The Effect of Institutional Quality on Economic Volatility

An empirical study of Latin American Countries

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Abstract
This analysis investigates the relationship between institutional quality and measures of macroeconomic volatility and economic performance. Previous literature provides evidence that there is a positive effect of institutional quality on economic growth, while higher levels of institutional quality seem to decrease measures of macroeconomic volatility. This paper performs a panel data analysis to examine the impact of institutional quality on economic growth and macroeconomic volatility measured as inflation as well as the GARCH variance of real GDP. The Kaufmann World Governance Indicators (WGI) are used as a proxy for institutional quality and the sample includes 214 countries covering the years 1996-2012. It is shown that higher institutional quality increases economic growth. In addition to that, there seems to be a significant negative effect of institutional quality on macroeconomic volatility, as measured by inflation in the panel fixed effect least squares regression. On the contrary, institutional quality has no statistically significant effect on output volatility in the instrumental variable regression for the full set of countries. However, there seems to be a more significant negative effect of institutional quality on output volatility in the panel least squares as well as the TSLS estimation of Latin American countries as compared to the full sample.

Keywords*: Institutional quality, Economic Growth, Inflation, Output Volatility, World Governance Indicators, GARCH variance series, Latin America, OECD countries*

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1. Introduction

In the last years, Latin American countries have been plagued by high macroeconomic instability, high levels of inflation and high income inequalities. Since the debt crisis in the 1980s, Latin American policies were focused on increasing macroeconomic stability: Reforms and outward-looking development policies aimed at the attraction of FDI in order to increase growth and development and to stabilize and lower high inflation and lessen the volatility of exchange rates (Prüfer and Tondl, 2008). With respect to the debt crisis, high levels of government spending were an important source of macroeconomic instability, so that higher tax revenues would have been needed, underlying the need for strong economic and political institutions, which can enforce the collection of taxes (Franko, 2007). According to experts, the levels of economic growth have been low due to very slow growth rates in total factor productivity. Sawyer (2010) claims that one of the main reasons thereof is the weak institutional quality in the region. Thus economic and political institution building is crucial for less developed countries in order to increase economic growth and to foster political and macroeconomic stability. According to Calderón et al. (2012) most emerging and developing countries have lower average levels of institutional quality, compared to developed countries. Acemoglue and Robinson (2012) state that many countries are poor and stay poor because of bad economic institutions and corruption, which have been taken over from colonial systems in developing countries and which are not adapted to the local conditions, often favoring a small extractive elite. Hence economic institutions have to respect norms, property rights and laws in order to provide incentives to save, invest and innovate, so that new technologies can be developed, which have the potential to accelerate economic growth and prosperity. Next to economic institutions, political institutions ensure that citizens can influence politicians through democracy, so that the public interest is respected. Low quality political institutions allow for political violence and fail to provide public goods and services, so that the positive externalities thereof are lost.

In addition to that, institutional quality not only affects economic growth, but also macroeconomic volatility. Many experts claim that less developed countries are also more volatile because of the lack of strong institutions. Acemoglu *et al.* (2003) find that countries which kept extractive institutions from the time of colonialism are more likely to experience high volatility and economic crises. Furthermore, when controlling for institutional effects, they report only a small effect of macroeconomic policies on volatility and crises. Thus it seems that weak institutions are the underlying cause of volatility through different micro-and macroeconomic channels. In addition to that, Calderón et al. (2012) claim that countries with high quality institutions are able to implement

counter-cyclical monetary and social policies.

This study will test the impact of institutional quality on macroeconomic volatility, as measured by the level of inflation and output volatility. A panel dataset of 214 countries with yearly observations between 1996 and 2012 is used, including the Kaufmann World Governance Indicators as a proxy for institutional quality. The effect of institutional quality on economic growth and macroeconomic volatility is tested using the panel least squares as well as a two-stage least squares estimation method, which accounts for endogeneity of the institutional quality index. The analysis contributes to previous research conducted on the relationship between institutional quality and output volatility by measuring output volatility as the GARCH variance series of real GDP instead of the standard deviation of real output. Furthermore, special attention is drawn to the regression results of a subsample of Latin American countries, which are compared to the findings of OECD countries. It is shown that there is a positive link between institutional quality and economic growth. In addition to that, there seems to be a significant negative effect of institutional quality on macroeconomic volatility as measured by inflation in the panel fixed effect least squares regression. On the contrary, institutional quality has no statistically significant effect on output volatility in the instrumental variable regression for the full set of countries. However, there seems to be a more significant negative effect of institutional quality on output volatility in the panel least squares, as well as the TSLS estimation of Latin American countries as compared to the full sample.

The structure of this paper is as follows: In section 2, the theoretical framework and previous literature on the importance of institutional quality are presented. The links between institutional quality and economic performance as well as macroeconomic volatility are examined in more detail. After that, the methodology, main regressors and control variables used in the main analysis are explained in section 3. The different measures of economic performance and macroeconomic volatility, as well as the different estimation methods are introduced Section 4 presents empirical test results and draws some attention to possible policy implications as well as the limitations of this analysis. Finally, the conclusions are presented in section 5.

2. Literature Review

2.1 Definition and Importance of Institutional Quality

The last financial crisis has revealed the importance of both economic and political factors, which could render an economy less exposed and prone to crises. As political and economic components, institutions play a major role in economic development, growth and performance. High institutional quality can reduce the consequences of economic shocks leading to fluctuations by ensuring that appropriate policy responses can be followed.

According to North (1994), institutions are the rules of the game which are "the humanly devised constraints that structure economic, political and social interactions". Moreover, institutions support social arrangements such as rule of law, property rights, legal traditions, democratic accountability of the governments and human rights (Easterly, 2005). Institutions therefore structure incentives in human exchange and the society. As such, weak institutional quality increases the cost and uncertainty of foreign direct investments, which can take the form of corruption, political instabilities or weak legal enforcements for instance. Thus, good institutions supporting a legal and regulatory system with supervisory capacity are needed in order to develop stock markets and functioning money markets, which can link banks to the capital markets (Franko, 2007).

Given the importance and relevance of institutions many researchers have investigated the impact of institutions, their origins and determinants. Determinants of institutions are the endowments of natural resources (Sokoloff and Engermann, 2000) or the colonial origin (Hall and Jones, 1999). For instance, the institutional quality seems to be influenced by the degree to which past colonial powers invested in institution building, as measured by the mortality of settlers (Acemoglu, Johnson, Robinson, 2001).

Today most empirical research makes use of an index variable of institutional quality, which combines all these previously mentioned indicators. The most commonly used index for institutional quality is the Kaufmann World Governance Index (WGI), consisting of six indicators of governance effectiveness. These are "Voice and Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption" (Kaufmann *et al*., 2010). The database contains information on public governance in 178 countries for the years 1996 until 2012. Originally, this index was used to establish the effect of institutions on FDI, so that this index is extended with more economic and political variables, in order to serve the analysis of institutions and economic volatility. The effect of some of these indicators will be examined in more detail below.

Most research has focused on the effect of institutional quality on economic growth. However, several economists suggest that unfavorable geography is the main cause of variations in economic development and one of the key obstacles for most developing countries preventing them to enjoy the full gains of agricultural productivity (Sachs, McArthur, 2001).

Unfavorable geography refers to tropical climate and high disease environments, which have a direct negative effect on technology, as defined as agricultural production and technologies of human health (1)[1]. Thus, geography-dependent variables, such as the life expectancy at birth or malaria occurrences, lead to low agricultural productivity and low levels of production, which result in low levels of GNP per capita (2) (Sachs and McArthur, 2001; Gallup, Sachs and Mellinger, 1999). In addition to that, unfavorable geography can also refer to high endowments of nonrenewable natural resources, which can lead to capital-intensive allocations of resources rather than investments in human capital or productive employment, thereby hindering the development of institutions and economic growth (Gallup, Sachs and Mellinger, 1999).

Hence, physical geography has a direct effect on economic development via production [(1), (2)] and institutions [(3), (4)], therefore leading some economists to suggest that weak historically determined institutions are the underlying reason for differences in economic development (4). Acemoglu, Johnson and Robinson (2001) find a statistically significant link between the average growth rate between 1970 and 1997 and institutions, instrumented by log of settler mortality, so that countries with better historically determined institutions seem to grow faster. Nevertheless the results of this analysis are limited given the small sample of past colonies.

In addition to that, institutions are directly affected by geography and technology in the following ways: adverse geography and high disease environments can lead to state predation and destructive institutions (3) which result in low levels of economic development (4) (Acemoglu, Johnson, Robinson, 2001). Furthermore, studies suggest that the distance from the equator is a good proxy for the relative infiltration of European economic institutions, so that the effect of latitude on development is influenced by European institutions (Hall and Jones, 1999).

However, geography also has an indirect effect on institutions through technology (5):

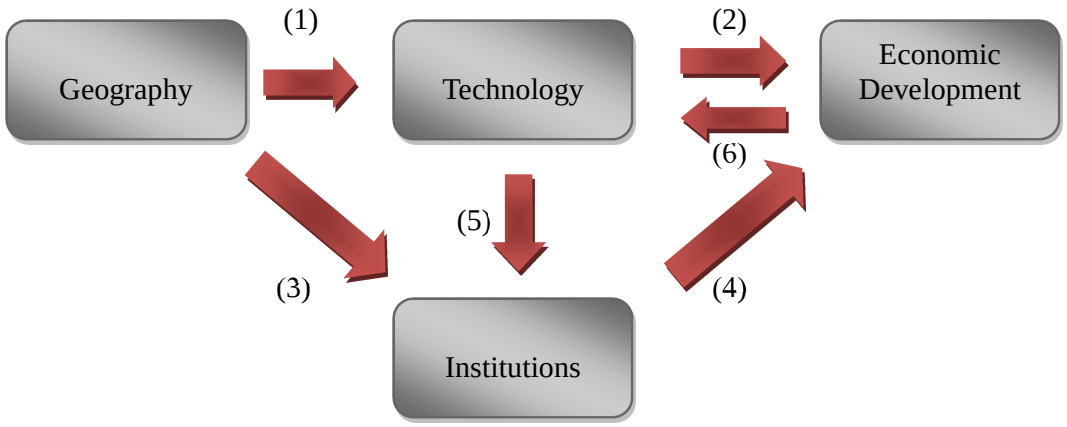
As seen before adverse geography leads to low agricultural productivity and low levels of production. In addition to that, Sokoloff and Engerman (2000) claim that the sub-tropical climate and good soils in North and South America resulted in increased production of crops in plantations where slaves were employed. At competitive international prices labor was moved to where they

[1] The numbers in brackets refer to the numbered references in Figure 1.

were most productive, so that slaves could be found in all colonies of major European powers. Due to early specialization in production of these crops and technological progress, the colonial economies became dominated by the plantation production and slaves, causing extreme distributional inequalities in human capital and wealth. These inequalities led to the development of institutions and legal frameworks that favored small elites with great political influence which restrict the opportunities for the rest of the society (Sokoloff and Engerman, 2000).

In addition to the effects of geography, technology and institutions on economic development, there is also a reverse causality from economic development to technology: Low levels of economic development lead to low levels of innovation and slow technological progress resulting in a reduced rate of endogenous growth (6) (Sachs and McArthur, 2000).

Figure 1: The Determinants and Linkages of Institutions *(Source: Sachs and McArthur 2000)*



Previous literature further states the ultimate determinants of economic growth in developing countries, such as policy, initial income, aid, but also institutional distortions (Burnside and Dollar, 1997). In the following, the effect of institutional quality on economic growth and development, macroeconomic stability and especially economic volatility will be examined.

2.2 Institutional Quality and Economic Performance

2.2.1 Link between Institutional Quality and Growth

According to the neoclassical growth model (Solow, 1956), countries with the same production functions, savings rates, identical depreciation rates and population growth will grow at the same rate in the steady state, so that economic growth converges in the long-term. The reason for that is that poor countries with lower initial income face higher growth rates than richer countries. Nevertheless, this convergence hypothesis fails, because in reality, production functions differ across countries due to differences in several factors: technological progress, human capital, public and social infrastructure, which includes institutions and the rule of law. As such, the endogenous growth theory claims, that economic growth is an endogenous result of an economic system rather than the result of external forces (Romer, 1994). Consequently, many economists suggest that political and economic institutions which ensure government protection of property rights and human capital endowments are crucial for developing countries, because they tend to improve economic performance, growth, the level of development and investment (North, 1981; Tornell and Velasco, 1992; Johnson *et al*., 2000; Hall and Jones, 1999). Knack and Keefer (1995) find strong evidence for conditional convergence after the inclusion of institutional quality to the regression of growth on initial income and other control variables such as primary and secondary school enrollment, government consumption and incidences of assassinations and revolutions. Institutional quality has been proxied by the International Country Risk Guide (ICRG) and Business Environment Risk Intelligence (BERI). The coefficient of initial income - indicating the degree of conditional convergence - increases in economic and statistical significance. This means that the negative coefficient of initial economic growth, as well as the corresponding t-statistics, become more negative after the inclusion of institutional quality. Thus, an increase in initial income is associated with a lower growth rate, *ceteris paribus*, so that the degree of convergence increases.

Moreover, according to growth empirics, half of the cross-section variation in growth rates can be explained by human capital, investment as a share of GDP, initial level of GDP and the average rate of population growth per year, whereas the remaining variance is mainly due to institutional and political features as well as indicators of economic policy (Burda, Wyplosz, 2009).

According to Andres Velasco and Mario Gutierrez, the complementary effect of institutional quality and technological progress are the main reasons for the very low growth in productivity in Latin America. Institutional quality is thus the key predictor for growth by providing incentives to invest

in technology (Franko, 2007). Hence improving institutional quality is especially important for developing countries in order to increase the growth in total factor productivity, which can accelerate sustainable economic growth. It seems crucial to study the effect of institutional quality and its determinants in order to improve both the allocation of public goods and the efficiency of decisions on economic policy.

Property Rights and the Rule of Law

As such, a broad range of literature presents the relevance of high-quality institutions which enforce property rights and the rule of law for sustainable economic growth and development (Acemoglu, Johnson, Robinson, 2001; Hall and Jones, 1999; Knack and Keefer, 1995).

Property rights are "*clearly defined rights of ownership, which are respected by others and systematically enforced by the state*" (Burda, Wyplosz, 2009). The rule of law relies on the separation of powers and rules-based governance and states that the government, its officials and agents have to be accountable under the law. Furthermore, the law has to be clear, stable and just, so that the enforcement of the laws and contracts can be accessible, efficient and fair. Access to legal institutions has to be provided to all citizens. As a result, secure property rights and good rule of law increase the incentive to innovate and invest in physical as well as human capital, which leads to a more efficient allocation of resources and a higher level of income (Dollar and Kraay 2003; Kaufmann, Kraay and Zoido-Lobaton, 1999). Thus, unsecured property rights combined with inefficient public investments or bad economic policy decisions, result in a lower initial steady state level of income (Knack and Keefer, 1995; Barro and Sala-i-Martin, 1992). Knack and Keefer (1995) estimate the impact of property rights and the rule of law on economic growth using the ICRG and BERI as measures of institutional quality, in order to evaluate the enforceability of contracts, the rule of law and the risk of expropriation.

Both institutions and the rule of law are essential preconditions for long-term economic growth because they foster trust, investments and improve democracies. Thus, there is a strong positive correlation between the rule of law and growth (Easterly, 1999): Low political corruption, low probability of government refusal of contracts and expropriation, as well as high quality of bureaucracy and maintenance of law, result in a better environment for high economic growth and higher government credibility (Knack and Keefer, 1995). As such, the enforcement of contracts increases the government effectiveness (Burda, Wyplosz, 2009).

Consequently, there is a significant effect of institutional indicators not only on growth but also on investments (Knack and Keefer, 1995; Clague *et al.*, 1999). In their paper of 2002, the Dollar and Kraay use a time-varying alternative for institutional quality, namely the contract-intensive money, which is measured by one minus the ratio of currency in circulation to the money supply, M2, which is the relative use of currency to contract-intensive money. According to Clague *et al.* (1999), this variable is a measure of good contract enforcement and secure property rights, because depending on the degree of contract enforcement in a country the preferred choice of money used might differ: In countries with unsecure contracts individuals commonly prefer currency, whereas in countries with strong property rights and contract enforcements people invest their currency in bank deposits and hold liquid assets through financial intermediaries. Thus, strong contract enforcements and property rights imply a higher share of contract-intensive money.

Democracy

Moreover, there is a tendency that rich and well-developed countries not only have secure property rights and a strong rule of law, but they also tend to be democratic. In order to ensure political stability, democratic institutions should give a voice to all people and include them in the policy making process, so that higher levels of democracy can lead to higher growth rates as a result of improved political and economic stability (Burda, Wyplosz, 2009). As mentioned before, democratic institutions appear to be correlated with other factors of institutional quality, especially with the rule of law, so that the institutional quality indicator rule of law is especially important for economic growth (Dollar and Kraay, 2002). Politically unstable countries with market distortions, more frequent riots and high corruption, tend to grow at a slower rate, most commonly measured by political disturbances, as well as a black market exchange rate premium (Knack and Keefer, 1995; Dollar and Kraay, 2004).

Thus, there can be more economic instability due to weak institutions if small elites have only few constraints, who may redistribute assets to themselves following an increase in political power, which can result in more turbulences and fights for power and control in institutionally weak societies (Acemoglu *et al.*, 2003). Knack and Keefer (1995) find a higher effect of property rights on growth and investment than found in earlier studies, using measures of political instability, such as frequencies of revolutions and political assassinations, as measures of institutional performance (see Barro, 1991). These results remain robust after the inclusion of economic policy.

Institutional quality, Foreign Aid and Economic Growth

Similarly, institutional quality seems to play an important role in the effectiveness of foreign aid with respect to economic growth. Foreign aid, received by countries with better institutions, leads to higher economic growth. Burnside and Dollar (1997) claim that foreign aid has a positive effect on economic growth in developing countries, but only when combined with good fiscal, monetary and trade policies. The good policy index used includes budget surplus relative to GDP, ln(1+inflation rate), the Sachs-Warner trade openness dummy, a black market premium, financial depth, as measured by M2/GDP and a trade to GDP ratio. All these measures for sound macroeconomic policies are positively correlated with economic growth. However, these findings have been challenged by Easterly (2003) who claims that foreign aid is not more effective in countries with good policies, given that the interaction term between aid and policy is insignificant. In both studies by Easterly (2003) and Burnside and Dollar (1997) institutional quality has been measured by the PRS Group's IRIS I11 dataset as described in Knack and Keefer (1995). It is based on 1982 values of institutional quality and is therefore one of the earliest measures available for institutional quality.

Furthermore, with respect to the volatility of foreign aid, there seems to be a negative effect of aid volatility on growth, which is reduced given high institutional quality. Kathavate and Mallik (2012) estimate this relationship with the Generalized Methods of Moments (GMM) approach.

2.2.2 Link between Institutional Quality and FDI

As a determinant of economic growth, further studies have investigated the effect of institutional quality on foreign direct investment (FDI): Alfaro *et al.* (2008) find two main causes for the Lucas Paradox, stating that less international capital actually flows to less developed countries with higher marginal returns to capital than predicted by the neoclassical trade model, namely firstly, failures on the international capital market and secondly, differences in the fundamentals of developing and developed countries (Lucas, 1990). The latter refers to weak institutional quality amongst others, which hinders economic growth and attracts less foreign capital than the neoclassical trade model would predict. Furthermore, Papaioannou (2008) finds that improving institutions has a significant positive effect on international finance and international lending, by investigating a time-varying composite index for institutional quality in a fixed-effects setting, in cross-section models as well as the instrumental variable approach. Moreover, the analysis examines the changes in lending in response to institutional reforms.

2.2.3 Link between Institutional Quality and Trade

With respect to the literature on international trade, several economists report a tendency that countries with better institutional quality trade more and have higher growth rates.

Dollar and Kraay (2003) examine the importance of trade and institutional quality on the log-level of per capita GDP in cross-country regressions, while instrumenting trade and institutional quality. The authors instrument institutional quality by using the index of rule of law from the Kaufmann World Governance indicators. This index will also be used in the following analysis. However, there is a very high correlation between trade and institutional quality, so that the partial effect of both variables on growth is difficult to distinguish suggesting a joint effect of institutions and trade on growth in the long run. Investigating changes in decadal growth rates due to changes in trade and institutional quality shows evidence that trade has a strong effect on growth, especially in the short-run, whereas changes in institutional quality have a smaller effect on growth.

In their paper of 2004, Dollar and Kraay extend the analysis using additional variables from the International Country Risk Guide (ICRG), the Freedom House index, an indicator for violent conflicts and contract-intensive money as an instrument for institutional quality, as described earlier. Nevertheless, the analysis concludes that the inclusion of additional variables in order to account for the possible omitted variable bias in the measurement of institutional quality does not seem to explain the partial correlation between growth and trade. Dollar and Kraay (2004) report only a weak link between changes in the measurement of institutional quality and changes in growth, since the institutional quality variable is positive but insignificant

In contrast to that, Rodrik (2000) claims that the apparent effect of trade on economic growth stems from institutional quality, which makes countries more attractive trading partners through the effect of decreased corruption and improvements in the rule of law for instance. The main reason for that is the fact that trade reforms tend to not only change relative prices, but also alter institutional reforms, so that they result in changes in policy and behavioral parameters. Hence, trade reforms should increase institutional quality in the domestic economy, which can lead to higher economic benefits compared to a free trade regime, as suggested by Rodrik (2000). Thus trade openness requires better governance and less corruption (Rodrik, 2007). In order for an economy to reach financial depth, an open capital account and good regulation and supervision are necessary (Rodrik, 2007). Additionally, Klein (2005) provides evidence for a non-monotonic link between the responsiveness of growth to capital account liberalization and institutional quality. Good institutions seem to lead to a significant effect of capital account openness on economic

growth. In theory, capital account liberalization allows for more efficient global allocation of capital, from capital abundant countries to capital scarce countries. This ensures capital account liberalizations demanding a higher degree of financial integration with the global economy through increased capital in- and outflows. However, there is a significant pro-cyclical element to international capital market access in countries that experienced a decrease in both income and consumption during the financial crisis.

All in all, it becomes clear that weak institutions which allow for corruption, unsecured property rights, weak policies concerning the enforcement of the rule of law, low bureaucratic quality and weak governance have negative implications on growth, investment and trade and tend to make foreign aid ineffective.
Consequently, it seems that institutions play a major role in increasing economic performance and providing the ground for economic stability.

2.3 Institutional Quality and Economic Volatility

2.3.1 Definition of Economic Volatility

As seen before, institutional quality impacts several measures of economic performance. Furthermore, it also influences the economic volatility of economies. This analysis will focus on the macroeconomic aspects of economic volatility, which can be measured in different ways: Several studies measure macroeconomic volatility by high levels of inflation (Dollar and Kraay, 2004). In addition, macroeconomic volatility can also be characterized by variations in output and interest rates as measured by the corresponding standard deviations.

2.3.2 Link Policy and Volatility

Advanced economies have implemented fiscal and monetary institutions in order to execute a stabilizing function. Most importantly, a lender of last resort, which is mostly the central bank, protects the economy from self-fulfilling banking crises. Following external shocks to demand for domestic goods or to productivity, the central bank aims at stabilizing output and inflation. A positive external demand shock leads to an increase in output and a real appreciation of the exchange rate. This is because higher demand for domestic goods increases the opportunity cost of leisure, so that labor supply increases. Nevertheless, the real value of debt in terms of foreign currency decreases as a result of the real appreciation, which has a positive effect on consumption

and a reverse effect on the labor supply. However, given low institutional quality, a country is less attractive to receive loans, so that a lower debt-to-consumption ratio can be observed in the steady state, causing the real value of debt to be less responsive to the real appreciation. Thus the real appreciation results in an increase of the labor supply and lower wages (Duncan, 2013). The central bank cuts the interest rates in order to stabilize inflation, so that there is a negative correlation between output gap and interest rates (procyclical). Furthermore, some developing countries might not adopt counter-cyclical policies due to the fear of floating: in order to prevent capital outflows during recessions, central banks prefer to increase interest rates to control the effect on the exchange rate rather than letting the currency float freely (Calvo, Reinhart, 2000).

Fiscal and monetary institutions in Latin America seem to have increased macroeconomic instability in the past instead of stabilizing financial markets and business-cycle fluctuations, because pro-cyclical rather than anti-cyclical policies have been followed (Rodrik, 2000). This is in line with a central bank that tries to stabilize inflation and output gap fluctuations simultaneously (Duncan, 2013).

The intuition behind this finding can be explained by the simple Taylor rule, where the interest rate is a function of the output gap and inflation: $i_t = \alpha + \beta(Y_t - \bar{Y}_t) + \gamma(\pi_t - \pi_t{}^*)$, where i_t is the target short term nominal interest rate, Y_t stands for the logarithm of real GDP and $\bar{Y}_t$ is the logarithm of potential output, also referred to as full employment. Furthermore π_t refers to the rate of inflation and $\pi_t *$ to the desired rate of inflation (Romer, 2012).

Then a counter-cyclical policy is reflected by positive values for β: tight monetary policy is necessary when output exceeds its potential. Counter-cyclical policies are also referred to as a strategy called “leaning against the wind”. In case of too much expansion, that is, when output exceeds its potential, the central bank leans against the wind by increasing the interest rate so as to slow down the economy. This results in a reduction of consumption, investments and money demand, so that output is brought back to its desired level.

Besides, emerging economies are often also characterized by high volatility in output and interest rates. According to Duncan (2013) this can also be the result of pro- or a-cyclical monetary policies, which are more likely given low institutional quality, as measured by the probability for foreign investors of incurring a loss in output, which decreases the economic value of the external liabilities. Kaminsky *et al.* (2004) provide empirical evidence that emerging market economies tend to be pro-cyclical using a sample of 104 countries during the years 1960-2003.

Especially fiscal policy seems to play an important stabilizing role (Fatás and Mihov, 2013).

However, if fiscal policy is used too often, it can result in higher volatility and lower growth. This finding is also robust to the inclusion of control variables such as institutional quality.

Fatás and Mihov (2013) use both panel and instrumental variable estimations in order to estimate policy volatility as measured by the variance of changes in government consumption.

Moreover, further research has focused on the link between economic instability and political crises and state failures in order to study the impact of institutions and volatility. Estimating a 5-year unbalanced panel model, Acemoglu *et al.*, (2003) use a dummy for state failure, which seems to significantly cause macroeconomic volatility as measured by the standard deviation of the growth rate of real GNP per capita as well as the worst drop in GNP per capita. Nevertheless there is only a small reduction in the coefficient of initial institutions in the regression regarding state failures, so that there seem to be more important factors that influence the volatility of real GNP per capita. The authors therefore propose that further research using more detailed measures of political crisis is needed to examine to what extent political crises can be the main mediating channel between institutions and macroeconomic volatility.

Given the possible link between political crisis and volatility, it seems that democracy has a negative impact on volatility. Mobarak (2005) finds a robust link between democracy and economic volatility. Furthermore Cavallo (2010) suggests, that strengthening democratic institutions can eliminate the negative effects of financial crisis. In addition to that, Klomp and de Haan (2009) present a dynamic panel model which suggests that democracy can decrease output volatility, as measured by the relative standard deviation of GDP per capita growth rates. This is defined as the standard deviation relative to the absolute mean growth rate and accounts for differences in growth rates. Also, certain factors of policy-uncertainty and political instability increase output volatility.

2.3.3 Importance of Institutional Quality

With regard to the findings thus far, institutional quality appears to influence economic performance as well as macroeconomic stability.

In countries with strong institutions, central banks react better to external demand shocks and can stabilize output and inflation more easily. Furthermore, high institutional quality enables countries to apply counter-cyclical monetary and fiscal policies:

Calderón *et al.* (2012) conduct GMM fixed effect estimations with instrumental variables for macroeconomic variables as well as institutional quality on a dynamic panel data set of 115 countries. The authors claim that countries with high (low) institutional quality are able to

implement counter-(pro-) cyclical monetary and social policies, which are reflected in a positive correlation between the output gap, the measure for business cycle movements, and interest rates. Thus, there is a negative association between institutional quality and macroeconomic volatility in output and interest rates as measured by their standard deviations (Duncan, 2013). This means that countries with strong institutions will follow "*contractionary policies during booms and expansionary policies during recessions*" (Calderón *et al.*, 2012). The authors furthermore state that similar levels of institutional quality are needed in order to conduct counter-cyclical monetary or fiscal policies. Calderón *et al.* (2012) find that, on the one hand, 29 out of the 115 countries have high levels of institutional quality, exceeding a threshold value at which monetary policy is a-cyclical, so that these countries conduct counter-cyclical monetary policies. All of these countries are OECD or advanced small open economies. On the other hand, 27 countries have levels of institutional quality below the threshold value. These countries are low-income countries from Asia and Sub-Saharan Africa, as well as middle-income countries from Latin America for instance. However, only the average values of institutional quality of the years 1984-2008 have been considered in the analysis, so that these results are likely to underestimate the current level of institutional quality of countries that remarkably improved their level of institutional quality, such as Chile, Peru, the Philippines or Poland.

A financial crisis tends to expose infrastructural weaknesses in institutions (Buchanan *et al.* 2011). However Latin America seems to have been resilient to the last financial crisis and less exposed to external shocks, given a successful system of inflation targeting, post debt crisis liquidity buffers that were created after the debt crisis and strong fundamentals (Montoro, Rojas-Suarez, 2012).
Hence, studying the link between institutional quality and macroeconomic volatility seems to be especially important for developing countries, which tend to be more volatile and prone to crises. This is because countries with low institutional quality have less ability to deal with economic shocks (Rodrik, 1999). Thus, many emerging countries open to international capital flows were hit more severely by crises during the end of the 1990s due to weak financial and political institutions (Johnson *et al.*, 2000). In contrast to that, Acemoglu *et al*. (2003) argue that institutionally weak societies are not necessarily more prone to crises during times of world economic slowdowns, but rather more unable to deal with the political and economic problems that cause their economic instability, so that societies with weak institutions slow down more than others during times of world economic slowdowns.
Acemogly *et al.* (2003) argue that there is a strong and robust relationship between initial

institutions, volatility and the severity of economic crises. Countries with weak historically determined institutions, as instrumented by the mortality rates of past colonists, face higher volatility, as measured by standard deviation of per capita output growth. Using the two-stage least squares approach, the authors find a causal effect of institutional differences on volatility, given that the settlers' mortality as an instrument for institutional quality is valid. They find that countries that kept extractive institutions from the time of colonialism are more likely to experience high volatility and economic crises, indicated by the largest drop in output. The log of initial income per capita has been added as a control variable, in order to account for the fact that poor countries are affected more by volatility (Acemoglu *et al*., 2003; Barro, 1991). As a consequence, distortionary macroeconomic policies do not seem to cause economic volatility, but should rather be seen as consequences of weak institutional quality. However, Calderón *et al.* (2012) show that macroeconomic policies in countries with high institutional quality are very important in order to stabilize business-cycle fluctuations.

Investigating different determinants of macroeconomic volatility measured as the standard deviation of GDP per capita growth between 1970 and 1997 Acemoglu *et al*. (2003) conclude that factors such as property rights protection, the rule of law and constraints on elites and politicians are the most important factors influencing volatility and economic performance. However, controlling for institutional factors, only a small effect of macroeconomic policies on volatility and crises can be observed. Thus, it seems that weak institutions are the underlying cause of macroeconomic volatility and economic instability through several micro-and macroeconomic channels. As such, weaker institutions are associated with several poor macroeconomic outcomes: Overvalued exchange rates, which often lead to economic crises, higher inflation rates, as measured by the log of average rate of inflation, indicating poor economic performance, greater volatility and more severe crises. Furthermore high government spending is a source of instability, as measured by government consumption to GDP ratio. Open economies tend to have bigger governments given high volatility in the terms of trade, domestic income and consumption, because the high volatility increases the demand for social insurance (Rodrik, 1998). With respect to these macroeconomic variables, exchange rate overvaluation is the only macroeconomic variable, which plays a mediating role on the effect of institutions on volatility, because exchange rate overvaluation is mostly correlated with volatility (Acemoglu *et al*., 2003).

In addition to that Barseghyan and DiCecio (2008) investigate the institutional causes of macroeconomic volatility. With respect to macroeconomic volatility, the authors instrument institutional quality for barriers to entry and find that a one standard deviation increase in the entry

costs can lead to a 40% increase in the standard deviation of output growth. In contrast to that, property rights do not seem to have a significant effect on volatility.

Similarly, Abdessatar and Rachida (2013) investigate the relationship between institutional quality and financial instability, using a financial stress index. The authors also make use of the governance indicators developed by Kaufmann *et al.* (2012). They claim that high institutional quality enables emerging countries to stabilize financial markets, using a panel of 21 developing countries. Furthermore, a significant effect of political stability, government effectiveness and the rule of law on the index of financial stress have been reported. In addition to institutional quality, macroeconomic fundamentals and contagion also influence the level of financial stress.

2.4 Link Previous Research and Empirical Analysis

As the review of scientific research literature has shown, it seems very important to extend the research on the impact of institutional quality on macroeconomic volatility.

With respect to emerging countries it is especially important to study the link between institutional quality and economic volatility in order for them to be able to manage economic shocks and crises, such as the latest global financial crisis, more successfully. With respect to the predictions from previous research, the following two hypothesis will be tested:

1. **Ho: There is a positive effect of institutional quality on economic growth.**
2. **Ho: There is a negative effect of institutional quality on macroeconomic volatility.**

The following analysis will provide an extension to previous literature in several ways, in order to investigate the relationship between institutional quality and macroeconomic volatility.

Firstly, the analysis will make use of a broader measurement of institutional quality using the Kaufmann Index of World Governance, in order to reduce the problem of omitted variables or measurement errors. These endogeneity issues are very likely in the measurement of institutional quality, which is a multi-dimensional concept. Therefore, more specific indicators of institutional quality will be examined in order to investigate which indicators improve economic instability and volatility. Second, given the different measurements of macroeconomic performance and volatility, different sensitivity tests will include alternative measures for macroeconomic volatility as the dependent variables. Furthermore, the instrumental variable approach will be used in order to control for endogeneity issues and measurement errors.

3. Methodology

3.1 Regressors

3.1.1 Institutional Quality Indicators

As afore mentioned, the World Governance Index (WGI) will be used as a measurement for institutional quality in the following analysis. This is one of the best measures for institutional quality and most commonly used in research on institutional quality. The WGI index is an Aggregate Indicators of Governance, reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide. It consists of six indicators constructed from more than 31 underlying sources from 33 organizations around the world covering 212 countries for the period 1996-2012.[2] Taking into account margins of error in accurately measuring governance, the WGI offers significant cross-country and over-time comparisons. For each of the six indicators the observed governance score per country is modeled as a linear function of unobserved governance and an error term. The intercept and the slope of the unobserved governance parameter capture differences in the units used to measure governance in different sources. The estimates of governance take values between -2.5, reflecting weak governance quality to 2.5, high governance performance. The six indicators incorporated in the WGI are the following:

1. **Voice and Accountability:** Refers to the freedom of association, expression, and the press, as well as the degree to which people can be involved in the selection of their government.
2. **Political Stability and Absence of Violence:** Indicates the probability that terrorism, violent or unconstitutional means result in the destabilization of the government.
3. **Government Effectiveness:** Refers to the capability of the civil and public service, the quality of policy formulation and implementation, as well as the independence from political pressures and the credibility of the government to commit to the policies.
4. **Regulatory Quality:** Describes the capability of the government to make appropriate regulations and policies that promote and enable private sector development.
5. **Rule of Law:** Refers to the degree to which the rules of the society are supported and followed by the citizens, which includes the quality of the police, property rights and the risk of crimes.

[2] Detailed description of the sources can be found in Kaufmann, D., Kraay, A., Mastruzzi, M. (2010) “The Worldwide Governance Indicators: Methodology and Analytical Issues”. World Bank Policy Research Working Paper No. 5430.

6. **Control of Corruption:** This index indicates the degree to which public power is used for private gain, as well as the extent to which the state is captured by an elite.

In order to compute a composite index for institutional quality, an equally weighted average has been calculated out of the 6 Kaufmann indicators of World Governance, later referred to as *IQ_avg*.

3.1.2 Control Variables

Moreover, these indicators will be extended with more political and economic factors influencing macroeconomic stability. For example, the money supply M2 relative to GDP, is a measurement for financial development and the importance of financial intermediation, which seems to be important for institutional property rights and contract enforcement (Burnside, Dollar, 1997). Furthermore, many economists claim that weak financial intermediation has been one of the main causes for economic volatility (Acemoglue *et al*., 2003). Similarly, investments in Research and Development (R&D) as a share of GDP will be included, given that better property rights and rule of law induce technological innovation and knowledge capital.

Additionally, measures of macroeconomic policies are added as control variables. It has been found that, for example the size of the government, as measured by the general government final consumption expenditures as a percentage of GDP, significantly decreases macroeconomic stability and has a negative effect on growth. Moreover, trade openness will be proxied by the volume of trade, which is the sum of exports and imports relative to GDP and investment, measured as the gross capital formation as a percentage of GDP, will be added as control variables. In addition to capital formation, net foreign direct investments and portfolio investments - both measured relative to GDP - have been added as control variables. Furthermore, the total labor force participation rate as a measure of the labor supply as well as the net official development assistance relative to GDP will be tested as a control variable.

Moreover, Acemoglu *et al.* (2003) suggest, that the logarithm of initial GDP per capita should be included in the analysis, in order to account for the convergence effect of long term growth. Also, this variable accounts for the fact that poor countries are affected more by volatility and it is highly correlated with historically determined institutional quality (Aceoglue *et al.*, 2003). Thus the log of 1996 per capita GDP will be included. Moreover, economic variables such as the logarithm of real interest rate, the current account balance as a percentage of GDP and the real effective exchange rate will be added to the model as control variables. According to Calderón *et al.* (2012) it is important to include the exchange rate as a control variable, since it reflects changes in monetary

policies by the Central Banks. As mentioned before, possible reasons for these changes can be "leaning against the wind" or "fear of floating".

3.2 Measures Economic Performance and Volatility

So far the independent variables of the analysis have been discussed. With respect to the dependent variables several measures will be tested. First, the effect of institutions on economic performance as measured by annual GDP per capita growth will be examined.

Second, the main focus of this paper is the impact of institutional quality on macroeconomic volatility. The following analysis will contain several sensitivity tests in order to check the robustness of the results, so that different measures of macroeconomic volatility will be tested:

1. As seen before the inflation rate is an important measure of macroeconomic performance and volatility, as measured by the annual log of the consumer price index (CPI), taken from the IMF international financial statistics.
2. With respect to previous literature, output volatility has often been measured by the historical standard deviation. For the following analysis, real output volatility will be measured by the General Autoregressive Conditional Heteroskedasticity (GARCH) model, which is estimated by the maximum likelihood. In order to do so, the variance will be estimated from the natural logarithm of GDP at constant prices, taken from the World Bank.

The GARCH time-varying variance series of the error term are derived from the mean equation, which is an autoregressive function of real GDP growth:

$$\Delta lnY_{it} = \alpha + \Delta lnY_{it-j} + \omega_{it} \qquad (1)$$

Then the GARCH variance can be calculated as

$$v_{it} = \alpha_0 + \alpha_1 \omega_{it-1}{}^2 + v_{it-1} \ , \qquad (2)$$

where the current variance depends on the squared residuals from the previous period, which are the changes in volatility of the previous period, called the ARCH term, and the variance of the previous period, the GARCH term. The GARCH model is used for time series that show heteroskedasticity and volatility clustering in the residuals, meaning that a period of low (high) volatility is followed by a period of low (high) volatility for a prolonged period. As can be seen in equation (2) in the GARCH model a function of the past variance is added to the ARCH term, so that the variance

carries over more smoothly (Verbeek, 2012). Thus the GARCH model is less significant than the ARCH model, so that there can be evidence for time-varying variance, even though there is no significant ARCH effect in the residuals, which means that there is no significant conditional heteroskedasticity. Given the time-varying variance, ω_{it} hence does change over time.

For the following analysis the GARCH(1,1) process, as described by equation (2), has been calculated for all countries for the construction of the variance series, which will be used in the panel regressions. Furthermore also the standard deviation of real output volatility as measured by the square root of the GARCH variance series will be tested.

3.3 Research Design

In order to investigate the effect of institutional quality on macroeconomic volatility, a panel data set of 214 countries with yearly observations for the period 1996-2012 will be examined.[3] Furthermore, the analysis of the full sample will be compared to effect of IQ on macroeconomic volatility in the sample of only Latin American and OECD countries.

3.3.1 Equations

The following regressions will be tested:

$$\Delta lnY_{it} = \mu_i + \alpha IQ_{i,t} + \delta' X_{it} + \varepsilon_{i,t}\,, \qquad (3)$$

$$log\ \pi_{i,t} = \mu_i + \alpha IQ_{i,t} + \delta' X_{it} + \varepsilon_{i,t}\,, \qquad (4)$$

$$v_{i,t} = \mu_i + \alpha IQ_{i,t} + \delta' X_{it} + \varepsilon_{i,t}\,, \qquad (5)$$

where ΔlnY_{it} refers to the GDP per capita growth, $\pi_{i,t}$ stands for the inflation rate, v_{it} is the GARCH variance of real GDP growth, $IQ_{i,t}$ stands for the measures of institutional quality and X_{it} is the set of important control variables, whereas δ' is the vector of the corresponding coefficients. Furthermore $\varepsilon_{i,t}$ is the error term and the subscripts *i* and *t* refer to the country and time period, respectively. Thus, in the following analysis, the effect of institutions on economic performance and macroeconomic volatility will be examined by regressing real GDP growth, (3), inflation (4) and real output volatility on institutional quality and a set of control variables.

[3] See a full list of countries included in the dataset in the Appendix 8.

3.3.2 Estimations

Panel Fixed Effect Estimation

The above mentioned regressions (3), (4) and (5) are measured using the Panel FE method, so that μ_i as seen in equation (3)-(5) is the country-specific time-invariant fixed effect. The panel fixed-effect estimation is appropriate due to the strong omitted variable bias, given that the method accounts for unobservable factors among individual countries, such as culture for instance, captured by the intercept. Thus, the heterogeneity in individual characteristics across countries, captured in the constant, ensures that the model estimation is not biased due to omitted time independent factors, since the fixed effect panel estimation eliminates the unobservable factors, so that OLS can be used. It is important to note, that the time-invariant country characteristics should not be correlated with other country specific factors, so that the countries' constant and error terms should not be correlated. Hence, the panel fixed effect assumes strict exogeneity, and the instrumental variable approach has to be used in case of endogeneity, as explained in the next section.

A key assumption under OLS estimation is homoscedasticity, meaning that the error terms of all observations have a constant variance. If this is not the case, one has to use robust standard errors, which account for heteroskedasticity. It is common to use the White standard errors, which are robust to heteroskedasticity and autocorrelation.

Furthermore, it is important to account for macro cross-sectional dependence, since the unbalanced panel is likely to be affected by common factors. In the case of cross-sectional time series different countries can be affected by global cycles for instance (Verbeek, 2012). Under cross-sectional dependence, the residual of different countries are correlated, so that panel period fixed effects have been used. These time dummies account for clustering by period and heteroskedasticity in the relevant dimensions and contemporaneous correlation. Hence, both cross-section and period fixed effects, as well as White cross-section robust standard errors, which are clustered by period, will be used in the following analysis.

Panel Two-stage Least squares Fixed Effects Estimation (TSLS)

Second, next to the panel fixed-effect estimation, an alternative estimation method will be used, in order to account for possible endogeneity of institutional quality. Given that there can be simultaneity and reverse causality in endogenous variables, such that endogenous variables influence both dependent and independent variables. In the case of endogeneity OLS is biased,

because the endogenous variable is correlated with the error term, so that the two-stage least squares panel estimation seems more appropriate instead of OLS. Therefore, valid instruments are needed that can solve for the reverse causality problem. However, the IV estimation is less accurate due to the imperfect information that results from measuring the effect of instruments instead of the actual variable of interest, so that standard errors and the variance are higher than under OLS estimation.

Instrumental Variables

In order to test the effect of institutional quality on macroeconomic volatility using the two-stage least squares estimation method, valid instruments have to be found first.

Valid instruments have to be relevant, meaning that they should be correlated with the regressors, including the control variables and the endogenous regressor, which is the institutional quality indicator. More importantly, instruments have to be uncorrelated with the error term and the dependent variable directly. This means that the instrument has to be exogenous but relevant for institutional quality.

With respect to previous research, it has been shown, that several instruments have been used for institutional quality, such as the contract intensive money (Knack& Keefer, 1995), the rule of law index or geographical factors. Assuming that the before mentioned conditions are met, the following variables will be tested as instruments:

According to previous research, democracy seems to be correlated with institutional quality, which possibly makes it a valid instrument for the instrumental variable approach. A democracy ranking of the quality of democracy, which combines political as well as non-political variables for 115 countries will be tested as a valid instrument.[4] Especially interesting are the political variables, which contain information on political rights, civil liberties, global gender gap, press freedom, and the corruption perception index amongst others. Furthermore, according to Alonso, Antonio and Garcimartín (2010), taxes are also an important determinant for institutional quality, given that they reflect the main resources to build high quality institutions and strengthen the social contract between citizens and the state. Taxes will be measured as tax revenue as a percentage of GDP from the IMF (IFS). However, taxes are likely to be correlated with GDP growth, so that taxes will only

[4] Global Democracy Ranking: http://democracyranking.org/ : The Quality of Democracy Index is set together out of measures on freedom, characteristics of the political system and the performance of the non-political dimensions, such as gender, economy, knowledge, health and the environment. For each dimension several indicators are assigned taking values between 1 (poorest quality) and 100 (best quality).

be used as an instrument in the macroeconomic volatility regressions (4) and (5). In case of large countries, large market size makes the enforcement of contracts and laws more difficult. The logarithm of the total population size will be used as a measure of the market size, which is negatively related to growth and highly correlated with GDP per capita as well as trade openness (Dollar and Kraay, 2004). Similarly, it seems likely that high population growth has a negative effect on institution building. Furthermore, as described earlier, there seems to be a link between institutional quality and income distribution: more equitable income distribution has led to higher income quality, whereas small extractive elites favored destructive institutions (Acemoglue *et al.*, 2003). Thus the GINI coefficient of inequality from the World Bank Development Research Group will be tested as a valid instrument. The GINI coefficient takes a value between 0 and 1, where 0 describes perfect equality and a value of 1 describes perfect inequality. Hence an increase in the GINI coefficient is associated with lower level of institutional quality. In addition to that, geographic variables such as the life expectancy at birth can be added as a control variable, given that geography seems to have an influence on institutions and economic development (Sachs, McArthur 2000). Moreover previous literature suggests to use lagged values of institutional quality as instruments, given that the initial enforcement of laws for instance has a lasting positive effect on the improvement of institutional quality (Dollar and Kraay, 2003).

In order to test the above mentioned instruments, the composite index of institutional quality has been regressed on the instruments. The regression results are presented in Appendix 1. Column 1 contains the regression result for the full model, containing all instruments mentioned above.

In contrast to previous expectations the GINI coefficient takes a positive value. Nevertheless, the GINI index has been excluded for reasons of robustness. Re-estimating the regression without the GINI index leads to the results presented in column 2. After excluding life expectancy due to its insignificance, one can see in column 3 Appendix 1, that tax revenue has a very small but highly significant positive effect on institutional quality. Surprisingly, population growth also seems to increase institutional quality, which is significant at the 1% significance level. Moreover, unlike expected the first difference of the democracy variable has a small negative effect on institutional quality, significant at the 5% significance level. Thus overall, tax revenue, population growth, the first difference of democracy and also the lagged value of institutional quality all have a significant effect on institutional quality and thus seem to be valid instruments explaining institutional quality, so that they will be used as instrumental variables in the two-stage least squares estimations.

3.3.3 Unit Root Tests

Before proceeding with the main regression analysis, the variables have been tested for a common panel unit root.[5] It is important to verify that a series in stationary, in order to ensure the predictability of the analysis, because non-stationary random walk series are not predictable due to possible spurious regressions resulting from underlying third factors. Rejecting the null hypothesis of a unit root indicates that the variable is stationary (Verbeek, 2012). Non-stationary variables of order one can be made stationary by their first differentiation.

Variables that are measured as a share of GDP are very stationary. The summary of the panel unit root tests of the remaining variables can be seen in Appendix 2. One can see that most variables are stationary, except for the standard deviation of real GDP, democracy and the official exchange rate as well as the real effective exchange rate index are non-stationary variables, so that their stationary first differences are used in the analysis, in order to avoid a spurious regression, which could result from the underlying trend in a non-stationary variable. Furthermore the logarithm of the total population is stationary. However, the logarithm of initial GDP seems to be non-stationary and its first difference cannot be calculated. Thus, this variable has been excluded from the analysis.

4. Discussion of Main Results

4.1 Preliminary Statistics

Before starting the main analysis, it is interesting to have a closer look at the developments of the Kaufmann indicators of institutional quality and the dependent variables during the sample period 1996-2012 for the full set of countries. Appendix 3 displays the mean scores of all six Kaufmann indicators, as well as the mean of the equally weighted average of the six Kaufmann indicators, GDP per capita growth, inflation and the variance of output. One can see that even though the overall score is still negative for all indicators, there have been great improvements in all indicators during 1996-2012, suggesting that global institutional quality increased. However, the scores of all indicators decreased again between 2011 and 2012. With respect to the mean score of the institutional quality average, one can see that institutional quality greatly improved throughout the

[5] Unit Root-Dickey Fuller test: $\Delta Y_{it} = \alpha_i + \gamma_i * Y_{it-1} + \mu_{it}$; Levin-Lu Chu test statistic has the null hypothesis that all panels contain a unit root (all series are non-stationary), which holds for γ_i=0. There are two different alternative hypothesis: 1) $\gamma_i = \gamma < 0$ for each country i and 2) γ_i<0 for at least one country i.
Additionally, the Im, Pesaran, Shin W-statistic tests for individual unit root. Ho: γ_i=0 for each country i. Thus rejecting the null hypothesis if one of the coefficients is less than zero does not proof that all series are stationary.

last ten years. Furthermore, following the latest crisis one can see lower GDP growth and a very high spike in inflation, as well as fluctuations in output volatility.

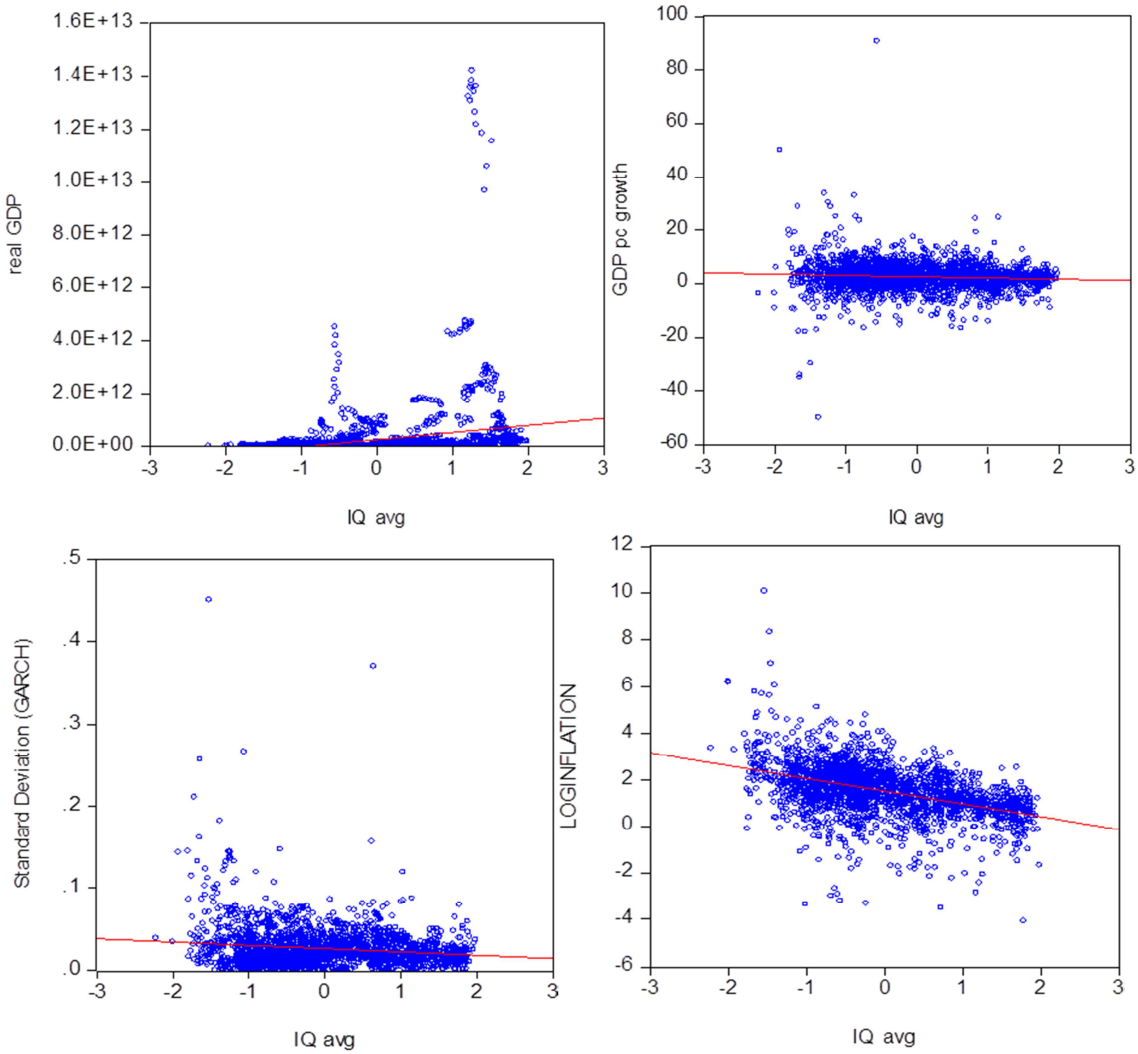


Figure 2: Scatter plots of the composite Institutional Quality Index and Measures of Growth and Macroeconomic Volatility

Figure 2 presents the stacked cross-section observations between the period 1996-2012 for the composite institutional quality index and measures of growth and macroeconomic volatility.

With respect to the scatter plots, one can see that there is a positive correlation between institutional quality and real GDP, as suggested by previous research. Further, there is a negative association between the composite index of institutional quality and the measures of macroeconomic volatility. The equally weighted average of the Kaufmann indices of institutional quality shows a negative correlation with both the logarithm of inflation as well as the standard deviation of real output, the

measure of output volatility. Nevertheless, there is no clear dependence between institutional quality and the deviation of real output, given that a few outliers largely account for the negative association. In general, the correlations seem to support the second hypothesis of a negative effect of institutional quality on macroeconomic volatility.

Before conducting the main analysis, the isolated effect of institutional quality, measured by the equally weighted index of the six Kaufmann indicators, on the three dependent variables is presented in Table 1. One can see that institutional quality has a positive effect on GDP growth per capita, which is significant at the 5% significance level. Furthermore institutional quality has a highly significant negative effect on the logarithm of inflation. Additionally, institutional quality also seems to decrease the variance of output, even though this effect is only significant at the 10% significance level. Nevertheless, the regression results of Table 1 suggest that there is a misspecification in the regression of the first difference of the standard deviation of output (GARCH) on institutional quality, so that this variable will be dropped from the following analysis.

Table 1: The Effect of Institutional Quality on Growth, Inflation, Output Volatility

Estimation Method: Panel Least Squares

Dependent Variable:	(1) GDP Growth per Capita	(2) Log Inflation	(3) Output Variance (GARCH)	(4) Output Standard Deviation (GARCH)
Constant	2.643	1.508	0.001	-0.000
	(0.012)	*(0.004)*	*(0.000)*	*(0.000)*
Institutional Quality	1.655**	-0.801***	-0.003 *	-0.005
	(0.612)	*(0.177)*	*(0.002)*	*(0.003)*
No. obs.	2635	2265	2442	2256
Adj. R^2	0.228	0.560	0.155	-0.071
Durbin Watson	1.687	1.313	1.997	2.898
F-statistic	4.703	15.7861	3.175	0.27
	(0.000)	*(0.000)*	*(0.000)*	*(1)*

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

Significance Level: * (10%), ** (5%), *** (1%)

4.2 Regression Results

4.1.1 Economic Growth regression

The first equation that will be tested is equation (3), which regresses economic performance measured as GDP per capita growth on the Kaufmann indicators of World Governance and several political and economic control variables. GDP growth per capita is chosen, because it also controls the welfare effects of an increase in the population size. An increase in GDP will result in higher growth rates, however, if population is also increasing, then welfare is still not improved.

Before presenting the regression results, the relationship between GDP per capita growth and several growth determinants have been depicted in scatter plots in Appendix 4**.** One can see that there seems to be a negative association between general government expenditures and GDP per capita. Similarly, both inflation and population growth are also correlated negatively with GDP per capita growth. Nevertheless, the negative association between inflation and GDP per capita growth is largely determined by an extreme outlier, which corresponds to the hyperinflation in Zimbabwe. When Zimbabwe is excluded from the sample, the negative association between inflation and GDP per capita growth vanishes. However, there is a positive association between capital formation and GDP per capita growth. As mentioned before, all growth regressions have been estimated with country and period fixed effects, as well as White robust standard errors in order to account for heteroskedasticity and cross-sectional dependence. In the following analysis the democracy index and R&D have been excluded for reasons of robustness. The first difference of the real effective exchange rate appears to have a significant effect on GDP per capita growth in the full panel least squares estimation, however it is important to note that the variable is not very robust due to many missing data observations.

First, equation (3) has been estimated with the panel least squares estimation method. The model contains all Kaufmann institutional quality indicators in the regression. During the general-to-specific approach total labor force participation rate, trade and the population growth have been excluded due to insignificance and the mode has been re-estimated each time. Furthermore 2 lagged dependent variables have been included in order to control for serial correlation, which seemed to be present as indicated by Durbin Watson test statistics taking values quite far from 2, so that the null hypothesis of no autocorrelation has been rejected. In the presence of autocorrelation OLS is still unbiased, however the estimates are inefficient, so that standard errors are smaller and the R^2 is

higher than in reality (Verbeek, 2012). In panel data autocorrelation can exist between and within panels. Thus 2 lags of GDP per capita have been included following the lowest AIC model selection criteria. The regression results of the full model can be found in Appendix 5 column 1.

There seems to be a highly significant positive effect of voice and accountability on output growth, which increases output by 6.269 per unit increase in the voice and accountability index. Furthermore the rule of law, political stability, regulatory quality and the control of corruption index seem to positively influence GDP per capita growth, even though the effect is not significant. The first difference of the real effective exchange rate index significantly increases GDP per capita growth by 0.06. Moreover output growth is significantly reduced by general government expenditures and inflation, as has been suggested by the scatter plots in Appendix 4. Additionally, the regression results suggest a large negative effect of net FDI/GDP on output growth (-27.65), which is significant at the 5% significance level. Moreover, the log of the real interest rate, the current account balance and the market seem to significantly increase GDP per capita growth. Furthermore also financial development, defined as commercial bank assets to total assets, has a positive effect on output growth, which is only significant at the 10% level. The Adjusted R^2 is 0.419, so that the full model explains only 41.9% of the variation in GDP per capita growth. However the F-test suggests that the variables are jointly significant and the Durbin Watson statistic shows no autocorrelation.

Second, equation (3) has been estimated in the panel least squares estimation model, which regresses GDP per capita growth on the composite index of institutional quality, which is the equally weighted average of the Kaufmann indicators of Governance Quality and several control variables. In this setting the first difference of the real effective exchange rate appears insignificant and has thus been excluded for reasons of robustness. Furthermore, net FDI relative to GDP has been excluded due to insignificance. The regression results can be found in Table 2.

Most interestingly, the regression results suggest that the coefficient α of equation (3) takes the value 5.074 and is significant at the 5% level. Furthermore, several control variables as described in section 3.1.2 have been added to the regression: a one unit increase in government expenditures significantly decreases GDP per capita growth by -0.457. This is in line with the intuition that inefficiencies resulting from wasteful government spending decrease overall economic growth.

With respect to the findings of Klein (2005), who reports a significant effect of capital account liberalization on economic growth in the presence of high institutional quality, the current account

balance has been included in the analysis. There is a negative effect of the current account balance on GDP per capita growth in the panel least squares estimation. A one unit increase in the current account balance reduces the GDP per capita growth by 0.068 and this effect is significant at the 10% significance level (Table 2). The current account shows the changes in the net foreign assets. A current account surplus indicates that a country is a net lender to the rest of the world. With respect to the regression result a current account deficit seems to induce faster output growth. Additionally, overall investment is associated positively with economic growth, as described by Alfaro *et al. (*2008*)* for example. Thus portfolio investments relative to GDP and capital formation as percentage of GDP are added as control variables. Capital formation significantly increases output growth by 0.246 per unit increase in the capital investment level. According to Rodrik (2000) there is a positive effect of trade on growth, however, this effect is not observed in the panel least squares estimation (Table 2).

With respect to previous literature by Dollar and Kraay (2004) claiming that there is a positive joint effect of institutional quality and trade. However there is no significant joint effect of institutional quality and trade on GDP per capita growth,

According to Burnside and Dollar (1997) foreign aid received in the presence of high institutional quality is more effective and increases output growth. Therefore also the effect of the interaction term between institutional quality and foreign aid on economic growth has been tested. There is a very negative and weakly significant joint effect of the composite institutional quality index and net Official Development Assistance (ODA) received relative to GDP, which is significant at the 10% significance level. Thus this finding contradicts the findings of previous research, since this result indicates a reduction of economic growth as result of foreign aid received in the presence of high institutional quality. The test statistics suggest that 58.9 % of the variation in GDP per capita growth is explained by the model and there seems to be no autocorrelation.

Table 2 GDP Growth Regressions

Dependent Variable: **GDP per capita growth (%, annual)**

Estimation Method:	**1. Panel LS FE**
Sample: 2005-2012 (adj.), (unbalanced Panel)	61 countries
Constant	-349.425*
	(188.862)
IQ Average	5.074 **
	(2.461)
Financial Development (M2/GDP)	-0.016
	(0.039)
Government Expenditures (% of GDP)	-0.457 **
	(0.216)
Current Account Balance (% of GDP)	-0.068 *
	(0.035)
Capital Formation (% of GDP)	0.246 **
	(0.082)
Net ODA received/GDP	-17.516
	(33.292)
Portfolio Investment/GDP	-0.086
	(0.449)
Inflation	-0.234 **
	(0.113)
Total Labor Force Participation Rate (% total population ages 15and older)	0.023
	(0.041)
log Population size	21.925 *
	(11.630)
log Real Interest Rate (%)	-0.025
	(0.218)
Trade (% of GDP)	-0.012
	(0.030)
IQ Average*Trade	-0.021
	(0.025)
IQ Averge* Net ODA rec/GDP	-48.133 *
	(25.053)
GDP per capita growth (-1)	-0.151
	(0.126)
GDP per capita growth (-2)	-0.185
	(0.152)
No. obs.	250
Adj. R^2	0.589
Durbin Watson	2.357
F-statistic	5.309
	(0.000)

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors
Significance Level: * (10%), ** (5%), *** (1%)

As a second sensitivity test, the same model has been estimated with the panel two-stage least squares estimation model, which allows to instrument institutional quality in order to account for possible underlying endogeneity in the model. With respect to the valid instruments, tax revenue has been excluded as an instrumental variables, since it is likely that GDP per capita and tax revenue are correlated. The regression results can be found in Appendix 5, column 2. Similar to the panel least squares estimation above, the coefficient of the institutional quality average as explained by the instruments still shows a positive effect on GDP per capita (10.116), however its effect is insignificant in the TSLS estimation. Furthermore, capital formation significantly increases GDP per capita growth by 0.257, which is significant at the 5% significance level. Government expenditures and inflation again decrease GDP per capita growth, however these effects are only significant at the 10% significance level. Again there is no significant effect of the interaction terms on GDP per capita growth. Finally, 61% of the variation in GDP per capita growth is explained by the Panel TSLS model, which has an instrument rank of 69, and a J-statistic probability of 0.069, suggesting only a weakly significant valid model specification.

All in all one can say that previous research suggesting a positive effect of institutional quality on economic performance can only be supported in the panel least squares estimation model regressing GDP per capita growth on the equally weighted institutional quality index (Table 2). However, government expenditures and inflation seem to have a significant negative effect on GDP per capita growth, while capital formation significantly increases output growth.

4.1.2 Macroeconomic Volatility Regressions

After having tested the effect of institutional quality on economic performance as measured by the GDP per capita growth in equation (3), the analysis will continue with the examination of the effect of institutional quality on measures of macroeconomic volatility, such as the inflation rate (equation (4)) and the volatility of real output, as described by equation (5). In the following regressions democracy, real effective exchange rate and research and development (R&D) have been excluded from the analysis for reasons of robustness. Furthermore, as mentioned earlier all regressions are estimated using country and period fixed effects, as well as White robust standard errors.

Table 3 presents the main results for equation (4) and (5), which will be discussed in more detail in the following section.

Table 3 Macroeconomic Volatility Regressions

Dependent Variable: **Log Inflation**		*Dependent Variable:* **Output Volatility (GARCH Variance Series)**	
Estimation Method:	**1. Panel LS FE**		**2. Panel TSLS [i]**
Sample: 2005-2012 (adj.), (unbalanced Panel)	85 countries	Sample: 2005-2012 (adj.), (unbalanced Panel)	67 countries
Constant	24.160	Constant	-0.113
	(29.198)		*(0.017)*
IQ Average	-0.979 ***	**IQ Average**	-0.002
	(0.290)		*(0.001)*
Financial Development (M2/GDP)	-0.0002	Financial Development	-0.000
	(0.007)		*(0.000)*
Government Expenditures (% of GDP)	-0.044 **	Government Expenditures	0.0001 **
	(0.019)		*(0.000)*
Current Account Balance (% of GDP)	0.005	Current Account Balance	0.000
	(0.005)		*(0.000)*
Capital Formation (% of GDP)	0.015 **	Capital Formation	0.000 **
	(0.007)		*(0.000)*
Net ODA received/GDP	0.957	Net ODA received/GDP	-0.003
	(1.030)		*(0.003)*
Net FDI/GDP	0.545**	Net FDI/GDP	0.001
	(0.231)		*(0.001)*
Portfolio Investment/GDP	0.229	Portfolio Investment/GDP	0.001 **
	(0.168)		*(0.0005)*
log Population	-1.468	log Population	0.007 ***
	(1.867)		*(0.001)*
log Real Interest Rate	-0.111 **	log Real Interest Rate	0.000
	(0.036)		*(0.000)*
Trade (% of GDP)	0.012 ***	Trade	-0.000
	(0.004)		*(0.000)*
IQ Average*Trade	0.009**	IQ Average*Trade	0.000
	(0.005)		*(0.000)*
IQ Averge* Net ODA rec/GDP	-1.745	IQ Averge* Net ODA rec/GDP	0.002
	(3.392)		*(0.002)*
No. obs.	449		353
Adj. R^2	0.545		0.623
Durbin Watson	2.426		1.80
F-statistic	6.17		8.042
	(0.000)		*(0.000)*
		Instrument Rank	89
		Prob (J-Statistic)	*(0.163)*
		[i] Instrumental Variables: Population Growth, Tax Revenue, IQ average lagged by 1 period	

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

Significance Level: * (10%), ** (5%), *** (1%)

Inflation

The first macroeconomic volatility variable that will be tested is inflation. Column 1 presents the regression result of equation (4), in which the log of inflation has been regressed on the equally weighted composite index of institutional quality combining the six Kaufmann indicators (IQ Average) and a number of control variables using the panel least squares estimation. One can see that the coefficient for IQ average, which is α in equation (4), takes the value -0.979. Thus a one unit increase in IQ average results in 97.9% decrease in inflation. Hence as expected IQ Average significantly decreases inflation at the 1% significance level, which is in line with previous expectations, namely that higher institutional quality results in lower macroeconomic volatility. Furthermore government expenditures significantly decrease inflation, while there seems to be a positive effect of capital formation on the log of inflation, both at the 5% significance level. A one unit increase in government expenditures results in a 4.4% decrease in inflation, whereas inflation increases by 1.5% due to a one unit increase in capital formation. Moreover, both net FDI relative to GDP and trade have a positive effect on inflation, whereas the effect of trade is only significant at the 1% significance level. Additionally the log of the real interest rate shows a negative effect on the log of inflation, which is in line with the theory of "leaning against the wind" as described by the Taylor rule above: During an expansion, that is when output or in this case inflation exceed their potential, the central bank increases the short-term interest rate in order to bring inflation back to its full employment level. All else held equal the coefficient of the logarithm of the real interest rate resembles the partial elasticity, so that a 1% increase in the real interest rate leads to a 0.111% decrease in inflation. Furthermore institutional quality and trade have a significant positive joint effect on the logarithm of inflation. The panel least squares regression of the log of inflation on institutional quality has an adjusted R-squared of 0.545, meaning that 54.5% of the variation in the response data are explained by the model presented in column 1. Table 3. Furthermore, the F-statistic suggests that the variables are jointly highly significant, and with a Durbin Watson test statistic of 2.426, the null hypothesis of no autocorrelation cannot be rejected.

In order to test the robustness of the estimation results of equation (4) two more regressions have been performed again as sensitivity tests.

Firstly, the log of inflation has also been regressed on the full set of Kaufmann indicators and several control variables. The regression results of the panel least squares estimation can be found in Appendix 6 column 1. However, only a few indicators appear to have significant effect on the log of inflation. Namely government effectiveness significantly decreases inflation at the 5%

significance level. A one unit increase in the index of government effectiveness results in a 51.1% decrease in inflation. Next to government effectiveness only the rule of law index has the expected negative sign, even though this effect is not significant. Concerning the control variables in the full panel least squares regression there is again a negative effect of the real interest rate, significant at the 1% level, and government expenditures on inflation (significant at 5%). In addition to that, the results presented in Appendix 6 column 1 suggest that the net official development assistance (ODA) received relative to GDP significantly increases the log of inflation at the 5% significance level. A one unit increase in the net ODA received relative to GDP results in a 188.1% increase in inflation. Moreover, trade again has a positive effect on inflation, such that a one unit increase in the level of trade leads to a 0.8% increase in inflation. This effect is significant at the 5% significance level. The adjusted R^2 suggests that 53.9% of the variation in the log of inflation is explained by the panel least squares regression containing all Kaufmann indicators as regressors and the variables have joint explanatory power, as suggested by the F-statistic. In addition to that, the Durbin Watson test statistic is quite high (2.447), but still indicates the absence of serial correlation.

Secondly, in order to account for endogeneity in the institutional quality variable, a two-stage least squares (TSLS) regression has been conducted, which is presented in Appendix 6 column 2. However there appears to be no significant effect of institutional quality explained by tax revenue, population growth, the first difference of democracy and the lagged institutional quality index on the logarithm of inflation. Unlike predicted, the IQ Average coefficient in the instrumental variable approach takes a positive value, indicating that higher institutional quality is associated with higher inflation. However a 0.451 J-statistic probability suggests that the specification of the model cannot be reject, so that the instruments used seem to be valid. As seen before, government expenditures significantly decrease inflation by about 5%. Moreover, a one unit increase in the current account, which is the change in net foreign assets, results in a 3.2% decrease in inflation, which is highly significant at the 1% level. Furthermore, the real interest rate still shows a negative effect on inflation, significant only at the 10% significance level, while trade still significantly increases inflation by 1.1% at the 5% significance level. Interestingly the total market size, as measured by the log of the total population is now significant at the 10% level in the TSLS regression, suggesting a 4.466% decrease in inflation due a 1% increase in the market size. Additionally, compared to the previous regression the net ODA received relative to GDP, now also has a significant negative effect on the log of inflation at the 5% significance level. A one unit increase in net ODA decreases inflation by 736.4%. Furthermore also the interaction term between the average of the Kaufmann institutional quality indicators and the net ODA received relative to

GDP has a very large significant negative effect on the log of inflation. Thus foreign aid in the presence of high institutional quality seems to significantly reduce inflation.

Real output volatility

Having discussed the effect of institutional quality on macroeconomic volatility as measured by inflation, the regression results of equation (5), which regresses real output volatility measured by the GARCH variance series on institutional quality and a set of control variables are presented next.

The panel least squares estimation of equation (5) containing all Kaufmann indicators as regressors is presented in Appendix 6 column 3. From the regression results of the full model one can see that government effectiveness significantly decreases output volatility. The voice and accountability, rule of law, political stability control of corruption as well as regulatory quality variables have the expected negative sign, however the effect these indicators is not significant. Nevertheless, general government expenditures have a very small, but highly significant negative effect on output volatility. In contrast to the effect on inflation, the market size measured as measured by the log of the total population size seems to increase the volatility of output by 0.004, which is significant at the 5% level. Furthermore Durbin Watson statistic indicates the absence of autocorrelation and 64.126% of the variation in output volatility is explained by the full model containing all indicators and control variables, which appear to be jointly significant.

Regressing output volatility on the composite index of institutional quality (IQ Average) and the set of control variables, shows a positive insignificant effect of IQ average on output volatility (Appendix 6 column 4). However, similar to the regression results above, government expenditures and the current account balance significantly decrease output volatility, whereas the log of population again shows a small positive and significant effect on output volatility. However trade and the interaction term between IQ Average and net ODA received relative to GDP seem to decrease output volatility, which is significant only at the 10% significance level. Even though the effect of IQ Average on output volatility is positive and insignificant, the equally weighted index of institutional quality and the control variables still explain 64.6% of the variation of output volatility and the variables are jointly significant. Additionally, the Durbin Watson statistic is very low, but still high enough to indicate the absence of autocorrelation.

The results above do not indicate a significant effect of institutional quality on output volatility. However, controlling for endogeneity in institutional quality shows a negative effect of institutional quality on output volatility measured by the GARCH variance of real output:

Table 3 column 2 presents the regression results of the two-stage least squares regression using population growth, tax revenue and IQ average lagged by 1 period as instruments for the equally weighted composite institutional quality index. The IQ Average variable, which is explained by the above mentioned instruments, shows the expected negative sign, which is in line with previous research suggesting that higher institutional quality seems to decrease real output volatility, but this effect is not significant in the TSLS estimation. Furthermore unlike in all the other regression, government expenditures seems to increase output volatility in the instrumental variable approach. Additionally also capital formation and portfolio investment relative to GDP have very small but positive effects on output volatility, significant at the 5% significance level. Furthermore similar to the least squares estimation of equation (5) the log of population, our measure for the market size, again appears to significantly increase output volatility by 0.007. The R^2 of the model is 0.623 and the variables appear to be jointly significant. Furthermore the instrument rank of 89 is quite high and the probability of the J-statistic indicates that the model specification is valid.

To summarize, one can see that there seems to be a significant negative effect of the composite institutional quality index on macroeconomic volatility, as measured by the log of inflation in the panel least squares estimation (Table 3, column 1). Moreover, institutional quality seems to decrease macroeconomic volatility as measured by output volatility only in the panel TSLS estimation. However, this effect appears to be insignificant (Table 3, column 2). Nevertheless, the results of this analysis, which regresses the output volatility as measured by the GARCH variance series of GDP growth on institutional quality, instrumented by population growth, tax revenue and one lag of the institutional quality average, support the findings of Barseghyan and DiCecio (2008), who report a significant increase in the standard deviation of output due to increases in institutional quality as instrumented by barriers to entry costs. In contrast to that Klomp and de Haan (2009) find a negative effect of democracy on output volatility as measured by the standard deviation of GDP per capita growth. Nevertheless, as mentioned before, this analysis finds no strong evidence for a negative effect of additional institutional quality indicators on output volatility. Consequently, the effect of institutional quality on measures of macroeconomic volatility largely depends on the estimation method, since the equally weighted institutional quality index shows a positive sign in the panel TSLS regression of inflation (Appendix 6, column 2) and in the panel least squares estimation of output volatility (Appendix 6, column 4). With respect to the effect of the separate Kaufmann indicators of institutional quality on measures of macroeconomic

volatility, government effectiveness seems to be especially important for the reduction of macroeconomic volatility. Concerning the control variables one can say that government expenditure and the market size seem to significantly decrease macroeconomic volatility as measured by the log of inflation. In contrast to that there is a positive effect of the market size on output volatility and the effect of government expenditures on output volatility differs depending on the estimation method.

4.1.3 Application to Latin American and OECD countries

According to previous literature, many scholars claim that institutional quality is especially important for less developed countries. The analysis presented above is extended by having a closer look at two subsamples of countries. The macroeconomic volatility regression results are presented for the subsamples of 41 Latin American and compared to the regression results for 31 OECD countries. In figure 3 one can see the mean of the IQ average for the two subgroups of countries. Even though the absolute scores of the institutional quality average are still lower than the scores in the OECD countries, there have been great improvements in the level of institutional quality in Latin America in recent years, whereas the scores decreased in OECD countries after 2004.

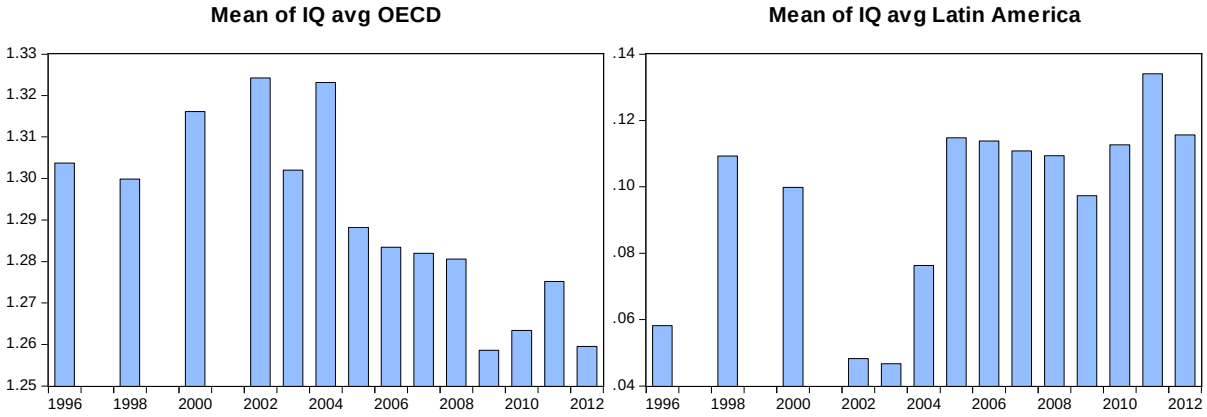


Figure 3: The mean scores of IQ Average for Latin American and OECD countries

Comparing the simple regression results of the equally weighted institutional quality index on the logarithm of inflation and output volatility of the 2 subsamples presented in Table 4 with the ones of the full sample in Table 2 one can see that there is no significant effect of institutional quality

inflation in Latin American and OECD countries, even though the effect is still negative. In contrast to that while the full sample indicated a weakly significant negative effect of institutional quality on output volatility, the results of the two subsamples indicate an insignificant positive effect, which contradicts the prediction of a negative effect of institutional quality on output volatility.

Table 4: The Effect of IQ_Average on Inflation and Output Volatility- Subsamples

Estimation Method: Panel Least squares

Dependent Variable:	(2) Log Inflation		(3) Output Variance (GARCH)	
	Latin America	**OECD**	**Latin America**	**OECD**
Constant	1.564	1.113	0.001	0.000
	(0.015)	*(0.344)*	*(0.000)*	*(0.001)*
Institutional Quality	-0.187	-0.242	0.001	0.0003
	(0.330)	*(0.266)*	*(0.001)*	*(0.001)*
No. obs.	399	401	429	403
Adj. R^2	0.51	0.444	0.277	0.263
Durbin Watson	1.398	1.439	1.918	2.044
F-statistic	10.203	8.247	4.568	4.329
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

Significance Level: * (10%), ** (5%), *** (1%)

As seen before, there is a highly significant effect (-0.979) of IQ average on the log of inflation in the full sample panel least squares estimation, while there is a negative but insignificant effect of the IQ Average output volatility in the two-stage least squares regression (Table 3).

Table 5 presents the regression results of equation (4) and (5) for Latin American and OECD countries. One can see that there is no significant effect of institutional quality on inflation in Latin America or OECD countries according to the panel least squares estimation.

Interestingly, there seems to be a weakly significant negative effect of institutional quality on output volatility in Latin America, while the effect is not significant in the OECD sample (Table 5, column 2). Also in the TSLS regression, in which IQ Average has been instrumented by population growth, tax revenue and a one period lagged value of IQ Average, there is a weakly significant negative effect of IQ Average on the output volatility of Latin American countries (Appendix 7, column 4).

Similar to the full sample there is a significant negative effect of government expenditures on Latin American inflation (Table 5, column 1). Furthermore the market size in Latin America seems to play a very important role in decreasing inflation: A one percent increase in the market size result in a 34.648% decrease. Moreover, trade seems to increase the level of inflation in Latin America,

which is in line with the result found for the full sample. A one unit increase in trade leads to a 6.5% increase in inflation in Latin America. Additionally the interaction effect between institutional quality and net ODA received relative to GDP significantly increases inflation in Latin America. With respect to output volatility, the regression results in Table 5 indicate, that capital formation has a weakly significant small positive effect on Latin American output volatility. This result is the same in the TSLS estimation, presented in Appendix 7, column 4, which contradicts the intuition that higher investment levels reduce output volatility.

The full regression including all Kaufmann World Governance Indicators can be found in Appendix 7. Similar to the full sample results government effectiveness significantly decreases inflation in Latin America (Appendix 7, column 1).

With respect to the macroeconomic volatility regressions of OECD countries, net ODA received relative to GDP has been excluded due to missing data observations. The results of the effect of institutional quality on inflation and output volatility of OECD countries seem less significant as presented in Table 5 and Appendix 7. With respect to output volatility one can find a negative but insignificant effect of IQ Average, which is in line with the result of the full sample.

Table 5 Macroeconomic Volatility Regressions- Subsamples

Dependent Variable: **log Inflation**			*Dependent Variable:* **Output Volatility (GARCH Variance series)**	
Estimation Method:	**1. Panel LS FE**		**2. Panel LS FE**	
Sample: 2005-2012 (adj.), (unbalanced Panel)	**Latin America** 26 countries incl.	**OECD** 21 countries incl.	**Latin America** 27 countries incl	**OECD** 21 countries incl.
Constant	516.769	-30.054	-0.015	-0.036
	(103.818)	*(93.701)*	*(0.038)*	*(0.150)*
IQ Average	**-2.491**	**0.598**	**-0.002 ***	**-0.0002**
	(3.332)	*(1.423)*	*(0.001)*	*(0.004)*
Financial Development (M2/GDP)	-0.029	0.004	0.000	0.000
	(0.038)	*(0.005)*	*(0.000)*	*(0.000)*
Government Expenditures (% of GDP)	-0.405 **	-0.116 *	-0.000	0.000
	(0.160)	*(0.068)*	*(0.000)*	*(0.000)*
Current Account Balance (% of GDP)	0.031	-0.020	0.000	0.000
	(0.061)	*(0.026)*	*(0.000)*	*(0.000)*
Capital Formation (% of GDP)	0.020	0.013	0.0001**	-0.000
	(0.039)	*(0.033)*	*(0.000)*	*(0.000)*
Net FDI/GDP	5.486	0.702	-0.001	-0.000
	(4.814)	*(0.817)*	*(0.003)*	*(0.002)*
Portfolio Investment/GDP	4.592	0.875 **	-0.000	-0.000
	(5.266)	*(0.339)*	*(0.002)*	*(0.001)*
log Population	-34.648***	1.854	0.001	-0.002
	(7.097)	*(5.611)*	*(0.003)*	*(0.009)*
log Real Interest Rate	-0.224	-0.052	0.000	0.000
	(0.202)	*(0.098)*	*(0.000)*	*(0.000)*
Trade (% of GDP)	0.065 ***	0.006	-0.000	-0.000
	(0.019)	*(0.017)*	*(0.000)*	*(0.000)*
Net ODA received/GDP	-20.268		-0.002	
	(13.688)		*(0.006)*	
IQ Average*Trade	0.045	0.007	0.000 *	*0.000*
	(0.037)	*(0.010)*	*(0.000)*	*(0.000)*
IQ Averge* Net ODA rec/GDP	44.670 **		0.001	
	(18.646)		*(0.007)*	
No. obs.	157	107	163	120
Adj. R^2	0.763	0.703	0.591	0.353
Durbin Watson	2.296	2.432	1.803	2.688
F-statistic	12.188	7.593	6.089	2.705
	(0.000)	*(0.000)*	*(0.000)*	*(0.000)*

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

Significance Level: * (10%), ** (5%), *** (1%)

4.2 Policy implications

With respect to the empirical findings of this study, there are several policy implications that can be drawn from the results:

For policy makers the results presented indicate the importance of strategies focused on decreasing government expenditures and inflation, while increasing the capital formation in order to achieve higher levels of economic growth. Furthermore the findings support the view that high institutional quality is an important determinant of lower levels of macroeconomic volatility as measured by the level of inflation. With respect to the indicators of institutional quality especially the government effectiveness indicator seems to play an important role in decreasing macroeconomic volatility. Hence, higher quality of public and civil services, the quality of policy formulation and implementation as well as a higher degree of independence from political pressures have a significant negative effect on macroeconomic volatility.

Concerning the ongoing debate about the effectiveness of foreign aid, there is no clear conclusion that can be made from the analysis, since the effect of the net official development assistance changes depending on the measurement of institutional quality. However, with respect to the interaction term of institutional quality and foreign aid the findings do suggest, that foreign aid has a very negative weakly significant effect on GDP per capita growth, even in the presence of institutional quality. Thus, this result seems to support the view of Easterly, who claims that foreign aid destroys incentives in the receiving country, leading to lower levels of growth.

4.3 Limitations

This last section will shortly address the limitations of the analysis presented. With respect to the results mentioned above one has to keep in mind that institutional quality is highly likely to be endogenous due to measurement errors and omitted variables. The relatively low R^2 indicates the difficulties in reliably predicting institutional quality. Thus, the possibility that institutional quality is not exogenous but endogenous has been tested in the two-stage least squares estimation. With respect to the robustness tests the effect of institutional quality on macroeconomic volatility differs depending on the measurements of institutional quality and the estimation method, even though Dollar and Kraay (2004) do not find significant differences in the effect of institutional quality on economic performance due to changes in the measurement of institutional quality. Hence, more research has to be conducted on the isolated effect of specific indicators in order to learn more

about the exact effect of institutional quality indicators on economic growth and macroeconomic volatility.

Another limitation of this study is the fact that the fixed estimator eliminates all the time invariant information, so that the explanatory power thereof is not included (Verbeek, 2012). In contrast to that, the random effects estimator offers the possibility to capture the short and long run impacts, because both the between and within dimension of the data can be exploited (Verbeek, 2012).

Unfortunately there are many data observations missing in the democracy ranking, so that this variable has been excluded most of the times in order to ensure the robustness of the results. Furthermore, even though the Kaufmann indicators of institutional quality are available for 1996-2012, the regression results mostly cover only the period from 2005-2012. Especially the regression results of the two subsamples of countries are not very robust, due to many missing data observation. Contrary to most previous studies conducted on the impact of institutional quality on output volatility, other measures of output volatility have been used. With respect to the two-stage least squares estimations the possibility of reverse causality is eliminated and the sign of the coefficient of the equally weighed institutional quality index shows differs depending on the subsamples. Moreover the analysis results can differ compared to previous research due to the differences in the measurement of institutional quality, as well as output volatility. Also the instruments used in the TSLS estimation of this analysis differ to the ones included in previous research. In addition to that, many studies on the relationship between institutional quality and macroeconomic volatility used the Generalized Method of Moments (GMM) method to estimate the model.

5. Conclusions

The relationship between institutional quality and economic growth has long been a focus of numerous studies. Taking everything into consideration, this study on the full set of 214 countries finds a weakly significant positive effect of the equally weighted average of the Kaufmann institutional quality indicators on economic performance as measured by the GDP per capita growth in the panel least squares estimation. Thus, the findings support previous studies by Acemoglu, Johnson, Robinson (2001), Hall and Jones (1999), as well as Knack and Keefer (1995) for instance, which state that higher institutional quality has a positive influence on economic growth. Therefore

the first hypothesis, namely that there is a positive effect of institutional quality on economic growth, is not rejected.

This paper pays special attention to the role of institutional quality on macroeconomic volatility, estimating panel least squares as well as two-stage least squares models of the effect on institutional quality on different measures of macroeconomic volatility. With respect to the main hypothesis of the effect of institutional quality on macroeconomic volatility, this study concludes, that there seems to be a significant negative effect of the average of institutional quality on macroeconomic volatility, as measured by the log of inflation in the panel least squares estimation. Hence the second hypothesis cannot be rejected when macroeconomic volatility is measured by the level of inflation.

Despite many studies indicating a negative effect on output volatility, the empirical findings presented in this paper do not show a significant effect of the average of institutional quality on macroeconomic volatility as measured by the GARCH variance series of real GDP growth.

With respect to the macroeconomic volatility regression results of Latin American and OECD countries one can conclude that institutional quality does indeed play an important role in stabilizing output volatility in Latin America. The regression results show a weakly significant negative effect of institutional quality on Latin American output volatility in the panel least squares estimation, as well as the TSLS regression, accounting for endogeneity in institutional quality. This result supports the study by Klomp and de Haan (2009), who find a negative effect of democracy on output volatility, while this analysis includes additional institutional quality indicators. In contrast to that the results are less significant in OECD countries.

This analysis contributes to the limited empirical studies investigating the effect of institutional quality on macroeconomic volatility by measuring output volatility not as the standard deviation of output but by the GARCH variance of real GDP growth. In that way, this study offers some insights into the effects of institutional quality on macroeconomic volatility, as measured either by inflation or the GARCH variance of real output growth.

To summarize, institutions do seem to play a very important role in determining economic outcomes, however, the effect on output volatility has to be investigated further theoretically, as well as empirically. With respect to the findings presented, it is not clear through which channels weak institutions decrease macroeconomic volatility. As said before, it seems that government effectiveness plays an important role in decreasing macroeconomic volatility. The isolated effects of specific indicators of institutional quality, however, have to be researched in more detail.

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7. Appendix

Appendix 1: Valid Instruments

Dependent Variable: Composite Index Institutional Quality

Final Model (3):104 countries, (adj.) 2005-2012 (unbalanced panel)

Panel Least squaress:	(1) Full Model	(2) Restricted Model	(3) Final Model
Constant	-2.141	-0.133	-1.53
	(5.381)	*(1.844)*	*(0.0.001)*
Log(Population)	0.227	0.014	0.011
	(0.314)	*(0.096)*	*(0.104)*
Tax Revenue	0.003	0.004 ***	0.004***
	(0.005)	*(0.001)*	*(0.001)*
Population Growth	-0.041	0.027***	0.027 ***
	(0.034)	*(0.008)*	*(0.008)*
IQ Average (-1)	0.482 ***	0.541***	0.540 ***
	(0.123)	*(0.085)*	*(0.086)*
D-Democracy	-0.002 **	-0.001**	-0.0004**
	(0.001)	*(0.001)*	*(0.0002)*
Life Expectancy	-0.026	-0.001 b	
	(0.011)	*(0.005)*	
GINI Index	0.003 a		
	(0.008)		
No. obs.	153	610	610
Adj. R^2	0.991	0.996	0.996
Durbin Watson	2.409	1.995	1.993
F-statistic	229.737	1278.708	1292.346
	(0.000)	*(0.000)*	*(0.000)*

a: excluded for reasons of robustness

b: excluded for reasons of insignificance

Notes: Sample data from 1996-2012. Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

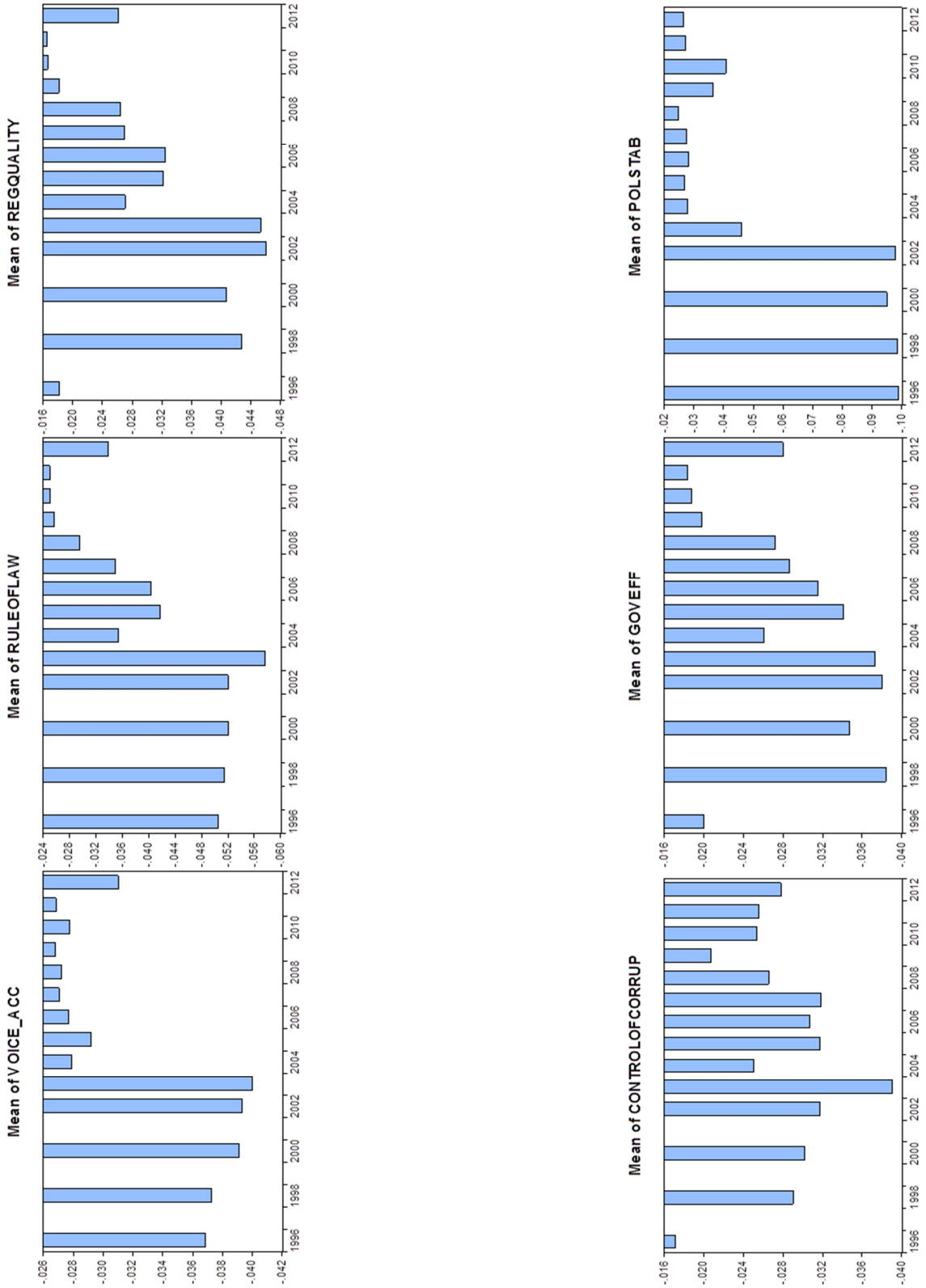
Significance Level: * (10%), ** (5%), *** (1%)

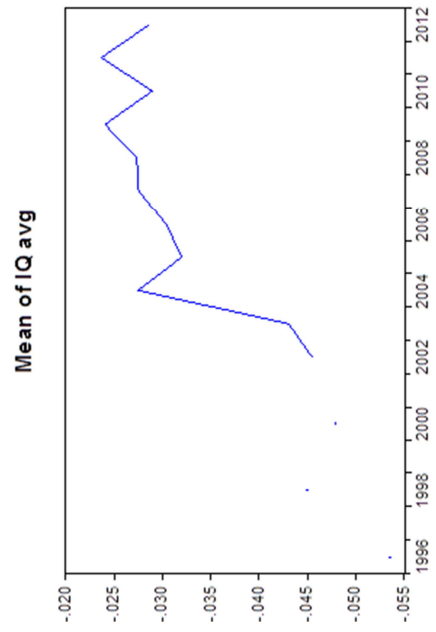
Appendix 2 Panel unit root test

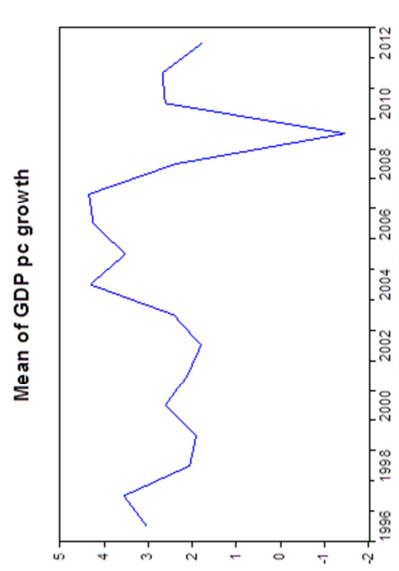
GDP growth per capita			**Real interest rate**		
*Levin, Lin Chu t**	*Prob.*	***0.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	3075		no. obs.	2251
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	3072		no. obs.	2248
Inflation			**Total Labor Force Participation**		
*Levin, Lin Chu t**	*prob.*	***0.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	2698		no. obs.	1345
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	2692		no. obs.	1333
Official Exchange Rate			**D(Official Exchange Rate)**		
*Levin, Lin Chu t**	*prob.*	***0.091***	*Levin, Lin Chu t**	*prob.*	***0.000***
	no. obs.	2521		no. obs.	2366
Im, Pesaran, Shin W-stat	*Prob.*	***1.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.029***
	no. obs.	2489		no. obs.	2357

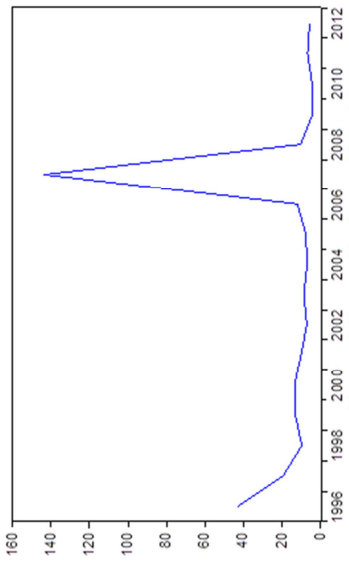
Real effective ER Index			**D(Real effective ER Index)**		
*Levin, Lin Chu t**	*prob.*	***0.140***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	1502		no. obs.	1408
Im, Pesaran, Shin W-stat	*Prob.*	***0.997***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	1502		no. obs.	1408
Log initial GDP per capita			**GINI**		
*Levin, Lin Chu t**	*prob.*	***0.615***	*Levin, Lin Chu t**	*prob.*	***0.000***
	no. obs.	16		no. obs.	287
Im, Pesaran, Shin W-stat	*Prob.*		*Im, Pesaran, Shin W-stat*	*Prob.*	***0.027***
	no. obs.			no. obs.	281
Total Population			**Log(Population)**		
*Levin, Lin Chu t**	*Prob.*	***1.000***	*Levin, Lin Chu t**	*prob.*	***0.000***
	no. obs.	3420		no. obs.	3420
Im, Pesaran, Shin W-stat	*Prob.*	***1.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	3420		no. obs.	3420
Population Growth			**Life Expecancy**		
*Levin, Lin Chu t**	*prob.*	***0.000***	*Levin, Lin Chu t**	*prob.*	***0.000***
	no. obs.	3411		no. obs.	3186
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	3411		no. obs.	3183
Real output volatility (SD)			**D(Real output volatility (SD))**		
*Levin, Lin Chu t**	*prob.*	***1.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	2668		no. obs.	2471
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	2668		no. obs.	2471
Real output volatility (Variance)			**Institutional Quality Avg.**		
*Levin, Lin Chu t**	*Prob.*	***0.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	2667		no. obs.	2007
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	2667		no. obs.	2004
Voice and Accountability			**Govenanment Effectiveness**		
*Levin, Lin Chu t**	*Prob.*	***0.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	2015		no. obs.	1982
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	2012		no. obs.	1979
Political Stability			**Control of Corruption**		
*Levin, Lin Chu t**	*prob.*	***0.000***	*Levin, Lin Chu t**	*prob.*	***0.000***
	no. obs.	1998		no. obs.	1987
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	1995		no. obs.	1984
Regulatory Quality			**Rule of Law**		
*Levin, Lin Chu t**	*prob.*	***0.000***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	1981		no. obs.	2013
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.000***
	no. obs.	1978		no. obs.	2010
Democracy			**D(Democracy)**		
*Levin, Lin Chu t**	*prob.*	***0.999***	*Levin, Lin Chu t**	*Prob.*	***0.000***
	no. obs.	817		no. obs.	601
Im, Pesaran, Shin W-stat	*Prob.*	***1.000***	*Im, Pesaran, Shin W-stat*	*Prob.*	***0.190***
	no. obs.	817		no. obs.	601
Battle related Deaths					
*Levin, Lin Chu t**	*prob.*	***0.000***			
	no. obs.	336			
Im, Pesaran, Shin W-stat	*Prob.*	***0.000***			
	no. obs.	321			

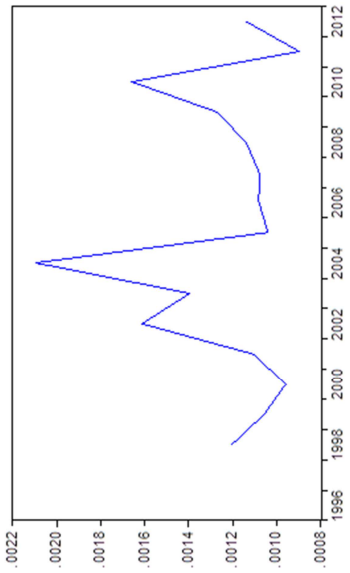
Appendix 3: The Evolution of Institutional Quality Indicators and Dependent Variables



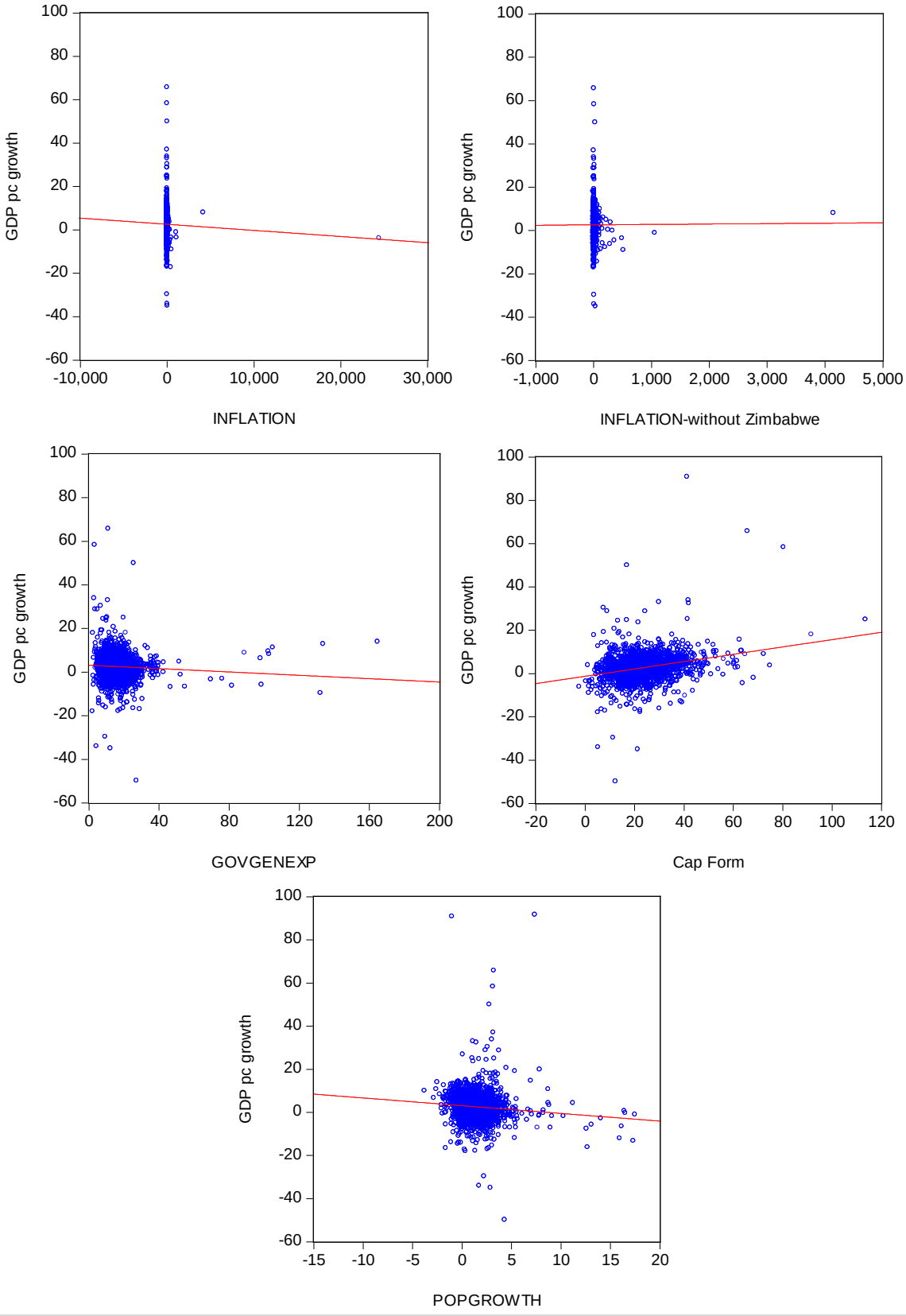

Mean of IQ avg
-.020
-.025
-.030
-.035
-.040
-.045
-.050
-.055
1996
1998
2000
2002
2004
2006
2008
2010
2012


Mean of GDP pc growth
5
4
3
2
1
0
-1
-2
1996
1998
2000
2002
2004
2006
2008
2010
2012


Mean of INFLATION
160
140
120
100
80
60
40
20
0
1996
1998
2000
2002
2004
2006
2008
2010
2012


Mean of Output Variance (Garch)
.0022
.0020
.0018
.0016
.0014
.0012
.0010
.0008
1996
1998
2000
2002
2004
2006
2008
2010
2012

Appendix 4: Growth Determinants -Scatter Plots



Appendix 5 : Economic Growth Regressions

Dependent Variable: **GDP per capita growth (% annual)**

Estimation Method:	**1. Panel LS FE**		**2. Panel TSLS [i]**
Sample: 2005-2012 (adj.), (unbalanced Panel)	42 countries	*Sample*: 2005-2012 (adj.), (unbalanced Panel)	44 countries
Constant	-360.217	Constant	-487.708
	(140.656)		*(330.482)*
Voice and Accountability	6.269 ***	**IQ Average**	10.116
	(1.603)		*(16.904)*
Rule of Law	1.351	Financial Development (M2/GDP)	-0.062
	(1.986)		*(0.056)*
Political Stability	0.975	Government Expenditures (% of GDP)	-0.505 *
	(1.112)		*(0.266)*
Government Effectiveness	-2.091	Current Account Balance (% of GDP)	-0.081
	(3.539)		*(0.063)*
Regulatory Quality	0.945	Capital Formation (% of GDP)	0.257 **
	(2.193)		*(0.127)*
Control of Corruption	0.980	Net ODA received/GDP	-25.644
	(2.316)		*(67.829)*
D(real effective Exchange Rate)	0.060 **	Portfolio Investment/GDP	-0.609
	(0.029)		*(1.506)*
General Government Expenditures (% of GDP)	-0 .383 **	Inflation	-0.157 *
	(0.139)		*(0.084)*
log(Real Interest Rate)	0.753 **	Total Labor Force Participation Rate	0.012
	(0.372)		*(0.049)*
Current Account Balance (% of GDP)	0.141 **	log Population	30.406
	(0.069)		*(20.450)*
Capital Formation (% of GDP)	0.079	log Real Interest Rate	-0.127
	(0.140)		*(0.283)*
Net ODA received/GDP	10.386	Trade (% of GDP)	-0.042
	(16.154)		*(0.041)*
Portfolio Investment/GDP	-5.108	IQ Average*Trade	-0.035
	(7.802)		*(0.068)*
Inflation	-0.156 **	IQ Averge* Net ODA rec/GDP	-125.382
	(0.048)		*(141.921)*
Log Population	23.751 **	GDP per capita growth (-1)	-0.087
	(9.104)		*(0.167)*
Financial Development (M2/GDP)	0.036 *	GDP per capita growth (-2)	-0.362
	(0.021)		*(0.193)*
Net FDI/GDP	-27.650 **		
	(10.107)		
GDP per capita (-1)	0.056		
	(0..087)		
GDP per capita (-2)	-0.073		
	(0.116)		
No. obs.	237		184
Adj. R^2	0.419		0.610
Durbin Watson	2.163		2.42
F-statistic	3.541		5.3
	(0.000)		*(0.000)*
		Instrument Rank	69
		Prob (J-Statistic)	*(0.068)*

[i] Instrumental Variables: Population Growth, D(Ddemocracy), 1 period Lagged IQ Average

Notes: Sample data from 1996-2012 . Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors

Significance Level: * (10%), ** (5%), *** (1%)

Appendix 6 : Macroeconomic Volatility Regressions

Dependent Variable: **Log Inflation**				*Dependent Variable*: **Output Volatility (GARCH Variance Series)**			
Estimation Method:	**(1) Panel LS FE**		**(2) Panel TSLS [i]**		**(3) Panel LS FE**		**(4) Panel LS FE**
Sample: 2005-2012 (adj.), (unbalanced Panel)	85 countries	*Sample*: 2005-2012 (adj.), (unbalanced Panel)	42 countries	Sample: 2005-2012 (adj.), (unbalanced Panel)	86 countries	Sample: 2005-2012 (adj.), (unbalanced Panel)	86 countries
Constant	23.433	Constant	76.607	Constant	-0.059	Constant	-0.064
	(30.379)		*(39.104)*		*(0.018)*		*(0.019)*
Voice and Accountability	**0.315**	**IQ Average**	**0.469**	**Voice and Accountability**	**-0.000**	**IQ Average**	**0.0003**
	(0.304)		*(1.008)*		*(0.000)*		*(0.001)*
Rule of Law	**-0.148**	Financial Development	0.004	**Rule of Law**	**-0.000**	Financial Development	0.000
	(0.199)		*(0.665)*		*(0.000)*		*(0.000)*
Political Stability	**0.002**	Government Expenditures	-0.048 **	**Political Stability**	**-0.000**	Government Expenditures	-0.0001 ****
	(0.128)		*(0.023)*		*(0.000)*		*(0.000)*
Government Effectiveness	**-0.511 ****	Current Account Balance	-0.032 ***	**Government Effectiveness**	**-0.001 ****	Current Account Balance	-0.000 *
	(0.258)		*(0.008)*		*(0.000)*		*(0.000)*
Regulatory Quality	**0.162**	Capital Formation	-0.013	**Regulatory Quality**	**-0.000**	Capital Formation	0.000 *
	(0.139)		*(0.016)*		*(0.000)*		*(0.000)*
Control of Corruption	**0.124**	Net ODA received/GDP	-7.364 **	**Control of Corruption**	**-0.000**	Net ODA received/GDP	0.001
	(0.181)		*(3.480)*		*(0.000)*		*(0.001)*
Financial Development	0.000	Net FDI/GDP	0.631	Financial Development	-0.000	Net FDI/GDP	0.001
	(0.007)		*(0.391)*		*(0.000)*		*(0.001)*
Government Expenditures	-0.045 **	Portfolio Investment/GDP	0.311	Government Expenditures	-0.000***	Portfolio Investment/GDP	0.000
	(0.022)		*(0.414)*		*(0.000)*		*(0.001)*
Log(real interest rate)	-0.104***	log Population	-4.466 *	Net FDI/GDP	0.001	log Population	0.004 ***
	(0.030)		*(2.369)*		*(0.001)*		*(0.001)*
Current Account Balance	0.005	log Real Interest Rate	-0.079 *	Current Account Balance	- 0.000	log Real Interest Rate	0.000
	(0.005)		*(0.040)*		*(0.000)*		*(0.000)*
Capital Formation	0.013 *	Trade	0.011 **	Capital Formation	0.000*	Trade	-0.000 *
	(0.007)		*(0.005)*		*(0.000)*		*(0.000)*
Net ODA received/GDP	1.887 **	IQ Average*Trade	0.005	Net ODA received/GDP	0.003	IQ Average*Trade	-0.000
	(0.714)		*(0.008)*		*(0.002)*		*(0.000)*
Net FDI/GDP	0.487 *	IQ Averge* Net ODA rec/GDP	-11.507 **	Portfolio Investment/GDP	0.000	IQ Averge* Net ODA rec/GDP	-0.004*
	(0.278)		*(4.309)*		*(0.001)*		*(0.002)*
Portfolio Investment/GDP	0.153			log(Population)	0.004 **		
	(0.187)				*(0.001)*		
log(Population)	-1.406			Log Real Interest Rate	0.000		
	(1.946)				*(0.000)*		
Trade	0.008**			Trade	-0.000		
	(0.003)				*(0.000)*		
No. obs.	448		198		479		479
Adj. R^2	0.539		0.634		0.641		0.646
Durbin Watson	2.447		2.205		1.515		1.536
F-statistic	5.843		6.805		8.912		9.314
	(0.000)		*(0.000)*		*(0.000)*		*(0.000)*
Instrument Rank			65				
Prob (J-Statistic)			*(0.451)*				

[i] Instrumental Variables: Tax Revenue, Population Growth, D(democracy), 1 period lagged IQ Average

Notes: Sample data from 1996-2012 . Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors. **Significance Level**: * (10%), ** (5%), *** (1%)

Appendix 7 : Macroeconomic Volatility Regressions: Subsamples

Dependent Variable: **Log Inflation**						*Dependent Variable*: **Output Volatility (GARCH Variance Series)**					
Estimation Method:	**Panel LS FE**			**2. Panel TSLS [i]**			**3. Panel LS FE**			**4. Panel TSLS [ii]**	
Sample: 2005-2012 (adj.),	**LA** 26 CS	**OECD** 21 CS	*Sample*: 2005-2012 (adj.),	**LA** 11 CS	**OECD** 20 CS	Sample: 2005-2012 (adj.),	**LA** 27 CS	**OECD** 21 CS	Sample: 2005-2012 (adj.),	**LA** 21 CS.	**OECD** 21CS
Constant	46.292	-73.821	Constant	112.78	-31.551	Constant	-0.008	0.051	Constant	0.023	0.005
	(44.328)	*(93.449)*		*(77.436)*	*(51.641)*		*(0.050)*	*(0.139)*		*(0.050)*	*(0.003)*
Voice and Accountability	**0.641 ***	**-1.692**	**IQ Average**	**1.876**	**2.648**	**Voice and Accountability**	**-0.001**	**0.002**	**IQ Average**	**-0.007 ***	**0.001**
	(0.386)	*(1.188)*		*(2.822)*	*(8.988)*		*(0.001)*	*(0.002)*		*(0.005)*	*(0.001)*
Rule of Law	**0.173**	**2.660 ****	Financial Development	-0.009	0.000	**Rule of Law**	**-0.001 ***	**-0.002**	Financial Development	-0.000	-0.000
	(0.402)	*(0.900)*		*(0.030)*	*(0.008)*		*(0.000)*	*(0.001)*		*(0.000)*	*(0.000)*
Political Stability	**0.149**	**-0.500**	Government Expenditures	-0.087	-0.067	**Political Stability**	**-0.000**	**0.001**	Government Expenditures	-0.000	-0.000
	(0.611)	*(0.438)*		*(0.164)*	*(0.074)*		*(0.000)*	*(0.001)*		*(0.000)*	*(0.000)*
Government Effectiveness	**-0.863 ****	**0.394**	Current Account Balance	-0.060 *	0.015	**Government Effectiveness**	**0.000**	**0.001**	Current Account Balance	0.000 **	0.000
	(0.343)	*(0.395)*		*(0.029)*	*(0.026)*		*(0.001)*	*(0.002)*		*(0.000)*	*(0.000)*
Regulatory Quality	**0.253**	**-0.490**	Capital Formation	-0.047	0.073 **	**Regulatory Quality**	**0.000**	**0.002 ***	Capital Formation	0.0001**	-0.000
	(0.430)	*(0.639)*		*(0.044)*	*(0.032)*		*(0.000)*	*(0.001)*		*0.000*	*(0.000)*
Control of Corruption	**-0.216**	**0.329**	Net FDI/GDP	0.921	2.935 **	**Control of Corruption**	**-0.001**	**-0.002**	Net FDI/GDP	-0.002	-0.001
	(0.243)	*(0.505)*		*(5.316)*	*(1.109)*		*(0.000)*	*(0.001)*		*(0.003)*	*(0.002)*
Financial Development	-0.015	0.006 *	Portfolio Investment/GDP	1.138	3.208 **	Financial Development	0.000	-0.000	Portfolio Investment/GDP	-0.001	-0.001
	(0.012)	*(0.004)*		*(3.825)*	*(1.028)*		*(0.000)*	*(0.000)*		*(0.002)*	*(0.001)*
Government Expenditures	-0.086 *	-0.157 **	log Population	-6.534	1.678	Government Expenditures	0.000	0.000	log Population	-0.002	*-0.0002 **
	(0.046)	*(0.072)*		*(4.715)*	*(3.581)*		*(0.000)*	*(0.000)*		*(0.003)*	*(0.0001)*
Log(real interest rate)	-0.108	-0.072	log Real Interest Rate	-0.201	-0.079	Net FDI/GDP	-0.001	-0.001	log Real Interest Rate	0.0001	0.000
	(0.113)	*(0.127)*		*(0.260)*	*(0.106)*		*(0.002)*	*(0.002)*		*(0.000)*	(0.000)
Current Account Balance	0.036 **	-0.005	Trade	0.005	0.011	Current Account Balance	0.000	0.000 *	Trade	0.000	0.000
	(0.016)	*(0.025)*		*(0.014)*	*(0.044)*		*(0.000)*	*(0.000)*		*(0.000)*	(0.000)
Capital Formation	0.027	0.021	IQ Average*Trade	-0.021	-0.002	Capital Formation	0.000**	-0.000	IQ Average*Trade	0.0001 *	-0.000
	(0.022)	*(0.020)*		*(0.019)*	*(0.045)*		*(0.000)*	*(0.000)*		*(0.000)*	*(0.000)*
Net FDI/GDP	1.262	0.748	Net ODA received/GDP	33.944		Portfolio Investment/GDP	-0.000	-0.001 *	Net ODA received/GDP	-0.004	
	(1.259)	*(0.946)*		*(44.336)*			*(0.002)*	*(0.001)*		*(0.008)*	
Portfolio Investment/GDP	3.816	0.946 **	IQ Averge* Net ODA rec/GDP	73.381		log(Population)	0.001	-0.003	IQ Averge* Net ODA rec/GDP	0.002	
	(2.441)	*(0.400)*		*(70.017)*			*(0.003)*	*(0.008)*		*(0.008)*	
log(Population)	-2.910	4.505				Trade	-0.000	-0.000 *			
	(3.0154)	*(5.681)*					*(0.000)*	*(0.000)*			
Trade	0.001	0.014				log Real Interest Rate	0.001 *	0.000			
	(0.012)	*(0.009)*					*(0.000)*	*(0.000)*			
Net ODA received/GDP	-1.428					Net ODA received/GDP	-0.001				
	(8.301)						*(0.005)*				

No. obs.	152	107		56	92	163	120		125	118
Adj. R^2	0.49	0.741		0.461	0.712	0.583	0.351		0.376	0.097
Durbin Watson	3.08	2.708		2.296	2.679	1.807	2.696		2.135	1.692
F-statistic	4.024	8.048		2.627	7.261	5.620	2.535		3.836	2.212
	(0.000)	*(0.000)*		*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*		*(0.000*	*(0.024)*
			Instrument Rank	34	41			Instrument Rank	43	14
			Prob (J-Statistic)	*(0.928)*	*(0.082)*			Prob (J-Statistic)	*(0.387)*	*(0.026)*
			[i] Instrumental Variables: Tax Revenue, Population Growth, Ddemocracy, 1 period Lagged IQ Average					[ii] Instrumental Variables: Population Growth, Tax Revenue, IQ average lagged by 1 period		

Notes: Sample data from 1996-2012 . Robust standard errors are reported in parentheses, all estimations include country and time fixed effects and are estimated with White robust standard errors. CS refers to cross-sections (countries) included.
Significance Level: * (10%), ** (5%), *** (1%)

Appendix 8: Descriptive Data

List of countries

Full Sample:

Afghanistan	Congo, Dem. Rep.	India	Montenegro	South Africa
Albania	Congo, Rep.	Indonesia	Morocco	South Sudan
Algeria	Costa Rica	Iran, Islamic Rep.	Mozambique	Spain
American Samoa	Cote d'Ivoire	Iraq	Myanmar	Sri Lanka
Andorra	Croatia	Ireland	Namibia	St. Kitts and Nevis
Angola	Cuba	Isle of Man	Nepal	St. Lucia
Antigua and Barbuda	Curacao	Israel	Netherlands	St. Martin (French part)
Argentina	Cyprus	Italy	New Caledonia	St. Vincent and the Grenadines
Armenia	Czech Republic	Jamaica	New Zealand	Sudan
Aruba	Denmark	Japan	Nicaragua	Suriname
Australia	Djibouti	Jordan	Niger	Swaziland
Austria	Dominica	Kazakhstan	Nigeria	Sweden
Azerbaijan	Dominican Republic	Kenya	Northern Mariana Islands	Switzerland
Bahamas, The	Ecuador	Kiribati	Norway	Syrian Arab Republic
Bahrain	Egypt, Arab Rep.	Korea, Dem. Rep.	Oman	Tajikistan
Bangladesh	El Salvador	Korea, Rep.	Pakistan	Tanzania
Barbados	Equatorial Guinea	Kosovo	Palau	Thailand
Belarus	Eritrea	Kuwait	Panama	Timor-Leste
Belgium	Estonia	Kyrgyz Republic	Papua New Guinea	Togo
Belize	Ethiopia	Lao PDR	Paraguay	Tonga
Benin	Faeroe Islands	Latvia	Peru	Trinidad and Tobago
Bermuda	Fiji	Lebanon	Philippines	Tunisia
Bhutan	Finland	Lesotho	Poland	Turkey
Bolivia	France	Liberia	Portugal	Turkmenistan

Bosnia and Herzegovina	French Polynesia	Libya	Puerto Rico	Turks and Caicos Islands
Botswana	Gabon	Liechtenstein	Qatar	Tuvalu
Brazil	Gambia, The	Lithuania	Romania	Uganda
Brunei Darussalam	Georgia	Luxembourg	Russian Federation	Ukraine
Bulgaria	Germany	Macao SAR, China	Rwanda	United Arab Emirates
Burkina Faso	Ghana	Macedonia, FYR	Samoa	United Kingdom
Burundi	Greece	Madagascar	San Marino	United States
Cabo Verde	Greenland	Malawi	Sao Tome and Principe	Uruguay
Cambodia	Grenada	Malaysia	Saudi Arabia	Uzbekistan
Cameroon	Guam	Maldives	Senegal	Vanuatu
Canada	Guatemala	Mali	Serbia	Venezuela, RB
Cayman Islands	Guinea	Malta	Seychelles	Vietnam
Central African Republic	Guinea-Bissau	Marshall Islands	Sierra Leone	Virgin Islands (U.S.)
Chad	Guyana	Mauritius	Singapore	West Bank and Gaza
Channel Islands	Haiti	Mexico	Sint Maarten (Dutch part)	Yemen, Rep.
Chile	Honduras	Micronesia, Fed. Sts.	Slovak Republic	Zambia
China	Hong Kong SAR, China	Moldova	Slovenia	Zimbabwe
Colombia	Hungary	Monaco	Solomon Islands	
Comoros	Iceland	Mongolia	Somalia	

Latin America:

Antigua and Barbuda	Haiti
Argentina	Honduras
Aruba	Jamaica
Bahamas, The	Mexico
Barbados	Nicaragua
Belize	Panama
Bolivia	Paraguay
Brazil	Peru
Cayman Islands	Puerto Rico
Chile	Sint Maarten (Dutch part)
Colombia	St. Kitts and Nevis
Costa Rica	St. Lucia
Cuba	St. Martin (French part)
Curacao	St. Vincent and the Grenadines
Dominica	Suriname
Dominican Republic	Trinidad and Tobago
Ecuador	Turks and Caicos Islands
El Salvador	Uruguay
Grenada	Venezuela, RB
Guatemala	Virgin Islands (U.S.)
Guyana	

OECD:

Australia	Norway
Austria	Poland
Belgium	Portugal
Canada	Slovak Republic
Chile	Slovenia
Czech Republic	Spain
Denmark	Sweden
Estonia	Switzerland
Finland	United Kingdom
France	United States
Germany	
Greece	
Iceland	
Ireland	
Israel	
Italy	
Japan	
Korea, Rep.	
Luxembourg	
Netherlands	
New Zealand	