The Size and Structure of Government

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2011

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Does government size and structure adapt to changes in government's organisational environment (particularly to uncertainty and complexity) as predicted by organisational theory? We find – using a range of statistical analyses – support for each of the major theories of organisation adaptation (the contingency-based view, resource-based view, and rational choice view). We find that both government size and structure change – holding other factors constant – for changes in the uncertainty and complexity of governments' organisational environments. We find seven clusters of governments which adapt their organisational sizes differently in response to changes in the uncertainty and complexity of their organisational environments – and four clusters of governments with differing preferences for the way they adapt governmental structures. We also use the available data to divide governments according to the extent to which they adapt their organisational size and structure reactively (after changes occur in their organisational environment), contemporaneously or strategically (before these changes in their organisational environment occur).

JEL Codes: F4, D7, E6, H1, H4

Keywords: contingency theory, public sector organisational theory, resource-based view, size of government, government structure

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Introduction

Despite over 40 years of theorizing about public sector organisation, we still know very little about how government responds – writ large – to changes in its organisational environment. A variety of theories predict how government size and structure should respond to the national macroeconomic environment it regulates and buys and sells labour, capital and goods in. Contingency theorists argue -- though are now in relative disrepute -- that government departments and agencies grow, shrink, divide and/or merge in response to changes in the macroeconomic environment (Gupta *et al.*, 1994). Resource theorists – and their newer off-spring who write about "competencies" -- argue that these government departments morph, depending on the resources (budgetary, staffing, know-how and so forth) they already have available – or can obtain through bureaucratic and/or political means (Bryson *et al.*, 2007). Rational-choice theorists, and select scholars in public administration, argue that government organisational structure does (or should) foresee upcoming challenges and respond to them before they occur (Robertson *et al.*, 1993 and especially Vietor, 2007). Finally, a new school of interpretative and post-modern scholars argue that government organisational structure reflects cognitive understandings, culture, politics and symbols which no empirical study can correctly capture – or even try to (Frumkin and Galaskiewicz, 2004). Yet, despite these 40-plus years of studying public sector organisational theory, most primers about organisational theory in the public sector contain almost no actual empirical studies of the theories they present (Christensen *et al.*, 2007).

Different governments' size and structure responds to its organisational environment (particularly the uncertainty and complexity of that environment) differently. Some governments' size and structure responds more to the resources they have at their disposal more than to changes in their organisational environments. In no case did we find that government size and/or structure does not correlate at all with changes in the uncertainty and complexity of the government's organisational environment (as we define them in this paper) – militating against institutionalist theories of government (which argue that cognitive and internal processes drive the size and structure of government more than external factors). In this paper, we answer three questions. First, do different countries' government size and structure respond to the uncertainty and complexity of the government's organisational environment (as we have defined these terms in our paper)? Second, do such changes in organisational adaptation occur strategically (in the year before changes in the macroeconomic environment), contemporaneous (in the same year as changes in the macroeconomic environment) or reactively (in the year after such changes)? Third, do some governments' organisational changes correspond with changes in resources available rather than external changes in the government's organisational environment?

While we arrive at many interesting (even exciting) results, the reader should keep three caveats in mind. First, we base our conclusions on very narrow proxies which we hope reflect the broad issues we study. For example, we base conclusions about changes in the structure of government on macroeconomic data about the composition of government expenditure – and hope that such changes reflect on the actual organisational changes we hope to explain. Second, we rely on statistical methods to find patterns in the data

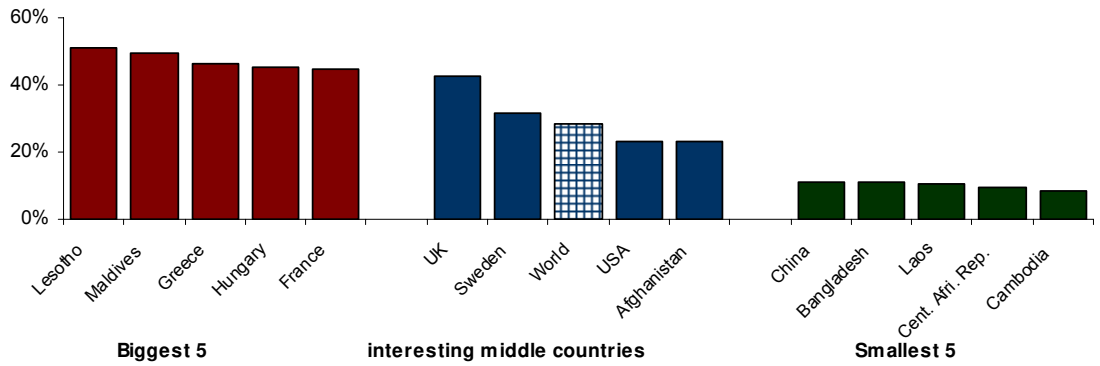
(where sometimes such patterns may reflect over interpretation rather than actual fact). We group countries using similarities in the way they spend government money and often treat statistical significance as practice significance. Third, we take 40 years of rich and deep research about public sector organisation – and reduce it to summary statistics based on data from the World Bank and IMF (often labelling governments' patterns of organisational adaptation with politically controversial labels). Given these caveats, we most certainly do not wish to pass any final judgments on the rich, already-existing public sector organisational theory literature. Instead, we hope the empirical patterns in the data stimulate debate and encourage a new generation of scholars to take-up again empirical methods in the study of public sector organisation.

What Do We Know About the Way the Size and Structure of Government Responds to Changes in the External Economic Environment?

A Brief Background on the Size of Government

The sizes of governments around the world vary between about 10% of GDP to over 50% of GDP. A cursory glance at Figure 1a shows few similarities between countries which allow for generalisations about government sizes. Lesotho, the Maldives, Greece, Hungary and France have some of the largest governments – in terms of the amount of national resources managed and spent by the government (spending about twice the world average).[1] Two countries often thought to be very different – Sweden and the USA – (on a world scale) have rather similar levels of government spending. Countries often noted for having relatively weak state capacity have some of smallest governments in the world (with the exception of China).

Figure 1a: Little Explains Differences in the Size of Government Around the World



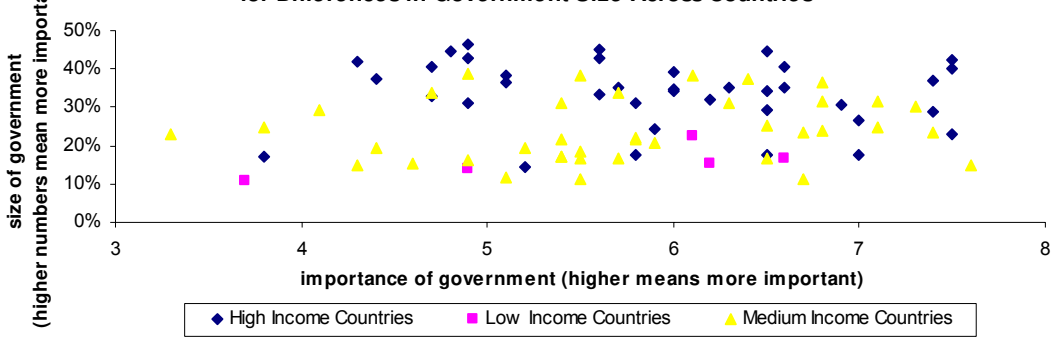
Note: The data in the figure show government expenditure as a percent of GDP for 14 "interesting" countries (and a world average) out of a set of 124 countries for which the IMF provide data. In cases where 2009 data were unavailable, we used data for the latest year available since 2004.
Source: World Development Indicators (2010).

The data do not support the conventional view that government sizes correspond with citizens' preference for public goods. In theory, the size of government should depend

[1] We assume, like most authors writing about the size of government, that government expenditure as a percent of GDP serves as the most relevant indicator of such size. Other measures used in the literature include employment by the government (at various levels), levels of government consumption, government revenue (earned through tax and non-tax methods). These other measures of government size correlate highly with government expenditure.

on the level of public goods and services demanded by a country's citizens. As Swedes, Americans and Mexicans demand more roads, hospitals and other large goods which no one individual can pay for (or exclusively benefit from), government needs to collect and spend more.[2] Figure 1b shows the correlation between citizens' opinions about the importance of government in providing (goods, services and social protection) for all citizens and the size of their government. No relationship appears to exist between the proportion of GDP spent by government and the importance of government assigned by survey respondents among low-income, medium-income and high-income countries. High-income countries tend to have larger governments and low-income countries tend to have smaller governments (judging by the few low-income countries for which the IMF provides data). Yet, the conclusion clearly emerges from these data that citizens' preferences for public goods (and government *writ large*) do not seem to explain the size of government.

Figure 1b: Attitudes about the Importance of Public Goods Offer Little Explanation for Differences in Government Size Across Countries



Data in the figure show the importance given by survey respondents to the role of government and the proportion of government expenditure as a percent of GDP. Respondents ranked - between 1 and 10 - the extent to which they thought "government should take more responsibility to ensure that everyone is provided for." Government expenditure as a percent of GDP measures the size of governnment on the ordinate-axis. We use data for the latest year available since 2005.
Sources: World Development Indicators (2010) and World Values Survey (2010).

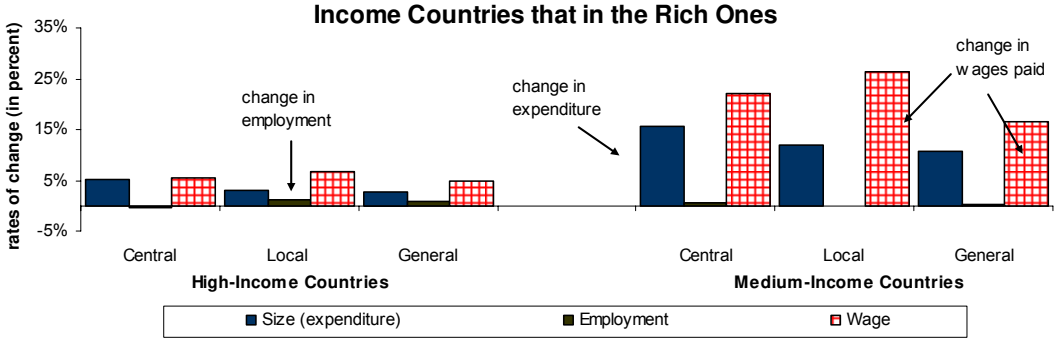
Government expenditure has grown almost everywhere in the world – mostly due to raising civil servant nominal salaries. Figure 2a shows the average change in government expenditure for high-income and medium-income countries throughout the 2000s.[3] In both groups of countries, government expenditure increased – though much more for medium-income countries than for high-income countries. Between 1999 and 2009, on average, high-income countries' governments increased their expenditure (relative to GDP) by about 5%. Employment in these countries generally fell very slightly at the central level and rose very slightly at the local level – as well as in government bodies like the social security administration and in state-owned enterprises. Across various levels of government, expenditure by medium-income governments increased much more – by about 10%. In these medium-income countries, employment also remained stagnant; while nominal compensation to (government) employees increased by about 15% or more. As such, **the story of expanding government – for**

[2] A number of non-economic explanations – like citizens' desire to use government programmes to ensure justice in society or promote good citizenship – help explain differences in government size. We do not discuss (or analyse) these factors as these values and preferences change more slowly over time and prove more difficult to study using economic methods.

[3] We use the terms medium-income and middle-income countries interchangeably throughout the paper. These terms refer to the World Bank's classification of countries by levels of income-per-capita.

high-income but especially for medium-income countries -- lies in paying existing workers more (in nominal terms) rather than hiring more staff.

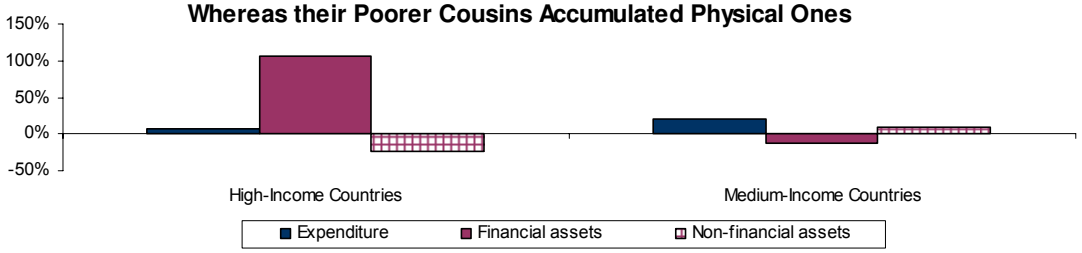
Figure 2a: Civil Servant Nominal Wages Expand in the 2000s - More in the Medium-Income Countries that in the Rich Ones



The figure shows weighted averages of rates of change of overall government expenditure, nominal wages and employment in countries for which the IMF and ILO provide data. For each individual country, we calculate these rates of change as the simple arithematic average between 1999 and 2009 of the annual growth rates of each of these three variables. We obtained weights for government expenditure by taking the country's US dollar government expenditure in 2007 and divided such expenditure by the total US dollar government expenditure for the country group which the country belongs to (either high-income or medium-income). We obtained weights for changes in employment by finding each country's proportion of employment as a percent of the total number of people employeed in general government for the income group the country belongs to in 2007 (or for the nearest year for which data are available). For changes in the compensation of employees (which proxies changes in wages), we weight rates of change by 2007 dollar government expenditure (as the IMF provides data for such compensation in local currency and thus we can not simply add pay across countries). Both the IMF and ILO provide data at the central, local and general government levels -- allowing us to provide averages across these levels of govenment. The IMF and ILO do not provide data on enough low-income countries in order to draw valid averages for low income countries in general.
Sources: World Development Sources (2010) and ILO Employment database (2010).

The growth of capital in the public sector does not really explain the expansion of government sizes in the 2000s. Figure 2b shows the average change in financial and non-financial assets (the nearest proxy to capital one can obtain using public data). High income countries loaded-up on financial assets during the period (almost doubling the amount of financial assets they held) and generally divested from non-financial assets. Medium-income countries tended to do the reverse – slightly divesting from financial assets and focused on acquiring non-financial assets. The rapid acquisition of financial assets during the end of the decade – during the financial crisis – only partly explains the overall acquisition of financial assets by high-income countries during the period.

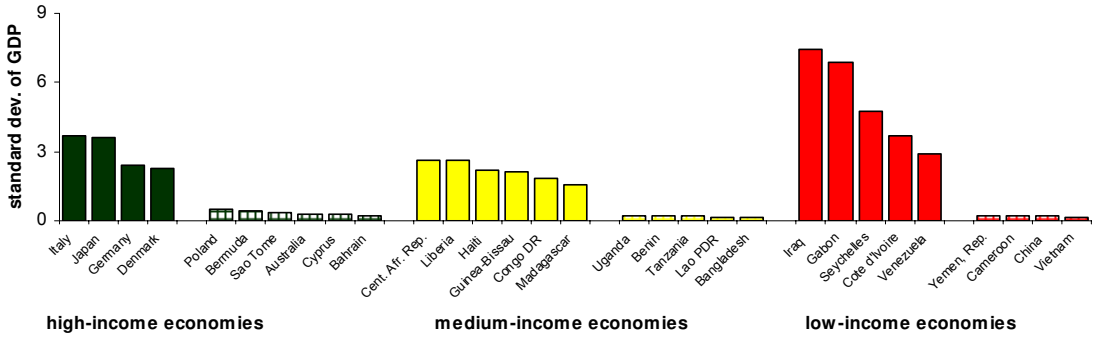
Figure 2b: High Income Governments Accumulated Financial Assets Whereas their Poorer Cousins Accumulated Physical Ones



The data in the graph show the average change in expenditure and the net acquisiton of financial and non-financial assets between 2000 and 2009 for all countries for which data are available. Period averages represent the simple arithemathic average of rates of change for each country over the 9 year period. In order to arrive at the average rates of change for high-income and middle-income countries, we used each country's current 2004 government expenditure (expressed in dollar terms) in order derive weights. For example, Germany's government expenditure (expressed in dollar terms) comprised roughly 11% of the total expenditure for the high-income country group. Thus, Germany's average rate of change of government expenditure contributed 11% of the total weighted average value for the high-income country group. We used a similar procedure to find group averages for changes in financial and non-financial assets. We used expenditure weights because the IMF reports financial and non-financial assets only in local currency. The IMF does not provide enough data to provide similar comparisons for low-income countries.
Source: IMF's Government Financial Statistics (2010).

Differences in the type and variability of economic shocks in these government's organisational environment (as we define it in this paper) may in-part explain differences in government sizes across countries.[4] Figure 3a shows the variability of GDP over the period 2000-2008 for selected high-income, medium-income and low-income countries. Low-income countries' GDP varied more throughout the period than GDPs in the other income groups. The most volatile economies in the high-income countries had variances similar to the most volatile economies in the medium-income countries group. The least volatile economies in all three income groups exhibited very similar levels of (non)volatility during the period – suggesting that income-level itself makes a poor predictor of the volatility (and thus uncertainty) of a national economic environment.

Figure 3a: Different Countries Have Very Different Economic Environments



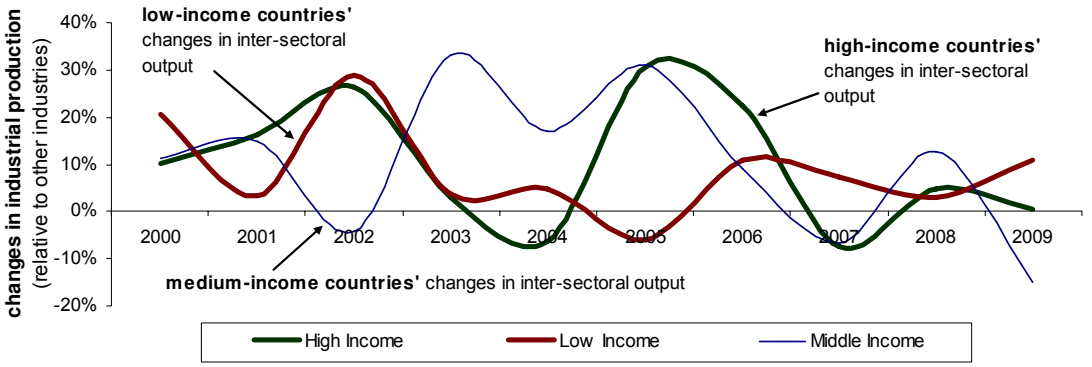
The data in the graph show the volatility of GDP between 1999 and 2009 for all countries for which the IMF provide data. We show examples of countries with the highest and lowest GDP volatility in each income group. We measure such volatility as the standard deviation of the log of GDP over the period divided by the average log value of GDP during the period. We used the natural log of GDP (rather than GDP itself) because using log values removes the effect of relvative size (as bigger economies will have a larger volatility of GDP simply because of their size). Log values - by their nature - describe changes in magnitudes. Thus, by looking at the standard deviation of the log of GDP, we are focusing on changes in the magnitudes of GDP over the period rather than levels themselves.
Source: World Development Indicators database (2010).

A more detailed analysis of asymmetric macroeconomic shocks reveals much about the uncertainty of various governments' organisational environments. Figure 3b shows the magnitude and timing of asymmetric shocks (shocks which affect one sector of the economy rather than the entire economy) for high-income, middle-income and low-income countries. The figure specifically shows changes in output in the industrial sector (as a percent of GDP) relative to changes in the service sector and/or the agricultural sector. The index we show in the figure rises as more resources are drawn into the industrial sector – and falls as more resources are pulled into the service or agricultural sectors. All three income groups have roughly the same magnitude of changes in sectoral production – albeit at different times. High-income countries tended to have larger volatility (measured by changes in the change) in industrial output than countries in the other income classification groups. Medium-income countries tended to have more steady growth rates in industrial output (with far fewer swings in the value of industrial

[4] The canonical definition of an organisational environment from the organizational theory literature defines such an environment as the "forces outside the boundaries [of the organization] that can impact upon it [the organization]" (Hatch, 2006). In this paper, we focus on the macroeconomic environment and leave out the other elements such as legal environment, societal, and other environmental factors in order to limit the scope of our analysis.

production). Low income countries tended – in general – to show much less inter-sectoral macroeconomic volatility than the simple measure of GDP volatility we used in Figure 3a above shows. For many low income countries, the size of GDP throughout the period varied much more than the composition of that GDP between the industrial, service and agricultural sectors. In all cases, the variance or change in the broader macroeconomic environment makes the government's organisational environment more uncertain – as both government and businesspersons have greater difficulty deciding to which sector of the economy they should allocate resources.

Figure 3b: Different Profiles of Uncertainty in Governments' Organisational Environment



The figure shows the changes in the relative proportion of GDP in the industrial sector as opposed to in the service sector or the agricultural sector. We use these changes as a proxy which might show the effects of sector-specific, asymmetric shocks (and thus measure the overall uncertainty of the macroeconomic environment). We constructed our proxy as follows. We subtracted the proportion of the service sector in overall GDP from the proportion of industry in overall GDP (giving the absolute change in the importance of the service and industrial sectors). We divided these differences by the proportion of GDP in the agricultural sector (thus expressiing all "shocks" relative to the size of the agricultural sector). We calculated the rates of change of these ratios for each year (removing any rates of change over 300% or -300% which might have popped up due to the country having a relatively small agricultural sector). We found the arithematic average of these growth rates between 1999 and 2009 and calculated a weighted average of these growth rates for each of the three groups of countries (high-income, medium-income and low-income). We used each country's share of 2004 GDP in current US dollars (as a proportion of the total GDP for that county's group) as the weight applied in our weighted average calculation.
Source: World Development Indicators (2010).

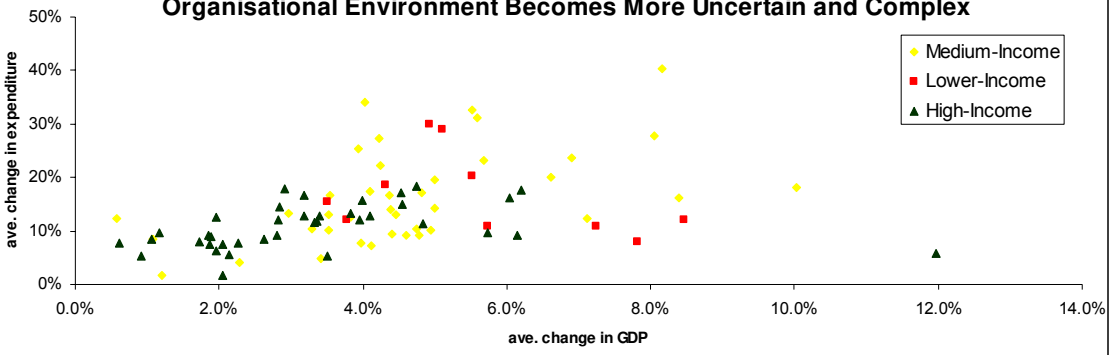
The Size of Governments Respond Weakly to a Changing Economic Environment

How does government size respond to changes in the uncertainty and complexity of the government's organisational environment? In the previous section, we showed the varying degrees to which the organisational environment of various governments around the world changed during the 2000s. Variance in GDP represents a simple proxy for the uncertainty and complexity of governments' organisational environment (and we will discuss more refined measured later in the paper). More volatility in GDP makes planning more difficult – thus increasing overall uncertainty. More volatility also likely corresponds with more complex economies – because more complex economies have a greater need to reallocate resources across economic sectors, respond quickly and effectively to changes in tastes and technologies – and so forth.

Changes in government size positively correlate with the uncertainty and complexity of government's organisational environment – as measured by the variance of GDP. Figure 4a shows the relationship between the uncertainty and complexity of government's organisational environment (as measured by average variances in GDP) and changes in the size of government (as measured by average changes in total government expenditure). For low-income, medium-income and high-income economies, more

output volatility corresponds roughly with more volatility in government expenditure during the 2000s. Such a correlation increases in strength for richer economies. Low-income economies exhibit a very weak pattern in the data while high-income economies show a relatively strong correlation between output volatility and the variance of government expenditure.

Figure 4a: The Size of Government Probably Increases as the Government's Organisational Environment Becomes More Uncertain and Complex



The figure shows the relation between average rates of nominal GDP growth and average growth in government expenditure (in USD terms) from 1999 to 2009. Our averages represent simple arithematic means over the period. We use the World Bank's classification of countries by income-per-capita in assigning countries to income-groupings.
Source: World Development Indicators (2010).

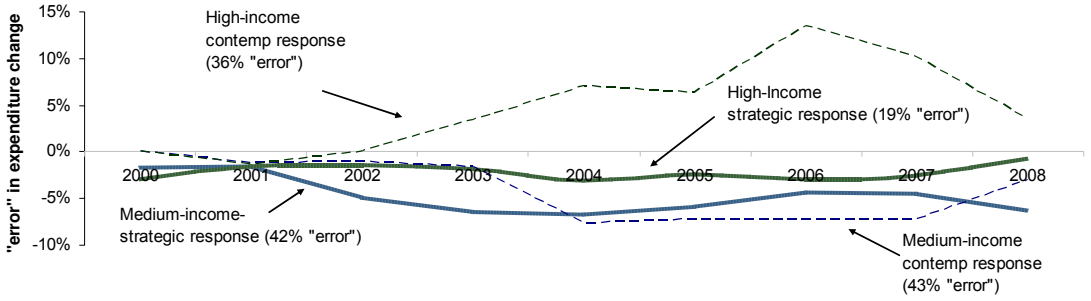
Different types of governments adapt to changes in their organisational environment with different speeds. Figure 4b shows the correlation between changes in government expenditure and changes in GDP for the previous year, the current year and the following year. We assume that differences between these correlations tell us about the government's overall adaptive stance toward changes in the macroeconomy. For example, the figure shows the contemporary response (occurring in the same year) of changes in government spending to changes in GDP. Subtracting the difference between changes in government expenditure and changes in GDP between 2000 and 2008 gives a total "error" in government's response to changes in output of roughly 36%.[5]

Depending on your view of the nature of change in government expenditure, governments in high-income countries adjusted government sizes strategically while governments in medium-income countries adjusted contemporaneously. As shown in Figure 4b, between 1999 to 2003 changes in government expenditure relatively closely matched changes in output in both sets of countries. Only by 2004 did the "match" between changes in government spending change significantly from changes in output. By 2008, we observe changes in government spending again returning to a closer tracking of changes in output. Moreover, high-income countries' governments tended to

[5] We assume that policymakers will want to adjust government expenditure pro-cyclically with changes in GDP -- and by exactly the same percentage amount (in other words, unity represents the optimal elasticity of government expenditure with respect to GDP). Much empirical evidence suggests that policymakers instead adjust government expenditure counter-cyclically. In this case, the largest "errors" in the figure would best explain the government's adaptive response to changes in its organisational environment. We use the figure to discuss the method of determining the government's responsiveness to changes in its organisational environment – namely whether certain kinds of governments adaptive reactively, contemporaneously or strategically – rather than use the figure to pass judgments or make definitive conclusions about fiscal policy in these countries. We put the word "error" in quotes to emphasize that we take a positive rather than normative view of the data in this paper – seeking to describe the data rather than determine a best or optimal response.

match changes in expenditure (and thus probably government size) sooner and more closely with changes in output than medium-income countries' governments. Figure 4b shows the annual differences between changes in government expenditure and changes in output – treating differences as an "error" (though such differences could reflect thoughtful policymaking in the presence of counter-cyclical organisational adaptation of organisational buffering against an excessively volatile organisational environment). For high-income countries, contemporaneous changes in output correlate less well with changes government spending than a similar correlation using lagged changes in output. The difference between changes in output and government expenditure is almost twice as large if we assume that high-income country governments respond contemporaneous rather than strategically (changing government size before changes in output occur).[6] For medium-income economies, however, the two approaches to government's organisational adaptation to changes in output yield roughly the same error. Using our measure of the "fit" of organisational response to changes in output, the figure shows that a model of contemporaneous response fit very well until about 2004 – whereas a model of strategic response fit less well. Thus, we have – for the purposes for labelling this set of countries in one category or the other – chosen to portray these countries governments' organisational response as contemporaneous rather than strategic.

Figure 4b: High Income Countries Adjust Expenditure Strategically while Medium-Income Countries Contemporaneously



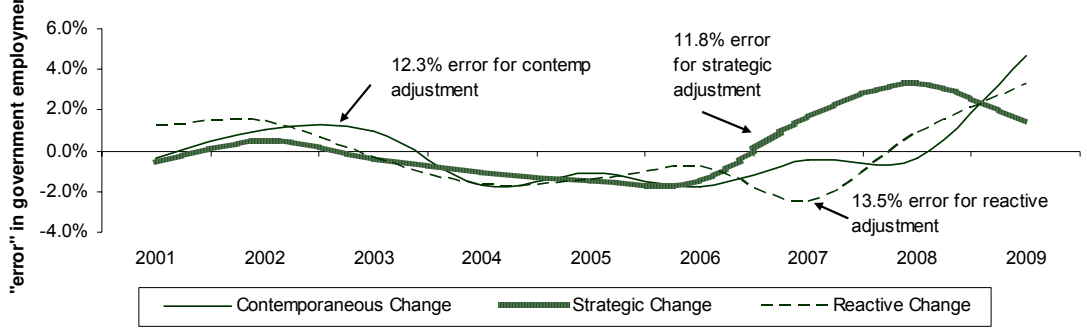
The figure shows the error in the adjustment of government expenditure to changes in GDP. The area under each line represents the difference between the change in government expenditure and GDP -- thus representing a type of "error" in government spending (assuming governments adapt pro-cyclically). We looked at three scenarios. We first substract the current year's change in GDP from the current year's change in government expenditure to investigate the extent to which government expenditure **contemporaneously** adjusts to changes in GDP. In the second set of calculations, we subtracted the current year's change in GDP from the following year's change in government expenditure to investigate the extent to which government expenditure changed **reactively**. In the third set of calculations, we subtracted the previous year's change in government expenditure from the current year's change in GDP in order to asses the extent of **strategic** change in government expenditure. We do not show reactive responses as they "fit" much less closely with changes in GDP.
Source: World Development Indicators (2010).

Government employment follows the same pattern of strategic adaptation to changes in the macroeconomic environment as expenditure does. Figure 5a shows three models of the "fit" of government employment to past, present, and future changes in output. When we compare the current year's change in general government employment with changes in the current year's GDP, we find a total "error" (as a defined previously) of 12.3%. In other words, using this measure results in about 12% difference between the sum of each year's change in employment and output over the 9 year period.[7] Assuming that high-

[6] As described previously, we use the word "strategic" to describe changes in government expenditure occurring before changes in output. The lack of a response, or a counter-cyclical response may be more "strategic" (as commonly understood in the public administration literature). We only use the word to describe changes in government spending in time and do not attach a value-judgment nor argue that strategic responses are necessarily superiour to other types of responses.
[7] The graph starts at 2001 because the ILO report employment data only starting in 2000.

income economies governments' adopted a reactive response to changes in output would result in a higher "error" of 13.5%. Yet, the reader should not interpret the lower "error" as a better error. The higher error attached the lagged change in government employment could as well reflect organisational buffering – an organisational strategy aimed at insulating the organisation from pernicious changes in its external environment.[8]

Figure 5a: High-Income Economies Exhibit Greater Strategic Organisational Change

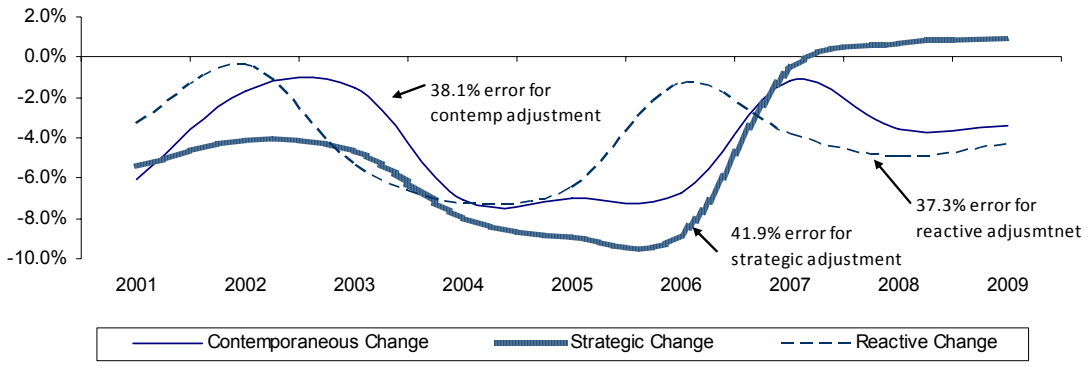


The figure shows the "error" in the current year's, the previous year's and the following year's adjustment in employment in the general government to changes in GDP for high-income countries. Controversially, we describe series with the least difference between changes in GDP and changes in government employment and ignore the possibility of organisational buffering or counter-cycle employment practices. For example, for the high-income countries we analyse, the sum of each year's difference between the current year's changes in GDP and previous year's change in government employment is lower than the sum of these differences using the current year's and the subsequent year's expenditure change. The three indicators shown in the figure represent weighted averages, where weights come from each country's share in its income group's total employment.
Source: World Development Indicators (2010).

Medium-income countries' government employment practices have responded much more sluggishly to changes in output. Figure 5b shows the annual difference between changes in GDP and changes in general government employment under 3 scenarios. Assuming that government employment responds contemporaneously to changes in output results in a 38% total difference between the change of employment and changes in output between 2001 and 2009. Assuming that medium-income countries respond strategically – that employment adjusts before changes in GDP – results in a larger difference between overall changes in employment and output over the period than assuming that they adapt reactively.

[8] Organisational theory does not provide specific predictions about the extent to which government organisations buffer against a highly volatile organisational environment. In theory, organisational complexity emerges to buffer the organisation from variation in the external environment up to a point. After a certain size and age, very large and complex organisations learn to adapt to their external environment (mostly out of necessity). Most academic commentators assume that buffering against largely un-diversifiable shocks represents one of the key functions of government – an assumption we do not make in this paper (as little large-scale empirical support for or against this hypothesis exists).

Figure 5b: Organisational Response of Medium-Income Countries Much Sloppier in Responding to Changes in the External Policy Environment

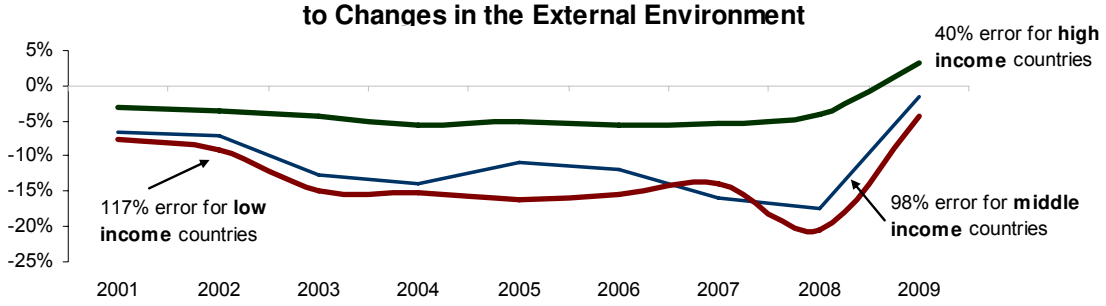


The figure shows the "error" in the current year's, the previous year's and the following year's adjustment in employment in the general government to changes in GDP for medium-income countries. Controversially, we describe series with the least difference between changes in GDP and changes in government employment and ignore the possibility of organisational buffering or counter-cycle employment practices. For example, for the medium-income countries we analyse, the sum of each year's difference between the current year's changes in GDP and subsequent year's change in government employment is lower than the sum of these differences using the current year's and the subsequent year's expenditure change. The three indicators shown in the figure represent weighted averages, where weights come from each country's share in its income group's total employment.
Source: World Development Indicators (2010).

Changes in government real wages also support the conclusion that government size (and probably structure) in the high-income countries responds more to changes in the external macroeconomic environment than low-income economies' government size and structures do. Changing real wages pull labour in, out, up and around government – serving as a useful proxy for larger structural changes in government.[9] As shown in Figure 6a, the differences between changes in GDP and changes in real compensation paid to government employees appeared the greatest in the high-income economies. Compensation for government employees (after adjusting for inflation) changed the least for low-income economies during the period – resulting in the largest differences between changes in compensation and national output. For governments in countries of all income-levels, inflation-adjusted compensation for government employees fell during the period (as shown the constantly negative differences between changes in government employment compensation and changes in GDP). These trends contrast with the trends in nominal wages shown in Figure 2a – which showed large increases in nominal government wages.

[9] In theory, changes in wages drive workers' decision to accept government employment, promotions within government and serve as an important variable in workers' decision to resign. As government departments emerge, expand, disappear – wages change (usually in practice through promotions or job category reassignments rather than explicit wage changes for the same job assignment). While government managers do not have the same right to engage in individual wage negotiations that their private sector counterparts have, they can greatly influence job reclassifications, promotions and reassignments which change the government worker's wage.

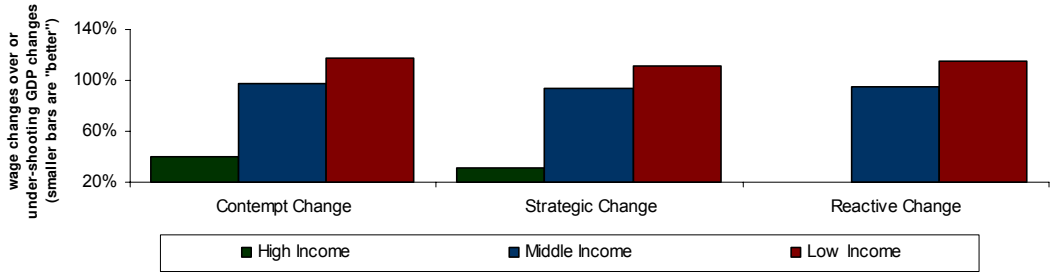
Figure 6a: High Income Economies Adapt Real Wages Most Closely to Changes in the External Environment



The figure shows the "error" in the response of central government inflation-adjusted wages to changes in GDP. Each indicator represents the weighted average of the change in real (government) employee compensation (adjusted for local inflation) minus the change in real GDP for that year. We weighted real employee compensations for each group of countries (given in the original data in local currency terms) by the total US dollar sum spent on government wages for that country relative to the total spend for all governments in that country's income group.
Sources: IMF's Government Financial Statistics (2010) for (government) employee compensation and the World Bank's World Development Indicators (2010) for US dollar expenditure on government wages.

Countries of all income levels "anticipated" falling output over the period with real wage compression. As shown in Figure 6b, the strategic scenario – where changes in the inflation-adjusted compensation of government employees precedes changes in output – fits more closely with changes in output than the other two scenarios. The overall difference or "error" centres on about 32% for high-income countries, 95% for medium-income countries and 112% for the few low-income countries for which the IMF provide data. In hindsight, reductions in government expenditure proved fortuitous in light of the sharp reductions in GDP (and thus in revenues) stemming from the 2009 global economic crisis. Thus, to some extent, all countries governments engaged in "strategic" adjustment (as we define the term strategic in this paper) of real wages (even if nominal wages increased during the same period).

Figure 6b: Was Real Wage Compression in All Economies Prescient or Just Lucky?

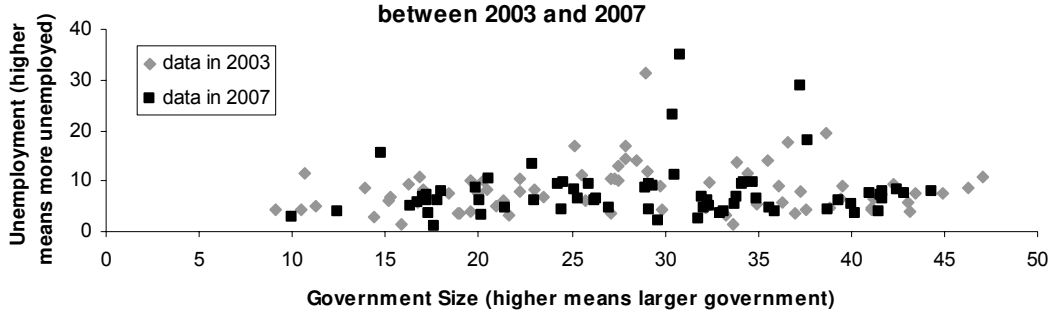


The figure shows the "error" in wage adjustments over the period from 1999 to 2009 for low, middle and upper-income countries. The smaller bars for the upper-income countries mean that these countries changed public sector wages more closely with changes in their countries' GDP. In order to calculate these errors, we used the indicators shown in Figure 6a (which show weighted averages of the real changes in public sector employees' compensation compared with changes in these countries' GDP). The contemporaneous change category shows the difference between changes in the current period's public sector wages minus changes in GDP. The strategic change shows the difference between changes in real wages for a period and the change in GDP in the following period. The adaptive change category shows the difference between the previous period's real wage changes and the subsequent period's change in GDP. High-income countries significantly reduced real wages throughout the 2000s, preparing them to adjust to the severe economic crisis of 2009.
Sources: IMF's Government Financial Statistics (2010) for (government) employee compensation and the World Bank's World Development Indicators (2010) for US dollar expenditure on government wages.

Using unemployment rather than GDP volatility as the measure of the uncertainty and complexity of the government's organisational environment produces much weaker correlations. Unemployment might serve as a better (or at least different) measure of the

uncertainty and complexity of the economic environment because unemployment represents a "bad" (which results according to popular expression from economic uncertainty and complexity) to which government should respond. Variance in output, on the other hand, does not represent a "good" or "bad" from a policy perspective. Figure 7a shows the unemployment levels for all the countries for which we could obtain data -- compared with government size (as measured by government expenditure as a proportion of GDP). The data rather clearly show that government sizes do not respond to changes in overall unemployment – neither across country nor across time. We do not observe upward or downward sloping data; which we would expect for relationships across countries between these two variables. We neither observe gray dots "moving" (as black dots) in any particular direction – as we might expect for a relationship between these variables across time. As such, government does not act as an "employer of last resort," shoring up unemployment during hard economic times. Government probably responds more to changing fundamentals in the macroeconomic environment rather than simply responding to domestic politics around employment (as we will discuss later in the literature review).

Figure 7a: No apparent pattern in the levels of government size and unemployment rates across countries nor with changes in those levels between 2003 and 2007

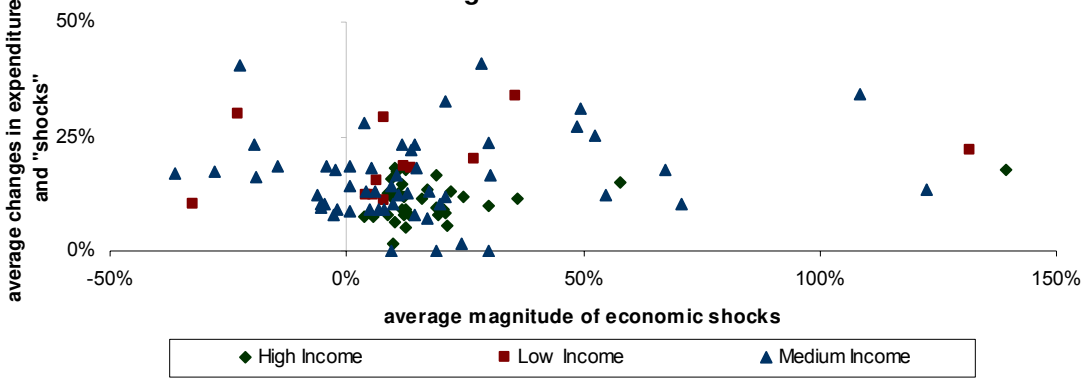


The figure shows the relation between government expenditure (as a share of GDP) and unemployment (as a share of the labour force) in 2003 as compared with 2007 for high and medium-income countries. Each gray dot shows the combination of unemployment and government expenditure for a particular country in 2003. Each black dot represent that same pair of data in 2007.
Source: World Development Indicators (2010).

We do not observe a relationship between changes in government size and the magnitude of asymmetric/sector-specific shocks. The data show – as shown in Figure 4a -- a relationship between the average size of shocks to a macroeconomy (which presumably results in greater policymaker uncertainty in choosing correctly sizes and targeted policies) and the size of that country's government. Yet, Figure 7b shows the relationship between the magnitude of asymmetric, sector-specific shocks – as measured by changes in industrial output relative to service-sector and agricultural sector output – and changes government size (as measured by expenditure). In the simple portrayal shown in Figure 7b, for economies of all income-levels, larger industrial sector shocks (relative to other sectors) do not correlate with changes in government size – as shown the circular clouds of dots in the figure.[10]

[10] The correlation coefficients for each pair of data are all below 0.40 and not significantly different than zero. For high-income countries, the correlation coefficient equals 0.34, the coefficient for medium-income countries equals 0.16 and for low-income countries equals 0.22.

Figure 7b: No Relation Between Average Changes in Expenditures and Changes in Economic Shocks

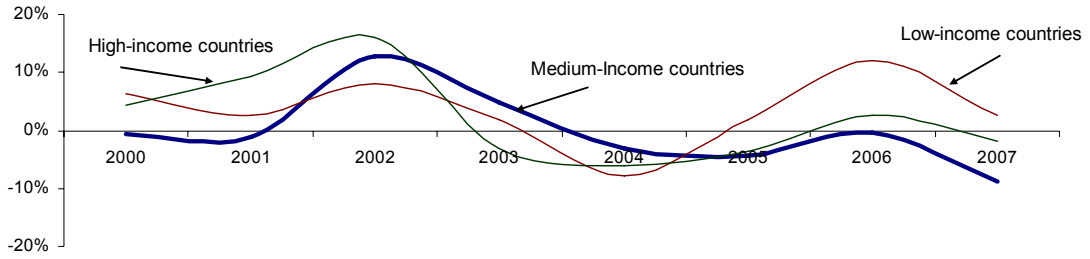


The data in the figure show the average changes in government expenditure compared with changes in the magnitude of economic shocks between 1999 and 2009. The index of economic shocks consists of subtracting the percent of industrial GDP from the percent of GDP in the service sector and dividing the resulting difference by agriculture's share in GDP. The average magnitude of economic shocks shown in the figure takes the arithematic average of changes in this index of economic shocks over the period 1999 to 2009 for each of the 96 countries shown in the figure. The average change in government expenditure shows the simple arithematic average change in dollar-valued government expenditure between the same period.
Source: World Development Indicators (2010).

The data also shows some validity for the resource-based view of organisational structure – that government size responds more to tax and other resources available than to changes in government's organisational environment? Figure 8 shows that such an explanation seems most plausible for medium-income countries – at least when looking at contemporaneous changes in government expenditure and revenue. Between 2000 and 2009, the sum of each year's differences between low-income country governments' expenditure and revenue resulted in an "error" (as we have previously defined such error) of 43%.[11] Adjustment in high-income economies' government expenditure showed an "error" of 47%. Medium-income country governments' expenditure mismatch between expenditure and revenue over the period summed to 36%. The resource-based explanation of government organisation clearly provides some explanatory power – depending on the particular country and time.

[11] Just like with our measure of adaptation to changes in government's organisational environment, our measure of government's "error" in responding to changes in resources only looks at the extent to which changes in government size contemporaneously adjusts to changes in revenues. Policymakers may wish to break the link between revenues and expenditure in any year in order to build up budget surpluses (in anticipation of future economic shocks), pay down previously acquired debts, or engage in fiscal policy to stimulate (or dis-stimulate) the macroeconomy. Given this wide range of organisational objectives, we only report the positive aspects of organisational adaptation -- ignoring the normative aspects (dealing with the desirability and/or optimality) of such changes.

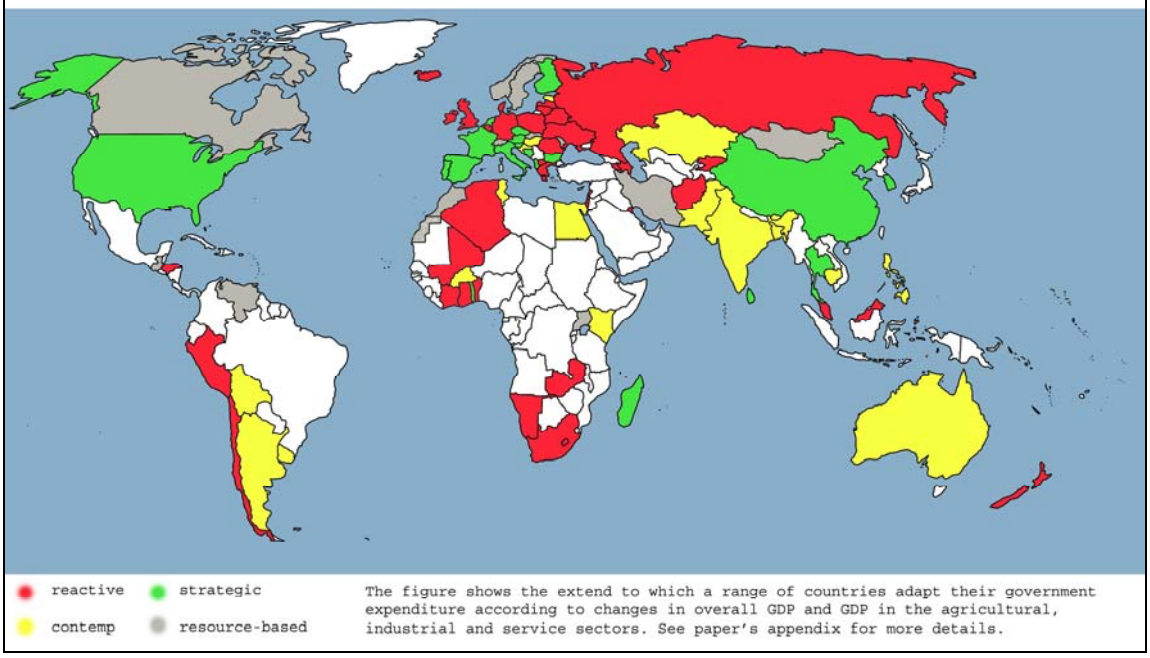
Figure 8: Resource-Based View of Government Organisation Most Valid for Middle Income Countries in the Short-Run



The figure shows the difference between changes in government expenditure and revenue for each of the three categories of countries shown. The difference between changes in contemporaneous government expenditure and revenue (with changes occuring in the same year) is lowest across the entire period for medium-income countries -- which we interpret as most strongly supporting the resource-based view of government (that government revenue determines expenditure rather than other considerations). To derive these indicators, we took the weighted average of changes in US dollar valued expenditure and revenue. Weights for changes in government revenues consisted of the country's 2004 government revenue (in US dollars) as a percent of the total revenue (also expressed in US dollars) for that country's income group. Weights for government expenditure consisted of that country's 2004 expenditure (expressed in US dollars) as a percent of that country's income group's total expenditure (again expressed in US dollars). Source: World Development Indicators (2010).

Different countries' governments adapt their organisational sizes at different speeds in response to changes in their organisational environments. Figure 9 shows the best fitting (possessing the least amount of "error") adaptive orientation for various countries' government sizes among strategic, contemporaneous, reactive and resource-based models of organisational adaptation to changes in the macroeconomic environment (as measured by the change in industrial GDP relative to other sectors). In general, the changes in the size of governments like those of the USA, China and Finland correlated more closely with changes in the sectoral distribution of output before such changes in output occurred. Changes in government sizes for countries like India, Australia, Kazakhstan and Argentina tended to correlate with changes in sector output as such changes in sectoral output occurred. Changes in government size for countries like Russia, Algeria, Germany and the UK tended to correlate with changes in industrial output (relative to other sectors) only after such changes in industrial output occurred. Finally, for countries like Canada, Iran, and Sweden, changes in government sizes correlated most closely with the revenue these governments had at their disposal in any given year.

Figure 9: Adaptive Orientation of Government Expenditure for Selected Countries



Each theory of government organisation provides a partial explanation for these data. Even the most die-hard critics of the contingency theory of government organisation must acknowledge that government size should respond (at least in part) to changes in the macroeconomic environment. Fiscal policy (namely government expenditure on goods, staff and assets like office desks) – by law if not by practice in many countries – smoothes out the effects of general and asymmetric macroeconomic shocks (which would be seen in relatively low correlations between changes in government sizes and macroeconomic changes in some countries). Critics of the resource-based theorists can not argue that governments can not expand beyond their means in the long-run (namely their revenue and borrowing power). Critics of rational-choice theorists can not argue that government can anticipate many kinds of shocks – rising grain or oil prices, demographic changes and so forth. Some of the "strategic" organisational adaptation we observe in the data probably does reflect actual strategic policymaking. Yet, some of the "reactive" organisational adaptation we observe in the data may reflect rational organisational buffering or anti-cyclical spending.

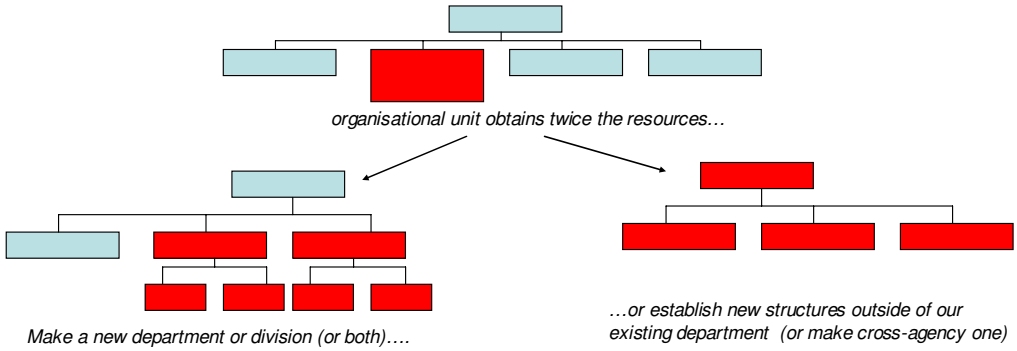
A Background on the Structure of Government

Changes in the size and composition of government expenditure must translate into changes we typically think of as the "structure of government." When an organisational theorist thinks about the structure of structure, concepts like the number of organisational units or agencies, the number of staff in a department, the number administrative or budgetary departments in a division or directorate come to mind. No public data exist on these classical organisational features. Yet, we can infer changes in the structure of government by looking at changes in the composition of government expenditure. Rather than define a formal model, we will present a very simple thought-experiment.

A simple thought-experiment shows the relation between the distribution of government expenditure and more classical notions of the "structure of government." Imagine you

hold a job in a government ministry (or department) in the late 1990s -- when government departments started using IT-technologies extensively (though the introduction of an anti-terrorism programme or any other policy initiative will do). The ministry of finance allocates money in order for your government department to install and use a couple of computers. Your minister might give an IT specialist(s) an office and maybe even create a separate small organisational unit for these IT specialists. Now image – as shown in Figure 10a – changes in IT technology (and thus large changes in the country's IT production or imports) cause the ministry of finance to allocate $20 million more in resources for the computerisation of your department. Your own minister or boss must spend the money somewhere. Your boss hires more people, purchases more equipment and so forth. After a point, the original IT manager can not cope with all the new staff. He or she can not manage unlimited amounts of staff and assets. Only three "structural" solutions exist – make the IT unit bigger (into a division or department), split it up by functions and scatter those functions around your ministry, or send it partially (or completely) outside your department. No other organisational responses exist. We can not deduce – only by looking at changes in resources – how organisational structure changed. But we can be fairly certain – particularly when we collect data about the large numbers of governments and their changing composition of expenditure – that the "structure of government" (as a classical organisational theorist would understand the term) changes as the composition of government expenditure changes.

Figure 10a: The Intuition Behind the Link Between Changes in the Composition of Resources and Changes in the Structure of Government

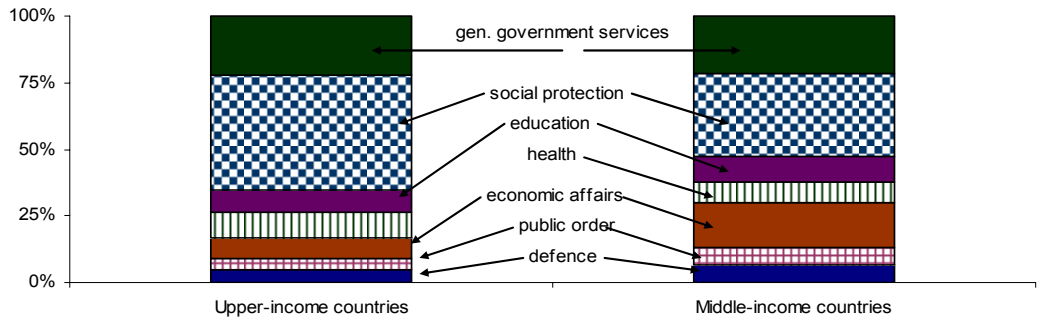


Resources "entering" the organisation must go somewhere…. and limits on spans of control, office space, and group-dynamics prevent unlimited expansion without more fundamental changes in the "structure" of the organisation (though not true if only storable financial resources come in).

We can infer that the "structure of government" probably differs between countries. Figure 10b provides a comparison of the allocation of expenditure across functional categories between high-income and medium-income countries (for ease of exposition, though we could show differences for each country). High-income and medium-income countries tend to allocate the same proportion of expenditure on general government services (about 22%), education (about 10%) and health (about 9%) – though with very significant variation between countries (which we do not show). Yet, even average levels differ greatly between high-income and medium-income countries in defence and public order (with a 3% difference) and economic affairs and social protection (with about an 8% to 10% difference). We know from anecdotal evidence and just plain

observation as well, that different countries structure their governments differently – by almost any definition of the "structure of government."

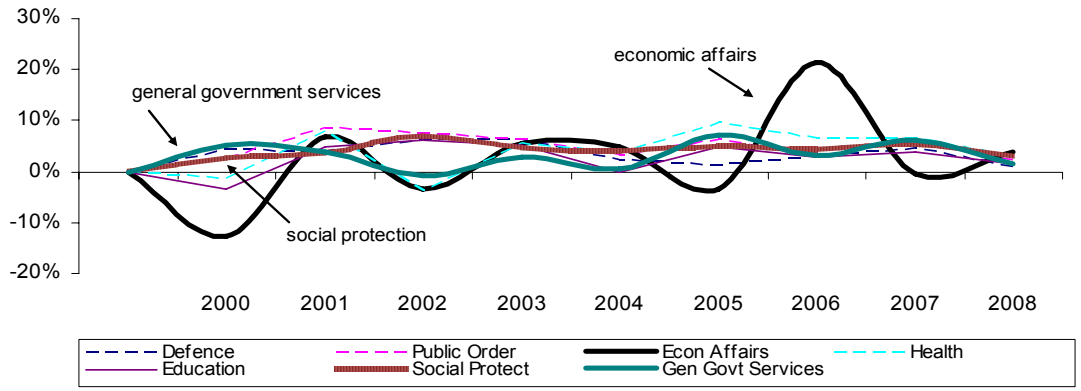
Figure 10b: Rich Countries Structure Expenditures Toward Social Protection and Away from Economic Affairs



The figure shows the average break-downs of overall government expenditure divided into functional categories for the upper-income and middle income countries for which the IMF provides data in 2007. We obtained these estimates by summing expenditure (given in local currency) over all 7 categories and then finding each category's share in that total. We used each country's total government expenditure (expressed in US dollars) as a percent of the country's income group's total government expenditure (expressed in US dollars) in order to derive the weighted averages shown in the figure. We chose to show only one year (2007) because that is the last year for which most data are avaiilable and showing multiple years would complicate the graph.
Source: IMF's Government Financial Statistics (2010) and World Bank's World Development Indicators (2010).

If changes in the allocation of expenditure across governmental functions reflect deeper changes in organisational structure, than organisational structures in various governments have changed during the 2000s. Figure 10c shows the extent of these changes in various areas of government spending. Expenditure – and thus the structure of government pertaining to economic affairs – has changed most in the high-income countries during the 2000s. General government services exhibits much less annual variation in expenditure patterns – suggesting that government structures providing these services tended to be more stable than those governing economic affairs. The size of these changes also tended to be relatively modest – changing by less than 10% in any given year (with the exception of economic affairs which likely had several countries changing their structure greatly in 2000 and 2006).

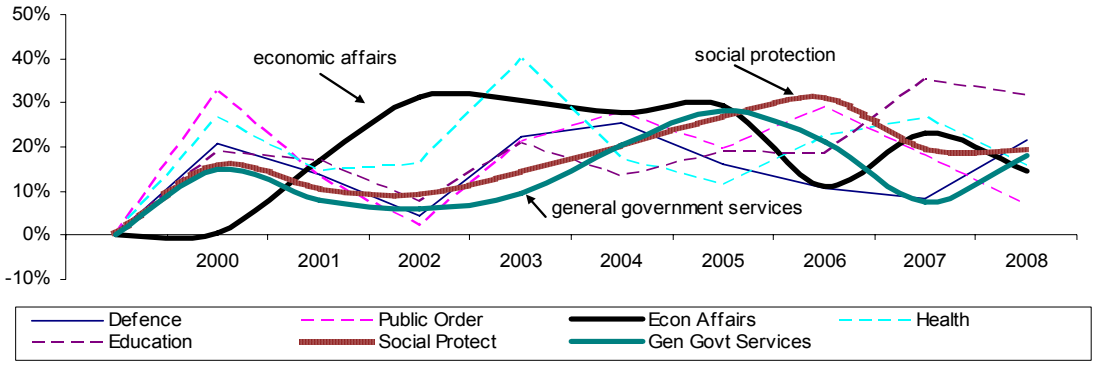
Figure 10c: Changes in the Resourcing of Government Agencies in Rich Countries



The figure shows changes in government expenditure in each of the 7 functional categories given by the IMF for high-income countries. We have highlighted changes in expenditures in economic affairs, social protection and general government services as these are most likely to respond to changes the macroeconomic environment. We have weighted these annual changes for each country by that country's share in total upper-income country government expenditure (in US dollar terms).
Source: IMF's Government Finance Statistics (2010) and the World Bank's World Development Indicators (2010).

During the 2000s, medium-income country governments reallocated expenditure between economic functions much more than high-income country governments. Figure 10d shows the average change – across the 15 medium-income countries for which we could obtain data – of expenditure in 7 categories of government expenditure. Like in the high-income economies, expenditure in economic affairs and general government expenditure exhibit relatively high volatility during the period. Unlike in the high-income economies, almost all expenditure categories in the medium-income countries show significant year-on-year variation.

Figure 10d: Medium-Income Countries Distributed Resources Across Organisational Units Much More Volatilely than in the Rich Countries



The figure shows changes in government expenditure in each of the 7 functional categories given by the IMF for medium-income countries. We have highlighted changes in expenditures in economic affairs, social protection and general government services as these are most likely to respond to changes the macroeconomic environment. We have weighted these annual changes for each country by that country's share in total medium-income country government expenditure (in US dollar terms). Source: IMF's Government Finance Statistics (2010) and the World Bank's World Development Indicators (2010).

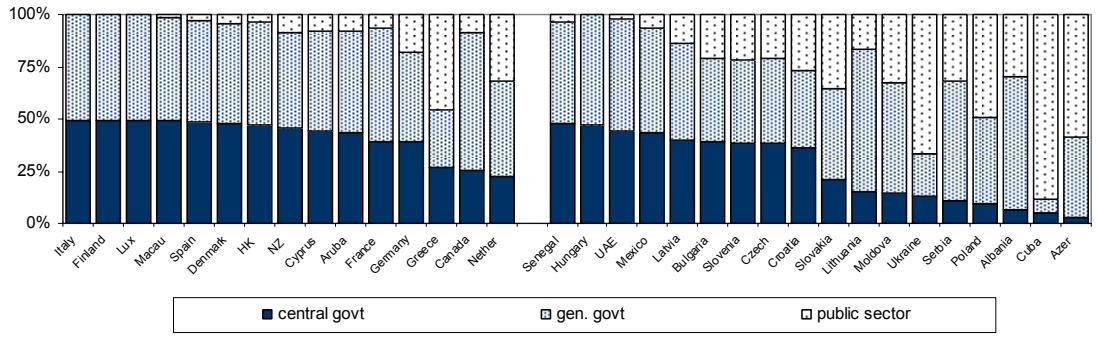
These data seem to contradict our previous assumption about the complexity of rich country governments' organisational environment. We showed in Figure 4a that the size of the economy might correlate or proxy the complexity of that economy. Thus, governments operating in bigger, richer economies should face more complex organisational environments. We showed in Figure 10b that government expenditure governments in high-income countries exhibits much less dispersion or spread between expenditure categories than in medium-income countries. Thus, governments operating in bigger, richer economies ostensibly face less complex organisational environments. Yet, according to the data in Figure 10d, medium-income countries' government expenditure volatility suggests that these governments face a more complex organisational environment – as their past expenditure has responded abruptly to some kind of changes we can not directly observe. Whether medium-income governments transact in a more complex or less complex organisational environment than their richer peer governments remains an open question to be addressed using other measures – like centralisation of central government – an in more refined regression analysis.

The centralisation of government – as measured by the size of central government expenditure relative to general government expenditure – serves as another proxy for the structure of government. The IMF provides data too poor to use to calculate the relative expenditure between the central and local levels of government.[12] However, the ILO

[12] The IMF provide data for government expenditure by central, regional, local and general government for a range of countries. However, central and local expenditure sometimes exceed general government

provides data on employment in various levels of government -- which we might use to infer the relative size and structure of government at the central government and other levels. Using these ILO data, we observe significant variation in the centralisation of government between countries. Figure 11 shows the relative proportions of labour at the central government level, in general government and for the whole public sector. Among high-income countries, countries like Italy and Finland have the largest central governments – whereas Canada and the Netherlands have the smallest. Countries like Greece and the Netherlands instead have a fair proportion of their government employment in public enterprises and areas outside of central government. To the extent we can trust these data, middle-income countries – overall – tend to much larger levels of employment outside of central government. Countries like Azerbaijan, Poland, and the Ukraine have around 50% or more of all employment outside of central government.

Figure 11: Division of Government Labour At the Core versus Periphery of Government



The figure shows the most recently available estimates of the relative amount of labour employed at various levels of government. We show employment in ministries, executive agencies and other institutions comprising the central government, the general government (which includes employees working for the social security agency or agencies), and other governmental not-for-profit organisations, and the public sector writ large (which includes state owned enterprises). We show the limiited number of countries for which the ILO provide reliable data and cross-country estimates may not be directly comparable as we take the last year for which such data are available after 2005 (as data before 2005 would be too dated to provide a useful picture of the distribution of labour in various parts of government).
Source: ILO (2010).

We might hypothesize that differing levels of government centralisation respond to differing degrees of uncertainty and complexity in government's environment across countries. On the one hand, governments might centralise to buffer against the effects of an uncertain and complex organisational environment (as government can – and should -- insure against shocks which no natural or legal person can insure against). Centralisation provides economies of scale in the provision of government services and prevents duplication. On the other hand, governments often decentralise in order to respond more quickly and in a more refined way to narrow shocks in a particular geographical area or economic sector. As such, a highly centralised government should be expected to respond to very symmetric, specific and predictable shocks. Whether centralisation represents a buffering strategy to insulate against a highly unstable external organisational environment -- or represents an optimal response to a rather simple environment -- remains an open question.

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expenditure (according to the official IMF statistics). Such inconsistencies – along with others – make the IMF too unreliable to use.

The Structure of Government Responds More to the Changes in the Policy Environment

Changes in the composition of government expenditure correlate – more or less closely depending on the country – with changes in the sectoral distribution of output. Figure 12a shows the highest correlation between our measures of changes in the allocation of expenditure and changes in the sectoral distribution of output for several countries. For about 50% of the 23 countries for which data are available, reactive organisational adaption (as we define such adaption in this paper) represents the explanation with the highest correlation with changes in the sectoral allocation of output. The explanations which we have previous labelled as strategic and contemporary both cover about 25% of this small sample of countries respectively.

Figure 12a: Organisational Structure Follows Strategy – At Least for Some Countries

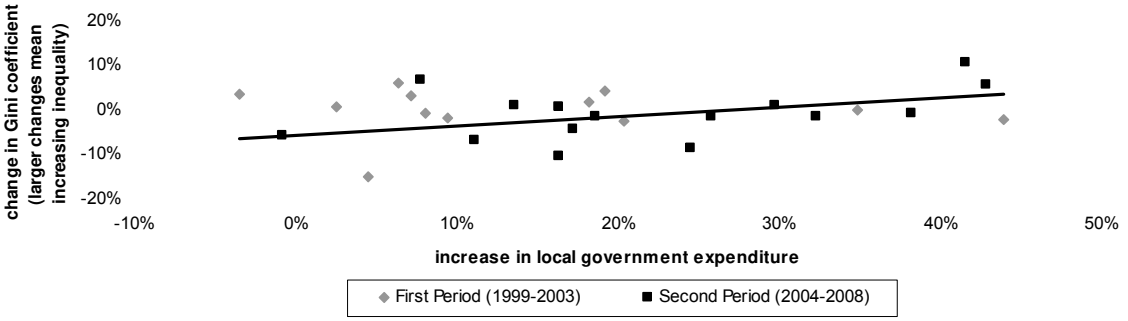
(correlation between sectoral changes in output and allocation of government expenditure across different functional spending categories)

Czech Republic	-54%	Reactive	Singapore	60%	Reactive
Denmark	-41%	Strategic	Slovenia	83%	Reactive
Estonia	-74%	Reactive	Spain	-89%	Reactive
Finland	40%	Strategic	Sweden	72%	Contemp
Greece	89%	Strategic	Switzerland	45%	Contemp
Ireland	-20%	Reactive	Tunisia	-88%	Strategic
Italy	59%	Reactive	Ukraine	58%	Strategic
Korea, Republic of	-80%	Strategic	Kazakhstan	-62%	Reactive
Lithuania	29%	Reactive	Pakistan	-75%	Contemp
Netherlands	-50%	Contemp	Moldova	74%	Contemp
Norway	51%	Reactive	Nepal	26%	Contemp
Poland	60%	Reactive			

The figure shows the highest correlation between asymmetric shocks to the economy and changes in relative expenditure for 23 countries. To construct the index measuring the extent of asymmetric shocks, we subtracted the share of service-sector output from industrial output and divided the result by the share of agricultural output in the economy. We found the rate of change per year of the resulting proportion. To construct the index measuring the change in government expenditure, we calculated the sum of the squared changes in the proportions of expenditure in each functional category. More simply stated, we first calculated the proportion of each functional category (health, education, economic affair, government services, etc.) to total expenditure. We then calculated the annual change of each of those proportions for each country – and then squared that rate of change (to remove the effects of any negative rates of change). We finally summed all these squared rates of change for all 7 functional categories – resulting in an index for each country of the variability of expenditure across expenditure categories. To compare changes in government expenditure with changes in sectoral output, we made three comparisons. For strategic adaptation of government expenditure to changes in the sectoral allocation of output, we found the correlation between changes in the sectoral allocation of output and the previous year's change in expenditure. For contemporaneous adaptation, we correlate the present year's index of output change with the same year's change in expenditure (using the indices we described above). For reactive adaptation, we found the correlation between our index of changes in the sectoral allocation of output and the following year's change in expenditure. We report the highest correlation among these three comparisons in the figure. We do not report the other correlations in order to keep the figure relatively easy to read. Positive correlations indicate that large changes in the allocation of government spending across functional categories correspond with large increases in industrial output. Negative correlations indicate that these large reallocations in government expenditure correspond with large growth of the service sector. As we care more about the magnitude of these changes – rather than which sector increased output – we do not comment on the possible reasons for these correlations. The reader can ignore the sign of the correlation. Source: authors based on data taken from the World Development Indicators database (2010).

The initial evidence suggests that local government expenditure responds to asymmetric shocks, like differences in the distribution of national income. Figure 12b shows (for the limited number of countries for which data were available) the correlation between changes in local government spending and changes in the inequality of household income (as measured by Gini coefficients). The data show a slightly positive relationship between income inequality and increases in government expenditure – both across countries and across time. These data suggest that decentralisation – for some countries at some times – represents an organisational response to one particular measure of the complexity of the government's organisational environment (in this case the distribution of income).

Figure 12b: Does Local Government Serve as an Amortiser for Income Inequality?



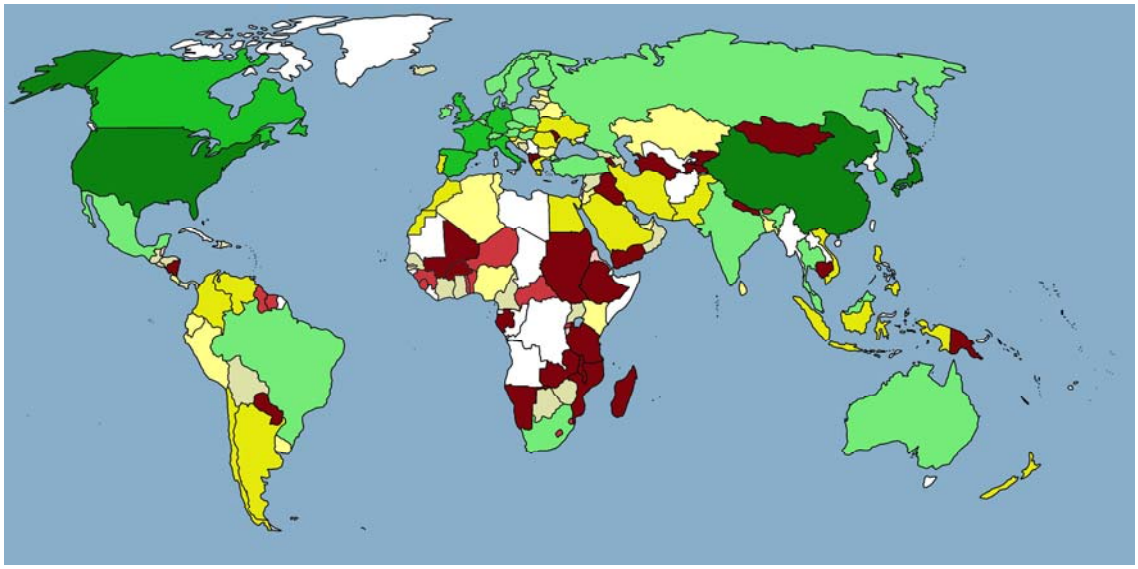
The figure shows the relation -- for a range of countries -- between changes in income inequality and changes in local government expenditure. To measure changes in income inequality, we calculate the average rate of change in Gini coefficients across each of the two periods we look at (1999-2003 for the first period and 2004-2008 for the second period). We plot the arithematic average of these rates of change in the figure. Similarly, we use the yearly rates of change in local government expenditure as the basis for the arithematic averages which we report for each of the two periods we analyse for our study. Across both periods, we observe a slight positive correlation between these variables.
Sources: IMF Goverment Finance Statistics (2010) for local government expenditure and World Development Indicators (2010) for Gini coefficients.

The share of high-tech, information technology (IT), industrial, scientific output represents another way of depicting the complexity of the macroeconomic environment that the government regulates and transacts in. Figure 13a presents values of an index describing the complexity government's organisational environment – as a weighted average of "complex" types of outputs (and the transactional/logistical structures needed to support the production of these outputs). Countries coloured in darker shades of green have higher values of the index we have constructed as a proxy for the complexity of government's targets of regulation. Countries coloured in lighter shades of red represent "simpler" organisational environments (as measured by our index).

The index representing the complexity of government's organisational environment tends to follow common sense – with some exceptions. The USA and Japan represent the world's most technological complex countries – an impression bourn out by the data. However, China falls into the same league of technological complexity as the US and Japan – having higher complexity index values than the Western European economies. China's high ranking probably reflects its economic size – as the index is not scaled by population. Western Europe follows closely behind -- and the BRIC as well as OECD member countries (with the exception of Portugal and Greece) all have high technological complexity scores. Countries with medium-ranking levels of technological complexity tend to congregate in Latin American, North Africa and the Middle East (with the exception of several Eastern European and Former Soviet countries). Countries

with the lowest technological complexity scores tend locate in Sub-Saharan Africa (with 14 exceptions scattered throughout the world).

Figure 13a: A Snapshot of the Complexity of Government's Organisational Environment



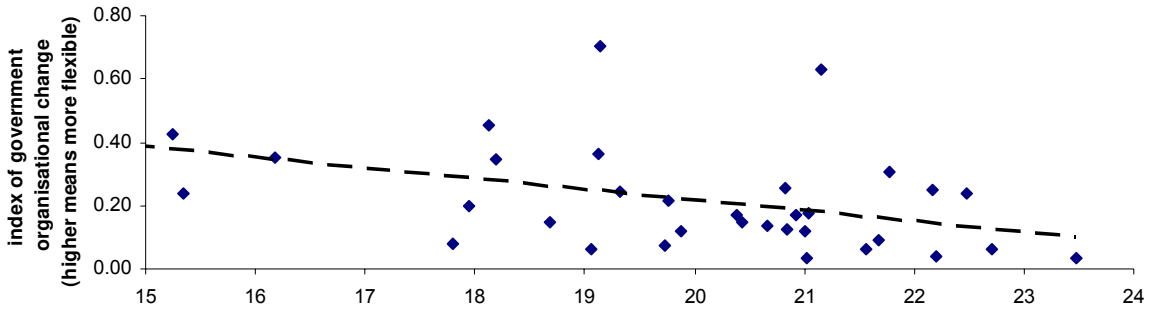
The figure shows colour codings for a complexity index we have constructed in order to gauge the complexity of the organisational environment that various national governments regulate and transact in. The index represents the weighted average (from 1999 to 2009) of each country's high-technology exports (in US dollars), expenditure on information and communication technologies, scientific and technical journal articles, and the value (in current US dollars) of the country's industrial and service sectors. We weighted each of these factors equally (except for the share of the service sector, which we gave half the weight of the other variables as the variable measures lots of things besides actual service-related activities). We took log values of each of these variables (in order to focus on changes and remove the effect of relative size). We then scaled the index (which ranges between 10 and 25) on a 10 point scale in order to make the data easier to read and interpret graphically. We coded 10, 9, and 8 (relatively highly complex economic environments) in various shades of green. We coded 7, 6 and 5 as various shades of yellow. Low complexity values received red colourings. Lighter shades represent less complex organisational environments (so a country coloured in light green received a lower complexity score than a country coloured in a darker shade of green… and so on with yellow and red coloured countries). Sources: IMF Government Finance Statistics (2010) for allocation of expenditure and World Development Indicators (2010) for spending on variables which proxy the complexity of the economic environment which government operates in.

The initial data suggest that government organisational structure seeks to buffer against a highly complex organisational environment. Figure 13b presents a simple correlation between the complexity index scores we discussed above and the extent of governmental organisational change. For the purposes of this graph, we measured the extent of organisational change as the ratio of the standard deviation of spending on economic affairs relative to the standard deviation of spending on social protection – serving as a proxy for the extent to which government redeploys resources in order to respond to a changing economic environment.[13] In general, economies having more complex

[13] We make the rather Anglo-Saxon assumption that governments would respond to economic change by responding with changes in spending on economic affairs – leaving its social safety net relatively unchanged. We acknowledge that if the government focuses on social protection objectives, government may significantly alter its social protection coverage in order to respond to economic shocks (the traditionally Scandinavian view of government). If social protection responds counter-cyclically (as one

economic environments tend to correlate with governments which change less their allocation of spending on economic affairs relative to social protection. Such a trend could either mean that governments operating in more complex organisational environments prefer to let private actors "fend for themselves" (facilitating rather than actively intervening like in developmentalist states) or constantly adjust welfare protection to respond to new risks emerging from new, emerging sectors.

Figure 13b: The Textbooks are Wrong? Government Seems to Change Less as the Organisational Environment Becomes More Complex



The figure shows the relation between the extent of organisational change in the public sector the complexity of government's organisational environment. We calculate the index of governmental organisational change as the standard deviation of a country's expenditure on economic functions as a proportion of its expenditure on social protection. Governments which allocate a large amount of resources to economic functions (and change that allocation in response to changing macroeconomic fundamentals) will have larger index values. The index of the government's environmental complexity comprises the same index as that shown in Figure 13a. Namely, we simply take a weighted average of the country's high-technology exports (in US dollars), expenditure on information and communication technologies, scientific and technical journal articles, and the value (in current US dollars) of the country's service sector. We weighted each of these factors equally (except for the share of the service sector, which we gave half the weight of the other variables as the variable measures lots of things because actual service-related activities).
Sources: IMF Government Finance Statistics (2010) for allocation of expenditure and World Development Indicators (2010) for spending on variables which proxy the complexity of the economic environment which government operates in.

High-income country governments' organisational structure seems to adapt more to the uncertainty of the organisational environment than its complexity or affluence. Figure 13c shows the magnitude of correlations between governments' organisational change (as proxied by changes in expenditure on economic affairs relative to social protection) and the measures of complexity, uncertainty and resource-availability which we have discussed previously. As a whole, high-income governments' changing resource allocations tend to correlate best with the contemporary and reactive view of government organisational adaptation. Assuming that government spending adapts either contemporaneously or reactively with changes in the organisational environment, such changes in expenditure correlate most with changes in economic uncertainty (as measured by the inter-sectoral reallocation of output). Changes in the allocation of government expenditure on economic affairs also negatively correlates with changes in

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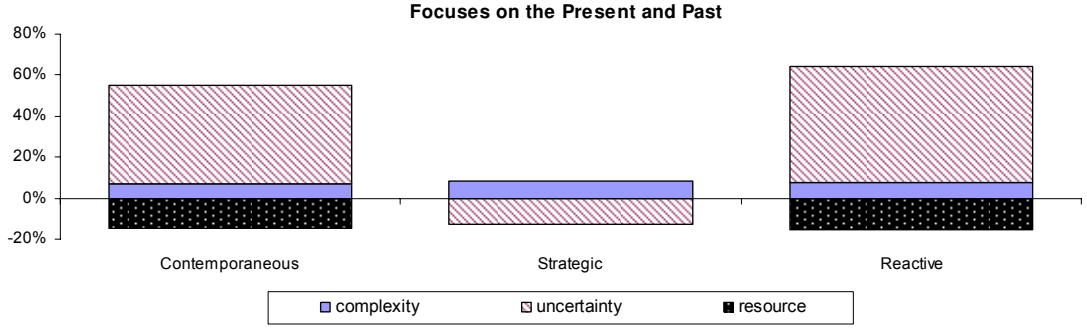
would expect), such a view of government would not change our conclusions. In the welfarist "Scandinavian" view of government, the denominator in our measure of government organisational change would change in the same direction as a change in pro-cycle economic policy. In about half of the countries in our sample, the standard deviation of expenditure on economic affairs exceeded the standard deviation of spending on social protection during the 2000s. See Appendix III for more information about the relative variability of spending in each category.

the resources (as measured by revenues) governments have available. The complexity of the macroeconomic environment seems to be a relatively unimportant consideration for organisational adaptation – as the proxy for such uncertainty correlates very little with changes in government expenditure on economic affairs.

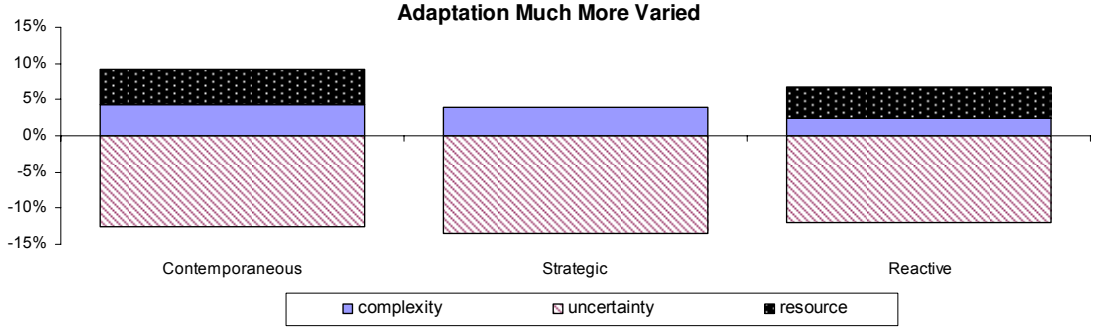
Figure 13c: Upper-Income Countries' Government Organisational Strategy Focuses on the Present and Past



The data in the figure show the correlation coefficients for changes in government organisational structure and three environmental factors -- the complexity of the organisational environment, the effect of uncertainty stemming from asymmetric economic shocks, and the effect of control over financial resources (revenues). We proxy changes in government organisational structure through the proportion of economic-related expenditure to social protection-related expenditure. A weighted average of each country's expenditure on high tech, IT, industrial output and service-related output forms the basis of the proxy for the complexity of the government's organisation environment. An index -- which subtracts industrial output from service sector output and divides this difference by agricultural output -- forms the basis for looking at the effect of sector-specific shocks (and thus the uncertainty of the macroeconomic environment). The level of government revenues (in the log value of US dollars) forms the basis of our proxy looking at the effect of resource-control on changes in the type of government spending. To test the effect of contemporaneous organisational adaptation, we find the correlation between the present year's proxy for government structural change and the current year's proxies for the effect of the complexity of the economy, the effect of sector-specific shocks and the effect of resources (namely government revenue). Tests for strategic orientation looked at the effect of the current year's government organisational structure and the following year's proxies for complexity, shocks and resources. Tests for adaptive orientation looked at the effect of the previous year's complexity, shocks and resources on the current year's government's organisational structure. Source: derived from data taken from the IMF's Government Financial Statistics (2010) and World Bank's World Development Indicators (2010). See paper for description and derivation of the indicators used to find these correlations.

Correlations between the changes in the allocation of government expenditure (as a proxy for changes in government structure) and changes in the government's organisational environment seem much more varied for medium-income countries. Figure 13d shows the magnitude of correlation coefficients for medium-income countries -- assuming that the allocation of government expenditure between economic affairs and social protection adapts contemporaneously, strategically or reactively to the uncertainty, complexity and resources available in the government's organisational environment. All correlations for medium-income countries are much lower than the correlations shown above for high-income countries – most likely reflecting the increased diversity of medium-income countries. All models of government's organisational adaptation show the highest (and negative) correlations with uncertainty in the economic environment (as measured by the shocks to the inter-sectoral allocation of output). Changes in the allocation of government expenditure correlate much less with changes in the complexity and resources available in the organisational environments in which these governments operate. The tentative conclusion thus remains that government organisational structure responds much more to uncertainty in the macroeconomic environment than other factors. Such a response is usually positive for high-income economies – while negative for medium-income economies.

Figure 13d: Medium-Income Countries' Government Organisational Adaptation Much More Varied



The data in the figure show the correlation coefficients for changes in government organisational structure and three environmental factors -- the complexity of the organisational environment, the effect of uncertainty and shocks, and the effect control over financial resources. We proxy changes in government organisational structure through the proportion of economic-related expenditure to social protection-related expenditure. A weighted average of the country's expenditure on high tech, IT, industrial output and service-related output forms the basis of the proxy for the complexity of the government's organisational environment. An index -- which subtracts industrial output from service sector output and divides this difference by agricultural output -- forms the basis for looking at the effect of sector-specific shocks (and thus the uncertainty of the macroeconomic environment). The level of government revenues (in the log value of US dollars) forms the basis of our proxy looking at the effect of resource-control on changes in the type of government spending. To test the effect of contemporaneous organisational strategy, we find the correlation between the present year's proxy for government structural change and the current year's proxies for the effect of the complexity of the economy, the effect of sector-specific shocks and the effect of resources (namely government revenue). Tests for strategic orientation looked at the effect of the current year's government organisational structure and the following year's proxies for complexity, shocks and resources. Tests for adaptive orientation looked at the effect of the previous year's complexity, shocks and resources on the current year's government's organisational structure. Source: derived from data taken from the IMF's Government Financial Statistics (2010) and World Bank's World Development Indicators (2010). See paper for description and derivation of the indicators used to find these correlations.

As with the size of government, each theory of government organisation provides a partial explanation for these data. All proxies for changes in the structure of government show that such government structures do change with variation in the external policymaking environment – thus validating to some extent the contingency-based view of government. However, the data also suggest that governments – particularly in high-income countries – use organisational structure to buffer against high levels of uncertainty and complexity in their organisational environment. The resource-based view of government clearly explains changes in the allocation of government spending in some countries – particularly in medium-income countries. Certain governments do seem to anticipate changes in their organisational environments – adjusting their organisational structures before these changes occur. However, other governments adapt reactively – waiting until such changes occur and then adapting (sometimes only partially) to these changes. Despite such a rich and varied tapestry of empirical data, the existing literature serves as a relatively poor guide in helping to understand the relationship between government organisational structure and its responsiveness to its organisational environment.

Literature Review

Despite the wealth of data available (such as the data we have just reviewed), scholars have conducted very few empirical tests of many of the basic concepts from organisational theory taught for past 40 years in a public sector context. Both Hatch's (2006) classic textbook and Christensen *et al.* (2007) more recent rehash of organisational theory in a public sector context include an entire chapter on the relation between the organisational environment and organisation structure – yet provide very little actual data. To grossly simplify the theory, organisational structure "complexifies"

(using a number of metrics which we will not describe in order to keep our exposition straight-forward) when the organisational environment becomes more complex and more uncertain. Yet, these canonical theories prove notoriously difficult to test empirically. Any related literature survey must analyse "by analogy" – drawing on disparate econometric studies on other topics (but which might suggest hypotheses for our current study).

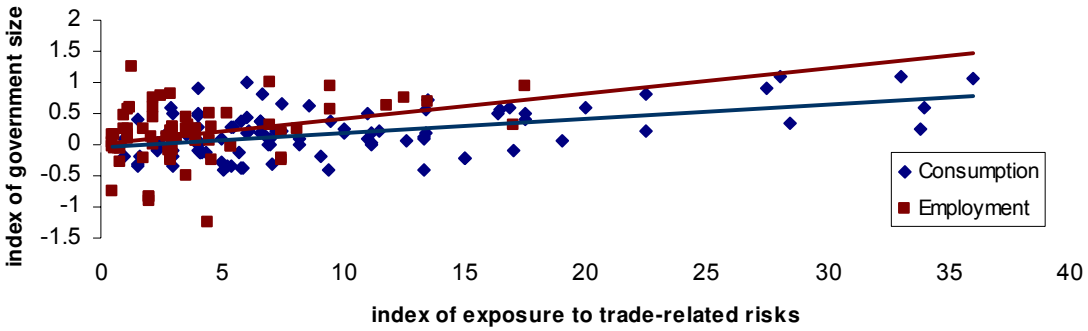
Return of Contingency Theory: Government Size and External Shocks

The political economy literature of the 1990s and early 2000s theorises about the size of government as government's response to macroeconomic change. A number of authors ask whether government size responds more strongly to external shocks or to internal political economy pressures – clearly mimicking the debate in the organisational theory between contingency theory and organisational politics (Rodrik, 1997; Alesina & Wacziarg, 1998 and Kimakova, 2008 for a much more recent revision of the debate). Almost all the empirical evidence points to a strong correlation between government size and increased openness to foreign trade and capital flows. Governments clearly grow in order to help off-set unwanted changes in output and employment from a more open "organisational environment" (to continue to use our own framework for interpreting this literature). Such evidence seems to provide powerful support for some form of contingency view of public sector organisation.

Rodrik (1997) – in a dated by still well-cited paper – served as the seed for this branch of the literature and still provides interesting insights into old questions in public sector organisation. Figure 14a shows the relationship between two measures of government size – the proportion of government consumption as a share of GDP and government employment as a share of total employment – and exposure to external shocks (basically trade openness). Rodrik – and other authors subsequently – have found a very weak – though positive – relationship in data such as these. As shown in the Figure, the trend in the data suggest that government size (as proxied by either expenditure or consumption) increases slightly with increased exposure to foreign economic shocks (as measured by the sum of imports and export values relative to GDP). Common sense also tells us that government size should respond to external shocks (rather than external shocks becoming worse for countries with larger governments).[14]

[14] On the one hand, larger governments may help to redistribute income from foreign trade which may affect the distribution of income. At the same time, larger governments may encourage foreign trade (indeed, many large governments have very active trade and investment promotion programmes). Rodrik does briefly discuss this chicken-and-egg problem (known in economics as the endogeneity problem). He creates another variable which should (at least in theory) not suffer from the problem that the country's exposure to external risks depends (in part) on government size. Explaining both his methods and the variable he uses -- known as an instrumental variable – would take our discussion beyond the confines of this paper. The reader should see the original paper for more details. As an aside, his instrumental variable does not perform much better than the original measure of exposure to external macroeconomic shocks and risks.

Figure 14a: Governments Increase their Size In Order to Help Respond to Trade-Related Macroeconomic Shocks?



The data in the figure show the relationship between government consumption (expressed as the log value of such consumption as a percent of GDP) and the volume of trade (imports plus exports again expressed as a percent of the country's GDP). We have plotted the relation between government consumption (in blue dots) and government employment (in red dots) on the same graph for comparison (though in the original, Rodrik split these data into two graphs). Each dot represents one country in the sample. Source: Rodrik (1991).

More interestingly, Rodrik also tests whether, what we might call the contingency view of government organisation, explains changes in government size better than a view focusing on internal politics and interests. In such a "political economy" view of government, government sizes would increase as the result of rent-seeking.[15] Rodrik (and subsequent authors) hypothesizes that exposure to trade opportunities in natural resources may lead to larger government sizes. More trade in natural resources should thus lead to bribe-taking and patronage in distributing the right to trade in these resources. Like us, Rodrik and subsequent authors writing in this vein, do not seek to explain in detail how bureaucratic interests inside of government militate for increased government employment and the creation of new departments set-up to capture rents from the trade in natural resources. Instead, they seek to use correlations between the trade in natural resources and government size to make inferences about the importance of rent-seeking and internal politics in public sector organisation.

Rodrik (and subsequent writers) find that the uncertainty from macroeconomic volatility (a contingency view) correlates more strongly with changes in government size than the possible rent-seeking opportunities inherent in natural-resource trade (an internal politics view). Figure 14b shows the importance of several variables Rodrik tested while explaining government size. Openness to foreign trade (which provides his measure of exposure to external risk) positively correlates with various measures of government size. Rodrik's constructed measure of exposure to external risks also explains about as much as using the original measure.[16] Exposure to foreign rents seems to offer little explanation of government size. As shown in the figure, out of Rodrik's 4 measures of rent-seeking, only trade in primary commodity exports significantly correlates with the size of government.

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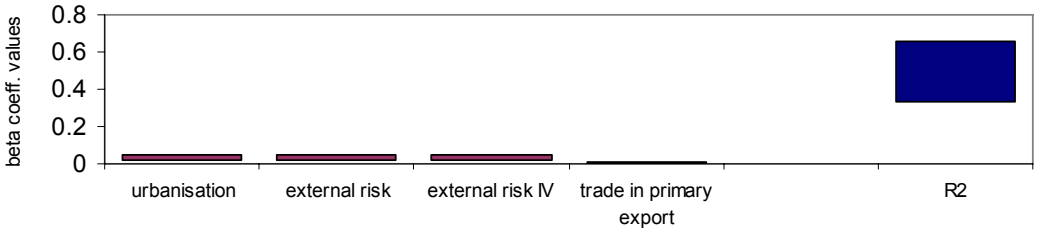
[15] We put the term political economy in quotes to indicate that the term (which has numerous meanings in various branches of the social sciences) refers to analysis which looks at the role of economic incentives (pay-offs) on various groups' support for various policies.

[16] As discussed in a previous footnote, the instrumental variable -- which we have labelled as external risk IV -- supposedly cancels out the possible effect of government size affecting openness to trade.

Figure 14b: Nothing Seems to Explain Government Size… But Exposure to External Shocks Explains It Less Poorly than Exposure to Trade-Related Rents



The bands show n in the graph represent the range of standardised beta coefficients explored by the author over a range of models. We only include coefficients significantly different from zero w ith 95% confidence or better (higher). Authors may have transformed variables for their analysis. For this graph, this have included the results of several panels of regression analyses.

Dependent variables: Governmemnt employment, government consumption, central government employment and public sector employment, and the grow th of government employment betw een the periods 1960-64 and 1985-89 (depending on the model).

Regression factors having little impact: Per capita income, being a Sub-Saharan country as opposed to an East Asian one, land area, trading in oil and having many positive terms of trade shocks.

Source: Rodrik (1991).

While Rodrik and his scholarly descendants establish that government size responds to the uncertainty and complexity of the macroeconomic environment, they do not discuss whether policymakers respond *on purpose* to external shocks. While economists must assume at government officials act rationally, organisational theorists make no such claims. The policymakers of economics can use economic models and statistics to predict the emergence of external shocks – and adapt government sizes to minimise the negative economic effects of those shocks. In the words of organisational theory, these policymakers can act strategically – by predicting changes in their organisational environment.[17] At the very least, if policymakers can not predict the future, they can reactively adjust to changes which have already occurred in the past. Much empirical work from economics helps us assess whether governments' organisational responses (or at least sizes) have reacted strategically or reactively to changes in these governments' external macroeconomic environment.

The extant data show little evidence that organisational sizes have reactively adapted to more uncertain and complex macroeconomic environments.[18] Figure 15a shows the relationship between government sizes among OECD member states and past economic shocks. Government sizes – at least in the OECD – do not "adjust" to long-run changes in the uncertainty and complexity of their macroeconomic policymaking environments.[19]

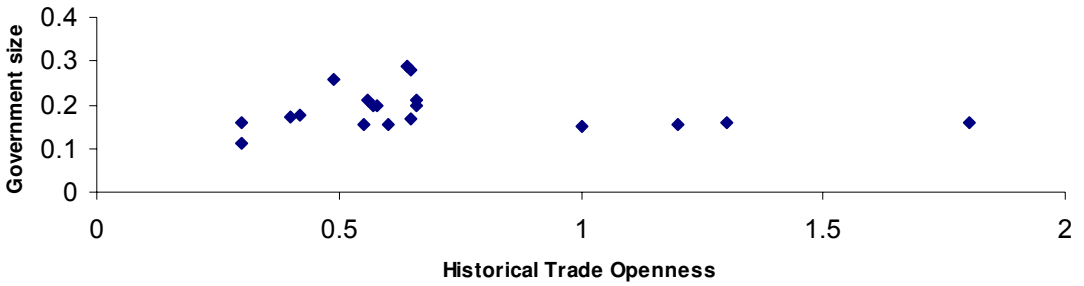
[17] We draw attention to a very basic misunderstanding about strategy between economic theory and organisational theory. In economics, strategy describes the best response to the action of another sentient player who can predict (and react to the predictions of) other players. Strategy, in organizational theory, usually refers to predicting the future and emerging trends and patterns. We adopt the "future seeing" definition of organizational theory as we attempt to test theories in organizational theory rather than economics.

[18] Openness to foreign trade should – by definition – increase the uncertainty and complexity of the macroeconomic environment. Foreign trade brings new technologies and new products (which increase overall complexity of the policymaking environment) as well as new shocks to prices, wages, and returns to capital -- which increases overall uncertainty. We deliberately use the words uncertainty and complexity to characterize these economic features as organizational theory makes predictions precisely about the uncertainty and complexity of the organizational environment (and offers predictions about organizational responses to such uncertainty and complexity).

[19] We put the word adjust in quotes because if OECD government policymakers chose organisational buffering as an optimal adaptation to a more complex and uncertain organisational environment, then the

Several of the most open OECD countries have relatively open economies and yet small government sizes (as defined by the proportion of government consumption in overall national consumption). Yet, several of the most closed economies also have relatively small government sizes. The timing of government responses to changes in its (macroeconomic) organisational environment plays an important part in the story.

Figure 15a: Among OECD Member Countries, Weak Relation Between Prior Exposure to External Shocks and Government Size



The data in the figure show the (lack of a) relation between historical trade openness (as measured by the sum of imports and exports as a percent of GDP from 1985 to 1994) and ex-post average government consumption as a percent of GDP (from 1995 to 1998).
Source: Molana *et al.* (2004).

Yet, the data suggest that some governments time their changes in organisational size much better (or at least differently) than others. Molina *et al.* (2004) – using time series analysis – test whether changes in government size follow or precede changes in trade openness (and thus possibly the complexity and uncertainty of the overall macroeconomic environment). We show in Figures 15b the correlation coefficients reported by Molina and co-authors between government size (as measured by government consumption) and the complexity-uncertainty of the government's macroeconomic environment. We note two trends in both figures. First, some countries' change in government size "fits" changes in trade openness better if we assume that that such changes occur due to strategic organisational adaptation (where government size changes precede changes in trade openness) or reactive adaptation (where government size changes follow changes in trade openness). Second, some countries respond (or at least change) to more trade openness by expanding government size while other countries' government sizes shrink. Why one government would grow in response to increased macroeconomic uncertainty, while another government contracts, remains one of the unsolved puzzles of public sector organisational theory.

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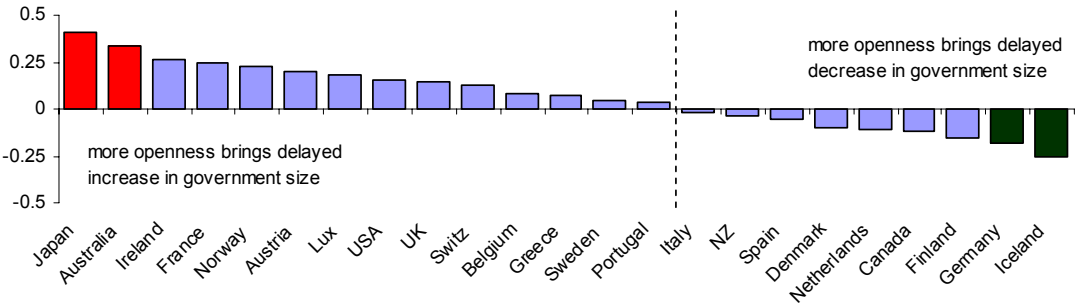
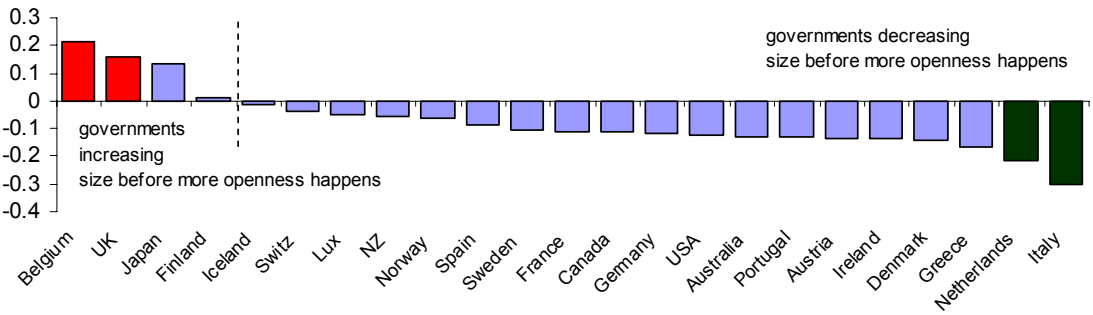
lack of a relationship in the data shown in the figure reflects the optimal (or at least equilibrium) organisational response.

Figures 15b: Reactive and Strategic Organisational Responses to Increased Exposure to External Shocks



The bars in the figure show the correlation coefficient between this year's change in trade openness (as defined as imports plus exports divided by the value of GDP for that year) and the next year's level of government consumption (again expressed as a percent of GDP). For example, changes in Japan's trade openness in any year "explain" about 40% of increases in the Japanese government's overall consumption of GDP in the following year. Similarly, increases in Ireland's trading openness in any year explain about 20% of decreases in the amount of Irish government consumption during the time period the authors explore. We interpret high correlations between this year's change in trade openness the next year's change in government consumption as a reactive organisational response.
Source: Molina *et al*. (2004).



The bars in the figure show the correlation coefficient between this year's change in trade openness (as defined as imports plus exports divided by the value of GDP for that year) and the previous year's level of government consumption (again expressed as a percent of GDP). For example, changes in Belgium's trade openness in any year "explain" about 20% of increases in the Belgian government's overall consumption of GDP in the following year. Similarly, increases in Italy's trading openness in any year explain about 20% of decreases in the amount of Irish government consumption during the time period the authors explore. We interpret high correlations between this year's change in trade openness the previous year's change in government consumption as a strategic organisational response.
Source: Molina *et al*. (2004).

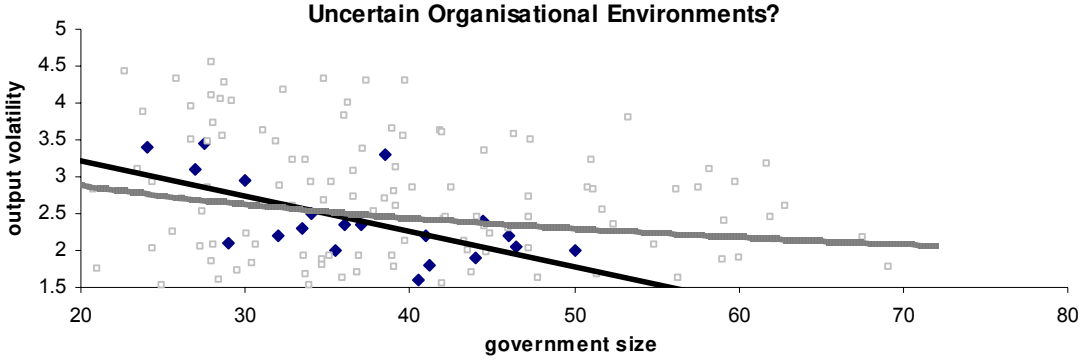
These data suggest that *when* governments adapt organisational size to environment factors tells us as much as *how* they respond to these factors. Governments such as Japan and Australia (at least in Molina *et al.*'s study) seem to have reactive organisational adaptation to environment factors whereas Belgium and the UK seem to have more strategic organisational responses. Countries such as Germany and Iceland seem to react to changes in the macroeconomic environment by shrinking government size whereas Italy and the Netherlands seem to pro-actively (or strategically in our terminology) contract.

Organisational Buffering: Government Size and Domestic Output Fluctuations

Another group of studies look at the way government size changes in response to domestic macroeconomic shocks -- rather than increased trade openness. The strong feedback between government spending and economic change make these studies fewer and harder to interpret. Economic change will affect government spending (the question which interests us). However, government spending will affect economic performance (the question which interests most economists and average citizens). A few studies though look at the question we seek to answer in our paper – by looking at how government responds to (rather than affects) macroeconomic shocks.

Much of the available data suggests that governments shrink in more unstable (and thus more uncertain) macroeconomic environments. Figure 16a shows a simple correlation between government size and output volatility. Countries with more output volatility correlate (rather strongly) with smaller government sizes. Such a conclusion appears robust to the number of countries included – as a larger sample (as shown in the figure) also shows that smaller governments operate in highly uncertain macroeconomic environments. Governments thus appear to shrink – rather than expand – when confronted with a high variable organisational environment (if we use domestic macroeconomic volatility instead of trade openness as our measure of environmental uncertainty and complexity).

Figure 16a: Forget the Openness Results: Governments Shrink in Response to More Uncertain Organisational Environments?



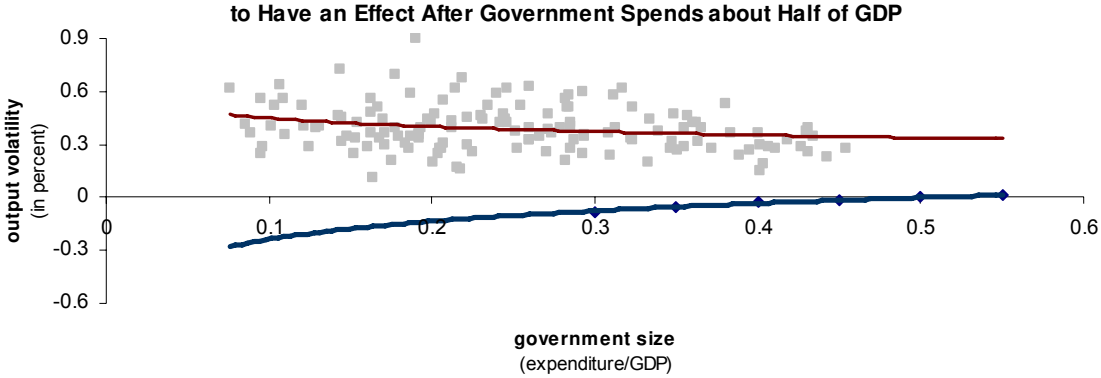
The figure shows the correlation between government size (as measured by the average amount of government spending to GDP between 1960 to 1997) and the standard deviation of real GDP over the same period. We have added the line of best fit to Fatas and Mihov's data for illustrative purposes only. For comparative purposes, we have superimposed on their graph data from 1999 to 2009 and a line of best fit (in gray) with a much larger group of countries from our own dataset.
Source: Fatas and Mihov (2001) for dark black line and authors for gray line.

Government probably grows or shrinks depending on the source and magnitude of uncertainty in the macroeconomic environment. Figures 14a and 15b suggest that governments grow when environmental uncertain emanates from foreign trade. However, governments shrink (as shown in Figure 16a) when environmental uncertainty stems from the macroeconomy itself – suggesting that government uses size as a "shock absorber."[20] Even for changes emanating from the domestic economy, government size

[20] A series of papers look at the extent to which government acts as a shock absorber (insulating the macroeconomy against averse shocks) through counter-cyclical spending and employment practices (Furceri, 2010).

probably does not grow or shrink indefinitely as the government's organisational environment becomes more or less uncertain. As Debrun *et al.* try to show in Figure 16b, governments will respond to increased macroeconomic volatility up to a point – consuming up to about 45% of GDP. After that point, governments become either unwilling to grow more (because increased expansion does not translate into reduction of macroeconomic uncertainty) or unable to grow more (because large governments crowd out household consumption and private sector investment). We find similar support for Debrun *et al.*'s model – plotting the line of best fit for the data in our own sample as the red line above the *x*-axis. In both cases, the reductions in output volatility – for a marginal increase in government size – seem to asymptote out when government expenditure equals about 45% of GDP.

Figure 16b: Strategic Adaptation to the Organisational Environment Fails to Have an Effect After Government Spends about Half of GDP

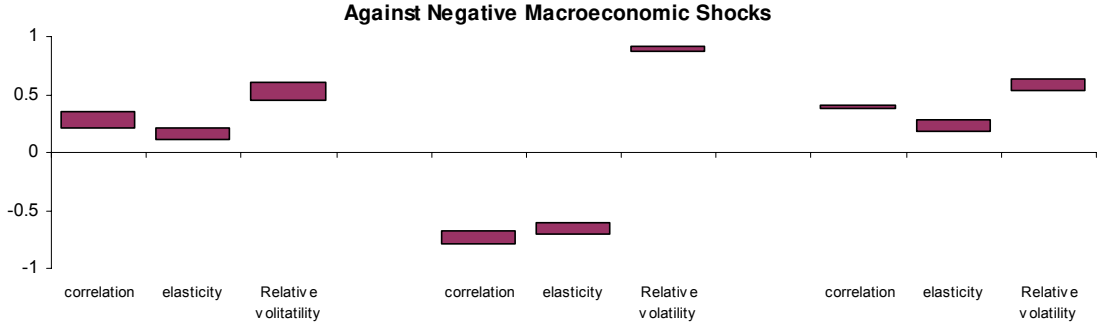


The data in the figure show the relation between the size of government (as measured by government expenditure over GDP) and two measures of output volatility. The lower blue line shows the line-of-best-fit between volatility of GDP growth rates and government size in Debrun and his co-authors' model. The upper red line depicts the relation between GDP volatility (in nominal US dollar terms) and government size between 1999 and 2009 in our own dataset. Both lines roughly show that government size no longer correlates with decreases in output volatility after expenditure-to-GDP ratios of about 0.45.
Source: Debrun *et al.* (2008) for the lower blue line and authors for the upper red line.

A glimpse at the government employment helps us to understand more fully the way that government size reacts to uncertainty in the external environment. Figure 17a – using data taken from 1948 to 2003 – shows the relationship between government employment and output volatility in the US. As output volatility rises, government employment increases (as shown by the first set of correlations) – obviously suggesting (in contrast to the findings we show in the first part of our paper), that public sector employment serves as a very partial buffer against these output fluctuations. To paraphrase the second set of correlations in the figure – all employment ships do not rise with the tide. Workers take public sector jobs by leaving their private sector jobs or by turning down such job offers when confronted with changes in the economic environment. However, as shown by the third set of correlations, employment in the public rises with rising employment opportunities in the private sector (ignoring changes in output). As also shown by all three sets of correlation, **employment in the government sector changes more (exhibits higher volatility) than changes in output and private sector employment.**[21]

[21] None of these results would surprise a microeconomist – though the last set of correlations might surprise a trade economist. Increased volatility in government employment would point to – in an open economy – a relatively high level of labour-intensive traded government-produced goods (or rigidities in public sector wages…which the next set of data do not show). These data (at first glance at least) confound the widely held view that government employment provides job stability with a steady income.

Figure 17a: Government Employment Serves a Very Partial Hedge Against Negative Macroeconomic Shocks

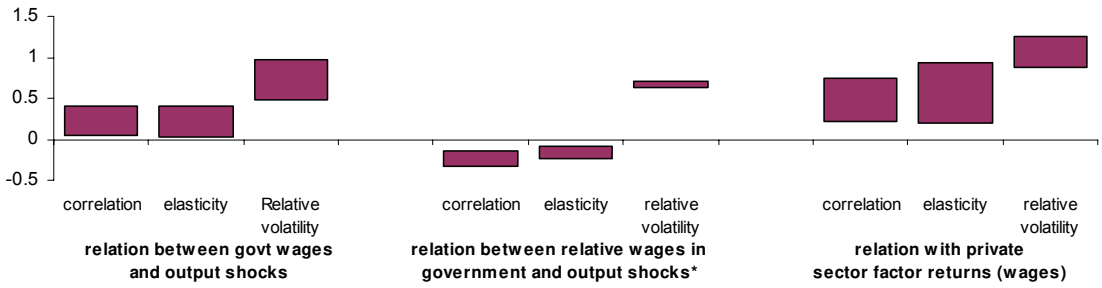


relation between govt employ and output shocks | **relation between relative employment in government and output shocks*** | **relation with private sector labour markets**

The bands show the correlation coefficients between the variables described in the figure. The term "correlation" on the x-axis describes the percent to which changes in government employment correlate with changes in output (or with changes in private sector hiring for the last set of variables). "Elasticity" describes the effect that a one percent change in output (or private sector hiring) has on employment in the government sector. "Relative volatility" describes how much more employment in the government varies as compared with changes in output or private sector hiring. (In formal terms, relative volatility describes the proportion of the normalised standard deviation of government employment to the normalised standard deviation in GDP or private sector employment). The second set of figures (denoted with an asterisk) use the proportion of government employment as a share of private sector employment as the variable of interest with which to compare with GDP changes.
Source: Quadrini and Trigari (2007).

Public sector wages also vary with changes in the government's organisational environment. Figure 17b shows correlations between government wages and changes in the government's external environment in the USA from 1948 to 2003. Government wages increase as shocks raise domestic output – but fall relative to private sector wages with a temporary wave of economic prosperity. Government wages generally rise as private sector wages rise – though less than in the private sector. **Figures 17a and 17b – when taken together – suggest that government size (or at least expenditure) responds quite a bit to changes in the government's external environment**.[22]

Figure 17b: Government Pulls In Labour During Good Times Through Higher Wages



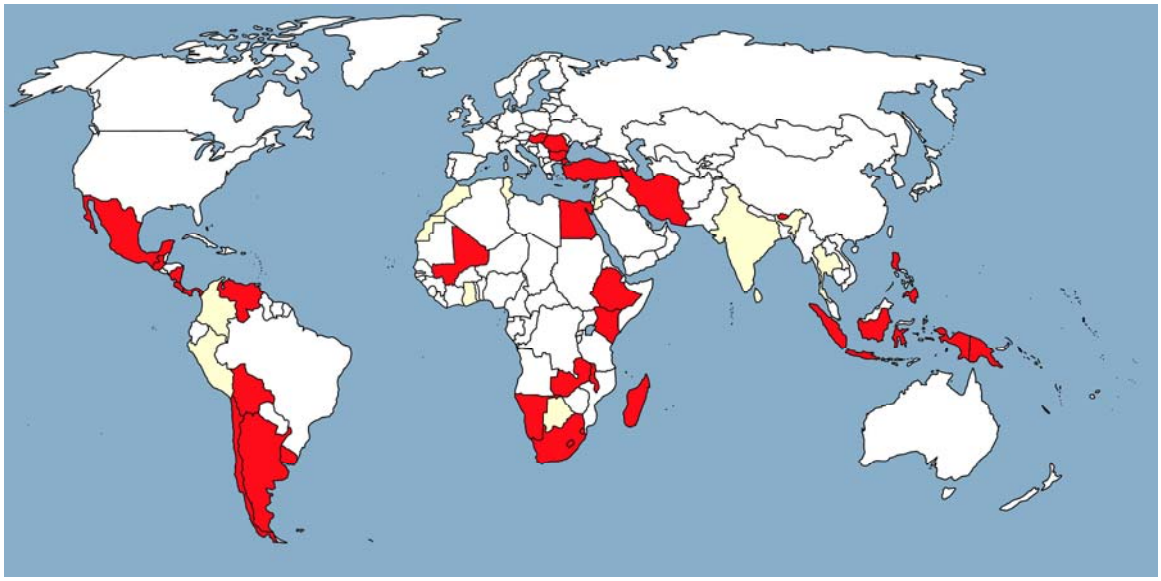
relation between govt wages and output shocks | **relation between relative wages in government and output shocks*** | **relation with private sector factor returns (wages)**

The bands show the correlation coefficients between the variables described in the figure. The term "correlation" referred to on the x-axis describes the percent to which changes in government employment correlates with changes in output (or with changes in private sector hiring for the last set of variables). "Elasticity" describes the effect that a one percent change in output (or private sector hiring) has on employment in the government sector. "Relative volatility" describes how much more employment in the government varies as compared with changes in output or private sector hiring. (In formal terms, relative volatility describes the proportion of the normalised standard deviation of government employment to the normalised standard deviation in GDP or private sector employment). The second set of figures (denoted with an asterisk) use the proportion of government employment as a share of private sector employment as the variable of interest with which to compare with GDP changes. Source: Quadrini and Trigari (2007).

[22] By "quite a bit", we mean that the elasticity of government labour in value and volume terms with respect to changes in output exceeds zero (and is probably less than unity).

Yet, not all countries' governments seem to respond much to changes in their external environments. Figure 18a shows the results of time series analyses assessing whether current government expenditure depends on previous government spending or on other factors.[23] The figure shows – marked in red or yellow – countries where past government expenditure very well explains current government expenditure. For most of the countries in Akitoby and co-authors' study, past government expenditure explains rather well current expenditure. The authors also test the extent to which changes in government expenditure correlate with changes in output in the current period and in the past.[24] Countries marked in red show countries where past changes in output best explain current changes in government expenditure. For a few countries – Colombia, Peru, India, Sri Lanka, Thailand, and Ghana – current changes in output best explained changes in current government expenditure.

Figure 18a: For Some Countries, the Size of Government This Year Depends on What that Size Was Last Year



The figure shows the results of an error correction model for changes in government expenditure for a sample of 51 countries. For countries marked in red, past changes in output best explain (have the largest regression coefficient for) changes in government expenditure. For countries marked in yellow, contemporary differences in output best explain (have the largest regression coefficients for) changes in government expenditure. The authors did not provide data for countries marked in white.
Source: Akitoby *et al.* (2006).

[23] The authors used a procedure known as Auto-Regressive Integrated Moving Average (or ARIMA) techniques. These techniques test the extent to which the value of a variable depends on previous levels of that variable. While a discussion of time series analysis extends beyond the scope of our paper, the reader should know that this test assesses whether past values of a variable explain that variable better than other variables.

[24] The reader familiar with time series analysis will recognize this as a co-integration test – using a error-correction model. The authors tested three independent variables to find their impact on differenced government expenditure – differenced past government expenditure, differenced output and the lag value for differenced output. We chose the most important factor for each country based on the size of the corresponding coefficient. For example, if the regression coefficient for past changes in output exceeded the value (either positive or negative) of the other regression coefficients, we classified that country having reactive organisational adaptation.

Naturally, government size (as measured by revenues and/or expenditure) responds to more than just the uncertainty and complexity of its organisational environment. Figure 18b shows regression results for several variables likely to impact on government expenditure. Governments tend to shrink mainly as inflation rises and grow when savings increase, as labour abounds and as exports rise. **These results seem to confirm that government sizes grow in the face of foreign economic shocks and shrink in the face of domestic shocks.**

Figure 18b: The Size of Government Responds to a Wide Range of Factors

The bands show n in the graph represent the range of standardised beta coefficients explored by the author over a range of models. We only include coefficients significantly different from zero w ith 95% confidence or better (higher). Authors may have transformed variables for their analysis.

Dependent variables: Tax revenue as a percent of GDP (denoted as purple bars) and government expenditure as a percent of GDP (w hose results are show n by blue bars).

Regression factors having little impact: Economic freedom index, index of globalisation, unemployment rate (as a share of the labour force), average number of years of education (for entire population), urban population (as a percent of the total population), fertility rate, total trade volumes (imports plus exports), imports, exports, percent of young people (aged below 15 years), grow th rate of average years of school education, and investment's share in GDP.

Source: Bergh and Karlsson (2010).

The Structure of Government: Composition of Expenditure and Decentralisation

At first glance, the structure of government also seems relatively insensitive to changes in government's macroeconomic environment. We previously described in Figure 10a that we might infer that changes in the allocation of government expenditure result in (many directly immeasurable) changes in the "structure of government" (as an organisational theorist might understand the term). Yet, the available data fail to show increasing complexity and uncertainty (at least as proxied by openness to foreign trade) correlate with changes in the allocation of government spending (and thus the structure of government writ large). Figure 19b shows the results of a panel of regressions looking at the correlation between a range of independent variables and changes in the allocation of government spending across 10 categories (in areas like spending on public services, defence and so forth).[25] Like Rodrik and most of the authors writing in this branch of literature, Dreher and co-authors assume that trade brings increased economic uncertainty and volatility. Unlike Rodik, Dreher and his co-authors also explicitly create proxies for economic, political and social globalisation. We summarise a large number of panel regressions in the figure below – showing statistically significant effects on various types of expenditure by marking **in black shading** effects related to trade, economic globalisation, political globalisation or social globalisation. Only defence expenditures correlate in any statistically significant way with trade; while education expenditure correlates with the authors' proxies for economic globalisation and political globalisation. Expenditure on recreational activities (and thus on the agencies

[25] The study uses the expenditure areas in the IMF's Government Finance Statistics – the same ones we show data from earlier. As previously described, we infer that changes in expenditure – in public order for example – must also correspond to changes in the organisations responsible for ensuring public order… such as the Ministry of Interior, Public Safety or its equivalent.

responsible for providing recreational opportunities) correlates with social globalisation. If a contingency theory of government held, Figure 19b should be covered with these black-shaded labels. Instead, **increased complexity and uncertainty of government's organisational environment seems to have a very limited impact on changes in the structure of government – and then only on areas like defence, recreation, and education.**

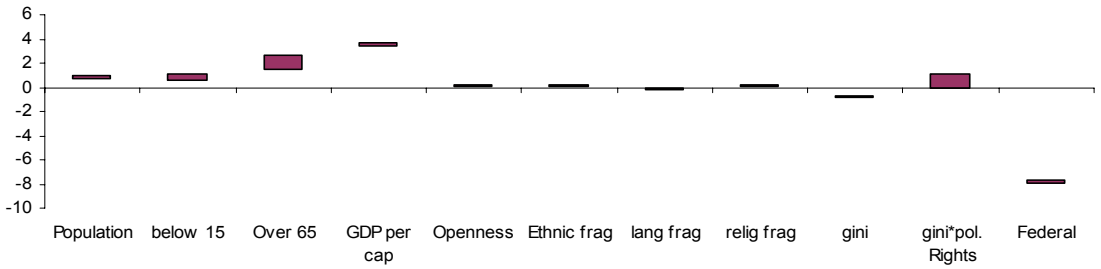
Figure 19a: The Allocation of Public Expenditure Does Not Respond to a Wide Range of Factors

area of government	factors influencing growth or decay
public services	expenditure share, age dependency ratio
defence	average expenditure share, **trade index**
public order	expenditure share
econ affairs	expenditure share, age dependency ratio, capital account restrictions
environ	expenditure share
housing	(none)
health	lending rate
recreation	lending rate, **social globalisation**
education	average expenditure share, age dependency, **economic globalisation**, **political globalisation**
social	average expenditure share, age depend, lending rate

Source: Dreher *et al.* (2006).

Other data suggests that the uncertainty and complexity of government's organisational environment has a limited impact on the structure of government. While no publically available data allow us to describe with precision these changes, we can infer such occur by changes in the composition of public expenditure. Figure 19b shows the results of regression analysis seeking to identify factors responsible for changes in the composition of government expenditure. Many of these factors relate to citizen heterogeneity (the percent below 15 years old and over 65 years old, the degree of ethnic, linguistic and religious fragmentation as well as Gini coefficients). The study also includes openness to trade (the proxy we have suggested leads to changes in the complexity and uncertainty of government's organisational environment). Two variables in the study – GDP per capita and federally structured government – describe structure characteristics which tell us relatively little about changes in the country's organisational environment).

Figure 19b: Little Explains the Structure of Central Government (Spending)



The bands shown in the graph represent the range of standardised beta coefficients explored by the author over a range of models. We only include coefficients significantly different from zero with 95% confidence or better (higher). Authors may have transformed variables for their analysis. We present significant results for any of the 12 dependent variables explored by the author. The author does not provide R-squared values for these regressions.

Dependent variables: The author provides results for 12 dependent variables related to central government: total expenditure, education, health care, social security, public safety, general government services, transport, defence, transfers, public goods, government consumption, and public sector wages and salaries.

Regression factors having little impact: Political rights, Majoritarian government, presidential system, and the interaction between majoritarian and presendetial systems.

Source: Shelton (2007).

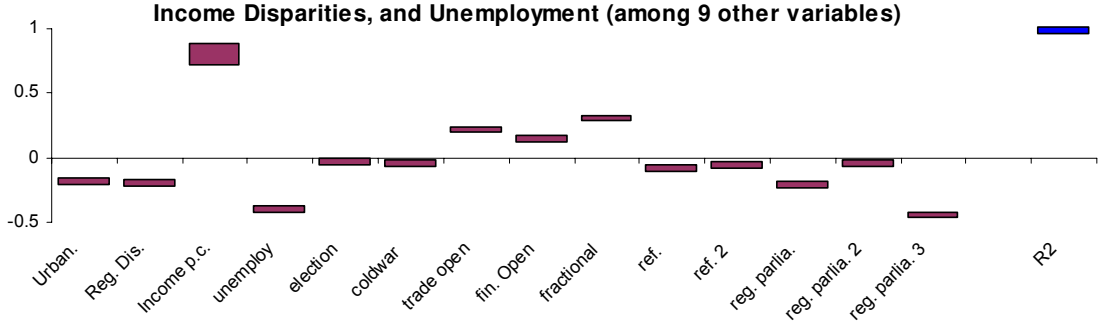
Structural factors -- describing very basic and slowly changing features – seem to explain the allocation of government expenditure better than variables measuring various aspects of governments' organisational environment. Countries with federal structures (unsurprising) spend less in expenditure categories – while richer countries' governments tend to spend more than their poorer cousins. All variables measuring various aspects of the complexity and uncertainty of the organisational environment come out having little practical significance (with very low beta coefficients).[26] Trade openness (measuring vulnerability to external shocks) positively, statistically significantly correlates with changes in various types of government expenditure – though has much less of an effect on the composition of government expenditure than GDP-per-capita or having a federal government structure. Ethnic fragmentation, language fragmentation and religious fragmentation could result in a more complex policymaking environment because government policies would (or at least should) accommodate the larger and more varied groups of voter and citizen interests. These three proxies for the complexity of the government organisational environment emerge statistically significant – though again with relatively small beta coefficients. Gini coefficients – which measure the dispersion of income in a country (and thus the "demand" for compensatory government policies) – also negatively correlate with changes in government expenditure. Government expenditure on various areas of policy increases as the distribution of income equalises across groups in a country.[27] Yet the conclusion remains – **the structure of government (as proxied by changes in the allocation of government expenditure) seems to respond little to changes in government's organisational environment.**

[26] We tend to use beta coefficients for regression analysis rather than b-values (which measure the change in the dependent variable for small changes in dependent variables) because these beta coefficients tell us a variable's importance in explaining changes in the dependent variable (in our case the allocation of government expenditure). Variables with low beta coefficient values are "less important" in explaining changes in the dependent variable (if the analyst runs his or her sets of regression analyses properly) than variables with large beta coefficients.

[27] The causality problem makes the results pertaining to the Gini coefficient difficult to interpret. Sweden for example has one of the lowest Gini coefficients in the world and a relatively high level of government spending. Yet, statistical analysis can not – at least not the analysis in this study – can tell us whether Swedish government expenditure (and Swede's appetite for government goods and services) increased as income equality grew…or whether Swedish government expenditure grew in the past precisely to head off possible increases in income inequality.

Increased uncertainty and complexity of government's organisational environment, though, appear to correlate with changes to the structure of government as measured by central government expenditure relative to general government expenditure. Figure 20a shows regression analyses attempting to find out which factors correlate with decentralised structures of government. Income per capita most strongly correlates with decentralisation of government expenditure – showing that increases in income per capita correlate with increased government sizes but decentralised government structures. The extent of a country's urbanisation and regional disparities surprisingly and positively correlate with centralisation (or negative decentralisation).[28] Unemployment – which often has a regional component – also correlates with more decentralised government structures. As such, **changes in the structure of government (as measured by structural centralisation) seem to respond more strongly to government's organisational environment than the allocation of expenditure.**

Figure 20a: Pressures for Centralisation include Urbanisation, Regional Income Disparities, and Unemployment (among 9 other variables)



The bands shown in the graph represent the range of standardised beta coefficients explored by the author over a range of models. We only include coefficients significantly different from zero with 95% confidence or better (higher). Authors may have transformed variables for their analysis. All reported models have R-squared values of 0.96 or higher.
Dependent variables: Decentralisation (as measured the amount of non-central government expenditure).
Regression factors having little impact: GDP Growth rate, share of the country's expenditure as a percent of total EU governments' expenditure, trade with EU, EU political integration.
Source: Stegarescu (2009).

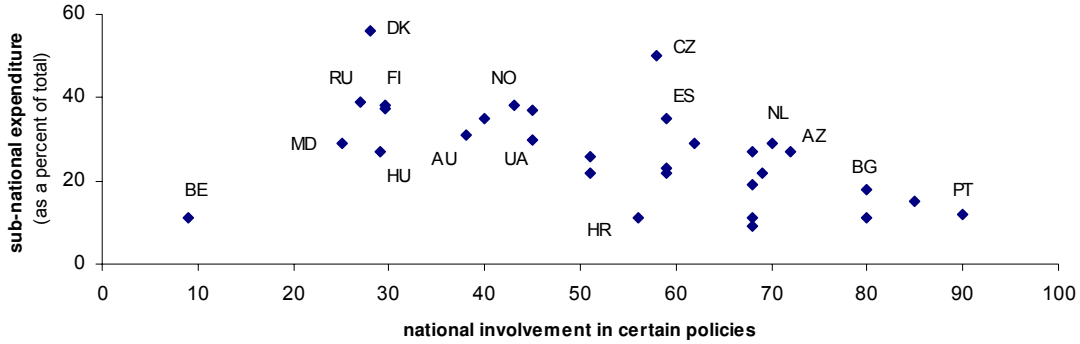
Exposure to a more complex and uncertain organisational environment – as proxied by greater trade openness -- broadly correlates with increased government decentralisation. Stegarescu's (2009) analysis – as summarised in Figure 20a and chosen because of the study's representativeness of other studies in the area – suggests that trade and financial openness correlate with increased in decentralised expenditure. His proxies for both trade and financial openness show statistically significant correlations with increased government decentralisation (after controlling for other factors). His proxies for the strength of regional government – legal provisions for the holding of referendums and the function of regional parliaments – on the other hand -- all correlate with less decentralisation (as measured by non-central government expenditure). **These results suggest that government can respond to increased complexity in its organisational environment – at least complexity as defined as the diversity of economic**

[28] The theoretical correlation between urbanisation (and regional disparities) and government centralisation depends on the dispersion of such urbanisation (or these regional disparities). For countries with one or two large urban agglomerations, economies of scale and lower transportation costs might militate for government centralisation. In countries with many large cities (or significant and relatively equal regional disparities), a decentralised government structure should respond more effectively to local wants and needs.

preferences concomitant with international trade and political preferences at the local level – by either centralising or decentralising. Government organisations sometimes seek isomorphism with their environment and at times seek to buffer themselves against very complex environments.

Previous studies also suggest that central and sub-national organisation serves as organisational substitutes rather than complements. Several authors have written about the Leviathan Hypothesis – that the growth of local government helps "reign in" the growth of central government (Fiva, 2006).[29] Figure 20c shows a negative relationship across countries between national involvement in certain policies and sub-national expenditure. Unsurprisingly, sub-national government expenditure decreases as central government assumes more competencies for engaging in a number of policies. The relations seems relatively strong – leaving little doubt that **the structure of government involves a trade-off between expanding local government as opposed to national government.**

Figure 20c: Sub-national Government Gets Less Involved with Central Government Gets More Involved in Policymaking



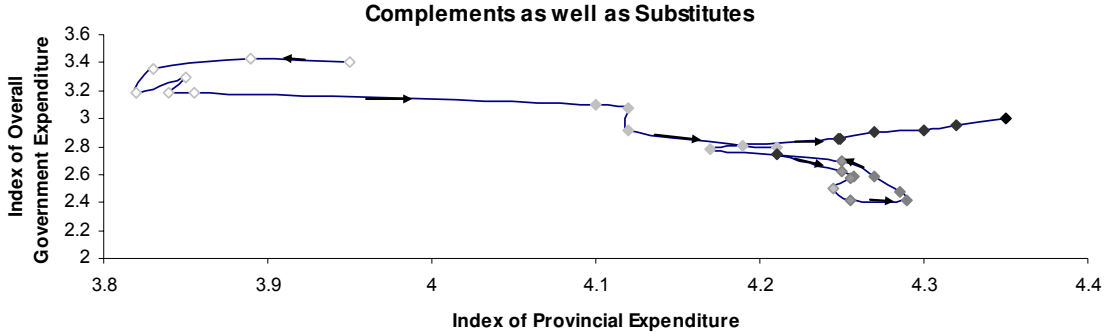
The figure shows, for various European countries, the percentage of 34 policies which national government has competency. The y-axis shows the percent of subnational expenditure (as a percent of total government expenditure) between 1995 and 2000. Source: Shinkel (2009).

More refined country-level data show that central and local government organisational forms can work as complements as well as substitutes. Figure 20d shows the change in national and provincial (sub-national) government expenditure in China from about to 1978-2007.[30] During the 1970s and 1980s, Chinese provinces accounted for greater amounts of total expenditure – with their proportion of expenditure rising from about 52% of total government expenditure in 1978 to almost 70% in the early 1990s. The 2000s though saw an increase in both government expenditure (as a share of GDP) and an increase in sub-national expenditure. Common sense suggests that China's policymaking environment become more complex and uncertain in the 2000s (due to increased participation in the global economy). Yet, across countries, the only robust conclusion emerges that **the structure of government (as measured by structural centralisation) can respond to changes in government's organisational environment by both centralising and decentralising.**

[29] We use quotes in order to reflect the sometimes sensationalistic language used in a branch of economics literature which has resurrected – using the language and tools of modern economics – old questions in political theory.

[30] We chose the China study partly to avoid over-citation of the US experience and partly because these data illustrate trends shown throughout the literature for a range of countries.

Figure 20c: Centralised and Decentralised Organisational Structures Serve as Complements as well as Substitutes



The figure shows total government expenditure-to-GDP versus expenditure by provential governments (as a proportion of total government expenditure). We have labelled these as indices as the author reports these proportions in natural logs (in order to show the changes in these proportions more clearly). We have marked the evolution of provincial expenditure by increasingly darker dots through time (so the whitest data represent the early 1980s and the blackest data represent the late 2000s).
Source: Zhang (2010).

Combining evidence about the structure of government – from both the allocation of expenditure across functional categories and between central-local government – paints a mixed picture about the structure of government. Figure 21a shows the results of regression analysis – trying to explain statistically significant differences in central and local government expenditure across 12 functional categories of government expenditure. For example, the size of the country's population explains expenditures on safety for both central and local government levels. The percent of the population of 65 years old and ethnic fractionalisation statistically significantly correlates with local government expenditure on education.

Central government appears to respond more vigorously to changes in government's organisational environment than local government. In order to help simplify Figure 21a, we have tallied the number of significant variables Shelton finds in his study across levels of government. Central government only expenditure statistically significantly responds to the most number of variables in Shelton's study – suggesting a particular propensity for government to centralise in the face of uncertainty in its organisational environment. However, of the variables which statistically significant correlate with changes in the allocation of local government expenditure across functional categories, most of these variables relate to the complexity of its regulatory environment (as measured by the diversity of citizen's political preferences and characteristics). These data suggest that other – non-economic – factors also affect the structure of government.

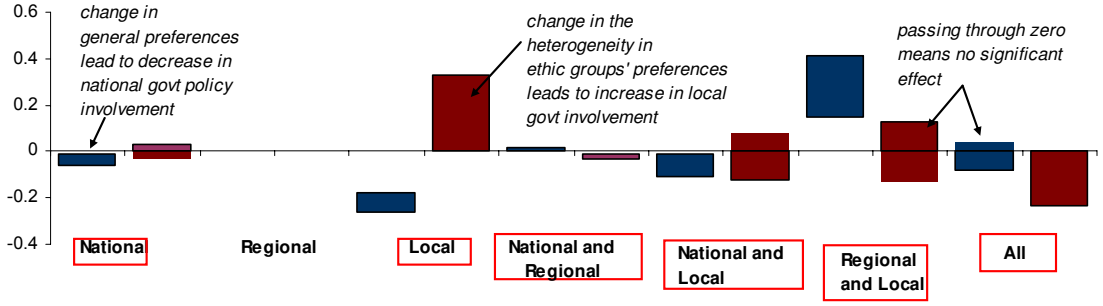
Figure 21a: Differences Between Central and Local Expenditures

type of expenditure	both levels of govt	central govt only	local govt only
total expenditure	population over 65 openness to trade	population under 15	per capita GDP openness among OECD
education		openness to trade total population	population over 65 ethnic fractionalisation
health			population over 65 ethnic fractionalisation
social security	population over 65	openness among OECD	ethnic fractionalisation
public order and safety	total population	population under 15 openness among OECD	population over 65 ethnic fractionalisation
general public services		total population population under 15 years old	population over 65
transport	openness to trade	total population openness among OECD under 15 years old population over 65	
defence		population under 15	
transfers		population over 65 openness among OECD	
public goods		population over 65 openness among OECD ethnic fractionalisation	
government consumption	total population	population under 15 openness among OECD ethnic fractionalisation	population over 65 ethnic fractionalisation
government wages	total population population over 65	per capita GDP	openness among OECD
Structural factors	**6**	**13**	**7**
Uncertainty	**2**	**8**	**2**
Complexity	**0**	**2**	**5**

The figure shows the variables statistically significantly explaining the variance in government expenditure at both the national and local levels. Empty cells indicate that no variable analysed by the author (among the roughly 8 variables they analysed) helps predict changes in government expenditure across time and countries. We provide – in the final three lines – the total number of significant variables for each level of government. We classify "structural" variables as slow-moving features of the state, like total population or GDP. Proxies for "uncertainty" consists of trade openness. Proxies for complexity consist of measures of voter heterogeneity (like ethnic fractionalisation).
Source: Shelton (2007), except for the final three lines which we calculate.

Other – non-economic – evidence suggests that the structure of government responds to the complexity of its organisational environment. Shrinkel (2009) presents data in a remarkable study attempting to find correlations between the level of policy-making and changes in general preferences (of the entire population) as well as changes in the heterogeneity of ethnic groups' preferences. Figure 21b shows – in the simplest way we could portray his data – the simulated effects of changes in preferences on national, regional and local level-policymaking. For example, changes in nation-wide citizens' preferences correlate with a decrease in central government involvement in policymaking (and a much larger decrease in local government involvement in such policymaking).

Figure 21b: Changes in Local and General Preferences Led to Some Changes in Level of Policy-making



The bars show n in the figure describe the changed in the predicted probability of that level of government becoming involved in policies studied by the author for a change in general preferences or changes in the heterogeneity of ethnic preferences. For example, a change in general preferences results in about a 5% decrease probability in national government involvement in policymaking. change in the involvement of government. Ranges highlighted by red boxes are statistically significant at 95% or better.
Source: Shinkel (2009).

Data such as Shinkel's suggest that changes in the government's organisational environment (as suggested by changes in citizens' preferences) does not have simple effects on the structure of government. Often various levels of government respond to changes in government's organisational environment. As insinuated by Figure 21b, both national and local levels of government decrease their involvement in policymaking for changes in general preferences – while regional and local governments (working together) increase their involvement. **Changes in government's organisational environment leads to complex changes in the structure of data – even if no one measure of such government structure can adequately capture them.**

The Public Sector Organisational Theory Literature

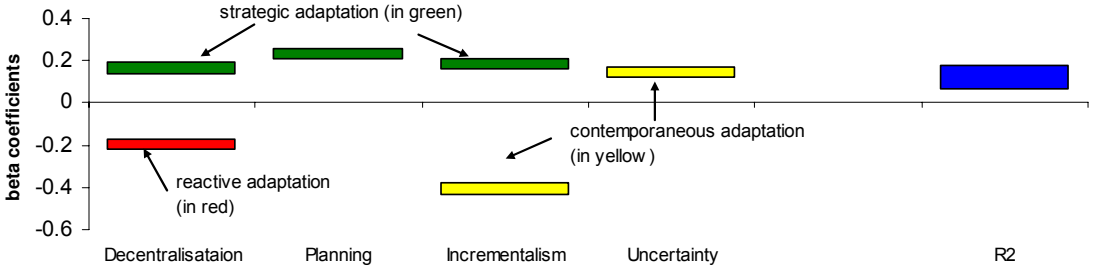
While a wide number of studies focus on various aspects of government size and structure at the micro and anecdotal levels, few studies in public administration tackle the issue definitively. For example, in a dated but still very relevant paper, Sharfman and Dean (1991) attempt to provide a definitive answer to conceptualising and measuring the organisational environment (to borrow the title of their paper). In their paper, they attempt to taxonomies the three dimensions of organisational environmental which we test in our paper. They also look – in a private sector context – at organisational characteristics correlating with each type of organisational environment. For example, they find that highly uncertain organisational environments (or revised dynamic environments in their terminology) correlate with the most profitable industries. They also find (with some relevance to our present study) that the use of written rules and market resource (or information gathering in a public-sector context) significantly correlate with high competitive and complex organisational environments.

In one of the most relevant studies for our own research, Andrews *et al.* (2008) uncover several statistically significant correlations between UK managers' perceptions of their agency's organisational environment and the type of organisational strategy their agency managers pursued.[31] As shown in Figure 22a, these managers thought that highly

[31] One study hardly seems like the basis for a valid literature review. In our defence, we searched all the major search engines for papers dealing with "organizational environment" and variations of government, structure, public sector, strategy, "strategic adaptation" and so forth. The paucity of papers in this area reflects deeper epistemological problems around the definition of government structure and the

centralised agencies followed a reactive as well as strategic organisational adaptation. Agencies highly involved in planning corresponded with reactive organisational adaptation (using our labels instead of theirs). Agencies following incrementalist policies tended to follow reactive and strategic organisational adaptation to changes ii their organisational environments. Agencies with a high amount of environmental uncertainty tended to adapt their agencies reactively.

Figure 22a: Decentralising and Incrementally Changing Agencies Engage in Stategic and Reactive Organisational Adaptation -- those in Highly Uncertain Environments Adapt Reactively



The data in the figure show the extent to which several variables correlate with the organisational strategy of UK government agencies. For example, the perception that an agency follows a decentralising strategy correlates with UK's managers' perceptions that their agency adapts reactive (and strategically) to its organisational environment. Agencies whose managers foillow incrementalist strategy correlate with managers' perceptions that those agencies engage in reactive and contemporanous organisational adaptation. We have relabelled the authors' labels for the dependent variables from prospective to "strategic," low cost and differentiated defending as "contemporanous" adaptation and reacting as "reactive" organisational structure. Source: Andrews *et al*. (208).

A more fruitful area of research has centred on the international institutionalisation of government structure. The institutionalist literature – and particularly literature dealing with the institutionalisation of organisational forms – has spawned a great many studies in the private sector (Scott, 2008). However, few studies deal with such institutionalisation in a public sector context (except the many policy studies from Eastern Europe describing how various governments copied models from Western European countries). Yet, reactive organisational adaptation could well occur because of the mimetic diffusion of institutional norms of government organisation occurring concomitantly with international macroeconomic shocks. In simple language, policymakers in many countries may choose to restructure their ministries and departments because they observe colleagues in other countries doing the same thing during an economic crisis or other macroeconomic event.

Previous studies – and our readers' own work experience -- provide some support for the theory that policymakers "copy" some attributes of government structure from other countries – irregardless of changes occurring in their own country's macroeconomy. Figure 24c shows the impact of interaction (as measured by international trade) on government sizes. For example, the authors find that government employment expanded for the US's trading partner countries when US government employment expanded (and visa versa). They also find correlations in government in countries likely to copy US government employment trends because of similarities in economic growth and trade balances. However, the authors fail to provide any convincing, detailed mechanism by

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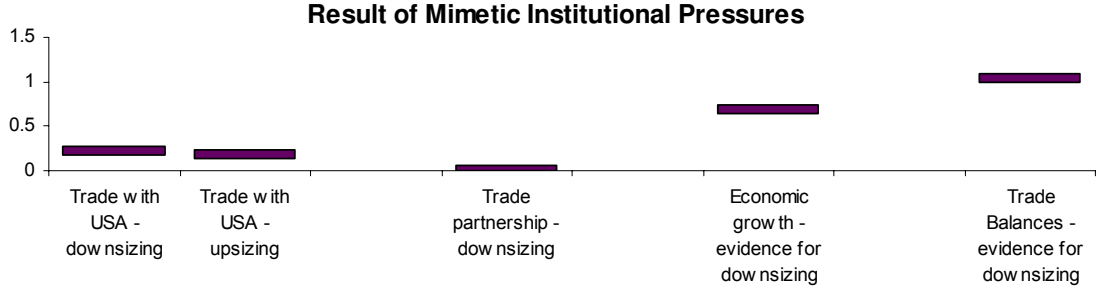
organisational environment of the public sector – as well as the lack of data from which to evaluate various theories. We rather blithely gloss over all these serious considerations in our study in order to arrive at some empirically-derived conclusions (however tenuous they might be).

which such organisational copying occurs. They also fail to show (in our opinion) that correlations in cross-country government employment does not occur because of similar shocks occurring in both countries – making a contingency-based theory of government the most relevant explanation of these data. These observations do not discredit these authors' research. Instead, they point out how much more empirical work remains to be done.

Figure 24c: The Reactive Government: Organisational Structure as the Result of Mimetic Institutional Pressures



The figure shows the extent to which various factors influence the copying of organisational structure between countries. Their dependent variable measures changs in general government employment of a country as the lagged proportion of changes in government employment in other "proximate" countries.
Source: Lee and Strang (2006).

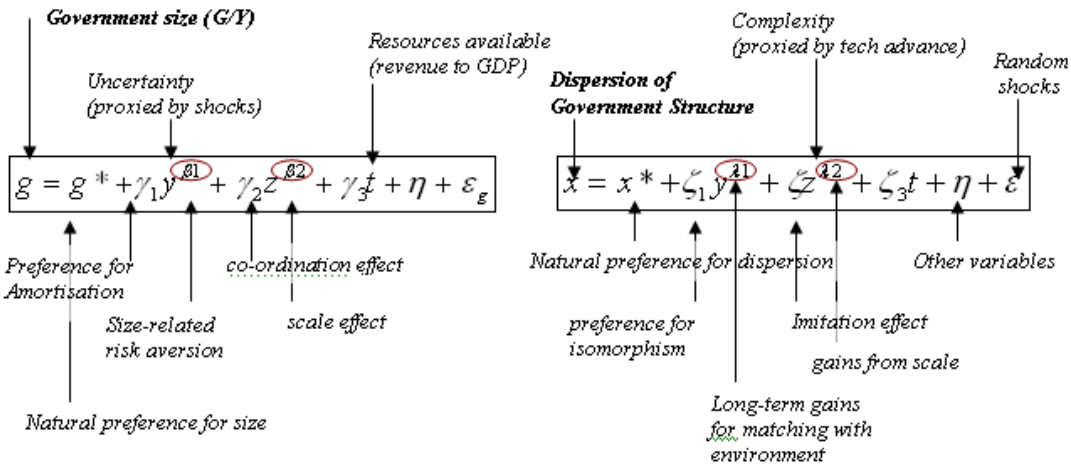
The public administration literature -- and all the literatures we have reviewed – leave many questions unanswered. Do changes in government size respond differently to external as opposed to internal macroeconomic shocks? Do macroeconomic shocks tell us something about the perceived or actual complexity and uncertainty of government's organisational environment (as we have defined it in this paper)? Does the allocation of resources across functional categories really intimate something about changes in the structure of government (as an organisational theorist would understand the term)? Does government centralisation occur in response to particular types of macroeconomic shocks? A model can help reduce the complexity of the research problem partly delineated by the existing literature.

The Model

Government size and structure should – in theory – depend on the uncertainty and complexity of government's organisational environment. The initial evidence from the literature suggests that government sizes should expand with the rising uncertainty stemming from international trade; and shrink with increasing macroeconomic (inter-sectoral) instability. The structure of government (as measured by the functional allocation of expenditure) should not vary very much for changes in the complexity of the organisational environment. Moreover, governments may centralise or decentralise their organisational structures in response to an increasing complex organisational environment. At first glance, these conclusions seem relatively solid. The US and EU Member State governments operate in uncertain and complex organisational environment – and have large and highly variegated government structures. Yet, as a percent of their GDP, some of the poorest countries – like Lesotho, Barbados, and Bosnia-Herzegovina – have some the largest governments in the world. The Chinese government, according to the initial data, operates in a highly complex macroeconomic environment – and has a rapidly changing organisational structure.

Our simple model posits a relationship between government size and structure and the uncertainty and complexity of the macro-economic environment, as well as other variables. Figure 25 shows the model for government size and structure which we describe in Appendix I and which we test in this paper. **Government size** (denoted by *g* and proxied by each country's government expenditure expressed as a percent of GDP) depends on economic uncertainty (*y*) and complexity (*z*). Economic uncertainty (as proxied by the changing proportions of national income in the industrial sector, as opposed to the service sector or agricultural sector) affects government size in two ways. Governments – through voters' and policymakers' preferences –will want to buffer the economy against various asymmetric shocks (or adjust to them if these are domestic macroeconomic shocks). Government also needs to provide more programmes and resources as the desire to insure against these shocks grows – thus increasing government size (again, unless these shocks originate domestically). Second, as the size of these shocks grow, governments are likely to be more risk averse – dedicating exponentially larger amounts of resources as the size of these shocks increase. The coefficient γ_1 represents the first set of (linear) effects while β_1 represents the second set of (geometric) effects.

Figure 25: A Model of Government Size and Structure



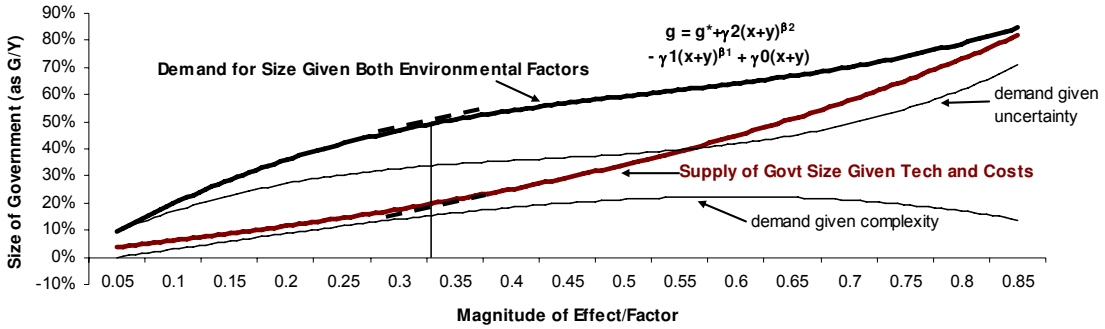
Governments also need to regulate (and for more interventionist governments to co-ordinate) an increasing complex economy. As represented by the linear coefficient γ_2), government may expand or shrink to provide more services to a more complex economy (or to avoid crowding out more efficient self-regulatory methods of the private sector). However, the size of such intervention may increase exponentially as the economy becomes increasing complex (represented by the geometric effect of β_2). Similarly, following the resource-based view of government, the amount of resources – proxied by revenues as a percent of GDP – passes through into an expansion of government programmes by γ_3. Similarly, other factors, such as the size of the country or the population should also affect government size – and these variables (η) serve as useful controls in testing our main effects.

Government structure depends on the uncertainty and complexity of the economic environment government regulates and transacts in. Government structure will depend on a natural preference for decentralised governance – measured either as the resources given to local rather than central government or by the proportion of government

functions aimed at economic activities rather than social protection. Some part of government structure x^* -- by pure practical necessity – will need to disperse across the country in order to provide government services somewhat efficiently and/or to provide some minimum amount of resource redistribution from well-off regions to regions in recession. The parameter ζ_1 measures the extent to which asymmetric or sector specific shocks translate into further changes in government structure. As these shocks become bigger, the gains to decentralisation become exponentially larger as government "matches" with its economic environment (λ_1). As economic complexity rises, government will naturally imitate the complexity of the environment in which it operates (using computers, creating facilitating offices like foreign investment offices). The parameter $\zeta 2$ reflects such a preference. As the complexity of the economic environment increases, government may wish to locate (by offering functionally targeted or decentralised services) to citizens working in high-tech or other sectors. Exponential gains accrue – as denoted by λ_2 -- as decentralisation matches specific offices with areas of the country more industrialised or advanced than others… as government offices in Silicon Valley may need to respond to a different set of business development and social welfare needs than offices in agricultural Nebraska.

The equilibrium government size depends on balancing act that governments play between matching their economic environment and suffocating it. Figure 26a shows – for some reasonable model parameters we inserted into the model for illustrative purposes -- that as the uncertainty and/or complexity of government's organisational environment rise, the benefits accruing to increased government size rise faster than the cost of expanding government. After some point – in the simulation shown in Figure 26a at about 33% of GDP, the cost of expanding government starts to exceed the gains.[32] These estimates lead to our first hypothesis -- **the size of government depends on uncertainty and complexity of the government's organisational environment.**

Figure 26a: Model of Government Size

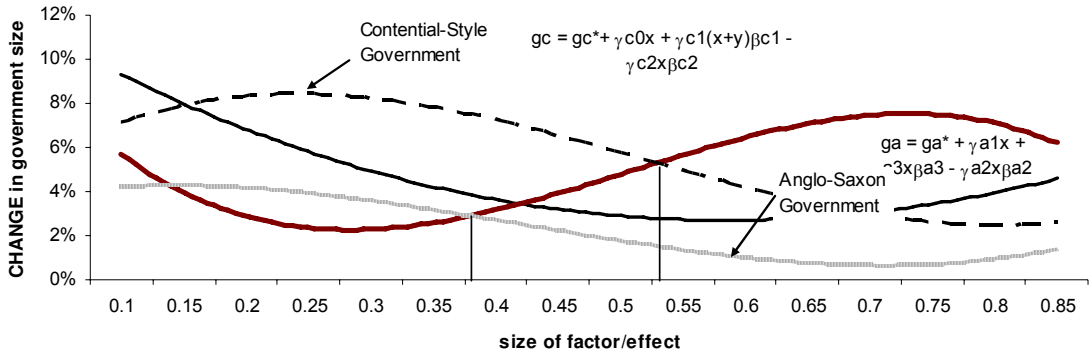


The model shows the effect of increased macroeconomic uncertainty and complexity on government size for a set of reasonable parameter values. In the simulation shown, we include uncertainty x and complexity y in order to derive general "pass through" effects on government size (the γs in the model) and exponential effects (the βs in the models). The simulation shows $g^*<0$, $\gamma 1>0$ and $\beta 1=3$, $\beta 2=2$, and $\gamma 2<0$ and simple assumptions related to the way that costs and the "technology" of increasing government size responds to changes in macroeconomic uncertainty and complexity (such that all parameter values are greater than zero but far less than one). Exponential effects are assumed no larger than 3.

[32] We show an optimal size of government in this simulation of about 33% of GDP whereas authors like Debrun *et al*. (2008) place this figure closer to 40%-45%. We use these model illustrations in all Figures 26 only to provide a fast and easy of illustrating model predictions without lots of complicated mathematical derivations, lemmas and other modeling basics which make typical economics papers relatively unapproachable to non-specialists (and PhD economists alike!).

Different governments will respond differently to even similarly sized changes in their macroeconomic environment. Figure 26b simulates the response of government size to changes in the macroeconomic environment -- depending on differing attitudes to risk and return. In order to simplify the figure, we only show two responses – using parameter estimates which might be expected the arch-typical Continental-Style government and Anglo-Saxon government. We assume the Continental-Style government will respond – by increasing government size – even to small changes in the macroeconomic environment. As these organisational environmental changes become larger, government will rely more on private sector adjustment (and the "infra-marginal" changes already made). The stereotypical Anglo-Saxon style government will adjust much less to external shocks and rely much more on private sector reaction. The figure shows – as in the previous figure – that government size will continue to change (grow) until the benefit of such changes equal the cost (as depicted by the red line showing the changes in the costs involved in increasing government size). As usual in economic theory, government size will reach an equilibrium in which the cost of marginal changes in government size equal marginal benefits of such change. These simulations suggest a second hypothesis -- **different governments will have different preferences for responding to the uncertainty and complexity of the macroeconomic environment.**

Figure 26b: Different Optimal Size of Different Types of Government

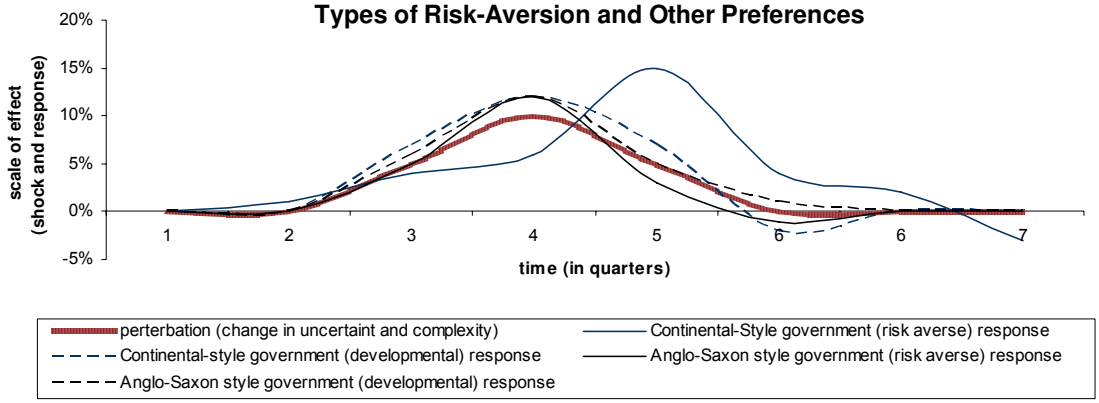


The figure shows the rates of change in each of the variables depicted in Figure 26a. We show the expected change in the size of government for changes in the uncertainty and complexity of the government's policy-making environment. We also simulate how government size might change as various parameters in our model change. We show two scenarios, using parameters which represent stereotypical depictions of government "styles." For the type of government which we label as a Continential-Style government, we assume a more risk-averse government which increases size much sooner and more vigourously to changes in the macroeconomic environment. For the type of government we label as an Anglo-Saxon government, we assume policymakers prefer to let the private sector respond to these shocks without much government involvement. Specifically, we assume that 0> γc0, γc1 and γc2 <1 and βc1=3 and βc2 =2 and γa0<γc0, γa1<γc1, and γa2<γc2 (for the same, corresponding βa1 and βa2). As shown in this simulatiion, the equilibrium change in government size decreases as the the preferences for intervention become "weaker."

Different governments will also respond to changes in their organisational environment more quickly than others. Figure 26c shows the response of government size to changes in macroeconomic uncertainty and/or complexity for a range of the model's parameters. In order to provide concrete, realistic examples, we illustrate 4 cases which roughly correspond to different stereotypical types of government. The scenarios which we have labelled as responses from Continental-style governments usually exhibit reactive responses to shocks (occurring in later time periods than when the shock occurred). In several of the cases, which we have marked as characteristic of stereotypical Anglo-Saxon style governments, organisational responses occur mostly contemporaneous (occurring at roughly the same time as the shock) or even slightly before (meaning that

government officials predicted the shock and took steps to increase government's size in response to the shock before the shock occurred). These simulation results lead to our third hypothesis -- **different countries will react reactively, strategically or contemporaneously to changes in the macroeconomic environment.**

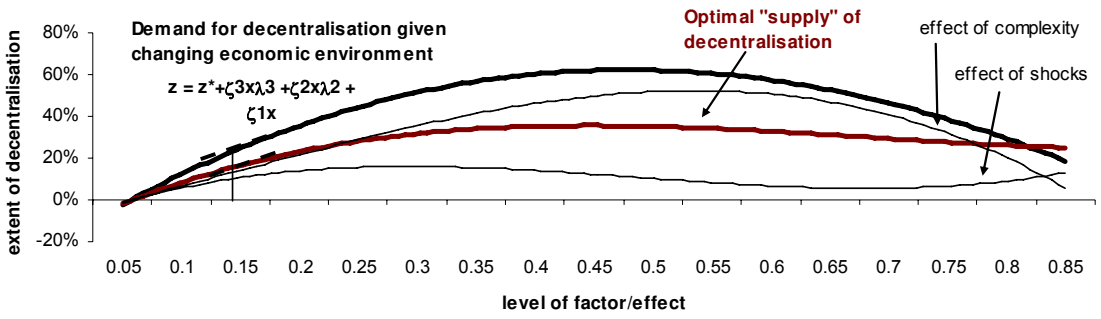
Figure 26c: Adaptive Orientation of Governments with Various Types of Risk-Aversion and Other Preferences



The figure shows simulations of the timing in changes in government size for changes in the sectoral composition of GDP as well as changes in the volume of high-tech, scientific and industrial production in overall output. The thick red line shows the magnitude of the shock (with the brunt of the shock occuring at the beginning of the second year). We show four "profiles" of governments -- changing their overall size depending on their preferences for avoiding risk and organising to adapt to these shocks. For the type of government we steretypically label as a Continential-Style government, the simulation shows that these governments respond less quickly to shocks. However, they respond more aggressively (by expanding more) than governments stereotyped as Anglo-Saxon-type governments. We treat changes in uncertainty (x) and complexity (y) the same for this simulation and assume a standard sized shock in order to highlight the way that government size will respond to these shocks for various assumptions about the γs and βs in the model.

Government structure – and particularly the extent of decentralisation – depends on the magnitude of economic shocks in our model. Figure 26d shows the relationship between the optimal level of decentralisation (as defined by the general measure for "dispersion" in our model rather than any specific measure which we will use in our empirical analysis) and the extent of uncertainty and complexity in the government's organisational environment. As shown, for relative anodyne assumptions about government risk aversion, government's desire to respond to sector-specific shocks, and other parameters, government should decentralise about 20% of its resources (into local government or into other functional categories depending on your interpretation of the variable). Such a result leads to our fourth hypothesis – that **government structure changes in response to changing uncertainty and complexity of the macroeconomic environment**.

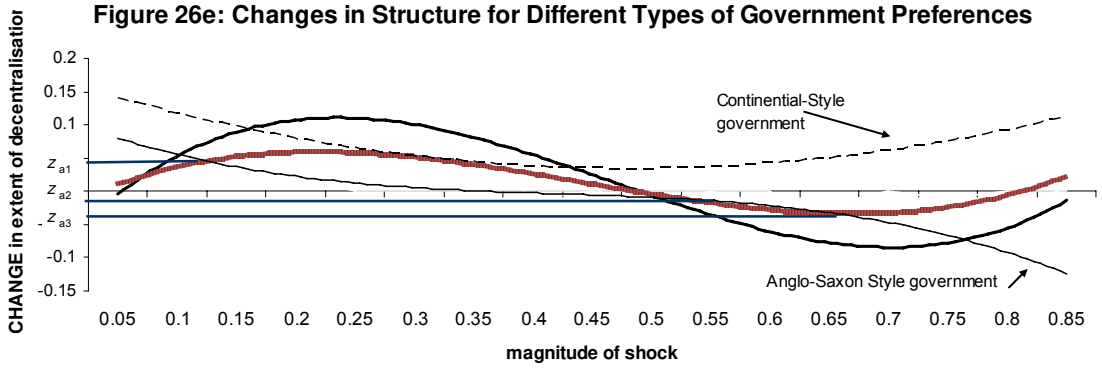
Figure 26d: Model of Government Structure (Decentralisation)



The figure shows the effect of changes in government structure (as defined by general "dispersion" of government and proxied by several variables which we discuss in the paper) concomitant with changes in macroeconomic uncertainty and complexity. The optimal level of decentralisation balances increasing costs of decentralisation (as the magnitude of shocks increases) and the benefits of decentralisation in responding more closely to asymmetric shocks. The parameter values for the demand for decentralisation are $\zeta 1$=0.17, $\zeta 2$=-0.0099 and $\zeta 3$=-0.00006 while $\lambda 2$=2 and $\lambda 3$=3 and z^*=-.18.

Governments with different attitudes toward adjusting to shocks will decentralise differently. Figure 26e shows the responses of various types of governments – classified according to their preferences for adapting to changing uncertainty and complexity in their macroeconomic environment. We label certain combinations of parameter values in our models using simple characterisations of governments in order to illustrate our model. For example, we simplistically characterise risk-averse governments which respond heavily to shocks (by decentralising only for very small shocks and very large shocks) as Continental-Style governments. Anglo-Saxon governments centralise for very, very large shocks – as we saw during the 2009 financial crisis. Clearly (as shown in the figure) governments with different preferences chose different levels of decentralisation. Our Continental style of government chooses to decentralise by 5% in response to changes in its macroeconomic environment. Our baseline-style of government chooses to centralise by about 1% and Anglo-Saxon style government chooses to centralise by about 4%. These differences in equilibrium changes in decentralisation lead to our fifth hypothesis -- that **differences in the uncertainty and complexity of various countries' macroeconomic environments significantly explain changes in government structures.**

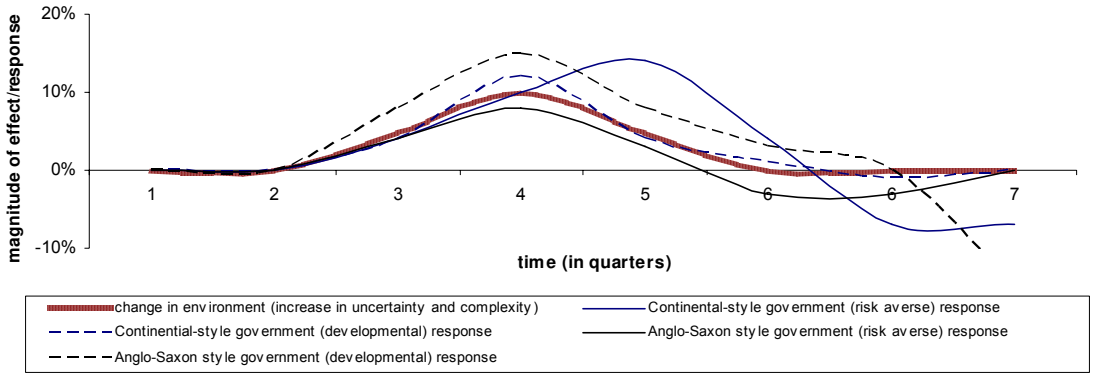
Figure 26e: Changes in Structure for Different Types of Government Preferences



The figure shows the optimal change in decentralisation for a range of parameter values in our model. The parameter values we used for the baseline case (shown by the heavy black line) consist of z^*=-.086, $\zeta 1$=0.09, $\zeta 2$=-0.013, $\zeta 3$=0.0005 while $\lambda 1$=1, $\lambda 2$=2 and $\lambda 3$=3. The parameters for the case we label as the Continential-Style government are different in that z^* is lower by about 0.07, $\zeta 1$ is very slightly negative, $\zeta 2$ is very slightly positive, and $\zeta 3$ is about the same. The Anglo-Saxon style government case differs from the baseline case in that z^* is much more positive (with z^*=0.11), $\zeta 1$ is slightly negative, $\zeta 2$ is slightly positive, and $\zeta 3$ is basically zero. Like in the last case, multiple equilibrium rates of decentralisation exist for various levels of changes in the uncertainty and complexity of the macroeconomic environment.

As governments time changes in their sizes in response to shocks to their organisational environments by adjusting their size, they also choose to centralise (or decentralise) with varying speeds in response to these changes. Figure 26f shows simulations of the extent of decentralisation in response to a non-specific shock (either in the uncertainty or complexity) to government's organisational environment. Again, we have labelled particular parameter combinations with simplistic monikers for governments which would be expected to react in the way predicted by the simulation. Risk-averse, developmental Anglo-Saxon countries react strategically – anticipating the shock and decentralising in order to minimise the negative effects of these shocks. Very risk-averse governments which we have labelled as Continental-style governments, react with a significant delay – and then markedly decentralise (only to strongly centralise shortly afterward). These differences in response speeds and styles lead to our final hypothesis -- that **different governments' structures can respond strategically, contemporaneously or reactively to changes in their macroeconomic environments**.

Figure 26f: Type of Adaptive Response for Decentralisation



The figure shows the structural response of government to changes in its external environment (increased uncertainty and complexity) for a range of parameter values in our model. The heavy red line shows the effect of a change to the uncertainty and complexity of the government's environment -- with most of the effect accruing at the start of the second year (4th quarter). For parameter combinations which we label as characterising an Anglo-Saxon style government, decentralisation occurs much sooner and more gradually. For parameter combinations which we characterise as becoming a Continential-style government, we observe more pronounced decentralisations (and subsequent more pronounced re-centralisations).

Empirical Results

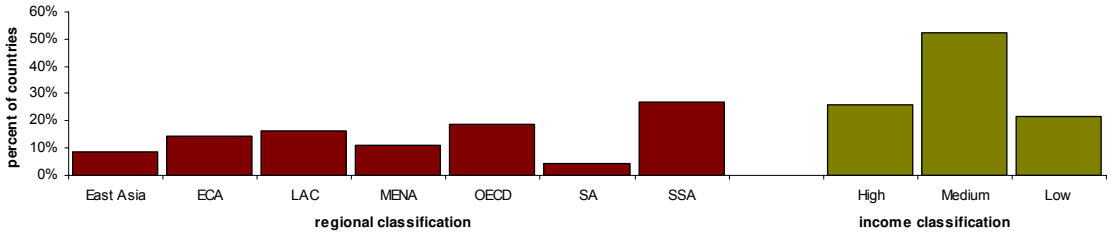
Overview of the data

Our sample included all countries for which the World Bank, IMF and ILO provide data. In total, our sample covered 165 countries between the period 1999-2009 -- for a total of 1815 possible observations (and we provide detailed statistics about data availability in Appendix III). Figure 27a shows the distribution of our sample according to the two groupings we used the most in our analysis – classification by geographical area and by income-group. Our sample slightly over-represents Sub-Saharan Africa – representing almost 5 times as many countries as South Asia. However, Sub-Saharan countries provide far fewer usable observations upon which to base our analysis.[33] The richer

[33] As we discuss in the Appendix, we needed long, uninterrupted stretches for data for numerous variables from a country in order to construct the graphs we provide in the first section of our paper (so that we could accurately aggregate, average and compare data across countries). On the other hand, we can draw strong conclusions from our regression analysis with relatively sparse data. Our regression analysis (in fact we use a variation known as a "generalized linear model") can find patterns the variation of relatively few

OECD countries take second place – comprising about 20% of the sample (and almost all of the usable sample for evaluating the effects of changes in the organisational environment on the structure of government). In our sample, as classified by the World Bank's most recent income grouping, about half of the countries in the sample come from medium-income countries. Roughly the same proportion of countries derive from high-income and low-income countries.

Figure 27a: The Distribution of Countries in Our Sample by Regional and Income Group Classifications



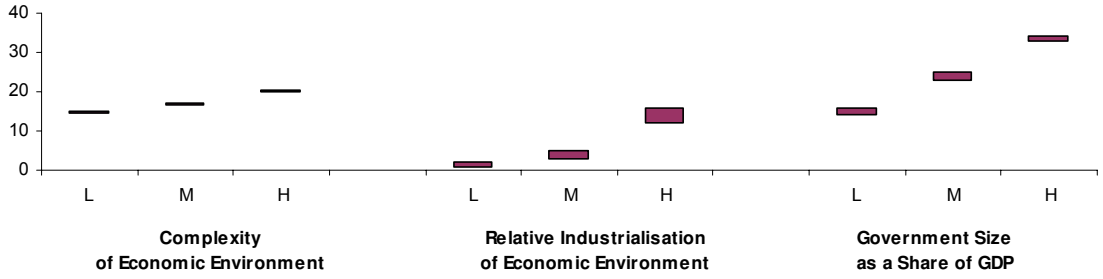
The figure shows the proportion -- out of 165 countries -- of countries falling into the major classification schemes used in the paper. The reader should interpret these data with caution (looking at the distribution of cases in Appendix III rather than simple number of countries we surveyed). For example, the figure shows that we surveyed the largest proportion of countries in Sub-Saharan Africa -- even though relatively few of these countries provide data for all 10 years we covered. We used the 2010 World Bank income groupings to classify countries by income group. Several of the countries we surveyed changed income group classification during the period (most of the countries changing classification moved "up" in the classification table).

At first glance, the data tend to confirm our common sense impression – that low-income country governments adapt relatively small organisational sizes to match their relatively certain and un-complex organisational environments. As shown in Figure 27b, average government sizes (as measured by government expenditure relative to GDP) of low-income country governments measure up to a little less than half the average government sizes of upper-income country governments. Relative industrialisation of low-income country governments (the figure which we base our proxy of organisational environment upon) rests at about one-fourth the level as that of their high-income country counterparts.[34] The average value for the proxy of the complexity of low-income countries' organisational environments lies at roughly half the value of high-income countries' values. The value of medium-income countries' government sizes, relative industrialisation, and macroeconomic complexity lie half-way between those values in the low-income and high-income countries.

observations which we could not find with the naked eye alone (albeit with less precision than we might wish for).

[34] The data in Figure 27b show the proportions of industrial output relative to output in other sectors, rather than changes in such output. We show such relative industrialization rather than the changes in such relative industrialization because we already showed these changes in the figure section of the paper. We do not use these averages in our analysis – presenting them mostly as background material.

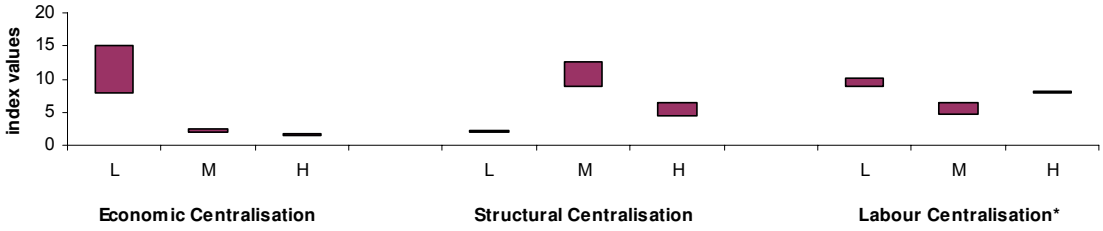
Figure 27b: Richer Governments Tend to Be Larger as well as Have More Uncertain and Complex Organisational Environments



The figure shows the range of average levels of three variables used in our econometric analysis. We calculated average values for the complexity of the economic environment by taking simple arithematic averages of the 10 year period (between 1999 and 2009) of the proxy for such complexity. The proxy for the complexity of the economic environment consists of a weighted average of the country's production of high-tech output, (valued in US dollars), export of IT (again valued in US dollars), the logirithm of scientific publications and patents, the proportion of industrial output and service output. The proxy for the uncertainty of the economic environment measures the extent to which resources moved between economic sectors. We calculated the proxy by subtracting the proportion of service-sector GDP from industrial GDP and divided the result by the value of agricultural GDP. We report overall levels (rather than changes) of this proportion as "relative industrialisation" in the figure.

Our measures for the structure of government show rather significant differences across countries in the three income groupings. The larger variation bands shown in Figure 27c reflect the much lower number of observations available upon which to create these proxies.[35] Low income countries' governments tend to spend a much larger amount on general government services and economic affairs (as defined by the IMF) than on social protection in comparison with medium-income and high-income countries. Medium-income country governments tend to spend about double the amount on central government (relative to non-central government) as high-income countries – and about 8 times as much as low-income countries. Using employment in central government organisations – rather than expenditure by them – follows a rather different pattern between income groupings. Employment in central government tends to be slightly lower (relative to employment in non-central government organisations) in low-income countries than in high-income or medium-income countries.

Figure 27c: Low-Income Country Governments More *Dirigiste,* but Medium-Income Country Governments more Centralised

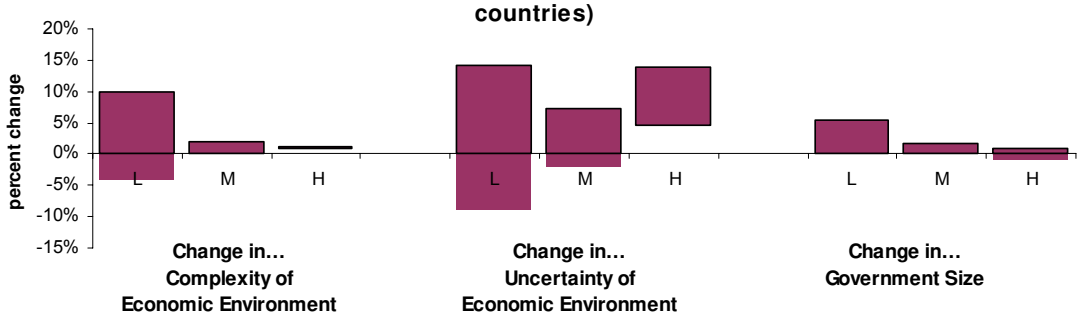


The figure shows the range of country averages of three variables aimed at understanding a country's government structure. The measure of economic centralisation uses the ratio of government expenditure on general governemnt services plus economic affairs as a proportion of expenditure on social protection. The measure of structural centralisation shows the percent central expenditure relative to general government expenditure. The measure of government labour centralisation -- which we show only for comparative purposes -- shows the ratio of civil servants in central government relative to local government (multiplied by 10 to make the numbers visually comparable with the other measures). Source: Calculated from the IMFs Government Financial Statistics (2010).

[35] As discussed previously, any attempt to create a proxy for the "structure of government" will run into serious definitional and measurement problems (as no universally recognized definition for the structure of government exists and governments report very little data upon which to construct even the most tentative proxies).

Looking at rates of change in government sizes and changes in government's organisational environment confirm our overall impressions about larger governments responding to a more volatile organisational environment (with some exceptions). Figure 27d shows the range of average rates of change in government sizes and our proxies for the uncertainty and complexity of the economic environment. The figure broadly shows that larger government sizes correlate with more uncertain and complex organisational environments (as shown by bars lying entirely above the x-axis). These data show two possible exceptions to such a trend. First, several low-income countries' government expand while facing a more uncertain and complex macroeconomic environment. Second, some high-income country governments shrink while interacting with a more uncertain and complex organisational environment. **These trends suggest that we can not simply generalise based on income groupings – we should look at more refined country groupings.**[36]

Figure 27d: Government Sizes Generally Growing... With Increasing Complexity and Uncertainty of the Economic Environment (and much higher variability among low-Income countries)



The figure shows the range of average changes in three of the main variables we analyse in our paper. We calculated these data by taking the difference of the log value of each of these three variables (our proxy for the complexity of the economic environment, the uncertainty of that environment and government size) between 1999 and 2009. We took the arithematic average of these differences and report them as percent changes (as the difference in log values usually closely resembles the normal rate of change calculated for the original variables). The range shown in the figure depicts the range of these averages across countries in each income-classification.

Hypothesis 1: The size of government depends on the uncertainty and complexity of government's organisational environment

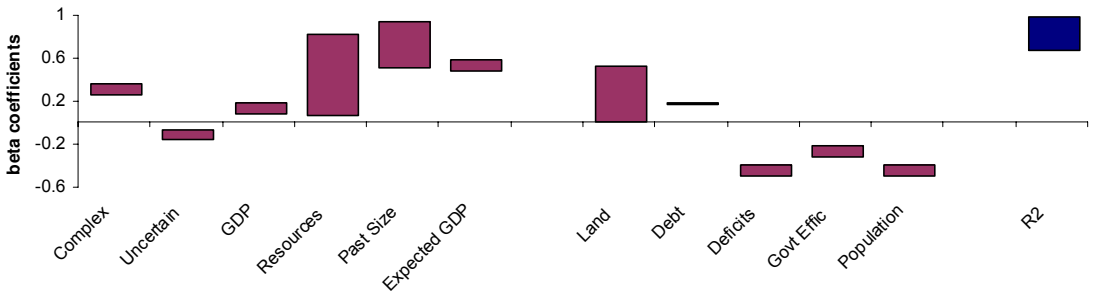
Government sizes do respond to their organisational environment. Figure 28a shows the effect of a number of variables on government size for all 165 countries we analysed. The largest effect consists of previous government size – strongly suggesting the prevalence of an inertial organisational strategy. In more simple language, policymakers tend to choose government sizes largely based on government's size last year. The availability of resources also (slightly) more strongly explains changes in government size than changes in the uncertainty and complexity of the organisational environment (as we have defined such uncertainty and complexity in this paper). Finally, the other variables we expect to influence government size – such as the country's population and the effectiveness of its government – have an impact (though less strongly than most of the other variables).[37] Quite understandably, less effective governments tend to spend

[36] In Appendix III, we provide a similar (but less edifying) analysis -- grouping countries by geographical grouping rather than income group.

[37] As we noted previously, beta coefficients (which we report in the figure) tend to indicate the relative importance of each variable in explaining and/or predicting the independent variable (government size in

more (as a percent of GDP) than more effective ones. **We can conclude, with a reasonable amount of confidence, that government sizes grow – holding all other variables constant – when government's organisational environment becomes more complex and more uncertain**.[38]

Figure 28a: Governments Grow in Size When their Organisational Environment Becomes More Complex and Uncertain (and for a bunch of other reasons)



The bands shown in the graph represent the range of standardised beta coefficients (over a range of models) which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis. The variable capturing the effects of uncertainty and economic shocks is negative -- meaning that more resources move from industrial sectors into service sectors when as government size increases.
Dependent variable: Governmemnt size (government expenditture as a percent of GDP)
Regression factors having little impact: Change in complexity over time, change de shocks, changes in revenue, membership in a particular geographic region, past levels of GDP, the proportion of the population living in urban centres, the level of business freedom, unemployment rates, and the country's level of development.

Nothing explains why some governments expand (or contract) rapidly while others change slowly. Figure 28b shows the importance of a range of variables in explaining the change in the government expenditure-to-GDP. All the beta estimates, taking into account their 95% confidence intervals, pass through zero. Such results suggest that government size responds to changes in government's organisational environment. However, **the rate of change of government size depends on some unknown variable which does not depend on features of government's organisational environment.** The model, then, provides a very poor basis for explaining why some governments expand rapidly and others expand slowly.

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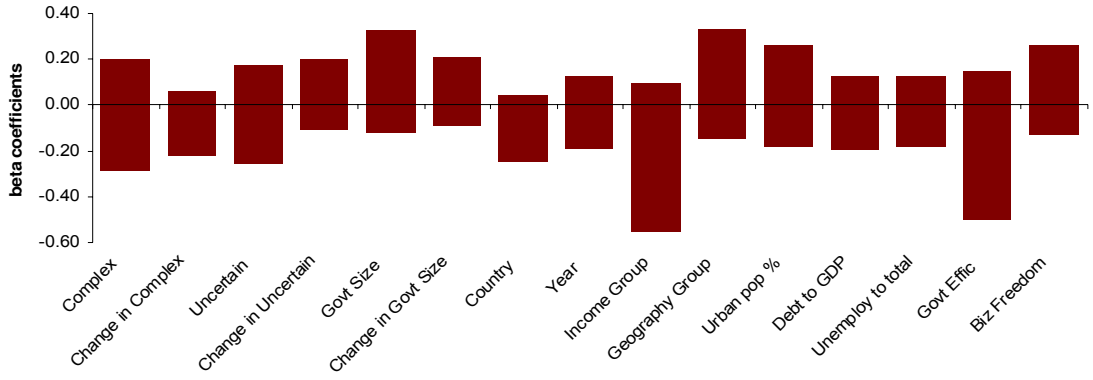
the case of this analysis). Variables with higher statistically significant beta coefficients are more likely to have a substantial effect on the independent variable than variables with low beta coefficients.

[38] We should qualify the term "reasonably confident" with two caveats (which apply to all the conclusions we reach in our regression analysis. First, our statistical tests have small probabilities (less than 5% and often less than 1%) of reporting that factors like the complexity and uncertainty of the organisational environment statistically significantly correlate with government sizes when, in fact, they do not (known as Type I error in statistics jargon). Second, if we mis-specified our model, our procedures will show relationships which do not really exist in the data. Problems like these – known as omitted variable bias, collinearity, and so forth – bedevil all empirical studies. We ran all the "usual" tests – often testing other models to check for the robustness of our results. We do not report all these procedures in order to keep this paper readable.

Figure 28b: Nothing Explains the Rate of Change of Government Size



The bands shown in the graph represent the range of standardised beta coefficients over a range of models -- all of which pass through zero (meaning that they are not statistically significant).
Dependent variable: Annual change in governmemnt size (annual difference in log government expenditure as a percent of GDP)
Regression factors having little impact: All.

Hypothesis 2: Different governments will have different preferences for responding to the uncertainty and complexity of the macroeconomic environment

Different governments should (in theory) respond differently to the uncertainty and complexity which characterises their economic environment. In our model, government sizes adapt to an uncertain economic environment differently; depending on their risk aversion and the level of overall changes occurring in the wider micro-economy (the γ_1 and β_1 in the model).[39] Governments also grow or shrink depending on the complexity of economic transactions – reflecting government's isomorphism with the macroeconomic environment and its role in facilitating that growing complexity (the γ_2 and β_2 in our model).

Our statistical analysis points to seven kinds of governments. Figures 29a and 29b show the results of regression analyses performed on clusters of countries -- which show the ways different groups of countries' governments respond to changes in their organisational environment. The statistical procedures we used chose these clusters of countries based on statistical similarities (which are described in the Figure and shown in Appendix III). Only about 20% of the governments we analysed seem to follow a **strong-form of our model** – adapting to changes in the uncertainty and complexity of their organisational environment (from group 3). Of these high-adapters, all comprise high-income countries. Almost double that proportion – almost 40% of the countries analysed – have governments whose size seems to respond almost exclusively to changes in spendable resources (from groups 1,2,4 and 5) . These governments seem to fit mostly closely the **resource-based view** of organisational strategy. Another 20% of the governments in our sample adapted their size in **response to the uncertainty** of their organisational environment (as proxied by changing sectoral weights in overall GDP). For these countries, only one of the two environmental variables we analyse seemed to explain changes in government size (group 6). For another set of countries (again about 20% of the sample), these countries' governments **grew with the increasing complexity** of their economies (group 7).

[39] In Appendix I, we derive the formal model and show more specifically under which circumstances governments with different preferences are likely to respond to changes in their organisational environments.

Figure 29: Statistically Suggested Groupings of Governments According to their Preferences for Responding to Changes in their Organisational Environment

Group 1: Advanced Resource-Based Growers			
These governments grow primarily in response to changes in the resources they have (or can borrow). However, they "match" the complexity of their organisational environment. **Members:** Belgium, Cyprus, Greece, Italy and Jamaica			
	b-value	**se**	**R2=0.75**
Revenue to GDP	0.87	0.11	
Debt to GDP	0.10	0.17	
Geometric Effect for the Complexity Proxy	**		
Group 2: Tax and Grow Economies			
The governments' size seem bounded strictly by the amount of resources they are able to raise. The heterogeneity of these countries makes further generalisation about these countries impossible – and their different variance profile excludes them from Groups 4 and/or 5. . **Members:** Bhutan, Brazil, Canada, El Salvador, India, Moldova, Pakistan, Papua New Guinea, Philippines, Senegal, Spain, Tunisia, Turkey, Uganda, Ukraine, Uruguay			
	b-value	**se**	**R2=0.87**
Revenue to GDP	0.81	0.04	
Group 3: The Environmental Adaptors			
These economies best exemplify the model presented in this paper. The levels, size and rates of change in all measurable parts of the government's organisational environment (complexity and uncertainty) reflect in changes in the size of government. **Members:** Austria, Denmark , Finland , France , Hungary, Netherlands , New Zealand, Norway , Poland , Portugal , Spain , Sweden			
	b-value	**se**	**R2=0.62**
Complexity Proxy	1.79	0.43	
Uncertainty Proxy	0.09	0.04	
Debt to GDP	0.23	0.02	
Geometric Effect for the Complexity Proxy	**		
Interaction between the Uncertainty Proxy and Revenue to GDP	**		
Interaction between the Uncertainty Proxy and Debt to GDP	**		
Interaction between Revenue to GDP and Debt to GDP	**		
Group 4: Low-Income Tax and Grow Governments			
Governments in these low-income economies -- like their counterparts in the rich countries (see Group 5) -- respond only to changes in their revenues. **Members:** Cote d'Ivoire, Kyrgyz Republic, Madagascar, Mongolia, Sri Lanka			
	b-value	**se**	**R2=0.67**
Revenue to GDP	1.05	0.20	
Group 5: High-Income Tax and Grow Governments			
These governments' size mainly appears tied to revenues – expanding slightly less than their colleagues in the low-income countries. **Members:** Germany, Switzerland, United Kingdom, United States			
	b-value	**se**	**R2=0.96**
Revenue to GDP	0.88	0.08	

Note: The groupings of countries shown in the figure reflect k-clustering – a statistically procedure which groups data according to the similarity of the data's variance. The procedure looks at variation in the entire dataset and constructs groups which minimise the variation in the data. We use these clusters of countries in order to test our model for each group of countries in order to estimate the way that changes in government size differs between groups of countries. The b-values show the change in government size (expenditure as a percent of GDP) for changes in the variables shown in the figure. Differences in these b-values indicate differences in the way that government size responds to the variable. For example, governments in group 1 expand 6% more for a similar increase in revenue-to-GDP in Group 2. Asterisks indicate the presence of a geometric effect. R2 represents the proportion of variance in the size of government "explained" by the model. We report b-values rather than beta coefficients in order to show the exact relationship (rather than only magnitudes of importance) between variables.

Figure 29: Statistically Suggested Groupings of Governments
(continued)

Group 6: Risk-averse social insurance governments			
These governments' size correlates strongly with changes in the sectoral distribution of national output (and the amount of resources these governments have to spend). Such a correlation suggests an organisational strategy which seeks to minimise the economically disruptive effects of asymmetric shocks and/or the shift in resources between sectors. **Members:** Australia , Belarus , Czech Republic , Estonia , Ireland , Latvia , Lithuania , Russian Federation and Slovak Republic			
	b-value	**se**	**R2=0.55**
Revenue to GDP	0.99	0.15	
Uncertainty Proxy	**		
Interaction between Uncertainty Proxy and Revenue to GDP	**		
Interaction between Uncertainty Proxy and Debt to GDP	**		
Group 7: Technology-adaptors			
These economies grow bigger as their economies are becoming more complex. **Members**: Bangladesh , Georgia , Guatemala , Indonesia , Kazakhstan , Mauritius , Mexico Oman , Peru , Thailand			
	b-value	**se**	**R2=0.82**
Complexity Proxy	-0.80	0.21	
Revenue to GDP	0.82	0.06	

Note: The groupings of countries shown in the figure reflect k-clustering – a statistically procedure which groups data according to the similarity of the data's variance. The procedure looks at variation in the entire dataset and constructs groups which minimise the variation in the data. We use these clusters of countries in order to test our model for each group of countries in order to estimate the way that changes in government size differs between groups of countries. The b-values show the change in government size (expenditure as a percent of GDP) for changes in the variables shown in the figure. Differences in these b-values indicate differences in the way that government size responds to the variable. For example, governments in group 1 expand 6% more for a similar increase in revenue-to-GDP in Group 2. Asterisks indicate the presence of a geometric effect. R2 represents the proportion of variance in the size of government "explained" by the model. We report b-values rather than beta coefficients in order to show the exact relationship (rather than only magnitudes of importance) between variables.

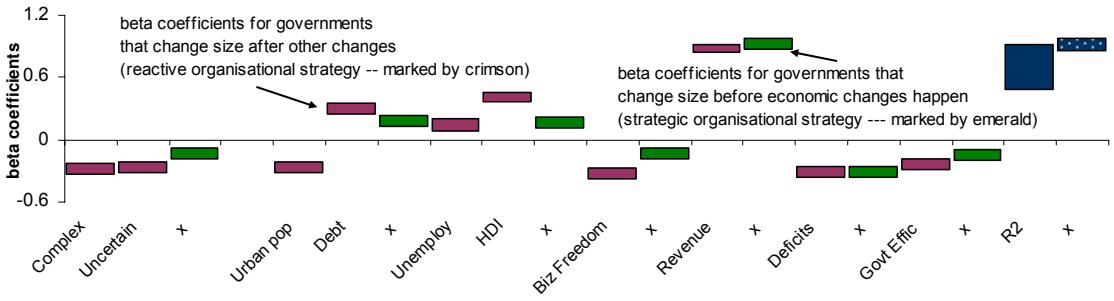
Hypothesis 3: Different countries will adapt reactively, strategically or contemporaneously to changes in the macroeconomic environment.

The data clearly show that changes in government size correspond with past and future (or expected) changes in their organisational environment. Changes in government size which correlate heavily with the previous year's changes in the organisational environment suggest a reactive public sector organisational strategy. Changes in government size which correspond to changes in future (next year's) changes in the organisational environment suggest a strategic or forward looking organisational adaptation. **In general, and across countries, government size exhibits elements of reactive, contemporary and strategic organisational adaptation.**

Except when responding to changes in revenues, much organisation adaptation seems reactive rather than strategic. Figure 30a presents the beta coefficients of regressions of government size on past and future values of organisational complexity, uncertainty and a range of structural factors (like the level of unemployment, debt and human development). In these regressions, government size increases with changes in past and expected macroeconomic uncertainty focused on the service-sector. Government size also decreases with past and expected macroeconomic uncertainty focused on the

industrial sector. Government size also decreases with changes in previous levels of the complexity of government's organisational environment – suggesting that government sizes may over-shoot in the short-term their equilibrium size as the complexity of government's organisational environment increases. Such a finding – along with the previous results showing that past government size strongly predicts present government size -- strongly supports the simulations from model we provide in this paper. **Governments will adjust their organisational size with an overall target level – sometimes overshooting or undershooting in any one period their adjustment to a shock in the organisational environment.**

Figure 30a: Changes in Resources and Long-Term Structural Factors Determine the Size of Reactive and Strategic Changes in Government Size



The bands shown in the graph represent the range of standardised beta coefficients over a range of models which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis. The variable capturing the effects of uncertainty is negative -- meaning that more resources move from industrial sectors into service sectors when as government size increases. We do not show in this figure the effect of the statistically significant control for a country's membership in its income group. Categories marked with an *x* denote beta coefficients for the model of strategic adaptation.

Dependent variables: Lagged governmemnt size (government expenditure as a percent of GDP regressed against variables in the previous year whose results are shown in crimson) and leading government size (regressed against variables in the subsquent year and whose results are shown in emerald).

Regression factors having little impact: Geographical group, population, governnment effectivness, changes in the complexity of the economic envrionment, changes in the uncertainty of the economic environment, GDP, and revenue.

Governments following a reactive organisational strategy adjust to a number of structural variables. They tend to shrink after their urban populations grows, they grow after they accumulate more debt, grow after unemployment becomes a bigger problem, they grow after their human development indices improve, and after they restrict business freedom (to paraphrase the regression results). They grow after revenue from the previous year increases, they shrink as previous year's government efficiency increases, and as deficits grow.

Governments following a strategic organisational strategy tend to adjust to expected changes in their organisational environment more than longer-term structural factors. They anticipate increased complexity and uncertainty of their economic environment by shrinking – following what we have flippantly labelled in our model as the Anglo-Saxon style of government. They respond strongest to expected changes in revenue – increasing size in the present period on the expectation of increased revenues in the future.

Yet, the data do not seem to support the view that particular types of countries – rich versus poor – have particularly reactive or strategic government organisational strategies. Figure 30b shows the explanatory power of the models we used for government size for low-income, medium-income and high-income countries. Looking only at the adjusted R-squared values of the models we used (and ignoring the margins

of error for each estimate), we find several counter-intuitive results. Models of strategic adaptation of government size have the highest explanatory power for low-income countries. Medium-income countries' government sizes seem to correlate most with contemporary changes in their organisational environment and other structural variables. Past values of the variables we analyse seem to explain best high-income countries' changes in government sizes.

Figure 30b: Explanatory Power of Three Models of Government Size for Low, Middle and High Income Countries

	Contempt Govt Size	Lagged Govt Size	Strategic Govt Size
Low-Income Countries	64%	34%	68%
Medium-Income Countries	89%	88%	87%
High-Income Countries	82%	84%	80%

The figure shows the R-squared coefficients for three models of government adaptation to changes in the government's organisational environment. We regressed – for the countries in each income group separately -- variables related to the uncertainty and complexity of government's organisational size as well as a range of control variables on the previous year's, current year's and following year's government sizes. For example, for medium-income countries, our regression of the current year's independent variables and control variables on the current year's government size yielded an R-squared of 0.89. We have highlighted in gray the model for each income-group with the highest R-squared value.

How can individual high-income countries demonstrate a strategic stance on organisational adaption (of their expenditure as a share of GDP), while as a group they demonstrate a reactive stance? The first explanation relates to the strong developmental aspects of low-income countries' governance. Low-income countries' governments have grown through the 2000s in order to tackle the problems of unemployment, low human development scores and so forth. High income countries, on the other hand – being much more complex and often tied together more tightly by trade and investment links – will respond to large scale changes in unemployment, demographic change or urbanisation after a period of reflection. For low-income countries, the direction of organisational change remains relatively clear – grow the government and the economy. In the high-income countries, the direction of organisational changes remains much less clear—as the demographic problems confronting Sweden will be drastically different than those of the USA.

Hypothesis 4: Government structure changes in response to changing uncertainty and complexity of the macroeconomic environment

Like the size of government, the structure of government should adapt to changes in the government's organisational environment. The proportion of spending on economic functions compared with social protection provides one proxy for larger changes in government structure (such as the creation of new departments, the transfer of functions from one agency to another and so forth). Figure 31a shows the exact composition of such spending – so that the reader might infer the changes in the structure of government which our proxy for the economic centralisation of government measures. Our proxy for changes in the composition of public expenditure includes spending on the "machinery of government" (as general government services – which most closely deals with the structure of government as a classical organisational theorist might conceive of the term). Our proxy also includes changes in economic affairs – spending on government programmes dealing with topics such as agricultural adjustment, forestry, fishing and

hunting programmes, as well as government programmes dealing with fuel and energy – and so forth. We divide expenditure in general public services and economic affairs by spending on social protection (which consists of spending expected in this category – on issues like pensions, unemployment benefits, regional support for disadvantaged regions and groups and so forth).

Figure 31a: Formula for Economic Structure

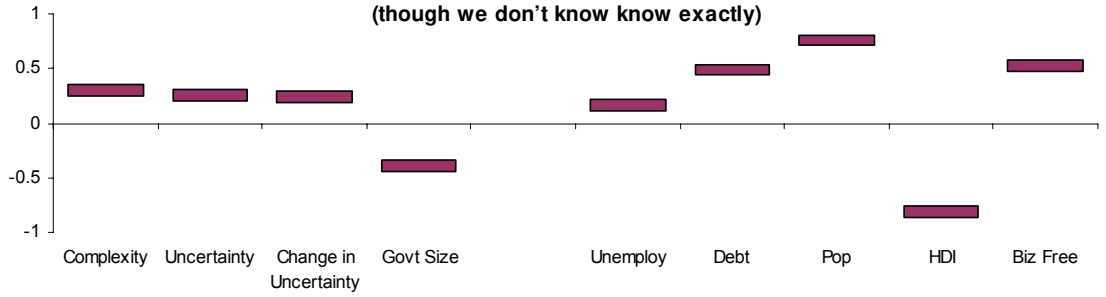
Economic Structure = Indicator	**General Public Services** executive and legislative organs, foreign economic aid, general services, basic research, R&D for general public services, general public services, public debt transactions, transfers between govt units	+	**Economic Affairs** general economic, commercial and labour affairs + agro, forestry, fishing and hunting + fuel and energy + mining, manufacturing and construction + transport + communication + other industries + R&D economic affairs
	Social Protection Sickness and disability + old age + survivors + family and children + unemployment + housing + social exclusion + R&D social protection		

Source: IMF Government Finance Statistics Manual (2001)

Despite the impression given by the authors reviewed in the literature review, government organisational structure (as proxied by economic centralisation) adjusts to changes in government's organisational environment. As shown in Figure 31b, governments operating in more uncertain and complex organisational environments tend – holding other variables constant and before looking at specific groupings of countries – to spend more on general government services and economic affairs as a proportion of their expenditure on social protection (which we describe as a more centralised economic centralisation indicator). Larger government sizes (as measured by government expenditure as a percent of GDP) also correlate with lower spending on general government services and economic affairs as a share of spending on social protection. We conclude then that **government's structure changes in response to changes in government's organisational environment – and smaller governments tend to focus their resources on economic affairs related activities instead of social protection.**

Changes in the composition of government expenditure (and thus possibly the structure of government) also correlates with a number of structural variables. Governments spend more general government services and economic functions as unemployment increases, as their debt increases and as population increases. These trends suggest that – for governments in general and holding other variables constant -- government policy seeks to grow out structural problems instead of alleviate them with palliative social protection programmes. The positive relation between increases in business freedom and expenditure on general government services and economic functions also corroborates this interpretation of these data. Such a trend is lamentable from a human development point of view. Lower government spending on social protection (relative to general government services and economic affairs) correlates with a country's lower human development indices.

Figure 31b: The Structure of Government Changes as the External Policymaking Environment Changes
(though we don't know know exactly)

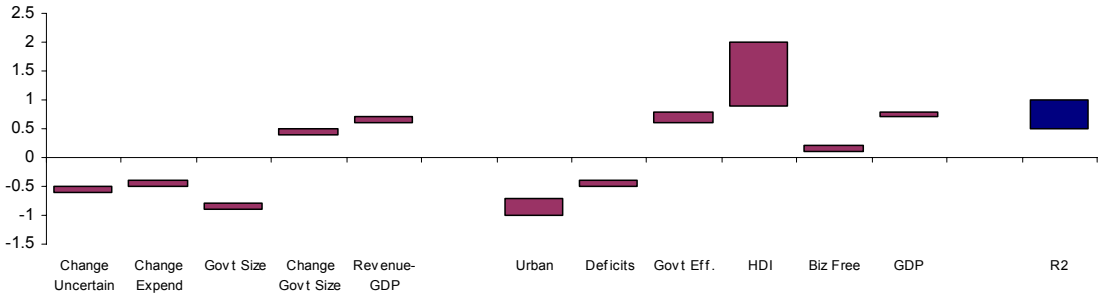


The bands shown in the graph represent the range of standardised beta coefficients over a range of models which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis. The variable capturing the effects of uncertainty and economic shocks is positive -- meaning that government spends more on general government services and economic functions relative to social protection as resources move into the industrial sectors from the service sectors.
Dependent variables: Proportion of government expenditure on generral government services and economic functions relative to expenditure on social protection (which proxies the organisational changes accompanying such a reallocation of expenditure).
Regression factors having little impact: Changes in complexity, changes in government size, revenue, changes in revenue year, deficits, percent of urban population as a share of total population, and government effectivenss.

The proportion of expenditure by central government – compared with the general government – also provides a measure of government structure. As discussed in the literature review, theory provides no clear-cut prediction about the effect that an increasingly uncertain and complex organisational environment would have on the allocation of expenditure between central government and the wider general government. On the one hand, governments should centralise as the organisational environment becomes more chaotic (as risk-averse governments seek to buffer themselves and the wider macroeconomy from disruptive output volatility) through co-ordinated and centralised government programmes. On the other hand, large and particularly diverse changes in government's organisational environment should lead to decentralisation – as government diverts resources to the areas where they can most directly affect changes in government's organisational environment.

Government centralisation responds more to structural variables and particularly fickle organisational environments. Figure 31c shows the effect of a number of variables on the level of central government spending relative to spending by the general government. Most significantly (from a practical point of view), such government centralisation does not statistically significantly correlate with changes in the uncertainty and complexity of government's organisational environment. However, government centralisation negatively correlates with the rates of change in the uncertainty and complexity of government's organisational environment. Governments decentralise as macroeconomic uncertainty and complexity speed up. **The structure of government (through decentralisation) responds more vigorously to fundamental structural factors and the speed of change of change in its organisational environment more than to change itself.**

Figure 31c: Centralisation Depends More on Structural Factors Than Government's Organisational Environment



The bands shown in the graph represent the range of standardised beta coefficients over a range of models which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis.
Dependent variables: The proportion of government expenditure at the central level compared with expenditure for the general government (reflecting local government and other entities).
Regression factors having little impact: Complexity of the economy, changes in the complexity of the economic envrionment, the level of shocks (uncertainty) in the economic environment, changes in GDP, changes in revenue, debt, and unemployment.

Our initial data provide contradictory views on the so-called Leviathan Hypothesis. As noted in the literature review, many authors have tested the extent to which regional and local government expenditure correlates with decreases in government sizes. Our data show that – controlling for the effects of government's organisational environment and other factors – larger governments (as a share of GDP) tend to have more decentralised structures (or at least expenditure). However, periods of rapid growth in government size tend to focus on central government growth rather than non-central government growth. Moreover, increases in government revenue (as a share of GDP) tend to pass to central government more than non-central government. **Our analysis thus finds very qualified support for the Leviathan Hypothesis – larger governments tend to have more non-central government expenditure (though rapidly growing government sizes do correlate with growth in revenue and expenditure of central government rather than non-central government).**

The extent of government centralisation also responds to more immutable structural variables. Government centralisation tends to correlate with higher human development indices, increased government efficiency, as well as higher levels of GDP and business freedom. These trends are impossible to interpret though -- as we can not tell if more central government results in overall higher government efficiency scores (for example) or whether a more efficient government prefers to govern centrally. This example – illustrating something called an endogeneity problem – makes the interpretation of these data difficult.

Hypothesis 5: Differences in the uncertainty and complexity of various countries' macroeconomic environments significantly explain changes in government structures.

Changes in the structure of government – in response to changes in government's policymaking environment – tend to fall into four categories. Figure 32 shows the results of cluster analysis which categorizes countries according to the variance in the composition of their governments' expenditure between general government services and economic affairs as opposed to social welfare spending.

Figure 32: Different Groupings of Countries According to the Way They Change Allocation of Expenditure (and Thus Most Likely Their Structures of Government) When Their Organisational Environment Changes

Group 1: Marginalist Response Governments			
The two governments in this group spend a tiny bit more on general government services and economic affairs as opposed to social protection (consequently causing minor changes in government structure) in response to the increased uncertainty and complexity of their organisational environment. **Members:** Greece and Italy			
	b	std.err	**R2=0.90**
Complexity Proxy	0.1	0.0	
Uncertainty Proxy	0.0	0.0	
Government Expenditure to GDP	0.1	0.0	
Group 2: Structure Follows Size			
Governments in this group spend a tiny bit more on general government services and economic affairs according to the overall size of the government. Such size could likely be tied to the overall complexity of the organisational environment and the government's ability to borrow. **Members:** El Salvador, Finland, Ireland, Moldova, Mongolia, Nepal, Netherlands, Norway, Poland Spain , Tunisia, Ukraine			
	b	std. err	**R2=0.60**
Complexity Proxy	-0.1	0.0	
Government Size	0.0	0.0	
Geometric Effect of Debt to GDP	**		
Group 3: Complex Adaptors			
These governments' expenditure – and thus possibly organisational structure – best exemplify the model presented in this paper. These governments' expenditure responds to the complexity and uncertainty of the economic environment. **Members:** Denmark, Germany , Netherlands, Sweden and Switzerland			
	b	std. err	**R2=0.88**
Complexity Proxy	-0.2	0.0	
Uncertainty Proxy	0.0	0.0	
Geometric Effect of Debt to GDP	**		
Interaction between Complexity and Uncertainty	**		
Interaction between Complexity and Debt-to-GDP	**		
Group 4: Developmentalist Governments			
These governments allocate more resources to general government services and economic affairs as their economic environment complexifies. **Members:** Czech Republic, Estonia, Indonesia, Ireland, Kazakhstan, Lithuania, Moldova, Norway, Spain and Thailand.			
	b	std. err	**R2=0.35**
Complexity Proxy	0.8	0.3	
Geometric Effect of Complexity	**		

Note: the figure shows the grouping of countries (for which the IMF provide data) according to the similarity of their composition of expenditure (as a proxy for changes in the structure of government), the complexity and uncertainty of their organisational environment and the amount of debt these governments take on (relative to their GDPs). We first used cluster analysis to divide the sample of countries into groups, according to the similarity of the variance in the variables we have just described. Using these groupings, we regressed the composition of expenditure (as our proxy to detect changes in government structure) on our proxies for the uncertainty and complexity of these governments' organisational environment – as well as range of other control variables. The b-values thus report the change in the structure of expenditure for a change in the variable listed in the figure. The R2 describes the proportion of the variance in this dependent variable explained by our group-specific regression. Asterisks indicate the presence of a geometric effect (which normal linear regression methods can not provide a slope for).

The first group of countries – consisting of Italy and Greece – have governments which statistically significantly change the composition of government expenditure in response to changes in the uncertainty and complexity of the external policymaking environment. These two countries increase their expenditure on general government services and economic affairs (as a proportion of their spending on social welfare) by about 10% for a one-unit change in our complexity proxy and about 1% for a 10% increase in government size. They edge, ever so slightly upward, such expenditure for a change in our uncertainty proxy. However, as shown by the extremely low (but still statistically significant) b-values, their response is extremely slight.

For governments in a second group of countries, the size of the government and the complexity of the organisational environment correlate with their composition of expenditure. These governments -- a mix of low and high-income countries – spend about 10% *less* on general government services economic functions (as a proportion of spending on social welfare) as the complexity of the economy increases (the stereotypical Anglo-Saxon style government we referred to when we described our model). Changes in these governments' composition of expenditure positively correlate ever so slightly with government size. However, governments in this group which rapidly incur debt tend to spend more on general government services and economic affairs than governments not rapidly increasing their debt burdens.

A third group of countries – most exemplifying the model we present in our paper – adapt the composition of government expenditure (and thus probably their structure of government) in response to changes in the organisational environment. As with the previous group, these governments tend to *withdraw* from spending on general government services and economic affairs as the nature of economic transactions in the macroeconomy complexifies. These governments also spend very slightly more on general government services and economic affairs (as a proportion of their spending on social welfare) as uncertainty in their economic environment increases – possible to "follow" the movement of resources between economic sectors. The composition of expenditure – and thus likely the structure of government – also changes, depending on the interaction of the complexity and uncertainty in the policymaking environment.

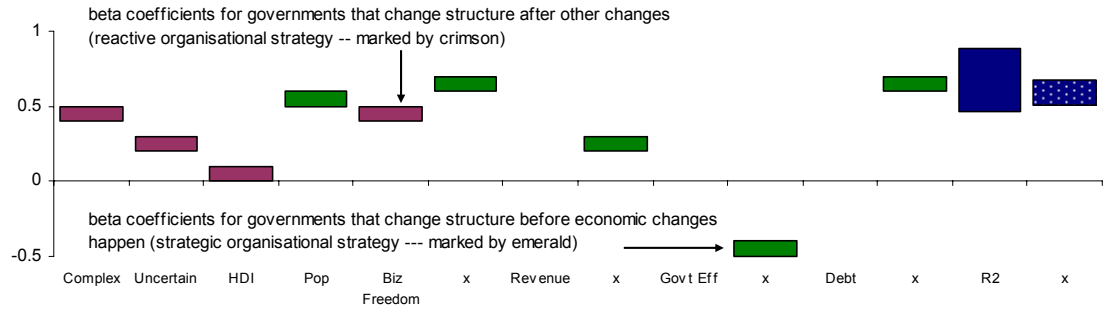
Governments in the final group change their composition of public expenditure (and thus likely their structure of government) mainly in response to changes in the complexity of their organisational environment. As shown by the *b*-value, a 1 point change in the complexity indicator (a proxy consisting of the log values of the value of high-tech, IT, industrial and service output as well as science-related publications and patents) correlates with a 0.8 point change in the amount of money these governments spend on general government services and economic affairs as to social protection. Moreover, governments in this group regulating very complex macroeconomic environments tend to change their expenditure on these general government services and economic affairs differently than those governments regulating relatively simple (un-complex) economic environments – as shown by the geometric effect on our complexity proxy.

Hypothesis 6: Different governments' structures can respond strategically, contemporaneously or reactively to changes in their macroeconomic environments

In theory, the structure of government expenditure should respond to changes in the external policymaking environment more quickly or slowing – depending on the preferences of the policymakers responding to these changes. Such changes in the structure of government may consist of altering their composition of expenditure between general government services and economic affairs (as opposed to social protection) or between the central government (as opposed to other government entities). Strategic adaption consist of changes in government structure which occur before changes in the policymaking environment – because policymakers anticipate these changes or observe the beginning steps of these changes and make large changes in government structure. Reactive adaption consists of changes in government structure occurring one year after the change in the policymaking environment – as policymakers are unwilling to unable to make changes sooner.

The data provide strong evidence that government organisational structure adapts reactively to changes in their organisational environment. Figure 33a shows the ranges of regression estimates for variables explaining past decisions to change government's allocation of spending (and thus indirectly its structure). Changes in the complexity and uncertainty of the policy environment correlate strongly with changes in the following year's allocation of expenditure on general government services and economic affairs (as opposed to social protection). Other structural variables – particularly the country's human development index values, population size and level of business freedom also positively correlate with the previous year's composition of government spending. We interpret these correlations as suggestive of a reactive adaptation of government organisational structure to its organisational environment (and a couple of other variables).

Figure 33a: Changes in the Policymaking Environment Lead to the Changes in Expenditure Priorities Which May Induce Changes in Governnment Structure



The bands shown in the graph represent the range of standardised beta coefficients over a range of models which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis. The variable capturing the effects of uncertainty is positive -- meaning that government spending on general government services and economic affairs increases as more resources move into the industrial sector from the service sectors.

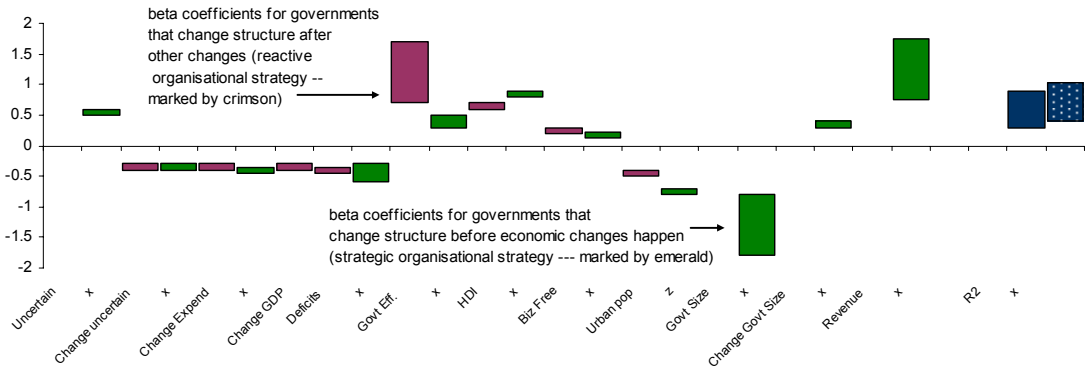
Dependent variables: Lagged proportion of expenditure on general government services and economic affairs relative to social protection (the economic structure indicator regressed against variables in the previous year) and the leading measure (regressed against variables in the subsquent year).

Regression factors having little impact: Changes in complexity, government size, changes in government size, government revenue, changes in government revenue, year, government debt, deficits, changes in absolute levels of government expenditure, government efficiency and the percent of the urban population.

The data also point to a limited amount of strategic adaption of government expenditure to changes in government's policymaking environment. Figure 33a also shows – in emerald bars – the range of regression coefficient values for variables regressed against the following year's composition of government spending. Government revenue (as a percent of GDP) and government debt both positively, statistically significantly correlate with a model of strategic adaptation of government structure (or at least the composition of expenditure). Such a correlation suggests that policymakers predict next year's level of revenues in deciding the current year's allocation of expenditure. Our regression analysis also strongly suggests that a number of structural variables determine strategic adaption of government structure. The next period's business freedom index values and government efficiency index represent two variables with the highest beta coefficients – suggesting these variables explain a relatively large amount of prescient (strategic) change in government organisational structure. **In brief, the data suggest that the structure of government (as measured by the allocation of government expenditure) adapts reactively to the uncertainty and complexity of its organisational environment and strategically to expected revenue and structural variables.**

Governments adopt many strategic responses in the centralisation of government structures in response to changes in their organisational environments. Figure 33b shows the results of regressions using the amount of expenditure at the central government level (as a proportion of general government expenditure) as a proxy for the structure of government. The predominance of emerald-coloured bars indicates that most of the variables we tested statistically significantly correlate with the previous year's change in central government expenditure. Increases in central government expenditure correlate with increased uncertainty in government's economic environment (as measured by the inter-sectoral reallocation of output) in the following year. Centralisation also correlates with increases in service-sector output (as opposed to industrial output) and with declines in government expenditure.

Figure 33b: Policymakers Generally Adopt Long-Term Decisions about the Centralisation of the Structure of Government



The bands shown in the graph represent the range of standardised beta coefficients over a range of models which were significantly different from zero with 95% confidence or better (higher). We may have transformed variables for their analysis. The variable capturing the effects of uncertainty and economic shocks is negative -- meaning that more resources move from industrial sectors into service sectors when as government size increases.
Dependent variables: Lagged percent of central government expenditure relative to general government expenditure (the centralisation indicator regressed against variables in the previous year) and the leading measure (regressed against variables in the subsquent year).
Regression factors having little impact: Complexity, changes in complexity, changes in government size, GDP, government revenue, changes in government revenue, country-specific effects, unemployment, government size (expenditure as a percent of GDP), and debt.

Measures of the structure of government focusing on centralisation (expenditure by the central government rather than other parts of government) weakly support the Leviathan Hypothesis. Increases in central government expenditure precede changes in revenue (suggesting that policymakers choose central government spending in part based on expectations about future revenues). Increased central government expenditure (relative to expenditure by other levels and parts of government) positively correlates with governments growing their government sizes quickly in the subsequent year. However, central government expenditure negatively correlates with large government sizes in the subsequent period.

Strategic changes in government structure (as measured by central government expenditure) correlate strongly with a number of slow-changing, structure variables. Central government expenditure (as a proportion of general government spending) rises in anticipation of higher levels of next year's government efficiency, human development indices, and business freedom. Such spending falls in anticipation of rising deficits and urban populations

Governments also adopt many reactive responses in the centralisation of government structures in response to changes in their organisational environments. Reactive changes in government structure (as proxied by the following year's changes in central-to-general government expenditure) correlate strongly with several (mostly structural) variables. Central government expenditure (relative to general government expenditure) increases with increases in the previous year's government efficiency, human development index, and business freedom. Increases in urbanisation seem to correlate with decentralisation (or at least decreases in central government spending relative to general government spending). **In brief, the statistical significance of past, present, and future values of model variables, combined with the importance of several structure variables, points to long-run decisions about the structure of government (as measured by central government expenditure relative to general government).**

Conclusions

The size and structure of government responds to changes in the government's organisational environment – much as predicted by organisational theory (theories). Some governments, at some times, adapt their organisational sizes and structures in line with the predictions of contingency-theory. Other governments, at some times, engage in organisational buffering – refusing to adjust size and structure to the uncertainty and complexity inherent in their organisational environments. Other governments tie size and structure to the resource available (in line with resource-based explanations of organisational strategy). Some governments – and we provide lists of countries for whose experience correspond to each of these theories – seem to adjust their organisational sizes and structures "rationally" (in anticipation of future changes in their organisational environments).

In this paper, we present a model of the size and structure of government which depends on the uncertainty and complexity of governments' organisational environments (and other controlling variables). We find statistical support for the classical view that government size and structure adapts to changes in the external policymaking environment. We categorise governments into seven types (depending on the way they adopt government size to increasing uncertainty and complexity of their organisational environments). We find strong evidence that some governments change their size

reactively (after) changes in the policymaking environment while others change them strategically (before asymmetric shocks or increased production of high-tech output occurs).

We also find statistical support for the classical view that the structure of government – or at least two proxies of government structure -- also adapts to changes in the government's organisational environment. We find four groupings governments – according to the way they modify their organisational structures in response to changes in the uncertainty and complexity of their organisational environment. We also find evidence for strategic and reactive structural adaptation in response to these changes in the government's organisational environment. As an addition, rather than a contradiction, we find a set of countries which do not significantly modify their size and structure in response to changes in their macroeconomic environment. Instead, these governments change their size and structure according to the revenues available.

These findings – probably some of the first comprehensive (or extremely tentative) attempts at testing the basic theories we all learn in public administration – provide only the start of a deeper debate on the relation between the public sector organisational environment and government organisation. The question lies not in which theory of organisational theory is right – but instead which theory is right for which country, during which time period, and to what extent. Further empirical work will help to answer these questions.

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Appendix I: The Model

Basic Set-Up

We start from a group of individuals (citizens) who are (as usual) profit maximising and risk averse. They produce output (Y) and either consume part of the resulting output (*c*), invest part (*i*), trade with foreigners for other goods they desire (*nx*) or "invest" part of their output in government (*g*). These citizens will want to invest in government in order to obtain public goods which improve their other investment and consumption possibilities. Governments collect resources for use through taxation – such that government consumption *g* will equal taxes *t*. These individuals' investment in *g* will thus equal $gY = Y - cY - iY - nxY$ which implies that $g = 1-c-i-nx$. We assume that investment in government depends on the relative risk and return of investments in other areas of the economic -- like future output and trade as well as the risk and return of receiving output in the next period. If we denote the rate of return for investment as r_I (and the other rates of return similarly) and the unpredictability of investment as σ_I (and the unpredictability of the other variables similarly), then we can represent the investment in government "size" as

$$g = t = c - i\,(r_I, r_G, r_Y, \sigma_I, \sigma_G, \sigma_Y) - nx\,(r_X, \sigma_X, r_G, \sigma_G, r_Y, \sigma_Y) \qquad (1).$$

Given the logic in equation (1), the **size of government must equal the resources available for government spending – which is determined by risks and rewards of investment in various sectors of the economy.**

Looking more specifically at the output side of the economy, we assume a 4-sector economy. These sectors consist of an agricultural sector (whose output we denote by Y_a), low-tech industrial sector (Y_i), a low-tech service sector (Y_s), and a high-tech sector which produces everything the low-tech industry and service sectors do not (Y_h). Output thus can be divided into:

$$Y = Y_a + Y_i + Y_s + Y_h \qquad (2).$$

Rates of return in the high-tech sector determine the returns on investment in the overall economy. Production in an economy will start from agricultural production, such that $Y=Y_a$ – until superiour returns for industrial production divert resources away into industrial production. At that point, overall returns in the economy will be such that $r_y=r_a=r_i$ (where the sub-script on the rate of return corresponds with the sector in which workers create output). Output will start to "fill in" in other the other sectors of the economy; until the rate of return on high-tech output starts to exceed rates of return in other parts of the economy. At that point, returns on high-tech output will need to exceed returns in other parts of the economy in order to draw resources into that sector. **Given the almost axiomatic role played by rates of return in high-tech sector, the size of the high tech sector must reflect the complexity of the economy and economic relations**.

The perceived unpredictability of investment will depend on the extent to which resources move between sectors – as proxied by differences in the sectoral composition of output. Imagine that – because of changing rates of returns in a sector – the majority

of output in any one year comes from agriculture. Subsequently, rates of return in the industrial sector start to pull resources into industrial production. At this point, citizens may wish to invest in government-produced social goods -- like electric cables, roads and city infrastructure – because these investments will raise the overall rate of return on industrial production. Or these citizens may wish to "invest" part of their output in government as a hedge against an agricultural disaster or industrial accident – and both events would reflect the proportion of agricultural to industrial output. Government also serves as useful savings vehicle – providing more security than leaving resources with neighbours as "deposits" (in our simple model, we do not need banks). Large shifts in output from one sector to another make investors less sure about where to invest their resources – and where government should invest in social goods and social protection. **Given the almost axiomatic role played by the relative distribution of output between sectors, changes in the allocation of output between sectors must reflect uncertainty of the economy and economic relations**.

Size of government

Given the exposition above, the size of government should be a function of tastes and technology, economic uncertainty, complexity and resources available to the government. The proportion of output "invested" in government equals *g*, such that the size of government equals *g*Y. Equation (1) indicates that the proportion of output invested in government, as well as the overall size of the economy Y are functions of risks and returns in various sectors of the economy. Substituting equation (2) into equation (1) yields

$$g = t = c - i\,(rY_a, rY_i, rY_s, rY_h, \sigma_a Y_a, \sigma_i Y_i, \sigma_s Y_s, \sigma_h Y_h) \quad (3a).$$
$$- nx\,(r_X, \sigma_X, r_G, \sigma_G, r_Y, \sigma_Y)$$

We can express each of these functions as linear functions, in order to make the maths easier. We can also assume (as we described above) that the rate of return on investment in all sectors equates to the highest rate of return.in any particular sector. Including these two assumptions gives us the following equation (and we explain each of these coefficients below)

$$g = t = c - \alpha_a rY_a - \alpha_i rY_i - \alpha_s rY_s - \alpha_h rY_h - \gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s \quad (3b)$$
$$- \gamma_h \sigma_h Y_h - \beta_x r_x + \gamma_x \sigma_X - \alpha_G r - \gamma_g \sigma_G + \alpha_Y r - \gamma_Y \sigma_Y$$

and rearranging terms a bit yields the following equation

$$g = [c - \alpha_G r - \gamma_G \sigma_G Y_G + \alpha_Y r - \gamma_Y \sigma_Y - \alpha_x r_x] + [\alpha_a rY_a - \alpha_i rY_i - \alpha_s rY_s] - \quad (3b).$$
$$[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s - \gamma_h \sigma_h Y_h + \gamma_x \sigma_x] - \alpha_h rY_h$$

The first set of parameters describes a **desired level of government** determined by tastes and technology. In this case, these tastes consist of consumption *c*, some natural desired pass-through effect of dividends of work into public goods α_G and aversion (γ_G) to the riskiness of government production σ_G (which depends on the way citizens organise their government). Such an intrinsically desired size of government also depends on overall economic risk σ_Y and the desire to contribute to government (α_x) in order to improve returns from the tradeable sector (to make up for future trade deficits, etc.). If

we simplify these effects into a single parameter (which we would estimate using regression analysis), we could represent these effects as g*, such that

$$g^* = [c - r(\alpha_G + \alpha_Y - \alpha_x) - [\gamma_Y \sigma_Y - \gamma_G \sigma_G] \quad (4a).$$

The next set of variables describe the amount of money citizens desire to give as taxes in order to improve output (through improving overall rates of return) in various sectors of the economy. Tax revenue *t* – representing the **resources available to the government** -- equals some proportion of output citizens want to set aside from the agricultural sector $\alpha_a rY_a$, the industrial sector $\alpha_i rY_i$, and service sector $\alpha_s rY_s$. The uncertainty of the macroeconomy – which we label innocuously as σ_y – depends on uncertainty in each sector of the economy $\{\sigma_a, \sigma_i, \sigma_s, \sigma_h\}$ and the aversion citizens have to each type of risk $\{\gamma_a, \gamma_i, \gamma_s, \gamma_h\}$. If β_t represents the effect that changes in output have on government size, then (rearranging the terms a bit from equation 3b gives the effect of revenue (taxes) as

$$\alpha_a rY_a - \alpha_i rY_i - \alpha_s rY_s = \beta_t (Y_a + Y_i + Y_s)$$

or

$$r(\alpha_a \frac{Y_a}{Y} - \alpha_i \frac{Y_i}{Y} - \alpha_s \frac{Y_s}{Y}) = \beta_t t \quad (4b).$$

As noted above, government size should also depend on the **complexity of the economy** the government regulates and transacts in. Our simple model tells us that the government will want to "match" the expansion of the economy in the high-tech area by a fixed amount α_h. The effect of macroeconomy complexity on government size, if we re-label complexity as z and the effect αr_h as $\beta_z z$, equals

$$\beta_z z = \alpha_h rY_h \quad (4c).$$

The **effect of macroeconomic uncertainty** on government size represents the most complex effect. If we denote β_y (beta with a little y sub-script rather than a big Y because big Y denotes national output) and use the terms describing the effects of such uncertainty from equation 3b, then the effect of macroeconomic uncertainty (as proxied by changes in the inter-sectoral composition of output) equals $\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s = \beta_y \frac{Y_i - Y_s}{Y_a}$. With a bit of algebra, we can show that $1 - \frac{\gamma_i \sigma_i Y_i}{\gamma_a \sigma_a Y_a} - \frac{\gamma_s \sigma_s Y_s}{\gamma_a \sigma_a Y_a} = \beta \frac{Y_i - Y_s}{Y_a}$ which equals $[\frac{\gamma_i \sigma_i Y_i}{\gamma_a \sigma_a Y_a} - \frac{\beta Y_i}{Y_a}] + [\frac{\gamma_s \sigma_s Y_s}{\gamma_a \sigma_a Y_a} - \frac{\beta Y_s}{Y_a}] = 1$. By rearranging terms, we find that $[\frac{(\gamma_i \sigma_i - \beta)}{\gamma_a \sigma_a}] \frac{Y_i}{Y_a} - [\frac{\beta - \gamma_s \sigma_s}{-\gamma_a \sigma_a}] \frac{Y_s}{Y_a} = 1$ or $\frac{(\gamma_i \sigma_i - \beta)}{\gamma_a \sigma_a} \frac{Y_i - Y_s}{Y_a} = 1$ or $\beta \frac{Y_i - Y_s}{Y_a} = \gamma_i \sigma_i \frac{Y_i - Y_s}{Y_a} - \gamma_a \sigma_a$. Finally, solving for our parameter and variable of interest leads to equation (4d)

$$\beta_y y = \gamma_i \sigma_i \frac{Y_i - Y_s}{Y_a} - \gamma_a \sigma_a \quad (4d)$$

As such, equation 3b can be expressed – for the purposes of regression analysis – as

$$G = g^* + \beta_y y + \beta_z z + \beta_t t \quad (5a)$$

which, if expanded to show all the parameters included in $\{\beta_y, \beta_z, \beta_t\}$ equals

$$\boxed{g = g^* + r(\alpha_a \frac{Y_a}{Y} - \alpha_i \frac{Y_i}{Y} - \alpha_s \frac{Y_s}{Y}) + \gamma_i \sigma_i \frac{Y_i - Y_s}{Y_a} - \gamma_a \sigma + \alpha_h r Y_h} \quad (5b)$$

Equation 5b leads to hypotheses about our **first hypothesis** that the size of government depends on uncertainty and complexity of the government's organisational environment. In order to find the effect of uncertainty and complexity on government size, we differentiate equation (5b) by a small change in output in one sector. The expected change in the size of government for changes in the complexity of the organisational environment is simply the elasticity of change with respect to output change in the high-tech sector or $\frac{\partial g}{\partial Y_h} = \alpha_h r$. The effect of changes in uncertainty on government size depends on which sector is affected. We will look at the effect of a change in industrial output just to show the intuition of our analysis. Differentiating equation 5b by a change in industrial output yields $\frac{\partial g}{\partial Y_i} = +r\alpha_i \frac{\partial Y_i}{\partial Y} + \gamma_i \sigma_i$.

The effect of different natural preferences for changing government size in response to changes in macroeconomic complexity and uncertainty – as suggested by our **second hypothesis** – simply equals partly the intercept of our regression equation $g^* = [c - r(\alpha_G + \alpha_Y - \alpha_x) - [\gamma_Y \sigma_Y - \gamma_G \sigma_G]$. In addition, to the extent that different countries' citizens prefer to contribute differing amounts of resources in response to changes in sectoral output, then the other part of this effect equals $\frac{\partial g}{\partial Y_i} = +r\alpha_i \frac{\partial Y_i}{\partial Y} + \gamma_i \sigma_i$

where $\{\alpha_{ij}, \gamma_{ij} \neq \alpha_{i(j+1)}, \gamma_{i(j+1)}$ for country *j*).

The reactive, contemporaneous and/or strategic response of government size to changes in the macroeconomic environment – as suggested by our **third hypothesis** – depend only policymakers' preferences. We need to expectation operators and lagged operators to equation 3b in order to find these effects. We denote these operators with a super-script *e*, which denotes an expected value and a sub-script *t-1* denotes the previous year's value. We reflect policymakers' preferences for responding in the present period to expected changes in the macroeconomic environment by γ^e (for changes in the expected uncertainty of the macroeconomic environment) and λ^e (for changes in the expected complexity of the macroeconomic environment). The parameters reflecting policymakers' preferences for responding in the subsequent period to the present period's changes in the macroeconomic environment equal γ_{t-1} (for the effect of the present period's uncertainty on later government size) and λ_{t-1} (for the effects of current environmental complexity on later changes in government size). Substituting these parameters into equation 3b gives

$$g = g^* + r(\alpha_a \frac{Y_a}{Y} - \alpha_i \frac{Y_i}{Y} - \alpha_s \frac{Y_s}{Y}) + \gamma_i \sigma_i \frac{Y_i - Y_s}{Y_a} - \gamma_a \sigma + \alpha_h r Y_h + \gamma^e [r(\alpha_a \frac{Y_a^e}{Y^e} - \alpha_i \frac{Y_i^e}{Y^e} - \alpha_s \frac{Y_s^e}{Y^e}) +$$
$$\gamma_i \sigma_i \frac{Y_i^e - Y_s^e}{Y_a^e} - \gamma_a \sigma] + \lambda^e \alpha_h r Y_h + \gamma_{t-1} [r(\alpha_a \frac{Y_{a(t-1)}}{Y} - \alpha_i \frac{Y_{i(t-1)}}{Y} - \alpha_s \frac{Y_{s(t-1)}}{Y}) + \gamma_i \sigma_i \frac{Y_{i(t-1)} - Y_{s(t-1)}}{Y_{a(t-1)}} - \gamma_a \sigma] + \lambda_{t-1} \alpha_h r Y_h$$

and completely differentiating yields for shocks in the industrial sector $\frac{\partial g}{\partial Y_i \partial Y_{i(t-1)} \partial Y_i^e} = r\alpha_i \frac{\partial Y_i}{\partial Y} + \gamma_i \sigma_i + \gamma^e [r\alpha_i \frac{\partial Y_i^e}{\partial Y^e} + \gamma_i \sigma_i] + \gamma_{t-1} [r\alpha_i \frac{\partial Y_{i(t-1)}}{\partial Y} + \gamma_i \sigma_i]$, while complete differentiation gives the effects of expected, present and past changes in sectoral output (in this case high-tech output) as $\frac{\partial g}{\partial Y_h \partial Y_{h(t-1)} \partial Y_h^e} = \alpha_h r Y_h + \lambda^e \alpha_h r Y_h^e + \lambda_{h(t-1)} \alpha_h r Y_{h(t-1)}]$·

Structure of government

Government structure responds to **uncertainty** in the macroeconomic environment by increasing spending in the sector experiencing a macroeconomic shock. We know – from our differentiation of equation 3b -- that government size responds to shocks by $\frac{\partial g}{\partial Y_i} = +r\alpha_i \frac{\partial Y_i}{\partial Y} + \gamma_i \sigma_i$. Government size changes in three ways in response to a sectoral shock. Government expenditure will respond to the extent that such expenditure: a) increases the productivity of industrial investment, b) it affects other sectors of the economy and, c) hedges against unwanted risks (unemployment, significant decreases in income, and so forth). We assume that this overall increase in the size of government can be divided into two parts. Part of the increase in government size will occur to respond – using spending on what we label empirically as "economic affairs" – to risks in the industrial sector γ_i. Part of the increase will deal with the effects in other parts of the economy by expenditure on what we have empirically referred to as expenditure on "social welfare" (though for modelling purposes, we assume that such expenditure is anything except spending on economic affairs and we use the sub-script *o* to denote spending on other sectors). If θ represents the overall proportion of expenditure on economic affairs and (1-θ) represents spending on other sectors, then $\frac{\partial g}{\partial Y_i} = r\alpha_i \frac{\partial Y_i}{\partial Y} + \gamma_i \sigma_i = \theta g_i + (1-\theta) g_o$ and expressed as a proportion $\frac{\theta g_i}{(1-\theta) g_o} = \frac{r\alpha_i}{\gamma_i \sigma_i} \frac{\partial Y_i}{\partial Y}$. Because $\frac{\partial Y_i}{\partial Y} = r$ because any growth in the economy must reflect the rate of return on investment *r*, the structure of government (the proportion of expenditure on economic affairs relative to expenditure on social protection) equals (when there are no technologically-improving shocks and affect the complexity as well as uncertainty of the macroeconomic environment)

$$\frac{g_i}{g_o} = \frac{r^2 \alpha_i}{\gamma_i \sigma_i} \quad \text{when} \quad \frac{g_h}{Y_h} = 0 \qquad (6a).$$

However, we need to find the <u>change</u> in government structure for changes in macroeconomic complexity. In our simple economy, all uncertainty stems from the high-tech sector (where all new inventions are made). In order to solve this equation, we need to make some simplifying assumptions. We assume that $Y=Y_a+Y_i+Y_s$ and assume that all risk aversions are the same ($\gamma_a\sigma_a= \gamma_i\sigma_i = \gamma_s\sigma_s$) so that if

$$\frac{g_o}{g_h} = \frac{g^*}{\alpha_h r Y_h} + \frac{t}{\alpha_h r}\frac{Y_a - Y_i - Y_s}{Y_h} - \frac{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]}{\alpha_h r Y_h} - \frac{\gamma_h}{r} - 1 \qquad (6b)$$

$$\frac{\partial(g_o / g_h)}{\partial Y} = \alpha_h r Y_h [t - \gamma_i \sigma_i] \qquad (6c).$$

and finally, to find the change in uncertainty (given the way that government expenditure in the non-high tech sectors changes), we need to apply the proportion of change in the industrial sector to changes overall government. Thus,

$$\beta_y = \frac{g_i}{g_o}\frac{\partial(g_o / g_h)}{\partial Y} = \frac{r^2 \alpha_i}{\gamma_i \sigma_i}\alpha_h r Y_h [t - \gamma_i \sigma_i] \qquad (6d).$$

Sector-specific government spending (as one proxy for the structure of government) will respond to changes in the **complexity** of the organisational environment in a slightly different way. Any change in complexity of the government's organisational environment will (by our own assumptions) be equivalent to an asymmetric shock to the economy's high-tech sector. Such a shock will increase the overall size of government (by increasing the size and complexity of the economy) and lead to specific-specific spending on all sectors which experience gains in productivity coming from the high-tech sector. The proportional response of government expenditure to changes in macroeconomic complexity will equal overall government size as a proportion of the size of the high-tech sector (from whence all complexity comes).

$$\frac{g_h}{g_o} = \frac{\alpha_h r Y_h}{[c - \alpha_G r - \gamma_G \sigma_G Y_G + \alpha_Y r - \gamma_Y \sigma_Y - \alpha_x r_x]} + \frac{\alpha_h r Y_h}{[\alpha_a r Y_a - \alpha_i r Y_i - \alpha_s r Y_s]} - \frac{\alpha_h r Y_h}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s - \gamma_h \sigma_h Y_h + \gamma_x \sigma_x]} - 1$$

We can now also drop the assumption that citizens pay "a la carte" – contributing resources to government to the extent they find such contributions useful in any particular sector. We thus equate all α's to the tax rate *t* – giving:

$$\frac{g_h}{g_o} = \frac{\alpha_h r Y_h}{g^*} + \frac{\alpha_h r}{t}\frac{Y_h}{Y_a - Y_i - Y_s} - \frac{\alpha_h r Y_h}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]} - \frac{r}{\gamma_h} - 1 \qquad (6b).$$

and remembering that a change in government size equals $\frac{\partial g}{\partial Y_h} = r\alpha_h \frac{\partial Y_h}{\partial Y} + \gamma_h \sigma_h$, we have $\frac{\partial Y_h}{\partial Y} = r$ for any change in economic complexity, leading to

$$\frac{\partial(g_h / g_o)}{\partial Y_h} = r^2 \alpha_h + \gamma_h \sigma_h + \frac{\alpha_h r Y_h}{g^*} + \frac{\alpha_h r}{t}\frac{Y_h}{Y_a - Y_i - Y_s} - \frac{\alpha_h r Y_h}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]} - \frac{r}{\gamma_h} - 1 \qquad (6c)$$

The structure of government should change with changes in macroeconomic complexity (which we relabel as z) by differentiating equation (6c) such that

$$\partial \frac{g_h}{g_o} / \partial z = \frac{\alpha_h r z}{g^*} + \frac{\alpha_h r z}{t(Y_a - Y_i - Y_s)} - \frac{\alpha_h r z}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]} - \frac{r}{\gamma_h} - 1$$

$$\partial \frac{g_h}{g_o} / \partial z = \frac{\alpha_h r}{g^*} + \frac{\alpha_h r}{t(Y_a - Y_i - Y_s)} - \frac{\alpha_h r}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]}$$

$$\beta_z = \partial \frac{g_h}{g_o} / \partial z = \alpha_h r \left[\frac{1}{g^*} + \frac{1}{t(Y_a - Y_i - Y_s)} - \frac{1}{[\gamma_a \sigma_a Y_a - \gamma_i \sigma_i Y_i - \gamma_s \sigma_s Y_s + \gamma_x \sigma_x]} \right]$$

$$\beta_z = \alpha_h r \left[g^* + (t - \gamma_a \sigma_a) Y_a - (t + \gamma_i \sigma_i) Y_i - (t + \gamma_s \sigma_s) Y_s + \gamma_x \sigma_x \right]^{-1} \quad (6d)$$

The change in the structure of government for a **change in revenues** (and thus taxes) equals:

$$\beta_t = \partial \frac{g_h}{g_o} / \partial t = \frac{1}{\alpha_h r} \frac{Y_a - Y_i - Y_s}{Y_h}$$

We can combine all these effects in order to predict the parameters our regression equation would show. If we have our normal equation, $\frac{g_h}{g_o} = \frac{g_h}{g_o}^* + \beta_y y + \beta_z z + \beta_t t$, then we have:

$$\boxed{\begin{aligned} \frac{g_i}{g_o} &= \frac{g_h}{g_o}^* + \frac{1}{\alpha_h r} \frac{Y_a - Y_i - Y_s}{Y_h} t + \frac{r^2 \alpha_i}{\gamma_i \sigma_i} \alpha_h r Y_h [t - \gamma_i \sigma_i] y \\ &+ \alpha_h r \left[g^* + (t - \gamma_a \sigma_a) Y_a - (t + \gamma_i \sigma_i) Y_i - (t + \gamma_s \sigma_s) Y_s + \gamma_x \sigma_x \right]^{-1} z \end{aligned}} \quad (7)$$

Another definition of the structure of government may comprise **expenditure by central government compared with non-central government**. In order to make the model tractable, we might assume that central government only responds to *symmetric shocks* – shocks which affect Y_a, Y_i,Y_s, Y_h equally (they diffuse from the high-tech sector and affect the other sectors – like the import of patents or licensing agreements for technologies like the personal computer). Government will respond to non-symmetric shocks by increasing the amount of non-central to central government expenditure – which is equivalent to reducing the central government to total government expenditure ratio g_c/g. In response to non-symmetric shocks, the government spending will respond reciprocally with the case above. Therefore, central government expenditure (as our proxy for the structure of government) will respond as

$$\frac{g}{g_c} = \left[\frac{g_h}{g_o}\right]^{-1} = \left[\begin{aligned} &\frac{g_o}{g_h}^* + \frac{\alpha_h r Y_h}{Y_a - Y_i - Y_s} t + \frac{\gamma_i \sigma_i}{\alpha_h r Y_h [t - \gamma_i \sigma_i] r^2 \alpha_i} y \\ &+ \alpha_h r \left[g^* + (t - \gamma_a \sigma_a) Y_a - (t + \gamma_i \sigma_i) Y_i - (t + \gamma_s \sigma_s) Y_s + \gamma_x \sigma_x \right] z \end{aligned} \right] \quad (8a)$$

We know that these shocks only come from the high-tech sector – but affect all sectors equally. So we only need to look at that proportion of government spending which responds to the shock as g_h, but treat the effect on all sectors of the economy equally. Thus, taking equation 6b and treating all sectors of the economy equally gives

$$\frac{g_h}{g_o} = \frac{\alpha_h r.25Y}{g^*} - \frac{\alpha_h r}{t} - \frac{\alpha_h r.25Y}{[\gamma_a\sigma_a.25Y - \gamma_i\sigma_i.25 - \gamma_s\sigma_s.25Y + \gamma_x\sigma_x]} - \frac{r}{\gamma_h} - 1$$

$$\frac{g_h}{g_o} = \alpha_h r[\frac{1}{4}\frac{Y}{g^*} - \frac{1}{t} + \frac{1}{\gamma_a\sigma_a - \gamma_i\sigma_i - \gamma_s\sigma_s + \gamma_x\sigma_x} - \frac{1}{\alpha_h\gamma_h}] - 1 \qquad (8b).$$

The equation above suggests that the effect of resources should be such that $\beta_t = \alpha_h r[\frac{1}{4}\frac{Y}{g^*} - \frac{1}{t}]$, $\beta_y = \alpha_h r\frac{1}{\gamma_a\sigma_a - \gamma_i\sigma_i - \gamma_s\sigma_s + \gamma_x\sigma_x}$ and $\beta_z = -\alpha_h r[-\frac{1}{\alpha_h\gamma_h}]$.

Functional Form for Regression Analysis

The equations derived above do not yet yield usable regression analyses. In equation (3c), we derived a testable equation for the size of government as $G = g^* + \beta_y y + \beta_z z + \beta_t t$. We showed that several of the coefficients (β_y and β_z in particular), likely have non-linear effects on government expenditure. If we start our analysis from the regression equation rather than micro-fundamentals, we might have an equation such as

$$g = g^{*'} + \beta_y^{'} y^{\rho 1} + \beta_z^{'} z^{\rho 2} + \beta_t^{'} t + \eta + \varepsilon_G \qquad (4a)$$

In this case, g*' represents the "natural" or desired size of government (just like in the derivation part of this section). The parameter β_y' can be interpreted as an amortisation effect (the effect of government in reducing uncertainty). The parameter $\rho 1$ represents risk aversion (as more uncertainty translates in bigger desired amortisation). The parameter β_z' represents a co-ordination effect (bigger government needed to put together different parts of a complex economy). The parameter ρ_2 represents the complexity size effect (more complex economies need geometrically more (or less) "putting together"). The parameter β_t estimates the effect of resources on government size (where *t* represents government revenues).

In the real world, several variables are likely to affect government expenditure in ways not envisioned in our Robinson Crusoe model depicted in the previous section. Real-world governments will expand expenditure as population and land mass increase (to serve a larger citizen base). Real world governments run deficits and resort to debt finance – breaking the link between revenue and expenditure in any period. Real world governments also operate with differing levels of efficiency (affecting how well they use they money they spend) and often have particular policy targets (like a target level of social development). We represent these variables by the vector η (which we show as just another normal variable for the time being and discuss more fully below). Finally, ε represents random factors (terrorist attacks, etc.) which might pull government size away from its long-term equilibrium level.

Economic and statistical theory suggest that we need to modify the simple empirical model of government size shown by equation 9. We may wish to analyse the rates of change of our variables. If we use levels, we have infra-marginal effects which distort our analysis – though better regression results using levels rather than rates of change will show demonstrate the importance of these infra-marginal effects. Specifically, statistically significant levels would indicate a desired government size. If Δ_i represents a difference operator, then taking a total difference of equation (9) above – for i where i is time or differences across countries – yields

$$\Delta_i g = g^* + \gamma_1 \Delta y^{\beta 1} + \gamma_2 \Delta z^{\beta 2} + \gamma_3 t + \eta + \varepsilon_G$$

We must also find the log values of variables – in order to obtain elasticities of changes in government size as well as to correctly estimate the geometric effects of uncertainty and complexity of the organisational environment on government size. Remembering that the difference of log variables gives a rate of change, variables like ln ΔG refer to the difference in the log values of a variable – like government expenditure. For illustrative purposes, we show the log value of the variables in η – though during the actual regression, several of the variables may not use log values. The final result comes to roughly

$$\boxed{\ln \Delta G = \ln g + \beta_1 \ln \gamma_1 \Delta \ln y + \beta_2 \ln \gamma_2 \Delta \ln z + \ln \gamma_3 \Delta \ln t + \ln \eta + \ln \varepsilon_G} \qquad (4b)$$

The **structure of government** – or at least the allocation of public expenditure across functional categories – can (as shown in the theoretical sector) take roughly the same form as equation (10) above. Let *x* represent a proxy for the structure of government – and specifically the ratio of expenditure on a sub-set of government services relative to all government spending. Using the same functional form – implied by equation (4) in the analytical section – we have

$$x = x^* + \zeta_y y^{\varphi 1} + \xi_z z^{\varphi 2} + \zeta_t t + \omega + \ln \varepsilon_x \qquad (5a)$$

In this case, x* represents the natural or desired structural dispersion of government expenditure (formed by tastes and technology). The factor ζ_y represents short-term isomorphism (or match with the environment) and ϕ_1 represents long-term isomorphism. The factor ζ_z represents short-term imitation of the organisational environment and ϕ_2 represents long-term match with the environment. As in the last case, we need to look at marginal changes, thus:

$$\boxed{\Delta \ln x = d^* + \zeta_y \varphi_1 \Delta \ln y + \zeta_z \varphi_2 \Delta \ln z + \zeta_t \Delta \ln t + \ln \omega + \ln \varepsilon_x} \qquad (5b)$$

Comparing the Regression Equations with the Model Equations

The regression coefficients given by the regression should represent citizens' preferences in different countries. Figure A shows the correspondence between the b-values given by regression analysis and model parameters.[40] A statistically significant intercept should indicate that government expenditure depends on domestic

[40] Regression analysis will also give beta values for the variables we test – which in this case indicates whether the b-value estimates of model parameters are statistically significantly different than zero.

consumption, the return on investment, preferences for giving resources to government and aversion to risks stemming from overall economic fluctuations and government spending. B-values for our proxy for the level of uncertainty in government's organisational environment should reflect mainly aversion to risk in the industrial sector (though, if we have mis-specified the model, this b-value would represent aversion in any sector of the economy). B-values for our proxy for the complexity of the organisational environment should reflect preferences for giving a share of expanding resources to government in high-tech (or quickly changing) area of economic activity. Unsurprising – as government in our model must spend everything it collects – increases in resources correspond to changes in government size. The b-value for our resources proxy estimates the preference for citizens in various parts of the economy for investment in government.

Figure A: Comparison of Model Parameters and Regression Coefficients for SIZE OF GOVERMENT

Variable	Variable Symbol	Parameter in Regression	Parameter in Model
Intercept	g*	g*	$[c - r(\alpha_G + \alpha_Y - \alpha_x) - [\gamma_Y \sigma_Y - \gamma_G \sigma_G]$
Uncertainty	y	γ_y	$\gamma_i \sigma_i$
Complexity	z	γ_z	$\alpha_h r$
Resources	t	γ_t	$r(\alpha_a \frac{Y_a}{Y} - \alpha_i \frac{Y_i}{Y} - \alpha_s \frac{Y_s}{Y})$
Geometric effect on uncertainty		β_1	$\gamma_i = f(\sigma_i, \frac{Y_i - Y_s}{Y_a})$
Geometric effect on complexity		β_2	$\alpha_h = f(r, Y_h)$
Geometric effect on resources		β_3	$\alpha_a = f(r, Y_a, \frac{Y_a}{Y}), \alpha_i = f(r, Y_i, \frac{Y_i}{Y}), \alpha_s = f(r, Y_s, \frac{Y_s}{Y})$
Covariates		η	see below
Error		ε	none

Source: authors.

The non-linear or geometric effects on our uncertainty, complexity and resource indicators will depend on the size of the economies analysed. The size of uncertainty will affect the size of government to the extent that risk aversion changes. Such changes in risk aversion (as shown in Figure A) might depend on the size of the standard deviation of output in any particular sector and the weight of that sector in the overall economy. The size of any non-linear effect on the size of government stemming from the amount of economic complexity in the macroeconomic environment (according to the model) will depend on may depend on the citizens' desire to invest part of the gains accruing to the fastest growing sector (in our case the high-tech sector) in government production. Again as shown in Figure A, such a preference for investing in government through taxes should depend on the return to such investments and the overall amount of output produced in that sector. The amount of resources available will have non-linear/geometric effects on government expenditure to the extent that the amount of such resources available affect citizens' desire to contribute part of their overall part toward the production of government-made public goods. The preference for contributing part of the fruit of their labour to the government will depend on the return to investment in

each sector, the overall level of output in each sector, and the relative proportion of output in any particular sector to total output in the economy.

The regression coefficients for the structure of government should represent basic model parameters shown in the second part of Figure A. The intercept g* for a regression on economic affairs (as a share of social protection expenditure) should equal contributions to government from the high-tech industry relative to all other industries. For regressions using central government expenditure (as a proportion of all general government expenditure), the intercept should represent the effect of several variables. Such an intercept will reflect the desired level of overall government size and aversion to trade-related risks. The intercept will also reflect the productivity of the high tech sector (as the most progressive sector and the sector requiring a decentralised structure).

Figure A (continued): Comparison of Model Parameters and Regression Coefficients for STRUCTURE OF GOVERMENT

Variable	Parameter in Regression	Parameter in Model
Intercept	g*	$\frac{g_h}{g_o} *$ and $\frac{4g^*+4\gamma_x\sigma_x}{\alpha_h rY}$
Uncertainty	y	$\frac{r^2\alpha_i}{\gamma_i\sigma_i}\alpha_h rY_h[t-\gamma_i\sigma_i]$ and $\alpha_h r\frac{1}{\gamma_a\sigma_a-\gamma_i\sigma_i-\gamma_s\sigma_s+\gamma_x\sigma_x}$
Complexity	z	$\alpha_h r\left[g^*+(t-\gamma_a\sigma_a)Y_a-(t+\gamma_i\sigma_i)Y_i-(t+\gamma_s\sigma_s)Y_s+\gamma_x\sigma_x\right]^{-1}$ and $-\alpha_h r[-\frac{1}{\alpha_h\gamma_h}]$
Resources	t	$\frac{1}{\alpha_h r}\frac{Y_a-Y_i-Y_s}{Y_h}$ and $\alpha_h r[\frac{1}{4}\frac{Y}{g^*}-\frac{1}{t}]$
Covariates	η	see below
Error	ε	none

The regression coefficients reflecting the effects of uncertainty in government's organisational environment will reflect risks and returns in the overall macroeconomy. For our proxy for the structure of government using expenditure on economic affairs relative to social protection spending, the regression b-value will incorporate the effect of returns on investments and tax payer's desires to give part of those returns to government in their own sector and in the high tech sector as well as risk aversion in their own particular sector. Government centralisation (as measured by spending on economic affairs rather than social protection) also expands in line with revenue. If we use spending by central government (relative to general government) as the proxy for the relative dispersion of the structure of government, then government decentralises as the least "progressive" and most widely spread-out sector (agriculture) becomes more risky (and as tolerance for these risks increases). On the other hand, government centralises as risks in industry and service sectors (which are usually more national and homogeneous in nature) increases. Government also decentralises as tax payers desire to spend more of

their output from the high-tech sector on government production (presumably to respond to positive asymmetric changes in that sector).

The regression coefficients reflecting the impact of macroeconomic complexity on the structure of government will reflect numerous factors. Decentralisation occurs as returns to the high-tech sector rise and as resources (in the form of taxes) decrease in the agricultural sector (or rise in the other sectors). Increased complexity in the macroeconomic environment also leads to more decentralisation as risk aversion rises in the industrial and industrial sectors. Increased aversion to the risks inherent in international trade lead to centralisation (as measured by expenditure in economic affairs rather than social protection). Our model also predicts than centralisation should occur as citizens working in the high-tech industries become more risk-averse.

The effect of increased resources depends heavily on the productivity of the high-tech sector. Using both proxies for government centralisation, growth in the high-tech sector reduces the effect of resources on government centralisation. Using the proportion of expenditure on economic affairs relative to social protection spending (as in the previous cases), growth in the agriculture sector leads to increased government centralisation – while growth in the other sectors leads to a decrease in government centralisation. Growth in the high-tech sector (as a willingness to give more output from that sector to government) leads to a relative decentralisation of government (presumably as individuals working in that highly volatile and unpredictable sector prefer relatively expansive government-provided social protection). Similarly using expenditure by central government (relative to general government) as a proxy reflecting the structure of government, a higher propensity to pay taxes (or earn income) in the high-tech sector should lead to decentralisation.

Other Variables Affecting Our Analysis

Government size depends on a number of other factors – besides the complexity, uncertainty, and affluence of government's organisational environment. Figure B shows the most important of these variables – as well the likely effects they might have on estimates of government size. In theory at least, omitting these variables should not lead to bias in our estimates related to the effect of uncertainty, complexity and affluence in the government's organisational environment on government size. Instead of using consumption, investment and net exports as controls – we chose to use only gross domestic output. We chose to use the aggregate measure of C+I+G+NX because if we used each of these variables as a control, we would have problems with our regression analysis.[41]

We include other controls to ensure that our regression estimates for our independent variables are relatively unbiased and precise. The relationship between population, land mass, and economic freedom with the inter-sectoral distribution of output or production in the high-tech sector should be non-existent. Yet, as shown in Figure B (in the Appendix below), these variables correlate very strongly with our independent variables. After a bit of reflection, these relatively high correlations seem logical. A proxy for the complexity of the organisational environment which relies on the (log) value of

[41] The decomposition of GDP into C+I+G+NX relies on an accounting identity. As such, we would expect collinearity in any regression using all these variables. Such collinearity would lead to bias and much less precise regression estimates.

production of high-tech goods and services will also correlate with land mass and population (as more people living on a larger area will produce more inventions – in absolute terms – than few people living in a small area). The Figure provides other correlations.

Regressions testing for the effect of various factors on the structure of government also require several controls. Figure C shows these controls – as well as the theoretical reasons why we included these controls in our regression analysis. These controls and the independent variables we seek to measure are also correlated. The dispersion of income positively correlates with the percent of central government spending (relative to general government expenditure). The dispersion of the population (as measured by urbanisation) and the dispersion of negative economic events (as measured by unemployment) negatively correlates with government size and central government spending. Excluding these variables would likely lead to significant bias in our results.

Figure B: Controls for Factors Affecting the SIZE OF GOVERNMENT

variable	Reason	Expected size and magnitude
C, I and NX (log)	As an accounting identity, the more resources other sectors of the economy use, the fewer resources available for government (in the short-run).	Higher values of C, I and/or NX should correlate strongly with decreased levels of government expenditure.
Population (log)	More citizens will require larger government (particularly if all do not generate equal amounts of output as our model assumes)...even if for pure administrative purposes (more births to record, more drivers to exercise surveillance over, etc.)	Larger populations should correlate with larger governments (as a share of output).
Land mass (log)	Transportation costs for providing government services included in the cost and price of public goods.	Larger countries should have larger governments.
Economic freedom	The level of economic freedom should correlate with government production of goods and services. If government "crowds in" private investment, large government should correspond with high levels of economic freedom. If government crowds out such investment, large governments should correlate with low levels of economic freedom. Government goods and services then can serve as complements or substitutes for private production.	Ambiguous…depends on the economic role played by government. Developmental states will have large governments and little economic freedom. Laissez-faire states will have small governments and lots of economic freedom. Centralised, repressive states will have smaller governments and little economic freedom.
Efficiency of government	More effective governments can be smaller on the one hand. On the other hand, governments may use legitimacy from such effectiveness to expand.	Ambiguous…depends on whether government has "leviathan" style nature in any particular country.
Deficits (log)	Deficit finance distorts (or helps improve) the link between changes in government size and macroeconomic events. Government may respond to future macroeconomic changes now with the help of deficit finance. Governments may also expand without consideration for short-term revenue.	Ambiguous. Deficits can distort relation between government size and environment (particularly if they need to be repaid) or strengthen the link (giving the state access to resources otherwise not available).
Debt (log)	A large debt may prevent government from expanding to its desired size – due to need to repay these debts. With empire building bureaucrats, debts help explain the size of government absent any changes in the macroeconomic environment.	Ambiguous – depends if debts used to finance government response to a changing organisational environment or to unnecessary expand.
Level of human development	A targeted level of development would encourage increases in government size (for developmental states). Very poor countries may be unable to draw on sufficient qualified labour to expand to optimal size.	Ambiguous – but a priori expected to reduce government sizes.
Generalised unemployment	Government one of the largest employers in many countries. Unemployment creates a pool of labour – and a demand for employment by government.	Should correlate with larger government sizes.

Source: authors.

Figure C: Controls for Factors Affecting the STRUCTURE OF GOVERNMENT

variable	Reason	Expected size and magnitude
dispersion of income (Gini coefficient)	Government organisations should locate closer to low income individuals to provide support.	More government dispersion as Gini coefficients rise.
concentration of population (urbanisation)	Higher levels of urbanisation should allow government to offer more goods and services in a more concentrated way.	Higher urbanisation should correlate with more centralised government structures.
Unemployment	Unemployment is geographical phenomenon – often tied to regional economic factors.	Expect greater government dispersion with higher levels of unemployment.
Market Quality	Government comes in places where markets function poorly	Decentralisation to occur when markets operate poorly – to act as surrogate for market forces.

Appendix II: Data Sources and Quality

The following table in Figure D summarises the variables we used in this paper. Except where noted, we downloaded data for all available countries between 1999 and 2009. We also show, in the final column, the total amount of data available for all countries during the time period. For example, for the 10 year period covering 181 countries (and another 5 years for one extra country), the World Bank provides only 47% of the total number of 1815 "country-years." Data for our uncertainty proxy were available for about 86% of these 1815 country years.

Figure D: List of Variables Used

Variable	Description and Source	Coverage*
Dependent Variables		
Government Expenditure (as a percent of GDP)	International Development Sources (2010).	**47%**
Economic structure of government index	The economic structure of government index divided expenditure on general government services plus economic affairs divided by expenditure on social protection (all as defined in the IMF's Government Financial Statistics database (2010).	**16%**
Centralisation structure of government index	Expenditure at the central level of government divided by expenditure by the public sector in general (both as defined in the IMF's Government Financial Statistics database (2010).	**11%**
Independent Variables		
Uncertainty proxy	The uncertainty proxy subtracts service-sector GDP (expressed as a percent of GDP) from industrial GDP (also expressed as a percent of overall GDP). The resulting difference is divided by agricultural GDP's share of overall GDP in order to "scale" changes in inter-sectoral output by the size of the country's agricultural sector. All variables in the proxy come from the World Bank's International Development Sources (2010).	**86%**
Complexity proxy	The complexity proxy takes the weighted average of several indicators of the production of outputs which might be considered characteristic of a highly complex economy. We found the weighted average of the log values of the following variables (all expressed in US dollars except for scientific citations and patents): the value of high-tech output, production of IT products, the number of patents and citations of nationals in scientific publications, the value of industrial production and the value of service-sector production. We used equal weights for each of these variables, except for the value of the service-sector. We gave the value of the service sector half the weight of the other variables (and of course all weights equal one). All variables taken from World Development Sources (2010).	**61%**
Revenue (as share of GDP)	World Development Sources (2010).	**48%**

Controls		
GDP (in current US dollars)	World Development Sources (2010). We used the log value of GDP.	**96%**
Land size	World Development Sources (2010).	**100%**
Population	World Development Sources (2010).	**100%**
Urban pop %	World Development Sources (2010).	**100%**
Debt to GDP	World Development Sources (2010).	**27%**
GINI coefficients	World Development Sources (2010).	**16%**
Unemployment to total working population	World Development Sources (2010).	**48%**
Deficits	World Development Sources (2010).	**47%**
Govt Efficiency	World Development Sources (2010).	**91%**
Human Development Index values	UNDP (2010)	**70%**
Business Freedom	Heritage Foundation (2010).	**89%**

* represents the number of observations for all countries out of 1815 total possible observations.

The figures in the first section of the paper often used only a small set of the total number of countries. These small sets resulted from missing data in various pairs of variables we analysed. In particular, when making calculations requiring data from the IMF's Government Financial Statistics database, we only had roughly 35 countries with more than 3 years of data. The World Development Sources database has relatively poor coverage of low-income countries' economic indicators like government expenditure. Figure E shows the availability of data by country income group. Our uncertainty proxy benefitted from the greatest data availability – with about 85% of all possible country-years having data. Both government size (expenditure-to-GDP) and revenue-to-GDP) had relatively poor data – with low and middle-income countries having data for fewer than 50% of all the possible 1815 country-years.

Figure E: Data Availability for Figures and Regression Analysis

	Complexity Proxy	Uncertainty Proxy	Government Size	Revenue to GDP
Low income	46%	85%	29%	33%
Middle income	63%	91%	42%	42%
High income	69%	75%	73%	73%

The conclusions which we drew from our regression analyses are statistically more reliable than the graphs we constructed for this paper. In order to construct the graphs for this paper, we had to omit any observations which did not have comparable data from other countries. For example, while constructing Figure 7b (comparing changes in government expenditure with changes in the magnitude of asymmetric, sector-specific shocks), we had to remove countries for the analysis if we lacked data on either variable, a weight for our weighted average of country groupings, for years where rates change were not available and so forth. On the other hand, regression analysis treats missing cases on a case-wise basis and looks at variation in the data available. The continuation of Figure E shows – on a country-by-country basis – the availability of data upon which

we based on regression analyses. These data show a strong bias against Sub-Saharan Africa in our analysis. Namely most countries outside of Sub-Saharan Africa had more than 50% of the possible number of 183 observations available (covering about 10 years for 18 variables – except for one variable where only 3 years of data were available).

Figure E (continued): Availability of Data by Country

	total obs.	**percent to total**		total obs.	**percent to total**
Afghanistan	86	**47%**	**Dominica**	75	**41%**
Albania	112	**61%**	**Dominican Republic**	122	**67%**
Algeria	120	**66%**	**Ecuador**	101	**55%**
Angola	81	**44%**	**Egypt, Arab Rep.**	149	**81%**
Antigua and Barbuda	66	**36%**	**El Salvador**	148	**81%**
Argentina	122	**67%**	**Equatorial Guinea**	86	**47%**
Armenia	140	**77%**	**Eritrea**	67	**37%**
Australia	152	**83%**	**Estonia**	176	**96%**
Austria	154	**84%**	**Ethiopia**	104	**57%**
Azerbaijan	105	**57%**	**Finland**	163	**89%**
Bahrain	115	**63%**	**France**	153	**84%**
Bangladesh	140	**77%**	**Gabon**	93	**51%**
Belarus	165	**90%**	**Gambia, The**	96	**52%**
Belgium	154	**84%**	**Georgia**	176	**96%**
Belize	102	**56%**	**Germany**	157	**86%**
Benin	123	**67%**	**Ghana**	135	**74%**
Bhutan	133	**73%**	**Greece**	162	**89%**
Bolivia	133	**73%**	**Grenada**	72	**39%**
Bosnia and Herzegovina	125	**68%**	**Guatemala**	159	**87%**
Botswana	100	**55%**	**Guinea**	93	**51%**
Brazil	129	**70%**	**Guinea-Bissau**	85	**46%**
Bulgaria	165	**90%**	**Guyana**	95	**52%**
Burkina Faso	113	**62%**	**Honduras**	132	**72%**
Burundi	89	**49%**	**Hong Kong SAR, China**	85	**46%**
Cambodia	119	**65%**	**Hungary**	167	**91%**
Cameroon	93	**51%**	**India**	157	**86%**
Canada	147	**80%**	**Indonesia**	135	**74%**
Cape Verde	109	**60%**	**Iran, Islamic Rep.**	165	**90%**
Central African Republic	93	**51%**	**Iraq**	63	**34%**
Chad	87	**48%**	**Ireland**	162	**89%**
Chile	150	**82%**	**Israel**	128	**70%**
China	118	**64%**	**Italy**	163	**89%**
Colombia	114	**62%**	**Jamaica**	141	**77%**
Congo, Dem. Rep.	94	**51%**	**Japan**	93	**51%**
Congo, Rep.	112	**61%**	**Jordan**	108	**59%**
Costa Rica	123	**67%**	**Kazakhstan**	183	**100%**
Cote d'Ivoire	127	**69%**	**Kenya**	143	**78%**
Croatia	171	**93%**	**Korea, Rep.**	162	**89%**
Cyprus	162	**89%**	**Kosovo**	42	**23%**
Czech Republic	183	**100%**	**Kuwait**	137	**75%**
Denmark	163	**89%**	**Kyrgyz Republic**	132	**72%**
Djibouti	84	**46%**			

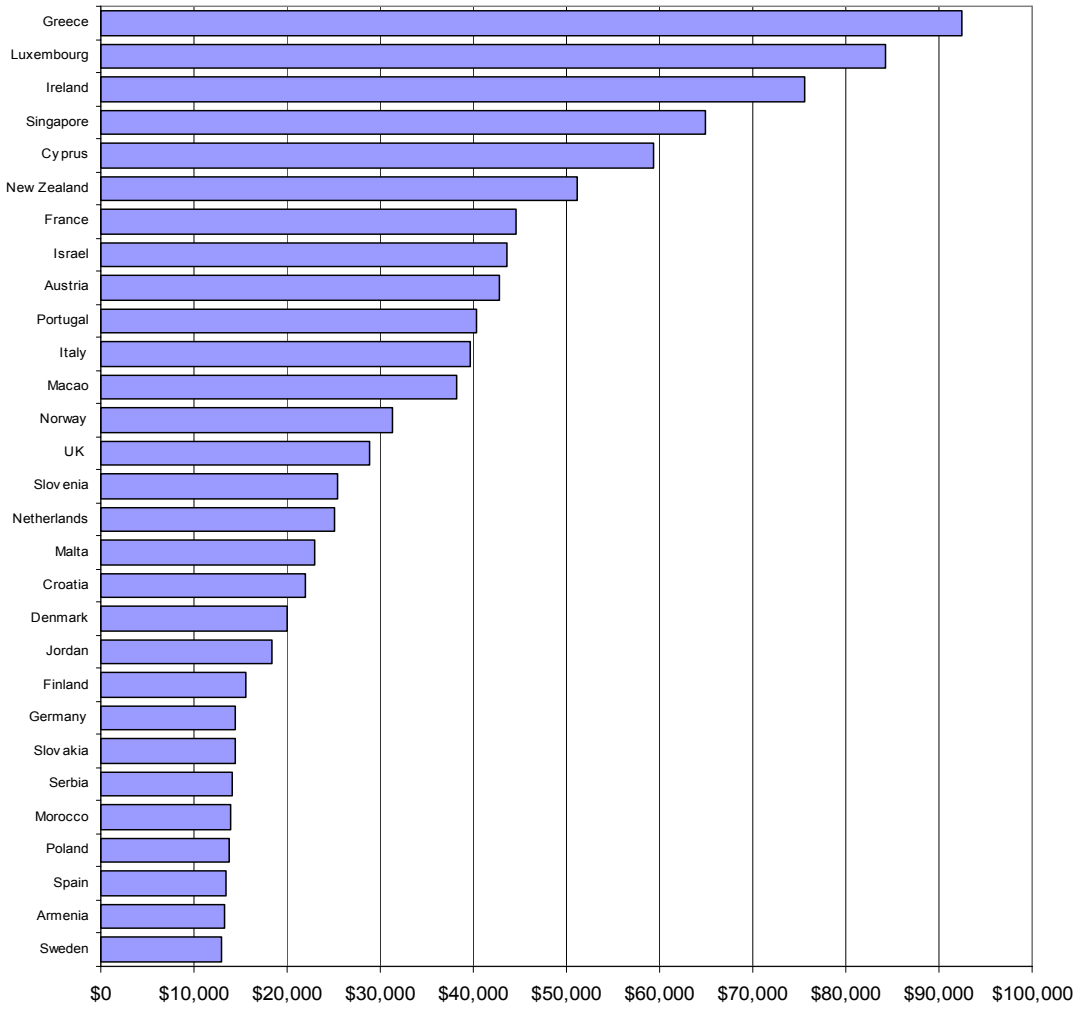
Lao PDR	91	**50%**
Latvia	171	**93%**
Lebanon	128	**70%**
Lesotho	135	**74%**
Liberia	77	**42%**
Libya	81	**44%**
Lithuania	166	**91%**
Luxembourg	142	**78%**
Macedonia	126	**69%**
Madagascar	143	**78%**
Malawi	97	**53%**
Malaysia	133	**73%**
Mali	139	**76%**
Mauritania	87	**48%**
Mauritius	171	**93%**
Mexico	120	**66%**
Moldova	183	**100%**
Mongolia	156	**85%**
Montenegro	71	**39%**
Morocco	141	**77%**
Mozambique	96	**52%**
Myanmar	69	**38%**
Namibia	141	**77%**
Nepal	125	**68%**
Netherlands	165	**90%**
New Zealand	126	**69%**
Nicaragua	116	**63%**
Niger	101	**55%**
Nigeria	85	**46%**
Norway	156	**85%**
Oman	94	**51%**
Pakistan	147	**80%**
Panama	123	**67%**
Papua New Guinea	107	**58%**
Paraguay	129	**70%**
Peru	171	**93%**
Philippines	147	**80%**
Poland	165	**90%**
Portugal	153	**84%**
Qatar	94	**51%**
Romania	152	**83%**
Russian Federation	155	**85%**
Rwanda	94	**51%**
Saudi Arabia	99	**54%**
Senegal	115	**63%**
Serbia	91	**50%**
Seychelles	124	**68%**
Sierra Leone	117	**64%**
Singapore	161	**88%**
Slovak Republic	144	**79%**
Slovenia	176	**96%**
Somalia	44	**24%**
South Africa	149	**81%**
Spain	162	**89%**
Sri Lanka	162	**89%**
Sudan	89	**49%**
Suriname	95	**52%**
Swaziland	99	**54%**
Sweden	164	**90%**
Switzerland	165	**90%**
Syrian Arab Republic	98	**54%**
Tajikistan	124	**68%**
Tanzania	94	**51%**
Thailand	153	**84%**
Timor-Leste	66	**36%**
Togo	113	**62%**
Trinidad and Tobago	137	**75%**
Tunisia	177	**97%**
Turkey	126	**69%**
Turkmenistan	84	**46%**
Uganda	154	**84%**
Ukraine	180	**98%**
United Arab Emirates	99	**54%**
United Kingdom	153	**84%**
United States	141	**77%**
Uruguay	167	**91%**
Uzbekistan	87	**48%**
Venezuela, RB	142	**78%**
Vietnam	103	**56%**
Yemen, Rep.	89	**49%**
Zambia	136	**74%**
Zimbabwe	87	**48%**

Appendix III: Empirical Analysis

Background material related to study

Our analysis resulted in a number of analyses that – while not very useful for our statistical study – provide insight into overall trends in international public sector management. Figure F presents one such graph – showing the average salary per government worker. According to the available data, Greece and Luxemburg have the highest average salaries per government employment – both exceeding $80,000 per year. Among this set of relatively generous governments, Sweden has the lowest salary – paying out less than $10,000 on average (if these data are correct) to government workers.

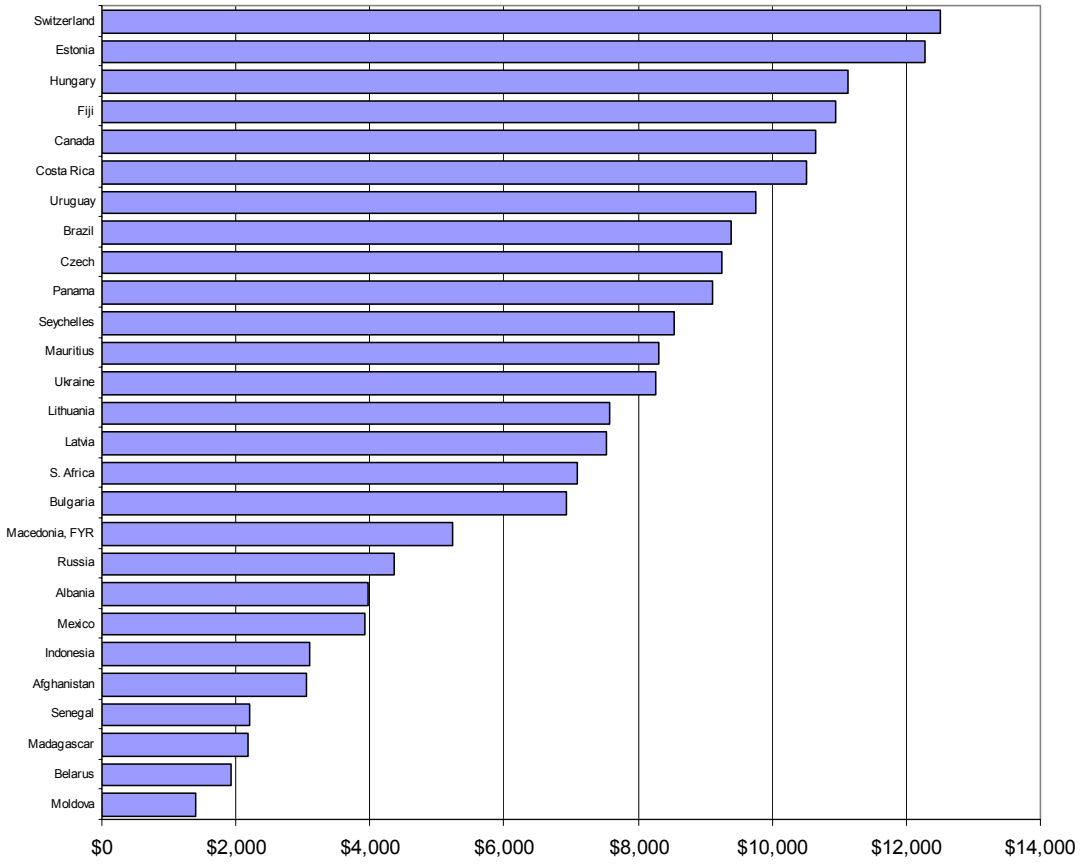
Figure F: Salary Per Government Worker
(latest year available)



The data in the figure show the expenditure in salaries (in US dollars) divided by the total number of employees in the general government for the latest year available (after 2005).
Sources: World Bank's World Development Indicators (2010) for data on governmemnt salaries and International Labour Organisation (2010) for data on general government employment.

Among the less generous countries, the Swiss and Estonian governments are the most profligate in terms of average pay-outs to their employees. At the low end, Belarus and Moldova pay less than $2000 per year on average to their government employees. Because these data represent simple averages – total salary expenditure divided by total general government expenditure – they mask a large amount of variation in wages among civil servants which might help explain the size and structure of government. However, because no more detailed data are easily available (and because these data look rather suspicious), we report these statistics without using them further.

Figure F (continued): Salary Per Government Worker
(latest year available)

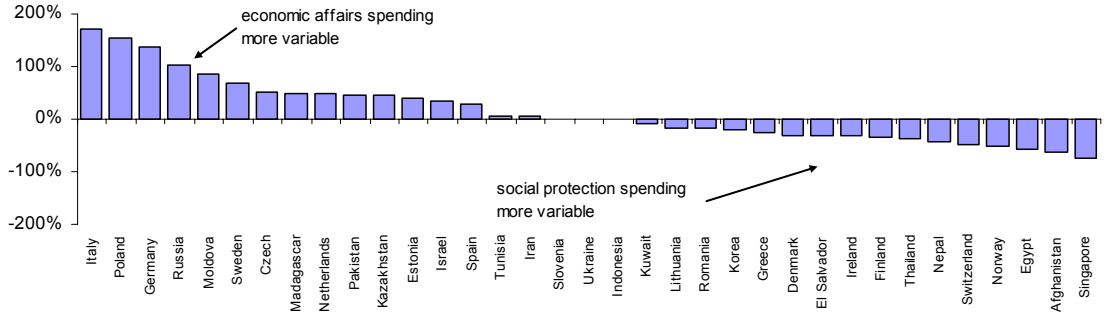


The data in the figure show the expenditure in salaries (in US dollars) divided by the total number of employees in the general government for the latest year available (after 2005).
Sources: World Bank's World Development Indicators (2010) for data on governmemnt salaries and International Labour Organisation (2010) for data on general government employment.

The volatility of government expenditure in different areas – while not useful for direct statistical analysis – sheds light on the structure of government in various countries. Figure G compares the volatility of expenditure on economic affairs as a proportion of the volatility of government spending on social protection. Governments like Italy, Poland and Germany tend to change from year-to-year spending on economic affairs far more than spending on social protection – suggesting relatively fluid structures of government. Countries like Singapore, Afghanistan and Egypt tend to change the allocation of resources on social protection far more than they change their economic

affairs-related spending. Such volatility suggests that these governments respond much less fluidly to changes in the economic environment than their European peers.

Figure G: Variability of Spending on Economic Affairs Compared with Spending on Social Protection

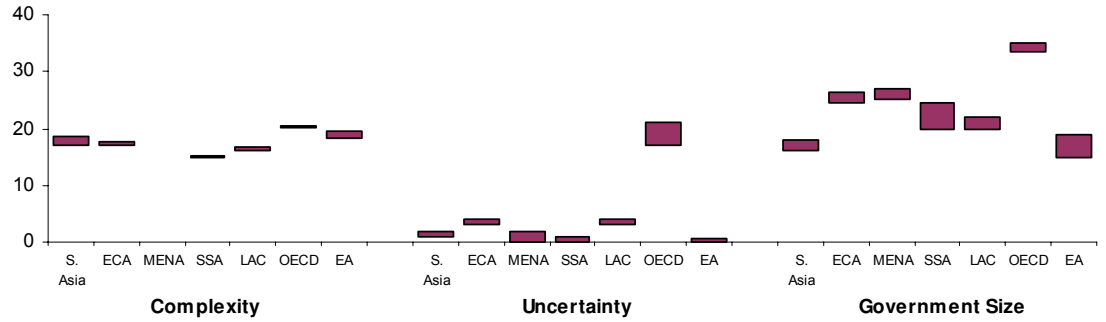


The data in the figure shows one minus the standard deviation of government expenditure in economic affairs as a ratio of the standard deviation of government spending on social protection. Values greater than zero indicate that the volatility of spending on economic affairs exceeds the volatility of spending on social protection. Values less than zero indicate that expenditure on social protection changes more significantly over time than spending on economic affairs.
Source: IMF (2010).

Descriptive Statistics for Regression Analysis

Several graphs help round out the background information on our dataset we give in the main body of the paper. Figure H shows the range of values we obtain for the complexity and uncertainty of governments' organisational environment in various regions as well as the range of government sizes (as proxied by government expenditure-to-GDP). The range of values of our complexity proxy do not vary greatly between regions. The OECD stands out as having significantly more uncertain policymaking environments than in other parts of the world. Government sizes tend to vary within regions – with OECD countries having some of the largest governments in the world (in GDP terms) while Sub-Saharan African and some East Asian countries tend to have the smallest.

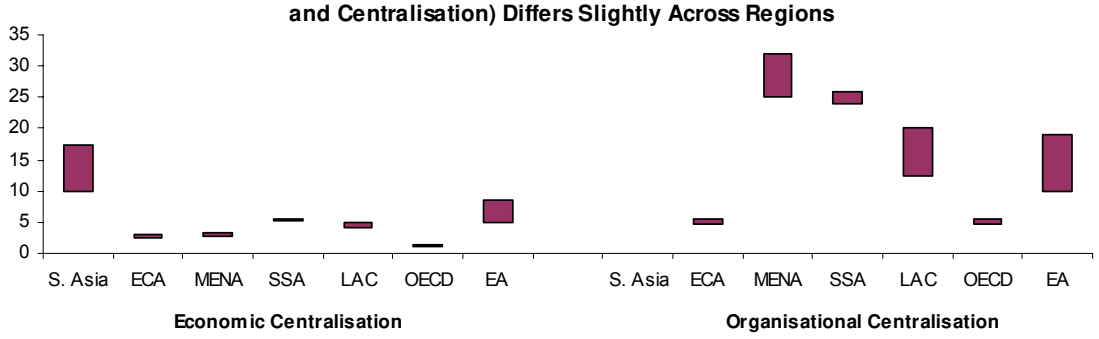
Figure H: Different Regions' Governments Face Slightly Different Organisational Environments



The graph shows the range of values of complexity, uncertainty and government size (as defined and discussed in the paper) of 95% of the countries in the regions shown in the figure. The scale for the complexity variables consists of the log values of a combination of several variables measuring technological attributes of the region's economies. The scale for uncertainty consists of the absolute value of the quotient of the value of GDP (in the denominator) and the difference between industrial and service output (in the nominator). Government size represents government expenditure as a percent of GDP.

The structure of government – given the limited data we have available – tends to vary within and between regions. South Asian countries tend to spend the most on general government services and economic affairs as a proportion of expenditure on social protection. OECD tend to spend more on social protection than on general government services and economic affairs. Middle-East and North African governments tend to spend more on central government activities than activities for other levels and branches of government. OECD member state governments tend to spend the least on central government (as a share of overall general government expenditure).

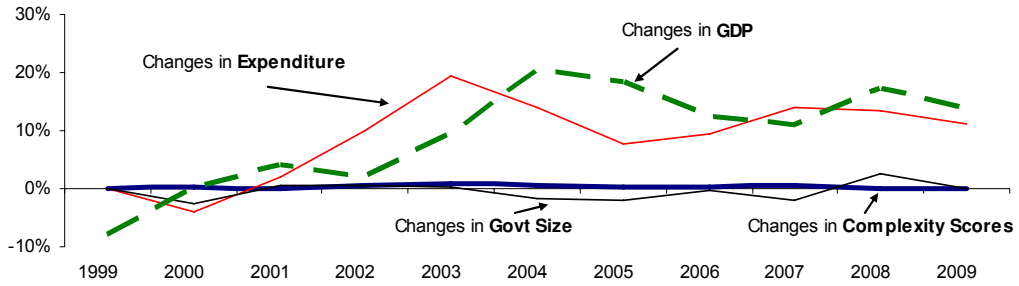
Figure I: The Structure of Government (as Measured by Economic Structure and Centralisation) Differs Slightly Across Regions



The ranges in the figure shows the values of economic and organisational centralisation for 95% of the countries in each region. The values for economic centralisation consist of the proportiion of countries' expenditure on general government services and economic affairs to social protection. The values for organisational centralisation consist of the proportion of central government expenditure to general government expenditure.

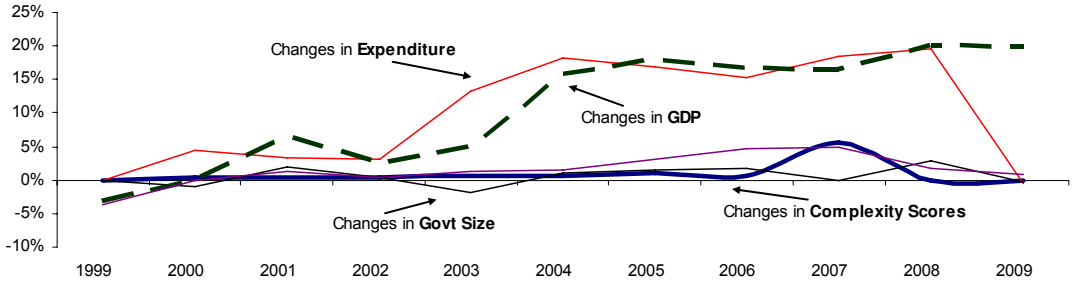
Changes in the size of government and the nature of its organisational environment tend to be rather different over time for various income-categories of countries. Figures J through Figure L show the change in government expenditure, expenditure relative to GDP, GDP and (of comparison) the complexity of government's organisational environment (as we have measured it). For changes in expenditure, high-income countries tend to see these changes most in the middle of the period whereas medium income countries see these changes toward the end of the period. Low income countries tend to see large increases in expenditure, relatively consistently throughout the 10 period. Except in the low-income countries, government sizes tend to shrink slightly in the middle of the 2000s and then expand again toward the end of the period. In the low-income countries, government sizes tend to increase throughout the period. Scores proxying the complexity of government's organisational environment changes most for low-income countries and least for high-income country governments through out the period. The proxy reflecting the complexity of government's organisational environment in middle-income countries tended to remain relatively stable – with an significant temporary increase toward the end of the period. Finally, all countries' economies experienced increasing growth of GDP toward the second-half of the 2000s.

Figure J: Changes over Time in Several Variables for HIGH-INCOME COUNTRIES



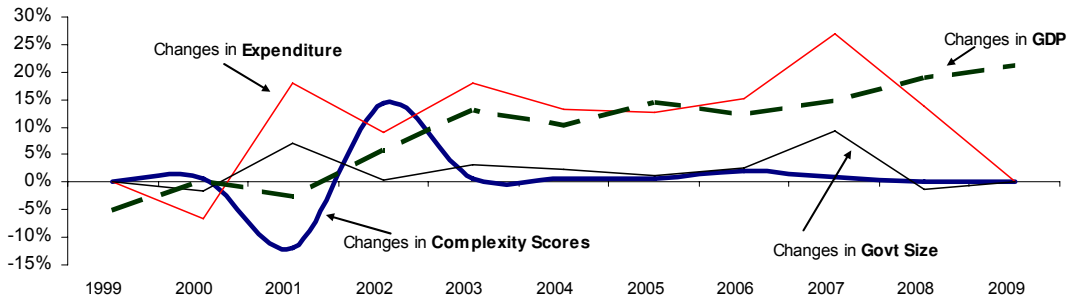
The data in the figure show changes in overall expenditure (in USD), changes in government size (as expenditure as a percent of GDP), changes in GDP and changes in the complexity of government's organisational environment (as measured by the log value of several indicators of technological, high-tech, scientific, industrial and service-sector production).

Figure K: Changes over Time in Several Variables for MEDIUM-INCOME COUNTRIES



The data in the figure show changes in overall expenditure (in USD), changes in government size (as expenditure as a percent of GDP), changes in GDP and changes in the complexity of government's organisational environment (as measured by the log value of several indicators of technological, high-tech, scientific, industrial and service-sector production).

Figure L: Changes over Time in Several Variables for LOW-INCOME COUNTRIES



The data in the figure show changes in overall expenditure (in USD), changes in government size (as expenditure as a percent of GDP), changes in GDP and changes in the complexity of government's organisational environment (as measured by the log value of several indicators of technological, high-tech, scientific, industrial and service-sector production).

Many of the control variables reflect a significant amount of variance (even for countries within their own income-group). Figure M shows the number of observations, the means and standard deviations for the controls we used in our regression analysis. We do not comment on the means – as we do not wish to conduct very extensive analysis or interpretation on these variables. Instead, we note the relatively large standard deviations which have almost certainly reduced the precision of our regression coefficients for our independent variables of interest.[42]

Figure M: Descriptive Statistics for Control Variables

	Urban pop %			Deficits Means		
	N	Mean	s.d	N	Mean	s.d
Low income	395	**29.5**	12.3	116	**-1.8**	5.7
Middle income	933	**55.4**	18.6	392	**-1.3**	4.0
High income	473	**73.8**	17.2	346	**0.3**	4.8
All Grps	1801	**54.5**	22.9	854	**-0.7**	4.6

	Debt to GDP			Govt Effic Means		
	N	Mean	s.d	N	Mean	s.d
Low income	33	**73.5**	47.8	360	**-0.9**	0.5
Middle income	190	**50.1**	28.9	853	**-0.3**	0.6
High income	267	**53.1**	30.6	430	**1.1**	0.9
All Grps	490	**53.3**	31.8	1643	**-0.1**	1.0

	GINI Coefficient			Human Dev. Indicators		
	N	Mean	s.d	N	Mean	s.d
Low income	45	**39.9**	6.2	335	**0.4**	0.1
Middle income	195	**43.4**	9.9	758	**0.6**	0.1
High income	42	**32.6**	4.1	189	**0.8**	0.1
All Grps	282	**41.2**	9.6	1282	**0.6**	0.2

	Unemployment			Business Freedom		
	N	Mean	s.d	N	Mean	s.d
Low income	38	**7.5**	6.0	325	**51.9**	9.9
Middle income	454	**10.7**	6.9	826	**60.3**	11.4
High income	374	**7.0**	3.6	473	**76.7**	12.0
All Grps	866	**8.9**	5.9	1624	**63.4**	14.5

[42] Large standard deviations in our control variables could reduce the precision of our regression analysis because the regression will try to "partition" such variation between these variables and the independent variables we care most about (the complexity, uncertainty, and affluence of government's organisational environment). The effect of such variance on our variables of interest will depend on such variance reflects noise or real information.

Figures N show a relatively high amount of correlation between our variables. Unsurprisingly, as shown in the first part of Figure N, the past and future values of our dependent and independent variables correlate with each other – as well as with the current values of these variables. These correlations show (again) the highly auto-regressive nature of government expenditure and the sectoral composition of GDP. The second part of Figure N – showing correlations between our control variables, dependent and independent variables – shows much less correlation between variables. Our proxy for the complexity of the organisational environment statistically significantly correlates with all our independent variables of government size and structure. Other variables like human development indicators, urbanisation, and country size (as measured by population and land size) also statistically significantly correlate with several of our dependent variables for government size and structure.

Our regression analysis – as shown by the results in Figures O to Figure Z – generally presents the results of four models of government size and structure. In general, the first model tests the expanded model without controls – looking at the effect of levels and rates of change of the uncertainty, complexity and affluence of the government's organisational environment on the size and structure of government (taking country-specific, year-specific, region-specific and grouping by income-level attributes into account). The second set of models tend to test the basic model with several of the most important controls. In these second sets of models, we regress our dependent variable on levels of our independent variables (uncertainty, complexity and resource availability in the government's organisational environment) and the key control variables which we predict should most significantly affect our results if excluded. The third set of models tests whether our controls explain government size and structure better than the independent variables we hypothesize might affect government size and structure. These models, then **substantively statistically** test the null hypothesis, that our model's variables have no effect on government size and structure.[43] These models – almost unanimously – fit the data (as measured by R-squared coefficients) much worse than the other models.[44] The fourth set of models tend to test whether the resource-based view of government organisational size and structure holds more explanatory power than contingency-view theories. In other words, we omit our proxies for the uncertainty and complexity of the organisational environment to test whether these models explain variation in government size and structure between countries and across time better than models which include these two variables.

Using these four models of government organisational size and structure, we also evaluate whether organisational change occurs reactively (after changes in the macroeconomy) or strategically (before these changes occur). To test the fit of models of reactive organisational adaptation to government's organisational environment, we use the previous year's data for government size and structure in our regression analysis – regressing them against any particular year's independent variables and control

[43] We use the phrase "substantively statistically" because usually various statistical tests can indicate (with a confidence level of 95% or higher) whether at least one variable in the model statistically significantly correlates with the dependent variable(s) of interest. We assess though, using statistical indicators to refine our qualitative judgment, whether the model omitting measures of uncertainty, complexity and resource availability fit the data for the dependent variable better.

[44] R-squared coefficients (the final line reported in most of our regression panels) indicate the amount of variation in the data "explained" by the independent variables we chose for that particular model.

variables. For example, a test of reactive government changes in organisational size for 2000 would use the expenditure-to-GDP for 2001 and the estimates for macroeconomic uncertainty, complexity, urbanisation and so forth for the year 2000. Similarly, tests of models of strategic change in government's organisational size for 2000 would use the expenditure-to-GDP ratio for 1999 – regressed against the values of all independent variables and controls for 2000. As explained previously, we defend this procedure on the basis that government policymakers can estimate changes in their organisational environment before they occur or during the year.

Figure N: Correlation Matrix for Model Variables

	Complex	Uncertain	Govt Size	Revenue/ Y	Economic Structural Indicator	Centralisation Structural Indicator	Cen to Gen Employ	Lag Size to GDP	Lag Economic Structural Indicator	Lag Centralisation Structural Indicator	Strategy Size to GDP	Strategy Economic Structural Indicator	Strategy Central Structural Indicator
Complexity	1.00	-0.34	0.49	0.25	-0.19	0.05	0.88	0.55	-0.25	0.08	0.54	-0.32	0.08
Uncertainty	-0.34	1.00	-0.77	-0.75	0.55	-0.80	-0.68	-0.81	0.62	-0.62	-0.62	0.58	-0.82
Govt Size	0.49	-0.77	1.00	0.85	-0.61	0.66	0.70	0.92	-0.68	0.63	0.85	-0.66	0.63
Revenue/Y	0.25	-0.75	0.85	1.00	-0.66	0.60	0.48	0.85	-0.80	0.50	0.81	-0.65	0.68
Economic Structural Indicator	-0.19	0.55	-0.61	-0.66	1.00	-0.56	-0.45	-0.46	0.60	-0.46	-0.66	0.68	-0.62
Centralisation Structural Indicator	0.05	-0.80	0.66	0.60	-0.56	1.00	0.47	0.59	-0.57	0.77	0.53	-0.51	0.92
Cen to Gen Employ	0.88	-0.68	0.70	0.48	-0.45	0.47	1.00	0.72	-0.48	0.39	0.69	-0.55	0.49
Lag Size to GDP	0.55	-0.81	0.92	0.85	-0.46	0.59	0.72	1.00	-0.62	0.50	0.74	-0.60	0.57
Lag Economic Structural Indicator	-0.25	0.62	-0.68	-0.80	0.60	-0.57	-0.48	-0.62	1.00	-0.50	-0.81	0.64	-0.72
Lag Centralisation Structural Indicator	0.08	-0.62	0.63	0.50	-0.46	0.77	0.39	0.50	-0.50	1.00	0.51	-0.52	0.72
Strategy Size to GDP	0.54	-0.62	0.85	0.81	-0.66	0.53	0.69	0.74	-0.81	0.51	1.00	-0.67	0.62
Strategy Economic Structural Indicator	-0.32	0.58	-0.66	-0.65	0.68	-0.51	-0.55	-0.60	0.64	-0.52	-0.67	1.00	-0.56
Strategy Centralisation Structural Indicator	0.08	-0.82	0.63	0.68	-0.62	0.92	0.49	0.57	-0.72	0.72	0.62	-0.56	1.00

Figure N (continued): Correlation Matrix for Model Variables

	Govt Size	Econ. Struct. Indic.	Cent. Struct. Indic.	Complexity	Uncertainty	REV./ Y data	Land	Pop	Urban pop %	Debt to GDP	GINI	U to total	Def.	wages lns	wages change	Govt Effic	HDI	Biz Free
Complexity	-0.84	0.87	-0.83	1.00	0.24	-0.87	0.98	0.97	0.96	-0.89	-0.68	0.67	-0.49	0.87	-0.78	0.22	1.00	-0.30
Uncertainty	-0.72	0.04	-0.72	0.24	1.00	-0.67	0.41	0.44	0.48	0.23	-0.56	0.77	0.55	-0.24	-0.38	0.17	0.26	-0.95
Govt Size	1.00	-0.68	0.99	-0.84	-0.72	0.99	-0.92	-0.94	-0.95	0.51	0.78	-0.87	0.02	-0.47	0.72	-0.27	-0.85	0.71
Revenue/ Y	0.99	-0.66	0.99	-0.87	-0.67	1.00	-0.95	-0.96	-0.97	0.56	0.82	-0.91	0.08	-0.55	0.75	-0.19	-0.88	0.69
Land	-0.92	0.82	-0.92	0.98	0.41	-0.95	1.00	1.00	1.00	-0.80	-0.78	0.79	-0.36	0.78	-0.76	0.22	0.99	-0.45
Pop	-0.94	0.81	-0.93	0.97	0.44	-0.96	1.00	1.00	1.00	-0.77	-0.79	0.80	-0.33	0.75	-0.76	0.23	0.98	-0.48
Urban pop %	-0.95	0.80	-0.95	0.96	0.48	-0.97	1.00	1.00	1.00	-0.74	-0.79	0.81	-0.30	0.72	-0.76	0.25	0.97	-0.51
Debt to GDP	0.51	-0.86	0.51	-0.89	0.23	0.56	-0.80	-0.77	-0.74	1.00	0.46	-0.32	0.73	-0.98	0.54	-0.12	-0.88	-0.17
GINI	0.78	-0.40	0.83	-0.68	-0.56	0.82	-0.78	-0.79	-0.79	0.46	1.00	-0.89	0.18	-0.47	0.48	-0.09	-0.72	0.58
Unemploy to total	-0.87	0.31	-0.89	0.67	0.77	-0.91	0.79	0.80	0.81	-0.32	-0.89	1.00	0.07	0.35	-0.68	-0.03	0.70	-0.82
Deficits	0.02	-0.56	0.00	-0.49	0.55	0.08	-0.36	-0.33	-0.30	0.73	0.18	0.07	1.00	-0.78	0.36	-0.34	-0.49	-0.40
wages lns	-0.47	0.77	-0.47	0.87	-0.24	-0.55	0.78	0.75	0.72	-0.98	-0.47	0.35	-0.78	1.00	-0.62	0.05	0.87	0.13
wages changes	0.72	-0.55	0.65	-0.78	-0.38	0.75	-0.76	-0.76	-0.76	0.54	0.48	-0.68	0.36	-0.62	1.00	-0.19	-0.77	0.57
Govt Effic	-0.27	0.53	-0.22	0.22	0.17	-0.19	0.22	0.23	0.25	-0.12	-0.09	-0.03	-0.34	0.05	-0.19	1.00	0.21	-0.15
HDI	-0.85	0.85	-0.84	1.00	0.26	-0.88	0.99	0.98	0.97	-0.88	-0.72	0.70	-0.49	0.87	-0.77	0.21	1.00	-0.32
Biz Freedom	0.71	-0.03	0.69	-0.30	-0.95	0.69	-0.45	-0.48	-0.51	-0.17	0.58	-0.82	-0.40	0.13	0.57	-0.15	-0.32	1.00
Economic Structural Indicator	-0.68	1.00	-0.65	0.87	0.04	-0.66	0.82	0.81	0.80	-0.86	-0.40	0.31	-0.56	0.77	-0.55	0.53	0.85	-0.03
Centralisation Structural Indicator	0.99	-0.65	1.00	-0.83	-0.72	0.99	-0.92	-0.93	-0.95	0.51	0.83	-0.89	0.00	-0.47	0.65	-0.22	-0.84	0.69

Figure O: Regression Results for Government Size

	1	2	3	4
Complexity of the Organisational Environment	-0.04	0.26		
	0.03	0.10		
Change in Complexity of the Organisational Environment	0.01			
	0.01			
Uncertainty of the Organisational Environment	-0.01	-0.06		
	0.01	0.03		
Change in Uncertainty of the Organisational Environment	0.01			
	0.01			
Levels of Gross Domestic Product (**GDP-logs**)	0.08	-0.14		
	0.03	0.09		
Government **Revenue to GDP** ratios	0.02	0.82		0.06
	0.02	0.03		0.02
Change in Government **Revenue to GDP** ratios	0.00			
	0.01			
Variable Capturing **Country-Specific** Attributes	-0.03	0.00	-0.06	0.00
	0.01	0.02	0.06	0.01
Variable Capturing **Year-Specific** Attributes	-0.02	-0.02	0.19	0.01
	0.01	0.02	0.06	0.01
Variable Capturing **Income-Group Specific** Attributes	-0.05	0.19	0.56	-0.02
	0.01	0.04	0.10	0.01
Variable Capturing **Geographical Group** Attributes	0.00	0.01	-0.11	0.00
	0.01	0.02	0.06	0.01
Country Size (in **kilometres of land**)	-0.03	-0.08	0.44	
	0.01	0.03	0.09	
Previous year's government size (**lagged G/Y ratio**)	0.51			0.94
	0.03			0.02
Previous year's change in GDP (**lagged GDP log diff**)	-0.01			
	0.01			
Following year's GDP (**leading GDP log**)	0.48			
	0.03			
Following year's change in GDP (**leading GDP log diffs**)	-0.09			
	0.01			
Percent of **urban population**		-0.03	0.00	
		0.03	0.08	
Debt-to-GDP ratios		0.17	0.19	
		0.02	0.06	
Proxy for **Government Efficiency**		-0.22	0.13	
		0.04	0.11	
Proxy for **Business Freedom**		-0.01	-0.01	
		0.03	0.08	
Population size			-0.39	
			0.08	
Unemployment as percent of total work-force			0.07	
			0.06	
Government deficits			-0.38	
			0.06	
Human Development Index (**HDI values**)			0.06	
			0.12	
Adjusted R2	**0.985**	**0.91**	**0.68**	**0.96**

Figure P: Regression Results for Changes in Government Size

	1	2	3	4
Complexity of the Organisational Environment	0.000		-0.06	
	0.125		0.07	
Change in Complexity of the Organisational Environment	-0.086	-0.04		
	0.074	0.05		
Uncertainty of the Organisational Environment	-0.034		0.00	
	0.108		0.02	
Change in Uncertainty of the Organisational Environment	0.040	0.01		
	0.079	0.05		
Change in Levels of Gross Domestic Product (**GDP log diffs**)	0.124	0.15		
	0.080	0.05		
Government **Revenue to GDP** ratios	0.046		0.06	
	0.115		0.04	
Change in Government **Revenue to GDP** ratios	0.051	0.02		
	0.090	0.06		
Variable Capturing **Country-Specific** Attributes	-0.113	-0.03	0.00	-0.05
	0.074	0.05	0.01	0.06
Variable Capturing **Year-Specific** Attributes	-0.087	-0.12	0.00	0.12
	0.088	0.05	0.01	0.06
Variable Capturing **Income-Group Specific** Attributes	-0.335	-0.10	-0.02	-0.12
	0.172	0.07	0.03	0.09
Variable Capturing **Geographical Group** Attributes	0.190	0.03	0.02	-0.01
	0.130	0.06	0.02	0.08
Percent of **urban population**	0.038			0.01
	0.113			0.07
Debt-to-GDP ratios	0.012			0.00
	0.084			0.06
Unemployment as percent of total work-force	-0.005			-0.07
	0.079			0.06
Proxy for **Government Efficiency**	-0.121	-0.06		
	0.162	0.07		
Proxy for **Business Freedom**	0.106			
	0.098			
Previous year's change in GDP (**lagged GDP log diff**)	0.023	-0.10		
	0.083	0.05		
Previous year's government size (**lagged G/Y ratio**)			4.97	
			0.08	
Levels of Gross Domestic Product (**GDP-logs**)			0.05	
			0.07	
Following year's government size (**leading G/Y ratio**)			-5.09	
			0.08	
Population size				-0.01
				0.06
Adjusted R2	**0.00**	**0.029**	**0.89**	**0.009**

Figure Q: Regression Results for Lagged Government Size
(Lagged Expenditure to GDP)

	1	2	3	4
Variable Capturing **Country-Specific** Attributes	-0.12	-0.02	0.00	-0.04
	0.07	0.03	0.01	0.02
Variable Capturing **Year-Specific** Attributes	0.10	0.06	0.00	-0.01
	0.07	0.04	0.01	0.02
Variable Capturing **Income-Group Specific** Attributes	0.46	0.72	0.07	0.25
	0.13	0.05	0.02	0.04
Variable Capturing **Geographical Group** Attributes	-0.03	-0.03	0.01	-0.03
	0.08	0.04	0.01	0.03
Population size	-0.09			
	0.07			
Percent of **urban population**	-0.22			
	0.08			
Debt-to-GDP ratios	0.25			
	0.06			
Unemployment as percent of total work-force	0.20			0.08
	0.07			0.02
Proxy for **Government Efficiency**	0.12			-0.19
	0.13			0.04
Human Development Index (**HDI values**)	0.36			
	0.15			
Proxy for **Business Freedom**	-0.28			
	0.10			
Complexity of the Organisational Environment		-0.23	-0.01	
		0.05	0.02	
Change in Complexity of the Organisational Environment		-0.02		
		0.04		
Uncertainty of the Organisational Environment		-0.22	-0.05	
		0.04	0.02	
Change in Uncertainty of the Organisational Environment		0.03		
		0.04		
Change in Levels of Gross Domestic Product (**GDP log diffs**)		-0.03		
		0.04		
Change in Government **Revenue to GDP** ratios		-0.01		
		0.04		
Government **Revenue to GDP** ratios			0.91	0.84
			0.02	0.03
Government deficits			-0.26	
			0.01	
Debt-to-GDP ratios				0.13
				0.02
Adjusted R2	**0.53**	**0.48**	**0.92**	**0.87**

Figure R: Regression Results for Lagged Changes in Government Size
(Lagged Changes in Expenditure to GDP)

	1	2	3	4
Complexity of the Organisational Environment	0.08	-0.01		
	0.07	0.24		
Change in Complexity of the Organisational Environment	0.01		0.02	
	0.04		0.06	
Uncertainty of the Organisational Environment	0.06	0.08		
	0.06	0.06		
Change in Uncertainty of the Organisational Environment	0.08		0.02	
	0.04		0.06	
Current year's government size (**G/Y ratio**)	-0.30			
	0.24			
Government **Revenue to GDP** ratios	-0.17	0.16		
	0.12	0.07		
Change in Government **Revenue to GDP** ratios	0.48		0.60	
	0.04		0.06	
Variable Capturing **Country-Specific** Attributes	0.05	0.02	0.03	-0.06
	0.04	0.05	0.06	0.12
Variable Capturing **Year-Specific** Attributes	-0.04	0.03	0.01	0.12
	0.04	0.05	0.06	0.11
Variable Capturing **Income-Group Specific** Attributes	-0.24	-0.22	-0.02	0.03
	0.08	0.09	0.10	0.23
Variable Capturing **Geographical Group** Attributes	0.02	0.02	0.08	-0.11
	0.05	0.06	0.10	0.15
Previous year's government size (**lagged G/Y ratio**)	0.65			
	0.25			
Levels of Gross Domestic Product (**GDP-logs**)		0.05		
		0.22		
Government deficits		-0.11	-0.23	-0.09
		0.05	0.06	0.13
Debt-to-GDP ratios			-0.02	-0.10
			0.06	0.11
Unemployment as percent of total work-force			-0.07	-0.04
			0.06	0.12
Population size				0.04
				0.12
Percent of **urban population**				0.19
				0.17
Proxy for **Government Efficiency**				-0.02
				0.21
Human Development Index (**HDI values**)				-0.35
				0.26
Proxy for **Business Freedom**				0.12
				0.17
Adjusted R2	**0.24**	**0.02**	**0.33**	**0.00**

Figure S: Regression Results for Previous Year's Government Size
(current year's government expenditure to GDP ratios regressed against the previous year's dependent variables)

	1	2	3
Complexity of the Organisational Environment	0.02	-0.02	
	0.03	0.01	
Change in Complexity of the Organisational Environment	-0.01		
	0.02		
Uncertainty of the Organisational Environment	-0.08	-0.02	
	0.03	0.01	
Change in Uncertainty of the Organisational Environment	0.08		
	0.02		
Government **Revenue to GDP** ratios	0.87	0.05	0.87
	0.03	0.03	0.03
Change in Government **Revenue to GDP** ratios	-0.05		
	0.02		
Variable Capturing **Country-Specific** Attributes	0.06	-0.02	-0.07
	0.02	0.01	0.03
Variable Capturing **Year-Specific** Attributes	0.01	0.01	0.02
	0.02	0.01	0.03
Variable Capturing **Income-Group Specific** Attributes	0.05	0.01	0.06
	0.04	0.02	0.05
Variable Capturing **Geographical Group** Attributes	-0.04	-0.02	-0.04
	0.03	0.01	0.03
Proxy for **Government Efficiency**	0.04		
	0.03		
Human Development Index (**HDI values**)	-0.05		0.12
	0.04		0.06
Current year's government size (**G/Y ratio**)		0.95	
		0.03	
Debt-to-GDP ratios		-0.01	0.04
		0.01	0.03
Percent of **urban population**			0.00
			0.04
Unemployment as percent of total work-force			0.00
			0.03
Government deficits			-0.26
			0.03
Proxy for **Government Efficiency**			-0.10
			0.05
Proxy for **Business Freedom**			-0.08
			0.04
Adjusted R2	**0.86**	**0.97**	**0.94**

Figure T: Regression Results for Previous Year's Changes in Government Size
(current year's changes in government expenditure to GDP ratios regressed against the previous year's dependent variables)

	1	2	3
Complexity of the Organisational Environment	0.01		
	0.07		
Change in Complexity of the Organisational Environment	0.09	0.10	
	0.05	0.05	
Uncertainty of the Organisational Environment	-0.10		
	0.09		
Change in Uncertainty of the Organisational Environment	0.09	0.04	
	0.06	0.05	
Current year's government size (**G/Y ratio**)	-0.38		
	0.14		
Previous year's government size (**lagged G/Y ratio**)	-0.05	-0.07	
	0.05	0.05	
Government **Revenue to GDP** ratios	0.39		
	0.14		
Change in Government **Revenue to GDP** ratios	-0.09	-0.07	
	0.05	0.05	
Variable Capturing **Country-Specific** Attributes	-0.04	-0.05	
	0.05	0.05	
Variable Capturing **Year-Specific** Attributes	0.07	0.06	
	0.05	0.05	
Variable Capturing **Income-Group Specific** Attributes	-0.01	-0.07	
	0.10	0.06	
Variable Capturing **Geographical Group** Attributes	-0.09	-0.10	
	0.06	0.06	
Government deficits		0.07	
		0.05	
Population size			-0.10
			0.09
Percent of **urban population**			0.04
			0.11
Debt-to-GDP ratios			-0.18
			0.08
Proxy for **Government Efficiency**			-0.18
			0.14
Human Development Index (**HDI values**)			-0.08
			0.14
Proxy for **Business Freedom**			0.07
			0.13
Adjusted R2		**0.047**	**0.03**

Figure U: Regression Results for Economic Structural Indicator
(dependent variable as the current year's ratio of expenditure on general government services and economic affairs as a proportion of social protection spending)

	1	2	3	4
Complexity of the Organisational Environment	0.25		0.13	
	0.07		0.10	
Change in Complexity of the Organisational Environment	0.01	0.05		
	0.05	0.06		
Uncertainty of the Organisational Environment	0.21		-0.02	
	0.07		0.08	
Change in Uncertainty of the Organisational Environment	0.24	0.19		
	0.05	0.06		
Current year's government size (**G/Y ratio**)	-0.34		-0.08	
	0.11		0.16	
Previous year's government size (**lagged G/Y ratio**)	0.05	0.03		
	0.05	0.06		
Government **Revenue to GDP** ratios	0.11		0.03	
	0.11		0.16	
Change in Government **Revenue to GDP** ratios	-0.05	-0.07		
	0.05	0.06		
Variable Capturing **Country-Specific** Attributes	-0.11	-0.09	-0.17	-0.94
	0.05	0.06	0.06	0.16
Variable Capturing **Year-Specific** Attributes	-0.05	-0.08	-0.12	0.23
	0.05	0.06	0.06	0.09
Variable Capturing **Income-Group Specific** Attributes	-1.17	-1.37	-1.20	-0.57
	0.11	0.10	0.12	0.24
Variable Capturing **Geographical Group** Attributes	1.08	1.21	0.91	0.34
	0.09	0.10	0.10	0.20
Unemployment as percent of total work-force	0.12	0.11	0.14	0.16
	0.06	0.06	0.07	0.12
Government deficits		0.09	0.07	0.12
		0.06	0.11	0.11
Debt-to-GDP ratios			-0.02	0.44
			0.07	0.16
Population size				0.71
				0.14
Percent of **urban population**				0.15
				0.23
Proxy for **Government Efficiency**				0.31
				0.25
Human Development Index (**HDI values**)				-0.76
				0.29
Proxy for **Business Freedom**				0.48
				0.15
Adjusted R2	**0.65**	**0.58**	**0.66**	**0.73**

Figure V: Regression Results on Lagged Economic Structural Indicator
(dependent variable as the subsequent year's ratio of expenditure on general government services and economic affairs as a proportion of social protection spending)

	1	2	3	4
Complexity of the Organisational Environment	0.37	0.52		
	0.09	0.11		
Change in Complexity of the Organisational Environment	-0.11		-0.12	
	0.06		0.06	
Uncertainty of the Organisational Environment	0.19	-0.23		
	0.08	0.18		
Change in Uncertainty of the Organisational Environment	0.28		0.09	
	0.07		0.06	
Current year's government size (**G/Y ratio**)	-0.46	-0.14		
	0.31	0.17		
Previous year's government size (**lagged G/Y ratio**)	-0.05		-0.12	
	0.06		0.08	
Government **Revenue to GDP** ratios	0.42	0.22		
	0.31	0.15		
Change in Government **Revenue to GDP** ratios	-0.08		-0.10	
	0.06		0.06	
Variable Capturing **Country-Specific** Attributes	-0.18	-0.81	-0.09	-0.71
	0.06	0.10	0.06	0.18
Variable Capturing **Year-Specific** Attributes	0.02	0.10	-0.06	0.22
	0.06	0.08	0.06	0.10
Variable Capturing **Income-Group Specific** Attributes	-1.43	-1.14	-1.16	-0.59
	0.14	0.18	0.10	0.28
Variable Capturing **Geographical Group** Attributes	1.00	0.71	0.92	0.44
	0.11	0.12	0.09	0.24
Debt-to-GDP ratios	-0.13	0.00		0.33
	0.07	0.10		0.18
Unemployment as percent of total work-force	0.10	0.37		0.16
	0.06	0.09		0.14
Government deficits	-0.18		0.02	0.20
	0.17		0.06	0.12
Human Development Index (**HDI values**)		-0.77		-0.70
		0.17		0.31
Change in Government Expenditure in USD terms (log diffs)			0.15	
			0.08	
Population size				0.56
				0.15
Proxy for **Business Freedom**				0.41
				0.16
Proxy for **Government Efficiency**				0.20
				0.29
Percent of **urban population**				0.37
				0.25
Adjusted R2	**0.70**	**0.88**	**0.46**	**0.69**

Figure W: Regression Results on Previous Year's Economic Structural Indicator
(dependent variable as the previous year's ratio of expenditure on general government services and economic affairs to social protection spending)

	1	2	3	4
Complexity of the Organisational Environment	0.80	0.11		
	0.67	0.07		
Change in Complexity of the Organisational Environment	-0.26		0.00	
	0.28		0.06	
Uncertainty of the Organisational Environment	-1.38	-0.05		
	1.51	0.09		
Change in Uncertainty of the Organisational Environment	0.51		0.26	
	0.35		0.06	
Current year's government size (**G/Y ratio**)	-1.60	-0.26		
	0.87	0.10		
Previous year's government size (**lagged G/Y ratio**)	0.12		0.00	
	0.20		0.08	
Government **Revenue to GDP** ratios	1.51	0.26		
	0.99	0.11		
Change in Government **Revenue to GDP** ratios	-0.24		0.00	
	0.27		0.06	
Variable Capturing **Country-Specific** Attributes	0.22	-0.04	-0.05	-0.91
	0.33	0.05	0.06	0.21
Variable Capturing **Year-Specific** Attributes	-0.68	-0.16	-0.14	0.17
	0.50	0.06	0.06	0.10
Variable Capturing **Income-Group Specific** Attributes	-1.80	-1.02	-1.65	-0.72
	1.58	0.12	0.12	0.28
Variable Capturing **Geographical Group** Attributes	0.92	0.99	1.45	0.47
	1.13	0.09	0.12	0.23
Percent of **urban population**	-0.09			0.23
	0.39			0.26
Gini coefficients	0.67			
	0.48			
Proxy for **Government Efficiency**	-0.74	-0.38		0.05
	0.77	0.09		0.29
Proxy for **Business Freedom**	-0.36			
	0.63			
Change in Levels of Gross Domestic Product (**GDP log diffs**)		0.04		
		0.06		
Change in Government Expenditure in USD terms (log diffs)			0.06	
			0.08	
Unemployment as percent of total work-force			0.00	0.11
			0.06	0.15
Debt-to-GDP ratios				0.57
				0.19
Government deficits				0.12
				0.13
Proxy for **Business Freedom**				0.57
				0.18
Human Development Index (**HDI values**)				-0.49
				0.34
Adjusted R2	**0.51**	**0.57**	**0.59**	**0.68**

Figure X: Regression Results for the Centralisation Structural Indicator
(dependent variable as central government expenditure as a proportion of general government expenditure)

	1	2	3	4
Complexity of the Organisational Environment	-0.46	-0.42		
	0.37	0.29		
Change in Complexity of the Organisational Environment	0.00		0.03	
	0.03		0.08	
Uncertainty of the Organisational Environment	0.07	0.07		
	0.16	0.15		
Change in Uncertainty of the Organisational Environment	0.00		-0.47	
	0.05		0.08	
Change in Government Expenditure in USD terms (log diffs)	-0.02		-0.44	
	0.07		0.15	
Current year's government size (**G/Y ratio**)	0.32	-0.79		
	0.32	0.26		
Previous year's government size (**lagged G/Y ratio**)	-0.02		0.38	
	0.07		0.13	
Change in Levels of Gross Domestic Product (**GDP log diffs**)	-0.03		-0.10	
	0.04		0.10	
Government **Revenue to GDP** ratios	-0.25	0.59		
	0.33	0.22		
Change in Government **Revenue to GDP** ratios	0.02		-0.08	
	0.04		0.08	
Variable Capturing **Country-Specific** Attributes	0.53	-0.10	-0.11	0.36
	0.12	0.09	0.09	0.07
Variable Capturing **Year-Specific** Attributes	0.00	0.04	0.31	-0.20
	0.09	0.08	0.09	0.06
Variable Capturing **Income-Group Specific** Attributes	-1.01	-0.18	-0.64	-1.03
	0.34	0.15	0.10	0.09
Variable Capturing **Geographical Group** Attributes	0.58	0.02	0.22	0.45
	0.24	0.11	0.13	0.09
Percent of **urban population**	-1.01			-0.71
	0.21			0.12
Debt-to-GDP ratios	0.17			0.03
	0.08			0.06
Unemployment as percent of total work-force	-0.04		0.08	-0.08
	0.08		0.13	0.05
Government deficits	0.04		-0.41	0.04
	0.09		0.09	0.08
Proxy for **Government Efficiency**	0.08	0.81		0.58
	0.12	0.12		0.11
Human Development Index (**HDI values**)	2.09	-0.47		0.89
	0.57			0.16
Proxy for **Business Freedom**	0.01	0.00		0.13
	0.08	0.10		0.05
Levels of Gross Domestic Product (**GDP-logs**)		0.75		
		0.26		
Adjusted R2	**0.99**	**0.51**	**0.54**	**0.95**

Figure Y: Regression Results for Lagged Centralisation Structural Indicator
(dependent variable as subsequent year's central government expenditure as a proportion of general government expenditure)

	1	2	3	4
Complexity of the Organisational Environment	0.09	-0.21		
	0.11	0.30		
Change in Complexity of the Organisational Environment	0.05		0.14	
	0.09		0.10	
Uncertainty of the Organisational Environment	-0.05	1.38		
	0.17	0.67		
Change in Uncertainty of the Organisational Environment	-0.39		-0.38	
	0.09		0.09	
Change in Government Expenditure in USD terms (log diffs)	-0.39		-0.34	
	0.17		0.17	
Change in government size (log diffs)	0.21		0.25	
	0.15		0.15	
Change in Levels of Gross Domestic Product (**GDP log diffs**)	-0.07	-0.21	-0.29	
	0.11	0.12	0.12	
Government **Revenue to GDP** ratios	0.09	-0.46		
	0.11	0.40		
Change in Government **Revenue to GDP** ratios	-0.08		-0.08	
	0.09		0.09	
Variable Capturing **Country-Specific** Attributes	-0.10	0.54	-0.05	0.30
	0.11	0.35	0.10	0.07
Variable Capturing **Year-Specific** Attributes	0.32	0.16	0.36	-0.09
	0.10	0.16	0.11	0.07
Variable Capturing **Income-Group Specific** Attributes	-0.78	-0.86	-0.42	-1.05
	0.17	0.69	0.15	0.13
Variable Capturing **Geographical Group** Attributes	0.32	0.09	0.15	0.14
	0.15	0.32	0.12	0.10
Unemployment as percent of total work-force	0.18	0.13		-0.01
	0.15	0.22		0.06
Government deficits	-0.42		-0.37	-0.16
	0.10		0.12	0.10
Current year's government size (**G/Y ratio**)		0.51		
		0.46		
Debt-to-GDP ratios		-0.16		0.00
		0.16		0.08
Proxy for **Government Efficiency**		1.81		0.72
		0.34		0.13
Human Development Index (**HDI values**)			-0.11	0.58
			0.15	0.17
Proxy for **Business Freedom**				0.16
				0.07
Percent of **urban population**				-0.37
				0.11
Adjusted R2	**0.64**	**0.75**	**0.34**	**0 .89**

Figure Z: Regression Results for the Previous Year's Centralisation Structural Indicator

(dependent variable as previous year's central government expenditure as a proportion of general government expenditure)

	1	2	3	4
Complexity of the Organisational Environment	-0.10	0.01		
	0.10	0.11		
Change in Complexity of the Organisational Environment	0.05		0.07	
	0.08		0.08	
Uncertainty of the Organisational Environment	0.56	0.08		
	0.19	0.14		
Change in Uncertainty of the Organisational Environment	-0.30		-0.44	
	0.09		0.08	
Change in Government Expenditure in USD terms (log diffs)	-0.36		-0.38	
	0.15		0.14	
Current year's government size (**G/Y ratio**)	-0.86	-1.98		
	0.34	0.39		
Change in government size (log diffs)	0.45		0.33	
	0.13		0.13	
Change in Levels of Gross Domestic Product (**GDP log diffs**)	-0.06	0.05		
	0.10	0.11		
Government **Revenue to GDP** ratios	0.76	1.83		
	0.31	0.35		
Change in Government **Revenue to GDP** ratios	-0.11		-0.11	
	0.08		0.08	
Variable Capturing **Country-Specific** Attributes	0.14	-0.06	-0.06	0.35
	0.11	0.10	0.08	0.08
Variable Capturing **Year-Specific** Attributes	0.20	0.12	0.16	-0.09
	0.10	0.10	0.09	0.06
Variable Capturing **Income-Group Specific** Attributes	-0.35	-0.46	-0.73	-0.93
	0.17	0.17	0.12	0.11
Variable Capturing **Geographical Group** Attributes	0.24	0.39	0.14	0.36
	0.15	0.13	0.12	0.09
Unemployment as percent of total work-force	0.11	0.22		0.00
	0.15	0.11		0.06
Proxy for **Government Efficiency**	0.55		0.30	0.53
	0.16		0.12	0.12
Government deficits		-0.60	-0.28	0.01
		0.13	0.09	0.09
Proxy for **Business Freedom**			0.00	0.12
			0.11	0.05
Percent of **urban population**				-0.70
				0.13
Debt-to-GDP ratios				0.00
				0.06
Human Development Index (**HDI values**)				0.82
				0.18
Adjusted R2	**0.52**	**0.42**	**0.40**	**0.95**

FIGURE AA: CLASSIFICATION OF GOVERNMENT SIZE ORGANISATIONAL ADAPTATION

(least error grouping of countries' expenditure to GDP, environmental complexity, environmental uncertainty and revenue to GDP)

CONTEMPORARY
Australia, Belarus, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Croatia, Czech Republic, Egypt, Estonia, Finland, Georgia, Ghana, Iran, Ireland, Jamaica, Kuwait, Latvia, Lebanon, Lithuania, Macedonia, Moldova, Mongolia, Morocco, Namibia, New Zealand, Norway, Oman, Papua New Guinea, Poland, Romania, Russian Federation, Sierra Leone, Slovak Republic, Slovenia, South Africa, Spain, Switzerland, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Uruguay, Venezuela.
STRATEGIC
Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lesotho, Netherlands, Norway, Portugal, Seychelles, Slovenia, Sweden,, United Kingdom, United States.
REACTIVE
Albania, Argentina, Armenia, Bangladesh, Benin, Bhutan, Cambodia, Canada, Chile, Cote d'Ivoire, El Salvador, Georgia, Ghana, Guatemala, Honduras, India, Indonesia, Iran, Kazakhstan, Kenya, Korea, Kyrgyz Republic, Madagascar, Malaysia, Mali, Mauritius, Mongolia, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Russian Federation, Senegal, Sri Lanka, Switzerland, Thailand, Trinidad and Tobago, Uganda, United States, Venezuela, Zambia.

The groupings in the Figure – which we used in our regression analysis to divide countries into groups -- show the best clustering of (country) cases using countries' expenditure to GDP, lagged expenditure to GDP, leading expenditure to GDP, revenue-to-GDP and our proxies for the complexity and uncertainty of the government's organisational environment. A country may appear in more than one category if a run of years data from that country fit best partially into one group (such as strategic or reactive organisational adaptation) while another run of data from different years fit into another category.

FIGURE AB: GROUPING OF COUNTRIES BY ECONOMIC-TO-SOCIAL PROTECTION STRUCTURE

CONTEMPORARY
Croatia, Czech Republic, Denmark, Estonia, Finland, Greece, Ireland, Italy, Kuwait, Lithuania, Moldova, Netherlands, Norway, Poland, Russian Federation, Slovenia, Spain, Ukraine.
STRATEGIC
Denmark, Germany, Italy, Netherlands, Sweden, Switzerland
REACTIVE
Egypt, El Salvador, Indonesia, Iran, Kazakhstan, Korea, Lithuania, Moldova, Mongolia, Nepal, Romania, Thailand, Tunisia, Ukraine, Venezuela.

The groupings in the Figure – which we used in our regression analysis to divide countries into groups -- show the best clustering of (country) cases using countries' expenditure on economic affairs relative to its spending on social protection as well as lagged and leading values of this economic centralisation indicator, as well as revenue-to-GDP and our proxies for the complexity and uncertainty of the government's organisational environment. A country may appear in more than one category if a run of years data from that country fit best partially into one group (such as strategic or reactive organisational adaptation) while another run of data from different years fit into another category.

FIGURE AC: GROUPING OF COUNTRIES BY CENTRALISATION

CONTEMPORARY
Armenia, Iran, Malaysia, Mauritius, Paraguay, Peru
STRATEGIC
Belarus, Bulgaria, Croatia, Czech Republic, Georgia, Kazakhstan, Latvia, Moldova, Mongolia, Peru, Russian Federation, Slovenia, Ukraine.
REACTIVE
Canada, Switzerland

The groupings in the Figure – which we used in our regression analysis to divide countries into groups -- show the best clustering of (country) cases using countries' expenditure by central government relative to general government expenditure as well as lagged and leading values of this centralisation indicator, as well as revenue-to-GDP and our proxies for the complexity and uncertainty of the government's organisational environment. A country may appear in more than one category if a run of years data from that country fit best partially into one group (such as strategic or reactive organisational adaptation) while another run of data from different years fit into another category.

Figure AD: Distances between Clusters of Countries Used for Regression Analysis

	Group Number						
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
No. 1	**	686	574	256	1100	1619	1616
No. 2	26	**	165	263	471	357	225
No. 3	23	12	**	505	255	279	386
No. 4	16	16	22	**	1041	1199	967
No. 5	33	21	15	32	**	341	461
No. 6	40	18	16	34	18	**	90
No. 7	40	15	19	31	21	9	**

The data in the figure show the (Euclidian) distances between clusters of data. The clustering procedure tries to maximise these distances in order to find distinct groups of data. These "distances" represent the values of each point of data subtracted from other points of data around it (very roughly translating the statistical procedure). We show the squared distances between each group above the diagonal (which we represent by asterisks).

FIGURE AE: Groupings of Countries According to the Best Fit for Changes in Government Size

(using least variance clustering of government size, complexity indices, uncertainty indices and resources)

Country	Grouping	Country	Grouping
Belgium	1	Cote d'Ivoire	4
Cyprus	1	Kyrgyz Republic	4
Greece	1	Madagascar	4
Italy	1	Mongolia	4
Jamaica	1	Sri Lanka	4
Bhutan	2	Germany	5
Brazil	2	Switzerland	5
Canada	2	United Kingdom	5
El Salvador	2	United States	5
India	2	Australia	6
Moldova	2	Belarus	6
Pakistan	2	Czech Republic	6
Papua New Guinea	2	Estonia	6
Philippines	2	Ireland	6
Senegal	2	Latvia	6
Spain	2	Lithuania	6
Tunisia	2	Russian Federation	6
Turkey	2	Slovak Republic	6
Uganda	2	Bangladesh	7
Ukraine	2	Georgia	7
Uruguay	2	Guatemala	7
Austria	3	Indonesia	7
Denmark	3	Kazakhstan	7
Finland	3	Mauritius	7
France	3	Mexico	7
Hungary	3	Oman	7
Netherlands	3	Peru	7
New Zealand	3	Thailand	7
Norway	3		
Poland	3		
Portugal	3		
Spain	3		
Sweden	3		

The groupings in the graph show the members of each cluster of data depicted in the previous figure. A country may appear in more than one category if a run of years data from that country fit best partially into one group (such as strategic or reactive organisational adaptation) while another run of data from different years fit into another category.

Figure AF: Groupings of Countries By the Rate of Change in the Size of Government

(using least variance clustering of changes in government size, changes in complexity indices, changes in uncertainty indices and changes in resources)

Group 1		Group 2		Group 3		Group 4	
Australia	1	Bangladesh	2	Austria	3	Belgium	4
Belarus	1	Denmark	2	Belgium	3	Cyprus	4
Czech Republic	1	El Salvador	2	Canada	3	Greece	4
Denmark	1	Finland	2	France	3	Italy	4
Estonia	1	Georgia	2	Georgia	3	Jamaica	4
Georgia	1	Germany	2	Hungary	3	Kyrgyz Republic	4
Guatemala	1	Ireland	2	India	3	Mongolia	4
Indonesia	1	Mauritius	2	Moldova	3	Sri Lanka	4
Ireland	1	Moldova	2	Mongolia	3	Uruguay	4
Kazakhstan	1	Netherlands	2	Papua New Guinea	3		
Latvia	1	New Zealand	2	Philippines	3		
Lithuania	1	Norway	2	Portugal	3		
Mauritius	1	Poland	2	Senegal	3		
Moldova	1	Slovak Republic	2	Sri Lanka	3		
Norway	1	Spain	2	Sweden	3		
Oman	1	Sweden	2	Tunisia	3		
Peru	1	Tunisia	2	Uganda	3		
Slovak Republic	1	Tunisia	2	Uruguay	3		
Switzerland	1	United Kingdom	2				
Thailand	1	United States	2				
Uganda	1	Uruguay	2				

The groupings in the graph show the members of clusters of data we found using the same clustering method as shown in the previous figures. We do not report the distance between groups as these distances do not tell (us at least) very much of qualitative importance. A country may appear in more than one category if a run of years data from that country fit best partially into one group (such as strategic or reactive organisational adaptation) while another run of data from different years fit into another category.