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The Causes of Government and the Consequences for Growth and Well-Being

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A range of factors drive size of government: relative prices, the age-dependency ratio, how long a country has been independent, relative political freedom, and openness in trade. Larger governments tend to limit growth, but that tendency can be offset by well-functioning institutions and high-quality bureaucracy. Size of government is not the only issue that matters.

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Summary findings

Using a large cross-country data set, Commander, Davoodi, and Lee examine the factors that cause governments to grow and analyze how the size of government affects growth, whether measured as income growth or other measures of well-being, such as infant mortality and life expectancy.

They find no robust link between government size and per capita income. The factors they find to be important in explaining government size are relative prices, the age-dependency ratio, how long a country has been independent, relative political freedom, and openness in trade. Their results also partially support the view that governments use consumption to buffer external risk, especially in low-income countries.

As for how government size affects growth, they find a robust and significant negative relationship between growth and government size, as measured by consumption. Policy distortions, predictably, also have a negative effect on growth. But the positive effects of well-functioning institutions and high quality in government bureaucracies can offset the negative influence of large government size alone.

Finally, they find that social-sector spending can exert a positive influence by reducing infant mortality and raising life expectancy. Better income distribution, higher per capita income, higher per capita income growth, and more political freedom have the same positive effect on those two measures of well-being.

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The Causes of Government and the Consequences for Growth and Well-Being

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Abstract

This paper uses a large cross country data set to look at the factors explaining the size of government and the consequences of government for income growth and other measures of well-being, such as infant mortality and life expectancy. We find no robust link between government size and per capita income. Relative prices, the age dependency ratio, years of independence, political freedom and openness are found to be important explanatory factors behind growth in government. Our results partially support the view that governments use consumption to buffer external risk, particularly in low income countries. With respect to the consequences of government for growth, we find a robust negative association with government consumption and with an index of policy distortions and a positive relationship with quality of bureaucracy. Finally, we find that social sector spending can exert a positive influence on infant mortality and life expectancy.

JEL classification: 047, H11, I31

1. Introduction

In recent years work on the determinants of cross-country growth has burgeoned. Several regularities have emerged from this research. Investment in both physical and human capital, as measured by educational attainment, stable macroeconomic policies combined with more open trade regimes, as well as better developed financial markets, have all been found to exert a positive effect on growth. Conversely, population growth, political instability, budget deficits, terms of trade shocks and associated volatility, as well as policy distortions -- such as the use of over-valued exchange rates -- tend to hold back growth.

In all this work one of the major outstanding questions relates to the consequences of government for performance. This is obviously a critical area given the widespread and significant expansion in the size of government in both industrial and developing countries over the last fifty years. In the Solow framework, a shift in government activity would be represented as a shift in the production function. In models of endogenous growth absent diminishing returns, government activity that affect technology could also affect growth. Thus, fiscal policy could influence the long run equilibrium growth path through the productivity of government spending. Yet much obviously depends on the activities performed by government. If government is assumed to provide only public goods, such provision can be shown to exert a positive effect on the marginal product of capital and the economy can benefit from greater scale. The taxation used to finance those goods will tend to exert a negative influence. As a consequence, the relation between government size and growth will be inverse U-shaped, with that shape determined by the

conflicting effects of public goods provision and distortionary taxation at various levels of government size. Moreover, public goods will tend to be subject to excess demand if no mechanism -- such as a production tax -- exists to offset such congestion [1].

The public goods model of government provides a useful benchmark for predicting the consequences of types of government activity. This is clearly useful given that governments characteristically do not restrict themselves to providing public goods. Yet, empirical tests for the effects of government have proven far from conclusive. Earlier work with cross country data sets, for example, has found not even marginal and average tax rates to be important explanatory factors behind comparative growth experiences, in part perhaps because of covariation with income, measurement problems and the lagged effects of taxation [2]. The evidence suggests that public spending on infrastructure [3] and the provision of a stable and predictable environment for transactions act positively on growth while government consumption tends to act negatively [4]. The latter result is generally explained by the fact that government consumption will not directly affect productivity nor enter private agents' production functions. Even if it affects productivity, its benefits at the margin fall short of the costs of distortionary taxation needed to finance it. However, this association may not be that robust, given

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[1] See Barro and Sala-i-Martin (1995).

[2] Easterly and Rebelo (1993).

[3] For example, Aschauer (1989) and Hulten (1996). See also, Pritchett (1996) for an alternative view and Devarajan,Swaroop and Zou (1996) for contrary evidence.

[4] See, Landau (1986), Barro (1991) and (1996b), and Barro and Sala-i-Martin (1995).

that government size may be a proxy for other factors, such as a fiscal deficit, lack of data on marginal tax rates or the gap between domestic and international prices [5].

While the ambiguity found in the empirical literature may be a function of the difficulty in identifying government activity, complete measures of government are difficult to implement, given the pervasive influence of non-fiscal policies as well as data limitations. Certainly, it appears that it is combinations of policies that matter and these combinations can include interventions in price setting and trade policy. To complicate matters further, institutional factors, such as the integrity of the judicial system, are increasingly recognised as mattering for growth. These factors themselves cannot be dissociated from the actions of government, signalling the importance of using better measures of government that capture not only size but also the scope of government.

This paper revisits the question of the consequences of different types of government activity for growth using a large cross-country data set. But prior to that, the paper starts by asking an equally fundamental question; what factors account for differences in the size of government over time and place ? Having looked at the determinants of government size, we try to measure the scope of non-fiscal government activity as well as get a measure of the quality of government. We then ask what the consequences of both government size and these other variables capturing the scope and quality of government have been for outcomes, such as growth in per capita income and measures of well-being, such as infant mortality and life expectancy ?

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[5] Bosworth, Collins and Chen (1996).

In addressing these questions, the paper is set out as follows. Section 2 gives a brief description of the data that are used and clarifies a number of basic measurement issues relating to both the size and scope of government. Section 3 then provides an overview of trends in government size in both industrial and developing countries, including changes in the composition of government expenditures over time. Section 4 considers the factors driving the expansion in government size. It reports the results of our cross-country regressions looking at the determinants of government size using a variety of specifications. Section 5 turns to a detailed investigation of the consequences of government size and scope for growth in per capita income. Section 6 continues by looking at how government affects other measures of welfare or well-being, such as infant mortality and life expectancy. Section 7 looks at how robust our individual estimates are by running the size, growth and the well-being equations in a system and, subsequently, by analysing the sensitivity of our results to potential measurement errors and specification of our estimated models. Section 8 concludes.

2. Data and Measurement

The paper is based on results from a large, cross-country panel data set that covers the period 1964 to 1993 and encompasses information on up to 132 countries. The data have been drawn from both the World Bank and the Summers-Heston World Tables. A full list of variables and their source is given in Appendix 1. The data cover the maximum period for which information is available for a wide range of developing countries and which also corresponds, in many cases, with independence from colonial

rule. Country coverage is given in Appendix 2. The data have been pooled so as to exploit the information in ten year averages with those averages covering 1964-73, 1974-83 and 1984-93.

The measure of government and the choice of deflators is clearly critical. One common measure of government size is the ratio of government expenditure to total expenditures or output as approximated by GDP. But the data are generally not comprehensive, with coverage of public enterprises -- an important expenditure item in many developing countries -- being particularly inadequate. In addition, this measure tends to ignore important off-budget items, such as tax concessions. Further, we need to distinguish between two basic components of government expenditure; consumption and investment. In the latter case, investment numbers disaggregated by public and private components are, when available, limited in coverage. Also definitions of public investment can differ and comparable deflators to the Summers-Heston are not available. As a consequence we rely on an aggregate measure of physical investment. For current expenditures, we could include transfers, such as pensions or social security benefits. But such transfers only redistribute resources whereas non-transfer or exhaustive expenditures require real resources. Government consumption -- mostly comprising government's wage bill -- may provide a narrower but more precise indicator of the current benefits for consumers from government spending [6].

[6] An alternative which avoids problems in measuring output is to use government employment, but this too has drawbacks, such as ignoring changes in labor productivity or substitution between inputs; see Lindauer (1988) and Gemmell (1993)

As we are mainly interested in looking at how the division of output across public and private goods affects performance, we work with data on real government consumption and real aggregate physical investment. These are expressed as fractions of GDP and are taken from the Summers-Heston data set. These data are based on international prices or purchasing power parity values and facilitate cross-country comparisons over time. The transformation to international prices is not innocuous. Using national prices to get real expenditure ratios gives quite significantly different measures of government size -- as indicated by *Table 1* -- particularly for low income countries with a large non-tradable sector and large labour intensive components in government consumption. For these countries, using international prices rather than deflating by constant 1987 US dollar values increases the government consumption ratio substantially.

These size measures obviously only capture the fiscal actions of government. But governments also provide a key component of the overall institutional environment, encompassing the rule of law, the protection of property rights and the effectiveness of its bureaucracy. Such institutions set the rules of the game for the players in an economy and are hence critical in determining the ability of any private sector to function effectively. Recent empirical evidence suggests that the consequences of stable property regimes can be very significant, possibly equivalent in magnitude to the effect of education in determining growth [7]. Similarly, surveys of entrepreneurs in developing countries that have looked at the effects of instability -- where rules themselves are subject to frequent

[7] Keefer and Knack (1995).

Table 1 Average Government Size By Region[a]

	Government Consumption/GDP in %[b]		Observations
	1985 International Prices	1987 US dollars	
All Countries			
1964-73	16.5	13.8	93
1974-83	18.4	15.5	113
1984-93	19.1	16.2	124
High Income OECD			
1964-73	13.4	16.9	22
1974-83	14.3	17.8	22
1984-93	14.3	17.7	22
All Developing Countries			
1964-73	17.5	12.5	67
1974-83	19.8	14.7	82
1984-93	20.6	15.6	93
Sub-Saharan Africa			
1964-73	19.9	13.1	29
1974-83	23.1	15.3	33
1984-93	25.5	17.4	38
Latin America and Carribean			
1964-73	14.2	10.5	20
1974-83	16.6	13.0	24
1984-93	17.7	13.7	26
East Asia and Pacific			
1964-73	16.0	15.4	10
1974-83	18.2	16.8	12
1984-93	16.3	14.6	14
South Asia			
1964-73	21.9	11.0	3
1974-83	19.6	9.7	3
1984-93	22.5	11.2	3
Middle East and North Africa			
1964-73	19.4	16.4	4
1974-83	20.3	19.5	10
1984-93	21.0	20.5	11
Europe and Central Asia			
1964-73	15.0	13.7	5
1974-83	12.0	11.2	7
1984-93	11.4	12.0	8

[a] Source: PWT5.6 and World Bank

[b] Government size in 1985 international prices only available up to 1992; unless otherwise noted, all regional breakdowns exclude high income countries; E. Asia and Pacific includes high income countries that are not OECD; Middle East and North Africa includes one high income country.

changes as also cases where rules may be stable but government agents have much discretion -- show, not surprisingly, that stability and transparency in the legal and policy-making environment is key for private sector decisions [8].

Aside from the presence of stable rules, the direct efficiency of governments, such as the perceived presence of corruption among civil servants and politicians and the extent of red tape have been shown to have clear consequences for performance [9]. For instance, bureaucratic inefficiencies generally raise transaction costs, while the integrity and efficiency of the judicial system will have an impact on the ability to resolve contractual and other disagreements, with low efficiency leading to higher uncertainty. Corruption generally results in lowering private investment and ultimately growth by reducing private returns to investment through this implicit tax.

To get a fuller appreciation of the consequences of government, we further consider a range of other measures that capture the broader interventions of government. First, drawing on earlier work by Knack and Keefer (1995) and Mauro (1993), among others, we include an explicit evaluation of the quality of government as given primarily by its bureaucracy. This evaluation is put together from a set of responses by foreign investors that focus on the extent of red tape involved in any transaction, the regulatory environment and the degree of autonomy from political pressure. While responses on foreign investors' are likely to be biased, these series provide the only currently available large-scale cross-country evaluations of the way in which government bureaucracies

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[8] Borner, Brunetti and Weder (1994).

[9] Mauro (1993), Keefer and Knack (1995), Clague et al (1996).

function. These responses provide us with a composite index of the quality of government bureaucracy or its capability. The manner of its construction is spelled out in Appendix 1. Second, we summarise governments' policy stance over time again through an index that combines three key indicators; the degree to which an economy is open -- as measured by the share of trade in GDP -- the degree to which a country's exchange rate has been over-valued -- as measured by the black market premium on the exchange rate -- and the degree to which local prices have departed from international prices. Details as to the construction of the index are again given in Appendix 1.

3. Growth of Government

Government size has grown throughout this century but the most dramatic part of this expansion has been since 1945. Aside from greater public provision of infrastructure, utilities, education and health services, there was also a clear shift toward greater direct control over production. In the industrial economies, large-scale transfer programmes -- such as unemployment benefits -- were established. For example, in the major countries of Western Europe, government expenditure which had on average only accounted for around 10% of GDP in 1870, accounted for some 30% in 1960 and over 50% by 1995 [10]. While long run data from the industrial economies suggest that wars have tended to

[10] These are nominal ratios of total government expenditure to GDP. Government expenditure includes central and local governments and the social security sector. Tanzi and Schuknect (1995); World Bank (1997).

ratchet up government size [11], it is remarkable that most of the expansion post-1945 has occurred in peacetime.

This growth in the industrial economies has been echoed in much of the developing world. At the start of the 1960s, government expenditure on average accounted for little over 15 % of GDP [12]. At the peak in the mid-1980s this had shifted to over 30% of GDP, before declining to around 26% in the mid-1990s. Part of the growth post-1960 can be attributed to state-building in the aftermath of colonialism, but also to movements in international commodity markets.

This widespread growth in government has also been accompanied by major changes in the composition of expenditures. In the industrial economies between 1945-1970 much of the increase in government size was driven by increases in transfers and subsidies. After 1970 growth in interest payments has predominated. By the early 1990s the share of spending allocated to traditional public goods -- such as defence, law and order -- had shrunk to no more than 10 percent of general government outlays in the major industrial economies, while over half the resources diverted to government through taxation were transferred to specific beneficiaries. Despite efforts to reduce fiscal imbalances, including cuts in government consumption and transfer programmes, the persistence in government size in the industrial economies is striking.

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[11] Peacock and Wiseman (1961).

[12] These are nominal ratios of total government expenditure to GDP. Government expenditure includes central government expenditure only. See World Bank (1997).

In developing countries, both government consumption and investment have tended to decline since the 1970s. Even so, by the 1990s government consumption continued to account for around 40% of total expenditure in developing countries and in Africa such outlays account for over half of total government spending. The share of transfers and subsidies has remained very much more restricted than in the OECD economies and has generally remained quite stable, except in Latin America where we observe a clear increase. Interest payments have climbed very significantly in all regions.

4. Explaining Government Size

What accounts for government size ? What have been the drivers behind this substantial growth in government in almost all regions ? In this section, we first survey the empirical literature before proceeding to our own estimations using the panel data set.

Explaining government size confronts major problems of endogeneity and causality. For example, it is widely held that urbanisation has been one of the factors that has sponsored growth in government. Yet it would be quite reasonable to argue that urbanisation itself is in part a response to government, with citizens moving to urban areas where government and other services are more available. Equally, a common, but mechanical, explanation relates government size to the level of income. This simple association -- often termed, Wagner's Law -- has government growing relative to national income with the correlation between growth in government size and per capita income being largely driven by demand factors. In the original formulation, it was hypothesised that industrialisation would lead to growth in demand for income elastic services, while

the greater complexity of an industrialised economy would require a larger role for government.

Empirical tests of this relationship have, however, proven largely inconclusive and certainly sensitive to the selection of deflators. While Easterly and Rebelo (1993) for a wide range of countries, and Oxley (1994) for Great Britain [13], find that either government revenue or expenditure to GDP rises with per capita income in both cross-section and time series estimations, Ram (1987) only very weakly replicates this result when using time series data for 115 countries to determine the elasticity of government size with respect to per capita GDP [14]. Positive elasticities dominate but only slightly. Further, on the cross-section data, the estimations -- using constant international prices to avoid relative price bias -- suggest that, if anything, the government share of GDP falls as incomes rises.

While the original argument was that the public sector would expand both through the action of income -- as luxury consumption -- and through structural change -- the greater complexity of public tasks associated with an industrialising economy -- this lumps all government spending types together and, particularly in the recent period, ignores the fact that technical change might actually reduce the need for public

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[13] Oxley (1994) uses data for Great Britain in the period 1870-1913 and finds strong support for a long run relationship between the government share and real or nominal income. Granger causality appears to run from income to public expenditure.

[14] Easterly and Rebelo (1993) use nominal government revenue to GDP, Oxley (1994) uses nominal and real government expenditure to GDP and Ram (1987) uses data on government consumption to GDP in 1975 international prices.

intervention [15]. Consequently, it may not be the case that all public services have income elasticities greater than unity. Further, this will depend not only on income growth but also changes in the relative prices of public and private goods. Courakis et al (1993) using time series data for Greece and Portugal distinguish between the components of public expenditure, namely transfers, consumption and investment [16]. They relate these shares to relative prices of public expenditure, permanent income, population and a nominal demand variable and find significant differences in responses across expenditure types. They find that income elasticities greater than unity only hold in the case of transfer expenditures in Greece and consumption expenditures in Portugal. For investment outlays income elasticities were no different from unity. Relative prices were found to have a negative influence on various components of public expenditure particularly for government consumption in Greece. The importance of including the relative price of government goods and services has always been noted in studies of demand for public goods (e.g., the median voter model) in the public finance and public choice literature [17]. To our knowledge, our paper is the first that includes such a relative price term as a determinant of government size for a large cross-country data set [18].

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[15] Think, for example, of telecommunications where technological change has shifted parts of the industry away from natural monopoly, facilitating multiple provision and changing with it the regulatory functions of government.

[16] This approach, of course, requires appropriate deflators, something lacking for most developing countries and which effectively stops us from systematically separating out the components of public spending.

[17] Borcherding and Deacon (1972), Buchanan (1977), Borcherding (1985), Mueller (1989).

[18] See also, Lybeck (1986) which concentrates on 12 OECD countries.

The likely variation in the sensitivity of different components of public expenditure to income and other determinants also signals the importance of political economy considerations. For instance, on the assumption that governments tailor their expenditures to the demands of the median voter, an extension of voting rights will shift the position of the median voter in the income distribution. This will imply a likely shift toward voters at the lower end of the income and wealth spectrum, possibly raising the demand for redistributive policies and hence for taxation [19]. An implication would be that democratic regimes will tend to have larger governments.

The substantial growth in transfer programmes in the industrial economies that was highlighted in Section 3, has to be related to a constellation of political economy factors. Most generally, we can think of such redistributive programmes being motivated by ideological preferences. Certainly, the provision of welfare supports to those experiencing transitory income fluctuations, as well as to the elderly and vulnerable groups, was a corner stone of the post-1945 consensus in Western Europe. The preferences embodied in this consensus in due course spilled over to many developing countries, albeit constrained by the lower level of resources to be redistributed. Probably the clearest link may run from the population structure and the age dependency ratio, in particular, to the demand for pensions. However, as our empirical work concentrates on real resource use -- and hence on consumption and investment -- we do not explicitly focus on the factors driving redistributive choices. Nevertheless, transfer programmes

[19] Meltzer and Richard (1981).

will not be neutral with respect to the size of government consumption as they will obviously tend to be linked with a larger administrative apparatus and there will be strong collinearity between consumption and redistribution.

Finally, another body of work has emphasised that the size of government will also depend on the extent of risk facing agents and the response of government to risk. This approach largely picks up from the empirical finding that economies that are more open tend to have larger governments [20] (Cameron, 1978). At one level, this relationship seems hard to explain, as openness would likely be associated with greater competition and less scope for government. Yet if openness raises the vulnerability of an economy, governments may feel bound to weaken the consequences by raising the size of the public sector and put in place policies that smooth such fluctuations. Indeed, it has also been argued that the adoption of such stabilisation policies were themselves a possible precondition for voters to accept trade opening and higher vulnerability. If this is the case, then openness would itself be endogenous and a function of at least some components of government spending [21] . Rodrik (1996) has a rather different emphasis in arguing that there is not only a positive partial correlation between openness and size but that the causality is from openness to size. Openness in an earlier period -- in this case the early 1960s -- is a statistically significant predictor of the subsequent change in government consumption. He links this to risk, as measured by both openness and volatility in the terms of trade, and argues that government consumption has been used to reduce income

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[20] Cameron (1978).

[21] A point made by Slemrod (1995).

volatility. As such, governments will be larger in terms of consumption in countries experiencing larger amounts of external risk and that controlling for risk, openness will not exert an independent effect on government consumption.

4.1. Empirical results

We now turn to our large cross-country data set to explore more systematically the factors accounting for government size over the period 1964-1993. Our approach is to relate government size measured as government consumption relative to GDP and expressed in 1985 international prices to a set of determining variables. The data are pooled with ten year averages with coverage of 131 countries. We report sequentially results from the OLS and IV estimations. Later we turn to 3SLS estimation.

In the light of the discussion above, we include on the right hand side; a per capita income variable; a relative price term, given as the ratio of the government consumption price deflator to the private consumption deflator; several demographic variables -- the urbanisation rate and the age dependency ratio; an openness variable defined as total trade normalised by GDP; a terms of trade variable to capture the price component of external risk and measured, as we shall see, in a number of ways; a variable summarising the years since a country has been independent -- to test for any nation-building effects associated with independence; a federal dummy to control for the federal form of government; and a measure of political freedom. The latter is the political freedom component of the Gastil index and is used to test for the positive impact of democracy on government size which presumably works through the median voter model. Finally, decade and regional

dummies are also inserted in the regressions. Results are presented in *Table 2* for OLS and IV estimations. The instruments in the IV regression are the average of the previous five year lags of each endogenous variable. (see footnotes to *Table 2*). These are valid instruments as the correlations between residuals across decades are almost zero. We instrument for per capita GDP, relative price of government consumption, openness, and political freedom. The OLS and IV estimates yield very comparable coefficients.

The main conclusions from *Table 2* are as follows. We find no robust support for Wagner's Law [22]. When we control for relative prices, the coefficient on the per capita income term is indeed positive but it is both small and insignificant. As expected, the relative price term enters negatively and very significantly. Real public expenditures could be expected to depend on their relative price and this indeed proves to be an important explanatory factor. With regard to the demographic variables, we find that urbanisation exerts no notable influence, the coefficient is in fact negative and insignificant. By contrast, the age dependency ratio enters positively and very significantly. Testing for the effects of nation-building among newly independent countries, the years of independence variable enters negatively and significantly, indicating that countries with shorter periods of independence tend to have larger governments. This gives some support to the nation-building hypothesis. The political freedoms variable -- included to see whether greater democratisation tends to be associated with larger government through increased demands for public spending --

[22] A simple correlation of government consumption to GDP to per capita income is, however, negative and significant at the 1 percent level.

Table 2 Government Size Regressions: OLS and Instrumental Variable[a]
(Dependent Variable: Government Consumption/GDP in 1985 International Prices)

Independent Variables	OLS	OLS	IV[b]	IV
Constant	-1.242***	-1.332***	-1.248***	-1.212***
	(0.334)	(0.341)	(0.387)	(0.379)
Dummy for 1974-83	0.061	0.062	0.077*	0.082**
	(0.043)	(0.041)	(0.042)	(0.041)
Dummy for 1984-93	0.109**	0.116***	0.131***	0.142***
	(0.043)	(0.042)	(0.043)	(0.043)
Per Capita GDP	0.050	0.051	0.055	0.048
	(0.042)	(0.042)	(0.046)	(0.045)
Age Dependency Ratio	0.446***	0.458***	0.461***	0.467***
	(0.131)	(0.131)	(0.135)	(0.135)
Urbanization Ratio	-0.034	-0.024	-0.044	-0.032
	(0.039)	(0.039)	(0.045)	(0.044)
Relative Price of Government Consumption	-0.644***	-0.644***	-0.730***	-0.724***
	(0.060)	(0.060)	(0.085)	(0.086)
Openness	0.137***	0.115***	0.135***	0.100***
	(0.031)	(0.033)	(0.036)	(0.038)
Terms of Trade Changes (TOT)	-0.534	-1.870**	-0.533	-2.228**
	(.475)	(0.735)	(.516)	(0.866)
Openness*TOT		-2.074***		-2.516***
		(0.792)		(0.876)
Years Since Independence	-0.103*	-0.099*	-0.090	-0.091
	(0.057)	(0.057)	(0.060)	(0.059)
Political Freedom (1high, 7 Low)	-0.031***	-0.028**	-0.025*	-0.026*
	(0.012)	(0.012)	(0.014)	(0.014)
Federal Dummy	-0.055	-0.063	-0.043	-0.058
	(0.045)	(0.045)	(0.043)	(0.043)
Latin America Dummy	-0.189***	-0.193***	-0.189***	-0.192***
	(0.051)	(0.050)	(0.056)	(0.055)
East Asia Dummy	-0.285***	-0.292***	-0.312***	-0.315***
	(0.041)	(0.040)	(0.050)	(0.048)
Number of Observations	357	357	345	345
R-squared[c]	0.5674	0.5764	0.5348	0.5473

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses.

[b] For the IV regressions in Table 2, the instruments for the following variables are the previous five year lag of itself and regional and decade dummy variables: per capita GDP; relative price of government consumption; openness; and political freedom. All other variables in the regression were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

enters negatively and significantly. This indicates that countries with fewer political freedoms indeed tend to have smaller governments. The coefficients on decade dummies indicate that government size increased over the periods. The dummy for countries with federal systems indicates that these are predictably associated with a smaller central government but the coefficient is not significant. Finally, we also experimented with a variable that carried information on whether or not a country has been at war -- civil and otherwise. We found that neither type of war was an important explanatory factor driving government size and the variable was duly omitted.

4.2. Government Size and External Risk

How much of government size can be attributed to risk aversion as government programmes attempt to mitigate the risk associated with greater openness and/or greater volatility or changes in the terms of trade ? As indicated above, we have explicitly tested for the effect of openness and indeed find that openness is positively and significantly correlated with government size. But openness is obviously only one component of external risk. A complete measure of risk would include price changes and would hence include some measure of the terms of trade changes. One approach is to use the standard deviation in the terms of trade as the usual measure of income volatility. Alternatively, one could simply apply a variable for the change in the terms of trade. Below we experiment with both.

We see that with openness and the volatility term in the estimating equation (*Table 3, Panel A*), both enter with the predicated sign but only openness is significant.

Table 3 Government Size and External Risk: OLS and Instrumental Variable Regressions[a]
(Dependent Variable: Government Consumption/GDP in 1985 International Prices)

Panel A **Independent Variables**	**OLS**	**OLS**	**IV**[b]	**IV**
Openness	0.152***	0.044	0.157***	0.049
	(0.033)	(0.049)	(0.037)	(0.051)
Volatility in Terms of Trade	-0.050	0.539	-0.204	0.438
	(.249)	(0.345)	(.249)	(0.368)
Openness*STOT		0.973***		1.017***
		(0.344)		(0.389)
Nunber of Observations	348	348	336	336
R-squared[c]	0.5614	0.5696	0.5308	0.5388

Panel B **Independent Variables**	**OLS**	**OLS**	**IV**	**IV**
Openness	0.135***	0.077*	0.132***	0.068
	(0.031)	(0.042)	(0.036)	(0.045)
Terms of Trade Increases (TOTI)	0.234	-1.788**	0.246	-2.068**
	(.580)	(0.896)	(.615)	(1.013)
Terms of Trade Decreases	-2.537*	-2.469	-2.472*	-2.471
	(1.380)	(2.247)	(1.483)	(2.839)
Openness & TOTI		-3.141***		-3.280***
		(0.939)		(1.038)
Openness & TOTD		0.103		-0.243
		(2.202)		(2.738)
Nunber of Observations	357	357	345	345
R-squared	0.5716	0.5831	0.5389	0.5525

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses. Coefficients on the other regressors are not shown. Other regressors are the same as those listed in Table 2.

[b] For all IV regressions in Table 3, the instruments for the following variables are the previous five year lag of itself and regional and decade dummy variables: per capita GDP; relative price of government consumption; openness; and political freedom. All other variables in the regression were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

Introducing an interaction term of openness and terms of trade volatility yields a highly significant -- at the 1 percent level -- and positive coefficient on the interaction term. Both the openness and terms of trade volatility variables lose all significance. This appears to be consistent with Rodrik's (1996) finding that the dominant channel is through terms of trade risk.

If the underlying motivation of governments and one that drives the public consumption decision is to reduce risk then it can be argued that there will be asymmetry in responses to positive and negative shocks. The terms of trade volatility by construction cannot distinguish between upside (positive) from downside (negative) risks. In particular, we could expect that to mitigate downside risk adverse shifts in the terms of trade would be met by raising or, at the least, maintaining the size of government. To test for this explicitly we add two terms of trade variables to the size regression; one giving the size of a terms of trade increase and the other the size of a decrease. For the asymmetry conjecture to hold, we would expect that coefficients on increases and decreases be unequal, inversely signed with a negative coefficient on decreases in the terms of trade that is larger in absolute value than the coefficient on the increases in the terms of trade. We find that, controlling for openness, this is indeed the case (*Table 3, Panel B*). There appears to be clear counter-cyclical behaviour with countries experiencing an adverse shift in their terms of trade tending to have larger governments. However, only the adverse terms of trade variable is significant at the 10 percent level. When we include the interaction between openness and the two terms of trade variables,

we still find that countries that are more open and experience an adverse terms of trade shock tend to have a larger government.

These results are effectively replicated when simply using a single variable for the change in the terms of trade (*Table 2*). The coefficient is negative but not significant. But when we introduce an interaction term for openness and the terms of trade, the coefficients on the openness, terms of trade and interaction term all remain highly significant. In this case, openness appears to exert a clear independent effect on government size even when we control for external risk.

While in the regressions we control for income and hence lower the risk that the terms of trade proxies for low income levels, we now explicitly look at whether the coefficients for different groups of countries classified by income levels would be the same in the government size regression. We report the coefficients from separate estimations by income categories for the specific variables of interest, namely openness, the terms of trade or the volatility term specification, and the interaction term in each instance. *Table 4* summarises our results. When we include the change in the terms of trade, we find significant differences across income levels. Controlling for openness, the high income countries have a positive but insignificant coefficient on the interaction term suggesting that government does not stabilise in terms of public consumption. By contrast, for both middle and low income economies -- and particularly the latter where the interaction term is very significant -- we find evidence that governments do adopt stabilising policies in response to external risk. Note, of course, that such counter-cyclical responses may of course be perfectly consistent with a destabilising policy in terms of growth. This would hold if in response to an adverse shock, the rise in government

Table 4 Government Size and External Risk by Income Groups: OLS and Instrumental Variables Regressions[a]
(Dependent Variable: Government Consumption/GDP in 1985 International Prices)

Panel A	**High Income Countries**	**High Income Countries**	**Middle Income Countries**	**Middle Income Countries**	**Low Income Countries**	**Low Income Countries**
Independent Variables	**OLS**	**IV**[b]	**OLS**	**IV**	**OLS**	**IV**
Openness	0.130*	0.051	0.204**	0.237***	0.147***	0.106
	(0.067)	(0.067)	(0.080)	(0.080)	(0.054)	(0.070)
Terms of Trade Changes (TOT)	1.650	1.087	-1.965*	-2.364	-1.294	-1.201
	(2.009)	(2.804)	(1.106)	(1.444)	(0.881)	(1.020)
Openness*TOT	1.445	1.723	-1.006	-1.307	-1.992**	-2.112**
	(1.728)	(2.834)	(1.248)	(1.532)	(0.937)	(0.933)
Number of Observations	74	73	154	145	129	127
R-squared[c]	0.6844	0.5763	0.558	0.5548	0.5146	0.4317

Panel B	**High Income Countries**	**High Income Countries**	**Middle Income Countries**	**Middle Income Countries**	**Low Income Countries**	**Low Income Countries**
Independent Variables	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
Openness	0.121	0.066	0.140	0.214**	-0.037	-0.093
	(0.086)	(0.087)	(0.093)	(0.093)	(0.081)	(0.094)
Volatility in Terms of Trade (STOT)	-3.478***	-4.035***	0.434	-0.89	1.497***	1.751***
	(1.165)	(1.026)	(0.482)	(0.544)	(0.563)	(0.630)
Openness*STOT	-0.031	-0.234	0.424	-0.36	1.596***	2.001***
	(1.134)	(1.167)	(0.652)	(0.742)	(0.453)	(0.584)
Number of Observations	65	64	154	145	129	127
R-squared	0.7789	0.6911	0.5452	0.5339	0.5225	0.4444

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses. Coefficients on the other regressors are not shown. Other regressors are the same as those listed in Table2.

[b] For all IV regressions in Table 4, the instruments for the following variables are the previous five year lag of itself and regional and decade dummy variables: per capita GDP; relative price of government consumption; openness; and political freedom. All other variables were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

consumption was associated with lower growth through the independent effect of government size on growth. We return to this later in Section 5 of the paper.

When we apply the volatility measure, we find that for the high income countries, the sign on the interaction term is actually negative and insignificant while for the middle income group it is positive -- as we would predict -- but insignificant. In the case of the low income countries while we find that the coefficient on the interaction term is not only positive but large and very significant, this is also true for the volatility term itself.

These findings suggest several conclusions. First, there is evidence of asymmetry in the response of government consumption to shocks. An adverse shift in the terms of trade is associated with more public consumption. Summarising external risk by the interaction of openness and the change in the terms of trade, a decline in the terms of trade is associated with an increase in government size. Second, using a volatility parameter instead likewise indicates that higher external risk is indeed associated with larger government consumption. Third, running the same regressions but distinguishing by income level, we find evidence of different behaviour across categories. Robust evidence of government stabilising through consumption only holds for low income countries, whether using the volatility or change in terms of trade measure. Fourth, while it is possible that government in high income countries may stabilise primarily through transfers, the link from external risk to consumption is less tight or general than Rodrik (1996), for one, has argued. Fifth, although our findings can partially be interpreted as consistent with government acting as a buffer against risk, they could also simply indicate the difficulties that countries have in reducing government size in the face of adversity.

What may look like a policy of risk mitigation may be little more than a more passive inability to roll-back earlier commitments.

5. Government and Growth

What are the consequences of government for growth ? Given the enormous disparity in growth rates in the period 1964-1993, it is clearly important to know to what extent such disparities can be attributed to difference in the size and actions of government.

Table 5 provides some descriptive numbers that indicate just how diverse regions' growth experiences have been. The most striking contrast is obviously from the poles of the growth story; Sub-Saharan Africa and East Asia. In 1960 average per capita income in Sub-Saharan Africa was equivalent to that in East Asia and government size was quite similar. By the 1990s East Asian incomes were on average double those in Africa but government consumption in the latter was over fifty percent larger when measured in international prices. We now look more systematically at the apparent implications of government size and other interventions on per capita growth in GDP.

The basic structure of the growth regressions reported in *Table 6* will be readily recognisable. Aside from a set of standard state variables that have been found in earlier studies to be robust [23]-- initial income, educational attainment as measured by the mean

[23] See, inter alia, Levine and Renelt (1992); Easterly and Rebelo (1993); Barro and Sala-i-Martin (1995).

Table 5 Average Per Capita GDP Growth by Region[a]

	Per Capita GDP Growth in % [b]		Observations
	1985 Int'l prices	1987 US dollars	
All Countries			
1964-73	3.1	3.0	112
1974-83	0.9	1.0	126
1984-93	0.5	0.7	137
High Income OECD			
1964-73	4.0	3.9	22
1974-83	1.4	1.6	22
1984-93	2.1	1.8	22
All Developing Countries			
1964-73	2.8	2.7	87
1974-83	0.9	0.8	97
1984-93	0.2	0.4	108
Sub-Saharan Africa			
1964-73	2.0	1.7	35
1974-83	0.1	0.0	38
1984-93	-0.6	-0.3	43
Latin America and Carribean			
1964-73	2.8	2.8	25
1974-83	0.1	0.2	27
1984-93	0.7	1.2	29
East Asia and Pacific			
1964-73	4.7	4.9	11
1974-83	3.3	3.8	12
1984-93	2.9	3.0	15
South Asia			
1964-73	-0.4	0.5	5
1974-83	2.8	2.2	5
1984-93	2.4	2.5	5
Middle East and North Africa			
1964-73	5.2	4.5	9
1974-83	-0.8	-0.0	13
1984-93	-2.5	-2.4	14
Europe and Central Asia			
1964-73	5.4	5.5	5
1974-83	2.8	2.7	8
1984-93	0.6%	0.3%	8

[a] Source: PWT5.6 and World Bank

[b] Per capita GDP growth in 1985 international prices only available up to 1992; unless otherwise noted, all regional breakdowns exclude high income countries; East Asia and Pacific includes high income countries that are not OECD members; Middle East and North Africa includes one high income country.

years of schooling, and the population growth rate -- we also include the share of investment in GDP; these are the four Levine-Renelt variables. While investment share of GDP does not precisely measure the direct effect of government spending on investment -- the numbers are not available broken down by public and private components -- it does allow us to capture the effect of aggregate investment on growth. We add a set of control variables. For government size, we use the share of government consumption in GDP. in the OLS estimation and for the IV estimation we plug in the predicted values from the government size regression. But, as indicated above, size alone -- whether given in terms of investment or consumption outlays -- cannot adequately summarise the dimensions of government action. Accordingly, we introduce two other variables that capture the indirect effects of government; a policy distortion index and a measure for the quality of bureaucracy. We also look at the combined effect of government size and bureaucracy through an interaction term. A terms of trade variable is included as well as decade and regional dummies [24]. As before, the regressions are run on the pooled data set and both OLS and IV results are initially reported in *Table 6*. In general, the OLS and IV estimates are very close; the discussion concentrates on the latter. In the IV regressions, we instrument for investment share of GDP, government size, the interaction of

[24] We also tested for the effect of political and civil freedoms -- as measured by the Gastil indices -- on growth, entering the term both linearly and in quadratic form, but found no significant association.

Table 6 GDP Growth Regressions: OLS and Instrumental Variable[a]
(Dependent Variable: Per Capita GDP Growth in 1985 International Prices)

Independent Variables	OLS	OLS	IV[b]	IV
Constant	0.171***	0.161***	0.167***	0.136***
	(0.022)	(0.024)	(0.027)	(0.038)
Dummy for 1974-83	-0.015***	-0.015***	-0.015***	-0.014***
	(0.003)	(0.003)	(0.004)	(0.004)
Dummy for 1984-93	-0.017***	-0.016***	-0.017***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.004)
Initial Per Capita GDP	-0.019***	-0.019***	-0.021***	-0.021***
	(0.003)	(0.003)	(0.003)	(0.003)
Initial Schooling	0.003	0.003	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
Population Growth	-0.184	-0.209	-0.260	-0.304
	(0.192)	(0.192)	(0.204)	(0.203)
Investment/GDP	0.009***	0.009***	0.008**	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)
Government Size	-0.016***	-0.022***	-0.023***	-0.038***
	(0.004)	(0.008)	(0.008)	(0.015)
Quality of Bureaucracy	0.017*	0.041	0.027***	0.085*
(0 worst, 1 best)	(0.009)	(0.027)	(0.010)	(0.044)
Government Size*Quality of Bureaucracy		0.014		0.033
		(0.014)		(0.024)
Policy Distortion	-0.006***	-0.006***	-0.005***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Terms of Trade Changes	0.034	0.034	0.042	0.044
	(0.040)	(0.040)	(0.042)	(0.042)
Latin America Dummy	-0.017***	-0.017***	-0.015***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.004)
Sub-Saharan Africa Dummy	-0.030***	-0.030***	-0.028***	-0.028***
	(0.006)	(0.006)	(0.006)	(0.006)
Socialist Dummy	-0.008	-0.008	-0.013**	-0.013**
	(0.006)	(0.006)	(0.005)	(0.005)
Number of Observations	271	271	258	258
R-squared[c]	0.5196	0.5213	0.487	0.4921

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heterscedasticity, are in parentheses.

[b] For the IV regressions in Table 6, the instruments for the following variables are the previous five year lag of itself and regional and decade dummy variables: policy distortion and investment/GDP. The instrument for the government size variable is the prediction from the government size instrumental variable regression reported in Table 2. All other variables in the regression were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

government size and the quality of bureaucracy and the policy distortion variable. The instruments are the average of the previous five year lags of each endogenous variable except for government size for which we use the predicted values from the IV government size regression (Table 2, column 4).

The state variables all have the predicted signs. The coefficient on the initial income term indicates a conditional convergence rate of 2.1 percent per annum [25]. Human capital formation, as given by schooling, affects growth positively, as does the investment rate; the latter very significantly. Population growth exerts a negative effect on growth while the terms of trade variable a positive effect. Both however are insignificant. In terms of the government variables, we pick up an unambiguously negative and significant effect from government consumption spending. A one standard-deviation increase in government consumption is associated with a decline in per capita growth rate of 0.65 percentage points per annum [26]. We also find an unambiguous negative growth effect of policy distortions that is significant at the 1 percent level. This indicates that policy distortions, as measured by our index, will have a predictably negative effect on growth. However, the size of that effect, controlling for other variables, as given by the coefficient on the policy term is not that large, at least relative to the government size variable (0.5 percentage points per annum). By contrast, the quality of bureaucracy variable exerts a sizeable, positive and significant effect on growth. Similarly, interacting the government consumption term with the quality of bureaucracy

[25] This is close to the estimate of 2.6 percent reported by Barro and Sala-i-Martin (1995).

[26] Again, close to the 0.7 estimate of Barro and Sala-i-Martin (1995).

variable -- an attempt to coax out the combined implications -- yields a positive coefficient.

In a simple standard endogenous growth model such as Barro (1991) the relationship between growth and government size is non-linear. Per capita growth can even become negative if government share of output approaches zero or unity. Under some parametric restrictions, Barro derives an inverted-U type relationship between government share of output and growth. This raises the question whether the log-linear regression that we have reported is a misspecification. We experiment by adding a quadratic term in government size to all growth regressions (as given in *Table 6*). The coefficients on the linear and quadratic terms are not significantly different from zero either jointly or individually. To investigate if this result is driven by the fact that government size is in logs, we take its anti-log and enter government size as a ratio ranging from zero to one. Under this specification, government size by itself is still negative and statistically significant. When we add the square of the ratio of government size to the regressions, we find a U-curve relationship. However only the linear term is negative and statistically significant (i.e. most of the observations lie on the downward sloping portion of the U-curve). In sum, we find that the linear-quadratic relationship as a simple form of non-linearity does not conform with the predictions of the standard endogenous growth model. However, within a linear specification, we still find a statistically significant negative relationship whether government is entered as a ratio or in logs, a finding that is consistent with the Barro-type model.

What have been the implications for the relative performance of countries and regions ? To look at this more closely, we now decompose these factors by region. *Figure 1* , based on the IV regression (*Table 6*, column 4) separates out the effects of government size, policy, investment, education and the quality of government on growth. The results are presented in terms of the factors accounting for the difference of particular regions' growth from the world average. We combine policy and investment, as we can think of the latter being strongly correlated with the quality of policy; a feature that clearly emerges from empirical work on the determinants of investment [27].

We can see that large government size has indeed been a factor accounting for the relatively poor performance of countries in Africa, the Middle East and North Africa, as well as in South Asia. But it is also clear that policy, investment and the quality of bureaucracy are important in explaining the differences across countries. Thus, Sub-Saharan Africa's poor performance over the period 1964-1993 can be attributed not only to low educational attainment, high population growth and large relative government size but also to the presence of poor policy and low investment. In addition, countries in that region have not benefited from a high quality of bureaucracy so that there is a strong combined negative effect from government size and the quality of bureaucracy.

In short, when evaluating the consequences of government for growth, it is not simply size that is relevant. Bad policies -- as indicated through over-valued exchange rates and pervasive trade restrictions -- hold down a country's growth while the quality of

[27] There is a large literature. Among others, Keefer and Knack (1995).

government can exert a positive effect on performance. And it is clear that countries and regions that have fared least well tend to do worst on all three indicators. It is the combination of government size and the quality of policy and institutions that seems to matter.

Figures 2 and 3 show another illustration of the growth decomposition. They are based on the IV regression of the *Table 6*, column 4 and use a methodology that is routinely used in the interpretation of regression results. The methodology is as follows. Each cell in the figures is constructed as one standard deviation band around the mean of the respective variable. This generates the four cells in each figure [28]. For each cell, we calculated the fitted regression at the average values of all the remaining right hand side variables. The fitted value is the implied growth rate for the cell and is plotted in each figure. *Figure 2* shows that, other things being equal, countries that are characterised by low quality of bureaucracy and high policy distortion will, on average, grow at a rate of 0.42 percent per year, whereas countries in the extreme polar case of high quality and low distortion (the best case scenario) will grow at a much higher rate of 3.04 percent per year.

These are staggering numbers. We have calculated the number of years it will take for an average country to double its per capita GDP under each of the scenarios in *Figures 2 and 3*. Results are shown in *Panels A and B* under each figure. *Panel A* shows that, other things being equal, a country that follows distortionary policies and has

[28] We also experimented with two standard deviations. The ranking of growth rates in the cells in each graph does not change.

a low quality of bureaucracy will, on average, take 165 years to double its per capita GDP as opposed to 23 years in the best case scenario of low distortion and high quality. Similarly, *Panel B* shows that, other things being equal, a country that has a high government size ratio and a low quality of bureaucracy will on average take 239 years to double its per capita GDP as opposed to 22 years in the best case scenario of high quality and low size. Are these number unrealistic? No; as the following examples illustrate. Starting in 1870, it took the United States 31 years and Brazil 57 years to double their per capita GDP. Since 1960, East Asian countries more than doubled their per capita GDP in 30 years. Sub-Saharan Africa countries on the other hand, while starting with comparable levels of per capita GDP and government size in 1960 as the East Asian countries, have only increased per capita GDP by about 50 percent in 30 years.

6. Government and Well-being

Growth in income is obviously critical; hence our concentration on the consequences of government for income. But it is only one of several measures that we can use to look at the consequences of government. For example, concern with raising peoples' ability to function implies that performance should also be judged on other standards of well-being, such as infant mortality, schooling and life expectancy [29]. These outcomes will reflect not only the impact of income growth but also the direct effects of social spending by government. The latter will in turn be affected by the average income

[29] Sen (1987).

level. For example, Anand and Ravallion (1993) attribute roughly two-thirds of the elasticity of life expectancy with regard to average income to the positive effect of income on public health spending and roughly one-third to the decrease in income-measured poverty associated with higher mean incomes.

We look at the direct relationship between the infant mortality rate and life expectancy and per capita GDP growth and the share of social sector spending in GDP. We control for initial income, a measure of income inequality -- as given by a country's Gini coefficient for income, a measure of political freedom -- as measured by the Gastil index , the quality of bureaucracy, and regional and decade dummies. We instrument for per capita GDP growth, social spending share of GDP, political freedom and income inequality. The instruments are the average of the previous five year lags of each endogenous variable except for per capita GDP growth rate for which we use the predicted values from the IV growth regression (Table 6, column 4). *Table 7* reports the OLS and IV results from two regressions explaining infant mortality and life expectancy. As usual, we concentrate on the IV estimates. Essentially, we get qualitatively similar results from the two regressions [30]. Life expectancy and infant mortality -- the latter significantly -- improve as a result of income growth. Further, the share of social spending by government is associated with higher life expectancy and lower infant

[30] This is not unexpected as some life expectancy data are extrapolated from infant mortality rates and therefore may not contain any additional information (See Pritchett and Summers (1996)). We thank Lant Pritchett for this observation.

Table 7 Government and Well-Being Regressions: OLS and Instrumental Variable[a]
(Dependent Variables: Infant Mortality Rate and Life Expectancy)

Independent Variables	Infant Mortality		Life Expectancy	
	OLS	IV[b]	OLS	IV
Constant	7.851***	11.872***	0.161***	-6.223***
	(0.024)	(0.383)	(0.024)	(0.383)
Dummy for 1974-83	-0.118	-0.794***	-0.015***	0.336**
	(0.147)	(0.199)	(0.003)	(0.130)
Dummy for 1984-93	-0.428**	-1.119***	-0.016***	0.538***
	(0.166)	(0.230)	(0.004)	(0.151)
Initial Per Capita GDP	-0.780***	-1.128***	0.450***	0.542***
	(0.097)	(0.137)	(0.060)	(0.089)
Per Capita GDP Growth	-5.684*	-31.446***	2.792	8.844*
	(3.061)	(7.367)	(1.940)	(5.183)
Social Spending/GDP	-0.341***	-0.289***	0.155***	0.136***
	(0.074)	(0.074)	(0.048)	(0.052)
Quality of Bureaucracy	-0.865**	0.142	0.076	-0.237
(0 worst, 1 best)	(0.392)	(0.446)	(0.236)	(0.282)
Political Freedom	0.023	0.034	-0.043*	-0.045*
(1 high, 7 low)	(0.036)	(0.038)	(0.022)	(0.025)
Income Inequality	0.036***	0.003***	-0.012**	-0.012**
	(0.009)	(0.009)	(0.005)	(0.006)
Latin America Dummy	-0.051	-0.475*	0.002	0.164
	(0.192)	(0.210)	(0.111)	(0.122)
Sub-Saharan Africa Dummy	-0.405*	-1.341***	-0.195	0.057
	(0.243)	(0.370)	(0.142)	(0.229)
East Asia Dummy	-0.434**	-0.239	0.007	0.005
	(0.188)	(0.184)	(0.094)	(0.097)
Socialist Dummy	-0.106	-0.317*	-0.033	-0.027
	(0.223)	(0.184)	(0.141)	(0.150)
Number of Observations	105	91	105	91
R-squared[c]	0.8723	0.8811	0.8494	0.8404

*** significant at 1% level ** significant at 5% level * significant at 1% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses.

[b] For all IV regressions in Table 7, the instruments for the following variables are the previous five year lag of itself and regional decade dummy variables: social spending/GDP; political freedom; and income inequality. The instrument for GDP growth is the prediction from the growth instrumental variable regression reported in Table 6. All other variables in the regression were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

mortality [31]. The point estimates on social spending are significantly different from zero at 1 percent level. In addition, the quality of bureaucracy also affects these well-being indicators. However, the effect is not significantly different from zero once we condition on initial income. In fact we find that initial income is a powerful indicator of how countries are doing with respect to infant mortality and life expectancy [32]. The elasticities of infant mortality and life expectancy with respect to initial per capita GDP are -1.128 and 0.542, respectively, both of which are significant at the 1 percent level [33]. Lack of political freedoms exerts a negative effect on both infant mortality and life expectancy but this is only significant at the 10 percent level in the case of life expectancy. It is interesting to observe that higher inequality of income in a country has unambiguously adverse consequences for these indicators. The point estimates are significantly different from zero at the 1 percent level. This suggests that one channel through which inequality will generate long run consequences is through poorer health outcomes. Poor health outcomes can in turn have long-run growth effects if life expectancy and infant mortality are in turn allowed to enter the growth regression.[34]

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[31] Alberto Alesina suggested controlling for total government expenditure. We reran the well-being regressions including total government expenditure net of social spending as a fraction of GDP in addition to the other variables given in Table 7. We found that this variable was not statistically significant and that the addition of this variable did not change our previous results.

[32] Like the growth regression, we do not instrument for the initial income since it is predetermined with respect to future movements in life expectancy and infant mortality.

[33] These point estimates are much higher than those reported by Pritchett and Summers (1996). The differences are due to the use of different conditioning variables, different transformations on the dependent variables and different time averaging of data. Our estimates can be considered as longer-run elasticities than those of Pritchett and Summers(1996).

[34] In fact as a sensitivity test we included these indicators separately in the growth regression. We found that better well-being indicators are indeed associated with higher growth and that other variables in the growth regression continued to be significant and with the same sign as before.

7. How Robust are these Findings ?

To this point, we have reported results from OLS and IV regressions. In both the size and growth regressions, the estimates were found to be stable. In the life expectancy and infant mortality regressions, the OLS and IV produced qualitatively similar results; and the variables that were statistically significant under OLS continued to be significant under IV as well. We now undertake two further exercises. The first involves the joint estimation of size, growth, infant mortality and life expectancy regressions. The second looks at how sensitive our results are to measurement error and the specification of the regression model.

7.1. System Estimation

The system of four equations represents a simultaneous equation system. Growth depends, among other things, on government size; government size is in turn determined by another equation; and in the remaining two equations, growth affects life expectancy and infant mortality. In addition to the four left-hand side variables, there are many other endogenous variables in the system. In terms of the empirical work, the resulting endogeneity needs to be addressed, otherwise it will lead to biased parameter estimates. So far, we have taken care of the endogeneity problem by applying the IV technique on each equation separately. Although preferable to OLS, the IV technique suffers from two shortcomings. First, even in the absence of simultaneity, it is more efficient to use system-wide estimation techniques than single-equation techniques since errors can be correlated across equations. Sources of cross-equation correlation can be the impact of

unobserved common shocks, unobserved country-specific effects or common omitted variables or all of the above. In the data we do find that errors across equations are correlated. Second, system-wide estimation methods are preferable to single equation methods since they use information in other parts of the system that will increase the efficiency of parameter estimates. However, with these advantages also comes one important disadvantage relative to the single equation IV technique: misspecification in one equation, when estimated as part of a system, can lead to biased and inconsistent parameter estimates in that equation and the rest of the system[35] . Because of these problems with both techniques and in the absence of a fully-specified structural model, it is good practice to report all three estimation techniques. This provides additional sensitivity tests needed for cross-country analysis. We use three stage least square (3SLS) as a system-wide estimation technique which takes care of simultaneity as well as cross-equation correlation[36] .

The four equation system has 14 endogenous variables and 16 exogenous variables [37]. Much like the single equation IV, we need to confront the choice of instruments for all the endogenous variables. We adopt two approaches. In the first, we use the same instrument set as in the single equation IV. These are predetermined

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[35] A typical mis-specification bias is an invalid exclusion restriction or an invalid instrument.

[36] For other applications of 3SLS in the endogenous growth literature, see Tavares and Wacziarg (1996), Barro (1996b), and Alesina and Perotti (1996).

[37] The system is identified via exclusion restrictions, parameter constancy across time periods and satisfies the rank and order conditions of the SEMs (see Green (1993), p.594).

variables (i.e., lagged endogenous variables in the model) [38]. However, unlike in the single equation IV regression where each lagged endogenous variable is used only as the instrument for that endogenous variable, in the system regressions, the entire instrument set for each system is used for all the endogenous variables. In the second approach, we use as instruments only variables within the model that we consider exogenous as well as exogenous variables that are not present in the model [39]; this instrument set does not include lagged endogenous variables. Again, these instruments are used for all the endogenous variables within the system.

In a simultaneous equation system, it is quite likely that instruments that are a better match with endogenous variables in one equation -- based on the criteria of a high adjusted R-squared from the first-stage regression *and* theoretically-correct signs from the second and third stage regressions -- may not be good instruments in other equations[40]. Indeed, in the context of our four equation system, the choice of the two instrument sets makes a great deal of difference. Specifically, we find that when lagged endogenous variables are used as instruments, the first-stage adjusted R-squared is consistently higher than when exogenous variables are used as instruments even though they are fewer lagged endogenous variables used as instruments. We also find that lagged endogenous variables are a better match with the growth and size regressions (based on the same

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[38] See Barro and Sala-i-Martin (1995), Barro (1996a ,1996b) for this approach. Note that lagged endogenous variables are predetermined variables since error terms are not correlated across decades.

[39] See Tavares and Wacziarg (1996) and Dollar and Burnside (1996) for this approach.

[40] We do not base our judgment on the R-squared from the 2SLS or 3SLS as these R-squared cannot be used as model selection criteria.

criteria as above) than with the life expectancy and infant mortality regressions. Consequently, we present 3SLS estimates of three systems: growth and size; life expectancy and infant mortality; and finally all four regressions.

Table 8 contains 3SLS estimates of growth and size regressions using lagged endogenous variables as instruments. All the variables in the growth regressions have the same signs as the OLS and IV regressions and with even higher statistical significance. In comparison, we seem to have achieved extra efficiency by a system estimation. Point estimates are also close to the OLS and IV estimates; only changes in the terms-of-trade has a higher coefficient which is now statistically significant at the 10 percent level; the convergence rate is about 2 percent per annum. With regard to the size regression, the signs of all the variables are the same as the OLS and IV regressions; Wagner's law still does not hold; and unlike the single equation OLS and IV regressions, the terms-of-trade changes and its interaction with openness are no longer significant.

Table 9 contains the 3SLS estimates of infant mortality and life expectancy regressions using exogenous variables as instruments [41]. In comparison to the OLS and IV regressions, per capita GDP growth has the wrong sign in the life expectancy regressions, but the right sign in the infant mortality regression. However, neither coefficient is significantly different from zero. Much like the OLS and IV regressions, growth does not matter much for these measures of well-being once we control for initial per capita GDP. Initial per capita GDP, income inequality and social spending continue to

[41] Using lagged endogenous variables does produce higher adjusted R-squared, but signs of some coefficients do not conform with the OLS and IV results.

Table 8 System Estimation of Two Equations:Three Stage Least Square[a]

Independent Variable: Growth		Independent Variable: Government Size	
Dependent variables		Dependent variables	
Constant	0.159***	Constant	-1.333***
	(0.026)		(0.422)
Dummy for 1974-83	-0.015***	Dummy for 1974-83	0.036
	(0.003)		(0.041)
Dummy for 1984-93	-0.017***	Dummy for 1984-93	0.089**
	(0.004)		(0.043)
Initial Per Capita GDP	-0.019***	Per capita GDP	0.066
	(0.003)		(0.050)
Initial Schooling	0.003***	Age Dependency Ratio	0.318***
	(0.002)		(0.111)
Population Growth	-0.335**	Urbanization Ratio	-0.002
	(0.165)		(0.050)
Investment/GDP	0.006**	Relative Price of Government Consumption	-0.697***
	(0.003)		(0.064)
Government Size	-0.021***	Openness	0.136***
	(0.008)		(0.041)
Quality of Bureaucracy	0.056**	Terms of Trade Changes	-0.851
(0 worst, 1 best)	(0.029)		(0.906)
Government Size * Quality of Bureaucracy	0.022	Openness * Terms of Trade Changes	-1.422
	(0.016)		(1.015)
Policy Distortion	-0.006***	Years Since Independence	-0.164***
	(0.002)		(0.058)
Terms of Trade Changes	0.064*	Political Freedom	-0.012
	(0.036)	(1 high, 7 low)	(0.014)
Latin America Dummy	-0.016***	Federal Dummy	-0.073
	(0.003)		(0.053)
Sub-Saharan Africa Dummy	-0.030***	Latin America Dummy	-0.199***
	(0.005)		(0.043)
Socialist Dummy	-0.015***	East Asia Dummy	-0.339***
	(0.005)		(0.067)
Number of Observations	257		257
System R-squared[b]	0.5581		

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Correlation among the error terms of the two equations is 0.02. The numbers in parentheses denote standard errors. The instruments are initial per capita GDP, initial per capita GDP squared and previous five year lagged averages of the following endogenous variables: investment/GDP; government size; government size * bureaucracy; policy distortion; per capita GDP; relative price of government consumption; openness; openness * terms of trade changes; and political freedom.

[b] System R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

Table 9 System Estimation of Two Equations: Three Stage Least Square[a]

	Dependent Variable	
Independent Variables	Infant Mortality	Life Expectancy
Constant	4.321**	-2.660**
	(1.966)	(1.278)
Dummy for 1974-83	-0.116	0.089
	(0.179)	(0.116)
Dummy for 1984-93	-0.349**	0.311***
	(0.186)	(0.121)
Initial Per Capita GDP	-0.584***	0.303***
	(0.157)	(0.102)
Per Capita GDP Growth	-7.534	-1.378
	(6.113)	(3.974)
Social Spending/GDP	-0.516***	0.233***
	(0.124)	(0.081)
Quality of Bureaucracy	-1.074**	0.077
(0 worst, 1 best)	(0.557)	(0.362)
Political Freedom	0.129	-0.121*
(1 high, 7 low)	(0.101)	(0.066)
Income Inequality	0.070***	-0.034***
	(0.017)	(0.011)
Latin America Dummy	-0.752**	0.354*
	(0.320)	(0.208)
East Asia Dummy	-0.560**	0.267
	(0.311)	(0.202)
Sub-Saharan Africa Dummy	-0.892***	0.004
	(0.351)	(0.228)
Socialist Dummy	-0.220	-0.159
	(0.527)	(0.343)
Number of Observations	91	91
System R-Squared[b]	0.8230	

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Correlation between the error terms of the two equations is -0.79***. Standard errors are in parentheses. The instruments are: initital per capita GDP; initial per capita GDP squared; population growth; initial schooling; quality of bureaucracy; terms of trade changes; number of assassinations; number of coups, age dependency ratio; urbanization ratio; population density; years since independence; federal dummy; socialist dummy; Latin America dummy; East Asia dummy; Sub-Saharan Africa dummy and decade dummy variables.

[b] System R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

be statistically significant at the 1 per cent level. Across the three estimation methods, we continue to find that countries that have high life expectancy and low infant mortality tend to have high social spending, more equitable distribution of income, higher per capita income, a higher level of political freedom and better bureaucracy.

Table 10 reports 3SLS estimates of the four equation system with lagged endogenous variables as the instruments. Except for per capita GDP growth in the life expectancy and infant mortality regressions, all variables in the system have the same signs as the previous two tables, but with fewer statistically significant coefficients. One reason has to with the reduction in sample size which has reduced cross-country variations in the dependent and independent variables. Another reason is that gains in efficiency via estimating a four-equation estimation may have been swamped by using the same instruments for all the endogenous variables, a factor which was alluded earlier. Estimating the same system with the exogenous variables as instruments produces more variables with signs that are different from the two equation system, the OLS or the IV regressions [42].

7.2. Sensitivity Analysis

How sensitive are our results to measurement errors and the specification of the estimated equations? We focus on three areas. First, we test for sensitivity to individual observations to see if our estimates are affected by outliers in the data with particular attention to the relationship between government size and growth. Second, we re-

[42] These results are available from authors upon request.

Table 10 System Estimation of Four Equations: Three Stage Least Square[a]

Dependent Variable: Growth		Dependent Variable: Government Size	
Independent Variables		Independent Variables	
Constant	0.146***	Constant	-1.780***
	(0.038)		(0.851)
Dummy for 1974-83	-0.009*	Dummy for 1974-83	0.031
	(0.005)		(0.083)
Dummy for 1984-93	-0.009*	Dummy for 1984-93	0.074
	(0.005)		(0.089)
Initial Per Capita GDP	-0.022***	Per capita GDP	0.135
	(0.004)		(0.113)
Initial Schooling	0.005	Age Dependency Ratio	0.267
	(0.006)		(0.240)
Population Growth	-0.333	Urbanization Ratio	-0.095
	(0.269)		(0.099)
Investment/GDP	0.001	Relative Price of Government Consumption	-0.887***
	(0.006)		(0.191)
Government Size	-0.037***	Openness	0.091
	(0.012)		(0.094)
Quality of Bureaucracy	0.059	Terms of Trade Changes	-1.021
(0 worst, 1 best)	(0.044)		(1.976)
Government Size * Quality of Bureaucracy	0.031	Openness * Terms of Trade Changes	-1.020
	(0.024)		(1.976)
Policy Distortion	-0.006***	Years Since Independence	-0.139
	(0.002)		(0.135)
Terms of Trade Changes	0.180***	Political Freedom	-0.029
	(0.054)	(1 high, 7 low)	(0.022)
Latin America Dummy	-0.018***	Federal Dummy	-0.110
	(0.005)		(0.108)
Sub-Saharan Africa Dummy	-0.026***	Latin America Dummy	-0.229***
	(0.009)		(0.084)
Socialist Dummy	-0.026***	East Asia Dummy	-0.304***
	(0.009)		(0.126)
Number of Observations	91		91
System R-squared[b]	0.7420		

[a] Standard errors are in parentheses. The instruments are: initial per capita GDP; initial per capita GDP squared; federal dummy; initial income inequality; initial social spending/GDP; socialist dummy; Latin America dummy; Sub-Saharan Africa dummy; constant; decade dummy variables; previous five year lagged variables of policy distortion, investment/GDP; relative price of government consumption, openness; political freedom, government size, and growth; lagged government size* quality of bureaucracy; and lagged openness*terms of trade changes.

[b] System R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

Table 10 continued System Estimation of Four Equations: Three Stage Least Square

	Dependent Variable	
Independent Variables	Infant Mortality	Life Expectancy
Constant	7.389***	-4.540***
	(1.208)	(0.726)
Dummy for 1974-83	-0.109	0.106
	(0.173)	(0.105)
Dummy for 1984-93	-0.363**	0.306***
	(0.182)	(0.110)
Initial Per Capita GDP	-0.765***	0.407***
	(0.117)	(0.071)
Per Capita GDP Growth	1.308	-1.891
	(6.589)	(3.952)
Social Spending/GDP	-0.376***	0.174***
	(0.097)	(0.058)
Quality of Bureaucracy	-0.855**	0.051
(0 worst, 1 best)	(0.436)	(0.264)
Political Freedom	0.029	-0.051**
(1 high, 7 low)	(0.043)	(0.025)
Income Inequality	0.037***	-0.015***
	(0.010)	(0.006)
Latin America Dummy	-0.049	0.022
	(0.232)	(0.139)
East Asia Dummy	-0.699***	0.135
	(0.279)	(0.166)
Sub-Saharan Africa Dummy	-0.335	-0.262
	(0.350)	(0.211)
Socialist Dummy	0.201	-0.234
	(0.325)	(0.196)
Number of Observations	91	91
System R-Squared	0.7420	

*** significant at 1% level ** significant at 5% level * significant at 10% level

Correlation Among Error Terms

	Life Expectancy	Infant Mortality	Growth	Size
Life Expectancy	1			
Infant Mortality	-0.78	1		
Growth	0.30	-0.17	1	
Size	-0.01	-0.01	0.05	1

estimate the growth and size regressions using the World Bank data in constant dollars. In particular, we focus on the measure of government size and the relative price of government consumption. Finally, we address the inclusion of regional dummy variables in the regression.

Individual data points with large residuals or high leverage - outliers - may or may not exert disproportionate influence on our estimates [43]. To test for outliers, we re-estimated our three sets of regressions - OLS and IV government size, growth and well-being regressions - after removing data points identified as having a large residual and/or high leverage in each regression. Anywhere from five to eleven data points were identified as outliers in each regression. The results after removing the outliers in all our regression sets were not significantly different from our estimations using the full sample.

We delve further in our outlier analysis to check for the robustness of the government size and growth relationship. In the growth regressions, there was a negative and significant relationship between government size and growth. To test whether this result is due to a few observations with either 1) a large government size and low or negative growth or 2) a small government size and high growth rates we re-estimated the two sets of growth regressions after removing outliers in government size and per capita GDP growth rates [44]. In all cases, the relationship remained negative and significant and the other parameters in the regression were not significantly affected.

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[43] See Belsley, Kuh and Welsch (1980).

[44] Four new sets of regressions were re-estimated. First, observations with large government size - one or one and a half standard deviations greater than the sample mean of government size - were removed. Second, observations with small government size - one or one and a half standard deviations less than the sample mean of government size - were removed. Third, observations with high per capita GDP

The second type of sensitivity analysis compares estimation of government size and growth regressions using Summers-Heston data with that using World Bank data. *Table 1* indicated the difference in the government consumption size measure that arose when using World Bank data in 1987 constant US dollar prices rather than international prices. In particular, government size in the low income countries of South Asia and Sub-Saharan Africa would be significantly reduced when using 1987 constant dollar prices, while government size in the high income countries would be increased relative to purchasing power parity values [45]. To test the sensitivity of our results to the deflators, we now re-estimate the growth and size regressions but this time use the World Bank data in constant dollars. *Tables 11* reports results of the size regression from the OLS and IV estimations for both constant dollar and international prices for the same set of countries.

While the explanatory power of the regression is very much lower using constant dollar values in the size regression (0.3675 versus 0.5791), the signs on the explanatory variables are generally the same. The main difference when using World Bank data is that we now find a significantly positive association between the income level and government size; an apparent confirmation of Wagner's Law [46]. One interpretation of

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growth - one or one and a half standard deviations greater than the sample mean of the per capita GDP growth rate - were removed. Fourth, observations with low or negative per capita GDP growth - one or one and a half standard deviations less than the sample mean of the per capita GDP growth rate - were removed.

[45] The greatest sensitivity -- as can be seen from Table 1 -- is in South Asia. To check the robustness of the estimates, we ran the same regressions without South Asia. The sign and size of the coefficients was not substantially affected.

[46] A simple correlation of government size and per capita income is also positive and significant at the 1 percent level.

Table 11 Government Size Regressions: Sensitivity of Estimation to Choice of Deflators[a]
(Dependent Variable: Government Consumption/GDP)

Independent Variables	1987 US Dollars OLS	1987 US Dollars IV[b]	1985 International Prices OLS	1985 International Prices IV
Constant	-2.539***	-2.410***	-1.431***	-1.193***
	(0.289)	(0.295)	(0.384)	(0.424)
Dummy for 1974-83	0.032	0.043	0.024	0.063
	(0.051)	(0.052)	(0.039)	(0.042)
Dummy for 1984-93	0.073	0.084	0.071*	0.106**
	(0.051)	(0.071)	(0.042)	(0.044)
Per Capita GDP	0.151***	0.129***	0.082	0.048
	(0.036)	(0.036)	(0.051)	(0.055)
Age Dependency Ratio	0.472***	0.318**	0.435***	0.373**
	(0.152)	(0.153)	(0.155)	(0.157)
Urbanization Ratio	-0.022	0.002	-0.025	-0.011
	(0.048)	(0.050)	(0.041)	(0.047)
Relative Price of Government	-0.216***	-0.225***	-0.700***	-0.720***
	(0.068)	(0.080)	(0.069)	(0.092)
Openness	0.184***	0.142**	0.116***	0.076*
	(0.053)	(0.056)	(0.036)	(0.044)
Terms of Trade Changes (TOT)	-2.784	-2.572***	-2.439***	-2.694***
	(0.949)	(0.043)	(0.894)	(0.968)
Openness*TOT	-3.181	-2.986***	-2.750***	-3.062***
	(1.181)	(1.101)	(0.940)	(0.942)
Years Since Independence	-0.004	-0.060	-0.116*	-0.155**
	(0.070)	(0.071)	(0.060)	(0.069)
Political Freedom	-0.024*	-0.021	-0.031**	-0.031**
(1 high, 7 low)	(0.014)	(0.014)	(0.013)	(0.014)
Federal Dummy	0.004	-0.021	-0.041	-0.053
	(0.059)	(0.059)	(0.043)	(0.043)
Latin America Dummy	-0.285***	-0.265***	-0.207***	-0.168***
	(0.062)	(0.065)	(0.050)	(0.057)
East Asia Dummy	-0.190**	-0.166*	-0.284**	-0.296***
	(0.081)	(0.086)	(0.042)	(0.053)
Number of Observations	297	290	297	290
R-squared[c]	0.3675	0.3402	0.5791	0.5404

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses.

[b] For all IV regressions in Table 11, the instruments for the following variables are the previous five year lag of itself and regional regional and decade dummy variables: per capita GDP; relative price of government consumption; openness; and political freedom. All other variables in the regressioin were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

this finding is that, in measuring government size and per capita GDP, Summers-Heston data has managed to correct for cost of living differences across countries. With the World Bank data, however, the relative ranking of countries based on government size or per capita GDP has on average remained the same. Relative prices of government consumption of goods and services continues to be negatively signed and significant at the 1 percent level no matter whether the data is measured in constant 1987 US dollar prices or constant 1985 international prices.

The point estimates of the relative price variable in the government size regression show perhaps an unusually large responsiveness of government consumption to its price measured relative to the price of private consumption goods (-0.644 OLS and -0.724 IV in *Table 2*). To the extent that relative prices of public and private goods differ systematically over time and across countries, this discrepancy is expected to affect the real quantity of goods and services purchased by the government. However, to the extent that government purchases of goods and services may not be comparable across countries (e.g., due to subsidies and taxes; monopsony power of government) the point estimates in *Table 2* could show too high a price elasticity. An alternative estimate of price elasticity can be derived using World Bank constant dollar prices which shows an elasticity of -0.225 (IV *Table 11*). This discrepancy can be traced to marked differences in the measurement of relative prices across the two data sets. In the Summers-Heston data, services are more expensive in high income countries whereas in the World Bank data,

services are more expensive in low income countries [47]. This is important because services compose a large share of government consumption in low income countries. Finally, to sharpen further the point estimate of price elasticity, we revisited the Summers-Heston data and excluded countries that Summers and Heston had given a low quality rating (quality D) and re-estimated the size regression of *Table 2* using the remaining data. As expected, this reduced the estimate of elasticity to -0.578 (OLS) and -0.697 (IV).

Turning to the growth estimations (*Table 12*), we can again largely replicate results. The growth regression that uses World Bank data has a lower R-squared (0.5602 versus 0.6161) than the regression with constant 1985 international prices [48]. For the IV regression, we again plug in the prediction from the size regression of *Table 11*. Lagged five-year averages are used as instruments for the other endogenous variables. The state variables generally yield similar signs and point estimates. In the case of the initial income or convergence term, the coefficient when using the World Bank values is smaller in absolute value, indicating a slower conditional convergence rate of 0.3 percentage points per year as opposed to 1.8 percentage points [49]. The government size variable is negative and significant in both estimations. The quality of bureaucracy variable

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[47] The correlation coefficient between relative prices of government consumption and real per capita GDP is 0.62 when using Summers Heston data and -0.1 when using World Bank data; both are significant at 1 percent level.

[48] The dependent variable is different, but it is known that per capita growth from the two data sets are closer to each other than the level of per capita GDP (see *Table 5* and Barro and Sala-i-Martin (1995) p. 444). Hence, the comparison of the R-squared is valid and is in fact equivalent to a non-nested J-type hypothesis test carried out by Barro and Sala-i-Martin (1995).

[49] See also Barro and Sala-i-Martin (1995).

Table 12 GDP Growth Regressions: Sensitivity of Estimation to Choice of Deflators[a]
(Dependent Variable: Per Capita GDP Growth)

Independent Variables	1987 US Dollars OLS	1987 US Dollars IV[b]	1985 International Prices OLS	1985 International Prices IV
Constant	0.111***	-0.040	0.169***	0.126***
	(0.020)	(0.035)	(0.022)	(0.025)
Dummy for 1974-83	-0.019***	-0.012***	-0.016***	-0.012***
	(0.003)	(0.004)	(0.003)	(0.004)
Dummy for 1984-93	-0.021***	-0.013***	-0.016***	-0.012***
	(0.003)	(0.004)	(0.003)	(0.004)
Initial Per Capita GDP	-0.009***	-0.003*	-0.020***	-0.018***
	(0.002)	(0.002)	(0.003)	(0.003)
Initial Schooling	0.003	0.001	0.005*	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Population Growth	-0.411*	-0.146	-0.240	-0.116
	(0.227)	(0.181)	(0.200)	(0.196)
Investment/GDP	0.014***	0.011**	0.010***	0.008**
	(0.004)	(0.005)	(0.003)	(0.003)
Government Size	-0.009**	-0.059***	-0.019***	-0.035***
	(0.004)	(0.012)	(0.004)	(0.009)
Quality of Bureaucracy	0.015	0.011	0.013	0.013
(0 worst, 1 best)	(0.009)	(0.010)	(0.008)	(0.009)
Policy Distortion	-0.006***	-0.008***	-0.006***	-0.005**
	(0.001)	(0.002)	(0.001)	(0.002)
Terms of Trade Changes	-0.020	0.013	-0.027	0.058
	(0.042)	(0.041)	(0.037)	(0.048)
Latin America Dummy	-0.017***	-0.030***	-0.016***	-0.020***
	(0.004)	(0.005)	(0.003)	(0.004)
Sub-Saharan Africa Dummy	-0.031***	-0.029***	-0.027***	-0.026***
	(0.005)	(0.005)	(0.005)	(0.005)
Socialist Dummy	-0.013***	-0.010*	-0.012*	-0.014*
	(0.005)	(0.006)	(0.007)	(0.008)
Number of Observations	231	217	231	217
R-squared[c]	0.5602	0.5417	0.6161	0.562

*** significant at 1% level ** significant at 5% level * significant at 10% level

[a] Standard errors, corrected for heteroscedasticity, are in parentheses.

[b] For all IV regressions in Table 12, the instruments for the following variables are the previous five year lag of itself and regional and decade dummy variables: policy distortion; and investment/GDP. The instrument for the government size variable is the prediction form the government size instrumental variable regression reported in Table 11. All other variables in the regression were treated as exogenous.

[c] The R-squared is not an appropriate measure of goodness of fit with instrumental variable regressions.

generates a similarly signed coefficient, as does the policy index which remains negatively signed and highly significant. These estimations with identical country coverage but using different deflators yield qualitatively comparable estimates, which suggests that the relationships we have pinned down in the earlier part of the paper are indeed robust [50].

Finally, we have included in each regression a set of regional dummy variables following previous researchers [51]. Like these studies, we find that some dummy variables are highly significant, confirming the prior expectation that some regions have registered surprisingly low or high values of the dependent variables (e.g., government size, growth, infant mortality and life expectancy). However, as Barro and Sala-i-Martin (1995) observe, this interpretation of the estimated coefficients on dummy variables is problematic since the choice of regional dummy variables is endogenous. Nevertheless, the presence of significant regional dummy variables poses a challenge; we need to explain, for example, why Sub-Saharan Africa has a below average growth rate or East Asia has a below average government size without resorting to the inclusion of dummy variables for these regions. We have taken care of this criticism in two ways. First, we re-estimated each regression without regional dummy variables and the results we get are essentially the same, albeit with a lower R-squared. Second, we re-estimated each regression using the random effect technique with and without regional dummy variables.

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[50] Of course, the growth decomposition can differ across the two data sets and depend as usual on point estimates and average of each variable. For example, for low income countries, World Bank data tend to overestimate investment/GDP, and underestimate per capita GDP and government consumption.

[51] See, for example, Barro and Sala-i-Martin (1995) and Easterly and Levine (1996).

Regional dummy variables were still significant and the results on the remaining variables were essentially the same in both sets of regressions and similar to the reported regression results [52].

8. Conclusions

In this paper we have looked again at a set of issues that have long been at the heart of economic analysis; namely the factors explaining the size of government and the consequences of government for growth, whether measured as income growth or other attributes of well-being. These questions remain particularly pertinent given the sharp growth in government size in the last half-century and the sharp disparity in growth rates that has characterised the same period.

We assembled a large cross-country data set and pooled observations across three decades. Our results point to a range of factors driving size. A robust association between government size and the level of income is not confirmed. Indeed, as technological change shifts the demands on government, this would further tend to dissipate the mechanical relationship between size and income. We do find that relative prices, the age dependency ratio, how long a country has been independent and political freedom to be important explanatory variables for growth of government. Our findings are also partial vindication of the argument that governments use their consumption to buffer external risk. We find that in low income countries governments use consumption more to

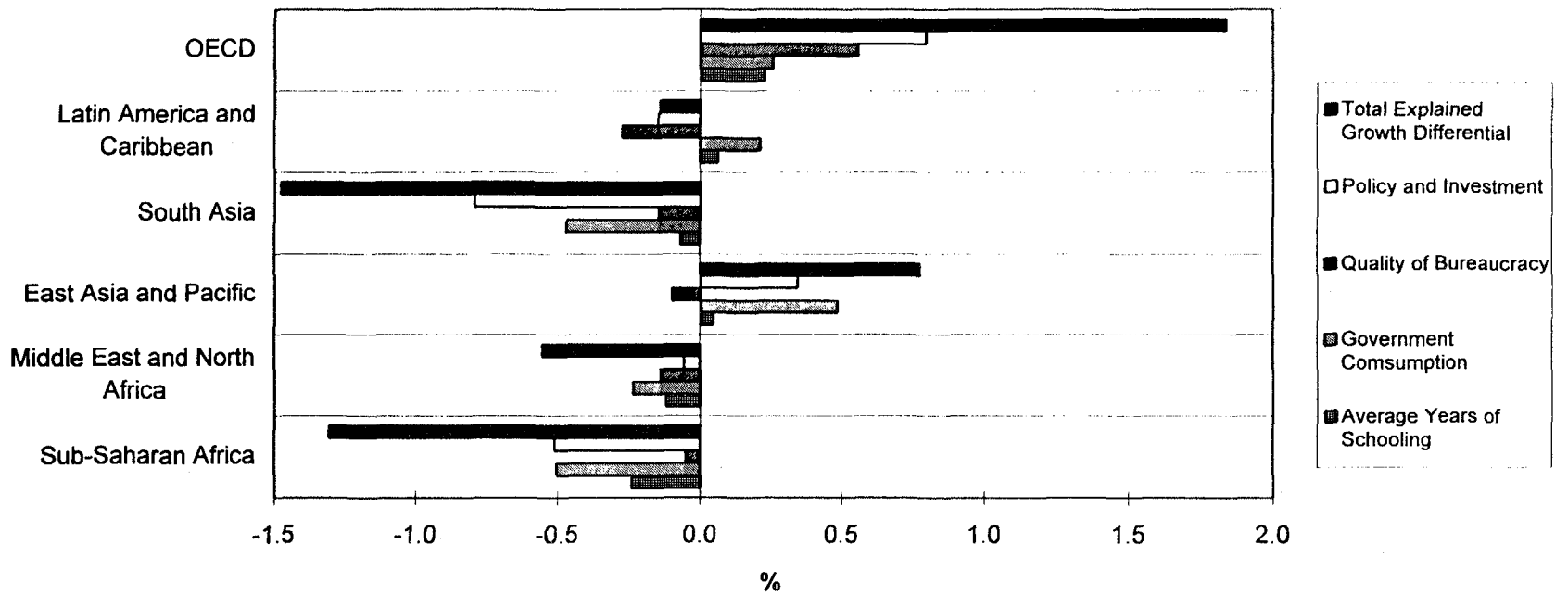
[52] The re-estimated regression results are available upon request.

stabilise income than in high income countries; the stabilisation effect is stronger, the more open a country is and the more a country experiences an adverse terms of trade shock.

Turning to the consequences of government for growth in income and well-being, we find investment in physical and human capital to have positive growth effects. But more importantly we find a robust and significant negative relationship between growth and government consumption, whether measured in international prices or in constant dollars. But size is only one component of government's intervention. Policy distortions -- predictably -- have a negative effect on growth but the quality of government and its bureaucracy is shown to be positively and significantly linked to performance. We show that governments with high quality of bureaucracy and well-functioning institutions can see these positive effects dominating the independent negative influence of size alone. The simultaneous interaction between government size and growth shows that, in low income countries, reduction in risks brought about by a larger government comes at a cost of a lower growth.

In addition, social sector spending is shown to exert a positive influence on our two well-being indicators, life expectancy and infant mortality, as do better income distribution, higher per capita income, higher per capita income growth and more political freedom.

Figure 1
Sources of Per Capita GDP Growth, 1964-1993[a]
(Deviation from World Average)



[a] Based on IV regression in Table 6, column 4. Each bar represents the contribution of each source to the deviation of growth of each region from the world average. Total explained growth differential is the sum of the four listed sources of growth, net of initial per capita GDP, population growth rate, the interaction of government consumption and quality of bureaucracy, and terms of trade changes.

Figure 2

Quality, policy distortion and growth[a]

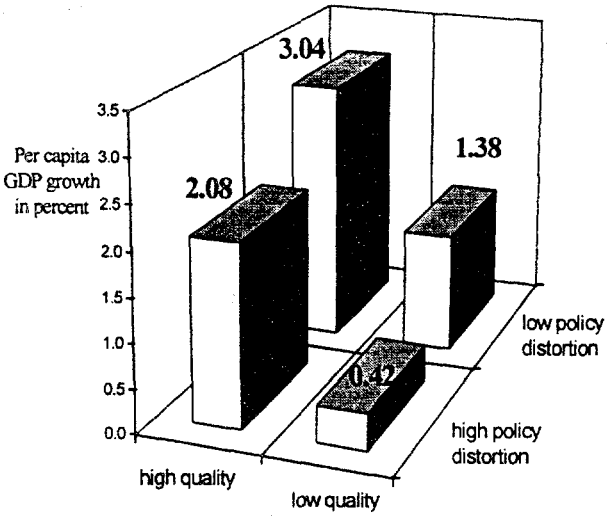
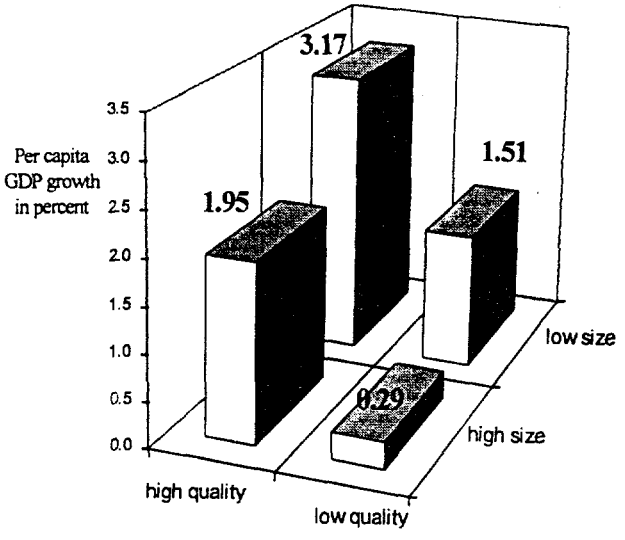


Figure 3

Quality, government consumption and growth[b]



Number of years needed to double per capita GDP

Panel A

Policy Distortion

Quality	Low	High
Low	50 years	165 years
High	23 years	33 years

Panel B

Government Size

Quality	Low	High
Low	46 years	239 years
High	22 years	36 years

[a] Based on the IV regression in Table 6, column 4.

[b] Based on the IV regression in Table 6, column 4.

Appendix 1 **Data: Description and Sources**

Variable	Description	Source
Government Size	Log of (government consumption/GDP) in 1985 international prices	Summers & Heston, PWT5.6
	Log of (government consumption/GDP) in 1987 US dollars	World Bank
Per Capita GDP	Log of Per Capita GDP in 1985 international prices	Summers & Heston, PWT5.6
	Log of Per Capita GDP in 1987 dollars	World Bank
Relative Price of Government Consumption	Log of (Government consumption price deflator/Private consumption price deflator) in 1985 international prices	Summers & Heston, PWT5.6
	Log of (Government consumption price deflator/Private consumption price deflator) in 1987 dollars	World Bank
Per Capita GDP Growth	Average annual growth of real GDP per capita in 1985 international prices	Summers & Heston, PWT5.6
	Average annual growth of real GDP per capita in 1987 US dollars	World Bank
Age Dependency Ratio	Log of (Ratio of population of under 15 and over 64 to working age population(15-64))	World Bank
Urbanization	Log of (urban population/total population)	World Bank
Openness	Log of (exports+imports/GDP) in current prices	World Bank
Terms of Trade Changes	Average annual percentage changes in terms of trade	World Bank
Terms of Trade Increases	Average annual percentage increases in terms of trade (set to 0 if negative)	World Bank
Terms of Trade Decreases	Average annual percentage decreases in terms of trade (set to 0 if positive)	World Bank
Terms of Trade Volatility	Standard Deviation in the changes in terms of trade	World Bank
Political Freedom	Gastil index of political freedom ranging from a high of 1 to a low of 7	Freedom House
Years Since Independence	The percentage of years since 1776 the country has been independent	Easterly, W. and R. Levine (1996)

Variable	Description	Source
Initial Per Capita GDP	Log of initial per Capita GDP in 1985 international prices	Summers & Heston, PWT5.6
	Log of initial per Capita GDP in 1987 dollars	World Bank
Population Growth	Average annual growth rate of the population	World Bank
Initial Schooling	Log of the average years of schooling	Nehru etal (1993) and Barro and Lee (1994)
Investment/GDP	Log of real investment over GDP in 1985 international prices	Summers & Heston, PWT5.6
	Log of real investment over GDP in 1987 US dollars	World Bank
Black Market Premium (BMP)	Log of (1+Black Market Premium/100)	World Development Report (1991); Pick's currency Yearbook (various years); and Barro and Lee (1994)
Price Level of GDP	PPP adjusted price level of GDP used to measure the distortion between domestic and international prices where USA is equal to 1	Summers & Heston, PWT5.6
Policy Distortion	Principal component of -1 times openness, BMP and the absolute value of the GDP price deflator minus 1. The index is constructed using principal component analysis to find the unit-length linear combinations of the three variables with the greatest variance. All variables have been standardized with mean zero and standard deviation of one. Higher values indicate a greater distortion in policy.	See individual components
Quality of Bureaucracy	Composite index based on data from 1) Business Environmental Risk Intelligence (BERI) index of Bureaucratic Delays, measuring the "speed and efficiency of the civil service including processing customs clearances, foreign exchange remittances and similar applications." 2) International Country Risk Guide (ICRG) index of Quality of Bureaucracy which measures the general efficiency of government bureaucracy. Specifically, it measures whether there is a "autonomy from political pressure...strength and expertise to govern without drastic changes in policy or interruptions in government services." 3) Business International/Economist Intelligence Unit's index of Bureaucracy and Red Tape. This index is a	Knack and Keefer (1995); Mauro (1995)

Variable	Description	Source
	measure of "the regulatory environment foreign firms must face when seeking approvals and permits. The degree to which it represents an obstacle to business." Scores of all indices where rescaled to range from 0 (worst) to 1(best). Pairwise correlations of the variables indicated a high degree of correlation among variables with values ranging form .76 to .88.	
Infant Mortality	Log of (Infant (0-1) Mortality rate-4) with 4 being the lowest infant mortality rate for any given country	World Bank
Life Expectancy	-1*Log of (80-Life Expectancy) with 80 being the maximum average life expectancy for any country	World Bank
Social Spending/GDP	Log of Nominal Government Expenditure on Health and Education over Nominal GDP	World Bank
Income Inequality	Gini coefficient for income that can range from a low of 0 to a high of 100	Deininger and Squire (1996)
Federal Dummy	Dummy variable equal to 1 if country is a federalist state, 0 otherwise	See Easterly and Levine (1996)
Sub-Saharan Africa Dummy	Dummy variable equal to 1 if Sub-Saharan African country by World Bank classification, 0 otherwise	World Bank
Latin America Dummy	Dummy variable equal to 1 if country in Latin America or Caribbean region by World Bank classification, 0 otherwise	World Bank
East Asia Dummy	Dummy variable equal to 1 if country in East Asia and Pacific region by World Bank classification, 0 otherwise	World Bank
Socialist Dummy	Dummy variable equal to 1 if socialist economic system, 0 otherwise	Kornai (1992)

Appendix 2 Regional Composition of Countries in OLS Regressions

Region	Number of countries
Sub-Saharan Africa	42
Middle East & North Africa	9
East Asia & Pacific	16
South Asia	5
Latin America & Carrbbean	29
Eastern Europe and Central Asia	9
High Income OECD	22
Total	132

Sub-Saharan Africa	High Income OECD	Latin America & Caribbean
Angola*	Austria***	Argentina**
Benin*	Australia*	Bahamas++
Botswana**	Belgium***	Barbados***
Burundi*	Canada***	Belize*
Cape Verde*	Denmark***	Bolivia**
Cameroon***	France***	Brazil***
Central African Republic*	Finland***	Chile***
Comoros*	Germany***	Colombia***
Congo*	Iceland*	Costa Rica***
Cote D'ivoire**	Ireland***	Dominican Republic***
Djibouti*	Italy***	Ecuador**
Ethiopia**	Japan**	El Salvadore**
Gabon*	Luxembourg***	Guatemala**
Gambia**	Netherland**	Guyana***
Ghana**	New Zealand*	Haiti**
Guinea*	Norway***	Honduras***
Guinea-Bissau**	Portugal***	Jamaica**
Kenya**	Spain***	Mexico***
Lesotho*	Sweden***	Nicaragua**
Liberia**	Switzerland**	Panama***
Madagascar**	United Kingdom***	Paraguay**
Mali**	United States***	Peru***
Malawi**		St. Kitts & Nevis*
Mauritania*		St. Lucia*
Mauritius*		St. Vincent & the Grenadines*
Namibia*		Suriname*
Niger**		Trinidad& Tobago**
Nigeria**		Uruguay**
Rwanda*		Venezuela***
Senegal***		
Seychelles*		
Sierra Leone**		
Somalia*		
South Africa**		

Sub-Saharan Africa Continued	East Asia & Pacific	Middle East & North Africa
Sudan**	China*	Algeria**
Swaziland*	Figi*	Egypt***
Tanzania***	Hong Kong+	Iran***
Togo**	Indonesia***	Israel**
Uganda**	Laos*	Jordan**
Zaire**	Malaysia***	Morocco***
Zambia***	Myanmar+	Syria**
Zimbabwe***	Papua New Guinea*	Tunisia***
	Philippines**	Yemen**
	Singapore***	
South Asia	Solomon Islands*	
Bangladesh**	South Korea***	**Eastern Europe and Central**
India***	Thailand***	Bulgaria*
Nepal*	Tonga*	Cyprus**
Pakistan**	Vanuatu*	Greece**
Sri Lanka***	Western Samoa*	Hungary***
		Malta**
		Poland**
		Romania***
		Turkey***
		Yugoslavia*

* In Government Size Regression Only
** In Government Size and Per Capita GDP Growth Regressions Only
*** In Government Size, Per Capita GDP Growth and Well-Being Regressions
+ In Per Capita GDP Growth Regression Only
++ In Government Size and Well-Being Regressions Only

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