product is suggested as optimal government size for Israel[34]. Pevcin (2004) uses panel data estimates of the Armey curve and finds that government expenditures making up 36% to 42% of GDP as an optimal size of government for 12 European countries from 1950 to 1996.

Following the already existing literature, we therefore expect a non-linear, inverted U-shape, relationship betweeneconomic growth and the size of government (government expenditure as a share of GDP). This means that economic development rises with a rise in government expenditures at first but after reaching an optimum level the further rise in government size decreases GDP growth.

[33] 25 years is considered as intermediate-run in this study.
[34] The suggested figure may appear big but it's realistic for countries where the presence of state has penetrated for a long time.

4.4) Data

In order to estimate the relationship between economic growth and the government size we collect annual data from 1981-2010 covering 79 countries[35]. Data collection and their organization take inspiration from two previous studies, Islam (1995) and Lee and Gordon (2005), though unlike them we examine the potential non-linear relationship between economic growth and the size of government. The control variables included are initial Real GDP per capita, openness to trade, the inflation rate, the population growth rate, secondary school enrolment rates, level of democracy, the rule of law and bank deposits as a share of GDP. These are collected following Lee and Gordon (2005) though their research agenda is different than ours.[36] Nevertheless, we replace their measure of institutions with the level of democracy and the rule of law as the data for institutions were not publicly available. Following Islam (1995)[37] we take averages for 5-year time intervals to control for the cyclical effects in the data. We have six data (time) points for each country, averages over – 1981-1985, 1986-1990, 1991-1995, 1996-2000, 2001-2005, 2006-2010. We apply 2SLS estimation and employ time and country fixed effects as used by Islam (1995). We also use errors clustered by country. Besides this, we also examine how changes in current government expenditures and capital expenditures affect economic growth using the same sample. In addition we also investigate how changes in direct taxes and transfers relate to GDP growth.

Our main variable, GDP growth is calculated from PPP converted GDP per capita[38] (chain series), at 2005 constant prices, which is collected from Penn World Table. Its mean value, 1.98, shows a moderate growth on average across the sample which is shown in table 4.1. However, its standard deviation, 4.82, exhibits notable variation across the sample as is indicated in Figure

[35] A country is included if its population is higher than a million and if they have enough observations.
[36] They study the impact of tax structure on economic growth.
[37] They test the convergence hypothesis.
[38] We collect PPP converted GDP growth,measured in millions, and then divide it by population, measured in millions, to get Real GDP growth per capita.

4.1.[39]The figure actually exhibits no trend but we can clearly see periods of falling, recovering and increasing economic growth. In the early 1990s, around 2000 and 2007 the GDP growth is in negative figures due to recession. Besides these periods, the figure shows periods of moderate increases in economic growth or falls.

Government expenditures as a share of GDP are taken from World Economic Outlook – International Monetary Finance (WEO-IMF). It is used to analyse how GDP growth is affected with changes in public expenditures following the hypothesis of Armey (1995). Its mean and standard deviation are 33.40 and 13.53 respectively. Graphical presentation of government involvement is shown in Figure 4.2. Around 1990 and 2007 the government expenditures are shown to be rising which may possibly indicate countercyclical fiscal policy. However, besides these periods the trend rather indicates procyclicality or acyclicality. This is supported by the previous literature. Talvi and Vegh (2005) find fiscal policy is acyclical for G7 countries and procyclical for developing countries. Ilzetzki and Vegh (2008) also find evidence that fiscal policy in developing countries is procyclical. This figure is clearly showing a counter-cyclical pattern when compared with Figure 4.1. Government expenditures as a share of GDP decrease when economy performs well and vice versa.

Besides analysing the impact of the government size on economic growth, we also analyse the impact of current government consumption and public investment on economic growth. We decompose the government expenditures into current and capital expenditures following Ghosh and Gregoriou (2008).

Data for current government expenditures are collected from International Monetary Fund: Government Financial Statistics (IMF-GFS). Its mean and standard deviations are 25.06 and

[39]The graphical presentation does not include all the countries across the sample due to missing data. It includes Bangladesh, Belgium, Botswana, Canada, Denmark, Ethiopia, Finland, France, Ghana, Norway, Spain, Sweden, UK and US only. Sample selection for Figures 4.2 and 4.3 are same.

10.13. The mean shows that it constitutes a considerable fraction of government spending whereas the standard deviation shows notable variation across the sample.

Data source for public investment is also IMF-GFS. Its mean, 3.20, shows that governments on average are not inclined to invest more on capital. Similarly, large variation is indicated by the standard deviation,2.28, across the sample.

We also test the impact of changes in transfers on GDP growth. Transfers are both collected from World Development Indicators. The mean value of direct transfers, 40.72, is suggestive of the fact that governments all over the sample distribute a lot. Contrarily the standard deviation, 20.63, shows big variation,

Initial real GDP per capita[40], measuring the level of development, is a key independent variable identified in the Solow model. It is used to control for the heterogeneity in the level of development across countries. To measure differences in the level of development across the countries in the sample, we take log of initial real GDP per capita. It is calculated by taking the five years average of each data (time) points. The mean and standard deviation of the whole sample are 8.67 and 1.22respectively.

Frankel and Romer (1999) and Dollar and Kraay (2003) suggest openness to trade as an important contributor to economic growth as they find a positive association between them[41]. Following them, we collect data for trade openness (measured by exports plus imports as a share of GDP) from the World Development Indicators (WDI) database. Its mean is 73.33 though substantial variation across the sample is also indicated by the standard deviation which is 46.99.

Comparing democracy with dictatorship, Feng (1997) argues that strong democracies are positively correlated with economic growth, though indirectly, through providing stable political

[40] [PPP converted GDP per capita (chain series), at 2005 constant prices]. Its unit is 2005 International dollar per person.
[41] Their evidence, however, is sceptically viewed by Rodriguez and Rodrick (2001).

system. In order to control for potential ideological effects on growth we take data on polity2[42] variable from Polity IV Individual Country Regime Trends, 1946 – 2013. Its range goes from -10 to 10 where 10 refer most democratic countries whereas -10 to extremely autocratic ones. As indicated by the standard deviation, 6.48, some countries are strongly democratic whereas some are weakly democratic.

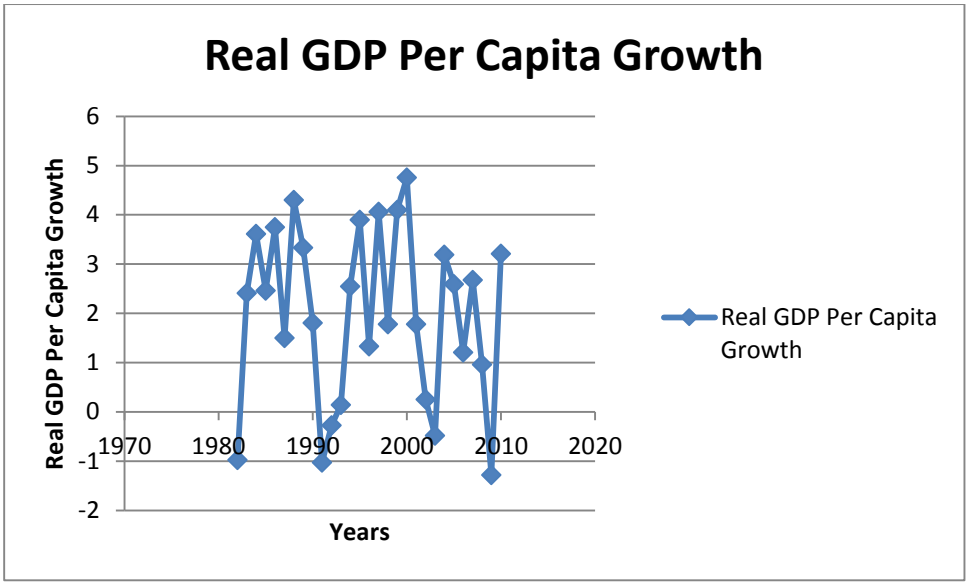
Following Temple (1999), population growth rate data are collected from the WDI database. Its mean value shows that annual population growth rate, on average, is 1.38 across the sample whereas the standard deviation, 1.27, also shows a substantive variation across countries.

[42] It is measured by deducting democratic ratings from autocratic ratings. Autocratic ratings range from -1 to -10 where -10 refer to extremely autocratic. Similarly the ratings for democracy span from 1 to 10 where 10 indicates extremely democratic.

Table 4.1: Summary Statistics of the Variables

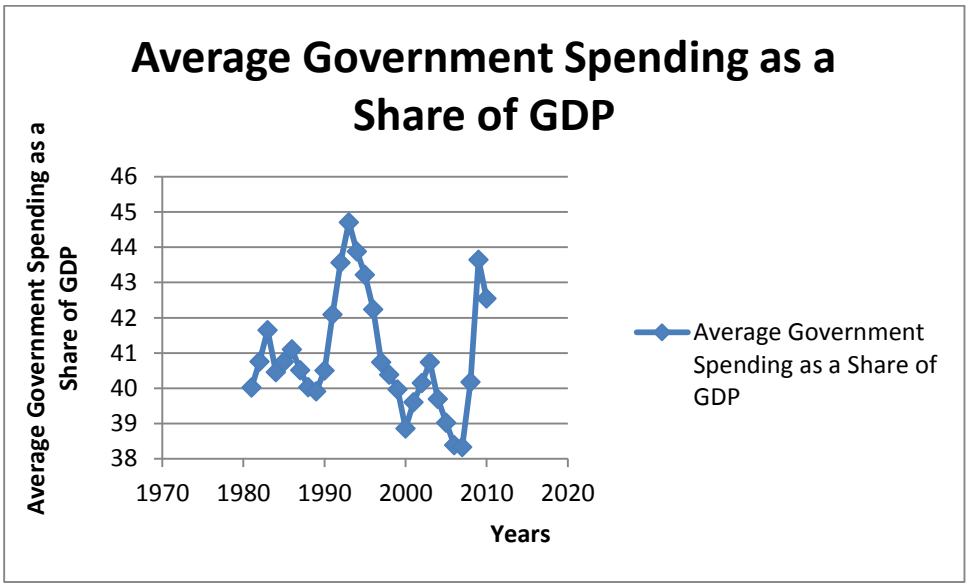
	Observations	Mean	Standard Deviation	Minimum	Maximum
Real GDP Growth Per Capita	406	1.98	4.82	.74	9.58
Government Expenditure (% of GDP)	420	40.92	14.74	12.38	59.112
Secondary School Enrolment	426	72.21	32.37	17.64	85.46
Quality of Democracy (polity2)	436	3.74	6.48	-3.8	10
Natural Log Real GDP per capita	420	9.39	1.37	5.55	11.02
Openness to Trade (Trade)	448	44.30	14.57	13.55	60.24
Investment as a share of GDP	443	22.82	7.02	11.23	32.14
Inflation Rate	405	8.08	6.91	2.77	17.89
Population Growth (Annual)	474	1.38	1.27	.03	2.78
Log Initial Real GDP per capita	448	8.67	1.22	6.48	10.60
public investment	186	3.20	2.28	1.13	9.88
Current Govt Expenditures	189	25.06	10.13	10.36	38.44
Direct Transfers	268	40.72	20.63	16.37	62.52
Bank Deposits/GDP	411	39.48	25.68	18.81	64.66
Rule of Law	237	.12	1.00	-1.38	1.66

Cross country data are taken from 1981-2010. Real GDP per capita (chained series-PPP) is taken from the Penn World Table and Real GDP Growth Per Capita, natural log real GDP per capita and initial real GDP per capita are calculated from real GDP per capita. Government expenditures as a fraction of GDP is taken from World Economic Outlook (IMF). Primary school enrolment rate, openness to trade, inflation rate and population growth rate are taken from World Development Indicators. Polity2 data are collected from Polity IV database.



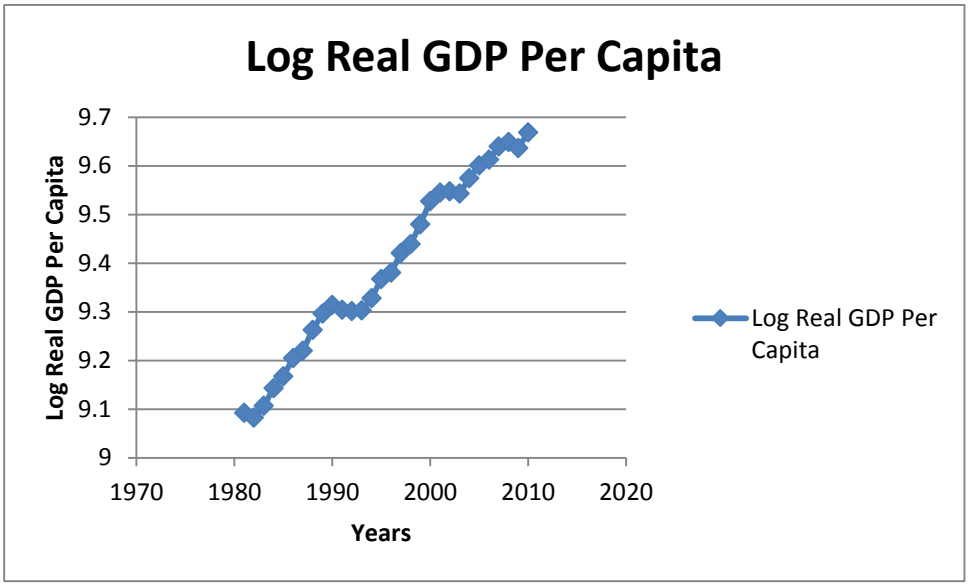
Cross country average annual real GDP growth per capita for Bangladesh, Belgium, Botswana, Canada, Denmark, Ethiopia, Finland, France, Ghana, Norway, Spain, Sweden, UK and US.

Figure: 4.1



Cross country average annual government spending as a share of GDP for Bangladesh, Belgium, Botswana, Canada, Denmark, Ethiopia, Finland, France, Ghana, Norway, Spain, Sweden, UK and US.

Figure: 4.2



Cross country average annual log real GDP per capita for Bangladesh, Belgium, Botswana, Canada, Denmark, Ethiopia, Finland, France, Ghana, Norway, Spain, Sweden, UK and US.

Figure: 4.3

Investment as s share of GDP is collected from World Development Indicators. Summers (1990) find investment to be positively correlated with GDP growth. Its mean and standard deviation are 22.82 and 7.02 respectively.

Education, as it defines the human capital of a country, is expected to be one of the most influential factors in economic growth. Mankiw et al (1992), an authoritative paper in the growth literature, use school enrolment rate in their analysis.[43] Following this paper and Lee and Gordon (2005) we collect primary school enrolment rate as a control variable.[44]

Following Lee and Gordon (2005) we collect inflation rates data. The data are collected from the WDI database. Its mean and standard deviation are 38.16 and 193.71 respectively. Its mean

[43] Nevertheless, there is no agreement on the best measure of education. For example, Benhabib and Spiegel (1994) and Pitchett (1996) can be consulted for detailed explanation.

[44] Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of the education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.

indicates that the inflation rate, on average, is high across the sample. But, nevertheless, the standard deviation shows the data are skewed by hyper-inflation.

Rule of law is included as a control variable to control for political stability. Data for this variable are collected from World Governance Indicators. As suggested by Alesina, Ozler, Roubini and Swagel (1996) that more politically stable governments are found have higher economic growth.

Bank deposits as a share of GDP is included to control for financial development following Gregorio and Guidotti (1995) though they used bank credit to the private sector as a proxy for financial development. They found a positive relation between financial development and economic growth.

4.5) Empirical Findings

This section is divided into two sub-sections. In the first sub-section we will analyse how changes in the government size, measured by government expenditures as a share of GDP, affect economic growth. We will de-compose government expenditures into current government consumption and public investment as shares of GDP and will analyse how these variables are related to economic growth following Ghosh and Gregoriou (2008) in the next sub-section. Building on Cashin (1995), how changes in transfers affect GDP growth is also analysed. Furthermore, we also analyse the impact of government size on real GDP per capita.

4.5.1) Government Size as a Share of GDP

This sub-section presents findings regarding how government size, measured by government expenditures as a share of GDP, affects economic growth. Presented in Table 4.2 are the estimated coefficients of the specification where we regress real GDP growth per capita on government expenditures including control variables. The control variables include initial Real GDP per capita, openness to trade, the inflation rate, the population growth rate, primary school enrolment, level of democracy, rule of law and bank deposits as a share of GDP. Five years averages of data from 1981 to 2010 are taken to control for the cyclical variation which could confound annual data. We apply OLS making use of country and time fixed effects in the specifications. Standard Errors are clustered by country. The relation between GDP growth and the size of government is also tested keeping in view possible correlation between extent of democracy and the government size.

Non-linearity between economic growth and the government spending along with initial GDP per capita taken as a control variable is tested in the first column of Table 4.2. The estimated

coefficients for the linear (at 5%) and quadratic terms (at 1%) are statistically significant. The finding supports presence of the Armey curve. A rise in the government size increases economic growth but once the government size constitutes 42.33% of GDP any further government involvement decreases economic growth. As far as determining the optimal size of government is concerned, the finding is closer to Radwan and Reiffers (2004) who find 44% as a benchmark for optimal government involvement. However, the estimated benchmark is higher than Peden (1991), Scully (1994) and Herath (2012).

Under the classical supply-side paradigm of productivity growth, for example, Peden (1991) finds the presence of Armey curve in the US economy. Data estimation from 1929-1986 finds the optimal government size when government expenditures represent 20% of GDP. In another study, Scully (1994), the size of government measured by income taxes as a share of GNP at all levels (local, state and federal) is estimated to decrease economic growth once these taxes increase beyond 23% of GNP in the United States. Data for this study are from 1949-1989. Along these lines Herath (2012) using time series data from 1959-2009 and second degree polynomial regression confirms presence of the Armey curve for Sri Lanka. Government expenditures composing 27% of GDP is estimated as the optimal government size. According to him, a further increase in government expenditures for additional, unproductive, projects financed by raising taxes and borrowings creates excessive burden and lack of incentives for the workers. Similarly, Radwan and Reiffers (2004) find the optimal government size at 44% whereas Pevcin (2004) finds it when government expenditures represent 36% to 42% of GDP.

Drawing an analysis between our result and previous literature clearly suggests that the optimal government size estimated is substantially large to most of the papers referred in the last paragraph. The coefficients representing government size may be capturing the omitted variable bias.

Besides the main variable in the first column, the estimated coefficient of log initial GDP per capita is negative and strongly significant statistically (at 1%). It supports the convergence hypothesis proposed by Solow (1956) that the GDP per capita of poor countries will grow faster than the GDP per capita of rich countries. The model explains 47.5% of the total variation in the economic growth.

In order to address the omitted variable bias problem we add investment as a share of GDP, trade as a share of GDP, population growth rate, secondary school enrolment rate and the level of democracy as control variables in the next column.

Evidence for the Armey curve is again found in the second column. The benchmark estimated to be efficient is 38.7%. Investment as a share of GDP is positively correlated with GDP per capita. This finding supports Summers (1990) who also finds higher GDP growth with more investment. Positive and strongly significant coefficient of trade implies higher GDP growth would be achieved with more openness. This is in accordance with Frankel and Romer (1999) and Dollar and Kraay (2003). Popualtion is found to be adversely affecting economic growth in previous literatures like Coale and Hoover (1958) and Becker, Glaeser and Murphy (1999). The estimated coefficient of population is negative and significant which supports previous literature.

In column 3 we add inflation rate, rule of law and bank deposits as a share of GDP as control variable. The coefficients related to the government size are estimated to suggest U-shaped association with the GDP growth though the coefficients are insignificant. Initial GDP per capita and investment support the previous findings. Rest of the control variables are not statistically significant.

In columns 4 and 5 the sample is de-composed into weak and strong democratic countries[45]. Drawing a comparison between weak and strong democracies as far as the size of government is concerned is important. Countries with strong democratic structure can arguably sustain larger governments as opposed to dictatorships or weak democracies.

Besley and Persson (2014) argue that the capacity to tax of developing countries is constrained by key factors. Such factors include a heavy reliance on the informal economy, aid and resource dependence, failure of governments to take action, weak political institutions, low contestability of power, weak checks and balances, absence/weak cultural norms and identity with regards to paying taxes and weak state building. Referring to the development cluster argument of Besley and Persson (2011) that different capacities of state coevolve, we may infer weak democracy may limit the capacity of state to tax.

Strong democracies with potentially higher capacity to tax than weak democracies does not imply that the former have limitless capacity to tax. Due to other dynamics related to raising taxes even the strong democracies cannot raise taxes at their will. The Laffer curve is a relevant idea here. A comparison in the previous paragraph is drawn only to make a point that the size of government is expected to be larger in strong democracies than weaker ones.

As expected, the relationship between GDP growth and government size is similar to Armey curve but the coefficients are not statistically significant across less democratic sample. However, statistically insignificant relationship between the two variables throughout the OECD countries is rather U-shaped. One possible interpretation of the results is that the OECD countries already have governments beyond the optimal point. This result reconciles with Besley and Persson (2011). However, such an interpretation runs counter to the public choice literature – where the size of government is determined by political process and is in general not optimally determined.

[45] Strong democratic countries are the ones where the value of polity2 is greater than 6.2 whereas weak democracies are those with polity2 less than or equal to 6.2. This benchmark actually refers to the median value of the level of democracy.

In columns 6 and 7 the full sample is now decomposed for the OECD and non-OECD subsamples. The OECD countries are strongly democratic whereas the non-OECD sample does include some weak democracies. The argument with regards to development cluster also seems to hold for the OECD and non-OECD samples. The OECD countries being strongly democratic can afford to have larger government size due to high fiscal capacity owing to factors discussed in Besley and Persson (2014). The threshold for the OECDs is estimated to be 39.25 whereas, on average, the share of expenditures in GDP is 44.69 across these countries in our sample. This threshold estimated may actually be out of the range of sample taken here.

While summarising Table 4.2, we find mixed evidence. Across less democratic and non-OECD samplesthe hypothesis for the presence of the Armey curve is supported though the coefficients lack significance. Throughout full sample and the OECDs as well as strongly democratic countries the estimated relationship is rather U-shaped. Even the coefficients suggesting a U-shaped correlation do not hold significance.

One possible problem with the results discussed so far is that government consumption is likely to be endogenous in growth: holding everything else constant, it should fall as growth accelerates (and therefore GDP increases) and vice versa. As we mentioned earlier, the endogeneity problem can be caused by many factors such as simultaneity, omitted variable bias and measurement error. In this chapter, government size and government spending may simultaneously affect each other. So the coefficient estimates yielded by OLS estimation may be inconsistent. Therefore, we use a different method, such as 2SLS for further estimation where we take two lags of government expenditures as instrumental variables to control for endogeneity bias in results.

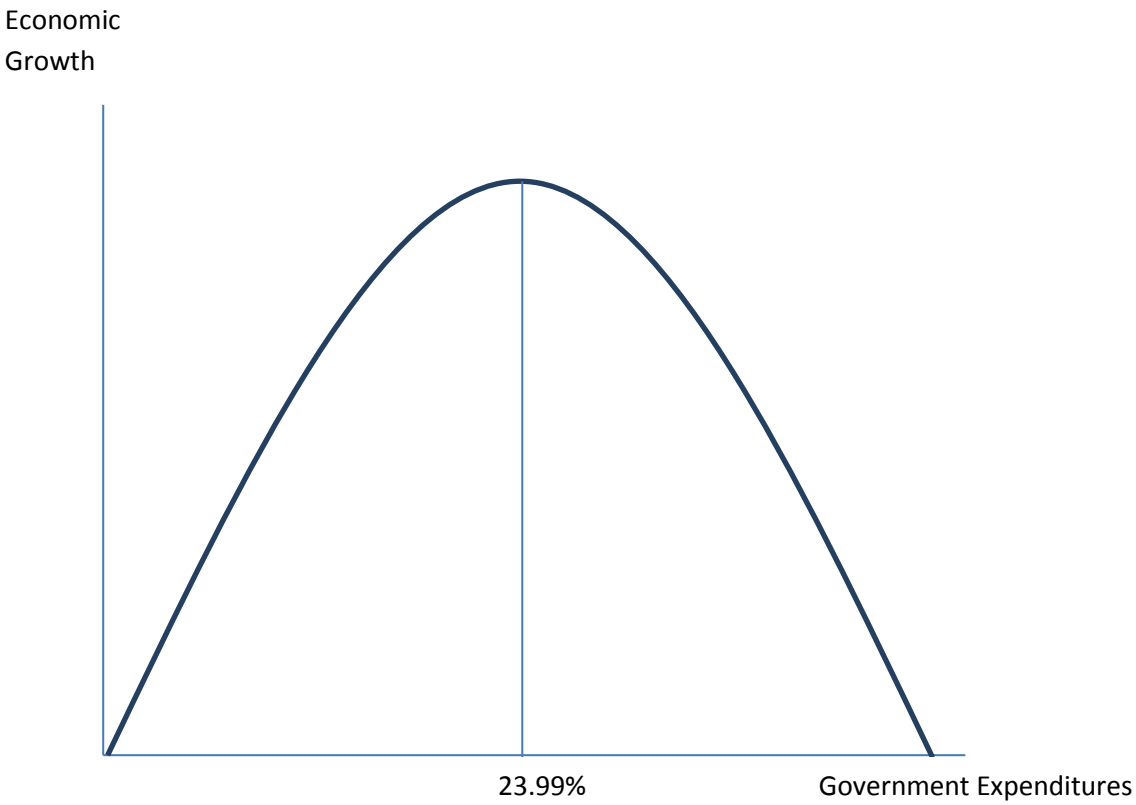
Non-linearity between economic growth and the government spending along with initial GDP per capita taken as a control variable is tested in the first column of Table 4.3. The estimated coefficients of government size do not support Armey Curve as they represent a U-shaped

association between economic growth and government expenditures as a share of GDP. Both linear and quadratic terms are not statistically significant.

Besides the main variable in the first column, the estimated coefficient of log initial GDP per capita is negative and strongly significant statistically (at 1%). It supports the convergence hypothesis proposed by Solow (1956) that the GDP per capita of poor countries will grow faster than the GDP per capita of rich countries.

In the second column we use control variables such as openness to trade, investment as a fraction of GDP, population growth, secondary school enrolment rate and level of democracy. The relationship between GDP growth and the size of government does not change. Rest of the control variables are insignificant except initial GDP per capita and level of democracy. These both variables are negative and significant at 1 and 10% respectively. According to the coefficient estimates of level of democracy, more democratic countries are found to have lower output growth. The finding does not support Feng (1997) who finds a positive correlation between the two variables though indirectly. This may be due to possible correlation between the extent of democracy and the size of government.

We add inflation rate following Lee and Gordon (2005), rule of law to measure political stability and bank deposits as proxy to incorporate the role of financial development in the third column. The finding related to GDP growth and the size of government still represents a U-shaped association but holds significance at 5%. Besides this the trade and investment as a share of GDP are positively and significantly correlated to economic growth. A positive association between trade and output growth supports Romer (1999) and Dollar and Kraay (2003) who also find a positive correlation between the two variables.The level of democracy is again negatively but strongly significant associated with GDP growth.



Graph 4.1: The relationship between the Government Size and Economic Growth

Unlike Table 4.2, we cannot estimate the relationship between economic growth and the government size decomposing the sample into weak and strong democratic countries. This is because the sample does not have enough observations. However, we test for the Armey curve across non-OECD and OECD countries.

The Armey Curve is found to exist in both sub-samples but statistically significant for non-OECD countries only. Across non-OECD countries the efficient level of government expenditures is found when they constitute 23.99% of GDP. For the OECD countries the benchmark is found to be 27.5% though the coefficients are insignificant. As far as determining the optimal size of

government is concerned, the finding for non-OECDs is closer to Peden (1991), Scully (1994) and Herath (2012).

A possible explanation for the lack of relationship across OECDs is that virtually all of them already have governments at or above the optimal level. As it is mentioned already, the fraction of GDP constituted as government expenditures is 44.69% which goes beyond the optimal level determined here. This may also be the reason why the findings related to the full sample are found to have a U-shaped relationship in the previous table.

There is no support found for the convergence hypothesis across non-OECD countries whereas population growth rate is negative and strongly significant. Secondary school enrolment rate is positively correlated with economic growth supporting Barro (2001), Nelson and Phelps (1966), Lucas (1988), Mulligan and Sala-i-Martin (1993),Rebelo (1991) and Becker, Murphy and Tamura (1990). Moreover, economic growth is also found to be higher with stable political system. This result is in accordance with previous literature as Alesina, Ozler, Roubini and Swagel (1996).

In short, we find substantial support for the presence of the Armey Curve in non-OECD countries. The optimal level of government expenditures is estimated to be 23.99% of GDP. The relationship found between GDP growth and the size of the government also supports the Armey Curve for the OECD sample but the estimated coefficients are insignificant. Contrary to sub-samples the findings of the whole sample rather suggest a U-shaped correlation. This does not support the Armey Curve hypothesis. This contrary finding of the full sample may be due to the fact that the OECD countries already have governments at or beyond this benchmark.

Another possible problem with results so far can be non-stationarity of data that may cause results to be spurious. We fail to reject the hypothesis that all variables, except the dependent variable (real GDP growth per capita), contain unit roots when we apply Im-Pesaran-

Shin (IPS) test, following Im, Pesaran and Shin (2003). Persistence of shocks likely to be infinite and the standard assumption for asymptotic analysis being invalid may potentially affect the results if unit roots are present. Thus, we difference the data of all variables to control for non-stationarity except real GDP growth per capita as it is found to be stationary.

We also explore the Armey curve using first difference estimation along with 2SLS in Table 4.4. Due to taking first difference we faced lack of data problem. Hence, Table 4.4 has only two columns. We find no evidence for the presence of the Armey curve in both columns when we control for possible endogeneity issue and the presence of unit roots.

Comparing the findings of Table 4.2, 4.3 and 4.4 (OLS, 2SLS where we take lags of government size and use them as instrumental variables and 2SLS with First Difference where we difference all variables except real GDP growth per capita as it is stationary), it can be safely said that the findings with 2SLS estimation give better information of the relationship between economic growth and the government size across non-OECD and the OECD countries. With 2SLS estimation there is substantial support for the presence of Armey curve throughout non-OECD and the OECDs though the coefficients are statistically significant only for non-OECD countries. The OECD countries are also found to sustain large governments. There is no evidence, nonetheless, for the presence of the Armey curve when we employ 2SLS in first differences estimation.

Since the government size can be correlated with the extent of democracy we also investigate further by using government size and extent of democracy variables as interactive variables in Table 4.5. Due to lack of data for the OECD countries we do not have estimated results for these countries. Thus, the Table 4.5 contains four columns. The sample composed of non-OECD countries is again found to support the presence of Armey Curve. An inverted U-shape correlation between GDP growth and the size of government suggests government size to be optimal at 23.02%. The results relating to full sample, however, are found to suggest rather a U-shaped association between the two variables.

The interactive variable is found to be consistently positive in all columns and statistically significant in the full sample and across non-OECD countries. The explained variation in the dependent variable is almost 97%.

To summarise, we find notable support for the presence of Armey Curve in non-OECD countries. The suggested benchmark is when government expenditures constitute 23.02% of GDP. This is very close to what we get for Table 4.2. The result of the full sample suggests a U-shaped correlation which is contrary to the Armey Curve hypothesis but the estimated coefficients are not statistically significant.

4.5.2) Tests for the validity of the Instrumental Variables

The lagged variables are considered as natural candidates to be used for instruments yet they are not necessarily good instruments. Given that the only instrumental variables (IVs) used here are lags of government expenditure, it is very well possible that these affect growth directly rather than only through their effect on contemporaneous government expenditure. Another potential problem is that they may be weak instruments which may cause IV estimates to be seriously biased even in large samples (Bound, Jaeger and Baker, 1995) and, thus, lead to spurious estimates of significance (Murray, (2006)). In order to analyse whether or not the instruments used are valid, a generally recommended criterion is to use F-test of joint significance of the instrumental variables in the first stage regression. The null hypothesis under this test is that the instruments are not valid or weak.

F-statistics are reported in Table 4.3. In most instances unfortunately we fail to reject the null hypothesis, i. e. the instruments used for analysis are found to be weak. Only in column 5 for the OECD sample are the instruments found to be reasonably strong. The validity of instruments used in Table 4.4 and Table 4.5 is also examined. The instrumental variables are still found to be

invalid. This inevitably raises scepticism about the accuracy of the estimates, especially in the non-OECD where the inverted U-shape (Armey curve) correlation between growth and government size was found.

We also apply Sargan-Hansen J test to investigate the exclusion restriction. This tests over-identifying restrictions in a statistical model. The null hypothesis under this test is that over-identifying restrictions are valid (hence that the instruments satisfy the exclusion restriction). According to the Sargan-Hansen J test, the instrumental variables in Table 4.3 are found to be valid in all columns except column 1 where we do not use control variables. This somewhat reduces the suspicion about the accuracy of coefficient estimates. Hence it appears that the exclusion restriction is not violated.

We also test for the quality of instruments in Table 4.4 and Table 4.5 where the data are differenced. The Sargan-Hansen J test suggests that the instruments are valid for column 1 of Table 4.4 but the instruments are found to be weak in column 2 where control variables are included in the regression. Along these lines, the instrumental variables are suggested to be valid in column 2 and column 4 of Table 4.5.

Given the doubts cast on the validity of lagged variables used as instrumental variables in our analysis, we acknowledge that the analysis presented may be biased to some extent. However, the previous literature does not suggest any suitable variable that can be used as instrumental variable for government expenditures. The existing literature investigating the Armey curve also suffers from this potential flaw.

4.5.3) Government Consumption and Investment

Following Ghosh and Gregoriou (2008), we test for how changes in composition of government expenditures (current government consumption and public investment) are related to GDP growth. We decompose government expenditures into current and public investment following Ghosh and Gregoriou (2008) where they surprisingly find current government expenditures to be positively correlated with economic growth whereas the correlation between public investment and output growth is negative.For example, public spending on operations and maintenance has a stronger impact on economic growth than both health and education expenditures. Likewise, Devarajan*et al* (1996), using data for 43 countries from 1970-1990, find a positive relation between current spending and per capita real GDP growth. However, they find that the capital component of expenditures negatively associated with economic growth. Nevertheless, there is some literature that finds contrasting results. Aschauer (1989) finds that capital spending such as; infrastructure of streets, water systems, mass transit, highways, airports and sewers, have a positive impact on productivity. Similarly, Easterly and Rebelo (1993) find investment in transport and communication positively correlated with growth.

Table 4.6 and Table 4.7 show results for current and public investment.We apply OLS estimation. Moreover, we do not include rule of law and bank deposits as a share of GDP as they do not have enough observations.

In column 1 (with only one control variable; log initial real GDP per capita) of Table 4.6, the estimated coefficient for current government consumption, measuring the government size, is positive though insignificant. In the second column, when we add other control variables, the coefficient estimates is found to be negative though the significance level stays the same. In the third column, which also includes inflation rate as an additional control variable, we find positive impact of current government expenditures on real GDP growth per capita. This result is in

agreement with Ghosh and Gregoriou (2008) and Devarajan*et al* (1996) who also find a positive correlation between the two variables.

As before, columns 4 and 5 report the coefficient estimates of a decomposed sample into weak and strong democracies. In strong democracies we find evidence for positive impact of current spending on economic growth whereas the weaker democracies are found to be negatively affected.

In non-OECD and OECD sub-samples, columns 6 and 7, the estimated coefficients are positive. These results again support Ghosh and Gregoriou (2008) and Devarajan*et al* (1996).

To be precise, we find support for Ghosh and Gregoriou (2008) and Devarajan*et al* (1996) across full sample (column 3), non-OECD and OECD and strong democracies. Increase in current government expenditures lead to higher output growth. Lack of significance may result from lack of variation in the data as we take five year averages to control for business cycle fluctuation.

The next Table 4.7 reports the results for the government size measured by public investment. The estimated coefficients in first three columns are positive implying a positive association between public investment and economic growth. These results do not support Ghosh and Gregoriou (2008) and Devarajan*et al* (1996). Nonetheless, the results are found to support Aschauer (1989) and Easterly and Rebelo (1993) who also find positive correlation between public investment and GDP growth.

The estimated coefficients are positive in columns 4 and 6 whereas these are negative in columns 5 and 7. In strong democracies and the OECD countries, public investment is estimated to be negatively associated with economic growth supporting the findings of Ghosh and Gregoriou (2008) and Devarajan*et al* (1996). On the contrary, higher public investment is found to positively affect economic growth in weaker democracies and non-OECD countries supporting Aschauer (1989) and Easterly and Rebelo (1993).

In a nutshell, we find evidence for positive effect of public investment on GDP growth for full samples, weak democracies and non-OECD countries. These results are in agreement with Aschauer (1989) and Easterly and Rebelo (1993). However, the findings across strong democracies and the OECD countries reconcile with Ghosh and Gregoriou (2008) and Devarajan*et al* (1996) as the estimated coefficients are negative.

In column 1 of Table 4.8, we find a U-shaped correlation between GDP growth and current government consumption. Both linear and quadratic coefficients are statistically significant at 5% and 1%. A rise in government spending decreases output growth but any further rise in government consumption increases GDP growth once it reaches 39.41%. This does not support Armey Curve though with a different dependent variable.

The association between output growth and government consumption remains U-shaped in second and third columns, though insignificant, when we add control variables. These results also oppose the presence of Armey Curve in our full sample.

We decompose the sample into weak and strong democracies in columns 4 and 5 respectively. For weak democracies, there is no support for the presence of the Armey Curve as the estimated coefficients refer to a U-shaped correlation. On the other hand, Armey Curve is supported in stronger democratic countries. For stronger democracies the efficient level of government size is found to be 40%.

Columns 6 and 7 report the analysis decomposing the sample into non-OECD and OECD countries respectively. We find a U-shaped correlation for the non-OECD countries whereas the association between the two variables in the OECDs is found to be an inverted U-shape. However, only the estimated coefficients for the OECD countries hold statistical significance. So we find enough support for the presence of the Armey Curve in OECDs whereas the finding is

totally opposite for the non-OECDs. The efficient level of the government spending is estimated to be 35.54%.

While summarising the findings of Table 4.8, it can be analysed that we find no support for the Armey Curve hypothesis for the full sample though with a different dependent variable. Drawing a comparison between OECDs and Non-OECDs, there is substantial support for an inverted U-shape hypothesis for current government expenditures in the OECD sample as well as strongly democratic sample. On the other hand, Non-OECD and less democratic countries are found to have a U-shaped association. The maximum public spending as a share of GDP is reported 38.44% which is closer to the benchmark we estimate for strong democracies (40%) and the OECD countries (35.54). According to these results, these countries should not increase public spending any more. On the other hand, the results indicate a U-shaped correlation in full sample (column 3), weak democracies (4) and non-OECD countries (column 6). Their estimated thresholds are 36.16%, 40.5% and 33.1% respectively. Hence, these countries are suggested to increase their public spending.

In Table 4.9 we investigate the relationship between GDP growth and public investment measuring the size of government. Both the coefficients (linear and quadratic) in the first column are positive though statistically insignificant. On the other hand, columns 2 and 3 where we add all control variables are found to suggest a U-shaped correlation between GDP growth and capital expenditures. Though with a different dependent variable, these results do not support the presence of the Armey Curve.

Next, we decompose the sample into less and more democratic countries. We find a U-shaped correlation between economic growth and capital expenditures for both sub-samples. The result does not support the Armey Curve hypothesis though the estimated coefficients are statistically insignificant.

As before, we further decompose the sample into non-OECD and the OECDs. In case of non-OECDs both the linear and quadratic coefficients are positive whereas the estimated coefficients related to the OECD countries are negative. However, none of them holds significance.

The results related to capital expenditures are rather more fragile. There is a U-shaped association found between economic growth and capital expenditures in the whole sample though insignificant. For non-OECD and OECD countries the estimated coefficients (linear and quadratic) are positive and negative respectively though statistically insignificant. On the other hand, less and more democratic samples are found to suggest a U-shaped association between GDP growth and public investment.

Because of possible endogeneity between these variables and the government size, we apply 2SLS estimation to assess non-linear relationship. To do so, we take two lags of current consumption and public investment as instrumental variables. We can only estimate results for full sample, strong democratic countries and the OECDs because the data for weak democracies and non-OECD countries were not sufficient. Due to possible non-stationarity, we applied Im-Pesaran-Shin test. But, owing to lack of observations the test failed to test the hypothesis of unit root presence could not be rejected. Thus, the results may be spurious.

Throughout Table 4.10, we consistently find an inverted U-shape correlation between current government consumption and economic growth. These results do not support the hypothesis of Armey curve. With 2SLS estimation, results for both strong democracies and the OECD countries also suggest a U-shaped relationship which was not the case with OLS estimation.

Across Table 4.11, the estimated coefficients suggest a U-shaped relationship between public investment and GDP growth except for column 1 where control variables are missing. The results do not confirm the presence of Armey curve for public investment. With controlling endogeneity

bias, the estimated coefficients retain significance. Moreover, the results consistently suggest a U-shaped unlike with OLS estimation.

Following Cashin (1995) we also analyse the impact of direct transfers on output growth in Tables 4.12. According to him, transfers and public investment are positively correlated with the output growth. We rather investigate the non-linear relationship of this variable with the GDP growth following the Armey Curve. This table consists of two columns only due to lack of observations. A U-shaped correlation is found between GDP growth and direct transfers in column 1, though statistically insignificant, where we only add initial GDP per capita as a control variable. The estimated coefficients in column 2 (where we add all control variables) of Table 4.12 support the hypothesis of Armey Curve and the coefficients hold statistical significance at 1%. An increase in direct transfers lead to higher economic growth but the association between the two variables becomes negative once transfers constitute 53.17% of GDP.

When we analyse the data statistics for this variable, the maximum amount of transfers is reported to be 62.52 whereas the mean is 40.72. On average, higher direct transfers can still be made that will stimulate economic growth as well. To be precise, we find considerable support for the hypothesis of Armey Curve when we investigate the correlation between GDP growth and government direct transfers including all control variables.

In Table 4.13 we estimate the impact of changes in the government size on GDP per capita with 2SLS estimation. We find no support for the presence of the Armey curve in Table 4.13 where the association between economic growth and GDP per capita is estimated to be U-shaped across the sub-samples though both the coefficients in the full sample are positive.

Table 4.14 replicates Table 2.13 but additionally with first difference estimation. We can only report two columns (one with one control variable and the other with all the control variables) as we lose information when we difference the data. Both column 1 and column 2 are estimated

to suggest an inverted U-shape association between GDP per capita and the government size though the significance at 5% is held by only the quadratic term in column 1. The estimated threshold in column 2 is found to be 45% which is very closer to Radwan and Reiffers (2004) who find it to be 44%.

4.6) Conclusion

This chapter analyses the optimal government size for economic growth following the Armey Curve (1995). We find some support for the presence of the Armey Curve (1995) across Non-OECD countries using data from 1981-2010. The estimated efficient level for government expenditures is attained when they represent 23.99% of GDP. Once government expansion reaches this threshold, further increases in government size are associated with lower output growth. Similar results hold for the sample of weak democracies. On the other hand, a U-shaped and inverted U-shape correlation is also found across the full sample and the OECD countries but the results lack robustness. This does not support the hypothesis of Armey curve and may imply the capacity of the OECD countries to sustain large governments as their share, on average, is already 44.69%.Moreover there is a potential endogeneity problem in this entire literature. When government size is instrumented with its own lags, these are found to be somewhat weak in the non-OECD countries. Thus it is not impossible to rule out the possibility that the estimated Armey curve results may be spurious.

We reproduce the empirical analysis after decomposing government expenditures into current government consumption and public investment followingGhosh and Gregoriou (2008). The evidence for the Armey Curve (1995) across the OECDs and strong democracies is substantial for government consumption though the results relating to public investment are rather fragile with OLS estimation. Nevertheless, the results are consistently found to be U-shaped when we control for endogeneity bias.

Furthermore, following Cashin (1995), we test the relationship between transfers and economic growth. Direct transfers are found to have an inverted U-shape relationship with economic growth supporting the evidence of the Armey curve across the full sample.

We also find evidence for the Armey curve hypothesis when we regress GDP per capita on the government size applying 2SLS estimation in first differences for the whole sample though the results are found to be U-shaped for decomposed samples.

The novelty of this study is the use of panel data analysis for estimating the optimal government size and the latest data. In addition, we extend the empirical analysis to investigate how composition of government expenditures affects economic growth. Besides this, empirical analysis on direct transfers and GDP per capita is also offered.

Table4.2: GDP Growth

	(1) OLS	(2) OLS	(3) OLS	(4) OLS Weak Democracy	(5) OLS Strong Democracy	(6) OLS Non-OECD	(7) OLS OECD
Govt Expenditures	0.254	0.387	-0.105	0.375	-0.645	0.041	-0.628
	(0.117)**	(0.181)**	(0.527)	(1.273)	(0.612)	(0.539)	(0.618)
Govt Expenditures Squared	-0.003	-0.005	0.003	-0.012	0.009	-0.002	0.008
	(0.001)***	(0.002)***	(0.007)	(0.022)	(0.007)	(0.008)	(0.007)
Initial GDP per capita	-8.333	-8.880	-9.628	-5.921	-10.672	-9.230	-9.198
	(1.738)***	(1.466)***	(1.983)***	(3.109)*	(2.835)***	(2.393)***	(3.855)**
Investment/GDP		0.147	0.250	0.300	0.334	0.123	0.226
		(0.071)**	(0.096)**	(0.325)	(0.115)***	(0.105)	(0.244)
Trade		0.053	0.023	0.031	0.010	0.017	0.111
		(0.024)**	(0.031)	(0.067)	(0.037)	(0.034)	(0.048)**
Population Growth		-1.452	-1.222	-0.255	-1.164	0.139	-1.200
		(0.676)**	(0.962)	(1.926)	(1.306)	(1.160)	(1.450)
Secondary School Enrolment		0.023	0.035	-0.056	0.013	-0.056	0.010
		(0.033)	(0.050)	(0.152)	(0.040)	(0.096)	(0.034)
Level of Democracy		-0.125	0.135	0.108	1.120	0.087	0.717
		(0.121)	(0.189)	(0.292)	(0.821)	(0.230)	(0.757)
Inflation			-0.179	-0.097	-0.374	-0.216	-0.001
			(0.164)	(0.197)	(0.146)**	(0.162)	(0.122)
Rule of Law			0.748	1.190	0.496	-1.176	1.491
			(2.088)	(4.200)	(2.973)	(2.571)	(2.404)
Bank Deposits/GDP			-0.034	0.162	-0.011	0.025	0.021
			(0.025)	(0.169)	(0.022)	(0.075)	(0.011)*
Observations	344	311	191	74	117	125	66
R-squared	0.475	0.557	0.651	0.780	0.745	0.722	0.837

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 4.3: GDP Growth

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS Non-OECD	(5) 2SLS OECD
Govt Expenditures	-0.519	-0.465	-2.547	3.215	0.055
	(1.265)	(0.921)	(1.186)**	(1.542)**	(0.604)
Govt Expenditures Squared	0.006	0.005	0.030	-0.067	-0.001
	(0.014)	(0.010)	(0.014)**	(0.023)***	(0.006)
Initial GDP per capita	-10.871	-12.863	-14.202	4.083	-23.555
	(3.584)***	(3.280)***	(2.851)***	(3.604)	(2.505)***
Trade		0.071	0.218	0.108	-0.128
		(0.060)	(0.068)***	(0.065)*	(0.034)***
Investment/GDP		0.052	0.195	-0.031	0.172
		(0.074)	(0.081)**	(0.097)	(0.081)**
Population Growth		-0.816	-3.973	-9.248	2.367
		(0.764)	(1.217)***	(2.607)***	(0.719)***
Secondary School Enrolment		0.067	0.151	0.918	-0.335
		(0.045)	(0.093)	(0.223)***	(0.050)***
Level of Democracy		-0.409	-0.785	-0.133	-9.202
		(0.238)*	(0.185)***	(0.320)	(1.465)***
Inflation			0.122	-0.161	-1.609
			(0.100)	(0.195)	(0.185)***
Rule of Law			1.670	7.162	2.479
			(3.458)	(3.649)**	(1.787)
Bank Deposits/GDP			0.023	0.115	-0.029
			(0.031)	(0.148)	(0.006)***
F-Statistic (p-value)	0.73	0.24	0.99	0.14	0.03
Sargan-Hansen J (p-value)	0.026	0.17	0.74	0.81	0.06
Observations	116	108	79	43	36
R-squared	0.712	0.816	0.910	0.959	0.994

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

We use 2SLS estimation taking two lags of Government Expenditures as instrumental variables to control for possible endogeneity.F-Statistic and Sargan-Hansen J are used to test the quality of the instruments.

Table 4.4: GDP Growth

	(1) 2SLS+FD	(2) 2SLS+FD
Govt Expenditures	-0.027	-0.223
	(0.378)	(0.475)
Govt Expenditures Squared	-0.003	0.0001
	(0.004)	(0.005)
Initial GDP per capita	-13.180	-7.434
	(4.722)***	(10.922)
Trade		0.095
		(0.253)
Investment/GDP		0.031
		(0.194)
Population Growth		-0.099
		(0.964)
Secondary School Enrolment		0.057
		(0.043)
Level of Democracy		-0.400
		(0.829)
F-Statistic (p-value)	0.27	0.13
Sargan-Hansen J (p-value)	0.14	0.0001
Observations	116	103
R-squared	0.622	0.730

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS, taking two lags of Government Expenditures as instrumental variables to control for possible endogeneity, and first difference estimations where we difference all variables except real GDP growth per capita as it is stationary.F-Statistic and Sargan-Hansen J are used to test the quality of the instruments.

Table 4.5: GDP Growth

	(1) 2SLS+FD	(2) 2SLS+FD	(3) 2SLS+FD	(4) 2SLS+FD Non-OECD
Govt Expenditures	-0.519	0.045	-1.441	2.625
	(1.265)	(1.126)	(1.121)	(0.947)***
Govt Expenditures Squared	0.006	-0.003	0.015	-0.057
	(0.014)	(0.014)	(0.014)	(0.014)***
Initial GDP per capita	-10.871	-11.561	-12.618	1.943
	(3.584)***	(3.199)***	(2.342)***	(2.136)
Trade		0.055	0.198	0.131
		(0.069)	(0.068)***	(0.057)**
Investment/GDP		0.093	0.219	0.065
		(0.062)	(0.079)***	(0.084)
Population Growth		-0.842	-2.444	-7.309
		(0.749)	(1.126)**	(1.837)***
Secondary School Enrolment		0.054	0.270	0.992
		(0.041)	(0.105)**	(0.227)***
Level of Democracy		-0.814	-1.869	-1.298
		(0.495)*	(0.540)***	(0.540)**
Democracy*GovernmentSize		0.022	0.044	0.044
		(0.024)	(0.018)**	(0.023)*
Inflation			0.088	-0.237
			(0.091)	(0.199)
Rule of Law			5.035	9.397
			(2.980)*	(3.448)***
Bank Deposits/GDP			0.049	0.175
			(0.032)	(0.142)
F-Statistic (p-value)	0.73	0.27	0.68	0.26
Sargan-Hansen J (p-value)	0.02	0.06	0.03	0.08
Observations	116	108	79	43
R-squared	0.712	0.810	0.923	0.968

Notes: Same as Table 4.5. However, we use government size and extent of democracy as control variables in the analysis. We use 2SLS, taking two lags of Government Expenditures as instrumental variables to control for possible endogeneity, and first difference estimations where we difference all variables except real GDP growth per capita as it is stationary.F-Statistic and Sargan-Hansen J are used to test the quality of the instruments.

Table 4.6: GDP Growth

	(1) OLS	(2) OLS	(3) OLS	(4) OLS Weak Democracy	(5) OLS Strong Democracy	(6) OLS Non-OECD	(7) OLS OECD
Current Govt Expenditures	0.104	-0.025	0.018	0.046	0.102	-0.018	0.051
	(0.139)	(0.146)	(0.151)	(0.337)	(0.249)	(0.324)	(0.240)
Initial GDP per capita	-8.377	-8.194	-4.748	-7.523	-5.385	-4.938	-7.018
	(2.452)***	(3.328)**	(3.324)	(4.797)	(2.353)**	(4.263)	(3.291)**
Investment/GDP		0.141	0.176	0.212	0.346	0.143	0.208
		(0.106)	(0.113)	(0.172)	(0.275)	(0.149)	(0.303)
Trade		0.056	0.056	0.087	0.015	0.086	-0.033
		(0.039)	(0.041)	(0.036)**	(0.042)	(0.046)*	(0.043)
Population Growth		-1.684	-2.066	-2.360	0.281	-2.619	-0.654
		(0.881)*	(0.856)**	(1.994)	(1.404)	(1.825)	(1.682)
Secondary School Enrolment		0.066	0.033	0.314	0.032	0.110	0.029
		(0.050)	(0.032)	(0.246)	(0.028)	(0.151)	(0.023)
Level of Democracy		-0.046	-0.111	-0.282	1.435	-0.104	0.325
		(0.210)	(0.201)	(0.337)	(1.112)	(0.256)	(0.184)*
Inflation			0.066	-0.083	0.191	0.021	0.104
			(0.116)	(0.244)	(0.098)*	(0.307)	(0.115)
Observations	183	161	139	57	82	68	71
R-squared	0.538	0.621	0.712	0.798	0.838	0.740	0.769

NOTES: Cross country regressions of Govt Consumption including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis.Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 4.7: GDP Growth

	(1) OLS	(2) OLS	(3) OLS	(4) OLS Weak Democracy	(5) OLS Strong Democracy	(6) OLS Non-OECD	(7) OLS OECD
public investment	0.167	0.156	0.182	0.290	-0.071	0.266	-0.854
	(0.287)	(0.301)	(0.240)	(0.362)	(0.313)	(0.329)	(0.525)
Initial GDP per capita	-9.671	-8.156	-4.976	-8.893	-4.571	-5.329	-6.213
	(1.690)***	(2.972)***	(2.863)*	(3.874)**	(3.213)	(3.320)	(3.333)*
Investment/GDP		0.134	0.165	0.173	0.272	0.123	0.089
		(0.108)	(0.106)	(0.157)	(0.132)**	(0.147)	(0.135)
Trade		0.061	0.057	0.094	0.001	0.089	-0.062
		(0.036)	(0.036)	(0.039)**	(0.034)	(0.043)**	(0.035)*
Population Growth		-1.601	-2.192	-2.602	-0.004	-2.551	-0.625
		(0.695)**	(0.613)***	(0.826)***	(1.563)	(0.782)***	(2.178)
Secondary School Enrolment		0.066	0.033	0.350	0.025	0.127	0.026
		(0.051)	(0.033)	(0.247)	(0.020)	(0.153)	(0.017)
Level of Democracy		-0.040	-0.120	-0.254	1.400	-0.111	0.263
		(0.195)	(0.175)	(0.321)	(1.050)	(0.259)	(0.171)
Inflation			0.063	-0.106	0.164	0.028	0.034
			(0.089)	(0.208)	(0.075)**	(0.201)	(0.114)
Observations	180	158	136	57	79	68	68
R-squared	0.530	0.622	0.715	0.805	0.833	0.748	0.786

NOTES: Cross country regressions of Govt Investment including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis.Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 4.8: GDP Growth

	(1) OLS	(2) OLS	(3) OLS	(4) OLS Weak Democracy	(5) OLS Strong Democracy	(6) OLS Non-OECD	(7) OLS OECD
Current Govt Expenditures	-0.473	-0.496	-0.217	-0.331	0.640	-0.324	0.782
	(0.212)**	(0.315)	(0.251)	(0.396)	(0.350)*	(0.387)	(0.376)*
Current Govt Expenditures Squared	0.006	0.006	0.003	0.005	-0.008	0.004	-0.011
	(0.002)***	(0.004)	(0.004)	(0.008)	(0.003)**	(0.005)	(0.004)***
Initial GDP per capita	-6.889	-7.497	-4.451	-6.978	-4.344	-5.340	-9.454
	(2.837)**	(3.229)**	(3.441)	(4.475)	(2.562)	(3.896)	(3.258)***
Investment/GDP		0.119	0.167	0.216	0.338	0.139	0.252
		(0.107)	(0.114)	(0.175)	(0.267)	(0.152)	(0.292)
Trade		0.059	0.060	0.094	0.004	0.091	-0.068
		(0.038)	(0.042)	(0.037)**	(0.039)	(0.048)*	(0.043)
Population Growth		-0.607	-1.483	-1.287	0.362	-1.852	-0.517
		(1.366)	(1.366)	(3.383)	(1.390)	(2.587)	(1.687)
Secondary School Enrolment		0.078	0.043	0.364	0.024	0.149	0.004
		(0.054)	(0.036)	(0.299)	(0.031)	(0.174)	(0.027)
Level of Democracy		-0.050	-0.087	-0.266	1.726	-0.081	0.385
		(0.201)	(0.211)	(0.362)	(1.144)	(0.264)	(0.139)**
Inflation			0.079	-0.021	0.214	0.035	0.066
			(0.123)	(0.294)	(0.103)**	(0.315)	(0.116)
Observations	183	161	139	57	82	68	71
R-squared	0.574	0.636	0.716	0.804	0.844	0.744	0.796

NOTES: Cross country regressions of Govt Consumption including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis.Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 4.9: GDP Growth

	(1) OLS	(2) OLS	(3) OLS	(4) OLS Weak Democracy	(5) OLS Strong Democracy	(6) OLS Non-OECD	(7) OLS OECD
public investment	0.122	-0.084	-0.197	-0.128	-1.805	0.025	-0.785
	(0.576)	(0.713)	(0.629)	(1.262)	(1.182)	(0.900)	(1.888)
public investment Squared	0.002	0.012	0.017	0.016	0.160	0.010	-0.011
	(0.017)	(0.021)	(0.019)	(0.037)	(0.099)	(0.026)	(0.260)
Initial GDP per capita	-9.660	-8.062	-4.708	-8.259	-7.919	-5.125	-6.202
	(1.688)***	(3.042)**	(3.007)	(4.701)*	(4.117)*	(3.602)	(3.349)*
Investment/GDP		0.141	0.176	0.196	0.240	0.134	0.088
		(0.113)	(0.109)	(0.187)	(0.120)*	(0.156)	(0.150)
Trade		0.059	0.056	0.089	-0.016	0.090	-0.063
		(0.038)	(0.038)	(0.045)*	(0.034)	(0.045)*	(0.036)*
Population Growth		-1.615	-2.234	-2.671	-0.604	-2.566	-0.619
		(0.713)**	(0.650)***	(0.895)***	(1.815)	(0.815)***	(2.302)
Secondary School Enrolment		0.065	0.032	0.338	0.016	0.122	0.026
		(0.051)	(0.032)	(0.260)	(0.019)	(0.156)	(0.018)
Level of Democracy		-0.036	-0.101	-0.228	1.364	-0.097	0.264
		(0.199)	(0.174)	(0.338)	(1.249)	(0.268)	(0.194)
Inflation			0.050	-0.121	0.077	0.017	0.035
			(0.087)	(0.215)	(0.103)	(0.193)	(0.117)
Observations	180	158	136	57	79	68	68
R-squared	0.530	0.624	0.719	0.808	0.852	0.750	0.786

NOTES: Cross country regressions of Govt Consumption including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis.Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.

Table 4.10: GDP Growth

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS Strong Democracy	(5) 2SLS OECD
Current Govt Expenditures	-0.591	-4.562	-2.166	-1.737	-12.970
	(0.714)	(2.058)**	(1.118)*	(0.772)**	(26.053)
Current Govt Expenditures Squared	0.002	0.031	0.008	0.007	0.180
	(0.006)	(0.016)**	(0.009)	(0.009)	(0.392)
Initial GDP per capita	-21.423	-29.539	-38.479	-7.862	20.337
	(3.273)***	(8.582)***	(9.754)***	(13.606)	(52.724)
Trade		-0.219	-0.296	-0.134	0.603
		(0.134)	(0.107)***	(0.079)*	(1.462)
Investment/GDP		-0.364	-0.054	-1.536	-1.862
		(0.305)	(0.207)	(0.536)***	(3.327)
Population Growth		-0.939	-2.031	4.003	3.271
		(3.151)	(2.101)	(1.610)**	(6.648)
Secondary School Enrolment		-0.069	-0.134	-0.077	0.352
		(0.084)	(0.058)**	(0.039)**	(0.994)
Level of Democracy		1.365	1.167	2.110	-4.893
		(0.816)*	(0.479)**	(0.638)***	(13.243)
Inflation			-0.297	-0.365	-0.389
			(0.193)	(0.175)**	(1.261)
Observations	77	71	66	37	44
R-squared	0.863	0.703	0.891	0.921	0.9

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS estimation taking two lags of Current Government Expenditures as instrumental variables to control for possible endogeneity. The data are not differenced due to lack of observations.

Table 4.11: GDP Growth

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS Strong Democracy	(5) 2SLS OECD
public investment	3.464	-8.455	-6.207	-10.152	-5.826
	(2.654)	(4.435)*	(3.012)**	(4.105)**	(4.787)
public investment Squared	-0.108	0.530	0.440	1.393	1.001
	(0.106)	(0.201)***	(0.125)***	(0.482)***	(0.563)*
Initial GDP per capita	-13.177	-12.170	-16.163	-27.028	2.893
	(2.583)***	(4.417)***	(5.071)***	(15.765)*	(5.834)
Trade		-0.007	-0.033	0.051	0.185
		(0.100)	(0.078)	(0.067)	(0.072)**
Investment/GDP		0.564	0.569	0.482	0.343
		(0.156)***	(0.066)***	(0.359)	(0.221)
Population Growth		0.351	1.369	0.970	0.738
		(1.329)	(1.077)	(0.951)	(1.169)
Secondary School Enrolment		0.037	0.021	0.026	0.021
		(0.059)	(0.070)	(0.035)	(0.041)
Level of Democracy		0.172	0.191	-0.209	0.526
		(0.303)	(0.195)	(0.489)	(0.895)
Inflation			0.003	-0.284	0.279
			(0.163)	(0.267)	(0.137)**
Observations	76	70	65	36	43
R-squared	0.732	0.873	0.931	0.887	0.897

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS estimation taking two lags of Government Investment as instrumental variables to control for possible endogeneity. The data are not differenced due to lack of observations.

Table 4.12: GDP Growth

	(1) 2SLS	(2) 2SLS
Transfers	-1.179	3.297
	(1.190)	(0.671)***
Transfers Squared	0.014	-0.031
	(0.012)	(0.007)***
Initial GDP per capita	-10.023	-4.695
	(9.849)	(6.964)
Trade		-1.243
		(0.254)***
Investment/GDP		0.358
		(0.312)
Population Growth		-0.390
		(0.766)
Secondary School Enrolment		1.049
		(0.313)***
Level of Democracy		0.357
		(0.376)
Observations	53	46
R-squared	0.624	0.963

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS estimation taking two lags of Government Transfers as instrumental variables to control for possible endogeneity. The data are not differenced due to lack of observations.

Table 4.13: GDP per capita

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS Non-OECD	(5) 2SLS OECD
Govt Expenditures	0.157	-0.015	0.022	-0.063	-0.050
	(0.093)*	(0.085)	(0.048)	(0.030)**	(0.031)
Govt Expenditures Squared	-0.002	0.00025	0.00005	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.0003)***	(0.0003)
Lag GDP per capita	0.908	0.470	0.893	1.041	0.600
	(0.416)**	(0.259)*	(0.218)***	(0.177)***	(0.214)***
Trade		0.002	0.002	0.003	0.0001
		(0.005)	(0.003)	(0.002)**	(0.002)
Investment/GDP		0.002	-0.002	0.0002	0.006
		(0.003)	(0.003)	(0.002)	(0.001)***
Population Growth		0.011	0.126	0.240	0.021
		(0.032)	(0.072)*	(0.090)***	(0.039)
Secondary School Enrolment		-0.001	0.004	0.003	-0.013
		(0.003)	(0.005)	(0.007)	(0.001)***
Level of Democracy		-0.018	-0.025	-0.034	-0.215
		(0.012)	(0.008)***	(0.008)***	(0.054)***
Inflation			-0.008	-0.005	-0.046
			(0.004)*	(0.006)	(0.006)***
Rule of Law			0.372	0.372	-0.032
			(0.217)*	(0.178)**	(0.067)
Bank Deposits/GDP			0.002	0.007	-0.001
			(0.001)***	(0.004)*	(0.000)***
Observations	116	108	79	43	36
R-squared	0.991	0.999	0.999	0.999	1.000

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS estimation taking two lags of Government Transfers as instrumental variables to control for possible endogeneity. The data are not differenced.

Table 4.14: GDP per capita

	(1)	(2)
	2SLS+FD	2SLS+FD
Govt Expenditures	0.014	0.027
	(0.010)	(0.019)
Govt Expenditures Squared	-0.0001	-0.0003
	(0.00006)**	(0.0002)
Initial GDP per capita		-0.208
		(0.403)
Trade		-0.005
		(0.009)
Investment/GDP		0.001
		(0.012)
Lag GDP per capita	0.097	0.355
	(0.113)	(0.440)
Population Growth		0.000
		(0.029)
Secondary School Enrolment		0.000
		(0.001)
Level of Democracy		-0.015
		(0.030)
Observations	116	103
R-squared	0.812	0.807

NOTES: Cross country regressions of the government size including Initial GDP per capita, Inflation, Trade, Population Growth, Secondary School Enrolment, Rule of Law, Bank Deposits/GDP and POLITY2 as control variables described in the text. Cluster standard errors are reported in the parenthesis. Strong democracy refers to Polity2 >= 6.2 (median value). Weak democracy refers to Polity2 < 6.2. Regressions control for time and country fixed effects which are not shown though. *, ** and *** respectively denote significance levels at 10%, 5% and 1%.
We use 2SLS estimation taking two lags of Government Size as instrumental variables to control for possible endogeneity. The data (all variables) are differenced.

Chapter 5

Conclusion and Directions for Future Research

5.1) Conclusion

In the second chapter the relationship between labor income tax rates and the relative share of the retirees is explored both theoretically and empirically building on Razin, Sadka and Swagel (2002). The empirical analysis covers data from 1991-2012 which is a bigger sample than previously analysed. This chapter also analyses how government size responds to changes in the retirees share. The possibility of within-family empathy is also explored.

Given the possibility of within-family empathy, we replicate the argument of Razin, Sadka and Swagel (2002) and argue for a U-shape relationship between labor income tax rates and the relative size of the aged due to a rise in the political power as a result of higher share of retirees and empathy towards them in the given family structure. The critical mass is achieved when retired people represent just 8.4% of voters unlike Razin, Sadka and Swagel (2002) whose critical mass is 50%. The old may become politically powerful much sooner than previously thought.

The empirical analysis finds support for our theory and Razin, Sadka and Swagel (2002) to an extent that the association found between the labor income tax rate and the share of retirees is U-shaped. It implies a rise in the share of retirees initially decreases labor income tax rate but the correlation between the two variables changes into positive once the retirees reach a certain

benchmark. This threshold is rather fragile but closer to our theory and less than what Razin, Sadka and Swagel (2002) predicted.

Extension of the empirical analysis is done taking children as dependent variable. There is evidence for a U-shaped correlation between labor income tax rate and the share of youth.

In addition, the empirical analysis is also extended taking the government size, measured by total tax revenue as a share of GDP, as the retirees may be more concerned about their overall expenditures. Our results are in agreement with what we find for labor income tax rate. When we enlarge the sample size including three more OECD countries, the results do not change.

The relationship between composition of taxes and income inequality in a median voter model is analysed in the third chapter. The hypotheses related to income taxes are consistent with Meltzer and Richard (1981) though the hypotheses related to expenditure taxes are new.

Expenditure taxes are relatively less redistributive than income taxes in nature but yet they still embody a redistributive impetus. So we propose that at lower levels of inequality the expenditure taxes will rise with inequality. However, once inequality attains a certain benchmark the expenditure taxes will decrease with further rise in inequality. The rationale follows from that the median voter who is generally poor in the median voter model gets worse off from redistribution through consumption taxes at higher levels of inequality and strongly prefers income taxes.

To empirically test the theory we collect cross-country data covering 129 countries. There is a positive correlation between the ratio of income to expenditure taxes and inequality. Furthermore, income taxes positively correlate with inequality whereas expenditure taxes are negatively correlated. We also find an inverted-U shape correlation between expenditure taxes and inequality as well as direct taxes and inequality. In general the theory is supported by empirical results. In addition the empirical findings lend substantial support to our theoretical

framework for countries with higher levels of democracy. Though the results for the whole and less democratic samples represent the same relationship the coefficients are weakly significant but this is consistent with a model of median voter preferences.

Given that the voters are myopic, we also estimate how changes in inequality affect deficits and debt. The empirical results confirm our hypotheses that higher income inequality will lead both deficits and debt levels to rise.

We also extend empirical analysis using panel data and controlling for non-stationarity in the data. For weak democracies, there is evidence found for theory related to direct and indirect taxes. The theory is also supported when we investigate non-linear association between direct taxes and inequality as well as indirect taxes and inequality. Moreover, results related to public debt also confirm tentative hypothesis. These findings with panel data estimation reconcile with cross-sectional results.

Following the Armey Curve (1995) we empirically estimate the optimal size of government for economic growth in the fourth chapter. Using data from 1981-2010 for 79 countries and taking five years averages, we find evidence for the presence of the Armey Curve (1995) across non-OECDs. At low levels of government expenditures, increases in government spending increases economic growth. Nevertheless, once government expenditures represent 23.99% of GDP then any increase in the government size is estimated to hamper economic growth. Across weak democracies, the empirical results also reconcile with the hypothesis of Armey curve. The results for the OECD countries and the full sample are mixed as we find a U-shaped and an inverted U-shape relation in these casesthough the coefficients lack robustness. The OECD countries are found to sustain larger governments. In addition, the possibility of spuriousness of results relating to the Armey curve cannot be eliminated as they may suffer with potential endogeneity problem.

Following Ghosh and Gregoriou (2008), the total expenditures are de-composed into current government consumption and public investment. Relating to government consumption, there is substantial evidence found to support the hypothesis of Armey curve across the OECD countries as well as strong democracies. With regards to public investment the results are rather fragile. On the contrary, with 2SLS estimation, a U-shaped relation is suggested by the coefficient estimates between both policy variables and economic growth.

The empirical analysis is also extended following Cashin (1995). He finds a positive correlation between direct transfers and economic growth. We rather investigate the efficient level of direct transfers through testing non-linearity between the two variables. An inverted U-shape association between economic growth and direct transfers is found that confirms the presence of Armey curve across the sample.

In addition, how changes in the government size affect GDP per capita is also examined. We find support for the presence of Armey curve between the two variables when we apply 2SLS in first differences estimation for the full sample. For the sub-samples, however, the results are U-shaped.

5.2) Directions for Future Research

Our analyses have several limitations. In the second chapter, we find support for our theory and Razin, Sadka and Swagel (2002) as the estimated correlation between labor income tax rate and the share of retirees is U-shaped. However, the coefficient estimates are insignificant. We actually lose enough information when we difference the data. Moreover, we collect data for labor income tax rate which also includes taxes on profits on individuals. The data are not available that solely tax labor incomes. Were the data available and also for a longer time period, the findings would have been rather more robust and accurate.

Besides, retirees may also be concerned about other sources of taxes that may affect them. The analysis in our chapter does not deal with other instruments of taxation. For example, Razin and Sadka (2007) also analyse how dependency ratio affects capital taxes. They find a negative association between the two variables. Similarly, the analysis how demographic structure, after decomposing dependency ratio into retirees and children, affects capital income taxes can be offered in future.

Moreover, there are other factors that may potentially affect income taxes which are not controlled for in our analysis since all the countries included in our sample are strongly democratic. Acemoglu and Robinson (2000) find a positive correlation between taxes and democracy. Similarly, the empirical analysis in second chapter may be extended including less democratic countries or developing countries for that matter.

We explore the relationship between composition of taxes and inequality in the third chapter. The empirical results support our theory as we find positive association between direct taxes and inequality as well as negative association between indirect taxes and inequality. The model of third chapter could be improved by decomposing direct and indirect taxes into various types. These instruments may include trade taxes, poll taxes, fee and toll taxes, effective taxes and other taxes. For example Borge and Rattso (2003) empirically test the hypothesis of Meltzer and Richard (1981) by including poll and property taxes.

In addition, the question of fiscal capacity can also be researched further. As is found by Besley and Persson (2014) that low income countries collect taxes between 10%-20% of GDP as compared to high income countries as their collection is almost 40% of GDP. They argue that fiscal capacity constraints in low income countries substantially limit their ability to collect taxes. For example, informal economy, weak institutions, fragmented politics, a weak sense of national identity and sociological and cultural factors are some characteristics which may stifle the tax revenue collection. Taking fiscal capacity into account may help the model improve considerably.

Furthermore, Atkinson (1977) and Cremer, Pestieau and Rochet (2001) investigate the optimal tax composition. Likewise, chapter three can also examine optimality of tax composition since it only analysed how inequality is related to tax composition.

In general, the second and third chapters are based on Median voter model where policy choice is with the decisive voter. The empirical findings in general support our theories and hypotheses in these chapters. Nevertheless, there are also some results which contradict our theories. This may raise some questions about how effective median voter models are in a wide range of majority rule and policy making decisions.

Quite contradicting literature about the median voter model is present. For example, Down (1957) and Black (1958) favoured median voter model. According to them, these models were to an extent accurate representation of public sector output. On the other hand, there is literature that rules out median voter models as true representation of public sector output. Niskanen (1974) used median voter model as the basis of his demand side model. Nevertheless, the conclusion of his research was so at odds with the median voter model that his work actually proved to be a critique of the median voter model. Similarly, Mckelvey (1976) rather argues that political issues are multidimensional as opposed to one-dimensional. Thus, he finds median voter model not the true representation of policy making decisions. In a nutshell, the median voter model that was so popular in early 1970s could not seek similar acceptance only in a decade's time. It can, therefore, incorporate multidimensional political issues rather than one-dimensional policy objective. Nonetheless, it is too ambitious and not easily manageable to deal with multidimensional characteristics in one model.

Similarly the fourth chapter also offers few areas of research for future. Lack of evidence regarding the presence of Armey curve (1995) in the OECD and strong democracies raise further questions. These countries seem to have enlarged fiscal capacity for government expansion which may help them sustain larger governments. However, there must be a point after which

even stronger democracies reach their optimal government size. Research in the future could also be dedicated to explore the threshold where the size of government becomes optimal in these countries. May be, as for chapter three, instead of cross country estimations we should opt for within-country estimations. Within-country estimation offers more homogenous setting in terms of institutions and policy making. For example, Meltzer and Richard (1983) test their theory collection data for 50 US states. Data for countries having many states can also be explored further.

5.3) Policy Recommendations

All three chapters are related to fiscal policy. Most of the results support our hypotheses in all chapters though few of them either do not support our theory or lack robustness. However, there are policy recommendations that we can offer based on the findings of this thesis.

In practice, policy makers do not only analyse the demands of median voter but also are influenced by their own agendas and self-interests. Therefore, political mechanism driving the fiscal policy should be reduced. For example, Macroeconomic literature favors counter-cyclical fiscal policies as the effective tool that policy makers can use to manage the economy efficiently. Nevertheless, in reality, there is strong evidence for pro-cyclical fiscal policy especially in developing countries. Talvi and Vegh (2005) and Ilzetzki and Vegh (2008) find fiscal policy to be pro-cyclical in developing countries. The finding in second chapter that indicates an inverted U-shape association between labor income tax rate and the share of retirees may be the demonstration of grey power and diminishing returns. In addition, politicians are socially influenced to retain their constituencies. There involves self-interest as well since they will be old tomorrow. Based on this, they may opt for raising the size of welfare state to receive more in the future irrespective of what policy actually should be.

Given the negative consequences of an alarming rise of aging societies on public expenditures in the EU countries (as we mentioned in the motivation of this thesis), social security can be suggested to be privatized. This may decrease the burden on public exchequer and would provide individuals with better rate of return. For example, Moore (1997)asserted that *"privatization offers a much higher financial rate of return to young workers than the current system... if Congress were to allow a 25 year old working woman today to invest her payroll tax contributions in private capital markets, her retirement benefit would be two to five times higher than what Social Security is offering".* Nevertheless, the literature opposing these claims also exists as there may be welfare concern. For example, Kotlikoff (1999) finds that there are positive effects of privatizing social security funds in the long-run but at the cost of existing generation.

There may be favourable effects of privatizing social securities in the long-run but the incumbent policy makers take the current generation more into their consideration as their re-election depends on them. Moreover, they also safeguard their own self-interests as they will also grow older. Having established that policy making is influenced by political opportunism we recommend to reduce the political intervention from policy decisions. Cusack (1999) finds a reduction in partisan character on policy making in recent decades. However, fiscal policy still needs to be made more independent.

Likewise, instead of optimizing tax composition (research question of chapter 3) policy makers rather find it easier to debt-financed redistribution. As the voters are assumed to be myopic, they support a rise in both deficits and debts for redistribution to be financed. In this regard, countries in the European Union signed Maastricht Treaty (1992). Its aim was to bind EU countries to keep their debt share at 60% of GDP. It witnessed moderate success as, on average, the debt levels of EU decreased. Nonetheless, due to political opportunism through economic policies the results that were designed could not be achieved. We can substantiate our analysis

by quoting figures from the WDI data agency. Public debt as a share of GDP was 127.16% for Italy whereas for the UK it was 97.16% in 2012. Similarly it touched to 94.28% for the US.

In the fourth chapter, we find efficient level of government size around 30% of GDP whereas the public expenditures in the OECD or advanced countries are already beyond these estimated thresholds. For example, in UK, the government expenditures constitute even more than 40%.[46] Similarly, in the US, proportion of GDP consisting of government expenditures is about 40%.[47] These levels of government spending obviously indicate political interference in the decision making. Debrun, Hauner and Kumar (2009) argue for the political involvement in formulation of fiscal policy that can be analysed through deficit bias, pro-cyclicality and pursuit of unsustainable policies.

We, therefore, recommend policymakers that their goal should be to formulate fiscal policy which is counter-cyclical and sustainable. As Corsetti, Kuester, Meier and Muller (2010) find that fiscal sustainability and macroeconomic stability could be achieved with effectively planned counter-cyclical fiscal policy. In addition, Padogan (2009) and Schick (2003) also find counter-cyclical fiscal policy to be effective at attaining two-pronged fiscal objectives such as fiscal sustainability and macroeconomic stability.

[46] The WDI data suggests it to be 46.11 in 2010.
[47] The WDI data suggests it to be 41.06 in 2010.

Appendices

Appendix A1

Labor Income Tax Rate = Data for the first dependent variable, the labor income tax rate, is calculated as the ratio of taxes on income and profits to labor income share. The OECD Revenue Statistics is used as a data source for taxes on income, profits and capital gains whereas OECD Statistics is the source to collect labor income share. The data spans from 1991 to 2012.

Tax revenue as a share of GDP = It is taken from the OECD Revenue Statistics.

Public debt as a fraction of GDP = It is taken from Reinhart and Rogoff (2009).

Dependency Ratio = The dependency ratio data, measured as 1 minus the total population aged 15-64 as a share of total population, is collected from the WDI Database.

Population 65 and above = World Development Indicators database are a source for population aging 65 and above.

Population 0-14 = World Development Indicators database are a source for population aging 0-14.

Trade = Openness to trade is measured by summing imports and exports as a fraction of GDP. These data are also from the World Development Indicators database.

GDP growth per capita = Data for GDP growth per capita is taken from the WDI.

Inequality = An updated inequality database of Deininger and Squire (1996) is used to derive the data for income inequality.

Unemployment Rate = The data for unemployment rate is taken from OECD Revenue Statistics.

GDP per capita = It is collected from the World Development Indicators. Its log is taken following Person and Tabellini (1999) to measure the level of development.

Note: All these variables collected from 1991-2012.

Appendix A2

Proof that $t_y < 1$

Using (9), then $t_y < 1$ requires that

$$(m-1)\left(\delta_y + \delta_c + (m-1)\right) < \delta_y m\left[\delta_y(m+1) - \delta_c(m-1)\right]$$

In turn this implies:

$$(m-1)\left(\delta_y + \delta_c + (m-1)\right) < \delta_y m\left[\delta_y + \delta_c + m(\delta_y - \delta_c)\right]$$

hence

$$(m - 1 - \delta_y m)(\delta_y + \delta_c) < \delta_y m^2(\delta_y - \delta_c) - (m-1)^2$$

Substituting in the minimum value $\delta_y - \delta_c = \frac{(m-1)}{m}$ into the RHS then a fortifori,

$$(m - 1 - \delta_y m)(\delta_y + \delta_c) < (m-1)\left(\delta_y m - (m-1)\right)$$

and

$$(m - 1 - \delta_y m)(\delta_y + \delta_c) < (m-1)\left(\delta_y m - (m-1)\right)$$

Which must hold because $\delta_y - \delta_c > \frac{(m-1)}{m}$ strongly implies that $\delta_y > \frac{(m-1)}{m}$

Proof that $\frac{d\tau}{dm} > 0$

Differentiating (10) with respect to m leads to the condition

$$m(\delta_y - \delta_c) - m - 1 - (\delta_y - \delta_c - 1)(\delta_y + \delta_c + m - 1) > 0$$

Simplifying yields the condition

$$\delta_y - \delta_c + (\delta_y + \delta_c)\left(1 - (\delta_y - \delta_c)\right) > 0$$

Which unambiguously holds given $0 < \delta_c < \delta_y < 1$.

Proof that $\frac{dt_y}{dm} > 0$

Differentiating (9) with respect to m leads to the condition

$$\left(m^2 - 1 + \delta_y + \delta_c\right) X - m\left(\delta_y - \delta_c\right)(m-1)\left(\delta_y + \delta_c + m - 1\right) > 0$$

Where $X \equiv \delta_y(m+1) - \delta_c\,(m-1)$. After some algebra, this can be rearranges as

$$2\,(m-1)m\left(\delta_y - \delta_c\right) + \left(\delta_y + \delta_c\right)\left\{m^2\left[1 - \left(\delta_y - \delta_c\right)\right] + 2m\left(\delta_y - \delta_c\right) + \left(\delta_y + \delta_c\right)\right\} > 0$$

This unambiguously holds given $0 < \delta_c < \delta_y < 1 < m$.

Appendix A3

Taxes on Income, Profit and Capital Gains (% of Revenue) = It is collected from World Development Indicators from 1990-2012.

Taxes on Goods and Services (% of Revenue) = It is collected from World Development Indicators from 1990-2012.

Relative Taxes = It is the ratio of Taxes on Income, Profit and Capital Gains (% of Revenue) to Taxes on Goods and Services (% of Revenue).

Income Inequality = Its source of collection is the University of Texas Inequality Project's estimate of household income inequality (Galbraith and Kum, 2005).

Real GDP per capita = Data for this variable are collected from Penn World Table. It is measured in constant chained PPP US$. Its natural log is taken to measure the difference in the level of economic development across the sample.

Deficit = Deficit as a fraction of GDP. These data are also from the World Development Indicators database.

Public Debt = Public Debt as a fraction of GDP. These data are also from the World Development Indicators database.

Trade = Same as Appendix A2.

Polity2 = This variable represents the level of democracy. -10 Refers to the weakest democracy (dictatorship) whereas +10 refers to the strongest democracy. It is collected from Polity IV database.

Note: All these variables collected from 1990-2012.

Appendix A4

Real GDP growth per capita = Data for this variable is collected from Penn World Table. We collect PPP converted GDP growth, measured in millions, and then divide it by population, measured in millions, to get Real GDP growth per capita. Further, we take its natural log to measure the heterogeneity in the economic development across the countries. Data range for all the variables collected for chapter 4 is from 1981-2010.

Government expenditures as a share of GDP = It is taken from World Economic Outlook – International Monetary Finance (WEO-IMF) to measure the government size.

Current government expenditures = Data for current government expenditures are collected from International Monetary Fund: Government Financial Statistics (IMF-GFS).

Public spending = Data for public spending are collected from International Monetary Fund: Government Financial Statistics (IMF-GFS).

Direct transfers = It is also taken from World Development Indicators database.

Real GDP per capita = Itmeasures the well-being of society better than economic growth. Unlike GDP growth, it takes into account the population size. Similarly, its natural log is taken.

Initial real GDP per capita = It is calculated by taking the five year average of each data (time) points.

Trade = This variable is the addition of Imports as a share of GDP and Exports as a share of GDP.

Polity2 = Same as Appendix A3.1.

Population Growth Rate = It is taken from World Development Indicators database.

Secondary School Enrolment Rate = It is taken from World Development Indicators database to measure human capital.

Inflation Rate = It is also taken from World Development Indicators database.

Note: All the variables are collected from 1981-2010. We take averages for 5-year time intervals to control for the cyclical effects in the data. We have six data (time) points for each country, averages over – 1981-1985, 1986-1990, 1991-1995, 1996-2000, 2001-2005, 2006-2010.

Rule of Law = It is used to measure political stability and collected from World Governance Indicators.

Bank deposits/ GDP = It is used to measure financial development and collected from World Governance Indicators.

Investment/GDP = It is also collected from WDI.

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