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Economic Growth and Inequality: The Role of Fiscal Policies

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ABSTRACT

This paper analyses the impact of different instruments of fiscal policy on economic growth as well as on income inequality, using an unbalanced panel of 43 upper-middle and high income countries for the period 1972-2006. We consider and estimate two individual equations explaining growth and inequality in order to assess the incidence of different fiscal policies. Firstly, our approach considers imposing orthogonal assumptions between growth and inequality in both equations, and secondly, it allows growth to be included in the inequality equation, and inequality to be included in the growth equation. The empirical results suggest that an increase in the size of government measured through current expenditures and direct taxes diminishes economic growth while reducing inequality, , being public investment the only fiscal policy that may break this trade-off between efficiency and equity, since increases in this item reduces inequality without harming output. Therefore, the results reflect that the trade-off between efficiency and equity that governments often confront when designing their fiscal policies may be avoided.

Keywords: fiscal policy, inequality, growth, panel data models

JEL classification numbers: E62, D31, O47, C23

1. Introduction

This paper investigates to what extent, and by means of which components, fiscal policy has an impact on economic activity and income inequality in a sample of 43 upper-middle and high income countries.

The interactions between economic growth and income inequality have attracted a great deal of attention in recent years. While earlier works suggested a negative *trade-off* between growth and inequality in the first stages of development, more recent studies suggest mechanisms by which inequality is indeed increased by economic growth or by which income inequality affects growth (positively or negatively).

Seminal studies by *Lewis (1954), Kuznets (1955)* and *Kaldor (1956)* suggested that income inequality is mostly determined by the level of economic development. More precisely, they analysed how economic development affects income distribution in the long-run suggesting a potential increasing effect of growth on income inequality in the first stages of economic development, and a decreasing effect in the later stages ("inverted-U hypothesis").[1] More recent studies have put forward new ideas about the effects of economic development on income inequality. These works have taken into account three phenomena: the rapid growth of international trade (*Wood and Ridao-Cano, 1996*); the increased diffusion of new technologies in different productive activities (*Eicher, 1996, Galor and Tsiddon, 1997, Aghion et al., 1999, and Hassler and Rodríguez-Mora, 2000*), and the emergence of new organizational forms (*Caroli, 1999*).

In contrast, in the extensive literature on development that has appeared during the 1990s, the causation between inequality and growth runs in the opposite direction. In fact, the central concern mainly focuses on the role of income and wealth inequality in the process of economic growth. Two main groups of studies can be identified in this theoretical literature.

[1] For theoretical studies of this "inverted-U hypothesis", see *Robinson (1976), Greenwood and Jovanovic (1990),* and *Helpam (1998)*. In turn, *Fields (2001)* offers a complete survey of the empirical literature.

One group suggests various transmission channels through which greater initial inequality fosters economic growth.[2] The other group suggests several economic and political channels through which initial inequality might be harmful for growth.[3]

The diversity of theoretical approaches that focus on the macroeconomic effects of fiscal policies; the shortage of empirical contributions examining their impacts for an extended set of countries, and the scarcity of works that relate the growth and associated distributive effects to different public policies, points to the need for an analysis measuring both effects. In this context, our paper does the aforementioned and connects these two strands of literature.

To provide a comprehensive analysis of the growth and distributive effects of different fiscal instruments, we consider and estimate separately equations of growth and inequality using an unbalanced panel of 43 upper-middle and high income countries for the period 1972-2006. We begin by considering independent models of growth and inequality (orthogonal equations) that incorporate a limited set of control variables commonly found in the literature, and evaluate, independently, the impacts of different instruments of fiscal policy on both macro-aggregates. According to the above-mentioned literature, there are solid economic arguments to believe that income inequality and economic growth determine each other. Consequently, our empirical strategy also considers the inclusion of income inequality in the growth equation and GDP growth in the inequality equation (structural equations). This makes it possible to analyse the relationship between both aggregates and to investigate the role of fiscal policy, which has traditionally been considered as an effective instrument for generating revenue and for redistributive purposes. The contribution of this paper is thus twofold. Firstly, we look simultaneously at GDP growth, income inequality and fiscal policies

[2] See *Rebelo (1991)* and *Deaton and Paxson (1997)*, among others.

[3] For studies that use purely economic reasons see, *Aghion and Bolton (1992 and 1997)*, *Galor and Zeira (1993)*, *Piketty (1997)*, *Galor and Zan (1997)*, *Murphy, Shleifer and Vishny (1998)*, and *Mookherjee and Ray (2003)*. For studies that analyse the influence of political channels see *Gupta (1990)*, *Bertola (1993)*, *Saint-Paul and Verdier (1993)*, *Alesina and Rodrik (1994)*, and *Bénabou (1996)*.

in an extended panel of countries. Secondly, we perform the analysis for a variety of disaggregated fiscal measures, both in terms of expense and revenue.

The results obtained show that fiscal policies have significant effects on growth and inequality. Higher direct taxes and current expenditures contract economic growth while, at the same time, reduce economic inequality. These results clearly reflect the *trade-off* between efficiency and equity that governments confront when designing their fiscal policies: increasing the size of the government diminishes economic growth, although it achieves a significant improvement in the equality of incomes. The only fiscal policy that may break this *trade-off* is public investment since, according to the results obtained; increases in this item reduce inequality without harming output.

This paper is organised as follows. Section 2 provides the theoretical framework, where different hypotheses concerning the influence of fiscal policies on economic growth and inequality are discussed. Section 3 details the data base and discusses the empirical methodology. In Section 4 the empirical results are presented, while in Section 5 we test their robustness to different assumptions. Finally, section 6 contains our conclusions.

2. Theoretical framework

In this section, we first present the theoretical priors underlying the empirical growth equations, in particular those related to the role of fiscal policies in economic activity; secondly, we present those that allow the impact of fiscal policies on economic inequality to be estimated; and lastly, we explain the fiscal variables considered in both models.

2.1 Fiscal policy and economic growth

The macroeconomic analysis distinguishes basically two general theoretical approaches when analysing the capacity of fiscal policy to affect economic activity. On the one hand, from a neoclassical approach, several models emphasise the short-term effects of different instruments of fiscal policy. In this approach, the steady-state growth is driven by exogenous

factors, such as the dynamics of population and the technological progress. Thus, the conventional wisdom has been that differences in tax and expenditure policies can be important determinants of the level of output, but are unlikely to have a significant permanent effect on the economic growth rate.[4]

The public-policy neoclassical growth models contrast with the predictions of the endogenous growth models, where growth is not conducted by exogenous factors. In these models, investment in human and physical capital does affect the steady-state growth rate and, consequently, there is much more scope for tax and government expenditure to play a role in the growth process. These works tend to transform the temporary growth effects of fiscal policy that the neoclassical model involves, into permanent effects. Thus, endogenous growth models that incorporate public policies predict that distorting taxes, as well as productive public expenditures, affect economic growth. It follows that fiscal policy can affect the level of output as well as its long-term growth rate.[5]

In line with these endogenous approaches, our benchmark equation of economic growth is based on the models developed by *Barro (1990)* and *Barro and Sala-i-Martin (1992)*. Additionally, and in order to avoid the biases associated with an incomplete specification of the government budget constraint, we follow *Kneller et al*'s *(1999)* strategy concerning the inclusion of fiscal variables.

We consider an economy of *n* producers, each one producing one product (*y)*, according to the production function:

$$y = Ak^{1-\alpha} g^{\alpha} \qquad (1)$$

[4] *Sato (1967), Krzyzaniak (1967)* and *Feldstein (1974)* use the neoclassical model to analyse the effects of different taxes on growth; *Chamely (1986)* and *Judd (1985)* use the model developed by *Cass and Koopmans (1965)* to study the effects of fiscal policy considering endogenous saving rates; *Summers (1981)* and *Auerbach and Kotlikoff (1987)* adapt the model of overlapping generations of *Diamond (1965)* to analyse the dynamic effects of fiscal policy.

[5] Since the pioneering contributions of *Barro (1990), King and Rebelo (1990), and Lucas (1990),* several papers have extended the analysis of taxation, public expenditure and growth. See, for example, *García-Peñalosa and Turnovsky (2007)*.

where k represents private capital and g the public capital used by the producer (what we consider the productive public expenditure).

The government balances its budget in each period by raising a proportional tax on output at rate τ (distortionary tax) and lump-sum taxes L (non-distortionary taxes). Therefore, the budget constraint that the government faces can be expressed as:

$$ng + C + b = L + \tau y \tag{2}$$

where C and g are the non-productive and productive public expenditure, respectively. Because we allow for the case of an unbalanced budget, we include a variable b that collects the budgetary surplus (deficit).

The economic growth rate of the country i during period t, $\Delta y_{i,t}$ is a function of a set of non-fiscal variables $X_{i,t}$, and a vector of fiscal variables $FP_{i,t}$:

$$\Delta y_{i,t} = \alpha + \beta \sum_{i=1}^{h} X_{i,t} + \sum_{j=1}^{m} \gamma_m FP_{j,t} + u_{i,t} \tag{3}$$

Assuming that vector FP includes all the relevant elements, we deduce that:

$$\sum_{j=1}^{m} FP_{j,t} = 0 \tag{4}$$

In order to avoid perfect collinearity in the estimation of equation (3) we exclude one element of vector FP. The omitted variable is effectively the assumed compensating element within the government's budget constraint (*Kneller et al., 1999*). Thus, considering that the growth equation can be expressed as:

$$\Delta y_{i,t} = \alpha + \beta \sum_{i=1}^{h} X_{i,t} + \sum_{j=1}^{m-1} \gamma_j FP_{j,t} + \gamma_m FP_{m,t} + u_{i,t} \tag{5}$$

we omit the element $FP_{m,t}$ to obtain the new growth equation:

$$\Delta y_{i,t} = \alpha + \beta \sum_{i=1}^{h} X_{i,t} + \sum_{j=1}^{m} (\gamma_j - \gamma_m) FP_{j,t} + u_{i,t} \tag{6}$$

According to this strategy, the interpretation of the estimated coefficient of each fiscal variable is the effect of a unitary change in the relevant variable (included in the regression) *offset* by a unitary change in the omitted fiscal variable, which is the implicit financial element. The interpretation of the estimated coefficients of the non-omitted fiscal variables varies if the omitted category is altered.

In order to reduce the specification error bias, we consider two growth orthogonal equations containing different sets of control variables. Model 1 considers a set of control variables based on the Solow growth model that includes the initial level of GDP per capita, private investment,[6] and population growth. Based on *Mankiw-Romer-Weil (1992)*, and in order to control for the impact of human capital accumulation, Model 2 includes the former Solow set and incorporates the average years of schooling of the population aged 25 and above.

Previous studies do not take into account inequality when calculating the effects of fiscal policy on output. As argued above, we also consider the inclusion of an inequality measure in the growth equations allowing for a joint analysis of the macroeconomic and distributive effects of fiscal policy, which constitutes a novel feature of our study. Thus, Model 3 and 4 (structural equations) expand our benchmark growth equations with the addition of an inequality variable (Gini index) in Model 1 and 2, respectively.

2.2 Fiscal policy and income redistribution

In contrast with the abundant theoretical literature relating fiscal policy and economic growth, contributions about the effects of such policies on income inequality have been very scarce until recently.

For economic inequality, our benchmark equation is based on the empirical approaches of *Li and Zou (1998), Li, Squire and Zou (1998), Castelló and Doménech (2002) and*

[6] The private investment variable was specially constructed for this study as a difference of total investment (from *Penn World Table 6.1*) and public investment (from *Government Finance Statistics of IMF*), as a share of GDP.

Lundberg and Squire (2003). The fiscal policy variables are incorporated following the same strategy used for the growth equation that excludes one of the elements of vector FP. Thus, the performance of income inequality depends on two sets of non fiscal (Z vector) and fiscal (FP vector) variables:

$$Ineq_{it} = \delta + \psi \sum_{l=1}^{l} Z_{it}^{l} + \sum_{j=1}^{m-1} \left(\zeta_j - \zeta_m\right) FP_{it}^{j} + \varepsilon_{it} \qquad (7)$$

In line with the aforementioned literature, controls for the inequality equation should take into account a measure of civil liberties, and a measure of educational inequality as a proxy of assets inequality. This first measure allows consideration for the political control of the richest segment of society and their influence on income distribution, given their political ability to protect their wealth. On the other hand, the inclusion of an educational inequality variable allows us to measure the importance of the distribution of human capital in explaining differences in income inequality.[7] Finally, the FP vector contains the fiscal variables, omitting the variable which we assume as the compensating element within the government's budget constraint.

In order to reduce the specification error bias, we consider two inequality orthogonal equations, Models 5 and 6, the only difference being that the last also includes a dummy variable that controls for the difference in the construction of the inequality variable (the value is 1 if the income inequality measure is calculated from an income concept net of taxes and 0 otherwise). The correspondent part of this strategy consists of the inclusion of economic growth in these inequality models, which constitutes our inequality structural equations (Model 7 and 8).

2.3 Fiscal policy variables aggregation

In line with *Barro (1990)* and *Barro and Sala-i-Martin (1992 and 1995)* we classify taxes as distorting or not distorting, depending on whether they do or do not affect the private

[7] It is important to note that this measure of education refers to the quantity of schooling, and does not take into account the quality of the education system (see *Castelló and Doménech, 2002*; and *Castelló-Climent, 2010*)

investment decision (with respect to physical and/or human capital) and, therefore, the economic growth rate. Similarly, we classify public expenses as productive or non productive, depending on whether they are or are not included as arguments in the private production function (when classified as productive, public expenses might have a positive direct effect on the growth rate).

In the case of the present study, the existing limitations concerning the availability of homogenous country fiscal data provided by the *Government Finance Statistics of the International Monetary Fund* (*GFS-IMF*), forced us to consider a set of seven fiscal variables that cover almost 100% of the total public revenues and expenses (see column 1 of Table 1).[8]

Following the categories listed on Table 1, we consider, firstly, direct taxes as being equivalent to distortionary taxes while indirect taxes are equivalent to non-distortionary taxes;[9] and secondly, public current expenditure is equivalent to unproductive expenses while public investment is equivalent to productive expenses. To these four relevant fiscal variables, we add the government budget surplus/deficit, revenues whose classification is ambiguous (we label these "other revenues"), and finally, net lending (including net transactions in financial assets and liabilities).

3. Data base and empirical methodology

3.1 Data base [10]

We construct a panel data for an extended set of 43 countries catalogued as high-income or upper-middle-income by the *World Bank*. The selection of countries was determined by two important factors. Firstly, in line with *Fölster and Henrekson (1999)* and *Castelló-Climent (2010)*, we consider that the empirical analysis of the relationships between growth,

[8] We have not included social security contributions in government revenues due to distorting effects.

[9] In other endogenous growth models, like *Mendoza et al. (1997)*, consumption taxation becomes distortionary, with a negative effect on growth if leisure is included in the utility function, affecting education/labour-leisure choices and thus capital/labour ratios in production.

[10] Appendix 1 provides the definition of all used variables, Appendix 2 the summary statistics, and Appendix 3 the list of the countries included.

inequality and size of the government should be restricted to countries with similar wealth ranges. Secondly, we consider the availability, frequency, quality and comparability of long data series. The panel is unbalanced using five-year average data; it covers the period 1972-2006, and contains harmonised economic, political and social data obtained from different sources.

Economic variables, related to the product and investment, are taken from *Penn World Table 6.1*. Variables concerning fiscal policies are taken from the *Government Finance Statistics of the International Monetary Fund (GFS-IMF*). The human capital variables are obtained from *Barro and Lee (2001)*; while the Gini index of education is obtained from *Castelló and Doménech (2002).*

The variables related to income inequality are taken from *UNU-WIDER version 2b*. Since we analyse the impact of government taxes and expenses on economic inequality, we use the Gini coefficient calculated with respect to the household disposable equivalent income and/or consumption, covering the entire population of the analysed economy. The compilation of inequality data carried out by the *United Nations* has certainly helped to improve the empirical analysis of inequality, although the provided data is not always methodologically homogeneous between and within countries. In order to build a homogeneous and comparable inequality data base, we select and adjust the available observations according to the following criteria. Firstly, low quality observations are eliminated (quality "4" and "3", the minor values in the ranking). Secondly, for each country we only consider data coming from the same source and survey. Thirdly, in order to maximise the sample, we consider household equivalent disposable income as well as consumption by the whole population of the country (the coverage had to be representative of the national

population);[11] in addition, all uses of consumption had to be accounted for, including own-consumption. And finally, each country should have a minimum of three observations (with a maximum of seven for the period 1972-2006).

3.2 Empirical methodology

We consider five-year averages of all variables for different reasons. Firstly, because we did not expect year-to-year changes in fiscal policy variables affect yearly changes in economic growth and inequality. Secondly, taking five-year averages will reduce the short-run fluctuations and therefore the influence of the economic cycle, allowing us to focus on the structural relationship that is of interest to us. Thirdly, by using five-year means, we partially compensate for the limited availability of annual country inequality data, allowing a more balanced data set to be considered. Although for most of the variables we have yearly observations, our data on Gini coefficients are more limited – many countries have less than 10 observations, whereas only a few countries have more than 20 annual observations. Because our aggregate measures of inequality are relatively stable over time, five-year averages will not result in much loss of information.[12]

In the empirical estimations we consider five different forms of panel data estimator for each regression: pooled OLS, one-way (country dummies) fixed effects (by OLS) and random effects (by GLS), and two-way (country and time effects) fixed and random effects models. We select the model specification according to the value of the log-likelihood function and the adjusted R^2.

In the growth equation, the *Hausman test* rejects the null hypothesis of no correlation between the individual effects and the error term, showing the convenience of estimating a fixed effects model. According to these criteria, the growth equations (Models 1 to 4) are

[11] As an exception, we have included *UNU-WIDER version 2b* data from two countries (Argentina and Uruguay) for which only urban area inequality figures were reported, the reason being that in both countries the urban population represents almost 90 percent of their total population.

[12] Examples that have used the same procedure are *Li and Zou (1998*), *Li, Squire and Zou (1998)*, *Forbes (2000)*, *Li, Xu, and Zou (2000)*, *Lundberg and Squire (2003)*, and *Barro (2008)*, among others.

estimated through a two-way fixed effects model. This enables us to control for cross-country heterogeneity as well as period-specific factors common to all cross-section units. Among other things, the unobserved country-specific effects may reflect differences in the initial level of efficiency, whilst the period-specific intercepts pick up productivity changes that are common to all countries.

In relation to the inequality equation, we should point to two important aspects concerning the economic inequality variable used (Gini index). Firstly, this variable is relatively stable within countries during the analysed period; and, secondly, it changes significantly between countries (see Appendix 2). Therefore, the statistical primary results offer sufficient evidence that inequality is determined by factors that differ substantially between countries though they tend to be relatively stable inside the same ones.[13] Thus, in the inequality equations (Models 5 to 8), considering a fixed effects model which ignores the between country variation and imposes too many restrictions was not viewed as the most adequate empirical strategy (see *Baltagui, 2008*). The most appropriate specification taking into account the aforementioned criteria is a one-way random effects model using temporal dummies.

4. Empirical Results

In this section we present the estimations of the different model specifications with respect to the impact of public expenditures and taxes on economic growth and also the effects of such fiscal policies on income inequality.

4.1. The effects of fiscal policy on growth

Table 2 summarises the results of the empirical growth models considering no relation between growth and inequality (orthogonal equations), and allowing for the influence of

[13] An analysis of the variance components (ANOVA) of the Gini coefficients shows that, for the entire sample, 91.8% of the variance is cross-country.

inequality on economic growth (structural equations). In each model, we consider first indirect taxes, and second direct taxes, as the implicit financing element. Finally, we only report the estimates of relevant and significant fiscal variables (other revenues, net lending, and the surplus/deficit variables are neither statistically nor economically significant).

A first noteworthy result is that the estimations of the orthogonal and structural equations are very similar; none of the control and fiscal policy variables present significant changes between both types of equations.

We begin by discussing the results concerning the control variables. We find that initial GDP enters into the regressions with a significant negative coefficient, indicating a conditional convergence of growth rates over the period; this result is in line with those obtained by *Barro (1991, 2008)*, *Kneller et al. (1999)*, and *Castelló-Climent (2010)*, but contradicts *Easterly and Rebelo (1993)*. Private investment has a significant and positive effect on growth; a result that differs with that obtained by *Kneller et al (1999)*, where a measure of the total investment (private and public) is considered and found to be not significant, possibly reflecting problems of collinearity with the measures of fiscal policy that include public investment.[14] Population growth, as in *Lin et al. (2009)*, is significant and presents the expected negative sign, something which again contrasts with the non significant coefficient that, using the workforce growth variable, *Kneller et al. (1999)* obtain. Finally, as in *Barro (1991)*, the initial stock of human capital is significant and positively related to economic growth.

The signs of the relevant fiscal variables are consistent with theory. Thus, current expenditure has a negative and significant impact on GDP growth, regardless of whether it is financed by direct or indirect taxes; however, this negative impact is greater when the implicit financing elements are direct taxes. This negative coefficient, which was also obtained by

[14] For studies that find a positive and significant coefficient of total investment to GDP ratio on growth, see, for example, *Voitchovsky (2005)* and *Lin et al. (2009)*, among others.

Barro (1990 and 2008) and *Castelló-Climent (2010)*, can be interpreted in several ways. Firstly, it is possible that part of that government spending is somehow wasteful. Secondly, it is also possible that government spending is just a proxy for the entire set of government non-price interventions (like employment legislation, health and safety rules and product standards), and, it may be that these non-price interventions are responsible for reducing growth, and not the level of expenditure.

Public investment is positive and with a smaller coefficient than private investment but it is not statistically significant, regardless of whether it is financed by direct or indirect taxes. Considering that public investment is constituted mainly by investment in infrastructures, one would expect that it influences the rate of economic growth both positively and directly. According to this argument, our result would be somehow surprising; however, as *Romp and Haan (2007)* and *Kamps (2005)* summarise, this positive but non-significant impact could be explained because the effect of public investment may differ considerably across the countries included in our sample.

A significant negative effect is found in the case of direct taxes. This result, which is also obtained by *Kneller et al. (1999*), is consistent with economic theory because of the distorting effects of this type of taxes. In contrast, indirect taxes do not have a significant impact on growth.

An important additional result derived from the structural equations is that income inequality, measured by the Gini coefficient, harms economic growth.[15] This result is consistent with the early 1990s empirical growth literature based on a cross-country approach (see *Persson and Tabellini (1994)* and *Perotti (1994 and 1996)*), and also with more recent studies that use a panel data approach (*Huang et al., 2009)*. However, the negative effect of inequality on growth is contradictory with the conventional textbook indicating that inequality

[15] To reduce any inconsistency resulting from the fact that some Gini coefficients are based on income, whereas a few are based on expenditure; in this structural equation we follow Deniniger and Squire's suggestion and add 6.6 to gini coefficients based on expenditure.

is good for incentives and therefore good for growth,[16] and also differs from the empirical studies of *Partridge (1997)*, *Li and Zou (1998)*, *Forbes (2000)*, *Barro (2000)*, *Lundberg and Squire (2003)*, and *Castelló-Climent (2010)*. Despite the fact that these latter papers also use a panel data approach, it is important to underline some important differences with respect to our work here. Firstly, they consider initial inequality as an explanatory variable while we use a continuous Gini variable constructed taking into consideration disposable income or expenditure; secondly, they use different estimation methods; and thirdly, the sets of control variables, countries and period considered are also different.

Given that in this empirical model we are considering fiscal policy variables, we think that the significant and negative impact of inequality on growth cannot be explained only by the traditional arguments based on the political economy literature (see *Alesina and Rodrik 1994;* and *Benabou, 1996;* among others). Additionally, given that we also control for investment (in human and physical capital), this result would indicate that income inequality has a direct negative effect on growth not coming from its effect on investment decisions.[17] In a context of upper-middle and high income economies, and considering that capital markets are imperfect and the agents are heterogeneous, one possible explanation could arise to explain the estimated negative effects of inequality on growth. Inequality is detrimental to growth, as borrowers tend to under-invest in effort when it is unobservable; when there are incentive problems, the more unequal the income distribution is, the lower the aggregate level of effort will be (see, for example, *Aghion and Bolton, 1997*).

4.2. Distributional effects of fiscal policy

The inequality equations allow the distributive effects of fiscal policies to be analysed. In Table 3 we present the main results obtained with the orthogonal and structural equations

[16] The traditional visions propose a positive effect of inequality on growth due to different rates of saving of rich and poor individuals (*Kaldor, 1956 and 1957*), and due to incentive effects (*Rebelo, 1991*).

[17] For works that analyse the role of investment to explain a negative impact of inequality on growth, see *Banerjee and Newman (1993)*; and *Piketty (1997).*

of inequality detailed in section 2.2. In each model, the first column shows the results considering indirect taxes as the implicit financing element, while the second column uses direct taxes. We only report the estimates of the relevant fiscal variables (other revenues, net lending, and the surplus/deficit variables are neither statistically nor economically significant).

The results of the orthogonal and structural equations are very similar and do not change in terms of significance, sign and magnitude of the control variables. In both types of equations, the control variables are significant and with the expected sign, which basically coincides with the results of *Li and Zou (1998)*, and *Li et al. (1998)*. Thus, increases in initial civil liberties index reduce income inequality while an increase in initial educational inequality increases income inequality. It is remarkable that educational inequality, as a proxy of assets inequality, has a much greater influence than those associated with political economy arguments, as is also pointed out by *Li et al. (1998)*. It is also important to emphasise that the dummy variable that controls for the differences caused by the different source of the Gini indices, which is incorporated in Model 6 and 8, is significant and increases the explanatory power of both types of equations (orthogonal and structural).

Concerning the fiscal variables, it is noteworthy that current public expenditure has a significant and sizeable negative effect on income inequality; it reduces income inequality regardless of whether it is financed by direct or indirect taxes. This result is consistent with *Bulir and Gulde (1995)*, *Gustafsson and Johansson (1999)*, *Li et al. (2000)*, *Galli and van der Hoeven (2001)*, and *Alfonso et al. (2010)*. One would expect that this type of expenditure reduces income inequality because it includes different social expenses with distributive implications through the immediate benefits, for example, expenses in transfers like pensions or different subsidies.

The effect of public investment on inequality is slight and not statistically significant in the orthogonal equations. However, the effect of this variable is negative and statistically significant in the structural regressions. This latter result showing a reduction in inequality is in line with the arguments of *Brennenman and Kerf (2002)* and with the empirical results obtained with a sample of Latin-American countries by *Calderón and Servén (2004)*. Conceptually, the development of public infrastructures helps underdeveloped areas of the economy to be connected to the cores of economic activity, allowing access to additional productive opportunities. Another argument along these lines is that infrastructures also improve access to help and education services.

The effect of direct taxes on inequality is negative and significant; nevertheless, the estimated coefficients are much smaller than those corresponding to current expenditure. This result is in line with *Chu, Davoodi and Gupta (2000)* for developing countries!!! (what we do? quot or not?). This negative impact may reflect the progressive structure of the tax systems of the analysed countries, many of them with a modern fiscal system. With a progressive tax system, increases in direct tax revenue – whether through increases in the tax base, in the overall average tax rate or in the progression of the tax structure – would yield a larger redistributive effect and thus lower inequality (*Lambert, 2001*). Finally, indirect taxes have a positive coefficient but not significant.

Lastly, the results obtained with the structural equations clearly show that economic growth has a statistically significant and negative effect on inequality. Considering that our sample contains a group of high-income and upper-middle-income countries, this result is in line with a *Kuznets-type* relationship.

5. Sensitivity Analysis

In this section we test the robustness of our main results by modifying some aspects of the estimated growth and inequality equations. In both cases, we begin by testing if the

coefficients of the fiscal variables are sensitive to the inclusion of new control variables in both equations.

Additionally, we use instrumental variables to examine the possibility of simultaneity between fiscal variables, growth and inequality. We deal with endogeneity in both equations by using the five-year lagged values of our endogenous explanatory variables as instruments. The use of five-year lagged values as instruments is justified for three reasons (*Murray, 2006*). Firstly, it is unlikely that economic growth and inequality will today affect past values of our fiscal policy variables. Secondly, the lagged values of these variables are correlated with the values without lags. Lastly, the only impact of these lagged values on economic growth and inequality must pass through the endogenous variables. This is suggested by the fact that including the explanatory endogenous variables and their five-year lagged values in the same regression yields no statistically significant effect of the latter.

Finally, in order to fathom whether the results are being driven by one particular country in our sample, we repeat the regressions of growth and inequality after removing each of the countries one at time. The results, in both equations, are stable indicating that no single country is driving our results.

5.1 Sensitivity Analysis I: The growth equations.

In first instance, we conduct a stepwise regression analysis by adding other variables discussed in the growth literature on Model 2 and 4 (those that also include a human capital variable). The works of *Barro (1990), Mendoza et al. (1997)* and *Lundberg and Squire (2003),* provide the new variables considered in this sensitivity analysis which are trade, inflation, financial development, and a measure of civil liberties. We report the results including only the variables that are significant (trade and inflation).[18] Columns 1 to 4 of Table 4 report the results of this sensitivity exercise.

[18] The significance and signs of the relevant fiscal variables remain unchanged including all new control variables.

Unfortunately there are well known problems with estimating growth regressions. The right-hand-side variables are typically endogenous,[19] and measured with error. Another difficulty is that of omitted variables. One variable that should be included in a conditional convergence regression, the initial level of efficiency, is not observed. One way to address these problems has been through a first-difference generalised method of moments estimators applied to dynamic panel data models. The developments in dynamic panel data models (e.g., *Arellano and Bond, 1991*; *Arellano and Bover, 1995*; *Kviet, 1995*) have focused mainly on those applications to micro data sets, which generally have a large cross-section dimension but a limited time series dimension (large N, small T). These properties also typically match the dimensions of our data based on five-year average (N around 43, T around 7) well. So, in second instance, we estimate a dynamic panel data model, and, apply a two-step GMM estimator.[20] The second four columns of table 4 report the results of this sensitivity exercise.

Throughout this sensitivity analysis, three main results emerge clearly. Firstly, the inclusion of new variables is not responsible for the strong fiscal effects identified earlier; the significance of the fiscal variables is not sensitive to the inclusion of these macro variables. Secondly, two of the new variables considered are significant and with the expected sign showing that an increase in international trade raises economic growth while an increase in inflation reduces it; both results were also found by *Mendoza et al. (1997), Barro (1990),* and *Castelló-Climent (2010)*; respectively. Finally, if we look at the results in Table 4 of the dynamic models with IV, we observe that the coefficients, signs and significance of inequality and all the relevant fiscal variables remain unchanged indicating that the effects identified earlier are not simply the result of endogeneity. Therefore, the interpretation of the role of key

[19] Obvious candidates in this case are private investment and fiscal variables.

[20] In studying economic growth, this procedure has important advantages over simple cross-section regressions and other methods for dynamic panel data models, such as the one-step GMM procedure. Firstly, estimates will no longer be biased by any omitted variables that are constant over the time ("fixed" effects). In conditional convergence regressions, this avoids the problem raised by the omission of initial efficiency. Secondly, the use of instrumental variables allows parameters to be estimated consistently in models which include endogenous right-hand-side variables such as private investment and fiscal variables. Finally, the use of instruments potentially allows consistent estimation even in the presence of measurement error.

fiscal variables on growth is substantially unaffected: increasing the size of government (through current expenditure and direct taxes) reduces economic growth while an increase in inequality reduces economic growth.

5.2 Sensitivity Analysis II: The inequality equations

In the case of the inequality equations, we proceed with a similar strategy to that employed in the growth equations. In first instance, we conduct a stepwise regression analysis by adding other control variables discussed in the inequality literature. Thus, the selection of the additional variables to include (inflation, private investment, trade and initial GDP), is based on the contributions of de *Li, Squire and Zou (1998)* and *Li and Zou (2002).*

In turn, while the data panel on growth and its determinants is big enough to introduce dynamics to the model, the data panel on income inequality is rather limited (for some countries there are only three available observations on an extended sample of seven five-year periods). In addition, the most common approach to estimate dynamic panel data models is the first-difference Generalised Method of Moments (*GMM*) estimator. This estimator takes first differences in order to eliminate the source of inconsistency and uses the levels of the lagged explanatory variables as instruments. However, by taking first differences, most of the variation of the inequality data, which comes basically from variability across countries, disappears. Hampered by these econometric difficulties and data limitations, the estimation of a dynamic panel data equation with instruments is not a viable option. Since our main concern is endogeneity, which is constantly raised in income distribution literature (see for example, *Li and Zou, 1998*), we apply the instrumental variables method (IV) via two-stage least squares to correct for the endogeneity of the fiscal variables.

Table 5 reports the results of this two sensitivity analysis applied to the inequality equations. In columns 1 to 4, we show the results adding the trade variable to the orthogonal and structural inequality equations corresponding to Model 6 and 8 (trade is the only

additional variable which turns out to be significant at least in some of the new regressions).[21] In columns 5 to 8, we present the instrumental variables (IV) estimation results of both inequality equations when the five-year lagged values of the independent variables are used as a set of instruments, since there is usually no correlation between the disturbance and the lagged values (see *Iimi, 2005*; and, *Enikolopov and Zhuravskaya, 2007*).

Two main results emerge clearly from Table 5. Firstly, throughout the sensitivity analysis, public current expenditure and direct taxes remain significant and the estimated coefficients are similar to those of the original regressions on Table 3; therefore these results appear to be quite robust to the inclusion of new variables and to instrumental variables (IV) estimation. Secondly, we also observe that public investment has a significant impact on inequality. Hence, we confirm the result obtained in the benchmark model using the structural equations in the sense that public investment reduces the levels of economic inequality. Taking into account that this investment is constituted mainly by infrastructures, one would expect that it reduces income inequality indirectly, as explained before.

6. Conclusions

Recent times have seen government spending, taxation, and deficit financing move to the forefront of policy analysis. Fiscal policy affects aggregate demand, the distribution of wealth, and the economy's capacity to produce goods and services. However, the majority of existing empirical studies have focused on the effects of fiscal policy on economic activity without considering the redistributive effects and, not offering, in turn, an analysis of the impact of different fiscal policy instruments.

In this paper, we consider an unbalanced panel of 43 upper-middle and high income countries for the period 1972-2006 to show that both the magnitude and the composition of the fiscal policy have significant impacts not only on economic growth but also on economic

[21] The inclusion of additional not significant variables did not change the significance and sign of fiscal variables.

inequality. Therefore, different fiscal policies could be used to affect both growth and income distribution.

Regarding the macroeconomic effects of fiscal policies, our empirical results are in agreement with those found in other empirical studies and suggest that cuts of direct taxes increase GDP, whereas increases of public current expenditures diminish it. Beyond that, and unlike other empirical work, our results also show that different fiscal policies have significant redistributive effects: an increase of public expenditure (current or in public investment) produces significant reductions in income inequality, as does increasing direct taxes. Moreover, the estimation of structural equations, where a relation of mutual influence between growth and inequality is allowed for, shows that a reduction in income inequality stimulates economic growth, whereas the process of economic growth reduces economic inequality. Consequently, these results suggest that some previously omitted characteristics of growth are related to inequality, and vice versa; therefore we could argue that the orthogonal equations were probably suffering from omitted variables bias. In any case, the results of both types of equations considered are very consistent showing that different fiscal policies have significant growth and distributive effects in the analysed economies. On the other hand, sensitivity analyses indicate that our macroeconomic results are robust to the inclusion of other control variables and also to different estimation techniques considering endogeneity problems.

From a policy perspective, our results have clear implications. According to our estimates, increasing the size of the public sector (through current expenditures and direct taxes) improves the distribution of income at the expense of economic growth. The effects of indirect taxes on both output and inequality are found to be statistically insignificant. The only fiscal policy that may break this *trade-off* between efficiency and equity is public investment, since increases in this item reduces inequality without harming output. The latter

results point on the same direction of *García-Peñalosa and Turnovsky (2007)* providing empirical support to the possibility of fiscal policies increasing the size of government -throughout indirect taxes to finance public investment- that increase economic growth reducing simultaneously inequality.

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Tables

Table 1 – Theoretical aggregation of fiscal policy

Theoretical classification	**Government Finance Statistics classification**
Direct taxes	• Taxes on income, profits, and capital gains • Taxes on payroll and workforce • Taxes on property
Indirect taxes	• Taxes on goods and services • Taxes on international trade and transactions
Other revenues	• Other taxes • Grants • Other revenue
Current public expenditure	• Compensation of employees • Use of goods and services • Consumption of fixed capital • Interest • Subsidies • Grants • Social benefits • Other expense
Public Investment	• Net acquisition of non financial assets
Transactions in financial assets and liabilities	• Net acquisition of financial assets • Net incurrence of liabilities
Government Surplus/Deficit	• Total revenues minus total outlays

Notes: The classification is based on the manual *GFS 2001* and corresponds to the General Government.

Table 2 – Economic Growth. *Dependent variable: Real per capita GDP growth*

	ORTHOGONAL EQUATIONS				STRUCTURAL EQUATIONS			
	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
Omitted Fiscal Variable:	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**
Initial GDP p.c.	-0.0100***	-0.0103***	-0.0079***	-0.0078***	-0.0086***	-0.0102***	-0.0095***	-0.0106***
Inequality	--	--	--	--	-0.0128***	-0.0099***	-0.0109**	-0.0091**
Private investment	0.0053***	0.0044***	0.0046***	0.0032***	0.0073**	0.0065***	0.0061***	0.0046*
Population growth	-0.0004*	-0.0020	-0.0014***	-0.0012***	-0.0016***	-0.0012***	-0.0018***	-0.0016***
Human capital	--	--	0.0044*	0.0036**	--	--	0.0038**	0.0029
Public investment	0.0018*	0.0017	0.0015	0.0011	0.0019	0.0020	0.0021	0.0022
Current public expenditure	-0.0053***	-0.0090***	-0.0077***	-0.0096***	-0.0073***	-0.0103***	-0.0085***	-0.0110***
Direct taxes	-0.0039***	Omitted	-0.0042***	Omitted	-0.0051***	Omitted	-0.0042**	Omitted
Indirect taxes	Omitted	0.0022*	Omitted	0.0001	Omitted	0.0009	Omitted	0.0003
Adjusted R^2	*0.60*	*0.59*	*0.57*	*0.54*	*0.60*	*0.55*	*0.58*	0.53
No. of observations	*149*	*146*	130	128	117	114	104	102
No. of countries	*43*	*43*	35	35	41	41	33	33

Notes: Estimation technique: 5-years averages, two-way fixed effects. All explanatory variables are expressed in logs except population growth.
** Significant at 10% level; ** Significant at 5%, *** Significant at 1%*

Table 3 – Income Inequality. *Dependent variable: log of Gini Index*

	ORTHOGONAL EQUATIONS				STRUCTURAL EQUATIONS			
	MODEL 5		MODEL 6		MODEL 7		MODEL 8	
Omitted Fiscal Variable:	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**
Civil liberties	0.0427**	0.0510**	0.0484**	0.0558***	0.0673***	0.0562**	0.0756***	0.0564**
Education inequality	0.1056**	0.1080**	0.1026**	0.1042**	0.0812*	0.1035*	0.0784	0.1014*
Growth	--	--	--	--	-0.017*	-0.0139	-0.0162*	-0.0128
Public investment	-0.0411	-0.0634**	-0.0525*	-0.0692**	-0.0450	-0.0680*	-0.0604**	-0.0778**
Current public expenditure	-0.1974***	-0.2948***	-0.2555***	-0.3320***	-0.2318***	-0.3113***	-0.3262***	-0.3811***
Direct taxes	-0.0857***	Omitted	-0.0702**	Omitted	-0.0680*	Omitted	-0.0385*	Omitted
Indirect taxes	Omitted	0.0510	Omitted	0.0410	Omitted	0.0672	Omitted	0.1175
Disposable income dummy	--	--	0.0780*	0.0827*	--	--	0.0935**	0.096**
Adjusted R2	*0.56*	*0.56*	*0.62*	*0.62*	0.57	0.54	0.65	0.63
No. of observations	110	109	110	109	101	100	101	100
No. of countries	35	35	35	35	34	34	34	34

Notes: Estimation technique: 5-years averages, random effects model with temporal dummies. All the variables are expressed in logs.
** Significant at 10% level; ** Significant at 5%, *** Significant at 1%*

Table 4 – Sensitivity Analysis I. *Economic Growth – Dependent variable: Real per capital GDP growth*

	More control variables on Model 2 and 4				**Dynamics on Model 2 and 4 with IV**			
	Orthogonal equations		**Structural equations**		**Orthogonal equations**		**Structural equations**	
Omitted Fiscal Variable:	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**
Initial GDP p.c.	-0.0072***	-0.0077***	-0.0078**	-0.0085**	--	--	--	--
(GDP p.c. growth t-1)	--	--	--	--	-0.3548***	-0.5133***	-0.3552***	-0.4968***
Inequality	--	--	-0.0066	-0.0046	--	--	-0.0070*	-0.0111**
Private investment	0.0032**	0.0022	0.0042	0.0025	0.0050	0.0073*	0.0030	-0.0036
Population growth	-0.0015***	-0.0012***	-0.0019***	-0.0014***	-0.0014***	-0.0006	-0.0010	-0.0003
Inflation	-0.0018***	-0.0018***	-0.0006*	-0.0012***	--	--	--	--
International trade	0.0057***	0.0066***	0.0046*	0.0062*	--	--	--	--
Human capital	0.0040*	0.0030	0.0027	0.0011	0.0082**	0.0094***	0.0040	0.0049*
Public investment	0.0014	0.0011	0.0015	0.0013	0.0015	0.0033	-0.0026	0.0010
Current public expenditure	-0.0097***	-0.0121***	-0.0092***	-0.0122***	-0.0164***	-0.0116**	-0.0268***	-0.0279***
Direct taxes	-0.0045***	Omitted	-0.0038**	Omitted	-0.0035*	Omitted	-0.0068***	Omitted
Indirect taxes	Omitted	0.0003	Omitted	0.0006	Omitted	0.0022	Omitted	0.0022
Adjust*ed* R^2	0.63	0.60	0.55	0.52	--	--	--	--
p-value for *Sargan* test of over identifying restrictions	--	--	--	--	0.49	0.80	0.98	0.96
p-value for the test of no-first-order serial correlation	--	--	--	--	0.02	0.10	0.10	0.10
No. of observations	121	119	97	95	57	55	41	39
No. of countries	33	33	31	31	29	29	23	22

*Notes: Estimation technique: 5-years averages, two-way fixed effects; Dynamic model - two-step GMM estimator. All explanatory variables are expressed in logs except population growth. * Significant at 10% level; ** Significant at 5%, *** Significant at 1%*

Table 5 – Sensitivity Analysis II. *Income Inequality. Dependent variable: log of Gini Index*

	More control variables on Model 6 and 8				**Instrumental Variables on Model 6 and 8**			
	Orthogonal equations		**Structural equations**		**Orthogonal equations**		**Structural equations**	
Omitted Fiscal Variable:	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**	**Indirect Taxes**	**Direct Taxes**
Civil liberties	0.0499*	0.0553*	0.0731**	0.0585*	0.0938*	0.0250	0.0644	0.0466
Education inequality	0.0985**	0.1129**	0.0733*	0.0993*	0.0856	0.1034**	0.1010	0.1568
Growth	--	--	-0.0114	-0.0083	--	--	-0.0090	-0.0106
Public investment	-0.0530	-0.0854***	-0.0647*	-0.1043***	-0.3181**	-0.4289**	-0.2679*	-0.4451
Current public expenditure	-0.2394***	-0.3465***	-0.3180***	-0.4176***	-0.4571***	-0.5365***	-0.4483***	-0.6204***
Direct taxes	-0.0738**	Omitted	-0.0452*	Omitted	-0.0583***	Omitted	-0.0619**	Omitted
Indirect taxes	Omitted	0.0823**	Omitted	0.0956**	Omitted	0.04385	Omitted	0.1176
International trade	-0.0658*	-0.0953**	-0.0441	-0.0668	--	--	--	--
Disposable income dummy	0.1125**	0.1212**	0.1174**	0.1252**	0.1134***	0.1165***	0.1232**	0.1256**
Adjusted R2	0.61	0.63	0.64	0.66	0.34	0.59	0.45	0.39
No. of observations	103	101	95	93	67	67	63	61
No. of countries	33	33	32	32	29	29	28	27

*Notes: Estimation technique: 5-years averages, random effects model with temporal dummies; IV two-stage least squares. All the variables are expressed in logs except disposable income dummy variable. * Significant at 10% level; ** Significant at 5%, *** Significant at 1%*

Appendix 1: Sources and Definitions of Data Used in Regressions

International Trade: *World Development Indicators of World Bank (WDI),* exports plus imports as a share of GDP.

Population growth: *World Development Indicators of World Bank (WDI),* annual growth rate of population.

Civil liberties: Freedom House: index on a scale of 1 to 7, with 1 representing the higher level and 7 representing the lower level.

Education inequality: Castelló and Doménech (2002), Gini index of education.

Inequality of income: UNU-WIDER version 2b, Gini index.

Private Investment: Penn World Tables 6.1 and Government Finance Statistics of International Monetary Fund (GFS-IMF), Total investment (PWT 6.1) minus public investment (GFS-IMF) as a share of GDP.

Human Capital: *Barro and Lee (2001),* average years of schooling of the population aged 25 and over.

Inflation: *World Development Indicators of World Bank (WDI),* december-to-december change in consumer price index in logs (CPI).

GDP: Penn World Table 6.1 database, Real GDP per capita in logs (RGDPCH, 2002 PPP$).

GDP growth - Penn World Table 6.1 database, annual GDP growth ($GDP_t - GDP_{t-1}$)

Current public expense: *Government Finance Statistics of International Monetary Fund (GFS-IMF),* current expenditure of general government as a share of GDP.

Public Investment: *Government Finance Statistics of International Monetary Fund (GFS-IMF),* public investment of general government as a share of GDP.

Direct taxes: *Government Finance Statistics of International Monetary Fund (GFS-IMF),* revenues of general government due to direct taxes as a share of GDP.

Indirect taxes: *Government Finance Statistics of International Monetary Fund (GFS-IMF),* revenues of general government due to indirect taxes as a share of GDP.

Transactions in financial assets and liabilities: Government Finance Statistics of International Monetary Fund (GFS-IMF), revenues minus expenses in financial assets as a share of GDP

Other revenues: Government Finance Statistics of International Monetary Fund (GFS-IMF), revenues of general government due to other taxes, grants and other revenues as a share f GDP.

Government Surplus/Deficit: Government Finance Statistics of International Monetary Fund (GFS-IMF), total revenues minus total outlays of general government as a share of GDP.

Appendix 2: Descriptive Statistics

		Mean	Standard Deviation	Minimum	Maximum	Observations
GDP growth	Overall	2.22	2.83	-21.49	13.96	N=284
	Between		1.70	-3.99	5.97	n=43
	Within		2.52	-15.44	10.65	T-bar= 6.60
Log (Initial GDP)	Overall	8.75	2.47	0	10.80	N=301
	Between		1.97	2.60	10.22	N=43
	Within		1.52	3.54	15.50	T=7
Inequality of income	Overall	34.48	9.09	18.66	58.7	N = 235
	Between		8.67	22.29	52.77	n = 43
	Within		2.64	25.74	43.02	T-bar = 5.46
Current public expense	Overall	17.18	5.64	3.99	39.34	N = 284
	Between		5.28	6.88	32.31	n = 43
	Within		2.04	10.54	24.76	T-bar = 6.60
Public investment	Overall	4.38	1.72	1.13	9.10	N = 178
	Between		1.40	1.90	7.35	n = 43
	Within		1.12	1.78	7.97	T-bar = 4.14
Private investment	Overall	15.99	7.18	2.22	45.91	N = 178
	Between		6.07	5.35	36.92	n = 43
	Within		3.26	1.73	26.07	T-bar = 4.14
Direct taxes	Overall	11.97	6.53	1.67	31.90	N = 242
	Between		6.32	2.17	28.35	n = 43
	Within		1.97	3.76	20.89	T-bar = 5.63
Indirect taxes	Overall	9.73	3.97	0.01	24.30	N = 205
	Between		3.72	2.58	18.82	n = 42
	Within		1.90	0.98	16.84	T-bar = 4.88
Other revenues	Overall	27.94	11.70	4.43	56.83	N = 233
	Between		10.69	8.88	45.42	n = 43
	Within		5.19	14.82	44.43	T-bar = 5.42
Transactions in financial assets and liabilities	Overall	1.99	4.84	-6.69	44.39	N = 236
	Between		2.76	-2.00	11.88	n = 43
	Within		3.96	-9.72	34.50	T-bar = 5.49
Government Surplus/Deficit	Overall	4.20	6.23	-16.20	28.10	N = 263
	Between		4.00	-6.20	14.77	n = 43
	Within		4.78	-13.68	18.66	T-bar = 6.11
Population growth	Overall	0.89	0.79	-1.33	3.15	N = 301
	Between		0.71	-0.13	2.44	n = 43
	Within		0.37	-0.70	1.96	T = 7
Human capital	Overall	2.26	1.21	0.39	5.08	N = 247
	Between		1.08	0.80	4.66	n = 36
	Within		0.57	0.77	3.55	T-bar = 6.86
International trade	Overall	75.54	42.24	13.49	231.53	N = 269
	Between		39.97	20.17	190.47	n = 42
	Within		15.05	11.23	143.16	T-bar = 6.40
Inflation	Overall	14.71	26.30	-0.34	198.51	N = 272
	Between		17.91	2.00	76.66	n = 43
	Within		21.00	-49.31	166.44	T-bar = 6.32
Education inequality	Overall	26.57	11.63	9.3	66.00	N = 252
	Between		10.82	12.7	54.5	n = 36
	Within		4.57	8.85	43.32	T = 7
Civil liberties	Overall	2.10	1.68	1	7	N= 284
	Between		1.29	1	5.33	n = 43
	Within		1.13	-1.47	6.10	T-bar = 6.60

Sources: Fiscal variables come from *GFS - FMI*
The Gini coefficient comes from *UNU-WIDER version 2b*
Investment and GDP come from Penn World Table 6.1
Education comes from *Barro and Lee (2001)*
Trade and inflation come from World Development Indicators of the World Bank *(WDI-WB)*
The Gini of education come from *Castelló and Domènech (2002)*
The variable of civil liberties comes from *Freedom House*, 2007

Appendix 3: Sample of countries

High Income (22):

Australia, Austria, Belgium, Canada, Denmark, Netherlands, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Korea Republic, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States.

Upper middle income (21):

Argentina, Belarus, Chile, Colombia, Croatia, Czech Republic, Dominican Republic, Greece, Hungary, Jamaica, Latvia, Malaysia, Malta, Mauritius, Peru, Poland, Singapore, Slovak Republic, South Africa, Turkey and Uruguay.

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