Explaining policy volatility in developing countries

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Abstract

This paper studies the causes of policy volatility in developing countries during 1970-1999. To construct composite policy volatility indicators, the paper applies a robust principal components analysis to Washington Consensus policy variables. The results suggest three dimensions of policy volatility: fiscal, macroeconomic and development policies. The paper shows that more stable macroeconomic policy is associated with higher income growth, before turning to the determinants of volatility. Using a Bayesian approach which addresses the model uncertainty problem, the paper finds that macroeconomic policy is more volatile in countries that adopt a presidential system, have weaker political constraints, where government stability is lower, and that are former British colonies. Adopting a parliamentary regime helps to stabilize policy.

JEL Classifications: C11, O11, O40

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1 Introduction

It is widely believed that the volatility of macroeconomic variables such as fiscal deficits and the real exchange rate is bad for income growth. But why some countries experience more volatile government policies than others is less well understood. Partly this is because much of the past literature has focused on a limited set of possible explanations. The literature on the determinants of inflation and real exchange rate volatility, for example, is mainly dominated by the role of trade openness.

Recent papers such as Acemoglu et al. (2003) and Easterly (2005) argue that sound macroeconomic policy appears to contribute to economic growth only because it is a proxy for good institutions.[1] Fatás and Mihov (2005) show that if we measure macroeconomic policy in term of its volatility rather than its level, macroeconomic policy volatility directly matters for growth. This emphasizes the importance of seeking to explain policy volatility.

An ability to explain policy volatility is especially important for developing countries. Table 1 shows that low-income countries experienced more volatile macroeconomic and development policies in the past three decades. Although their fiscal policy was not excessively volatile compared to developed countries, the ability to maintain price and real exchange rate stability was much poorer. Table 1 also documents that low-income countries experienced more volatile growth rates.

This paper seeks to explain why some developing countries had more volatile government policies than others during 1970-1999. I first construct new composite indicators of policy volatility by applying the method of principal components to a set of Washington Consensus policy variables. The results suggest three dimensions of policy volatility indicators, namely, fiscal deficit volatility, macroeconomic policy volatility and development policy volatility. These indicators are available for 87, 72 and 65 developing countries, respectively. Note that macroeconomic policy volatility reflects

[1] In particular, when institutional variables are also included in growth regressions, the explanatory power of policy variables is less strong. Using Bayesian methods, Sirimaneetham and Temple (2006) provide some evidence that sound macroeconomic policy is associated with higher income growth in developing countries even after controlling for a range of institutional variables and other growth determinants.

an unstable inflation rate and real exchange rate, while development policy volatility reflects changes in liberalization policies in the areas of international trade, government regulation and the protection of property rights.

Using standard growth regressions, I then show that income per capita growth is negatively associated with macroeconomic policy volatility during 1970-1999. The strength of the association is also sizeable. A one-standard-deviation decrease in macroeconomic policy volatility raises growth by 0.63-0.73 percentage points. This negative relationship remains strong even when proxies for the quality of institutions are also included. I however find that unstable fiscal deficits and variation in development policy do not have much explanatory power for growth.

One can imagine that there are many variables which could potentially explain policy volatility, while there seems to be no established theories that guide how these variables may affect policy volatility. This implies that the model uncertainty problem is likely to prevail in this context. This paper adopts a Bayesian model averaging (BMA) approach to deal with the model uncertainty problem.

The Bayesian method allows us to consider a much wider range of possible explanatory variables compared to the existing research. My preferred model considers 44 possible variables. Since the main focus is on a political economy approach, many of these variables are political variables, although I also investigate the roles of social and pre-determined factors such as media development and social heterogeneity.

The key findings of the paper are that macroeconomic policy is more volatile in countries that adopt a presidential system, have weaker executive constraints in the policy-making process, where government stability is lower, and where electoral outcomes are less competitive. Countries which are former British colonies and have a larger population also experience less stable policy. Finally, adopting a parliamentary regime helps to stabilize policy. The size of these associations is notable. A one-standard-deviation change in these variables results in a 0.40-0.57 standard deviation change in macroeconomic policy volatility.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature on the growth effects and determinants of policy volatility. Sec-

tion 3 describes the proxies for Washington Consensus policy indicators and some key explanatory variables. Section 4 discusses the concept of Bayesian model averaging (BMA). Section 5 briefly explains principal components analysis and describes the construction of composite policy volatility indicators. Section 6 reports the relationship between policy volatility indicators and income per capita growth. Section 7 presents the findings from BMA and then tests whether the independent variables suggested by BMA can explain policy volatility in a more orthodox regression analysis. The final section concludes.

2 Causes and Effects of Policy Volatility

This section reviews the literature on growth and investment effects of policy volatility and socio-political determinants of policy volatility. It does not however cover the related literature on output volatility.[2]

2.1 Macroeconomic Policy Volatility

Much of the empirical work on the effects of macroeconomic policy volatility tests the investment theory proposed by Dixit and Pindyck (1994) where, in an uncertain policy environment, investors might delay investment as a result of irreversibility and uncertainty of fixed projects. This could result in slower growth rates.[3]

The link between macroeconomic policy volatility and investment and growth is widely studied. One robust finding is that volatile real exchange rates are associated with lower output growth and a lower share of investment in output.[4] For example, Brunetti (1998) shows that only the negative relationship between Dollar (1992)'s real exchange rate distortion index and growth is robust in an extreme bound analysis, which also includes other

[2] See Ramey and Ramey (1995), Easterly et al. (2000), Imbs (2004), Hnatkovska and Loayza (2004), Malik and Temple (2005), Raddatz (2005), Breen and García-Peñalosa (2005), Anbarci et al. (2005), Koren and Tenreyro (2005), and Spiliopoulas (2005).

[3] More recent theoretical work includes Hopenhayn and Muniagurria (1996), Jeong (2002) and Varvarigos (2005).

[4] See Servén and Solimano (1993), Servén (1998), Brunetti and Weder (1998), Bleaney (1996), and Bleaney and Greenaway (2001).

policy measures such as fiscal deficits, the inflation rate, and the black market premium. Various papers argue that macroeconomic policy uncertainty should affect only private investment, not government investment. Aizenman and Marion (1999) provide supportive evidence by showing that volatility in the real exchange rate, government consumption, and money growth lowers the private investment rate, but not total investment.

Another common finding in the literature is that inflation and money growth volatility do not seem to affect growth and investment.[5] Moreover, unlike stability in real exchange rates, stability in the inflation rate does not appear to help to reduce poverty (Agénor, 2004).

In general, the literature suggests that fiscal policy volatility in term of unstable government consumption has a negative effect on growth in developing countries (Aizenman and Marion (1993) and Turnovsky and Chattopadhyay (2003)). This link however disappears when using government budget deficit volatility as a proxy. Fatás and Mihov (2005) constructed a measure of discretionary fiscal policy volatility, defined as the share of government consumption in output that is not predicted by government consumption in earlier periods and other control variables such as income and the inflation rate. They find that this measure has a direct, negative effect on growth.

While most studies are concerned with more than one type of policy volatility, an attempt to combine them is not common. An exception is Elbadawi and Schmidt-Hebbel (1998), which constructs an indicator of macrofinancial volatility. This measure is a simple average of the standard deviations of public sector deficits, reserve money stock growth, real exchange rate, and current account deficits. They however find that this composite measure lacks explanatory power for growth.

Fewer studies attempt to explain cross-country variation in macroeconomic policy volatility. The role of trade openness dominates the research that tries to explain real exchange rate volatility. Hau (2002) argues that a more open economy should experience less volatile real exchange rates be-

[5] See Servén (1998), Brunetti (1998), Brunetti and Weder (1998), and Aizenman and Marion (1993). Exceptions include Servén and Solimano (1993) and Turnovsky and Chattopadhyay (2003).

cause imported goods should help an economy to adjust its domestic price level more quickly during shock periods. This therefore reduces the real effects of shocks on consumption and the real exchange rate. Using export and import values as a proxy for trade openness, he finds supporting evidence for this argument. Calderón (2004) reports the same results when measuring trade openness by the Sachs and Warner (1995) index of trade policy.

Placing more emphasis on pre-determined factors, Bravo-Oetega and di Giovanni (2005) show that higher trade costs, as measured by distance between a particular country and its trading partners, raise real exchange rate volatility because higher costs result in a larger non-tradable sector. Finally, Satyanath and Subramanian (2004) show that nominal parallel market exchange rates are more volatile in countries that have lower international trade relative to GDP, a more unequal income distribution, and weaker constraints on the executive.

The degree of trade openness is also used to explain inflation volatility. Bowdler and Malik (2005) show that trade openness helps to stabilize the inflation rate because it reduces volatility in money growth. Lo, Wong and Granato (2003) obtained similar results. Both studies find that this negative link is stronger in developing countries.

Much of the literature that explains fiscal policy volatility follows two lines of enquiry. The first group emphasizes the role of political constraints and finds that stronger constraints on executives tend to limit their power in implementing discretionary fiscal policy (Fatás and Mihov (2003, 2004)). They also find that countries that adopt a presidential regime in general experience more volatile government spending while electoral rules and the frequency of elections have limited explanatory power. Henisz (2004) reports similar results when using government subsidies and transfers, and capital expenditures as proxies for fiscal policy volatility.

The second body of research focuses on the detrimental role of social fragmentation on political instability, which leads to volatile fiscal policy. Dutt and Mitra (2004) find that government consumption is more stable in countries with lower political instability, defined as a lower probability of regime switch between democracy and dictatorship. Woo (2003) also reveals

that public sector deficits are more volatile with a less equal income distribution. He however discovers no association between fiscal policy volatility and a political instability index.[6]

On a wider perspective, Ali and Isse (2004) document that more democratic countries seem to enjoy more stable macroeconomic policy in terms of public sector debts, fiscal deficits, deposit interest rates, inflation rates, and a real effective exchange rate index.

2.2 Development Policy Volatility

Research on the volatility of development policy mainly focuses on growth and investment effects of the uncertainty of government regulations and protection of property rights. Pitlik (2002) shows that volatile liberalization policies, as measured by the uncertainty of the economic freedom index from the Fraser Institute, reduce growth even though the long run path is towards a more liberalized economy.[7] A stable liberalization policy is also shown to be more important to growth than an improvement in policy over time. Dawson (2005) also finds that a volatile government regulations score from the Fraser Institute index is associated with slower growth.

Using a firm-level survey in 73 countries, Brunetti, Kisunko and Weder (1998) test whether uncertainty in government rules affects growth and investment. They show that more stable judicial enforcement promotes growth and investment. The result is less strong for the uncertainty associated with rule making by the government.

Finally, unstable trade policy, as measured by the volatility of taxes on international trade, does not seem to affect growth (Brunetti, 1998). Trade policy becomes more stable with lower political instabilty (Dutt and Mitra, 2004) and stronger constraints on the executive (Henisz, 2004).

[6] The index is derived from a principal components method and includes the frequencies of political assassinations, government crises, cabinet changes, and military coups.

[7] The Fraser Institute's composite index covers various aspects of an economy including government consumption, price stability, freedom of international trade, freedom of capital and financial markets, and the protection of property rights. It is therefore a measure of both macroeconomic and development policies.

3 The Data

This section first discusses proxies for Washington Consensus policy variables. These variables will be used to construct new composite policy volatility indicators in section 5.2. It then highlights some key independent variables that could potentially explain policy volatility.

3.1 The Dependent Variables

To construct new composite indicators of policy volatility, I follow the idea of the Washington Consensus as summarized by Williamson (1990) and Fischer (2003). The Consensus consists of ten policy areas including fiscal discipline, interest rate liberalization, a competitive exchange rate, tax reform, public expenditure prioritization, liberalized trade policy, foreign direct investment promotion, privatization, deregulation, and protection of private property rights. I add a low inflation rate into this list. The sample covers developing countries where the population size in 1970 was greater than 250,000 but excluding transition economies. The sample period is 1970-1999.

Unless otherwise stated, I always measure the degree of policy volatility by the natural logarithm of the standard deviation of policy variables over 1970-1999. Another commonly used method is to use the standard deviations of the residuals from a first order autoregressive process or AR(1). I also experimented this with the four key macroeconomic policy variables. The simple correlations between the two measures are very high.[8]

The proxies for fiscal discipline are central government budget deficits over GDP ($VDEFICIT$) and central government debt over GDP ($VDEBT$).[9] The degree of financial market liberalization is measured by the level of the real interest rate, defined as a lending rate adjusted by the rate of change of the GDP deflator ($VREALI$). I use the growth rate of the annual GDP deflator to measure the inflation rate ($VINFLA$). These variables are taken from the World Bank (2004).

[8] The correlations are about 0.97 for $VDEFICIT$ and over 0.99 for $VINFLA$, $VBMP$ and $VOVERVALU$.

[9] Appendix Table 2 shows the correlations among the Washington Consensus variables. Appendix Table 3 lists description and sources of data.

To capture exchange rate management, I adopt the black market premium ($VBMP$) and a currency overvaluation index or real exchange rate distortion index ($VOVERVALU$). The black market premium is the difference between the value of official exchange rate and any illegal, market-determined rate from Easterly and Sewadeh (2002). The currency overvaluation index is originally from Dollar (1992) and extended by Easterly and Sewadeh (2002). It is based on evaluating price levels in a common currency, after correcting for the possible effects of factor endowments on the prices of non-tradeables. This correction is achieved by using the component of price levels that is orthogonal to GDP per capita, its square, population density and two regional dummies. If a country's price level is higher than predicted by these controls, this indicates the domestic price of tradeables may be relatively high, and so high index values could indicate real overvaluation and trade restrictions.[10]

I use the volatility of the share of public spending on education ($VEDU$) and health ($VHEALTH$) in GDP to indicate whether the government has followed stable policies towards necessary social programmes.

To assess tax reform, this paper uses the volatility in marginal tax rate score ($VMARTAX$) which measures progressivity of tax rates.[11] A higher score value indicates that a lower top marginal tax rate is applied to high-income threshold level. This is taken from Gwartney and Lawson (2004) at the Fraser Institute. In total, I use five different subjective scores from this source. The value of these scores ranges from 0 to 10, with higher value indicates a more liberalized policy. For all five scores from this source, I take the standard deviations of the scores as our policy volatility indicators.[12]

I adopt three variables to proxy for the extent of trade liberalization. The first variable is the standard deviation of the share of import duties in import values ($VMDUTY$) from Yanikkaya (2003) and World Bank (2004). The second variable is the mean tariff score ($VTRADEFI$) from Gwartney

[10] Sirimaneetham and Temple (2006) discuss this variable in more detail. See also Falvey and Gemmell (1999) and Rodriguez and Rodrik (2000).

[11] Alternatively, Padovano and Galli (2002) obtain an effective marginal tax rate on income by regressing total tax revenue on total income.

[12] During 1970-1999, the scores from Gwartney and Lawson (2004) are available for six five-year periods from 1970 to 1995.

and Lawson (2004). The third variable is the standard deviation of the Sachs and Warner (1995) trade openness index (VSW), which is updated by Wacziarg and Welch (2003).

The last three variables are all from Gwartney and Lawson (2004). First, the extent of privatization programmes is proxied by the government enterprises and investment score ($VSOEFI$), which measures the share of state-owned enterprises and government investment in total investment.[13] Next, score for the regulations of credit markets, labour markets, and businesses ($VREGFI$) involves government regulations such as government ownership of financial institutions, market-based price settings, and labour collective bargaining. Finally, the protection of private property rights score ($VPROPFI$) represents the independence and efficiency of judicial system, contract enforceability, and government expropriation risk.

3.2 The Independent Variables

This section describes some of the key independent variables. Appendix Table 5 lists description and sources of data for all independent variables. First, perhaps the most widely studied political variables are political regime types (presidential and parliamentary) and electoral rules (plural and proportional), particularly their comparative effects on the size of government spending. I take these variables ($DIRCPRES$, $PARLIA$, $PLURAL$ and $PROPOR$) from Beck et al. (2001). In term of policy volatility, countries that adopt a presidential regime and plurality rule tend to have smaller responses of government spending to economic and political events (Persson and Tabellini, 2003).

When constraints on the policy-making process are strong, we would expect fewer policy changes. Political constraints ($POLCON$), from Henisz (2000), are considered stronger when there are many independent veto players (such as presidents and judiciary), those veto players are not aligned, and they exhibit different political ideologies. A variable closely related to $POLCON$ is the legislative index of electoral competitiveness ($LIEC$)

[13] A more direct measure would be the share of state-owned enterprise investment and output in an economy. World Bank (1995) provides this data but for a limited number of developing countries.

(Beck et al., 2001). Higher values correspond to more intense competition in elections. For example, the maximum score indicates that the largest party obtained less than 75 percent of total seats in the election while the minimum score indicates that there is no legislature.

The concept of political constraints highlights the importance of difference in political ideology across political agents ($WINGDIFF$). This is measured by comparing the ideologies of the government party with those of the three largest government parties and the largest opposition party. In this paper, political ideology has three classifications: right-wing ($RGHTWING$), left-wing ($LEFTWING$) and centre-wing ($CNTRWING$). Right-wing parties can be labelled as conservative, and in general adopt liberal, market-based policies. Left-wing parties can be labelled as communist, socialist or social democratic parties, and would typically believe in state-based policies. Finally, centrist-wing parties are those that adopt both right- and left-wing policies, e.g. promoting private enterprise but also social liberalism. These variables are taken from Beck et al. (2001).

When the constitution allows the government to serve additional terms in the office (and each term has a specific length of time), this should act as an incentive for the government to implement more effective and stable policies in order to attract more votes in the next election. I refer to this as the re-electability incentive ($FIMUTERM$). In contrast, when the threat of changes in government is persistent, the government may decide to implement short-term, discretionary policy since it is unlikely that it will face the consequences. I measure government instability by two pairs of variables. The first pair, from Beck et al. (2001), measures the actual changes in executives and executive parties during 1975-1999 ($EXECHG$ and $PARTYCHG$). The second pair, from Feng (1997) and Feng, Kugler and Zak (2000), measure probabilities of changes in the government ($PROBIRCH$ and $PROBMJCH$).[14] $PROBIRCH$ predicts unconstitutional, irregular changes such as those result from coups, while $PROBMJCH$ predicts constitutional, major changes such as changes in leadership.

[14] These probabilities are derived from a logit model, and depend on various factors such as past macroeconomic performance and political disorder.

On a wider scale, I measure political stability ($POLSTAB$) by the variable introduced in Kaufmann, Kraay and Mastruzzi (2003). This composite index covers events such as political protests, coups, riots, civil wars, and ethnic and religious-based tensions. The alternative proxies for $POLSTAB$ are two new variables which I construct from a principal components analysis. First of these is violent unrest ($VIUNREST$), which measures assassinations, guerilla warfare, government crises, purges, revolutions, coups, and riots. A measure of non-violent unrest ($NVUNREST$) reflects general strikes and antigovernment demonstrations.[15] I use the data from De Mesquita et al. (2003).

In measuring the degree of democracy, I use the Polity score ($POLITY$) by Marshall and Jaggers (2002). The score is obtained by subtracting an autocracy score from a democracy score, and this depends on factors such as political constraints and competitiveness of political participation. In democratic societies, a transparent, corruption-free election should typically result in a more efficient government being elected. Beck et al. (2001) provides a dummy variable indicating the presence of election fraud, such that the outcome is not reliable ($FRAUDELE$).

In a society where the citizens are much concerned about their public affairs, the government should be less likely to implement a severely discretionary or harmful policy. I proxy how active political participation is by voter turnout ($TURNOUT$) (Pintor, 2002). But such interest in politics may be more beneficial when the mass media is sufficiently developed. When the media is more developed, voters are better informed about their government performance, and politicians are held accountable for their actions. I construct a measure of media development ($MEDIADEV$) from a principal components analysis which includes the number of television sets, radios, and daily newspaper circulation during 1970-1999.[16]

[15] See section 5.1 for a brief discussion of principal components analysis. $VIUNREST$ = 0.360∗assassinations + 0.316∗purges + 0.466∗revolutions + 0.235∗coups + 0.308∗riots + 0.422∗ government crises + 0.475∗guerilla warfare. The first principal component explains nearly 40 percent of the total variation in the data. $NVUNREST$ = 0.707∗general strikes + 0.707∗antigovernment demonstrations.

[16] $MEDIADEV$ = 0.572∗television set + 0.577∗radio + 0.583∗newspaper. The first principal component explains about 84 percent of the total variation in the data.

An important set of historical variables are proxies for the quality of current institutions (Acemoglu et al., 2001 and Hall and Jones, 1999). This includes the mortality rates of European settlers between 17th and 19th centuries ($MORTAL$), the proportion of population that was European in 1900 ($EURO1900$), and the proportion of population that speak European languages ($EURFRAC$).

Finally, I also test the effects of geographic variables on policy volatility. The examples are land area ($AREAKM2$), latitude ($LATILLSV$), the proportion of land area with a tropical climate ($TROPICAR$), distance to a major market ($LMINDIST$), a dummy for landlocked countries ($LANDLOCK$), and a dummy specifying that a country is an exporter of point-source natural resources such as gold ($RESPOINT$) (Isham et al., 2005).

4 Bayesian Model Averaging

Even when the main focus is on a political economy approach, one can imagine that there are many variables that could potentially explain policy volatility. There also seems to be no established theories that guide how these variables affects policy volatility. This suggests that the model uncertainty problem is likely to prevail in our context.

This section briefly discusses a Bayesian model averaging (BMA) approach. It follows closely the discussions in Raftery (1995), Raftery, Madigan and Hoeting (1997), and Malik and Temple (2005). BMA reduces model uncertainty by taking into account many possible models. A standard Bayesian principle can be expressed as:

$$\Pr(\Delta \mid D) = \sum_{k=1}^{K} \Pr(\Delta \mid M_k, D) \Pr(M_k \mid D) \tag{1}$$

where Δ is a parameter of interest, $\Pr(\Delta \mid D)$ is the posterior distribution of Δ given the data D, and M_1, M_2,.., M_K denote models. Equation (1) suggests that the posterior density of the parameter Δ given the data D is the weighted average of the posterior distributions of Δ under each model,

$\Pr(\Delta \mid M_k, D)$, where the weights are the corresponding posterior model probability (PMP), $\Pr(M_k \mid D)$.

PMP is the probability that model M_k generates the data D, and can be computed by Bayes' theorem:

$$\Pr(M_k \mid D) = \frac{\Pr(D \mid M_k)\Pr(M_k)}{\sum_{\ell=1}^{K} \Pr(D \mid M_\ell)\Pr(M_\ell)} \tag{2}$$

where

$$\Pr(D \mid M_k) = \int \Pr(D \mid \theta_k, M_k)\Pr(\theta_k \mid M_k) d\theta_k \tag{3}$$

$\Pr(D \mid M_k)$ is the marginal likelihood of the data given M_k, θ_k is the vector of parameters of model M_k, $\Pr(D \mid \theta_k, M_k)$ is the likelihood of θ_k under model M_k, $\Pr(\theta_k \mid M_k)$ is the prior density of θ_k under model M_k, and $\Pr(M_k)$ is the prior probability that M_k is the true model. Without reliable prior information, it is assumed that each model has an equal probability of being the true model, so that $\Pr(M_1) = \Pr(M_2) = ... = \Pr(M_K) = 1/K$. It should also be noted that the sum of all PMPs equals one, $\sum_{\ell=1} \Pr(M_\ell \mid D) = 1$.

In a simplified, two-model case, the predictive ability of the models is represented by the posterior odds (for M_2 against M_1), which can be written as:

$$\left[\frac{\Pr(M_2 \mid D)}{\Pr(M_1 \mid D)}\right] = \left[\frac{\Pr(D \mid M_2)}{\Pr(D \mid M_1)}\right] \left[\frac{\Pr(M_2)}{\Pr(M_1)}\right] \tag{4}$$

The first term on the right-hand side of equation (4) is called the Bayes factor for M_2 against M_1, denoted by B_{21}. Here, the posterior odds depend only on the Bayes factor because $\Pr(M_1) = \Pr(M_2) = 0.5$. When $B_{21}>1$, M_2 has better predictive ability than M_1.

When there are many possible models, calculating the integral in equation (3) is computationally intensive. One solution is to use the Bayesian Information Criterion (BIC) to approximate the Bayes factors. For a linear regression with normal errors, the BIC of model M_k takes the following form:

$$BIC'_k = n\log(1 - R^2_k) + q_k \log n \tag{5}$$

where n is the sample size, R^2_k is the R^2 value for model M_k, and q_k is the number of independent variables (excluding the intercept). Essentially, BIC'_k assesses how well M_k can predict the data, given its number of explanatory variables. A model with a higher R^2 and fewer parameters (which results in a lower BIC' value) is regarded as a better model by the BIC approximation.

An approximation, as in Raftery (1995) and Sala-i-Martin et al. (2004), suggests that $\Pr(D \mid M_k) \propto \exp(-0.5BIC'_k)$, and hence equation (2) can be re-written as:

$$\Pr(M_k \mid D) \approx \frac{\exp(-0.5BIC'_k)}{\sum_{\ell=1}^{K} \exp(-0.5BIC'_\ell)} \tag{6}$$

With many possible models, applying BMA is practically not feasible because the number of terms in equation (1) will be huge. In this case, there may be as many as 44 independent variables, so there are 2^{44} models to estimate. This is over 17 thousand billion models. One solution is Occam's window due to Madigan and Raftery (1994). This paper uses a symmetric version of Occam's window, where it excludes models that can predict the data much less well than the best model (the model with the highest PMP).[17]

A search algorithm is needed to find good subsets of all models, and place these models in Occam's window. The search algorithm that is adopted here is the leaps and bounds algorithm (Furnival and Wilson, 1974). It finds the best subsets of all models, containing p variables where p = 1,2,...,$k-1$ and k is number of independent variables, that have minimum residual sum of squares. To perform a BMA exercise, I use the *bicreg* software which implements the Occam's window algorithm for linear regression using BIC' approximation of Bayes factors.[18]

[17] More specifically, I drop all models whose PMP is only 1/100 or less that of the best model. The strict version of Occam's Window also excludes models that predict the data worse than their smaller submodels.

[18] The software is written by Adrian Raftery and revised by Chris Volinsky.

In addition to the Occam's window approach, I also experimented with a Markov chain Monte Carlo model composition (MC^3) approach as a robustness check (Hoeting, Raftery and Madigan, 1996). MC^3 uses a Markov chain Monte Carlo method to approximate all models in equation (1). The $MC3.REG$ software is used to perform this task.[19]

One important statistic is the posterior inclusion probability (PIP), defined as the probability that the coefficient of an independent variable is not equal to zero, $\Pr(\beta_i \neq 0 \mid D)$. It is calculated by summing the PMPs across models where $\Pr(\beta_i \neq 0 \mid D)$. For the purpose of this analysis, all explanatory variables with PIP value of 0.20 and greater are considered important and should be included in the model.

Finally, it should be noted that the *bicreg* software cannot be applied where data are missing. I thus employed a simple imputation method, which predicts missing data from a given set of independent variables by a best-subset regression. A best-subset regression finds subsets of independent variables that best predict responses on a dependent variable. Even though up to 53 independent variables need imputation, the proportion of imputed data in the main data set is only 1.20 percent of the total data. Appendix Table 6 provides more detail on variable imputation.

5 Measuring Policy Volatility

This section first briefly discusses a method of classical and outlier-robust principal components. Using this approach, section 5.2 explains how composite policy volatility indicators are constructed.

5.1 Principal Components Analysis

I use a principal components analysis (PCA) to construct the composite policy indicator. PCA takes n specific variables (in this case, policy variables) and yields principal components P_1, P_2,..., P_n that are mutually uncorrelated. Each principal component is a linear, weighted combination of n spe-

[19] The software is written by Jennifer Hoeting with the assistance of Gary Gadbury. Both the *bicreg* and $MC3.REG$ softwares were originally written in the S-Plus language and were modified for the R language by Ian Painter.

cific variables X_1, X_2,..., X_n or more formally $P = \alpha_1 X_1 + \alpha_2 X_2 + ... + \alpha_n X_n$ where $\alpha' s$ are component loadings.

The first principal component, P_1, has the maximum variance for any possible weights, subject to the sum-of-squares normalization that $\alpha'\alpha = 1$. Thus, P_1 always accounts for the largest proportion of the variance in the data.

The method of principal components is a data reduction method because much of the total variance in the data can generally be accounted for by the first few principal components. I use only the first principal component to represent the composite policy indicator. Because the measurement units differ across the proxies for the policy variables, the correlation matrix is used for the analysis. This makes component loadings comparable, and means the weights are determined independently of the measurement scales.

Note that the analysis based on a classical PCA can be sensitive to outlying observations. This is because its aim is to maximize the variance given the covariance (or correlation) matrix, and both the variance and the covariance matrix can be highly influenced by outliers. A preferred method is therefore a outlier-robust PCA as discussed in Hubert et al. (2005).

A robust PCA finds h observations out of the whole data set of n observations whose covariance matrix has the smallest determinant. This covariance matrix is used to derive robust principal components. I use the default choice $h = 0.75n$, which drops 25 percent of the most outlying data points. The degree of outlyingness assigned to each observation is based on the minimum covariance determinant (MCD) estimator. When the number of n (and therefore h) is large, a robust PCA uses an approximate algorithm as in Rousseeuw and Driessen (1999) to find the h observations.

A principal component from a robust PCA can be written as $P_{robust} = \alpha_1 X_1^{/} + \alpha_2 X_2^{/} + ... + \alpha_n X_n^{/}$ where X''s are the original data adjusted by their robust centre using a robust estimate of their location. This is performed by the *robpca* software written in the S-Plus language.[20]

[20] The software is written by Jan Wijfels and adapted by Karlien Vanden Branden.

5.2 Constructing Composite Policy Volatility Indicators

This section shows how the new composite policy volatility indicators are derived. Recall that I construct the policy volatility indicators by applying a principal components analysis (PCA) to a set of the Washington Consensus policy variables. The emphasis will be on the results obtained from a robust PCA rather than a classical PCA.

I begin by including all policy variables into a single model, as shown in column (1) of Table 2. The results are promising. Apart from $VDEFICIT$, all other policy variables have an expected, positive correlation with the first principal component (PC), which explains over 25 percent of the total variance in the data. This however leaves us with only 37 countries.

Column (2) then drops the variables which are available for a limited number of countries. The results reveal that three out of five policy variables which are the development elements of the Consensus ($VMDUTY$, VSW, $VSOEFI$, $VREGFI$ and $VPROPFI$) are more correlated with the second PC than the first PC. Although this cannot be interpreted as a clear-cut evidence, it seems to suggest that there are at least two dimensions of policy volatility. More specifically, while the first PC seems to represent macroeconomic policy volatility, the second PC appears to capture development policy volatility. It is therefore more sensible to measure them separately.[21]

Table 3 presents the results for the macroeconomic elements. Column (1) includes all policy variables, and shows that they all have an expected correlation of the expected sign (positive) with the first PC. In column (2) I exclude $VDEBT$ and $VMARTAX$ to increase the sample size, and $VEDU$ and $VHEALTH$ as they tend to represent the volatility of social policy while the focus is on macroeconomic policy. I find that $VDEFICIT$ virtually has no relationship with the first PC while all other variables are highly correlated with the first PC with the correct sign.[22] This justifies classifying $VDEFICIT$ as one distinct dimension of policy volatility, and

[21] Intuitively, these two types of policy are different. While macroeconomic policy volatility reflects the lack of government ability in maintaining macroeconomic stability, volatile development policy in general results from policy shifts or liberalization programmes. I discuss this argument later in more detail.

[22] The results remain unchanged if we drop only $VDEBT$ and $VMARTAX$ from column (1).

I will refer to it as a fiscal policy volatility indicator.

Recall that $VDEFICIT$ is the natural logarithm of the standard deviation of government budget deficits over GDP. I test the correctness of this functional form by applying a Box-Cox regression to the standard deviation of budget deficits over GDP ($VDEFICITNL$). For our purpose, the Box-Cox regression method is used to find the maximum likelihood estimate of the parameter θ of the Box-Cox transform, defined as: $y^{(\theta)} = \frac{y^{\theta}-1}{\theta}$. The model that I estimate takes this form: $\frac{VDEFICITNL}{\theta}^{\theta-1} = \beta_1 x_{1j} + \beta_2 x_{2j} + ... + \beta_k x_{kj} + \epsilon_j$ where x's are the independent variables.[23] The results suggest that the value of θ of zero cannot be rejected, and $y^{(\theta)}$ is therefore transformed to $\ln(y)$. This confirms that taking the natural logarithm transformation is appropriate.

Column (3) proceeds with the rest of the four macroeconomic policy variables. The preferred model is column (4) where I drop $VREALI$ because, in our sample of developing countries where average inflation rates are high and hyperinflation episodes are not uncommon, movements in the real interest rate depend significantly on the movements of the inflation rate. Including $VREALI$ in the analysis could potentially hide the effects of $VINFLA$. The robust macroeconomic policy volatility indicator, $RVMACRO$, therefore consists of three variables, and can be written as:

$$\begin{aligned} RVMACRO &= 0.220 * VINFLA' + 0.786 * VBMP' \\ &\quad +0.577 * VOVERVALU' \end{aligned} \tag{7}$$

where the $'$ on the policy variables indicates that each has been centred using a robust estimate of their location. The component loadings or weights are comparable across variables, as they are derived from the correlation matrix. A higher $RVMACRO$ value indicates a more volatile macroeconomic policy.

[23] I obtained these independent variables by performing BMA exercises similar to those in Table 6. The explanatory variables that form the best model (model with the highest PMP value) include the degree of democracy, presidential system, right-wing government, military head, corruption, trade openness, East Asia dummy, Latin America dummy, land area, and latitude.

It should be noted that the decision to drop $VREALI$ in column (3) and the use of robust rather than classical scores in column (4) are unlikely to affect the results in a meaningful way.[24] According to this measure, the top five countries with most stable macroeconomic conditions during 1970-1999 were Singapore, Tunisia, Thailand, Malaysia and Cyprus. In contrast, Democratic Republic of Congo, Ghana, Peru, Uganda and Iran seemed to suffer most from unstable policy.

An alternative measure to $RVMACRO$ is an indicator that assigns equal weights to all policy variables. To construct this, I first apply the Box-Cox regression to the geometric average of the standard deviations of the inflation rate, black market premium and the overvaluation index ($VMACROGA$).[25] The results again suggest the natural logarithm transformation, which yields $LNVMACROGA$ and can be written as:

$$\begin{aligned} LNVMACROGA &= 1/3 * VINFLA + 1/3 * VBMP \\ &\quad +1/3 * VOVERVALU \end{aligned} \tag{8}$$

Recall that $VINFLA$, $VBMP$ and $VOVERVALU$ are in the natural logarithm form. The differences between $RVMACRO$ and $LNVMACROGA$ are therefore the weights and that the policy variables which form $RVMACRO$ are centred. Despite these differences, the simple correlation between the two indicators is very high (0.95). Even though they are highly correlated, the preferred indicator is $RVMACRO$ because the weights are derived more systematically rather than imposed.

[24] The simple correlation between $RVMACRO$ and the robust scores obtained from column (3) with four policy variables is 0.96. The macroeconomic volatility indicator from the classical scores, $VMACRO$, from column (4) can be written as: $VMACRO = 0.519 * VINFLA + 0.609 * VBMP + 0.600 * VOVERVALU$. The correlation between $RVMACRO$ and $VMACRO$ is 0.98.

[25] $VMACROGA$= *stdev*(inflation rate)$^{1/3}$ × *stdev*(black market premium)$^{1/3}$ × *stdev*(overvaluation index)$^{1/3}$. I use the geometric average instead of an arithmetic average to reduce the effects of measurement errors and outlying observations. The model I estimate is $\frac{VMACROGA^{\theta-1}}{\theta} = \beta_1 x_{1j} + \beta_2 x_{2j} + ... + \beta_k x_{kj} + \epsilon_j$ where x's are the independent variables. The independent variables in the best model include political contraints, political stability, constitutional government instability, presidential system, election fraud, government tiers, real GDP per capita in 1970, British colony, French colony, East Asia dummy, South Asia dummy, state antiquity, landlocked country dummy, and latitude.

Finally, Table 4 presents the results for the development elements. In column (2), most policy variables have higher correlations with the first PC with the correct sign. The first PC explains over 31 percent of the total variance in the data. The robust development policy indicator, $RVDEV$, can be expressed as:

$$\begin{aligned} RVDEV &= 0.074 * VMDUTY' + 0.778 * VSW' + 0.375 \\ &\quad * VSOEFI' + 0.301 * VREGFI' + 0.397 * VPROPFI' \end{aligned} \tag{9}$$

A higher $RVDEV$ value indicates a more volatile development policy. The top five countries with the most stable development policy during 1970-1999 were Chad, Burundi, Algeria, Mauritius and China. In contrast, Chile, Peru, Bolivia, Turkey and Argentina experienced the least stable policy. As in the case of macroeconomic policy, the use of robust rather than classical scores is unlikely to affect the results.[26] It is however not sensible to apply the Box-Cox regression to the geometric average of the standard deviations of development policy variables ($VDEVGA$) because the values of VSW and $VSOEFI$ are zero for many countries.

In summary, the three main policy volatility indicators are $VDEFICIT$, $RVMACRO$ and $RVDEV$. These indicators are available for 87, 72 and 65 developing countries, respectively. As a preliminary test, I find that all three indicators have a negative relationship with the GDP growth rate during 1970-1999, although only the correlation between growth and $RVMACRO$ (-0.48) is significant at the 5 percent level. The next section provides a more systematic regression analysis.

6 Policy Volatility and Growth Regressions

This section empirically tests the growth effects of the three policy volatility indicators. The growth regression specification that I use is based on Mankiw, Romer, and Weil (1992). The growth rate is defined as the log

[26] The simple correlation between $RVDEV$ and the indicator obtained from a classical PCA in column (2), $VDEV$, is 0.93. $VDEV$ = 0.187 $* VMDUTY$ + 0.407 $* VSW$ + 0.420 $* VSOEFI$ + 0.572 $* VREGFI$ + 0.544 $* VPROPFI$

difference in GDP per capita between 1970 and 1999. The explanatory variables include the log of GDP per capita in 1970, the log of the investment share in GDP, the log of population growth adjusted by the capital depreciation rate (0.05), a measure of educational attainment in 1970, and regional dummies.

Column (1) in Table 5 shows that, without any other explanatory variables, $RVMACRO$ has a negative relationship with growth and this is significant at the 1 percent level. RVMACRO alone can explain over 23 percent of the total variation in growth rates. Column (2) adds the standard growth determinants while column (3) further adds the regional dummies. $RVMACRO$ remains significant at the 5 percent level. The size of the association is sizeable. In column (3), a one-standard-deviation decrease in $RVMACRO$ (from Senegal to Thailand's level) raises growth by 0.63 percentage points. Over the 30-year period, this means a 20 percent increase in the income per capita level.

In column (4), I exclude the investment variable, and show that the size of the growth effect of $RVMACRO$ increases. This implies that the volatility of macroeconomic policy partly reduces growth by reducing the level of investment.

Columns (5)-(8) test whether volatile macroeconomic policy reduces growth directly or only because it reflects the poor quality of institutions. My main proxy for the quality of institutions is the political constraints variable ($POLCON$). First, column (5) shows that $POLCON$ has an expected, positive relationship with growth. Importantly, columns (6) and (7) reveal that $RVMACRO$ remains negatively associated with growth at the 5 percent level after controlling for the effect of institutions. Column (8) confirms this finding when an additional three institutional variables are also included. This result is consistent with Fatás and Mihov (2005) who use government consumption as a macroeconomic policy indicator.

These results are not sensitive to the deletion of outlying observations, as detected by median or least absolute deviation (LAD) regression[27], DFIT,

[27] Outlying observations are defined as countries whose residuals are greater (less) than the mean value of all residuals plus (minus) two times standard deviation of that country's residual.

DFBETA, and added-variable plots.[28] Diagnostic tests do not indicate any problems with omitted structure and functional form (from Ramsey's regression specification error test) and heteroskedasticity (from the Breusch-Pagan and White tests).

Despite having an expected, negative sign, $VDEFICIT$ and $RVDEV$ do not seem to have a link with growth. This finding is not sensitive to dropping outliers and dividing the sample into groups of countries with high and low policy volatility. The absence of a budget deficit volatility and growth relationship is also found in Aizenman and Marion (1993).[29] The limited role of development policy casts more surprise, as it might be expected that unstable policy such as unpredictable government regulations would discourage investment and growth. A closer look at the data reveals that many countries with highly volatile development policy are those that implemented liberalization programmes (such as Chile, Peru and Argentina). In contrast, many countries with very stable policy are in fact those that appear to have persisted in poor policy (such as Burundi and Chad).[30]

In addition to output growth, I also tested the relationship between the policy volatility indicators and the shares of total and private investment in output during 1970-1999. The results are less promising than the growth regression findings. The regional dummies seem to play a great role here. For example, the analysis shows that $RVMACRO$ reduces total and private investment and $RVDEV$ reduces total investment only when regional dummies are not included.[31]

[28] The results are available upon request. Cook and Uchida (2003, pp. 153-54) briefly explain how DFITS and DFBETA are computed and used.

[29] The stylized fact in Table 1 also shows that while the difference in output growth rates between high and low-income countries is sizeable, low-income countries are not subject to much higher budget deficits. It is important to note that most studies which document a negative link between fiscal policy volatility and growth use central government consumption as a proxy. This paper uses government budget deficits because my main objective is to explain a government's ability to maintain macroeconomic stability, not the use of discretion in implementing policy.

[30] For example, the average value of the Sachs and Warner (1995) index during 1970-1999 for the top five countries with the most (least) volatile development policy is 0.51 (0.20). This means that the top five countries with the most volatile policy are considered as open economies in about 15 out of 30 years while the corresponding statistic is only 6 years for countries with stable policy.

[31] The results are available upon request.

7 Explaining Policy Volatility

In the last section, we saw that only macroeconomic policy volatility has an explanatory power for growth. The rest of this paper will therefore investigate the factors that explain the variation in $RVMACRO$. It first uses a Bayesian model averaging (BMA) approach to evaluate sets of possible independent variables. Section 7.2 then uses the sets of variables that are suggested by BMA to estimate regressions that explain the causes of policy volatility.

7.1 BMA Results

This section describes how a BMA exercise is performed and suggests two lists of explanatory variables that form the best models from two different samples. I start in column (1) of Table 6 by including 39 main independent variables. These are political and social variables, which tend to have a clearer interpretation as to how they affect policy volatility than variables such as pre-determined factors. Only variables with a posterior inclusion probability (PIP) value of 0.20 and over are considered important. The first column suggests 16 of these variables, while (+) and (-) indicate the directions of relationship between that variable and $RVMACRO$.[32] These results are not sensitive to various alternative proxies.[33]

[32] In another experiment, I also included some variables which have a less clear interpretation than these 39 main variables such as special interests of the executive party (nationalist and regional-oriented) and the shares of population with different religions. These variables however have low PIP values.

[33] This includes (1) replace $POLITY$ with the degree of democracy variables from Reich (2002, $REICEDEM$) and Golder (2004, $GOLDERDE$). (2) Replace $POLSTAB$ with $NVUNREST$, $VIUNREST$, and three indicators of socio-political instability by Vu Le (2001, $VULESPI$, $VULESPI1$ and $VULESPI2$). (3) Replace $POLCON$ with the number of government seats over total seats ($MAJORITY$), the Herfindahl index of government seat shares ($HERFGOV$), the chance that two deputies randomly selected will be from different parties ($GOVFRAC$), a dummy indicating whether the party of executives controls all houses that have lawmaking powers ($ALLHOUSE$), the score that measures the strength of checks and balances system ($CHECKS$), and the proportion of veto players who drop from the government ($STABS$). All these variables are from Beck et al. (2001). I also tried the executive constraints variable from Marshall and Jaggers (2002, $XCONST$). (4) Replace $MEDIADEV$ with an index of press freedom by Karlekar (2004, $FREEPRES$). (5) Replace $FRUADELE$ with the score of free and fair elections by Coppedge and Reinicke (1990, $POLYARC$) and a variable that measures the universal

One can imagine that in countries where political violence is common, the mechanisms by which these main variables influence policy volatility might be different from countries where social order is maintained. An inclusion of variables which measure severe disorder might therefore bias the results of other variables. To test this argument, column (2) drops three variables including adverse regime changes ($ADREGCHG$), the probability of unlawful changes in the government ($PROBIRCH$), and political stability ($POLSTAB$). The results in column (1) do not seem to change significantly.[34]

Column (3) adds five regional dummies while column (4) adds four historical variables and eight geographic variables into column (2).[35] Among others, column (4) suggests that macroeconomic policy is more stable in countries where government instability is low, elections are more competitive, the difference in the political ideologies among political parties is small, and the executive party follows a liberal ideology. In addition, countries which are more democratic, are former British colonies, and adopt parliamentary system tend to have more stable macroeconomic policy.

Finally, column (5) drops the settler mortality variable ($MORTAL$) from column (4) because it is available for a lower number of countries. In total, column (5), which is the preferred set of results, suggests 14 variables with PIPs over 0.20. Among others, it reveals that while adopting a presidential system tends to raise policy volatility, stronger political contraints help to reduce policy volatility.

Table 7 displays the structure of the top ten models, ranked by their posterior model probability (PMP) values, from column (5) of Table 6. It shows that the best model consists of ten variables. These variables will

application of the right of voting by Paxton et al. (2003, $SUFFRAGE$). The only unrobust case is when we replace ethnic fragmentation ($ETHNFRAC$) with linguistic ($LINGFRAC$) and religious fragmentation ($RELIFRAC$). Unlike $ETHNFRAC$, the PIP values of $LINGFRAC$ and $RELIFRAC$ are lower than 0.20, and the results of other variables remain largely the same.

[34] This finding remains unchanged when dropping only $ADREGCHG$ and $PROBIRCH$, which have the PIP values over 0.20 in column (1).

[35] Although the *bicreg* software for R can handle up to 49 variables in a single model, the maximum number of variables I use is 45 variables to allow for a manageable computation time. As a result, I drop 11 variables in column (4). These are the variables with low PIP values in column (3).

form the baseline model in the next section. The PMP value of the best model is 0.04, compared with the prior probability, considering that there are 2^{44} possible models to estimate, of 5.7×10^{-14}. Table 8 displays the top ten models from column (4) of Table 6.

Overall, it can be argued that the results are not excessively fragile. Those variables with very high PIP values in column (1) remain important across all experiments. It is also shown that electoral rules and media development do not seem to influence policy volatility. In addition, while historical and geographic variables appear to influence the results in column (5), they themselves have limited explanatory power.

To check the robustness of these results from the *bicreg* approach, I applied a MC^3 approach to columns (4) and (5). The results are shown in columns (4.1) and (5.1). An important software limitation here is that the number of variables that can be included in a MC^3 exercise must not be greater than half of the number of observations. Hence, in column (4.1), only the top 20 variables with the highest PIP values in column (4) are included. In column (5.1), they are the top 25 variables from column (5). Similar to the *bicreg* case, the variables with the posterior probabilities of 0.20 or greater are considered important and are in bold.

Column (4.1) shows that out of 13 variables that have PIP values greater than 0.20 in column (4), 12 of these variables are also suggested by a MC^3 approach. The results are less strong in column (5.1) where eight (out of 15) variables are emphasized by both approaches. It can however be seen that results for the variables with high PIPs value are robust. Overall, these robustness results are promising, considering that columns (4) and (5) have many more variables than columns (4.1) and (5.1). This suggests that the results from the *bicreg* appraoch are not excessively influenced by outlying observations.

7.2 Regression Results

This section uses a simple regression analysis to study the roles of the variables in the best models in Tables 7 and 8 in explaining $RVMACRO$.

Column (1) in Table 9 contains ten variables that form the best model

in Table 7 (the sample that excludes $MORTAL$). It shows that nearly all variables have a significant relationship with $RVMACRO$ at the 5 percent level. Taken together, these variables explain over half the total variation in the data. Column (2) adds the initial income level and regional dummies as control variables. It suggests that macroeconomic policy is more volatile in countries that adopt a presidential system and where electoral outcomes are less competitive. Countries which are former British colonies and have larger populations also experience less stable policy.

Note that the political constraints variable ($POLCON$) is the only variable that is not significant in column (1). The reason might be that the electoral competitiveness variable ($LIEC$) hides the effect of $POLCON$ since both variables proxy for government power in implementing discretionary policy (the simple correlation is 0.71). Column (3) therefore drops $LIEC$ and reveals that stronger constraints in the policy-making process do lower policy volatility.[36] It also shows that macroeconomic policy is less volatile when the chance that the government in power will be replaced (via constitutional means) ($PROBMJCH$) is lower. These results are robust to the deletion of outlying observations as detected by the median regression method.

Column (4) contains nine variables that form the best model in Table 8 (the sample that includes $MORTAL$). Five of these variables also appear in the best model in the sample without $MORTAL$. The overall results remain unchanged, i.e. government instability, less competitive electoral outcomes, and being a former British colony increase policy volatility. Column (5) adds control variables and somewhat weakens the findings in column (4).

The results in column (5) are not sensitive to excluding three outliers as suggested by the median regression method (Iran, Guatemala, and the Democratic Republic of Congo) as shown in column (6). An exception is the relationship between $RVMACRO$ and a parliamentary system ($PARLIA$) which became significantly negative at the 1 percent level. That is, parliamentary regimes are associated with more stable policy.

The sizes of association between these explanatory variables and macro-

[36] Between the two variables, $POLCON$ is preferred since it appears in all ten models in Table 7 while $LIEC$ only appears in the best model.

economic policy volatility are displayed at the bottom panel of Table 9 (only the variables that are significant at the 5 percent level in columns (3) and (6) are shown). The beta value indicates the size of the change in $RVMACRO$ (in terms of its standard deviation) given a one-standard-deviation change in the independent variable. For example, based on the estimates in column (3), a one-standard-deviation increase in $PROBMJCH$ (from Thailand to Chile's level) raises $RVMACRO$ by 0.57 of a standard deviation (from Thailand to Jordan's level).

One general conclusion that can be drawn from this section is that while a presidential regime leads to a more volatile policy, stronger political constraints help to stabilize policy. This is true when we measure policy volatility both in terms of inflation and real exchange rates as in this paper, and in term of government spending as in Fatás and Mihov (2003). Moreover, while the literature has highlighted the important role of trade openness in explaining the volatility of inflation and real exchange rates, this paper documents that once we control for a wider range of independent variables, the explanatory power of trade openness seems to disappear.

8 Conclusions

This paper has sought to explain the causes of government policy volatility in developing countries. To measure policy volatility, I applied a method of classical and outlier-robust principal components to the proxies of Washington Consensus policy variables. The results suggest three dimensions of policy volatility, namely, fiscal, macroeconomic and development policy volatility.

I showed that more volatile macroeconomic policy is associated with lower income per capita growth even after controlling for the proxies for the quality of institutions. The size of the association is notable. In the preferred model, a one-standard-deviation decrease in the composite macroeconomic policy volatility indicator raises growth by 0.63 percentage points. It is also shown that changes in development or liberalization policy and unstable fiscal deficits do not appear to affect economic growth.

The paper then adopts a Bayesian method to address the model uncer-

tainty problem. The key findings are that macroeconomic policy is more volatile in countries that adopt a presidential system, have weaker political constraints, and where government stability is lower. Countries which are former British colonies and have larger populations also experience less stable policy. Finally, adopting a parliamentary regime seems to help to stabilize policy. A one-standard-deviation change in these variables results in a 0.40-0.57 standard deviation change in the policy volatility indicator.

Two important issues arise from these findings. First, it is arguable that macroeconomic instability can also influence the strength of political constraints (e.g. through changes in legislature) and the degree of government stability. The next empirical task is therefore to study the casual relationships between these two variables and macroeconomic stability. Second, we saw that the type of political regime (presidential and parliamentary) plays an important role in explaining policy volatility in developing countries. While theoretical work which attempts to explain how political regimes affect policy outcomes is growing rapidly (see for example Persson and Tabellini, 2003), much of this work focuses on democratic countries. An ability to explain how political regimes and policy outcomes interact in less democratic contexts remains a challenge.

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Table 1: Policy volatility, investment and income per capita growth around the world

	High-income countries	Low-income countries						
		Total	East Asia & Pacific	Sub-Saharan Africa	Latin America	South Asia	Middle East & North Africa	East Europe & Central Asia
Macroeconomic policy volatility								
Government budget deficit/GDP [a]	2.29	2.63	2.24	2.81	3.94	1.65	5.07	2.99
Government debt/GDP [a]	10.50	12.76	11.54	23.21	11.99	7.90	10.56	17.42
Inflation [b]	4.51	129.28	12.33	378.17	396.57	5.74	11.62	368.02
Real interest rate [b]	3.29	8.29	5.01	13.68	13.63	3.08	7.64	25.31
Black market premium [a]	0.87	72.45	55.26	156.97	40.55	31.16	273.00	81.79
Real exchange rate distortion index [a]	14.11	33.58	20.51	55.01	35.56	24.12	63.31	23.04
Development policy volatility								
Import duties/import value [b]	1.00	4.89	2.10	9.43	2.88	8.87	3.75	3.14
Government enterprises and investment score [c]	1.20	1.44	0.37	1.59	2.60	2.38	0.96	1.89
Legal structure and property rights score [c]	0.74	0.84	0.64	0.74	0.86	1.15	1.39	0.56
Regulations of credit, labour and business score [c]	0.54	0.59	0.71	0.60	0.56	0.31	0.41	0.99
Annual GDP per capita growth	2.28	1.40	4.80	-0.69	1.48	2.61	1.67	2.18
GDP per capita growth volatility	2.38	4.56	3.99	7.03	4.32	3.09	6.20	7.16
Investment/GDP	23.47	14.86	17.79	9.03	16.88	11.60	13.49	17.35

Notes: [a] denotes the variables from Easterly and Sewadeh (2002), [b] denotes the variables from World Bank (2004), and [c] denotes the composite scores constructed by Gwartney and Lawson (2004). The data on GDP and investment are from Heston et al. (2002). All volatility measures are calculated from the standard deviation. The regional figures are the population-weighted averages of individual country figures. The average population during 1970-2003 is used. The annual GDP growth for low-income countries shown in the table excludes China. When both China and India are excluded, the growth rate declines to 0.77 percent. When both China and India are included, the growth rate is 2.97 percent.

Table 2: Principal components analysis for the Washington Consensus volatility indicators

Variable	Expected sign	(1) Classical		(1) Robust		(2) Classical		(2) Robust	
		1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC
VDEFICIT	+	-0.145	**-0.311**	-0.130	**-0.609**	-0.067	**0.580**	0.041	**0.752**
VDEBT	+	0.315	**0.546**	**0.350**	0.308				
VEDU	+	0.404	**-0.505**	**0.420**	-0.328	0.421	**0.615**	**0.514**	0.415
VHEALTH	+	0.111	**-0.454**	0.241	**0.279**	0.114	**0.269**	**0.124**	-0.066
VMARTAX	+	0.183	**-0.497**	0.222	**-0.647**				
VINFLA	+	**0.813**	-0.057	**0.699**	-0.063	**0.831**	-0.074	**0.682**	-0.180
VREALI	+	**0.736**	-0.242	**0.743**	-0.136	**0.683**	0.032	**0.662**	-0.092
VBMP	+	**0.838**	-0.201	**0.888**	-0.117	**0.733**	0.210	**0.822**	-0.315
VOVERVALU	+	**0.794**	-0.155	**0.840**	-0.327	**0.652**	0.339	**0.798**	0.014
VMDUTY	+	0.052	**0.063**	**0.095**	-0.018	0.163	**0.246**	**0.262**	-0.122
VSW	+	**0.491**	0.059	**0.499**	0.349	0.382	**-0.461**	0.257	**-0.655**
VTRADEFI	+	**0.602**	0.131	**0.618**	0.493				
VSOEFI	+	**0.427**	0.284	**0.381**	0.037	**0.451**	-0.047	**0.415**	0.054
VREGFI	+	**0.503**	0.293	**0.303**	0.019	**0.557**	-0.549	0.259	**-0.335**
VPROPFI	+	0.498	**0.532**	**0.392**	0.050	**0.499**	-0.247	0.380	**-0.392**
Number of countries		37		37		56		56	
% Variance explained		27.69	11.35	25.38	14.02	27.10	13.25	26.89	17.53

Notes: Numbers shown are the correlations between principal components (PCs) and corresponding variables. Numbers in bold indicate the higher correlations between that PC and corresponding variables.

Table 3: Principal components analysis for the macroeconomic policy volatility indicators

Variable	Expected Sign	(1) Classical		(1) Robust		(2) Classical		(2) Robust	
		1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC
VDEFICIT	+	0.022	**-0.384**	0.049	**0.482**	-0.004	**-0.960**	-0.037	**-0.968**
VDEBT	+	0.144	**0.820**	0.267	**-0.705**				
VEDU	+	**0.545**	-0.457	**0.475**	0.292				
VHEALTH	+	0.238	**-0.371**	**0.184**	-0.030				
VMARTAX	+	**0.324**	-0.251	0.347	**0.696**				
VINFLA	+	**0.763**	-0.125	**0.676**	0.036	**0.801**	-0.132	**0.698**	-0.145
VREALI	+	**0.767**	0.072	**0.755**	-0.039	**0.793**	-0.125	**0.731**	-0.189
VBMP	+	**0.878**	0.065	**0.875**	-0.016	**0.743**	0.355	**0.815**	0.256
VOVERVALU	+	**0.810**	0.361	**0.877**	-0.064	**0.772**	-0.081	**0.822**	-0.181
Number of countries		41		41		66		66	
% Variance explained		34.18	15.39	36.44	20.45	48.37	21.75	49.93	27.04

Variable	Expected Sign	(3) Classical		(3) Robust		(4) Classical		(4) Robust	
		1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC
VDEFICIT	+								
VDEBT	+								
VEDU	+								
VHEALTH	+								
VMARTAX	+								
VINFLA	+	**0.802**	-0.371	**0.701**	-0.445	**0.713**	0.700	**0.563**	-0.058
VREALI	+	**0.776**	-0.474	0.707	**-0.760**				
VBMP	+	**0.732**	0.502	**0.830**	0.274	**0.838**	-0.262	**0.908**	0.209
VOVERVALU	+	**0.755**	0.395	**0.783**	-0.352	**0.825**	-0.340	**0.834**	-0.690
Number of countries		68		68		72		72	
% Variance explained		58.77	19.27	58.90	25.63	63.00	22.45	66.31	25.37

Notes: See notes in Table 2.

Table 4: Principal components analysis for the development policy volatility indicators

Variable	Expected sign	(1) classical		(1) robust		(2) classical		(2) robust	
		1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC	1st PC	2nd PC
VMDUTY	+	0.207	**-0.712**	0.048	**-0.149**	0.240	**-0.845**	0.125	**-0.139**
VSW	+	**0.736**	0.376	**0.864**	-0.025	**0.521**	0.493	**0.792**	0.160
VTRADEFI	+	**0.713**	0.463	**0.838**	0.122				
VSOEFI	+	**0.515**	-0.202	0.391	**0.486**	**0.537**	-0.004	**0.526**	0.523
VREGFI	+	**0.588**	-0.091	0.420	**-0.435**	**0.731**	0.256	**0.575**	-0.417
VPROPFI	+	0.513	**-0.587**	0.311	**-0.755**	**0.696**	-0.343	0.535	**-0.729**
Number of countries		56		56		65		65	
% Variance explained		32.78	20.95	33.93	21.29	32.73	22.83	31.76	26.96

Notes: See notes in Table 2.

Table 5: The macroeconomic policy volatility indicator (RVMACRO) and GDP growth regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RVMACRO	-0.995	-0.677	-0.630	-0.730		-0.883	-0.618	-0.589
	(0.26)**	(0.24)**	(0.28)*	(0.28)*		(0.25)**	(0.28)*	(0.28)*
Initial GDP per capita		-0.647	-0.818	-0.638			-0.880	-0.897
		(0.32)*	(0.38)*	(0.31)*			(0.44)*	(-0.45)
Investment		0.943	0.796				0.678	0.666
		(0.31)**	(0.36)*				(-0.37)	(0.41)
Population growth		-0.136	-0.084	0.030			-0.090	-0.070
		(-0.19)	(-0.23)	(-0.25)			(0.21)	(0.24)
Literacy in 1970		0.717	0.660	0.913			0.700	0.683
		(0.25)**	(-0.33)	(0.32)**			(0.31)*	(0.32)*
Political constraints					0.763	0.569	0.226	0.019
					(0.29)*	(0.27)*	(-0.45)	(0.70)
Degree of democracy								0.043
								(0.70)
Plurality								0.108
								(0.23)
Parliamentary								0.300
								(0.45)
Regional dummies	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.23	0.51	0.56	0.47	0.13	0.31	0.57	0.59
Number of countries	71	69	69	69	70	70	68	68
hettest	0.75	0.02	0.10	0.42	0.64	0.81	0.05	0.03
whitetst	0.63	0.19	0.63	0.65	0.27	0.26	0.71	0.55
Ovtest	0.04	0.89	0.76	0.95	0.17	0.14	0.79	0.94

Notes: The dependent variable is the annual GDP per capita growth over 1970-99, in percentage points. ** and * denote significance at the 1% and 5%, respectively. Numbers shown in parentheses are MacKinnon and White (1985) heteroskedasticity-consistent (hc3) standard errors. The explanatory variables are standardized to have a standard deviation of one, and so the coefficients represent the effect of a one-standard-deviation change on the annual growth rate. All regressions have a constant. Regional dummies are for East Asia and the Pacific, Sub-Saharan Africa, South Asia, Latin America and the Caribbean, and Middle East and North Africa. hettest performs the Breusch-Pagan test for heteroskedasticity in the independent variables. whitetst performs a variant of the White test for heteroskedasticity that uses the predicted values from the original regression and their squared values. ovtest performs the Ramsey's regression specification error test for omitted variables. The corresponding numbers shown are p-values.

Table 6: Posterior inclusion probability (PIP) of independent variables explaining the macroeconomic policy volatility indicator (RVMACRO)

	Independent variable	(1)		(2)		(3)		(4)		(4.1)	(5)		(5.1)
1	Const government instability	1.000	(+)	1.000	(+)	1.000	(+)	1.000	(+)	**0.999**	0.999	(+)	**1.000**
2	British colony	0.997	(+)	0.988	(+)	1.000	(+)	1.000	(+)	**0.997**	1.000	(+)	**0.998**
3	Parliamentary system	0.953	(-)	0.983	(-)	0.910	(-)	0.994	(-)	**0.973**	0.396	(-)	**0.996**
4	Re-electability incentive	0.953	(+)	0.940	(+)	0.990	(+)	0.232	(+)	**0.228**	0.778	(+)	**0.908**
5	Military head	0.938	(+)	0.989	(+)	0.982	(+)	0.014			0.222	(+)	**0.999**
6	Women in parliament	0.915	(+)	0.868	(+)	0.679	(+)	0.864	(+)	**0.568**	0.642	(+)	0.132
7	Electoral competitiveness	0.863	(-)	0.989	(-)	0.890	(-)	0.952	(-)	**0.687**	0.256	(-)	**0.903**
8	Right-wing government	0.475	(+)	0.351	(+)	0.253	(+)	0.473	(+)	**0.322**	0.001		
9	Population in 1970	0.422	(+)	0.322	(+)	0.882	(+)	0.004			0.429	(+)	0.078
10	Centre-wing government	0.415	(-)	0.474	(-)	0.044		0.167		0.089	0.000		
11	Ideology difference	0.405	(+)	0.364	(+)	0.484	(+)	0.654	(+)	**0.560**	0.999	(+)	0.091
12	Lack of corruption	0.399	(-)	0.451	(-)	0.319	(-)	0.000			0.013		0.035
13	Changes in executives	0.370	(-)	0.278	(-)	0.261	(-)	0.918	(-)	**0.735**	0.011		
14	Adverse regime changes	0.331	(+)			0.242	(+)	0.001			0.000		
15	Ethnic fragmentation	0.331	(+)	0.205	(+)	0.001		0.012			0.009		
16	Unconst gov't instability	0.270	(+)			0.408	(+)	0.873	(+)	**0.556**	0.007		
17	Trade openness	0.134		0.279	(-)	0.094		0.036		0.175	0.078		0.053
18	French colony	0.066		0.132		0.085		0.006			0.004		
19	Lack of political rights	0.056		0.029		0.001							
20	Changes in constitutions	0.049		0.024		0.007							
21	Presidential system	0.043		0.028		0.118		0.018			0.567	(+)	0.053
22	GDP per capita in 1970	0.035		0.000		0.014		0.024			0.010		
23	Degree of democracy	0.033		0.034		0.016		0.478	(+)	**0.255**	0.000		
24	Income inequality	0.021		0.006		0.000							
25	Government tiers	0.019		0.028		0.002							
26	Media development	0.008		0.000		0.000		0.000			0.000		
27	Plurality	0.002		0.007		0.013		0.000			0.000		
28	Changes in executive parties	0.000		0.000		0.004							
29	Election fraud	0.000		0.000		0.006							
30	Int'l political engagement	0.000		0.000		0.000							
31	Left-wing government	0.000		0.001		0.080		0.000			0.101		0.028
32	Other colonies	0.000		0.000		0.008							
33	Political constraints	0.000		0.000		0.000		0.063		**0.201**	0.996	(-)	0.177
34	Political particularism	0.000		0.044		0.010							
35	Political stability	0.000				0.000		0.012			0.000		
36	Political system maturity	0.000		0.000		0.005							
37	Proportionality	0.000		0.000		0.000		0.017			0.000		
38	Spanish colony	0.000		0.010		0.005		0.008			0.000		
39	Voter turnout	0.000		0.000		0.012							
40	South Asia					0.794	(-)	0.072		0.167	0.996	(-)	**0.339**
41	East Asia & Pacific					0.631	(-)	0.000			0.001		
42	Latin America					0.146		0.022			0.064		**0.481**
43	Middle East & N. Africa					0.137		0.001			0.001		
44	Sub-Sahara Africa					0.220	(+)	0.101		0.144	0.361	(+)	0.095

Table 6 (continued)

	Independent variable	(1)	(2)	(3)	(4)		(4.1)	(5)		(5.1)
45	State antiquity				0.286	(+)	0.188	0.084		0.098
46	Settler mortality				0.190		**0.311**			
47	European settler				0.006			0.003		
48	European-speaking pop				0.002			0.024		0.111
49	Land area				0.946	(+)	**0.628**	0.380	(+)	**0.554**
50	Elevation				0.004			0.126		**0.355**
51	Tropical land area				0.029		0.048	0.015		0.054
52	Distance to major market				0.002			0.013		0.103
53	Landlocked				0.000			0.000		
54	Latitude				0.000			0.024		0.034
55	Point-source resources				0.000			0.000		
56	People in tropics				0.001			0.016		0.033
	Number of variables	39	36	44	45		20	44		25
	Number of countries	71	71	71	49		50	56		63

Notes: Numbers shown are the posterior inclusion probabilities (PIPs), i.e. the probabilities that coefficients of independent variables are not zero. Variables whose PIPs are 0.20 or greater are considered important. (+) and (-) show the signs between the variables and RVMACRO. The results in columns (4.1) and (5.1) are obtained from the MC^3 approach.

Table 7: Top ten models and their posterior model probabilities for the sample without the settler mortality variable (MORTAL)

Independent Variable	PIP	1	2	3	4	5	6	7	8	9	10
British colony	1.000	●	●	●	●	●	●	●	●	●	●
Const government instability	0.999	●	●	●	●	●	●	●	●	●	●
Ideology difference	0.999	●	●	●	●	●	●	●	●	●	●
Political constraints	0.996	●	●	●	●	●	●	●	●	●	●
South Asia	0.996	●	●	●	●	●	●	●	●	●	●
Re-electability incentive	0.778	●		●	●	●		●	●		●
Women in parliament	0.642	●	●		●		●	●		●	●
Presidential system	0.567	●	●	●	●	●	●	●	●	●	●
Population size in 1970	0.429	●		●		●		●	●		●
Land area	0.380		●		●		●			●	
Sub-Saharan Africa	0.361			●		●	●				●
Electoral competitiveness	0.256	●									
Military head	0.222					●					
Latin America	0.064										
European-speaking population	0.024									●	
Number of variables		10	8	9	9	10	9	9	8	9	10
Posterior model probability		0.0400	0.0390	0.0381	0.0361	0.0304	0.0302	0.0282	0.0256	0.0236	0.0230

Notes: The posterior inclusion probabilities (PIPs) shown are taken from column (5) in Table 6.

Table 8: Top ten models and their posterior model probabilities for the sample with the settler mortality variable (MORTAL)

Independent Variable	PIP	1	2	3	4	5	6	7	8	9	10
Const government instability	1.000	●	●	●	●	●	●	●	●	●	●
British colony	1.000	●	●	●	●	●	●	●	●	●	●
Parliamentary system	0.994	●	●	●	●	●	●	●	●	●	●
Electoral competitiveness	0.952	●	●	●	●	●	●	●	●	●	●
Land area	0.946	●	●	●	●	●	●	●	●	●	●
Changes in executives	0.918	●	●	●	●	●	●	●	●	●	●
Unconst government instability	0.873	●	●	●	●	●	●	●	●	●	●
Women in parliament	0.864	●	●	●	●	●	●	●	●	●	●
Ideology difference	0.654	●	●	●			●	●		●	
Degree of democracy	0.478			●	●	●			●	●	●
Right-wing party	0.473		●			●		●			●
State antiquity	0.286		●								●
Re-electability incentive	0.232						●			●	
Settler mortality	0.190		●								
Centre-wing government	0.167				●						
Number of variables		9	12	10	10	10	10	10	9	11	11
Posterior model probability		0.0538	0.0375	0.0368	0.0351	0.0328	0.0326	0.0293	0.0281	0.0226	0.0212

Notes: The posterior inclusion probabilities (PIPs) shown are taken from column (4) in Table 6.

Table 9: Determinants of the macroeconomic policy volatility indicator (RVMACRO)

	(1)	(2)	(3)	(4)	(5)	(6)
British colony	1.690	1.476	1.512	1.301	1.529	1.644
	(0.34)**	(0.39)**	(0.42)**	(0.36)**	(0.42)**	(0.33)**
Const government instability	8.522	7.372	10.193	9.988	10.331	10.872
	(2.99)**	(4.83)	(4.74)*	(2.86)**	(4.70)*	(3.41)**
Ideology difference	0.925	0.735	0.698	0.570	0.634	0.549
	(0.39)*	(0.51)	(0.56)	(0.42)	(0.47)	(0.37)
Women in parliament	0.069	0.043	0.036	0.064	0.059	0.076
	(0.03)*	(0.03)	(0.03)	(0.03)*	(0.03)	(0.03)
Electoral competitiveness	-0.334	-0.380		-0.346	-0.243	-0.117
	(0.13)**	(0.16)*		(0.12)**	(0.16)	(0.12)
Political constraints	-1.760	-1.092	-2.490			
	(1.20)	(1.42)	(1.23)*			
South Asia	-2.135	-0.869	-0.586			
	(0.53)**	(2.17)	(2.90)			
Re-electability incentive	0.941	1.261	0.781			
	(0.39)*	(0.47)**	(0.44)			
Presidential system	1.839	1.480	1.540			
	(0.36)**	(0.39)**	(0.41)**			
Population in 1970	1.001	1.158	1.024			
	(0.25)**	(0.28)**	(0.31)**			
Unconst government instability				6.160	11.620	13.159
				(8.38)	(8.33)	(6.56)
Changes in executive parties				-4.666	-4.494	-3.244
				(2.27)*	(2.73)	(1.98)
Parliamentary system				-1.350	-1.243	-1.537
				(0.60)*	(0.64)	(0.53)**
Land area				0.000	0.000	0.000
				(0.00)	(0.00)	(0.00)
Sample with MORTAL?	No	No	No	Yes	Yes	Yes
Control variables	No	Yes	Yes	No	Yes	Yes
R^2	0.55	0.59	0.55	0.50	0.54	0.63
Number of countries	72	71	71	69	68	65
hettest	0.92	0.83	0.52	0.32	0.34	0.71
whitetst	0.99	0.49	0.36	0.62	0.58	0.71
ovtest	0.05	0.01	0.07	0.13	0.11	0.06

Beta value	Col (3)	Col (6)
Const government instability	0.57	0.69
British colony	0.52	0.63
Population in 1970	0.47	
Presidential system	0.44	
Political constraints	-0.40	
Parliamentary system		-0.44

Notes: The dependent variable is the macroeconomic policy volatility indicator (RVMACRO). ** and * denote significance at the 1% and 5%, respectively. Numbers shown in parentheses are MacKinnon and White (1985) heteroskedasticity-consistent (hc3) standard errors. Control variables include GDP per capita level and population in 1970, and five regional dummies. Column (6) drops three outlying observations as suggested by the median regression method. For other notes, see notes in Table 5.

Appendix Table 1: Descriptive statistics

	Variable	Obs.	Mean	Std. Dev.	Min	Max
	VDEFICIT	87	1.097	0.730	-0.867	3.039
	VDEBT	68	0.461	0.307	0.069	1.626
	VEDU	89	1.052	1.407	0.156	12.866
	VHEALTH	90	0.461	0.414	0.031	2.170
	VMARTAX	58	2.049	0.992	0.000	4.619
	VINFLA	90	2.908	1.535	0.799	8.496
Washington	VREALI	85	2.206	0.783	0.861	5.520
Consensus	VBMP	88	3.176	1.852	-0.798	9.188
	VOVERVALU	74	3.350	0.769	1.698	6.983
	VMDUTY	87	4.525	11.501	0.000	108.285
	VSW	77	0.249	0.240	0.000	0.509
	VTRADEFI	64	1.557	1.225	0.000	4.347
	VSOEFI	77	1.127	0.808	0.000	3.371
	VREGFI	76	0.485	0.310	0.086	1.842
	VPROPFI	74	0.934	0.603	0.039	3.886
Composite	RVMACRO	72	0.000	1.000	-1.921	2.594
indicator	RVDEV	65	0.000	1.000	-1.908	2.541
	RGDP7099C	71	0.012	0.021	-0.053	0.064
	LITERACY	70	3.678	0.675	1.749	4.536
	INVEST	72	2.469	0.582	0.797	3.814
	PRIINVEST	66	2.466	0.511	0.855	3.261
	PUBINVEST	66	2.025	0.376	1.296	3.119
	RGDPPC70	71	6.443	0.692	5.189	7.927
	POPG	72	-2.576	0.089	-2.894	-2.419
Growth	RGNEAP	72	0.111	0.316	0.000	1.000
regressions	RGNECA	72	0.014	0.118	0.000	1.000
	RGNMENA	72	0.111	0.316	0.000	1.000
	RGNSA	72	0.069	0.256	0.000	1.000
	RGNSSA	72	0.417	0.496	0.000	1.000
	RGNLAC	72	0.264	0.444	0.000	1.000
	POLITY	71	-0.878	5.612	-9.000	10.000
	POLCON	71	0.231	0.221	0.000	0.784
	PLURAL	71	0.762	0.413	0.000	1.000
	PARLIA	71	0.208	0.367	0.000	1.000

Notes: Descriptive statistics for growth regression variables are computed from 72 countries that RVMACRO is available.

Appendix Table 2: Simple correlations among the proxies of Washington Consensus policy variables

	VDEFICIT	VDEBT	VEDU	VHEALTH	VMARTAX	VINFLA	VBMP	VOVERVLU	VMDUTY	VSW	VTRADEFI
VDEFICIT	1.000										
VDEBT	0.257	1.000									
VEDU	0.435	0.437	1.000								
VHEALTH	0.185	-0.045	0.016	1.000							
VMARTAX	-0.048	-0.284	0.003	0.075	1.000						
VINFLA	0.185	0.251	0.171	0.213	-0.007	1.000					
VBMP	-0.074	0.275	0.127	0.181	0.330	0.451	1.000				
VOVERVALU	0.270	0.417	0.215	0.159	0.185	0.498	0.656	1.000			
VMDUTY	0.269	0.474	0.885	-0.078	0.056	0.037	0.143	0.183	1.000		
VSW	-0.101	0.121	-0.059	0.183	0.028	0.198	0.090	0.042	-0.076	1.000	
VTRADEFI	-0.074	0.133	0.018	0.369	-0.076	0.309	0.223	0.191	-0.033	0.584	1.000
VSOEFI	0.098	0.085	0.169	0.010	0.108	0.302	0.123	0.260	0.148	0.219	0.270
VREGFI	0.054	0.077	-0.004	0.200	0.019	0.582	0.254	0.345	-0.081	0.270	0.283
VPROPFI	0.089	0.111	0.437	0.014	0.160	0.102	0.095	0.130	0.279	0.136	0.078
VREALI	0.284	0.294	0.238	0.320	-0.004	0.659	0.338	0.597	-0.043	0.189	0.229

	VSOEFI	VREGFI	VPROPFI
VSOEFI	1.000		
VREGFI	0.241	1.000	
VPROPFI	0.188	0.240	1.000
VREALI	0.271	0.490	0.014

Appendix Table 3: Variables and definitions for the Washington Consensus policy variables

Variable	Variable description	Source
Budget deficit (VDEFICIT)	Natural log of the standard deviation of central government budget deficit over GDP	World Bank (2004)
Government debt (VDEBT)	Natural log of the standard deviation of central government debt over GDP	World Bank (2004)
Public spending on education (VEDU)	Natural log of the standard deviation of public expenditure on education over GDP	World Bank (2004)
Public spending on health (VHEALTH)	Natural log of the standard deviation of public expenditure on health over GDP	World Bank (2004)
Marginal tax rate score (VMARTAX)	Standard deviation of the top marginal tax rate score. Higher score value means low top marginal tax rate is applied to high income threshold level.	Gwartney and Lawson (2004)
Inflation (VINFLA)	Natural log of the standard deviation of GDP deflator	World Bank (2004)
Real interest rate (VREALI)	Natural log of the standard deviation of lending rate adjusted by GDP deflator	World Bank (2004)
Black market premium (VBMP)	Natural log of the standard deviation of black market premium	Easterly and Sewadeh (2002)
Overvaluation index (VOVERVALU)	Natural log of the standard deviation of the currency overvaluation index. The original data (1976-85) are from Dollar (1992), and extended to 1970-99 by Easterly and Sewadeh (2002).	Dollar (1992) and Easterly and Sewadeh (2002)
Sachs and Warner index (VSW)	Standard deviation of a dummy variable with the value of one indicates open economy. Closed economy is associated with high tariff rates, high non-tariff barriers, high black market premiums, adopting a socialist system, and having the state as an export monopolist.	Sachs and Warner (1995) and Waczairg and Welch (2003)
Import duty (VMDUTY)	Standard deviation of a proportion of import duties over import value.	World Bank (2004) and Yanikkaya (2003)
Mean tariff rate score (VTRADEFI)	Standard deviation of the tariff rate score. Higher score value means lower average tariff rates.	Gwartney and Lawson (2004)

Government enterprises and investment score (VSOEFI)	Standard deviation of the government enterprises and investment score. Higher score value means lower extent of state-owned enterprises and government investment in the economy.	Gwartney and Lawson (2004)
Regulation of credit, labour, and business score (VREGFI)	Standard deviation of the regulation of credit, labour, and business score. Higher score value means less regulated economy.	Gwartney and Lawson (2004)
Legal structure and property rights score (VPROPFI)	Standard deviation of the legal structure and property rights score. Higher score value means better protection of private property rights.	Gwartney and Lawson (2004)

Appendix Table 4: Variables and definitions for the growth regressions variables

Variable name	Variable description	Source
Investment (INVEST)	Natural log of real investment over real GDP	Heston et al. (2002)
Population growth (POPG)	Natural log of average annual growth rate of population aged 15-64, 1970-99. This rate is added with depreciation rate of 0.05.	World Bank (2004)
Schooling (SCHOOL70)	Natural log of average years of schooling at all educational levels of population aged over 15 in 1970	Barro and Lee (2000)
Literacy rate (LITERACY)	Natural log of (100 - illiteracy rate of population aged over 15 in 1970)	World Bank (2004)
Initial GDP (RGDPPC70)	Natural log of real GDP per capita in 1970	Heston et al. (2002)
GDP growth (RGDP7099)	Natural log of real GDP per capita in 1999 minus that of 1970. This is divided by 29, to obtain annual growth rates.	Heston et al. (2002)
Regional dummy	Five regions: East Asia and the Pacific, Middle East and North Africa, South Asia, Sub-Sahara Africa, and Latin America and Caribbean	Easterly and Sewadeh (2002)
Macroeconomic policy volatility indicator (RVMACRO)	A score from a principal components analysis derived from VINFLA, VBMP and VOVERVALU. Higher value means more volatile macroeconomic policy. See text for more details.	Own construction. See data sources in Appendix Table 3.

Appendix Table 5: Variables and definitions for the independent variables

Variable	Variable description	Source
Political variable		
Degree of democracy (POLITY)	Degree of democracy=democratic score-autocratic score. Higher value indicates more democratic society. This is the main proxy for degree of democracy variable.	Marshall and Jaggers (2000)
Degree of democracy (GOLDERDE)	Two classifications: democracy and dictatorship. Higher score value indicates less democratic society.	Golder (2004)
Degree of democracy (REICEDE)	Three classifications: authoritarian, semi-democratic and democratic. These are assigned the values of 0, 1 and 2 respectively. Hence, a higher score value indicates more democratic society.	Reich (2002)
Parliamentary system (PARLIA)	Share of years between 1975-99 that a parliamentary system was adopted	Beck et al. (2001)
Presidential system (DIRCPRES)	Share of years between 1975-99 that a direct presidential system was adopted. An omitted category for political regime variables (PARLIA and DIRCPRES) is elected presidential.	Beck et al. (2001)
Right-wing party (RGHTWING)	Dummy variable indicates Conservative or Christian democratic parties adopting liberal policies	Beck et al. (2001)
Left-wing party (LEFTWING)	Dummy variable indicates Communist or socialist parties adopting state-based policies	Beck et al. (2001)
Centre-wing party (CNTRWING)	Dummy variable indicates parties adopting both market- and state-based policies	Beck et al. (2001)
Political constraints (POLCON)	Extent of political constraints in policy-making process. Higher value means stronger constraints. This is the main proxy for political constraints variable.	Henisz (2000)
Executive constraints (XCONST)	Extent of political constraints in policy-making process. Higher value means stronger constraints.	Marshall and Jaggers (2000)
Government Herfindahl index (HERFGOV)	The sum of the squared seat shares of all parties in the government	Beck et al. (2001)
Government fragmentation (GOVFRAC)	Probability that two deputies selected at random from among government parties will be from different parties	Beck et al. (2001)
Margin of majority (MAJORITY)	Share of government seats in total seats	Beck et al. (2001)
All houses control (ALLHOUSE)	Dummy variable indicates whether executive party has an absolute majority in all houses that have law-making powers	Beck et al. (2001)

Checks (CHECKS)	Extent of checks and balances in policy-making process. Higher value means stronger checks and balances (e.g. by having competitively elected executives)	Beck et al. (2001)
Stability (STABS)	Percent of veto players who drop from the government. Higher value means less stable roles of veto players.	Beck et al. (2001)
Political system maturity (PARTYAGE)	Average age (in years) of the largest two government parties and the largest opposition party	Beck et al. (2001)
Nationalist party (NATIOPAR)	Dummy variables indicates executive party being a nationalist party	Beck et al. (2001)
Regional-oriented party (REGIOPAR)	Dummy variables indicates executive party being a regional-oriented party	Beck et al. (2001)
Electoral competitiveness (LIEC)	Legislative index of electoral competitiveness. Higher score value means more intense competition in the election for legislative body.	Beck et al. (2001)
Proportionality (PROPOR)	Share of years between 1975-99 that a proportional electoral rule was adopted	Beck et al. (2001)
Plurality (PLURAL)	Share of years between 1975-99 that a plural electoral rule was adopted.	Beck et al. (2001)
Ideology difference (WINGDIFF)	Difference in political ideology between executive party and those of the three largest government parties and the largest opposition party.	Beck et al. (2001)
Election fraud (FRUADELE)	A dummy indicates whether election fraud tends to affect electoral outcomes significantly	Beck et al. (2001)
Re-electability incentive (FIMUTERM)	Dummy variable equals to one if there is a finite office term for executive and serving multiple terms is possible	Beck et al. (2001)
Military head (MILIHEAD)	Dummy variable indicates having military as a head of state	De Mesquita et al. (2003)
Political stability (POLSTAB)	Extent of political stability including a chance that a current government will be overthrown and political violence. Higher score means higher political stability.	Kaufmann et al. (2003)
Violent political unrest (VIUNREST)	A score from a principal components analysis derived from assassinations, guerrilla warfare, major government crises, purges, riots, revolutions and coups. Higher value means more frequent political unrest. See text for more details.	Own construction with data from De Mesquita et al. (2003)
Non-violent political unrest (NVUNREST)	A score from a principal components analysis derived from general strikes and anti-government demonstration. Higher value means more frequent political unrest. See text for more details.	Own construction with data from De Mesquita et al. (2003)

Socio-political instability	Three different indicators. VULESPI1 and VULESPI2 are scores from a principal components analysis. VULESP1 includes general strikes, riots and government demonstrations. VULESPI2 covers assassinations, guerrilla warfare and purges. VULESPI includes all six variables, derived from a logit method.	Quan Vu Le (2001)
Unconstitutional government instability (PROBIRCH)	Probability of irregular, violent changes in government such as those from coups. It is derived from a logit model, and depends on variables such as past macroeconomic performance and political disorder.	Feng, Kugler and Zak (2000)
Constitutional government instability (PROBMGCH)	Probability of regular, major changes in government such as the public desire in replacing a current government. Same methodology as PROBIRCH.	Feng, Kugler and Zak (2000)
Changes in executives (EXECHG)	Number of changes in executives during 1975-99	Beck et al. (2001)
Changes in executive parties (PARTYCHG)	Number of changes in party of executives during 1975-99	Beck et al. (2001)
Changes in constitution (CONSTCH)	Number of changes in constitutions during 1970-99	De Mesquita et al. (2003)
Adverse government changes (ADREGCHG)	Measure of the magnitude of events such as shifts from democratic to authoritarian system and collapses of central state authority.	Marshall et al. (2002)
Polyarchy scale (POLYARCH)	Extent of fair and free elections. Higher score value means less freedom for political participation and expression.	Coppedge and Reinicke (1990)
Suffrage (SUFFRAGE)	Right of voting index. Higher index value indicates fewer restrictions on characteristics of citizens who can vote.	Paxton et al. (2003)
Government tiers (GOVTIER)	Number of government tiers, e.g. central and local governments	Treisman (2002)
Voter turnout (TURNOUT)	Share of actual number of voters in total registered number of voters	Pintor et al. (2002)
Political particularism (PARTICU)	The degree to which individual politicians are concerned about their own narrow geographic districts versus about their party as a whole. Simple average of ballot, pool and vote.	Seddon et al. (2003)
International political engagement (POLENGAGE)	Degree which a country engages in international politics, measured by number of embassies in a country, membership in international organizations, and participation in the United Nations. Higher value means more involvement.	Dreher (2003)
Women in parliament (WOMENPAR)	Share of women seats in total seats in parliament	UN common database

Social variable		
Media development (MEDIADEV)	A score from a principal components analysis derived from daily newspaper circulation per capita, radio per capita, and television per 1,000 people. See text for more details.	Own construction with data from World Bank (2004) and De Mesquita et al. (2003)
Press freedom (FREEPRES)	Extent of freedom of press and media. Lower value means higher freedom.	Karlekar (2004)
Lack of political rights (POLRIGHT)	Extent of free, fair elections and political participation. Higher score value indicates freer political rights.	Piano and Puddington (2004)
Income inequality (GINI)	GINI coefficient of income	Dollar and Kraay (2002)
Ethnic fragmentation (ETHNFRAC)	Extent of social diversity in term of different ethnic groups. Higher value means higher diversity.	Alesina et al. (2003)
Linguistic fragmentation (LINGFRAC)	Extent of social diversity in term of different languages spoken. Higher value means higher diversity.	Alesina et al. (2003)
Religious fragmentation (RELIFRAC)	Extent of social diversity in term of different religions. Higher value means higher diversity.	Alesina et al. (2003)
Population with different religions	Share of population with different religions. Four classifications: Protestant (PROTEPOP), Catholic (CATHOPOP), Muslim (ISLAMPOP) and other religions (NARELPOP).	La Porta et al. (1999)
Lack of corruption (CORRUPT)	Control of corruption index. Higher index value means lower corruption.	Kaufmann et al. (2003)
Economic variable		
Trade openness (OPEN)	Share of exports and imports in GDP	Heston et al. (2002)
Population size (POP70)	Population size in 1970	World Bank (2004)
GDP per capita 1970 (GDPPC70)	Real GDP per capita in 1970	Heston et al. (2002)
Fixed, historical variable		
Latitude (LATILLSV)	Absolute value of the latitude	La Porta et al. (1999)
Landlocked (LANDLOCK)	Dummy variable indicates whether a country has direct access to seas and oceans	Easterly and Sewadeh (2002)

Distance to major market (LMINDIST)	Natural Log of minimum distance to a major market (USA, Japan and Belgium)	Haveman's website
Land area (AREAKM2)	Total land area in squared kilometres	Gallup et al. (1999)
Elevation (ELEV)	Mean elevation	Gallup et al. (1999)
Tropical land area (TROPICAR)	Share of land area in tropical climate	Gallup et al. (1999)
People in tropics (KGPTEMP)	Share of people living in the Koeppen-Geigger temperate zone	Gallup et al. (1999)
Point-source resources (RESPOINT)	Dummy variable indicating exporters of point-source natural resources such as gold	Isham et al. (2005)
European settler (EURO1900)	Share of European settlers in total population in 1900	Acemoglu et al. (2001)
European-speaking population (EUROFRAC)	Share of population speaking a European language	Hall and Jones (1999)
Regional dummy	Six regions: East Asia and the Pacific (RGNEAP), East Europe and Central Asia (RGNECA), Middle East and North Africa (RGNMENA), South Asia (RGNSA), sub-Saharan Africa (RGNSSA), and Latin America and Caribbean (RGNLAC)	Easterly and Sewadeh (2002)
Colonial dummy	Four classifications: British (COLOGBR), French (COLOFRA), Spanish (COLOESP) and other colonies (COLOETC). COLOETC includes former Portuguese, Dutch, Belgian, Italian and German colonies.	Acemoglu et al. (2001)
Settler mortality (MORTAL)	Natural log of settler mortality rate between 17th and 19th centuries.	Acemoglu et al. (2001)
State antiquity (STATEHIS)	Extent of independence and maturity of states. Countries with high index score will have had government above the tribal level during 1-1950 C.E, such government is locally based (i.e. not colony), and over 50 percent of the modern territory was ruled by this government.	Bockstette et al. (2002)

Appendix Table 6: Description of data imputation

Imputed variables	Number of imputed data cells: RVMACRO data set	Number of imputed data cells: VDEFICIT data set	Imputed variables	Number of imputed data cells: RVMACRO data set	Number of imputed data cells: VDEFICIT data set
GOVTIER	9	16	ALLHOUSE	2	4
WOMENPAR	2	4	XCONST	2	3
PARTICUL	3	4	FRAUDELE	2	3
VULESPI	0	4	POLYARC	2	4
VULESPI1	0	4	TURNOUT	3	8
VULESPI2	0	4	LEFTWING	2	2
POLSTAB	1	1	RGHTWING	2	2
EXECHG	1	1	CNTRWING	2	2
PARTYCHG	3	5	NAWING	2	2
PROBIRCH	3	11	PLURAL	1	5
PROBMGCH	3	11	PROPOR	3	9
PROTEPOP	1	1	DIRCPRES	1	1
CATHOPOP	1	1	ELECPRES	1	1
ISLAMPOP	1	1	PARLIA	1	1
NARELPOP	1	1	NATIOPAR	1	1
ETHNFRAC	0	1	REGIOPAR	1	1
LINGFRAC	3	3	PARTYAGE	3	5
MEDIADEV	0	1	FIMUTERM	1	1
POLITY	2	3	LIEC	1	1
VANDEMOC	0	3	WINGDIFF	1	1
REICEDEM	7	12	POLRIGHT	4	12
POLCON	1	1	POLENGAG	6	12
CHECKS	1	1	OPEN	0	3
STABS	1	1	GINI	1	4
HERFGOV	1	1	CONSTCHG	1	1
GOVFRAC	1	1	CORRUPT	1	1
MAJORITY	1	1			

	RVMACRO data set	VDEFICIT data set
(1) Number of imputed observations	94	188
(2) Number of independent variables	109	109
(3) Number of policy indicators	72	87
(4) Number of total observations; (2)*(3)	7,848	9,483
(5) Share of imputed data; (1)/(4)	1.20%	1.98%