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Working Paper

The Growth Penalty of High Government Pay Rates

ERD Working Paper Series, No. 118

Provided in Cooperation with:

Asian Development Bank (ADB), Manila

Suggested Citation: Sugden, Craig; Taniguchi, Kiyoshi (2008) : The Growth Penalty of High Government Pay Rates, ERD Working Paper Series, No. 118, Asian Development Bank (ADB), Manila, <https://hdl.handle.net/11540/1773>

This Version is available at:

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The Growth Penalty of High Government Pay Rates

Craig Sugden and Kiyoshi Taniguchi

June 2008

Asian Development Bank



ERD Working Paper No. 118

THE GROWTH PENALTY OF HIGH GOVERNMENT PAY RATES

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JUNE 2008

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Asian Development Bank

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/economics

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June 2008
ISSN 1655-5252

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FOREWORD

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ABSTRACT

This study examines the role of government pay rates in economic growth. A trend decline in government pay rates, expressed relative to what an economy can afford, is identified in many developing countries. The decline is attributed to the erosion of economic rents. Drawing on the theoretical insights of the Harris-Todaro two sector model, the study argues that static and dynamic benefits from the erosion of rents would lead to a negative relationship between government pay rates and economic growth. Utilizing the pooled regression models as well as the feasible two-stage generalized method of moments estimator, the study concludes that relative government pay rates are negatively related with economic growth in developing countries; hence, high government pay rates penalize economic growth. Countries that retain high government pay rates are identified.

I. INTRODUCTION

Theory explains that government expenditure can contribute to economic growth through the provision of public goods and the correction of other market failures. Government expenditure that corrects market failure can achieve a social return that exceeds private returns from displaced private savings. But inefficiency in production by government agencies and rent seeking can result in adverse effects from government expenditure. Furthermore, the deadweight costs borne in raising taxes to fund expenditure, and the crowding out and inflationary effects of government expenditure can be significant. Theory alone cannot determine whether the positives outweigh the negatives and the “optimal” size of government. Empirical studies are needed to shed light on whether the benefits of government expenditure outweigh the costs and whether the net benefits depend on the size of government.

Early empirical studies of government size tended to identify a negative relationship between size and economic growth in both a developed and developing context, where size is measured by aggregates of government expenditure and revenue. The finding of a negative relationship has supported the view that the long-run expansion in government, observed in many countries, has penalized economic growth. Such a view is important given the implications for public policy and associated political overtones in many countries. More recent studies suggest caution in reaching the view that larger governments penalize economic growth, citing the sensitivity of the earlier findings to model specification and estimation technique. The debate on the relationship between economic growth and government size in developing countries is best seen as remaining open.

The labor intensity of government means that government employment levels and pay rates are potentially key factors in determining the effect of government on economic growth. Notably, an expansion in government employment is likely to have a very different effect when public employees are “over-paid” compared to when they receive a reasonable rate of pay. It is safe to argue that the affordability of government employees is a significant influence on whether governments provide the essential inputs needed for economic growth. This is likely to be a particularly important consideration during the early stages of economic development when extensive market failures impair the emergence of private sector service providers.

Existing studies of aggregate government expenditure and revenue obscure the potential role of government employment and government pay rates. This study complements past work by investigating international patterns in government employment and pay rates. Our measure of government pay rates is expressed relative to what is affordable for an economy. Indirect measures of government employment shares and relative pay rates are adopted to overcome data limitations that have curtailed past research in this area.

Drawing on a panel data set covering more than 150 countries, evidence is presented of an upward trend internationally in government employment shares and a downward trend in relative government pay rates. Relative government pay rates are found to be trending down to a level that is apparent at high income levels, and to be inversely related with the government employment share. While the focus of the study is on developing countries, it is noted that this broad depiction is relevant to both developing and developed countries. The downward trend in relative pay rates is, however, more pronounced in a developing context.

We argue that the decline in relative pay rates identified in many economies as they develop is attributable to the erosion of rents embedded in government pay rates. These rents are attributed to rent seeking behavior and scarcity in the supply of skilled labor. Drawing on insights from the Harris-Todaro two sector model and plausible dynamic effects, it is hypothesized that the reduction in relative government pay rates contributes to economic growth in developing countries. Notably, a decline in rents in government pay rates is seen to assist growth by making public services that are important for the effective functioning of an economy more affordable, and by supporting a shift in an economy's resources out of low productivity activities.

Empirical investigation of the experience of a large sample of developing countries concludes that relative government pay rates are negatively related to economic growth. In contrast, there is no apparent relationship between government employment share and economic growth in developing countries in the sample. It is concluded that it is government's relative pay rates, rather than its size as measured by employment share, which matters for economic growth in developing countries.

The paper is structured as follows. The next section presents the background to our study of government employment and pay rates by reviewing empirical studies of the relationship between government size and economic growth. Measures of government employment shares and relative pay rates and trends in these measures are then presented. The paper then presents a theoretical rationale for the relationship between these measures of government and economic growth in developing countries. Regressions are presented for developing countries that explore the relationship between per capita gross domestic product (GDP) growth and either the measure of relative pay rates or employment shares, controlled for policy, institutions, and initial endowments. A final section presents the key implications of the study, including the identification of those countries that appear to be paying a growth penalty by preserving their public servants as a well-paid elite.

II. STUDIES OF GOVERNMENT SIZE AND ECONOMIC GROWTH

The consequences for economic growth of government size have been explored widely through the examination of government expenditure and taxation aggregates. On the basis that it is the production decisions of government that matter to economic growth and not the transfer function of government, many of the early empirical studies favored the examination of government consumption. Such studies were spurred on by the development of national accounts at international prices. Others examined the level of taxation in order to capture the deadweight costs and impacts on the economy of raising revenue.

As of the early 1990s, the weight of empirical evidence was tending toward the view that larger governments penalized economic growth, in both a developed and developing context. Findings of a negative relationship between economic growth and size are presented in Smith (1975), Landau (1983), Marsden (1983), Landau (1985), Saunders (1985), Landau (1986), Marlow (1986), Grier and Tullock (1989), Barth and Bradley (1988), Barro (1989), Grier and Tullock (1989), Alexander (1990), Barro (1991), and Engen and Skinner (1992). Nonetheless, some studies found a positive relationship between the size of government and growth, or the absence of such relationship. Examples included Robinson (1977), Katz et al. (1983), Kormendi and Meguire (1985), Ram (1986 and 1993), and Conte and Darrat (1988). Grossman (1988) presents evidence of a nonlinear relationship for the United States and no net impact of government size.

These earlier studies were conducted against a background of predictions from the prevailing growth models that government expenditure would not affect the steady-state growth rate, although it would potentially having important transition effects. Ram (1986 and 1993) presented one of the more developed, earlier theoretical frameworks. Rather than testing for a partial correlation between expenditure or revenue and economic growth, Ram (1986) tested for the presence of an externality effect of government activities on private production. This approach was criticized by Carr (1989) and Rao (1989), as it rested on restraints on relative productivity that were set on a priori grounds and cannot be inferred from the data.¹

The development of endogenous growth models has provided new directions by arguing how government activities could affect the steady-state growth rate. Barro (1990) distinguished between productive and nonproductive expenditure and distortionary and nondistortionary taxation, arguing that tests should focus on the relationship between growth and productive expenditure. Dowrick (1996) extended Barro's (1990) framework to identify the importance of the nominal level of government expenditure, on the basis that the deadweight losses from taxation arise from the nominal level and not the real level. Other contributions from endogenous growth perspectives include Lucas (1988), Easterly (1989), Rebelo (1991), Barro and Sala-i-Martin (1992), and Mendoza et al. (1997).

More recent empirical studies drawing on both the insights from endogenous growth theory and improved econometric methods have tended to find more support for a positive relationship between government size and growth. Studies finding a positive relationship include Romer (1989 and 1990), Devarajan et al. (1996), Caselli et al. (1996), Kneller et al. (1999), and Romero-Avila (2006). But some studies, such as De La Fuente (1997), Folster and Henrekson (1999 and 2001) and Durlauf et al. (2008) have repeated earlier findings of a negative relationship. Easterly and Rebelo (1993) conclude that the view that tax rates matter for economic growth is fragile, and Miller and Russek (1997) report that tax-financed increases in expenditure raise economic growth in developing countries while debt-financed increases retard economic growth. Karras (1993 and 1996), Dowrick (1996), and Aly and Strazicich (2000) find support for the view that the costs of government do outweigh the benefits as governments get "too large" (relative to a hypothetical socially optimal level), at least for higher income countries, yet governments are not necessarily at the point of being "too large."

Notably, the more recent findings of a positive relationship have tended to concentrate on developed countries; an emphasis that appears to arise from the greater demands placed on data by new theoretical frameworks and estimation techniques. Hence it is unclear how well the more recent support for a positive relationship carries to a development context.

Kneller et al. (1999) and Bleaney et al. (2001) argue that insufficient attention has been paid by empirical studies to the implications of the government budget constraint. This requires that a change in one fiscal variable must be financed by a change in another or in a range of fiscal variables. They highlight that the fiscal variables included in growth equations are defined relative to the omitted fiscal variables, which can be on the revenue or expenditure side of the budget, or be financing items. This makes it difficult to isolate the factors behind empirical findings on the relationship between a measure of government size and economic growth.² Others to raise this issue include Helms (1985), Mofidi and Stone (1990), and Miller and Russek (1997).

¹ Rao (1989) also criticized Ram (1986) on econometric grounds.

² Only when the omitted fiscal variable is uncorrelated to economic growth would the estimated coefficient describe the effect of the included fiscal variable on economic growth. Otherwise the estimated coefficient includes the relationship with growth of both the identified fiscal variable and the omitted variable.

Some have argued that a micro approach is necessary to add up the impact of the components of government expenditure and revenue in order to understand the impact of government size. Disaggregated studies have tended to find a negative relationship between transfers and economic growth and a positive relationship between government investment and growth.³ The International Monetary Fund (1995) highlighted evidence of the productivity of primary education and community health services, particularly in developing countries, as well as health education and preventative health care expenditures. Gerson (1998) highlighted the potential for expenditure on health, education, and infrastructure to contribute to growth, while arguing that spending on defense and social services could also contribute by maintaining the social fabric and supporting political stability. Miller and Russek (1997) also report different growth effects for different sectors of expenditure.

An alternative perspective on the economic growth and government size debate is that the marginal government expenditure and revenue is of most concern as these determine the impact of cutting back or expanding government size. Easterly and Rebelo (1993) present some evidence of a negative relationship between growth and marginal tax rates, while citing the difficulty of measuring marginal tax rates. Gupta et al. (2002) argue that fiscal adjustments achieved by cuts to government wages, salaries, and transfers, rather than increasing revenues and cuts to public investment, can foster growth and are more likely to be sustainable. Evidence for this view in a developed country context is presented in Alesina and Ardagna (1998), Alesina et al. (1998), Alesina and Perotti (1997), McDermott and Wescott (1996), and Von Hagen and Strauch (2001). In a developing country context, Gupta et al. (2002) found that fiscal consolidations tended to have the most positive effects for economic growth when they lead to a reduction in the domestic borrowing requirement and when public investment is protected.

The data limitations facing a study of government size have also received attention. Bergstrom (1997), Bairam (1990), and Gould (1983), among others, point out that the inclusion of government consumption and investment in GDP biases analysis of total government expenditure or government consumption toward finding a positive relationship between government size and economic growth. Carr (1989) also points to the bias toward a positive relationship that arises from the standard practice of measuring government consumption at cost, rather than the unobservable value of output. Carr (1989) points out that as government consumption is a combination of final demands and intermediate usage, inclusion of the latter biases upward measurement of GDP where this bias is likely to grow with the level of government expenditure.

III. STYLIZED FACTS

A. An Indirect Measure of Government Employment Shares and Relative Pay Rates

There are considerable difficulties faced in preparing measures of government pay rates that are consistent across countries and time. One approach is to obtain information from government budgets or payrolls on official pay scales. But such information are often confidential and, when they are publicly released, it can be difficult to amass a collection sufficient for research. Some form of average pay rate or measure of pay compression needs to be derived from such data based on the level of employment at different or representative pay grades. But information on employment by pay

³ See Easterly and Rebelo (1993) and the overview in Kneller et al. (1998). Devarajan et al. (1997) contest the finding of a positive relationship between capital expenditure and economic growth in developing countries.

grade is typically even harder to obtain than information on pay scales. And then when available, information on employment by pay grade often only covers permanently engaged employees and excludes temporary or casual employees. It may also be impractical to convert the information to a usable form, as it is often contained in detailed records only. The approach of analyzing official pay scales is also vulnerable to variations across countries in administrative arrangements, notably whether agencies under government control are on-budget or off-budget and whether budgets record employment funded by the activities of international donors or only by internally funded expenditure. A further conceptual issue to be faced is whether the size of government should be measured by direct government employment, or whether it should also include those private sector employees that are funded via government revenue (such as those in education and health).⁴

These difficulties have created a barrier to research into government pay rates and employment size.⁵ We seek to overcome this barrier by adopting an industry defined in the national accounts as a proxy of general government. This forms a unit of measure for the study that is standardized across countries and time. The community, social, and personal services industry has been used in some studies as a proxy of the nonmarket sector, for example by Gemmell (1986). The community, social, and personal services industry is industry nine of the one-digit industrial classification and by international practice includes: public administration, defense and compulsory social security; education; health and social work; other community, social, and personal services; private households with employed persons; and extra-territorial organizations and bodies.⁶ For the purposes of this study, it would be preferable to base analysis on the government component of this industry, or at least to separate personal from community and social services. However such disaggregated data are typically unavailable or difficult to obtain for a sufficient time period for developing countries.

Given the data limitation, and on the basis that it is typical for the output of the community, social, and personal services to be provided or at least largely funded by government, the study adopts the community, social, and personal services industry as a proxy for general government. That is, employment by general government is proxied by employment in the community, social, and personal services industry.

The national accounts adopt a simplification in incorporating general government that can be used to advantage in deriving a measure of government pay rates. For a normal industry, value-added is reflected in the prices of the industry's output, and labor productivity can be found as value-added per employee. As there is no price for public administration and most other activities of general government, the value-added and hence productivity of general government is difficult to measure. The international standard is to measure value-added of general government as the

⁴ The measurement of government pay and employment from such data is discussed in Kray and Rijckeghem (1995), Schiavo-Campo et al. (1997), Schiavo-Campo (1998), and World Bank (2001).

⁵ See for example Helller and Tait (1983) and Schiavo-Campo (1998).

⁶ This definition is the International Standard Industrial Classification of all Economic Activities (ISIC-Rev. 3 1993). Under the International Standard Industrial Classification of all Economic Activities (ISIC-Rev. 2 1968), the industry is defined to include: Public Administration and Defence; Sanitary and Similar Services; Social and Related Community Services (Education services, Research and scientific institutes, Medical, dental, other health and veterinary services, Welfare institutions, Business, professional and labour associations, and Other social and related community services); Recreational and Cultural Services (Motion picture and other entertainment services, Libraries, museums, botanical and zoological gardens, and other cultural services not elsewhere classified and Amusement and recreational services not elsewhere classified); Personal and Household Services (Repair services not elsewhere classified and Laundries, laundry services, and cleaning and dyeing plants, Domestic services and Miscellaneous personal services); and International and Other Extra-Territorial Bodies.

addition of the government wage bill and an estimate of the capital consumed. Hence what is reported as value-added in general government is more accurately described as a measure of cost. As the sector is labor-intensive, value-added of general government is close to the total cost of labor. By implication, value-added in general government divided by the number of persons employed can be used as an estimate of the average pay rate in general government.

International comparisons of the size of government have drawn on measures of government consumption estimated at constant international prices (i.e., purchasing power parity adjusted terms). The underlying international price deflators could be applied to this study's estimate of average, nominal pay rates in government to derive an estimate of the real pay rate. However it is unclear whether these deflators would provide a sufficiently reliable representation of changes in the nominal price of labor. The study instead derives a measure of relative pay rates—the ratio of the average wage in the community, social and personal services industry to value-added per employed person. That is:

$$\text{Relative government pay rate in general government} = \frac{\text{Value-added in community, social, and personal services}}{\text{Employment in community, social, and personal services}} \times \frac{\text{Total value-added}}{\text{Total employment}}$$

This measure has the intuitive interpretation of providing an indicator of the affordability of government wage rates. For example, a relative pay rate of 400% would point to a less affordable government than a relative pay rate of 100%.

One of the potential limitations of our indirect measure of relative government pay rates is the presence of the private services component in community, social, and personal services. Inaccuracy may arise if: (i) the private services share of community, social, and personal services changes markedly over time and the private and government relative wage is markedly different; or (ii) there is a change in the wage of the private component relative to the government component. Data on the government versus private component of community, social, and personal services are not readily available. But data are available on the public administration, education, and health component of the community, social, and personal services industry. An evaluation of this data fails to find an obvious problem from the mix of activities in the community, social, and personal services industry. Public administration, education, and health are found to average approximately 75% of employment in community, social, and personal services in 53 non-OECD countries; it averages approximately 80% in the Organization for Economic Cooperation and Development (OECD) countries. The share is found to decline over time on average, but at a slow rate. For 53 non-OECD countries, the share is found to have declined by 0.3% per annum on average, while the rate of decline is found to be lower in OECD countries on average (Table 1).

Comparisons of our indirect measure of relative government pay rates and employment shares and direct measures prepared by the World Bank are presented at Table 2. The indirect and direct measures are found to be positively correlated for periods where sufficient observations are available for meaningful comparisons. The direct and indirect measures present a similar pattern across regions. Notably, relative government pay rates are found to be lowest in the OECD countries and the Central and Eastern Europe and Commonwealth of Independent States, and highest in Sub-Saharan Africa, the Pacific Islands, and South Asia in the 1990s (see Appendix Table A1.1). A similar regional pattern is also evident in earlier periods for our indirect measures and the direct measures prepared by Heller and Tait (1983) and Kray and Van Rijckeghem (1995).

TABLE 1
PUBLIC ADMINISTRATION, EDUCATION AND HEALTH EMPLOYMENT

	PERCENT OF SECTOR EMPLOYMENT ^a	CHANGE IN THE SHARE OF SECTOR EMPLOYMENT (PERCENT PER ANNUM) ^a	NUMBER OF COUNTRIES
All countries	76.7	–0.21	78
OECD countries ^b	80.8	–0.02	25
Non-OECD countries	74.8	–0.31	53

OECD = Organization for Economic Cooperation and Development.

^a Sector is defined as community, social, and personal services.

^b The estimate derived from the OECD's STAN Database (OECD 2005), excluding Japan (which appears to have an error in the data), is –0.05.

Source: International Labour Organization's Key Indicators of the Labour Market.

TABLE 2
CORRELATIONS FOR INDIRECT AND DIRECT MEASURES

DIRECT MEASURE ^b	INDIRECT MEASURE ^a			
	PAY RATES FOR 1994–1997	PAY RATES FOR 1998–2001	EMPLOYMENT SHARE FOR 1994–1998	EMPLOYMENT SHARE FOR 1998–2001
Pay rates for the mid-1990s	0.2715** n=59			
Pay rates for the mid-1990s		0.3851*** n=56		
Employment share for the mid-1990s			0.6673*** n=64	
Employment share for the late 1990s				0.3609 n=20

*** significant at 1% level; ** significant at 5% level.

^a Pay rate is defined as the ratio of value-added per employed person in community, social, and personal services to the average for all industries. Employment share is the community, social, and personal services share of total employment. Data are derived as unweighted four-year averages of the available data for 1950–2006.

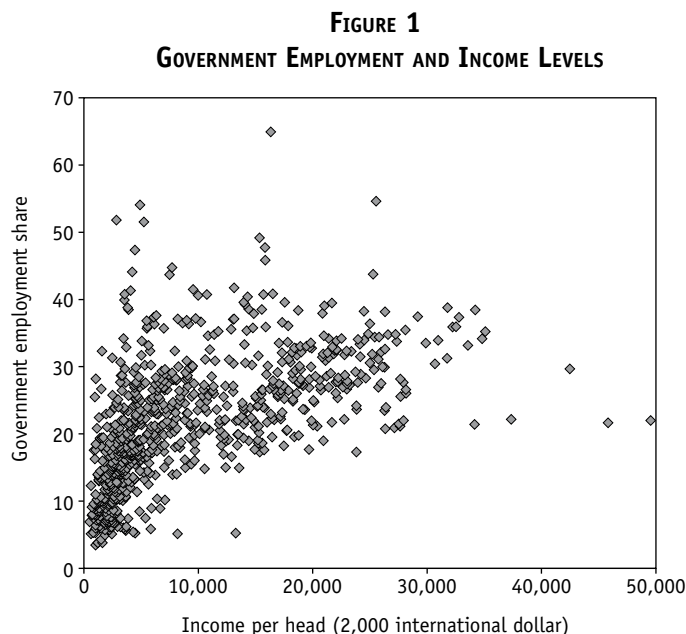
^b Pay rate is defined as the average wage of the total general civilian government as a multiple of per capita gross domestic product. Employment share is employment in total general civilian government as a percentage of the population. Estimates are from Schiavo-Campo (1998) for 1993 to 1996, or when unavailable, the latest available year for 1991–1995 from World Bank (2001).

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); census releases and statistical compendiums of the Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database, International Labour Organization's Key Indicators of the Labour Market and LABORSTA; Schiavo-Campo (1998); and World Bank (2001).

B. Government Employment Share, Pay Rate, and Income

Wagner's Law hypothesizes that the demand for government services rises with income levels. The relationship is evident in our data on the government employment share in developing and developed countries. Higher government employment shares, i.e., larger governments, are evident

at higher income levels (see Figure 1).^{7, 8} The potential contributors to the widespread growth in the size of government include an elastic demand for public services with respect to income and the public choice rationale that emphasizes the self-interest of politicians and bureaucrats in expanding size in the face of weak constraints on the use of revenue-raising powers.⁹



Note: Data are 4-year averages of the available data for 1950 to 2006; N = 809; n = 155 (high- and low-income countries).

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database; International Labour Organization's Key Indicators of the Labour Market and LABORSTA; and Heston et al. (2006).

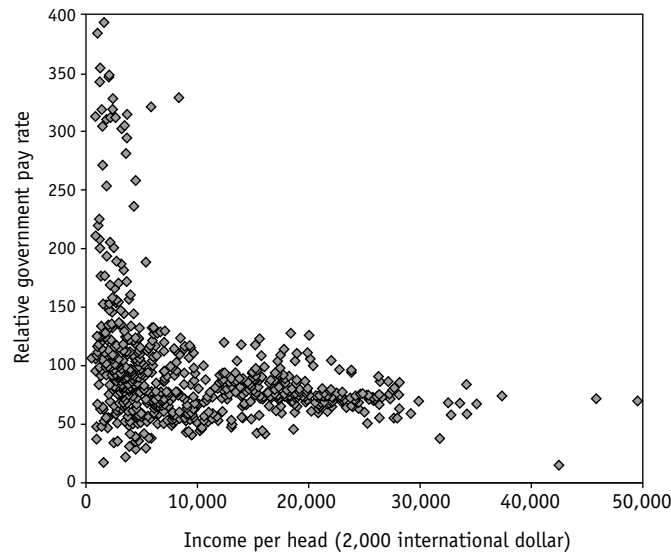
Our finding of a positive relationship between the government employment share and income level is not surprising given the existing support for Wagner's Law. However what has been paid little attention is the apparent relationship between income level and government pay rates. Relative government pay rates tend to be highest at lower income levels and vice versa (see Figure 2). The relationship is not as apparent as between employment shares and growth, because relative pay rates have increased in some countries as incomes have risen. Countries that have moved against the international trend and increased relative government pay rates as incomes have risen include Bolivia; Colombia; Costa Rica; India; Taipei, China; and Venezuela.

⁷ A similar finding is presented, albeit from a smaller dataset, in Heller and Tait (1983), Kray and Van Rijckeghem (1995), Schiavo-Campo et al. (1997), and Schiavo-Campo (1998).

⁸ For the sake of comparison, data in Figures 1–3 include developing as well as developed countries.

⁹ Cullis and Jones (1998, 357–71) provide an overview of the literature on Wagner's Law. Diamond (1977), Ram (1987), and Easterly and Rebelo (1993) present supporting data. Rodrik (2000) also advances the argument that countries use safe government jobs as insurance against nondiversifiable external risk.

FIGURE 2
GOVERNMENT PAY RATES AND INCOME LEVELS



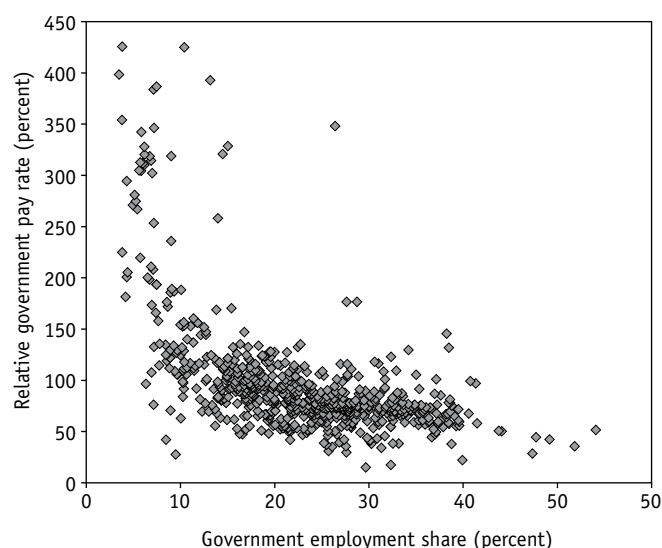
Note: Data are 4-year averages of the available data for 1950 to 2006; N = 656; n = 131 (high- and low-income countries).

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database; International Labour Organization's Key Indicators of the Labour Market and LABORSTA; and Heston et al. (2006).

A floor is apparent in relative government pay rates in the order of 50%. This floor is most pronounced in developed countries, but is also evident in some developing countries. Very few countries have relative pay rates below this level, and once the floor is reached, government employment appears to grow as incomes rise. A likely explanation for such a floor is that governments would find it difficult to attract and retain staff if, on average, pay rates were too much below this level. Attempts to lower government pay rates below the floor are likely to see labor favor employment in the private sector, reducing the labor supply and lifting pay rates in government back to the floor level.

These data are suggestive of a negative relationship between the government employment share and relative government pay rates. This negative relationship is indeed evident visually (see Figure 3). That is, a decline in relative government pay rates is associated with a rise in the government employment share. This relationship is evident across regions and over time, whether developed or developing (see Appendix Table A1.1). But the strength of the relationship in developing countries suggests that a decline in relative government pay rates is a feature of the economic development process.

FIGURE 3
GOVERNMENT PAY RATES AND EMPLOYMENT



Note: Data are 4-year averages of the available data for 1950 to 2006; N = 725; n = 154 (high- and low-income countries)

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database; International Labour Organization's Key Indicators of the Labour Market.

Turning to the experience of developing countries, the focus of this study, correlation coefficients for developing countries are consistent with the visual relationships (Table 3). The government value-added share derived at current prices is found to be positively correlated with relative government pay rates, the government employment share and income levels. In contrast there is no apparent relationship between relative government pay rates and government employment share with a commonly used measure of government size, the ratio of government consumption to GDP measured at international prices.

TABLE 3
CORRELATIONS FOR DEVELOPING COUNTRIES

	RELATIVE GOVERNMENT PAY RATE	GOVERNMENT EMPLOYMENT SHARE	GOVERNMENT VALUE-ADDED (PERCENT OF GDP AT CURRENT PRICES)	GOVERNMENT CONSUMPTION (PERCENT OF GDP AT INTERNATIONAL PRICES)
Government employment share	-0.5989*** N = 444	1.0000		
Government value-added (percent of GDP at current prices)	0.3085*** N = 444	0.3673*** N = 444	1.0000	
Government consumption (percent of GDP at international prices)	-0.0174 N = 417	0.0525 N = 538	0.1126** N = 417	1.000
GDP per head (at international prices)	-0.2917*** N = 417	0.5206*** N = 538	0.1696*** N = 417	-0.1366*** N = 1414

*** significant at 1% level; ** significant at 5% level.

GDP = gross domestic product.

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database; International Labour Organization's Key Indicators of the Labour Market and LABORSTA; and Heston et al. (2006).

IV. THEORY

A. The Presence of Economic Rent

The observed behavior points to economic rents being embedded in relative government pay rates early in the economic development of many countries. Governments are commonly able to expand employment even as they reduce their pay rates relative to average value-added in the economy as-a-whole. This suggests that the initial payment to labor was above the competitive or supply price, and hence embodied rents.

Potential causes of such rents in developing countries include the scarcity of skilled labor employed by government and rent seeking behavior. There are a number of ways in which rent seeking behavior may manifest, including minimum wages set above the competitive wage or an established practice of regular cost of living adjustments in excess of productivity growth. The civil service would favor high pays for obvious reasons and may form unions to strengthen their negotiating position and secure market power. Politicians and rulers may favor high pays in a misguided attempt to raise incomes, in order to secure the support of the civil service or in the expectation that high civil service pays would form a benchmark that also provides them a high remuneration.¹⁰ High government pay rates may also be favored as a means of redistributing wealth acquired by governments (e.g., from natural resources or foreign aid) in the absence of formal mechanisms for

¹⁰ For example, in commenting on the experience of Africa over the 1950s and 1960s, Todaro (1971, 396) argues that "in their natural and understandable desire to raise the standard of living of their working populations, African governments acquiesced to pressure from both trade unions and from civil servants in setting urban wages at levels considerably in excess of rural average incomes and the over-all opportunity cost of urban labour."

doing so. It appears that as development proceeds pressures build to erode these rents while at the same time encouraging government to expand employment. The apparent result is that relative government pay rates decline and the extra funds made available are at least in part allocated to increase public employment, presumably so as to provide more services to the public.

B. The Modified Harris-Todaro Model

We will build a theoretical model of the dual economy for developing economies. This section is largely adopted from Harris and Todaro (1970), Gelb et al. (1991), and Basu (2000).

In the economy of our interest, there are only two sectors: the informal (I) and the formal (F). At the early stage of growth, the informal sector consists of subsistence agriculture, while the formal sector is assumed to be dominated by general government. In order to produce X_I and X_F units of output, each sector employs L_I and L_F units of labor, respectively. L_I and L_F are non-negative. Available total labor units, L , are fixed.

$$L_I + L_F \leq L$$

Let w be the formal sector wage, hence the public sector pay rate due to the general government domination of the sector, in real terms. The informal sector wage, which is assumed to be equal to marginal productivity of labor in the informal sector, is denoted as w_I . Due to the government's budget constraint as well as the limited number of skilled labor eligible to work for the formal sector, the employment capacity of the government is fixed at any given wage. That is, the number of formal sector jobs is exogenously fixed, while the informal sector has a fairly large labor absorptive capacity. The number of the unemployed in the formal sector can be denoted as $(L - L_I) - L_F$, while there is no unemployment in the informal sector. Under this setting, the expected income (wage)

in the formal sector can be denoted as $w \frac{L_F}{L - L_I}$. Assuming that there are no rigidities on labor mobility between two sectors, people transfer from informal to formal as far as the strict inequality, $w \frac{L_F}{L - L_I} > w_I$ holds, while migration will cease once the equality $w \frac{L_F}{L - L_I} = w_I$ is obtained.

Assuming fixed capital endowment in the short run, output is produced by the labor inputs according to the following production function:

$$X_I = f_I(L_I)$$

$$X_F = f_F(L_F)$$

The production function is assumed to be twice differentiable, and $f' > 0$ and $f'' < 0$ hold.

The general government, the dominant employer in the formal sector, is assumed to maximize its own (usually unseen) objective function, which is interpreted as giving rise to cost minimization by government at any given wage. The formal sector employment decision is given by the following equation:

$$f'_F(L_F) = w$$

Further, we assume that the wage in the formal sector has a political or institutional lower bound of the wage range, \bar{w} . Hence, the following condition will hold:

$$w \geq \bar{w}$$

In equilibrium, the cost minimization (or profit maximization) will ensure to hold:

$$f'_F(L_F) = \bar{w}$$

As mentioned above, the informal sector wage is determined at its marginal productivity of labor:

$$f'_I(L_I) = w_I$$

We revisit the sectoral transfer condition. Workers will transfer from the informal to the formal sector as far as the following condition holds: $f'_I(L_I) < \bar{w} \frac{L_F}{L - L_I}$. Transfer equilibrium where there is no sectoral transfer is obtained when the following equality holds, $f'_I(L_I) = \bar{w} \frac{L_F}{L - L_I}$.

Following Harris and Todaro (1970), the model is represented in Figure 4. Total labor supply, L , is shown as the distance of the horizontal axis, which is $L = O_F - O_I$. The vertical axis depicts formal and informal sector marginal productivity of labor, noted as MP_F and MP_I , respectively.

As far as the first order condition of the production function is strictly positive, unemployment is not desirable. It is not too difficult to show that the socially optimal solution (competitive equilibrium) for this economy is the following:

$$L_I + L_F = L$$

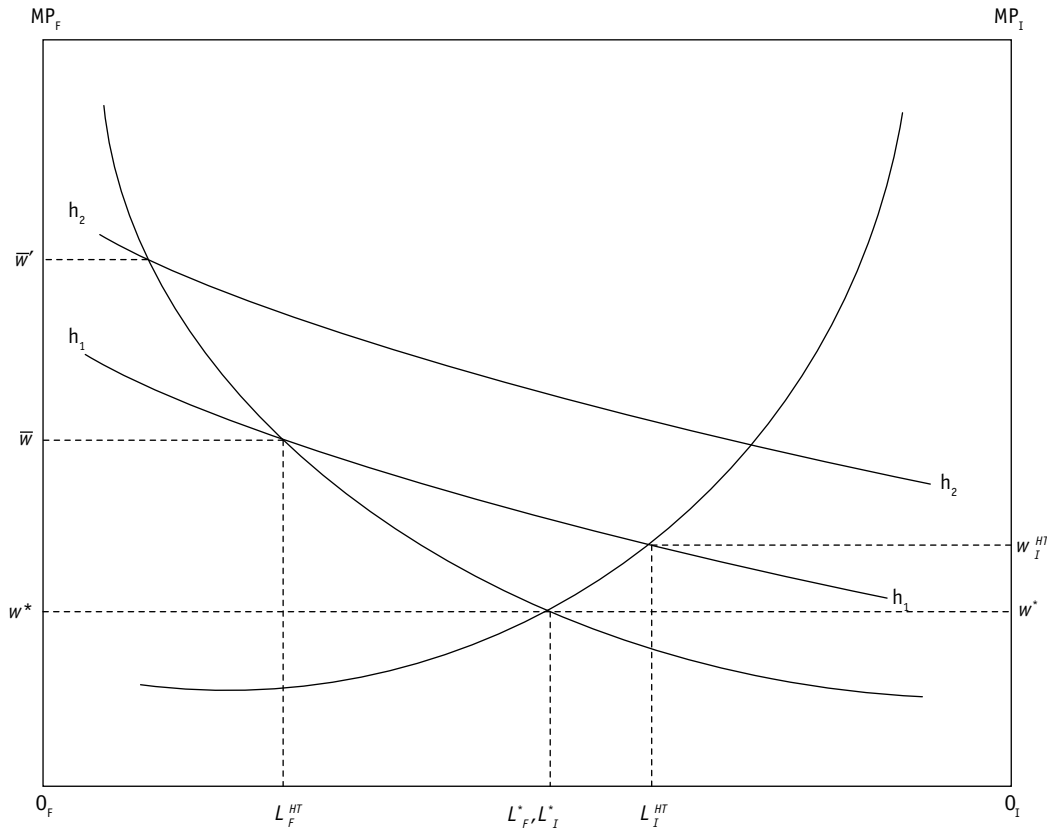
$$f'_F(L_F) = f'_I(L_I)$$

This is the point where the marginal productivity curves for the formal and informal sector intersect.¹¹ Under the socially optimal equilibrium, $O_F - L_F^*$ and $O_I - L_I^*$ is employment, and the rural and urban wage is w^* . There is no unemployment.

A politically and institutionally fixed minimum wage for the formal (public) sector, \bar{w} , and a probabilistic transfer relationship of labor, $\bar{w} \frac{L_F}{L - L_I}$, will inevitably create formal sector unemployment. We will introduce the rectangular hyperbola (h_1 - h_1) to represent the formal and informal sector employment under the Harris-Todaro equilibrium. The formal sector workers are employed by $O_F - L_F^{HT}$, receive \bar{w} , while the rural workers are employed by $O_I - L_I^{HT}$, receive w_R^{HT} . The superscript HT denotes the Harris-Todaro equilibrium. The $L_F^{HT} - L_I^{HT}$ workers are unemployed. The rectangular hyperbola (h_1 - h_1) can be also interpreted as a job search function by laborers. The unemployed would be concentrated in formal sector, where government employment tends to dominate, but would also include those that withdraw from subsistence agriculture and other forms of informal employment in order to identify and secure opportunities of government employment.

¹¹ We abstract from the cost of staff turnover, which as argued by Stiglitz (1974), can give rise to a divergence between the urban and rural wage in a competitive equilibrium.

FIGURE 4
ALLOCATION OF LABOR UNDER THE HARRIS-TODARO EQUILIBRIUM



Sources: Derived from Gelb et al. (1991), Basu (2000), and Corden and Findlay (1975).

In Figure 3, there is a clear inverse relationship between employment share and pay rate. Assuming the economies are under the Harris-Todaro equilibrium, what we observe in the figure is the intersection of marginal productivity of the public sector and the rectangular hyperbola for each country, which is set by the minimum wage for the public sector. The higher the public sector minimum wage, the lower the public sector employment share along with the marginal productivity line.

Under this simple Harris-Todaro context, the pay rate in this study can be interpreted in the following way. Under the Harris-Todaro equilibrium, $0_F - L_F^{HT}$ and $0_I - L_I^{HT}$ are employed in the formal and informal sectors, respectively. The public sector wage is denoted as \bar{w} , while the informal sector wage is denoted as w_I^{HT} . Hence, the employment share, EM, can be denoted as follows:

$$EM = \frac{0_F - L_F^{HT}}{(0_F - L_F^{HT}) + (0_I - L_I^{HT})}$$

The economy's average pay is weighted average between the urban and the rural sector. Hence, the relative pay rate to the general government, PAY, can be defined as follows:

$$PAY = \frac{\bar{w}}{EM * \bar{w} + (1 - EM) * w_I^{HT}}$$

C. The Harris-Todaro Equilibrium and Economic Rent

So far, the formal sector fixed minimum wage, \bar{w} , is assumed to be determined exogenously, i.e., set by institutional or political conditions. It is exogenous because there is no assumption on how \bar{w} is set, and the public sector does not have any monopolistic power to alter this wage rate. We partially relax this assumption, which maintains that \bar{w} is a function of factors such as rent seeking behavior, income level, level of public investment, and government consumption, while the government still remains to be “wage taker” from the pool of labor. We assume that \bar{w} is determined by one or both of two factors: (i) scarcity rent and (ii) rent-seeking behavior.¹² First, there is scarcity in skilled labor that is eligible to work for the formal sector at the early stage of development. Hence, a certain region of the labor supply curve of the skilled labor is vertical, which will create the scarcity rent. Second, we assume that the public sector has two distinctive bodies: policymakers and service providers. Policymakers have some monopolistic power to determine the supply price of public services. There is room for rent-seeking by increasing the price of public services artificially higher than social optimal, hence to increase their profits. The service providers are still wagetakers, where the wage is set by policymakers.

The fixed wage for the public sector is endogenously determined by some unobservable factors. Under the endogenous setting, our hypothesis is that \bar{w} shifts upward or downward according to the determinants of \bar{w} . For some countries, the rectangular hyperbola is set higher to h_2-h_2 due to the higher fixed wage \bar{w}' derived from economic rents. Under this new equilibrium, the public sector employees will receive higher wages (\bar{w}'), while the employed, less. The level of employment in the rural area decreases, while unemployment will be increased.

The erosion of rents embedded in government pay at the wage rate of \bar{w} is associated with shift of labor from low productivity employment outside government, possibly the unemployed, to higher productivity employment in government. As noted in Corden and Findlay (1975, 60), the model such as presented in Figure 4 is a comparative static model that can be seen “either as representing steady state equilibria or as being an ingredient in a more complete dynamic model.” The model of Figure 4 depicts static gains from the erosion of rents in government pay rates. There are also potential dynamic gains, which are not shown in Figure 4 but are identified in the endogenous growth models. A likely source of such dynamic gains is the potential for an expansion in government employment and hence public services such as education, health, law, and order to raise productivity in the private sector (e.g., via a better educated workforce or improved law and order). The depiction of Figure 4 also omits the potential savings in the resource cost incurred by those engaged in rent seeking within government or in search of government employment.

¹² Harris and Todaro (1971, 129) assume that in many developing countries there are institutional factors that set an urban wage substantially above that set an urban minimum wage substantially higher than the free market would allow. We interpret our analysis as clarifying the nature of at least some of these institutional factors. It is important to note that rent seeking behavior is a potential contributor to scarcity rents. For example, a country’s elite may limit access to nonbasic education (e.g., by overfunding tertiary education) in order to preserve their position.

Our interpretation is these static and dynamic benefits of the erosion of rents embodied in government pays would lead to a negative relationship between relative government pay rates and economic growth in developing countries. Associated with this interpretation is the potential for a positive relationship between the government employment share and economic growth. Whether this positive relationship exists would also depend on the negative impact on economic growth of raising revenue to fund an expansion in employment over and above that funded by a reduction in relative government pay rates.

There are a number of mechanisms that could explain why rents embedded in government pay rates are eroded over time and government employment rises. For example, an expansion of education that increases the supply of skilled labor could erode rents. Public choice perspectives offer a number of possible explanations. One possible interpretation is there is a shift in power during the development process away from the well-paid elite employed in government to the broader community, who demand more services from government but without an additional tax impost on them. This shift in power may be led by the political process that, as development proceeds, identifies the broader community as a more sustainable support base that the public service (i.e., than government employees). An alternative interpretation is that the self-interest of politicians/rulers is maximized through the employment of additional persons rather than maximizing pay rates for a smaller number of public servants, and hence politicians and rulers pressure for the erosion of rents in government pay rates.

V. EMPIRICAL ANALYSIS

A. Introduction

In this section, we estimate the growth penalty of high pay rates to the government. The growth penalty of high pay is shown as a relation between GDP growth and relative government pay rates. Based on the theoretical implications from the Harris-Todaro two sector model, we hypothesize that relative government pay rate or employment share costs the economy in terms of GDP growth. In order to estimate the growth penalty, we formulate growth as a function of the relative government pay rate or the employment share in addition to the institutional environment, the quality of economic policy, and initial endowments to control the relevant factors to affect the economic growth. In doing so, we draw heavily on the literature on the relationship between foreign aid and economic growth as summarized in Easterly et al. (2004) and Roodman (2007). This literature in turn has considerable common ground with studies on the relationship between government expenditure and economic growth as summarized above.

B. Data

Our time periods are 4-year averages for the period 1950 to 2001. All variables in this study are included in Table 4. Even though our main focus is relative government pay rate (PAY) and government employment share (EM), we included variables for the budget balance, aid, initial GDP, population, and some qualitative variables in order to control effects that are not controlled by the PAY or EM variable. The strong inverse relationship between the PAY and EM variables indicates that a reduction in relative pay rates is used to fund, at least partially, increases in employment. Furthermore, our growth regression includes the log of initial GDP to capture convergence effects,

and we include an institutional quality index. Institutional quality is captured by: an update of Knack and Keefer's (1995) composite measure of the state of governance (i.e., the International Country Risk Guide's Economic Rating [ICRGE]); assassination and postconflict variables as measures of episodes of civil unrest; an ethnic fractionalization variable represented by the diversity of languages in a country as a measure of social cohesion; and the lagged ratio of M2 to GDP as a measure of financial sector depth. The potential effect of colonial histories on the growth rate is also controlled for. We follow Easterly et al. (2004), who in turn follow Burnside and Dollar (2000) in including dummies for fast-growing East Asia and sub-Saharan Africa.

TABLE 4
DATA SUMMARY FOR DEVELOPING COUNTRIES

VARIABLE NAME	DESCRIPTION	NUMBER OF OBSERVATIONS	MEAN (STANDARD DEVIATION)	MIN	MAX
GDPG	Real GDP per capita growth rate	N = 1,324 n = 162	1.466 (5.382)	-43.65	46.85
PAY	Relative government pay rate	N = 435 n = 111	100.9 (60.57)	14.98	398.4
EM	Government employment share	N = 598 n = 134	19.77 (9.263)	3.469	64.92
BB	Budget surplus per GDP	N = 910 n = 133	-0.033 (0.055)	-0.450	0.478
AID	Share of effective development assistance to GDP in PPP terms	N = 1,268 n = 124	1.335 (2.665)	-12.61	33.09
AIDsq	Square of the AID variable	N = 1,268 n = 124	8.882 (42.87)	0	1,095
LGDP	Initial PPP GDP per capita in a logarithmic form	N = 1,169 n = 125	7.495 (0.914)	4.214	10.98
ICRGE	Index of institutional quality	N = 1,495 n = 115	4.425 (1.955)	0	10
M21	Share of M2 to GDP, lagged one period	N = 977 n = 147	32.02 (29.63)	0.046	534.6
LPOP	Population in a logarithmic form	N = 1,601 n = 162	15.06 (2.006)	9.680	20.94
TROPICAR	Share of land area in tropics	N = 1,651 n = 127	0.572 (0.468)	0	1
ETHNF	Index of ethnic fractionalization	N = 1,365 n = 105	0.440 (0.293)	0	0.930
ASSAS	Number of assassinations	N = 1,495 n = 159	0.188 (0.677)	0	11.50
POSTCON	Postconflict dummy	N = 2,223 n = 171	0.010 (0.099)	0	1
COL	Number of years being a Western colony	N = 2,132 n = 164	135.4 (142.3)	0	513
IND	Number of years since independence from the West	N = 2,132 n = 164	46.23 (56.48)	0	202

continued.

TABLE 4. *continued.*

VARIABLE NAME	DESCRIPTION	NUMBER OF OBSERVATIONS	MEAN (STANDARD DEVIATION)	MIN	MAX
EASIA	East Asia dummy	N = 2,223 n = 171	0.058 (0.234)	0	1
SSA	Sub-Saharan Africa dummy	N = 2,223 n = 171	0.281 (0.449)	0	1
For the endogenous model (instrumental variables)					
KG	Share government consumption to GDP	N = 1,406 n = 158	22.84 (11.90)	1.547	78.64
KI	Share of investment to GDP	N = 1,414 n = 155	12.83 (9.027)	0.916	93.18

GDP = gross domestic product; PPP = purchasing power parity.

Note: *N* denotes the overall and within observation, while *n* denotes the between observation. For instance, there are 1,324 observations of the GDPG variable for the 162 countries.

Source: Authors' calculation.

C. Simple Pooled Regression

In this regression analysis, we test if the relative government pay and government employment share affect GDP growth. Our particular interests are at the PAY and EM variables. In the previous section, the theory implied that static and dynamic benefits of the erosion of rents embodied in relative government pay rates, which are embodied as \bar{w} , would lead to a negative relationship between relative government pay and economic growth in developing countries. If the theoretical implication were correct, the empirical results should indicate that the PAY variable negatively associated with economic growth. Furthermore, we should also observe a positive relationship between the government employment share, the EM variable, and economic growth.

In order to estimate the relationship between the PAY and EM variables, we begin by defining the growth rate of GDP per capita as follows:

$$g_{ct} = \alpha + \sum_{i=1}^n \beta_i x_{ct}^i + \varepsilon_{ct} \quad \text{for } c = 1 \dots n \text{ countries and } t = 1 \dots T \text{ time periods}$$

where g is the growth of rate real GDP per capita. β is a vector of marginal effects of the explanatory variables, and x_{ct} represents observable factors to influence economic growth. ε_{ct} is an error term, which incorporates the influences of omitted variables. The subscript c indicates a country, and the subscript t denotes the time period.

Since we are utilizing panel data, the omitted variables can be (i) country-varying, but time-invariant; (ii) time-varying, but country-invariant; or (iii) country- and time-varying variables. Following Baltagi (2002), the error term can be further decomposed to the following:

$$\varepsilon_{ct} = \mu_c + v_{ct}$$

where μ_c denotes the unobservable country specific effect with the usual properties, and v_{ct} denotes the reminder disturbance. Then, inserting the error term back to the original equation, we get:

$$g_{ct} = \alpha + \sum_{i=1}^n \beta_i x_{ct}^i + \mu_c + v_{ct}$$

It is known that running ordinary least squares (OLS) without considering the decomposed error structure may lead to misleading results, depending on the influences from the unobservable variables. Hence, the literature suggests applying fixed, between, and random effect models. The detailed technical discussion of such models is in Appendix II.

The results from the pooled OLS, the fixed-effect, between-effect, and random-effect estimator regression for relative government pay rate and employment share are shown in Table 5.

We confirmed that the estimation results are similar across the different models. The simple pooled OLS regression models show that relative government pay rate adversely affects GDP growth as predicted by the theory, while government size, as measured by employment share, is insignificant for economic growth. The budget surplus per GDP (BB) and East Asia geographical dummy (EASIA) are also positively affect GDP growth. From the negative sign of initial purchasing power parity (PPP) GDP per capita (LGDP) indicates the converging effect.

According to the test score of the Breusch-Pagan Lagrange multiplier test for the two-way random-effect model, the null hypothesis of homoskedsticity is rejected; hence, the random-effect model dominates the pooled OLS. The Hausman test score over the fixed- and random-effect models indicates that the null was rejected; hence, the random-effect dominates the fixed-effect model. We can conclude that it is likely that the random-effect model results are consistent and efficient. However, it is also noted that the estimation results across the different estimators are similar.

TABLE 5
GOVERNMENT SIZE REGRESSIONS: POOLED OLS, FIXED (WITHIN), BETWEEN, AND RANDOM ESTIMATOR

VARIABLE NAME	DEPENDENT VARIABLE: GDPG							
	OLS		FIXED (WITHIN)		BETWEEN		RANDOM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PAY	-0.011*** (0.004)		-0.015** (0.007)		-0.013* (0.007)		-0.013*** (0.005)	
EM		0.003 (0.031)		-0.041 (0.066)		-0.045 (0.056)		-0.002 (0.038)
BB	15.48*** (3.544)	16.94*** (3.651)	24.07*** (5.390)	24.73*** (5.038)	15.82** (7.503)	18.14*** (7.163)	17.94*** (4.279)	19.66*** (4.090)
AID	-0.167 (0.370)	-0.274 (0.378)	0.202 (0.463)	0.230 (0.434)	0.382 (0.756)	0.397 (0.628)	-0.022 (0.350)	-0.020 (0.330)
AIDsq	0.022 (0.043)	0.030 (0.049)	0.015 (0.048)	0.026 (0.045)	-0.037 (0.059)	-0.042 (0.050)	0.016 (0.032)	0.017 (0.031)
LGDP	-1.451*** (0.427)	-1.306*** (0.446)	-0.534 (0.879)	-0.221 (0.811)	-1.008 (0.858)	-0.064 (1.055)	-1.239*** (0.499)	-0.982** (0.514)
ICRGE	0.286*** (0.118)	0.291*** (0.119)	0.165 (0.209)	0.229 (0.191)	0.251 (0.237)	0.012 (0.247)	0.206 (0.135)	0.221* (0.131)
M21	-0.006 (0.011)	-0.001 (0.009)	-0.065*** (0.027)	-0.065*** (0.025)	0.024 (0.024)	0.035 (0.025)	-0.020 (0.015)	-0.0189 (0.015)
LPOP	0.049 (0.152)	0.104 (0.139)	-0.380 (1.147)	0.144 (1.080)	0.154 (0.288)	0.096 (0.295)	0.075 (0.197)	0.103 (0.194)
TROPICAR	-0.483 (0.518)	-0.904* (0.507)	(dropped)	(dropped)	-0.702 (0.873)	-1.269 (0.889)	-0.564 (0.740)	-1.251* (0.779)
ETHNF	-1.432** (0.707)	-1.704*** (0.638)	(dropped)	(dropped)	-0.970 (1.307)	-1.351 (1.307)	-1.485 (1.140)	-1.660 (1.136)
ASSAS	-0.133 (0.196)	-0.234 (0.167)	-0.070 (0.184)	-0.197 (0.164)	-0.592 (0.675)	-0.461 (0.656)	-0.118 (0.173)	-0.216 (0.156)
POSTCON	1.613* (0.973)	1.551* (0.945)	1.843 (1.127)	1.773 (1.127)	1.927 (2.953)	0.914 (1.684)	1.681 (1.036)	1.708* (0.970)
COL	-0.001 (0.002)	0.001 (0.002)	(dropped)	(dropped)	-3.99e-06 (0.003)	0.001 (0.002)	-0.001 (0.003)	0.002 (0.003)
IND	-0.005 (0.004)	-0.004 (0.004)	(dropped)	(dropped)	0.003 (0.006)	0.001 (0.006)	-0.005 (0.005)	-0.005 (0.005)
EASIA	2.451*** (0.562)	2.458*** (0.547)	(dropped)	(dropped)	2.770*** (0.979)	2.636*** (1.076)	2.786*** (0.748)	2.927*** (0.791)
SSA	-1.517 (1.013)	-0.504 (0.886)	(dropped)	(dropped)	-0.773 (1.035)	0.121 (1.035)	-1.508 (1.030)	-0.585 (0.996)
CONST	14.37*** (4.942)	10.84*** (4.413)	15.96 (17.78)	3.561 (16.35)	7.194 (9.813)	1.555 (10.47)	13.17** (5.689)	9.228* (5.340)
Number of observations	227	267	227	267	227	267	227	267
R-squared	0.361	0.3383	0.0065	0.0444	0.2857	0.2595	0.3511	0.3262

OLS = ordinary least squares; GDPG = real gross domestic product per capita growth rate.

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

Note: Standard errors are shown in parentheses.

D. The Endogenous Model

In this section, relative government pay rate is assumed to be jointly (endogenously) determined by some other variables. The theory does not tell us if the economic growth is caused by relative government pay rate and other governance indicators or vice versa, i.e., relative government pay rate is endogenously determined by economic growth itself and other exogenous instrumental variables. Under this endogenous setting, the causality hypothesis maintains that government relative pay rates and governance indicators are causing the high (or low) GDP growth, and that the high (or low) GDP growth and exogenous instrumental variables are also endogenously causing the high (or low) relative government pay rates. Theoretically speaking, relative government pay rates (\bar{w}) is not simply given as endowment, but \bar{w} is a function of other variables. The new theoretical direction adopted by more recent studies on the relationship between government size and growth has been associated with the adoption of more sophisticated estimation techniques. Some studies point to the sensitivity of earlier findings to corrections for endogeneity of the variables. In order to take these in consideration, we applied the feasible efficient two-step generalized method of moments (GMM) estimator, which is described in Appendix II.

The feasible two-stage GMM estimator is preferred to the simple pooled regressions for several reasons. First, the GMM estimator accounts for unobserved country-specific effects, which may bias the estimates. The GMM estimator will control these potential unobserved effects. Hence, the GMM estimator is more efficient than the standard instrumental variable estimator if heteroskedasticity exists. Second, we use the instrumental variables to account for potential endogeneity represented by the PAY variable. We believe that the PAY variable is a proxy for rent seeking behavior, and the instruments are chosen to control those unobserved behavioral and qualitative effects. Third, the validity of the model can be tested through some specification tests in addition to the standard hypothesis tests. The following two hypothesis tests were conducted: (i) Hansen's J overidentification test of all instruments and (ii) the Anderson canonical correlations likelihood-ratio test to identify excluded instruments are relevant.

The GMM regression results in Table 6 show that all significant coefficients have the correct signs. The PAY variable negatively affects the economic growth as in the simple pooled regressions. The years of colonization affects negatively, while the years of independence turn out to be insignificant. East Asia dummy becomes insignificant, while the sub-Saharan dummy is negative and significant.

The Pagan-Hall statistics of no heteroskedasticity was rejected; hence, the GMM estimator is deemed to be more efficient than the standard instrumental variable estimator or two-stage least squares. The test results from the Hansen's J statistics indicate that we do not reject the null hypothesis of no correlation. Hayashi (2000) noted that the finite sample of the J test in small samples tends to exceed the nominal size; hence, the test rejects too often. Given the small sample in the data set, this test result indicates that it is more likely the null of independence is correct. The test score from Anderson canonical correlations likelihood-ratio test rejects the null of under-identification; hence, the model is identified.

TABLE 6
GOVERNMENT SIZE REGRESSIONS: ENDOGENOUS MODEL

ESTIMATION METHOD: FEASIBLE EFFICIENT TWO-STEP GMM ESTIMATOR (DEPENDENT VARIABLE: GDPG)		
	COEFFICIENT	STANDARD ERROR
PAY	-0.2529 **	0.1166
BB	36.336 **	17.417
AID	2.9999	2.6936
AIDSq	-0.1572	0.1948
LGDP	-6.7326 **	3.1509
ICRGE	1.0784	0.6674
M21	-0.1422 *	0.0783
LPOP	0.4737	0.6793
TROPICAR	9.9949 *	5.3182
ETHNF	5.9700	5.1519
ASSAS	0.5406	0.5983
POSTCON	-3.9633	6.4046
COL	-0.0501 **	0.0238
IND	-0.0278	0.0205
EASIA	0.2108	2.6074
SSA	-17.044 *	9.1730
CONST	75.836 **	34.911
Number of observations		220
Centered R-squared (Sargan's Stats)		-10.32
Uncentered R-squared		-6.224
Pagan-Hall statistics		1.355
Hansen's J statistic		3.832
Anderson canonical correlations likelihood-ratio		5.940

GMM = generalized method of moments; GDPG = real gross domestic product per capita growth rate.

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

Note: Instrumented: PAY; Included Instruments: BB, AID, AIDSQ, LGDP, ICRGE, M21, LPOP, TROPICAR, ETHNF, ASSAS, POSTCONFLICT2, COL, IND, EASIA, SSA; Excluded instruments: GDPG, KG, KI.

E. Interpretation of Empirical Analysis

The key finding of the empirical analysis is that relative government pay rates are negatively related with economic growth in developing countries regardless of pay rates being exogenously or endogenously determined. No empirical relationship is identified between the government employment share and economic growth. This means that the higher the relative government pay rates, the lesser the economic growth attained. Hence, high relative government pay rates cost the country in terms of economic growth, while the higher employment share does not seem to have any economic growth impact.

This finding is potentially linked to the relatively high rate of growth in government employment. A decline in relative pay rates fully funds an increase in the government employment when the proportionate decline in relative pay rates equals the inverse of the proportionate increase in the employment share. For example: when the relative pay rate halves, it fully funds a doubling of the employment share; and when the relative pay rate falls to a third of its initial level, it fully funds a tripling of the employment share. However, employment shares have typically risen at a faster rate than relative pay rates have declined. This is illustrated for the case of the 19 Asian and Latin American countries included in the Groningen Growth and Development Centre's 10 sector database. Only in Peru did relative pay rates decline by enough to fully fund the expansion in employment. In these 19 countries the decline in relative pay rates is found to fund 30% or less of the expansion in employment or relative pay rates rose over the period studied.

Even though our empirical model partially captures the theoretical implications from the Harris-Todaro model, the model suggests that lowering the relative government pay rate should be accompanied by higher employment in the rural sector as well as less unemployment in the economy. Also, the labor that was trapped by the high government pay rate should be reallocated to more productive use within and outside the government as a consequence of lowering the relative government pay rate. Lowering the government pay rate increases the supply of factors to private production, and the dynamics suggest this will lead to higher sustainable growth in the long run. The resource cost of rent-seeking behavior is also reduced. It is plausible to think that the robust negative relationship between GDP growth and government relative pay rates captures these static as well as dynamic labor resource allocation effects.

It is concluded that the fall in pay rates has only funded part of the expansion in employment. Additional increases in revenue, cuts in other expenditure, or deficit financing have therefore been required to fully fund expansion in employment in most developing countries. The empirical findings are consistent with the interpretation that the cost to economic growth of these measures has offset any benefits from an expansion in employment.

VI. CONCLUSION

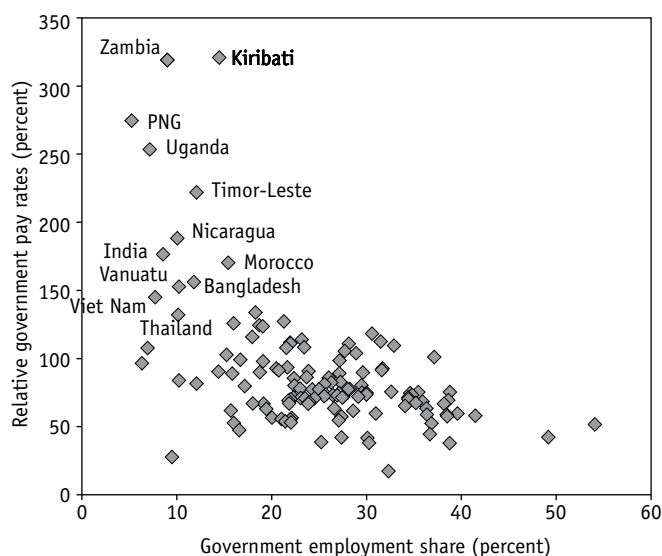
Relative government pay rates, which can be interpreted as a measure of the affordability of general government, have declined substantially over time in most countries. These relative pay rates are negatively related to income and economic growth in developing countries, and a decline in relative pay rates is found to be associated with an increase in economic growth. The results from the endogenous regression model show that pay rates inversely affect economic growth, while economic growth also affects pay rates; hence, pay rates and economic growth are jointly determined. Even though data show a negative relationship between pay rates and employment share, there

is no apparent relationship between changes in government employment and economic growth. It is concluded that relative government pay rates, rather than government “size” as measured by employment, are what matter most for the growth of developing countries.

Our interpretation is that economic rents in embedded in government pay rates reduce the affordability of government and reduce the coverage of public services essential to economic growth. Rent-embedded high government pay leads to far less employment in government, and the creation of a group of unemployed labor in search of government employment. The adverse static and dynamic effects of these outcomes impair economic growth.

A form of international convergence has occurred in government pay rates, when expressed relative to affordability and to government employment shares. In most countries, relative government pay rates are in the range of 50–125%, where this is matched by a government employment share of 15–40% (see Figure 5). Within this broad range, higher-income countries tend toward higher employment shares and lower relative government pay rates.

FIGURE 5
LATEST ESTIMATE OF GOVERNMENT PAY RATES AND EMPLOYMENT SHARES



PNG = Papua New Guinea.

Note: Data are the latest 4-year averages of the available data for 1990 to 2006. n=130 (high and low income countries)

Sources: Authors' estimates derived from OECD (2005); Timmer and de Vries (2007); Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific; United Nations Statistical Division's National Accounts Database; International Labour Organization's Key Indicators of the Labour Market and LABORSTA.

Our data set identifies those countries that are most likely to be paying their government employees too much and employing too few.¹³ For these countries, the empirical analysis suggests they could raise their economic growth by reducing relative pay rates in government and using the

¹³ The empirical analysis does not shed light on whether those countries with low government employment shares combined with low government pay rates would raise growth by expanding government employment.

budget savings to expand employment.¹⁴ The list of countries that appear to be paying more than their economies can afford includes Bangladesh, India, Timor-Leste, Viet Nam, and a number of African and Pacific island nations (high-paying countries are identified in Figure 5).

The Pacific islands include three high-pay-rate countries, with a fourth, the Solomon Islands, a candidate for a similar classification.¹⁵ The Pacific islands provide a good case study of the implications of high relative government pay rates. The poor long-term performance of the high-paying Kiribati, Papua New Guinea, Solomon Islands and Vanuatu stands in contrast to the low pay and markedly better-economic-performing Cook Islands, Palau, and Samoa (see Sugden and Taniguchi 2007).¹⁶

Our data set has a relatively low representation of sub-Saharan economies. The direct measures of government pay rates and employment shares from the World Bank and International Monetary Fund (see Schiavo-Campo 1998, and World Bank 2001, and Kray and Rijckeghem 1995) provide a broader coverage of the region, and suggest that a substantial number of sub-Saharan nations are also candidates for inclusion on the list of high-pay countries (see Appendix Table A1.1).

India stands out among the high-pay countries, as it has experienced one of the most pronounced increases in relative government pay rates in recent decades. Estimates for Bangladesh appear to suffer from inaccuracy in the national accounts. The least favorable estimates identify Bangladesh as a country with one of the highest relative government pay rates. While Viet Nam is identified as a high-pay country, its relative government pay rate has fallen rapidly, and it may no longer be of concern.¹⁷

Government actions that increase the supply of skilled labor, or measures that curb rent seeking behavior, are recommended for countries with relatively high government pay rates. Examples of the former include expanded education, an efficient health care system, gender reform to increase the participation of women in the formal workforce, measures to include labor mobility, and relaxed controls on foreign workers. Examples of antirent seeking measures include improved governance, outsourcing of public service delivery to reduce the scope of government influence, and removal of labor market imperfections that impede competition (e.g., excessive minimum wages, wage indexation, or centralized bargaining).

The indirect measure prepared of relative government pay rates provides a practical indicator for monitoring the extent to which high pay countries do succeed in eroding rents embedded in

¹⁴ The expansion in employment would be fully funded by the decline in relative pay rates if the proportionate expansion in employment is limited to the inverse of the decline in relative government pay rates.

¹⁵ Solomon Islands is not shown given the unavailability of a recent estimate for relative government pay rates. The most recent estimate is of more than 300% (as of the 1980s) with a government employment share of less than 10% (as of 1999).

¹⁶ Two members of the list, Kiribati and Timor-Leste, have gross national income substantially above GDP owing to high offshore income. For Kiribati, the offshore income is from a large public trust, fishing revenue, and remittances from seamen; while for Timor-Leste it is derived from offshore oil and gas. If gross national income was used as the measure of affordability (and not value-added), the relative government pay rate for Kiribati would be approximately half that shown. While the adjustment is appropriate for Kiribati, only a small adjustment is considered appropriate for Timor-Leste. This is because Timor-Leste has committed to save almost all its offshore income and only 3% of its projected savings are available annually to fund government expenditure.

¹⁷ Preliminary national accounts for 2006 suggest that Viet Nam has reduced its relative government pay rate to within the broad range of other countries, although its employment share remains relatively high (see General Statistics Office of Vietnam 2008).

their government pay rates.¹⁸ The measure is best suited to providing a general guide for the long-term movement in average, relative pay rates. It is possible that at any point in time, segments of government employment may warrant an increase in pay rates even though relative pays should be trending down on average. Such pay increases may be justified to retain mobile labor or, per the formulation of Ul Haque and Sahay (1996), to curb the incentive to engage in corruption. It is also possible that, consistent with the formulation of Gelb et al. (1991), there may be segments of unproductive labor that should be removed in government even though as a whole, high relative pay rates are leading to underemployment in government. It is possible that at any point in time, segments of government employment may warrant an increase in relative pay rates even though average pays should be trending down.¹⁹

¹⁸ The indirect measure is favored over comparisons of average government pays with wages outside government. This is because of the potential for rents in government pay rates to create rents in wages outside government (for example, because government acts as a price leader in the labor market). When rents are present in wages both in and outside government, comparisons may lead to a conclusion that government pay rates should rise even though the preferred policy response is to act to erode rents in government pay.

¹⁹ Schiavo-Caampo et al. (1997) report estimates of average employment shares by segment of general government for the early 1990s (regional averages are presented as a share of the population, where the averages do not include all countries of a region). The average employment share of central government administration is estimated as 1.4% in the Middle East and North Africa, 1.8% in the OECD, 1.2% in Latin America and the Caribbean, 0.9% in Africa, 1.1% in Eastern Europe and the former Union of Soviet Socialist Republics (USSR), and 0.9% in Asia. The average employment share of noncentral government administration is estimated as 0.9% in the Middle East and North Africa, 2.5% in the OECD, 0.7% in Latin America and the Caribbean, 0.3% in Africa, 0.8% in Eastern Europe and the former-USSR, and 0.7% in Asia. The average employment share for education and health is estimated as 1.2% and 0.4% in the Middle East and North Africa respectively, 2.1% and 1.4% in the OECD, 0.8% and 0.3% in Latin America and the Caribbean, 0.6% and 0.2% in Africa, 3.2% and 2.1% in Eastern Europe and the former-USSR, and 0.8% and 0.2% in Asia. The average employment share of the armed forces is estimated as 0.7% in the Middle East and North Africa, 0.5% in the OECD, 0.4% in Latin America and the Caribbean, 0.3% in Africa, 1.1% in Eastern Europe and the former-USSR, and 0.8% in Asia.

APPENDIX I

Our primary data source for the regression analysis is the Roodman (2007) Anarchy of Numbers data set, which in turn is an extension of the Easterly et al. (2004) data set. Data are appended to this from Version 6.2 of the Penn World Tables (Heston et al. 2006), Olsson (2007), and the study's estimates of relative government pay rates and the government employment share (see Appendix Table A.1). Data are 4-year-averages.

Relative government pay rates and employment shares are 4-year simple averages of the available data. Relative government pay rates are found as the ratio of value-added per employee in Community, social, and personal services to total value-added per employee (derived from value-added at nominal prices). Total value-added is derived at basic prices less imputed rent or, where that is not separately estimated, value-added from real estate, renting, and business activities (as an estimate of imputed rent). The government employment share is found as the share of employment of Community, social, and personal services in total employment.

In deriving the estimates of relative government pay rates and employment shares presented in Appendix Table A.1, the following data sources were used (in decreasing order of reliance):

- The Organisation for Economic Co-operation's (OECD) STAN Database (OECD 2005). This provides data for 1970 to 2002 for 28 OECD countries (data for Japan is excluded due to an apparent error in the classification of value-added).
- The Groningen Growth and Development Centre 10-sector database of Timmer and de Vries (2007). This provides data for 1950 to 2002 for 19 Asian and Latin American countries: Argentina; Bolivia; Brazil; Chile; Colombia; Costa Rica; Hong Kong, China; India; Indonesia; Japan; Republic of Korea; Mexico; Malaysia; Peru; Philippines; Singapore; Thailand; Taipei, China; and Venezuela. Indonesia value-added is corrected for the omission of public administration (as verified by comparisons with national accounts data).
- The census releases and statistical compendiums of national statistical bureaus of the Pacific islands and Timor-Leste (Secretariat of the Pacific Community [2007], supplemented by the statistics authorities in the Pacific). Estimates of employment are prepared following the methodology of Timmer and de Vries (2007).
- The United Nations Statistical Divisions National Accounts Database, SNA68 and SNA93 (<http://unstats.un.org/unsd/>, as downloaded December 2007).
- The International Labour Organization's Key Indicators of Labor Markets Database Version 4 (compact disc released 2006; internet version available at <http://www.ilo.org/public/english/employment/strat/kilm/>).
- LABORSTA, prepared by the International Labour Organization (available at <http://laborsta.ilo.org/>, as downloaded December 2007). Data are excluded when the government employment share is implausibly low or when the nonclassified category of employment accounts for a large share of total employment. Data for People's Republic of China are adjusted to include the nonclassified category in Community, social, and personal services employment.

APPENDIX TABLE A.1
MEASURES OF RELATIVE GOVERNMENT PAY RATES AND GOVERNMENT EMPLOYMENT SHARES

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Albania	CEE/CIS	Pay rate Employment															1.3 4.6	3.2	
Algeria	MENA	Pay rate Employment							13						38 33	38 30	2.9 4.2	1.8 4.9	
American Samoa	Other	Pay rate Employment								45									
Angola	SSA	Pay rate Employment															1.3 1.9		
Anguilla	Carib.	Pay rate Employment													71 23				
Antigua and Barbuda	Carib.	Pay rate Employment											29				0.9	0.7	
Argentina	LA	Pay rate Employment	51 21	53 21	51 22	53 22	53 23	52 24	46 26	47 27	41 30	44 30	41 30	61 33	59 35	45 37	2.4 4.9	1.9	
Armenia	CEE/CIS	Pay rate Employment														67 22	0.8 10.5	0.5	
Aruba	Other	Pay rate Employment												104 29					
Australia	High inc.	Pay rate Employment							98 19	99 22	92 23	79 25	75 27	74 27	73 27	28	1.3 7.6	1.3	
Austria	High inc.	Pay rate Employment							109 18	109 18	104 20	101 21	97 22	95 24	87 24	81 26	1.0 7.6	1.7 7.9	
Azerbaijan	CEE/CIS	Pay rate Employment	13		96 14						18	132 16	82 17	89 19	57 20		1.6	1.0 11.2	
Bahamas	Carib.	Pay rate Employment						27				88 33	87 33	78 32	80 29		6.5	1.5	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Bahrain	MENA	Pay rate Employment				10	31			46			60				1.3	1.9	
Bangladesh	SA	Pay rate Employment							63		135	202		187		156	4.1	3.6	
									10		8			9		12	0.6		
Barbados	Carib.	Pay rate Employment							56	47	50	54	56	55	58		1.7		
									35	37	37	38	40	39	39	41	6.8		
Belarus	CEE/CIS	Pay rate Employment															0.5		
																	7.9		
Belgium	High inc.	Pay rate Employment						86	89	88	82	73	73	73	71	71	2.4		
								22	24	27	31	32	32	32	33	34	7.6		
Belize	Carib.	Pay rate Employment											78	105	108			3.8	
													30	25	23		4.2		
Benin	SSA	Pay rate Employment											8					7.6	
Bermuda	Other	Pay rate Employment												68					
													34	36					
Bhutan	SA	Pay rate Employment																3.8	
																	0.1		
Bolivia	LA	Pay rate Employment			106	109	118	93	76	77	59	66	59	102	106	116	1.8	3.3	
			8	8	10	10	10	14	17	20	24	26	24	18	18	18	2.7		
Botswana	SSA	Pay rate Employment									82			60	61	75	3.5	2.0	
											24			37	36	30	5.8	6.1	
Brazil	LA	Pay rate Employment																	
			8	9	11	12	13	15	17	19	21	24	21	27	29	30			

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
British Virgin Islands	Carib.	Pay rate Employment											24					
Brunei Darussalam	SEA	Pay rate Employment					36								55			
Bulgaria	CEE/CIS	Pay rate Employment				12			18	17	17	18	20	20	18	24	1.4	1.0
Burkina Faso	SSA	Pay rate Employment															11.8	10.7
Burundi	SSA	Pay rate Employment															7.7	8.7
Cambodia	SEA	Pay rate Employment													108		1.6	1.1
Cameroon	SSA	Pay rate Employment							136								3.7	4.7
								8							5		1.4	
Canada	High inc.	Pay rate Employment							80	76	78	77	81	75	72		1.7	1.5
									25	26	27	27	29	29	28	28	4.0	
Cape Verde	SSA	Pay rate Employment								47			90					1.8
										23			14				3.2	
Cayman Islands	Carib.	Pay rate Employment										63	71					
												24	25					
Central African Republic	SSA	Pay rate Employment															5.2	
									6			6					1.3	
Chad	SSA	Pay rate Employment																8.7

continued next page.

APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Chile	LA	Pay rate	99	99	96	91	94	109	95	66	55	50	55	67	73	72	4.2	2.0
		Employment	23	23	24	23	23	25	24	27	32	26	32	25	26	26	0.9	2.2
China	EA	Pay rate											55	51	49	56	1.3	1.2
		Employment											17	19	23	22	2.8	
Colombia	LA	Pay rate	92	93	91	92	92	91	81	97	113	101	113	122	128	134	2.4	
		Employment	15	15	16	17	17	18	18	17	17	17	17	17	20	18	1.7	
Comoros	SSA	Pay rate																5.2
		Employment								7							1.2	
Cook Islands	PI	Pay rate									91	87	76	83	60			
		Employment		16	20	22	24	30	31	34	35	37	37	32	31			
Costa Rica	LA	Pay rate	81	80	84	85	84	78	74	70	59	71	59	91	104	124		
		Employment	14	17	18	18	19	21	23	24	25	23	25	22	21	19		
Côte d'Ivoire	SSA	Pay rate															7.6	
		Employment															0.8	
Croatia	CEE/CIS	Pay rate											100	115	94		1.4	1.5
		Employment											22	22	22		5.2	
Cuba	LA	Pay rate											101	59	57	63		
		Employment											27	34	36	36		
Cyprus	Sth. Eur.	Pay rate		189				71	79	92	98	94	95	104	106	105		
		Employment		9				9	20	18	19	20	21	22	25	28		
Czech Republic	CEE/CIS	Pay rate											80	78	80		1.5	0.8
		Employment											19	20	22			

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Denmark	High inc.	Pay rate Employment						93	89	85	81	79	77	76	76	75	1.3	1.3	
Djibouti	SSA	Pay rate Employment				5		23	26	30	33	32	34	35	35	35	12.7		
Dominica	Carib.	Pay rate Employment																9.8	
Dominican Republic	LA	Pay rate Employment			7			144					39	42	23	27		2.0	2.3
Ecuador	LA	Pay rate Employment						13	74	93	58		39	30	29	24	1.9	1.5	
Egypt	MENA	Pay rate Employment							17	16	25		25	30	26	28	3.4	2.4	
El Salvador	LA	Pay rate Employment							99	80	87	87	71	26	26	28	4.7	1.0	
Equatorial Guinea	SSA	Pay rate Employment							18	19	21	21	24	20	22	19	6.2	6.7	
Estonia	CEE/CIS	Pay rate Employment							85	89	86		123	104	124	124	3.6	2.1	
Ethiopia	SSA	Pay rate Employment						18	17	17			20	22	19	19	1.7		
Ethiopia (incl. Eritrea)	SSA	Pay rate Employment																	
Faeroe Islands	Other	Pay rate Employment						17	20										

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Falkland Islands (Malvinas)	Other	Pay rate Employment										25						
Fiji Islands	PI	Pay rate Employment					77 13	78 15	112 17	120 17	147 17	135 16	103 16	107 16	104 17	98 19		3.0
Finland	High inc.	Pay rate Employment						94 19	81 21	75 24	76 26	77 28	80 31	70 33	65 33	65 34	1.3 12.4	1.1
France	High inc.	Pay rate Employment						67 21	72 24	74 26	75 28	71 30	69 31	69 34	68 34	70 34	1.0 7.0	1.0
French Guiana	Other	Pay rate Employment							146 38		132 38							
French Polynesia	Other	Pay rate Employment							81 39		72 39	84 34						
Gabon	SSA	Pay rate Employment															1.7	2.3
Gambia	SSA	Pay rate Employment															0.9	6.2
Georgia	CEE/CIS	Pay rate Employment													80 21	90 19	0.1 10.5	1.0
Germany	High inc.	Pay rate Employment											80 26	77 28	76 28	75 30	1.3 4.5	
Western Germany	High inc.	Pay rate Employment						93 18	94 21	88 22	83 24	80 25	77 25					
Ghana	SSA	Pay rate Employment						99 10									4.0 1.5	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Gibraltar	Other	Pay rate Employment					24					26	31					
Greece	High inc.	Pay rate Employment												88 22	89 23	91 24	4.2 2.7	
Greenland	Other	Pay rate Employment	13				27	29										
Grenada	Carib.	Pay rate Employment										97 21	83 27					
Guadeloupe	Other	Pay rate Employment							30	177 28								
Guam	Other	Pay rate Employment					29	49					30					
Guatemala	LA	Pay rate Employment										15		12	15	13		1.1
Guernsey	Other	Pay rate Employment												23				
Guinea	SSA	Pay rate Employment								8				6				
Guinea-Bissau	SSA	Pay rate Employment															2.8 1.5	2.3
Guyana	Carib.	Pay rate Employment											51 22	89 16			3.7 2.3	2.1
Haiti	Carib.	Pay rate Employment					7											
Honduras	LA	Pay rate Employment							114 12	144 12	152 13		92 21	92 18	99 17	14	4.0 1.8	4.2 1.4

continued next page.

APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Hong Kong, China	EA	Pay rate Employment							115	86	96	87	96	87	91	86		
									15	17	17	18	17	21	23	26		
Hungary	CEE/CIS	Pay rate Employment											84	74	77	89	0.6	0.7
													26	27	26	27	8.1	
Iceland	High inc.	Pay rate Employment			5								68	67	75	73		
													31	33	32	35		
India	SA	Pay rate Employment			106	109	112	119	125	125	122	129	122	134	172	176	7.1	4.8
					10	9	9	9	8	9	9	10	9	9	9	9	1.2	1.3
Indonesia	SEA	Pay rate Employment			9			106	92	76	84	83	84	61	68	82	1.6	1.0
								11	12	13	14	14	14	15	14	12	2.1	2.1
Iran, Islamic Rep. of	MENA	Pay rate Employment						77						71		17	5.0	
								16						22				
Iraq	MENA	Pay rate Employment		70					34			36		17				
				13					31			52		32				
Ireland	High inc.	Pay rate Employment						18	19	21	23	24	25	27	24	27	1.2	5.0
Isle of Man	Other	Pay rate Employment							15	6			33	34				
Israel	MENA	Pay rate Employment						72	66	68	69	72	72	78	74	75		1.5
								31	33	35	36	36	37	34	34	35		4.8
Italy	High inc.	Pay rate Employment						92	78	77	77	73	74	69	70	71	1.4	1.4
								18	20	21	23	25	27	28	28	27	5.4	
Jamaica	Carib.	Pay rate Employment											64	51	56	57		
													25	26	28	27		
Japan	High inc.	Pay rate Employment	156	147	125	117	117	112	120	118	116	112	116	112	115	113		
			12	13	13	14	15	17	18	20	22	23	22	27	29	31	3.2	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Jersey	Other	Pay rate Employment												22				
Jordan	MENA	Pay rate Employment		109 18					50 44						78 38	75 39	2.7 3.5	2.4
Kazakhstan	CEE/CIS	Pay rate Employment													59 21	54 21	0.1 6.8	0.9
Kenya	SSA	Pay rate Employment															6.2 2.0	
Kiribati	PI	Pay rate Employment				14	14	13	12	12	13	14	14	13	321 14			
Korea, Republic of	EA	Pay rate Employment				112 10	109 11	101 13	113 11	112 11	115 13	99 14	100 15	104 15	94 18	93 20	4.6 2.2	1.5
Kuwait	MENA	Pay rate Employment																0.7
Kyrgyzstan	CEE/CIS	Pay rate Employment										22	52 24	62 21	66 19	67 19	0.8	1.4
Lao People's Democratic Republic	SEA	Pay rate Employment												97 6			2.0 1.4	
Latvia	CEE/CIS	Pay rate Employment												27	26	27	7.1 8.4	1.3
Lebanon	MENA	Pay rate Employment					67 28	28	28					28			1.4 1.4	
Lesotho	SSA	Pay rate Employment							96 18					13				

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Liberia	SSA	Pay rate Employment							125 10									
Libyan Arab Jamahiriya	SSA	Pay rate Employment				12		38 33										
Lithuania	CEE/CIS	Pay rate Employment								70 22	65 24		24	24	27	26	4.8 8.2	1.2 8.8
Luxembourg	High inc.	Pay rate Employment								75 22	79 21	84 21	74 22	72 22	70 22			2.4
Macau, China	SEA	Pay rate Employment									24	27	31	28	31			
Macedonia, The former Yugoslav Rep. of	CEE/CIS	Pay rate Employment									16						0.9 3.2	
Madagascar	SSA	Pay rate Employment														8	4.3 0.8	
Malawi	SSA	Pay rate Employment													5		1.2	
Malaysia	SEA	Pay rate Employment							82 17	77 18	70 20	70 20	56 20	52 21	53 22		3.4 4.5	2.8
Maldives	SA	Pay rate Employment							8				19	21			4.9	
Mali	SSA	Pay rate Employment							8									10.6
Malta	LA	Pay rate Employment				104 28			68 36		62 37	54 41	56 42	91 29	111 28			0.9

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Marshall Islands	PI	Pay rate Employment								22	25	29	32	106	101			
Martinique	Other	Pay rate Employment									177							
Mauritania	SSA	Pay rate Employment						36			29						5.9	3.3
Mauritius	SSA	Pay rate Employment						73					69	75	82	85	1.4	1.4
								24					24	24	22	22	5.5	
Mexico	LA	Pay rate Employment	83	84	89	95	100									114	1.6	1.1
			14	15	16	17	17									23		
Micronesia, Federated States of	PI	Pay rate Employment								25	29	34	41	41	33		4.7	7.1
												130	99	97	109		6.3	
Moldova, Republic of	CEE/CIS	Pay rate Employment													19	20	0.5	2.0
																	7.3	
Mongolia	EA	Pay rate Employment												48	65	63		1.0
													27	19	18	19		
Montserrat	Carib.	Pay rate Employment						6					29					
Morocco	MENA	Pay rate Employment						169								170	4.5	
								14								15	2.3	2.1
Mozambique	SSA	Pay rate Employment																0.6
			9					8										
Myanmar	SEA	Pay rate Employment								205	201	182	76	42	28		1.5	
										4	4	4	7	8	9		1.2	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Namibia	SSA	Pay rate Employment											132	116	93				
													22	27	32				
Nepal	SA	Pay rate Employment											84						
													10						
Netherlands	High inc.	Pay rate Employment						88	88	86	76	74	74	73	73	76	2.0	2.3	
								27	29	31	34	33	32	32	31	33	5.2		
Netherlands Antilles	Other	Pay rate Employment						27		84	78	76	89	92					
										30	39	36	31	32					
New Caledonia	Other	Pay rate Employment							77					69					
								19	24					39					
New Zealand	High inc.	Pay rate Employment										65	62	60	62	28	3.2	1.4	
												25	27	28	29		8.6		
Nicaragua	LA	Pay rate Employment						68	70				90	93	105	188	3.2	3.4	
								20	18	19			17	18	17	10			
Niger	SSA	Pay rate Employment															10.3	8.2	
Nigeria	SSA	Pay rate Employment										37	48						
												25	16						
Niue	PI	Pay rate Employment										37							
Norway	High inc.	Pay rate Employment						75	72	65	60	65	60	59	58	59	1.1		
								24	27	30	31	32	36	37	37	38	13.0		
Oman	MENA	Pay rate Employment												46	65	41		2.0	
Pakistan	SA	Pay rate Employment	7					208	186	154	154	153	123	111	109	103	1.9	2.6	
								7	9	10	10	11	13	15	15	15	1.5	1.8	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a																DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d		
Palau	PI	Pay rate Employment						28	32	37	45	44	37	41	37	41				
Panama	LA	Pay rate Employment						42		30	66	78	78	72	73	77	7.8	1.7		
Papua New Guinea	PI	Pay rate Employment					302	328	310	320	312	304	305	267	275					
							7	6	6	6	6	6	6	5	5					
Paraguay	LA	Pay rate Employment						94						80						
								17						17	21	22				
Peru	LA	Pay rate Employment												92	93	91				
														20	20	21				
Philippines	SEA	Pay rate Employment						117	99	80	82	92	82	120	125	126	2.3	3.7		
								12	13	14	15	15	15	16	17	16	2.1	1.8		
Poland	CEE/CIS	Pay rate Employment											133	113	110	108		1.4		
													17	17	18	22	4.2	2.8		
Portugal	High inc.	Pay rate Employment							94	87	81	81	88	90	94	99	1.6			
									16	18	20	21	24	26	26	27	5.1			
Qatar	MENA	Pay rate Employment												51	38			1.5		
														44	39	34				
Réunion	Other	Pay rate Employment									85		52							
											38		54		52					
Romania	CEE/CIS	Pay rate Employment											92	72	63	47	0.9			
													10	14	14	17				
Russian Federation	CEE/CIS	Pay rate Employment											53	55	43	55	0.3			
													21	26	31	27	8.6			
Rwanda	SSA	Pay rate Employment											225							
													4							

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Saint Helena	SSA	Pay rate Employment													23			
Saint Lucia	Carib.	Pay rate Employment											94 19	103 19	82 20	69 22		
Saint Pierre and Miquelon	Other	Pay rate Employment					6		34		36	42						
Saint Vincent and the Grenadines	Carib.	Pay rate Employment											72 23		86 24			
Samoa	PI	Pay rate Employment		14	14	14	15	16	18	19	20	18	14	18	97 68			
San Marino	Other	Pay rate Employment							30	29	31	33	33	28	30	36		
Sao Tome and Principe	SSA	Pay rate Employment								128 19								
Saudi Arabia	MENA	Pay rate Employment													45 48	42 49	0.4	
Senegal	SSA	Pay rate Employment															11.8 0.8	4.9
Seychelles	SSA	Pay rate Employment						24	66 28	67 34		61 35						1.0
Sierra Leone	SSA	Pay rate Employment														9		
Singapore	SEA	Pay rate Employment						60 25	63 21	61 19	67 19	66 20	67 19	55 21	55 21	55 22	2.1 2.0	4.3

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Slovakia	CEE/CIS	Pay rate Employment												61	63	73	1.0	1.0	
														25	26	26	7.7		
Slovenia	CEE/CIS	Pay rate Employment											118	118	114	112			0.9
													19	19	21	22			4.0
Solomon Islands	PI	Pay rate Employment							7	319	314	384	8	8	9		4.6		
South Africa	SSA	Pay rate Employment			8			21							78	72	5.6		
															28	29	3.4		
Spain	High inc.	Pay rate Employment							86	80	74	74	74	74	75	74	1.8		1.6
									20	22	24	27	27	28	27	27			
Sri Lanka	SA	Pay rate Employment				5		92	56	70	12		65	65	52	62	1.8		
								14	14	12			17	17	17	16	4.5		
St. Helena	Carib.	Pay rate Employment													40				
Sudan	SSA	Pay rate Employment	117					11		127									
										10									
Suriname	LA	Pay rate Employment											29	22	52				
													47	40	37				
Swaziland	SSA	Pay rate Employment										69							4.8
												28							
Sweden	High inc.	Pay rate Employment	73	71	74	67	63	65	61	64	67						0.8		1.1
			29	32	36	38	38	39	39	38	38						17.4		
Switzerland	High inc.	Pay rate Employment															1.5		
																	7.6		

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Syrian Arab Republic	MENA	Pay rate Employment													56 21	3.0 3.2	0.7		
Taipei,China	EA	Pay rate Employment				103 15	109 15	113 15	122 14	118 14	121 15	111 16	121 15	124 19	128 20	127 21			
Tajikistan	CEE/CIS	Pay rate Employment											96 16	53 16					
Tanzania, United Republic of	SSA	Pay rate Employment													7	1.8 1.1	1.0		
Thailand	SEA	Pay rate Employment			398 3	354 4	294 4	271 5	220 6	198 7	193 7	166 7	193 7	130 9	129 10	132 10	4.2 2.8		
Timor-Leste ^f	PI	Pay rate Employment													222 12				
Togo	SSA	Pay rate Employment								7						3.9 0.9	8.3		
Tonga	PI	Pay rate Employment										76 25	63 31	69 29	73 26				
Trinidad and Tobago	Carib.	Pay rate Employment						65 23				67 29	60 30	57 31	53 30	42 30			
Tunisia	MENA	Pay rate Employment					133 7		112 14		106 16	111 22					3.0 3.7	2.8 3.8	
Turkey	Sth. Eur.	Pay rate Employment				211 7		98 10	11 11	13 13							1.9	2.1 3.3	
Tuvalu	PI	Pay rate Employment								425 10	329 15	135 23	108 32	101 32	116 31	118 31			

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d	
Uganda	SSA	Pay rate Employment														253 7	8.4 0.9		
Ukraine	CEE/CIS	Pay rate Employment													59 25	67 24	0.7 8.4		1.2
United Arab Emirates	MENA	Pay rate Employment							15 30					30 30					1.5
United Kingdom	High inc.	Pay rate Employment						87 22	86 24	82 25	77 27	73 27	77 28	74 29	74 29	74 30	1.5 7.0		1.4
United Republic of Tanzania	SSA	Pay rate Employment																	
United States	High inc.	Pay rate Employment						70 33	69 33	68 32	69 32	71 32	72 34	70 33	68 33	67 35	1.5 7.1		1.4
Uruguay	LA	Pay rate Employment							67 29						71 35	59 36	2.1 6.5		
Uzbekistan	CEE/CIS	Pay rate Employment												77 22	111 22				
Vanuatu	PI	Pay rate Employment									157 10	161 11	137 11	140 11	153 10				
Venezuela, Bolivarian Rep. of	LA	Pay rate Employment	19	21	23	25	27	28	28	28	28	28	28	29	29	28			
Viet Nam	SEA	Pay rate Employment												200 7	173 7	145 8	1.1 3.2		4.1
Virgin Islands (British)	Carib.	Pay rate Employment																	

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
Virgin Islands (US)	Carib.	Pay rate Employment	8		6				24				26					
West Bank and Gaza Strip	MENA	Pay rate Employment												28	27	32	2.4	2.5 3.0
Yemen	MENA	Pay rate Employment													67	18	3.3 3.5	5.3 2.6
Yemen Arab Republic [former]	MENA	Pay rate Employment										20						
Yemen, Republic of	MENA	Pay rate Employment						51 24										
Yugoslavia, The former Socialist Fed. Rep. of	CEE/CIS	Pay rate Employment														104 22		
Zambia	SSA	Pay rate Employment												236 9	319 9		3.2 1.7	
Zimbabwe	SSA	Pay rate Employment										13					6.8 1.9	1.6
Regional averages^e																		
Caribbean	Carib.	Pay rate Employment	8		6			65 16	56 35	47 38	50 37	70 28	72 27	78 26	74 28	62 30	2.1 5.0	2.0 2.1
CEE and CIS	CEE/CIS	Pay rate Employment				12			18	17	19	20	19	80 21	82 22	78 23	1.4 7.3	1.1 6.0

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a														DIRECT MEASURES ^b	
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	MID-90S ^c	LATE 90S ^d
East Asia	EA	Pay rate Employment				107 13	109 13	107 14	117 13	105 14	111 15	99 16	93 18	83 18	85 20	85 22	3.0 2.5	1.2
High-income OECD	High inc.	Pay rate Employment	156 13	147 13	110 11	117 10	117 18	86 22	87 24	84 25	80 27	77 27	77 29	75 30	75 30	76 31	1.7 7.4	1.5 7.9
Latin America	LA	Pay rate Employment	81 15	82 16	84 16	16 18	89 19	84 19	76 21	77 22	72 25	65 25	69 27	77 24	87 25	99 24	3.1 2.9	2.1 2.0
Middle East and North Africa	MENA	Pay rate Employment		70 13	109 18		133 7	90 25	67 23	61 33	88 24	76 33	68 33	54 30	57 36	76 31	2.9 3.6	2.0 4.1
Other OECD/ Europe	Other	Pay rate Employment	13				13	25	30	32	35	80 32	70 35	83 30	41 36			
Pacific Islands	PI	Pay rate Employment		14	16	16	14	17	17	19	20	176 23	136 23	138 24	131 23	114 26	4.7 6.3	5.1
South Asia	SA	Pay rate Employment	7		106 10	109 7	112 9	140 10	125 9	112 11	120 10	161 9	98 12	124 14	111 15	124 13	3.7 2.1	3.7 1.6
Southeast Asia	SEA	Pay rate Employment		398 6	354 6	294 4	138 4	138 18	111 14	116 13	116 13	110 15	95 16	95 15	92 19	99 17	2.3 2.3	2.6 2.7
Southern Europe	SE	Pay rate Employment		189 9	211 7		84 10	79 15	92 15	98 16	94 17	95 18	104 18	106 18	105 20	105 22	1.9 3.3	2.1 3.3

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APPENDIX TABLE A.1. *continued.*

ECONOMY	REGION	INDICATOR	INDIRECT MEASURES, 4-YEAR AVERAGES ^a																DIRECT MEASURES ^b		
			50	54	58	62	66	70	74	78	82	86	90	94	98	02	90S ^c	MID-LATE	90S ^d		
Sub-Saharan Africa	SSA	Pay rate	50	54	58	62	66	70	74	78	82	86	90	94	98	02	90S ^c	5.5	5.1		
		Employment	9		8	12		19	13	17	15	17	17	17	18	18	1.9		2.4		
All countries		Pay rate	93	89	124	123	123	99	94	103	107	97	87	89	89	89	2.9	2.7			
	Employment	13	15	13	14	15	19	20	22	23	24	24	24	24	25	25	4.5	3.6			

Carib. = regional members of the Caribbean Development Bank; CEE/CIS = Central and Eastern Europe and Commonwealth of Independent States; EA = East Asia; High Inc. = high income members of the OECD (Organisation of Economic Cooperation and Development); LA = Latin America; MENA = Middle East and North Africa; Other = Territories, overseas department, autonomous region or self-governing territory of OECD countries and small, high-income European nations; SA = South Asia; SEA = South East Asia; SSA = Sub-Saharan Africa, Sth. Eur. = Southern Europe

^a Pay rate is defined as the ratio value-added per employee in Community, social, and personal services to total value-added per employee expressed as a percentage. Employment share is the percentage share of Community, social, and personal services in total employment; derived as unweighted averages of the available data for the 4-year period (initial year of the 4-year period shown).

^b Pay rate is defined as the average wage of the total general civilian government as a multiple of per capita gross domestic product. Employment share is employment in the total general civilian government as a percentage of the population.

^c Estimates from Schiavo-Campo (1998) for 1993 to 1996; or where these are not available, the latest available year for 1991 to 1995 are from World Bank (2001).

^d Latest year for 1996 to 2000 from World Bank (2001).

^e Unweighted average for the available data.

^f Estimates for Timor-Leste are based on value-added in 2003 and employment in 2004.

Note: Blanks indicate no data are available.

Sources: Authors' estimates derived from OECD (2005), Timmer and de Vries (2007), Secretariat of the Pacific Community (2007) supplemented by the statistics authorities in the Pacific, United Nations Statistical Divisions National Accounts Database (downloaded August–October 2007), International Labour Organization's Key Indicators of Labour Markets and Laborsta Internet (ILO 2007, downloaded December 2007), Schiavo-Campo (1998), and World Bank (2001).

APPENDIX II

In this Appendix, we provide technical discussions on the empirical models.

1. The Exogenous Model

We start to estimate the model assuming that relative government pay rate (PAY, and \bar{w} in the theory section) and the employment share are exogenously determined. The ordinary least square (OLS) is applied for estimation.

a. Fixed-Effect Estimator

If there exist unobserved variables that account for any country-specific effect, the OLS estimation will be biased. There are two ways to apply the fixed effect model. The first method is to include a dummy variable for each country and to drop the intercept. This estimator is called the least square dummy variable (LSDV) model. The second method is to eliminate the individual fixed effect by differencing the sample by subtracting away group means. Applying OLS on the transformed data will also produce the fixed effect slope estimate, which is also known as the within estimator. In this study, we used the latter (within) estimator for the fixed effect model.

As introduced in the main text, we set up the model as follows:

$$g_{ct} = \alpha + \sum_{i=1}^n \beta_i x_{ct}^i + \varepsilon_{ct} \quad (1)$$

All notations are the same as in the text. We can transform equation (1) to the following form by taking within average:

$$\bar{g}_c = \alpha + \sum_{i=1}^n \beta_i \bar{x}_c^i + \mu_c + \bar{v}_c \quad (2)$$

where $\bar{g}_c = \sum_t g_{ct} / T_c$, $\bar{x}_c = \sum_t x_{ct} / T_c$, and $\bar{v}_c = \sum_t v_{ct} / T_c$. By subtracting equation (2) from (1), we will get

$$(g_{ct} - \bar{g}_c) = \sum_{i=1}^n \beta_i (x_{ct}^i - \bar{x}_c^i) + (v_{ct} - \bar{v}_c) \quad (3)$$

Applying OLS for equation (3) will produce the fixed effect slope estimate.

b. Between-Effect Estimator

The fixed-effect estimator can take advantage of the country-specific (within-group) time-series variation by subtracting away group means. However, the fixed-effect estimator cannot take advantage of variation across countries. The between-effect estimator is useful when we want to control for unobserved variables that might change over time but are consistent across countries. In sum, the between-effect estimator utilizes the cross-sectional information in the data. The between-effect estimator is obtained by taking the mean of each variable across time and within each group, and running OLS using the group means. In short, we use OLS for Equation (2), which will produce the between-effect results.

c. Random-Effect Estimator

If there is enough reason to believe that some unobserved variables are invariant over time but vary across countries, and other unobservable variables may be fixed across countries but vary over time, the random-effect estimator is required. The random-effect estimator is a weighted average of the fixed and between estimates. Under the random-effect estimator, the group and time effects are combined to create

a composite error term. Since the composite error term is typically nonspherical, a generalized least squares (GLS) estimator is applied.

For the random effect model, the following is assumed on the error term:

$$E[v_{ct} | \mu_c] = 0$$

$$E[v_{ct}^2 | \mu_c] = \sigma_v^2$$

$$E[v_c | x_{ct}] = 0 \quad \forall c, t$$

$$E[v_c^2 | x_{ct}] = \sigma_v^2$$

$$E[v_{ct}\mu_d] = 0 \quad \forall c, t, d$$

$$E[v_{ct}\mu_s] = 0 \quad \forall c \neq d \text{ or } t \neq s$$

$$E[\mu_t\mu_s] = 0 \quad \forall t \neq s$$

There are several benefits to use the random effect estimator: (i) the model allows both time-variant and time-invariant variables; (ii) fewer parameters need to be estimated; and (iii) the model is potentially efficient. However, there are some drawbacks, which include: (i) the estimator is potentially inconsistent and biased unless the above assumptions on the error term are met, and (ii) the estimation can be computationally costly.

d. Hypothesis Tests for Individual and Time Effects

For the simple pooled approach, specifications of equations were estimated with fixed-, between-, and random-effect models in addition to OLS estimation. The Breusch-Pagan Lagrange multiplier (LM) test is designed to test random effects; and the null hypothesis is variances of groups are zero, i.e., homoskedastic. Under the null, LM is asymptotically distributed as chi-squared with two degrees of freedom.

The generally accepted way of choosing between the fixed-effect and random-effect model is running a Hausman test. The Hausman test tests a more efficient model against a less efficient but consistent model to ensure that the efficient model provides consistent results. Under the Hausman test, the null hypothesis maintains that the coefficients estimated by the efficient random-effect estimator are the same as the ones estimated by the consistent but less efficient fixed-effect estimator. If the null hypothesis is rejected, the random effect model is efficient and consistent. Otherwise, we should use the fixed effect model. Under the null, the Hausman test is asymptotically distributed as with degrees of freedom equal to $N - k$.

2. The Endogenous Model

Our regression models are classified into two: (i) a simple pooled approach and (ii) the endogenous model. The pooled OLS, fixed effect, between-effect estimators, and random-effect estimators fall into the first category; while a feasible, efficient, two-step GMM estimator is the latter.

a. Generalized Method of Moments (GMM) Estimator

This section followed the description in Hayashi (2000), Greene (2000), Baltagi (2002), Jonston and DiNardo (1997), and Baum et al. (2003).

The equation to be estimated is represented by the matrix form:

$$y = X\beta + \varepsilon$$

where the matrix regressor, X , is $n \times K$. n is the number of observations, and K is the number of regressors.

If the model is correctly specified, it should hold $E(X'\varepsilon) = 0$. However, inclusion of endogenous regressors will result in $E(X'\varepsilon) \neq 0$. The set of instrumental variables is denoted as Z , which is $n \times L$, where L is the number of instruments. Since this set of instrumental variables is assumed to be exogenous, the orthogonality condition is $E(Z'\varepsilon) = 0$. Given this orthogonality condition, the GMM estimator solves the following equation:

$$\min_{\beta} \left(\frac{1}{n} [Z'(y - X'\beta)]' W \frac{1}{n} [Z'(y - X'\beta)] \right)$$

where W_n is an $L \times L$ weighting matrix, and $L > K$. W is assumed to be positive, definite, and symmetric.

Hansen (1982) showed that the optimal estimator for this class is an estimate of the inverse of the asymptotic variance matrix of the moment condition, denoted as $W = \hat{V}^{-1}$, where \hat{V}^{-1} is a consistent estimate of $\left(\text{var} \left[\frac{1}{n} (Z'\varepsilon) \right] \right)^{-1}$, which could be denoted as $\left(\frac{1}{n^2} \overline{Z'\Omega Z} \right)^{-1}$ where Ω is an $n \times n$ covariance matrix. Hence, the GMM estimator can be denoted as follows:

$$\hat{\beta}_{GMM} = \left[X'Z(\overline{Z'\Omega Z})^{-1} X' \right]^{-1} X'Z(\overline{Z'\Omega Z})^{-1} Z'y.$$

For a model with heteroskedastic error disturbances, we can assume that each error term ε_i is normally distributed with variance σ_i^2 , where the variance is not constant over observations. Hence, we will consider two special cases for Ω :

Homoskedasticity: $\Omega = \sigma^2 I$; and

$$\text{Heteroskedasticity: } \Omega = \begin{pmatrix} \sigma_1^2 & & & 0 \\ & \ddots & & \\ & & \sigma_i^2 & \\ 0 & & & \ddots \\ & & & & \sigma_n^2 \end{pmatrix}.$$

In this study, we used residuals from the instrumental variable estimation for $\hat{\sigma}_i^2$ for the heteroskedastic model. This is called the feasible efficient two-step GMM estimator, which estimates for the endogenous model. It is known that the efficiency gain compared to the traditional two stage least squares derives from the use of the weighting matrix, W , if the model is overidentified, and the independent, identically distribution assumption can be relaxed.

In order to account for the small sample property, mean square error applied for estimation is the square root of the residual sum of squares divided by the difference between the number of observation and the number of regressors ($n - K$).

b. Hypothesis Tests for the Endogenous Model

The GMM estimator is more efficient than the standard instrumental variable estimator if heteroskedasticity exists. If it is homoskedastic, we should use the standard instrumental variable estimator. The Pagan-Hall statistics of heteroskedasticity for instrumental variables estimation is a standard test for of the presence of heteroskedasticity. Under the null of no heteroskedasticity, the test statistic is distributed as chi-squared with degrees of freedom equal to the number of indicator variables.

In the context of GMM, the overidentifying restrictions can be tested by the J statistics (Hansen 1982 and Baum et al. 2003). This is a specification test, testing the orthogonality conditions required for the GMM employment. The null hypothesis maintains that the instruments are satisfying the orthogonality conditions. If the null hypothesis is rejected, either the instruments are not exogenous or they are incorrectly excluded from the equation, or both. Under the null, the J statistic is distributed as chi-squared with degrees of freedom equal to the number of overidentifying restrictions.

The Anderson canonical correlations likelihood-ratio test identifies excluded instruments are relevant. The null hypothesis of this test is if the equation is underidentified. Under the null of underidentification, the statistic is distributed as chi-squared. Degrees of freedom equal to the number of overidentifying restrictions (L-K) plus one. Rejection of the null indicates that the estimated model is identified; however, weak instrument problems might still exist according to Baum et al. (2003).

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About the Paper

Craig Sugden and Kiyoshi Taniguchi examine the role of government pay rates in economic growth. The authors conclude that high government pay rates penalize economic growth. The paper also identifies countries that retain high government pay rates.

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Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/economics
ISSN: 1655-5252
Publication Stock No. 061908



Printed in the Philippines