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What Determines the Size of Public Employment?

An Empirical Investigation

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Abstract

This paper explores the determinants of public employment across the world and finds that it is negatively associated with country size (by population) and positively associated with the income level. The findings show that a country's openness to trade is positively associated with public employment in low- and middle-income countries, but inversely related in high-income countries. The estimated models are used to predict the expected public employment for a country given its income, population, and openness to trade, and to compare the actual levels with the predicted ones. In general, public employment in Latin American countries is below the predicted levels, except for Argentina, Brazil, Ecuador, Mexico, Suriname, Trinidad and Tobago, and the República Bolivariana de Venezuela. Public employment in the Middle East and North Africa is above the predicted levels, particularly in the Arab Republic of Egypt and the Islamic Republic of Iran. East Asian and Pacific countries' public employment is significantly below the predicted levels, particularly in Hong Kong SAR, China; Japan; the Republic of Korea; and Mongolia. Countries in Europe and Central Asia show higher than predicted public employment, mostly in Romania, Denmark, Sweden, Armenia, and Belorussia. Public employment in Sub-Saharan Africa appears to be below the predicted levels, with the notable exceptions of Botswana and South Africa. The deviations from predicted levels are positively correlated with the union density rate, which is negatively associated with private employment rates. Finally, the study finds no statistical association between public and private employment, suggesting the absence of crowding-out in the employment levels.

What Determines the Size of Public Employment? An Empirical Investigation

Santiago Herrera and Ercio Muñoz[1]

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1. Introduction

While extensive theoretical and empirical literature has studied the size and composition of government expenditure (see for example Shelton, 2007 for a review of the literature), less is known about the determinants of public employment. Two notable exceptions are Rodrik (2000) and Alesina, et al. (2000) who developed theoretical models to explain the behavior of public employment. The first one shows that public employment could play a welfare-enhancing social insurance role in an economy buffeted by external shocks, and presents evidence of a positive association between the exposure to external risk and the share of public employment across countries. The second one motivates public employment as a redistributive tool to circumvent opposition to explicit tax-transfer schemes, predicting a positive relationship between the size of public employment and inequality or fractionalization, and provide empirical evidence of cities in the United States.

Public employment and its determinants is an important topic because it affects not only the size of expenditure, but it also affects its composition due to the rigidity of the wage bill (Vegh, et al., 2017). Recent empirical literature that uses expenditure-based measures of government size explores the relationship between trade openness and size, but its counterpart with employment measures has received less attention. The robustness in a panel data context over a period that goes beyond the 1990s has not been tested, in part because data on public employment is much more scarse than data on government expenditure. In the same vein, there is not much evidence about how alternative hypotheses to explain the size of the government can help to explain the size of public employment. This paper attempts to fill this gap in the empirical literature.

2. Data, Stylized Facts, and Methodology

i.   Data

The paper uses three measures of public employment from the International Labor Organization Statistics (ILO Stats): total public-sector employment, general government employment, and central government employment. The coverage of each employment aggregate is the standard one.[2] Data on private employment and the total labor force come from the same source.

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[2] Total public-sector employment covers all employment of general government sector as defined in the System of National Accounts 1993, plus employment of publicly owned enterprises and companies, resident and operating at central, state (or regional) and local levels of government. It covers all persons employed directly by those institutions, without regard for the type of employment contract. The general government sector employment is the total employment of all resident institutional units operating at central, state (or regional) and local levels of

Altogether there are 145 countries[3] with at least one observation of public employment in any of the three aggregates, with 60 of the countries classified as high income. On average, countries have 13 years of data when considering the general government aggregate. The sample period starts in 1980, although the number of countries with data changes over time, making it an unbalanced panel. It is important to have in mind the level of agregation (public sector, general government, and central government) when comparing with wage bill data (IMF, 2016).

Total government expenditure as a share of GDP and government expense in compensation to employees as share of GDP are obtained from the IMF's World Economic Outlook and Government Finance Statistics (October 2018).

ii.   Expenditure-based measures and public employment: The wage bill

Most of the literature that explores the size of government uses expenditure-based measures, either of the wage bill or other aggregates. The relationship between the size of the government, measured as expenditure as percentage of GDP, and public employment as percentage of the labor force can differ considerably (Figure *1*). On the other hand, the wage bill, although highly correlated with total government expenditure (Figure 2), shows significant heterogeneity across countries, with some having a wage bill that is twice the size of others that have similar government expense levels.

Figure 1: Public employment (% labor force) and general government expenditure (% GDP) (each dot is a country-year obs.)

government; i.e. all government units, social security funds and non-market nonprofit institutions (NPIs) that are controlled and mainly financed by public authority (Hammouya, 1999). Finally, the central government aggregate is composed of departments or ministries, of autonomous agencies carrying out special functions, and of all NPIs which are controlled and mainly financed by public authority. Their fiscal, legislative and executive authority extends over the entire territory of the country.

[3] The number is reduced to 122 when we consider employment as percentage of the labor force.
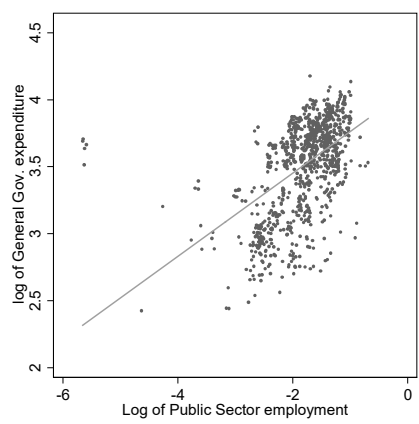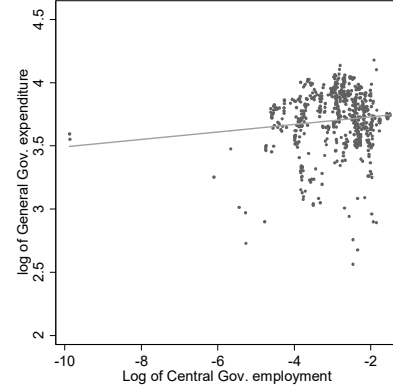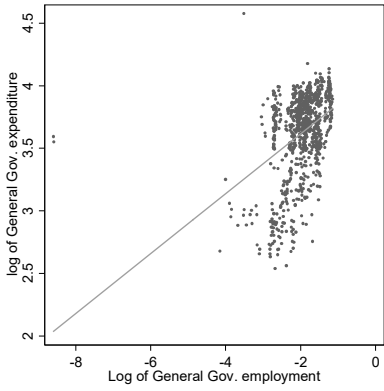
Source: ILO Stats and IMF

Figure 2: The wage bill and total government expense
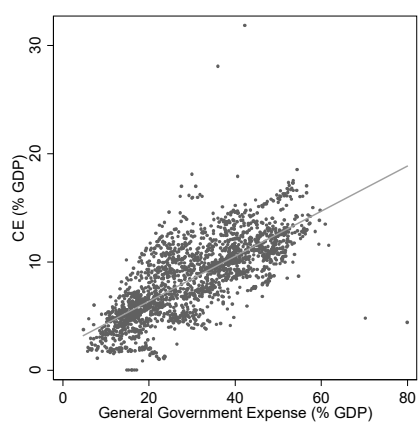
Source: ILO Stats and IMF

iii.   The wage bill: Price versus quantity

Changes in the public wage bill can be due to variations in wage and/or changes in the public employment level. We observe a positive correlation between the three measures of public employment (as share of the labor force) and size of the wage bill (as percentage of GDP), with the General Government and Public Sector aggregations showing the clearest association (Figure 3).

Figure 3: Public employment (% labor force) and compensation to employees (% GDP)
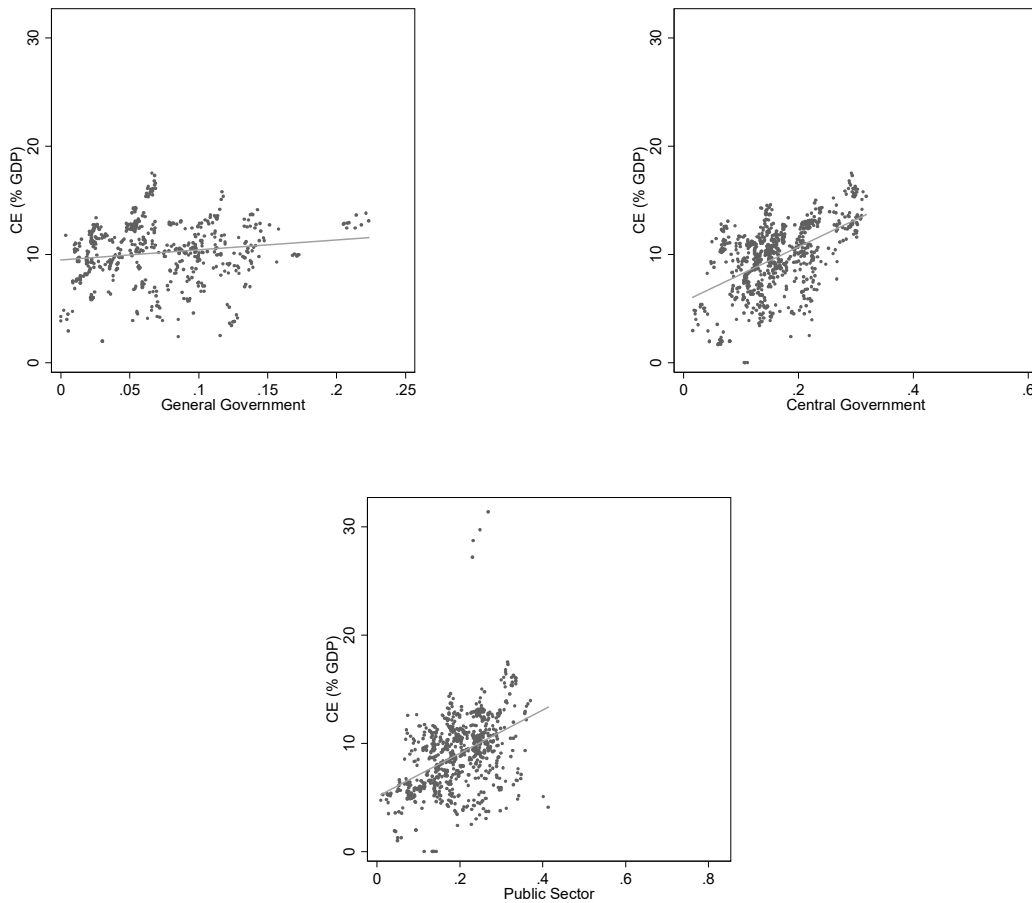
Source: ILO Stats and IMF

A variance decomposition of the wage bill into the variance of its components (employment and wages) may be a useful starting point.[4] The decomposition is done using country-year level data (80 countries)

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[4] The variance of the wage bill is equal to the variance of employment, plus the variance of wages (proxied by total wage bill divided by public employment) and twice the covariance between both components:
$$Var(\ln(G_{it})) = Var(\ln(E_{it})) + Var(\ln(W_{it})) + 2 * Cov(\ln(E_{it}), \ln(W_{it}))$$
Where G_{it} corresponds to the wage bill in constant 2011 international dollars, E_{it} is general government employment (in thousands), and W_{it} is a proxy of wage level constructed by dividing G_{it} by E_{it}.

(Figure 4, left panel) or using 5-year averages to decrease the potential role of measurement error in employment levels (Figure 4, right panel). Both results suggest that, across countries, changes in employment explain a large share of the variance of the wage bill. This result is only suggestive and must be taken with a grain of salt, given the quality of the information and the assumptions to construct the average wage.

Figure 4: Variance decomposition (annual frequency on the left and 5-year averages on the right)
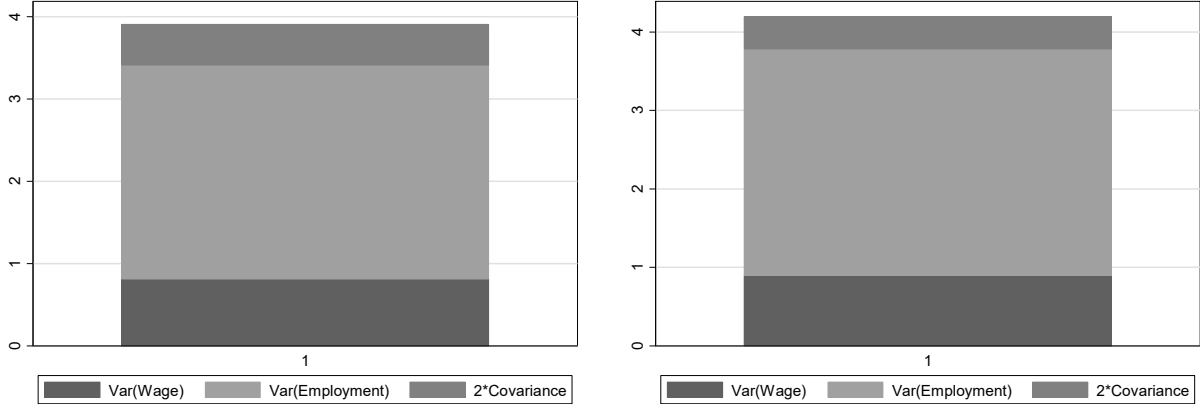
Source: calculations based on ILO Stats and IMF

iv. Public employment across countries and over time

The different measures of public employment are highly correlated (Table 1), although when using a cross section, like year 2005 in the table, the correlation may be stronger. The data set is an unbalanced panel which increases its coverage in the mid-1990s reaching almost 60 countries in some years in the mid-2000s. However, as Figure 5 shows, the coverage varies over time and across the three different measures.

Table 1: Correlation of different measures of public employment as a share of the labor force

a) Panel data			
	Central Government	General Government	Public Sector
Central Government	1.00		

	Central Government	General Government	Public Sector
General Government	0.37	1.00	
	(0.000)		
Public Sector	0.20	0.71	1.00
	(0.000)	(0.000)	

b) Cross section in 2005

	Central Government	General Government	Public Sector
Central Government	1.00		
General Government	0.41	1.00	
	(0.02)		
Public Sector	0.40	0.81	1.00
	(0.05)	(0.00)	

c) Cross section of country average values

	Central Government	General Government	Public Sector
Central Government	1.00		
General Government	0.50	1.00	
	(0.00)		
Public Sector	0.048	0.50	1.00
	(0.74)	(0.00)	

Source: calculations based on ILO Stats.

Figure 5: Number of countries with data per year (max in 2006, 2005, and 2008)
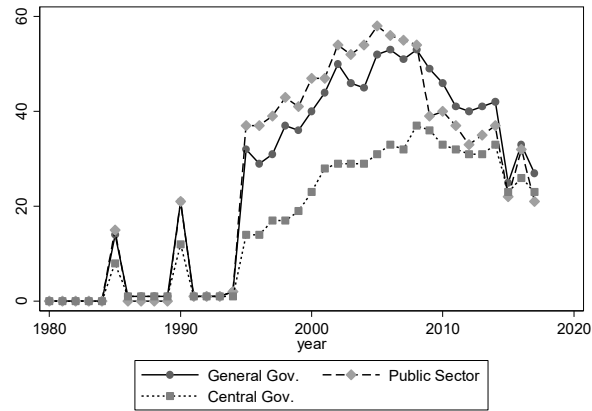
The size of public employment, as percentage of the labor force, varies widely across regions. Middle East and North Africa (MENA) shows the highest levels of public employment in the three measures (Figure 6). Europe and Central Asia (ECA) and Sub-Saharan Africa (SSA) also show high levels of public employment compared to other regions. South Asia (SA) and East Asia Pacific (EAP) show lower levels of public employment at all the levels.

The evolution of absolute employment levels over time is volatile and noisy, so we plot the average over each decade to better visualize the trends by region (Figure 7). Most of them have a declining trend, except LAC and MENA, which show the opposite in central and general government levels since the 1990s. These regional trends are only suggestive because the country composition changes over time due to data availability.[5]

Figure 6: Public employment (% of Labor Force), by region

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[5]Figures 13, 14, and 15 in the Appendix show the three time series of employment by country.

Central Gov.	General Gov.	Public Sector
EAP 6.2	EAP 7.4	EAP 9.7
ECA 7.3	ECA 17.0	ECA 22.8
LAC 3.7	LAC 12.5	LAC 14.0
MENA 15.5	MENA 21.2	MENA 23.4
NA 2.2	NA 14.3	NA 17.9
SA	SA 5.7	SA 12.3
SSA 7.4	SSA 11.2	SSA 13.6
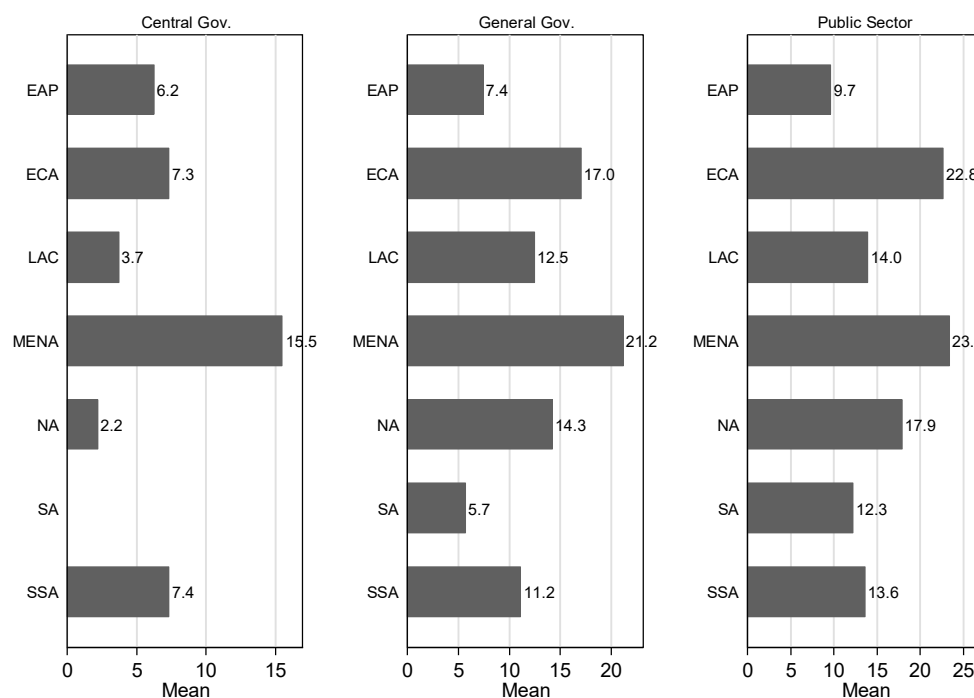
Notes: Simple averages for each region. The Appendix has weighted averages by the size of the labor force.
The regions in the case of general government employment are constructed in the following way[6]:
EAP includes Fiji; Hong Kong SAR, China; Indonesia; Japan; Republic of Korea; Macau; New Zealand; Philippines; Singapore; Thailand; and Timor-Leste.
ECA includes Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Moldova, Netherlands, Norway, Poland, Portugal, Russian Federation, San Marino, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and United Kingdom.
LAC includes Argentina, Aruba, Belize, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Guatemala, Mexico, Nicaragua, Panama, Paraguay, Trinidad and Tobago, and Uruguay.
MENA includes Arab Republico f Egypt, Israel, Malta, Oman, Qatar, and United Arab Emirates.
NA includes Canada and the United States.
SA includes Afghanistan and Sri Lanka.
SSA includes Botswana, Cabo Verde, Ethiopia, Guinea, Madagascar, Mauritius, Senegal, Seychelles, South Africa, Tanzania, and Zimbabwe.
Source: ILO Stats

Figure 7: Employment (%LF) over time, by region

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[6] Our total sample consists of 88 countries, but central government employment data are reported for only for 56 countries, while public sector employment data are reported for 113 countries.

| Central Government | General Government | Public Sector | Private Sector |
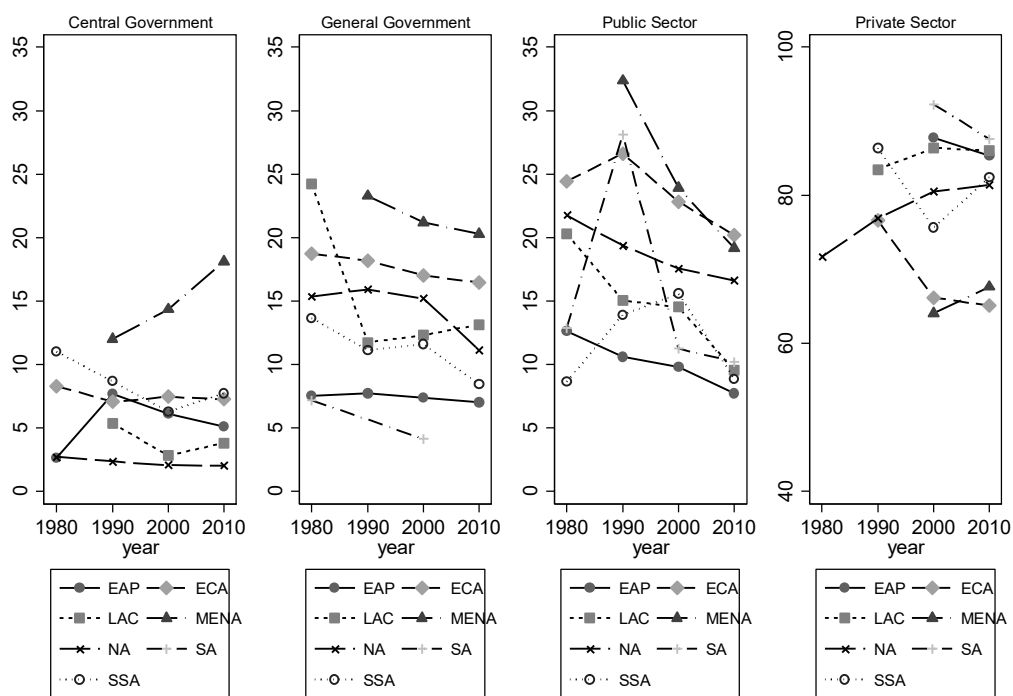
Source: calculations based on ILO Stats

v.   Determinants of public employment

This section explores the potential factors that explain these differences across regions and over time, and has two parts. The first one focuses on Rodrik's (2000) hypothesis of public employment as a tool to mitigate the country exposure to undiversifiable external risk. The second one expands the list of potential determinants of public employment.

We initially replicate Rodrik's baseline econometric specification, but with more recent data and additional countries. The summary statistics and cross correlations of the main variables (Tables 2 and 3) are presented to facilitate comparisons with the original work. The central variable in Rodrik's model is exposure to external risk, which is calculated as the product of the volume of trade with the unanticipated component of variability in the external terms of trade, which he argues, it is the theoretically appropriate measure of external risk, as it yields the unpredictable variation in the streams of incomes associated with foreign trade. Hence, let x, m, and y stand for the volumes of exports, imports, and GDP, respectively, and T represent the terms of trade. The measure of exposure to external risk corresponds to:

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$$R = \left(\frac{x+m}{y}\right) st.\,dev.\,(dlog(T))$$

Table 2: Descriptive Statistics

	N	mean	sd	min	max
Central gov. employment (% LF)		6.99	4.39	0.01	22.33
General gov. employment (% LF)		15.49	6.42	1.58	31.78
Public sector employment (% LF)		19.93	7.60	2.33	54.09
GDP per capita, PPP (constant 2011 international $)		29340.27	16493.10	599.95	98184.64
Urbanization rate (%)		72.34	15.12	14.55	100.00
Trade openness (% GDP)		101.00	72.13	15.16	455.37
External risk		3.50	2.81	0.43	27.59
Population (Millions of persons)		35.24	59.68	0.03	325.44
Observations	948				

Table 3: Matrix of Cross Correlations

Unbalanced panel data: 948 observations							
	lcg	lgg	lps	lGDPPC	lurb	open	R
Log of central gov. employment (% LF)	1						
Log of general gov. employment (% LF)	0.639	1					
	0						
Log of public sector employment (% LF)	0.361	0.803	1				
	0	0					
Log of GDP	0.135	0.253	0.094	1			
	0.001	0	0.011				
Log of urbanization rate	-0.008	0.147	-0.096	0.676	1		
	0.85	0	0.01	0			
Openness (% GDP)	0.374	0	0.005	0.222	0.183	1	
	0	0.996	0.884	0	0		
External risk	0.182	-0.053	0.053	-0.322	-0.28	0.263	1
	0	0.104	0.157	0	0	0	

Note: p-value reported below the correlation coefficient.

The baseline regression model (omitting the subscripts *i* or *it*) has government employment (as percentage of the labor force) as dependent variable, and the per capita income, urbanization rate and exposure to risk as explanatory variables using a cross section of data:

$$\log(GOVEMPL) = \beta_0 + \beta_1 \log\left(\frac{income}{population}\right) + \beta_2 \log(urbanization) + \beta_3 R + \varepsilon$$

Our cross-section results are not as robust as Rodrik's, as we find that trade openness and external risk are positively associated with government employment in only two of the six specifications, while the GDP per capita is the only significant variable, in addition to regional dummies (Table 4).

Table 4: Cross section for 2005: Rodrik's framework

VARIABLES	(1) Central Gov.	(2) General Gov.	(3) Public sector	(4) Central Gov.	(5) General Gov.	(6) Public sector
log GDP per capita	0.268	0.260**	0.298***	0.622**	0.258**	0.370***
	(0.220)	(0.101)	(0.095)	(0.277)	(0.109)	(0.101)
log urbanization	-1.225	-0.150	-0.118	-1.191	-0.066	-0.135
	(0.878)	(0.338)	(0.249)	(0.997)	(0.346)	(0.242)
Trade openness	0.006***	-0.000	0.001			
	(0.002)	(0.001)	(0.001)			
External risk				0.078	0.009	0.037*
				(0.054)	(0.021)	(0.019)
East Asia & Pacific	0.831	-0.656***	-0.764***	0.656	-0.812***	-0.629***
	(0.646)	(0.201)	(0.190)	(0.728)	(0.240)	(0.196)
Sub-Saharan Africa	-0.701	-0.673**	-0.569*	-0.465	-0.256	0.133
	(0.686)	(0.283)	(0.328)	(0.812)	(0.310)	(0.421)
Constant	-0.906	-3.846***	-4.236***	-4.358	-4.217**	-4.958***
	(3.942)	(1.159)	(0.762)	(4.832)	(1.569)	(0.842)
Observations	31	52	57	30	48	52
R-squared	0.407	0.423	0.430	0.260	0.311	0.389

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

When the regression is estimated with pooled country data over time, trade openness and external risk are not robust and are only statistically significant for central government employment (Table 5).

Table 5: Pooled OLS: Rodrik's framework

	(1)	(2)	(3)	(4)	(5)	(6)

VARIABLES	Central Gov.	General Gov.	Public sector	Central Gov.	General Gov.	Public sector
log GDP per capita	0.302	0.204**	0.181**	0.551**	0.228**	0.182**
	(0.225)	(0.102)	(0.082)	(0.241)	(0.107)	(0.080)
log urbanization	-0.786	0.133	-0.195	-0.780	0.145	-0.253
	(0.709)	(0.229)	(0.209)	(0.727)	(0.238)	(0.228)
Trade openness	0.319**	0.007	0.016			
	(0.125)	(0.051)	(0.055)			
External risk				6.878**	1.065	-0.461
				(2.647)	(1.283)	(2.171)
EAP	0.781	-0.614***	-0.700***	0.818	-0.630***	-0.669***
	(0.567)	(0.137)	(0.171)	(0.605)	(0.135)	(0.153)
SSA	0.731	0.002	-0.351	1.178*	0.044	-0.322
	(0.615)	(0.259)	(0.278)	(0.612)	(0.252)	(0.292)
LAC	0.701*	0.108	-0.249**	0.875**	0.103	-0.281**
	(0.375)	(0.174)	(0.118)	(0.362)	(0.169)	(0.131)
MENA	1.899***	0.566***	0.401**	2.264***	0.572***	0.447**
	(0.257)	(0.181)	(0.162)	(0.224)	(0.172)	(0.170)
SA		-0.289	-0.457		-0.189	-0.519*
		(0.331)	(0.296)		(0.376)	(0.297)
ECA	0.911***	0.266**	0.279***	1.028***	0.263**	0.289***
	(0.189)	(0.121)	(0.088)	(0.153)	(0.109)	(0.082)
Constant	-3.674	-4.615***	-2.505***	-6.238*	-4.919***	-2.281***
	(2.972)	(0.966)	(0.692)	(3.288)	(1.086)	(0.723)
Observations	634	953	949	623	926	908
R-squared	0.289	0.327	0.513	0.285	0.315	0.519

Robust standard errors clustered by country in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Finally, estimating the same regression but using a panel with country fixed effects, shows that external risk has a statistically significant positive sign in two of the three specifications (for central and general government), though the sign switches for the public sector aggregation; trade openness is not statistically significant (Table 6). Hence, controlling for unobserved time-invariant heterogeneity seems to be relevant to confirm the positive relationship between openness and public employment.

Moving from Rodrik's framework to a more encompassing one, and following Shelton (2007), we include additional potential explanotory variables, including those proposed by Alesina et al. (2000) (Table 7).

Table 6: Determinants of the government expenditure size

Variable	Expected sign	Main references:
Openness	+	Rodrik, 1998; Rodrik, 2000; Benarroch & Pandey, 2008; Garen & Trask, 2005; Ram, 2009; Vianna & Mollick, 2018
Country size	-	Alesina & Wacziag, 1998; Jetter & Parmeter, 2015
Fragmentation	+ -	Easterly & Levine, 1997; Alesina, et al., 1999; Alesina, et al., 2003; Alesina, et al., 2001; Alesina & Wacziag, 1998; Alesina, et al., 2000
Income	+	Henrekson, 1993; Oxley, 1994; Ram, 1987; Stein, et al., 1998; Easterly & Rebelo, 1993
Income inequality	+	Meltzer & Richard, 1981; Meltzer & Richard, 1983; Alesina, et al., 2000
Political rights	+	Lott & Kenny, 1999; Husted & Kenny, 1997; Mulligan, et al., 2004; Mulligan, et al., 2002; Easterly & Rebelo, 1993
Institutions of government	+ -	Milesi-Ferretti, et al., 2002; Persson, et al., 1998; Austen-Smith, 2000; Persson & Tabellini, 1999

Table 7: Panel data regression: Rodrik's framework

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Central Gov.	General Gov.	Public Sector	Central Gov.	General Gov.	Public Sector

log GDP per capita	0.140	0.136**	-0.097***	0.217	0.179**	-0.104***
	(0.151)	(0.069)	(0.035)	(0.157)	(0.072)	(0.036)
log urbanization	0.800*	0.604***	0.739***	1.289***	0.608***	0.734***
	(0.454)	(0.206)	(0.126)	(0.471)	(0.225)	(0.132)
Trade openness	0.001	-0.000	-0.000			
	(0.001)	(0.001)	(0.000)			
External risk				**0.055****	**0.023***	**-0.011***
				(0.026)	**(0.012)**	**(0.006)**
EAP	0.319	-0.652*	-0.991***	0.115	-0.668*	-1.013***
	(0.617)	(0.341)	(0.353)	(0.616)	(0.346)	(0.358)
SSA	0.402	-0.209	-0.732*	0.938	-0.171	-0.703*
	(0.717)	(0.378)	(0.376)	(0.742)	(0.398)	(0.387)
LAC	0.718	-0.083	-0.633*	0.624	-0.102	-0.668*
	(0.630)	(0.345)	(0.345)	(0.614)	(0.352)	(0.348)
MENA	1.079	0.365	-0.082	0.911	0.404	-0.074
	(0.705)	(0.373)	(0.377)	(0.768)	(0.407)	(0.402)
SA		-0.021	-0.078		0.158	-0.081
		(0.660)	(0.426)		(0.680)	(0.429)
ECA	0.642	0.083	0.084	0.521	0.062	0.087
	(0.553)	(0.319)	(0.336)	(0.539)	(0.325)	(0.337)
log of Population	-0.168**	-0.071**	-0.076***	-0.248***	-0.069**	-0.092***
	(0.067)	(0.032)	(0.025)	(0.072)	(0.035)	(0.028)
Constant	-5.536**	-4.631***	-2.365***	-6.976***	-5.142***	-1.978**
	(2.310)	(1.068)	(0.872)	(2.444)	(1.225)	(0.924)
Observations	632	948	944	623	925	907
Number of countries	55	82	100	49	73	90

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Using 5-year non-overlapping averages, we estimate a panel with random effects model[7]:

$$\log(P_{it}) = \beta_0 + \beta_1 \log(S_{it}) + \beta_2 \log(G_{it}) + \beta_3 O_{it} + \beta_4 E_{it} + \beta_5 X_{it} + \varepsilon_{it}$$

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[7] As in Shelton (2007), we use a random effects model over a fixed effects (FE) one, considering the trade-off between measurement error bias and omitted variable bias, and that an FE model would exacerbate the first one.

where P_{it} corresponds to the measures of public employment over labor force, S_{it} log of population, G_{it} stands for GDP per capita, O_{it} for openness (imports plus exports as share of GDP), E_{it} for ethnic fractionalization and X_{it} for other controls. Table 8 reports a set of descriptive statistics of the main variables used in the analysis, where each observation corresponds to a 5-year average.

Table 8: Descriptive statistics

	N	mean	sd	min	max
Central gov. employment (% LF)		6.97	4.55	0.22	21.82
General gov. employment (% LF)		14.85	6.61	1.58	31.25
Public sector employment (% LF)		19.72	8.03	2.33	54.09
Population (Millions of persons)		33.32	56.38	0.03	321.02
GDP per capita, PPP (constant 2011 international $)		25993.43	17031.91	601.82	91798.26
Openness (% GDP)		99.50	73.30	15.16	422.39
Ethnic fractionalization		0.32	0.22	0.00	0.88
High income		0.66	0.47	0.00	1.00
Age dependency ratio, young		34.32	16.03	15.09	94.00
Age dependency ratio, old		18.02	7.75	0.90	42.47
Gini		36.27	9.48	17.50	69.70
Observations	286				

The extended model shows a negative and statistically significant association of public employment (as a % of labor force) with country size by population and a positive association with income (Table 9). The size of the income coefficient is similar to Rodrik's' and the impact of a change in income is similar to recent IDB estimates according to which a 25% increase in GDP per capita in LAC is associated with a 1 percentage point increase in public employment.[8]   However, openness is negatively associated with public employment (see column 1 in *Table 9*), contradicting Rodrik's model prediction.[9]

Table 9: Determinants of general government employment; extended model.

 Dependent variable: Log of general government employment as share of labor force.

Variables	(1)	(2)	(3)	(4)	(5)	(6)

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[8] The impact of a 25 percent increase in GDP per capita evaluated at the average general government employment level (14.85%) is 0.25x0.223x0.1485=0.008, or 0.8%.

[9] This result also holds when external risk is defined as in Rodrick's paper (see Table 17 in the appendix).

Log of Population	-0.147***	-0.130***	-0.137***	-0.138***	-0.143***	-0.138***
	(0.029)	(0.029)	(0.032)	(0.035)	(0.035)	(0.036)
Log of GDP per capita	0.239***	0.223**	0.222	0.275**	0.226	0.250
	(0.076)	(0.093)	(0.139)	(0.108)	(0.189)	(0.195)
Openness	-0.190***	0.217	0.195	0.179	-0.077	0.155
	(0.072)	(0.224)	(0.220)	(0.275)	(0.293)	(0.251)
Ethnic fractionalization	-0.739***	-0.607**	-0.617**	-0.465		-0.462
	(0.269)	(0.267)	(0.280)	(0.330)		(0.321)
High income		0.490*	0.472*	0.433	0.333	0.430
		(0.285)	(0.280)	(0.367)	(0.379)	(0.349)
*High income * Openness*		-0.448**	-0.413*	-0.463*	-0.233	-0.437*
		(0.211)	(0.213)	(0.262)	(0.280)	(0.249)
Age dependency ratio, young			-0.001		-0.007	-0.002
			(0.005)		(0.007)	(0.008)
Age dependency ratio, old			-0.003		-0.003	-0.001
			(0.005)		(0.007)	(0.007)
Gini				0.002	0.003	0.003
				(0.008)	(0.010)	(0.011)
Constant	0.904	0.587	0.718	0.058	0.819	0.376
	(0.743)	(0.795)	(1.439)	(0.801)	(1.616)	(1.751)
Observations	286	286	284	223	224	223
Number of countries	80	80	79	72	73	72
Country FE	No	No	No	No	No	No
R-2	0.347	0.355	0.358	0.352	0.372	0.351

Robust standard errors clustered by country in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

This result is driven by the assumption of homogeneity of the coefficients across all countries. When that assumption is relaxed and heterogeneity across groups of countries (by income group) is allowed, results change. When a dummy variable for high-income countries is included and interacted with openness (Table 9, Column 2), a robust negative coefficient associated with the interaction term is present in most specifications. Hence, openness is negatively associated with public employment in high-income countries, but positively associated in the rest. [10] In the case of ethnic fractionalization, we find a negative association, implying that more fragmented countries have lower public sector employment, while the age dependency ratio and income inequality are not statistically significant determinants of public

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[10] Openness appears imprecisely estimated, but when the dependent variable is changed to public employment over population instead of labor force (to increase the sample size by 15%), results are similar, with the openness coefficient being positive and statistically significant (Table 13 in the Appendix).

employment. The hypothesis of public employment being used as a redistribution tool is not supported by these findings, while the role of public employment as an insurance to mitigate exposure to undiversifiable external risk finds better support, though differently across groups of countries.

It is possible that the use of public employment varies along the business cycle, expanding during booms, but being rigid during recessions. We tested the hypothesis of asymmetric or ratchet effects in the response of public employment to changes in GDP per capita, with a dummy variable equal to 1 when GDP per capita growth is positive, included by itself and interacted with GDP per capita. We found no significative difference in the response of public employment to changes in GDP along the cycle and hence reject the ratchet effects hypothesis.[11]

vi.   Actual public employment compared with its predicted level

Based on the preferred specification in terms of goodness of fit and statistical significance (column 2 in Table 9), we predict the public employment levels to compare with actual public employment.[12]   The comparisons, grouped by geographic region and averaging over all the years available,[13] show clear differences across regions (Figure 8).   EAP shows public employment lower than the predicted by the model, while MENA shows the opposite.   In Latin America and the Caribbean, most countries have lower public employment than the predicted levels, except for Argentina, Brazil, Mexico, Suriname, Trinidad and Tobago, and the República Bolivariana de Venezuela, supporting the IDB's conclusion that the wage bill in LAC is driven by large public sector wage premiums (IDB, 2018).   ECA has higher employment than predicted by the model, while AFR has mixed results, with Botswana and South Africa showing significantly higher public employment levels.

We examine the potential role of political ideology driving these deviations, under the hypothesis that left-leaning governments would have larger public employment levels. Hence, we correlate the deviations with a variable that captures the political ideology of the government in office (left, center of right) obtained from the Database of Political Institutions 2017 from the Inter-American Development Bank. The deviations from the predicted level do not appear to be driven by political ideology, as suggested by
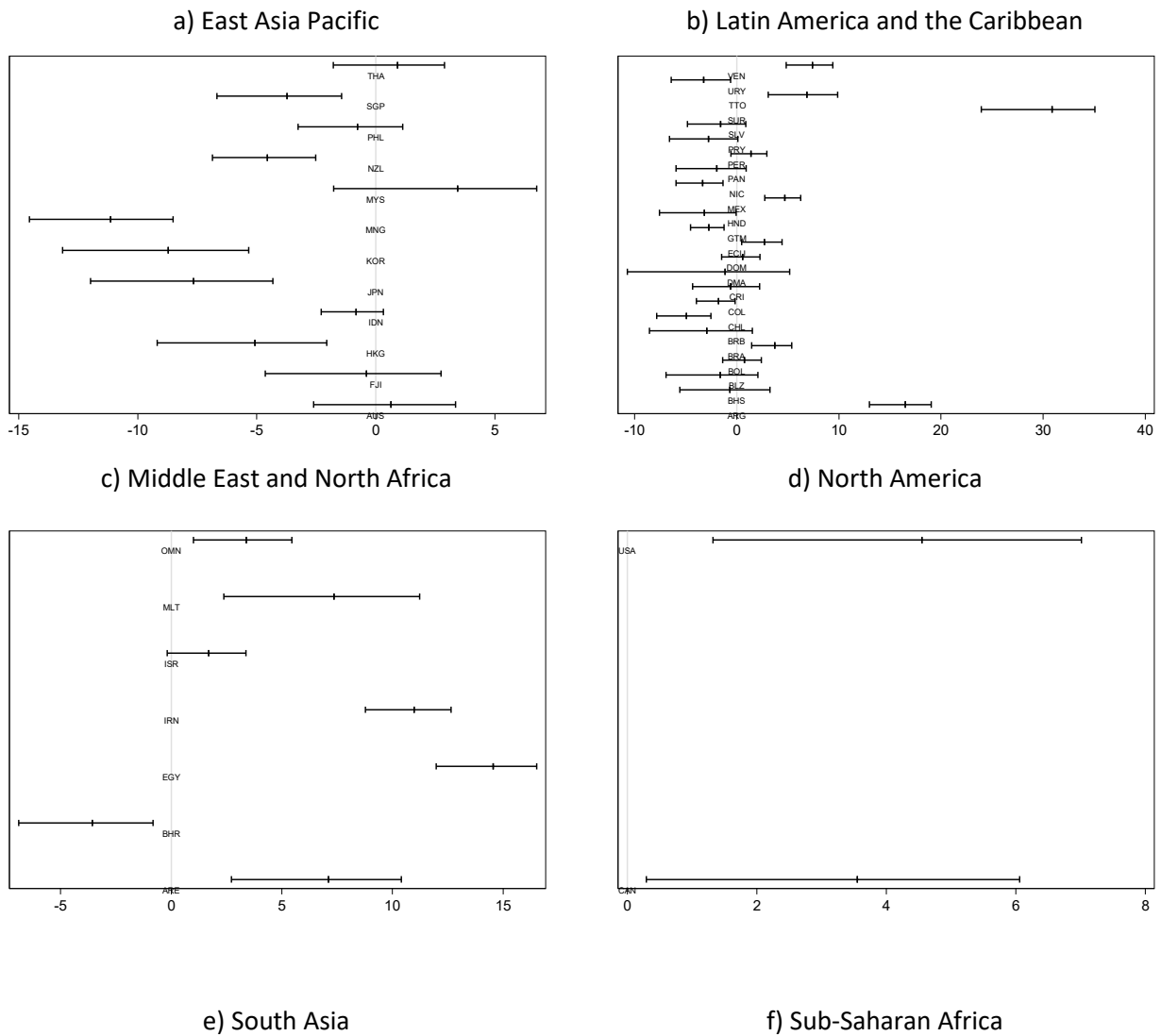
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[11] The model is estimated at an annual frequency (not five-year averages) to examine the public employment along the business cycle. Results are not presented to save space but are available from the authors upon request.
[12] To increase the number of countries, in cases where general government employment data are not available, we substitute it with public sector employment.
[13] Figure 16 shows the comparison using only the last available 5-year window.

the null correlation (Figure 17 in the Appendix).[14] In contrast, we find that these deviations are positively correlated with union density rate, which is obtained from the Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts and is available for 51 countries (see Figure 9).

Figure 8: Actual minus predicted (general government employment as share of labor force), average over the available years by country

a) East Asia Pacific

b) Latin America and the Caribbean

c) Middle East and North Africa

d) North America

e) South Asia
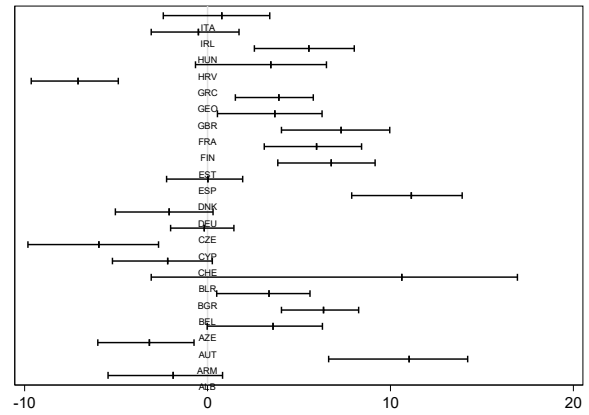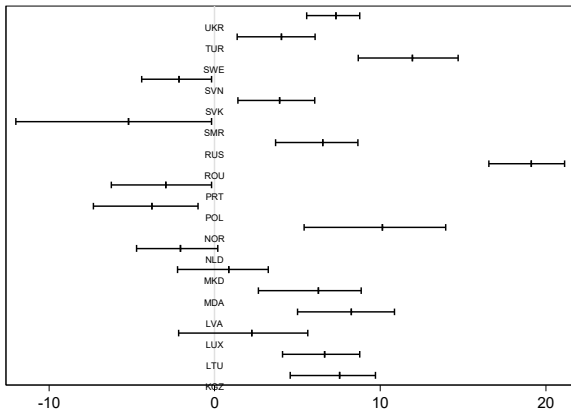
f) Sub-Saharan Africa

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[14] Using the political ideology variable in the model would imply losing a significant part of the sample due to data availability. Hence, we do the correlation analysis between the deviations estimated with the entire sample and the available data on political ideology.
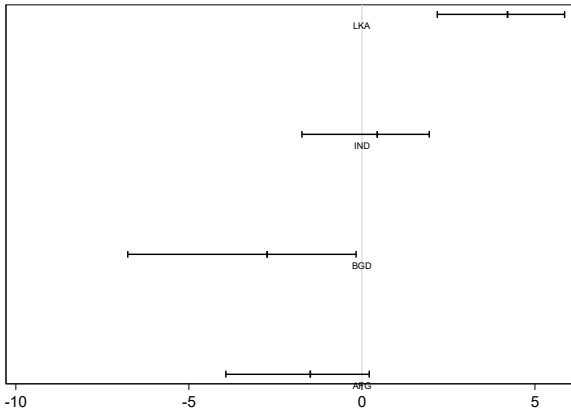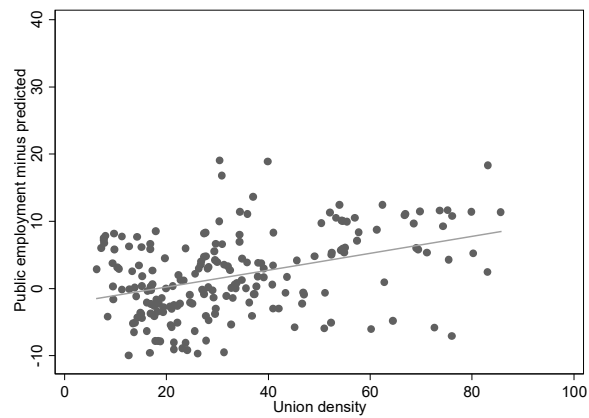
g) Europe and Central Asia 1
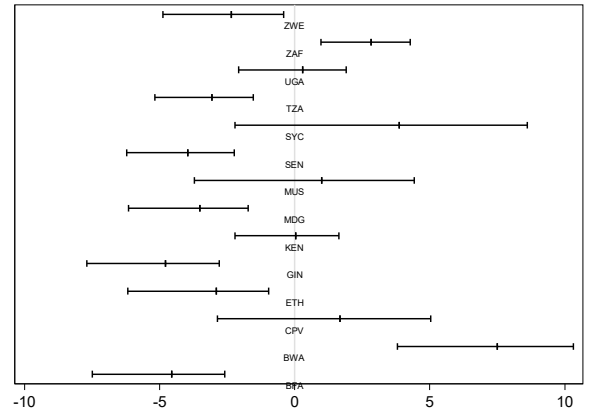
h) Europe and Central Asia 2

Notes: The prediction model is log(E/LF) = -1.38 - .11*log(Population) + .10*log(GDPPC) + .11*Openness - .56*Ethnic + .47*HighIncome - .27*HighIncome*Openness

*Figure 9: Union density rate and difference between public employment and predicted level*

vii.   Does public employment crowd- out private employment?

So far, we have analyzed the determinants of public employment without any reference to the private sector employment. However, it is possible that both variables are related and we have omitted the relationship from the analysis. There is mixed evidence of crowding out in the literature. On the one hand, Behar & Mok (2013) find that public employment fully crowds out private employment using a cross section of developing and advanced countries. Similarly, Malley & Moutos (1996) argue that increases in government employment can have a negative effect on private employment and support this hypothesis with Swedish data. On the other hand, Faggio & Overman (2014) use data on local labor markets in England to show that the impact of public sector employment has no identifiable effect on total private sector employment.

First, we examine some stylized facts of our data set. The scatter plot between private and public employment shows a negative correlation between public sector and private sector employment (Figure 10).[15] The plot of public employment and unemployment rates shows no clear relationship in the data (Figure 11). The measure of public sector employment seems to be more closely related with private employment or the unemployment rate, while the other two measures show more dispersion and a flatter relationship.
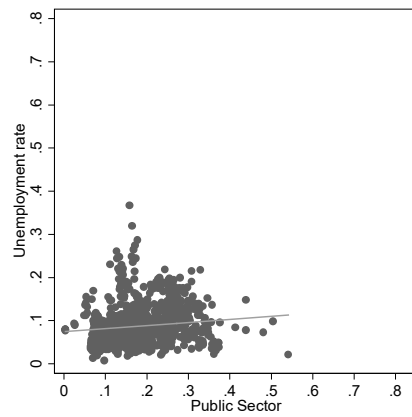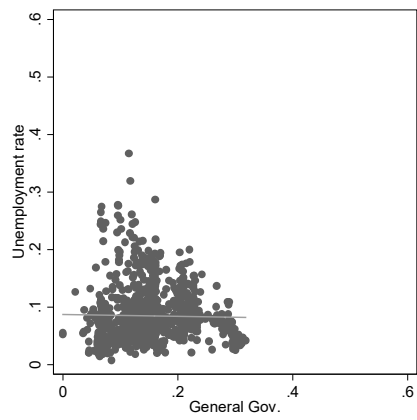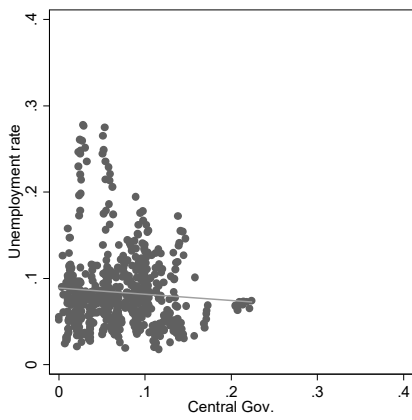
Figure 10: Public and private employment

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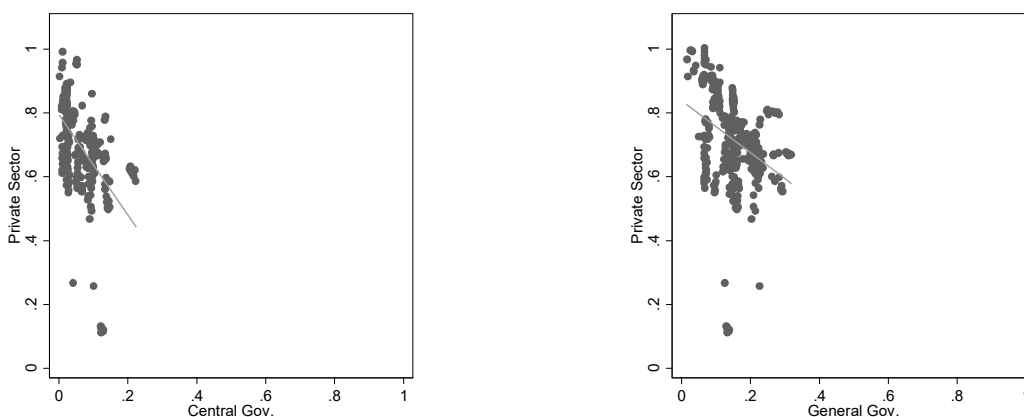
[15] Each observation is a country in a specific year.
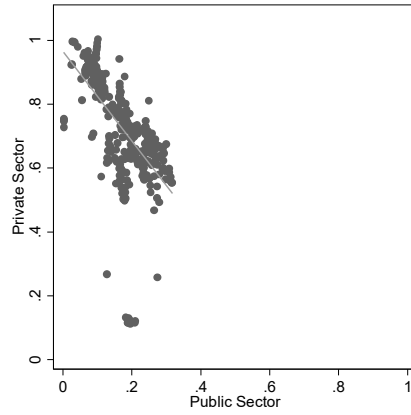
Figure 11: Public employment and unemployment rate

To examine more carefully the relationship between private and public employment, we follow Behar and Mol (2013) and estimate the following two regressions:

$$E_{it} = \beta_i + \beta_1 P_{it} + \gamma Z + \delta_t + \varepsilon_{it}$$

$$U_{it} = \beta_i + \beta_1 P_{it} + \gamma Z + \delta_t + \varepsilon_{it}$$

where E_{it} corresponds to private employment over labor force, P_{it} public employment over labor force, U_{it} unemployment rate, and Z a vector of controls that includes log of GDP per capita, urbanization rate, trade openness, and union density rate. The data come from sources already described and we use 5-year non-overlapped averages.

We do not find evidence of a crowding-out of private employment or an effect on the unemployment rate (see Tables 10 and 11). This result holds using the three measures of public employment. In addition, we find that the union density rate decreases the size of private employment (see column 2 in Table 11) and the unemployment rate (see column 2 and 4 in Table 10 and 11). This is consistent with our finding that union density increases the size of the public sector, while the effect on the unemployment rate suggests a stronger positive effect in public employment than the negative impact on private employment, however further research is needed to make that statement categorically.

Table 10: Dependent Variable: Unemployment rate

	(1)	(2)	(3)	(4)	(5)	(6)
General gov. (% LF)	-0.158	-0.172				
	(0.112)	(0.150)				
Central gov. (% LF)			0.021	0.281		
			(0.175)	(0.252)		
Public sector (% LF)					-0.019	-0.050
					(0.056)	(0.105)
Urbanization rate	11.022	-5.910	11.579	-7.137	8.058	-6.857
	(8.240)	(11.021)	(10.738)	(13.361)	(8.623)	(13.844)
Openness	-0.001	-0.001	-0.002	0.006	0.002	-0.006
	(0.009)	(0.015)	(0.014)	(0.018)	(0.009)	(0.015)
log of GDP per capita	-10.248***	-14.034***	-13.275***	-17.466***	-10.991***	-15.544***
	(1.234)	(2.180)	(1.963)	(2.641)	(1.311)	(2.607)
Union density rate		-0.073**		-0.100*		-0.077
		(0.031)		(0.051)		(0.050)
Constant	103.412***	158.969***	131.728***	191.178***	109.165***	171.264***
	(14.398)	(24.664)	(21.897)	(29.856)	(15.151)	(29.993)
Observations	270	174	183	141	287	152

	(1)	(2)	(3)	(4)	(5)	(6)
R-squared	0.314	0.319	0.348	0.390	0.315	0.337
Number of countries	70	43	51	38	84	41
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Dependent Variable: Private employment

	(1)	(2)	(3)	(4)	(5)	(6)
General gov. (% LF)	-0.106	-0.196				
	(0.598)	(0.627)				
Central gov. (% LF)			-0.547	2.181		
			(0.815)	(2.178)		
Public sector (% LF)					-0.150	-0.065
					(0.472)	(0.660)
Urbanization rate	-10.657	102.695	80.421	3.972	6.315	118.322
	(70.828)	(90.142)	(110.580)	(85.469)	(64.484)	(99.628)
Openness	-0.047	-0.006	-0.082	0.006	-0.029	0.016
	(0.041)	(0.058)	(0.050)	(0.049)	(0.039)	(0.053)
log of GDP per capita	24.658***	32.782***	37.814***	27.785***	18.886***	27.231***
	(7.318)	(8.574)	(9.307)	(8.809)	(6.571)	(8.950)
Union density rate		-0.640**		-0.201		-0.228
		(0.261)		(0.348)		(0.201)
Constant	-153.845	-302.752**	-351.076**	-221.599*	-104.241	-269.917*
	(93.478)	(121.838)	(140.327)	(120.366)	(82.424)	(132.392)
Observations	116	61	87	59	131	62
R-squared	0.255	0.600	0.374	0.567	0.203	0.450
Number of countries	55	31	39	29	64	30
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3. Concluding Remarks

We examined the determinants of public employment based on the ILO data set, which is the most complete source for analysis of public employment across countries, We found a negative association between the size of public employment and country size by population, and a positive association with

income. Openness was found to be positively associated in low- and middle-income countries, but negatively associated in high-income countries.

Based on the estimated models, we predicted the public employment levels for each country, given its population size, income level, and level of openness to trade. The deviations between the actual and predicted levels show clear regional differences. EAP has, in general, lower public employment than that predicted by the model, while MENA has the opposite. In Latin America and the Caribbean region, Argentina, Suriname, Trinidad and Tobago, and the República Bolivariana de Venezuela show the largest positive deviation with respect to the prediction. These differences do not appear to be driven by political ideology of the government holding office, but they are positively correlated with union density rates.

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Appendix

Table 12: Descriptive statistics

Region	stats	Central Gov. employment	General Gov. employment	Public Sector employment	Private employment	Unemployment
EAP	mean	0.062	0.074	0.097	0.859	0.047
	sd	0.041	0.020	0.039	0.119	0.025
	min	0.005	0.030	0.004	0.502	0.007
	max	0.118	0.136	0.230	1.022	0.118
ECA	mean	0.073	0.170	0.228	0.655	0.092
	sd	0.037	0.060	0.071	0.128	0.060
	min	0.000	0.000	0.120	0.112	0.002
	max	0.158	0.318	0.751	0.941	0.384
LAC	mean	0.037	0.125	0.140	0.861	0.092
	sd	0.029	0.056	0.092	0.102	0.045
	min	0.012	0.048	0.025	0.146	0.012
	max	0.139	0.283	0.831	0.979	0.276
MENA	mean	0.155	0.212	0.234	0.666	0.095
	sd	0.045	0.045	0.063	0.102	0.035
	min	0.085	0.146	0.079	0.307	0.034
	max	0.223	0.306	0.361	0.902	0.201
NA	mean	0.022	0.143	0.179	0.785	0.073
	sd	0.003	0.034	0.019	0.056	0.019
	min	0.019	0.069	0.123	0.687	0.040
	max	0.031	0.189	0.218	0.902	0.120
SA	mean		0.057	0.123	0.891	0.056

	sd		0.022	0.079	0.078	0.024
	min		0.041	0.043	0.594	0.023
	max		0.072	0.323	0.963	0.159
SSA	mean	0.074	0.112	0.136	0.806	0.126
	sd	0.062	0.063	0.087	0.168	0.086
	min	0.002	0.016	0.010	0.105	0.017
	max	0.169	0.255	0.370	1.081	0.278
Total	mean	0.070	0.153	0.189	0.764	0.085
	sd	0.044	0.065	0.088	0.152	0.054
	min	0.000	0.000	0.004	0.105	0.002
	max	0.223	0.318	0.831	1.081	0.384

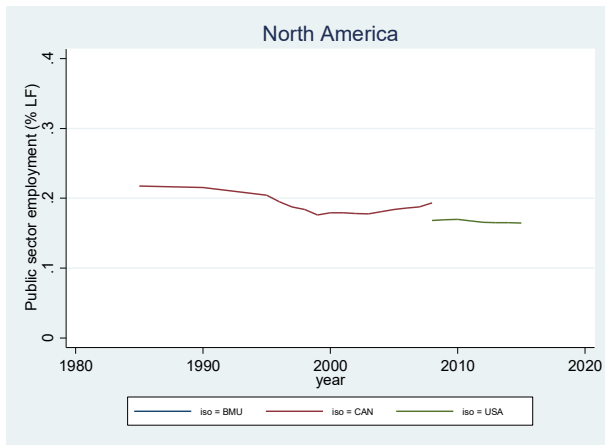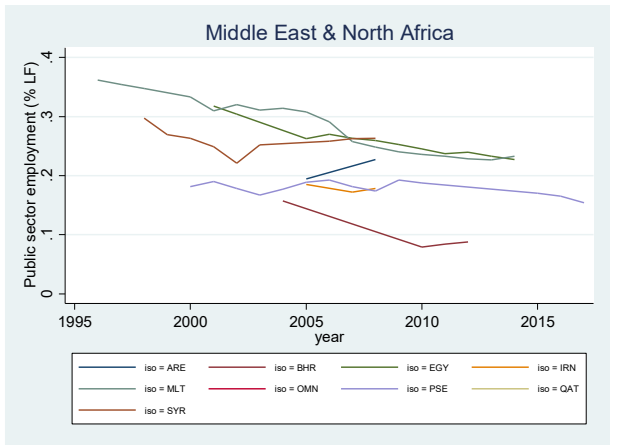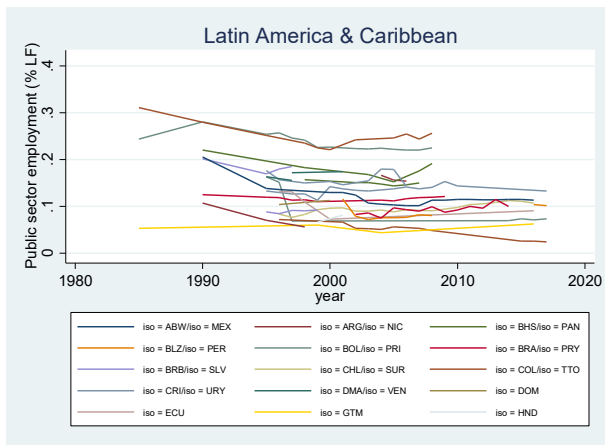*Figure 12: Public employment (% labor force) by region (weighted by labor force size)*
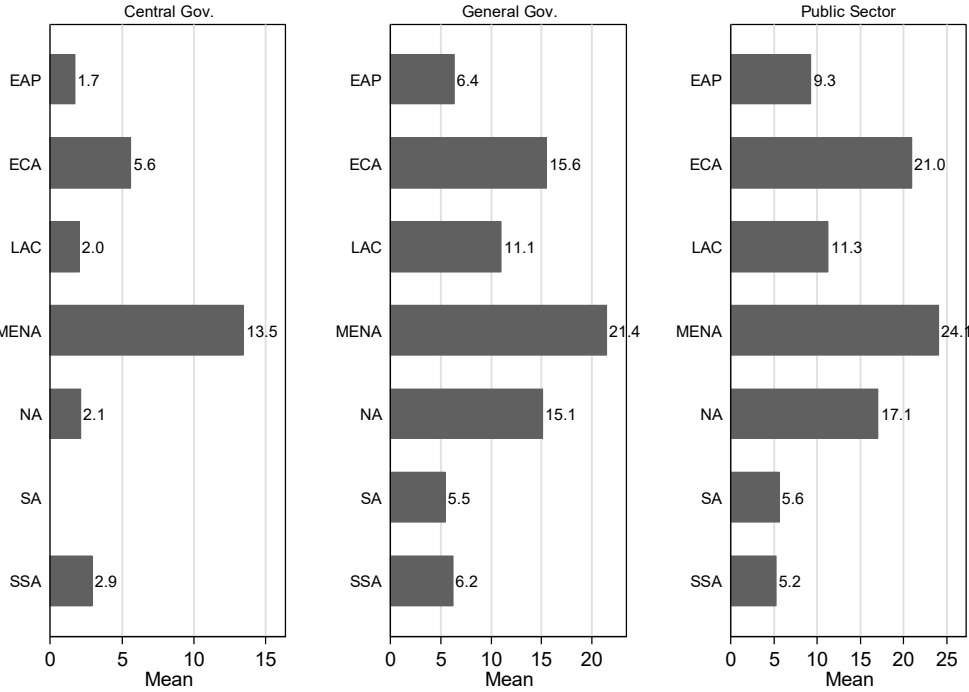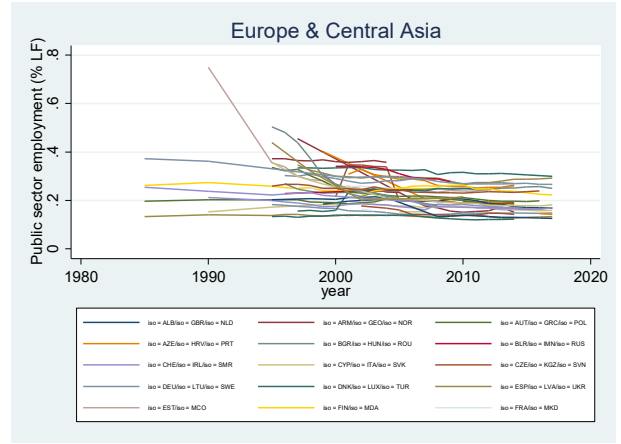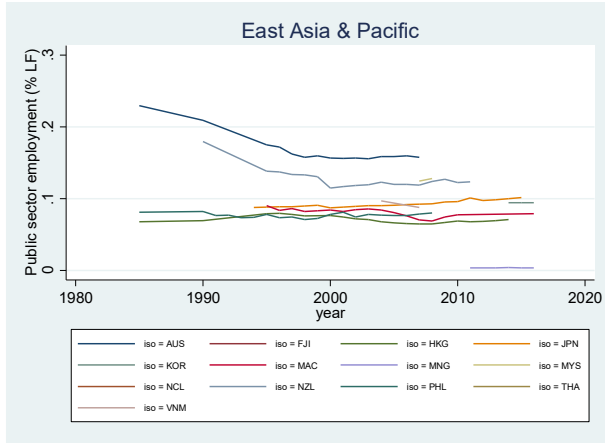

Source: ILO Stats

Figure 13: General Government Employment by country

Figure 14: Public sector employment by country[16]

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[16] Estonia is the country with high employment that falls rapidly. Bolivia and Ecuador in LAC shows a rapid fall.
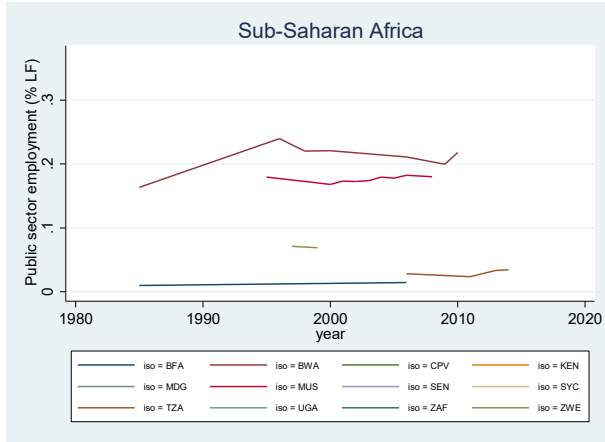
East Asia & Pacific

Europe & Central Asia

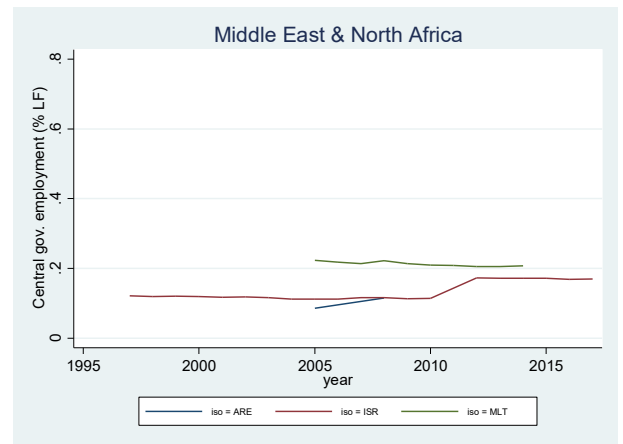Latin America & Caribbean

Middle East & North Africa
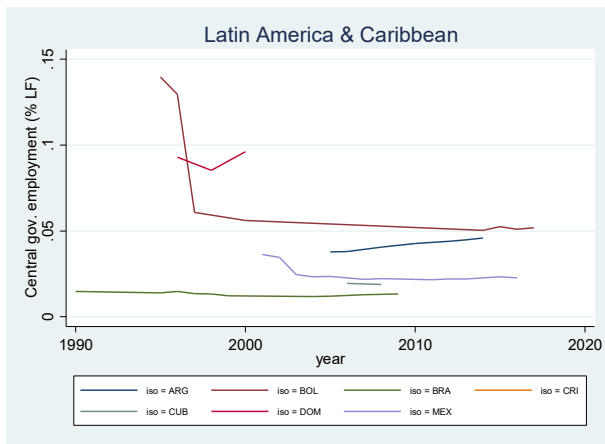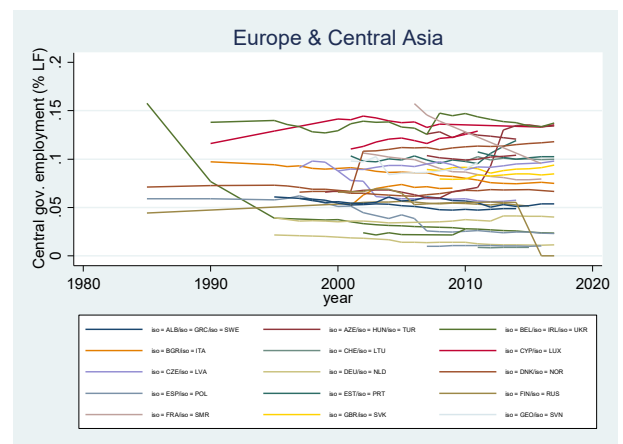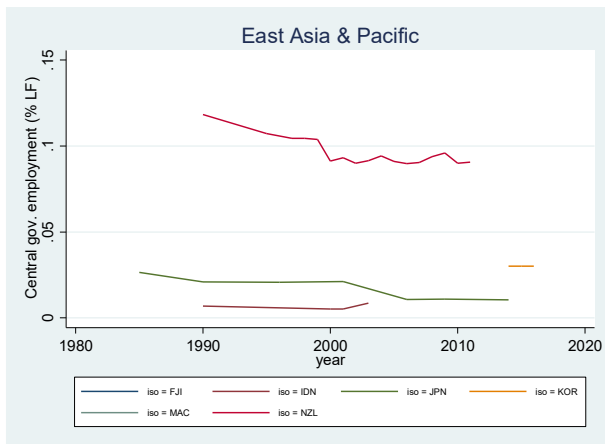
North America

South Asia

33
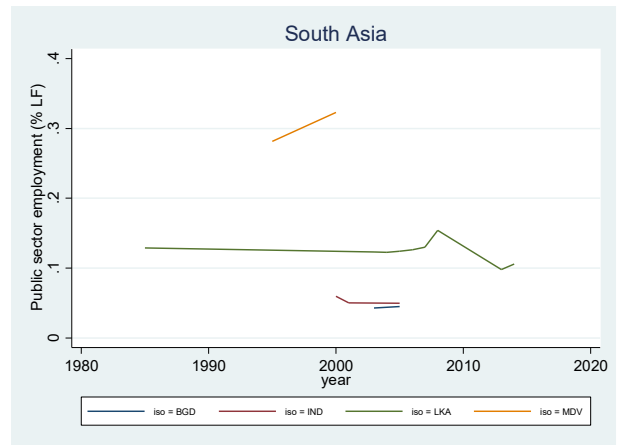
Figure 15: Central government employment by country[17]

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[17] Estonia shows a rapid fall from the beginning. Russia goes to almost zero at the end of the sample. Hungary increases rapidly since 2010. Norway increase rapidly around 2000.
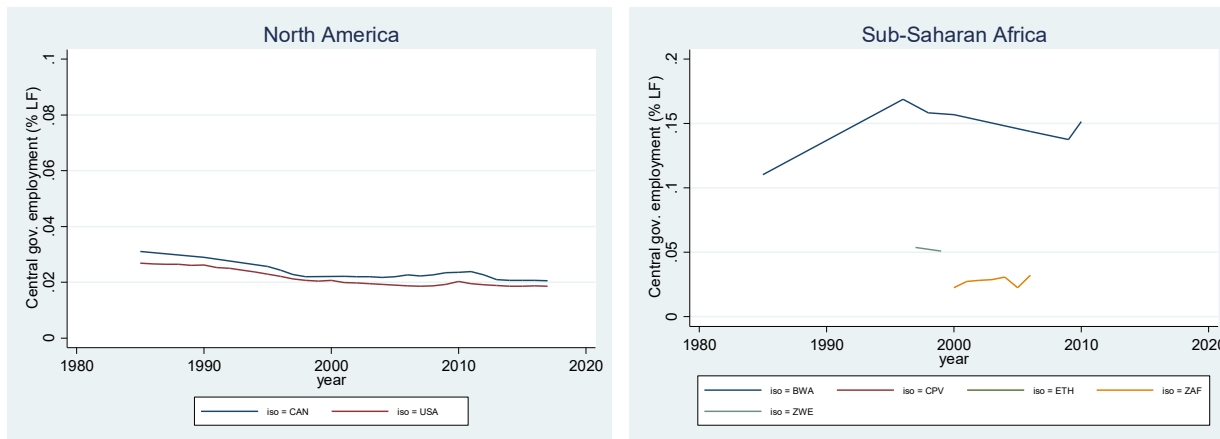
North America / Sub-Saharan Africa

Table 13: Determinants of public employment. Dependent variable: Log of general government employment as share of population

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Population	-0.132***	-0.138***	-0.164***	-0.121***	-0.117***	-0.123***
	(0.029)	(0.027)	(0.034)	(0.030)	(0.029)	(0.029)
GDP per capita	0.404***	0.462***	0.285***	0.304***	0.136	0.160
	(0.064)	(0.090)	(0.088)	(0.083)	(0.148)	(0.149)
Openness	-0.137	0.213***	0.104	0.128***	0.031	0.079
	(0.110)	(0.054)	(0.078)	(0.042)	(0.083)	(0.049)
Ethnic fractionalization	-0.785***	-0.789***	-0.473**	-0.734**		-0.570**
	(0.225)	(0.227)	(0.229)	(0.295)		(0.275)
High income		0.255	0.205	0.417**	0.542***	0.460**
		(0.199)	(0.226)	(0.184)	(0.196)	(0.197)
High income * Openness		-0.490***	-0.404***	-0.383***	-0.305**	-0.331***
		(0.091)	(0.094)	(0.092)	(0.120)	(0.104)
Age dependency ratio, young			-0.013***		-0.016**	-0.011*
			(0.005)		(0.006)	(0.006)
Age dependency ratio, old			-0.000		-0.008	-0.007
			(0.008)		(0.008)	(0.008)
Gini				-0.003	-0.000	-0.001
				(0.006)	(0.007)	(0.007)
Constant	-11.277***	-11.898***	-9.282***	-10.634***	-8.775***	-8.847***
	(0.644)	(0.723)	(1.176)	(0.886)	(1.563)	(1.575)
Observations	355	355	353	263	264	263
Number of countries	92	92	91	80	81	80
Country FE	No	No	No	No	No	No

Robust standard errors clustered by country in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 14: Basic specification with central government employment

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log of Population	-0.259***	-0.233**	-0.195*	-0.337***	-0.318***	-0.283***
	(0.088)	(0.101)	(0.109)	(0.105)	(0.102)	(0.107)
Log of GDP per capita	0.093	0.006	0.136	0.104	0.259	0.166
	(0.200)	(0.244)	(0.318)	(0.274)	(0.401)	(0.415)
Openness	-0.084	0.330	0.532	1.037	1.200	1.266
	(0.186)	(0.647)	(0.558)	(0.937)	(0.784)	(0.779)
Ethnic fractionalization	-1.202**	-0.972*	-1.283**	-1.272*		-1.529**
	(0.526)	(0.537)	(0.525)	(0.705)		(0.749)
High Income		0.673	0.873	1.177	1.610*	1.454*
		(0.616)	(0.539)	(0.928)	(0.866)	(0.828)
High Income * Openness		-0.415	-0.478	-1.306*	-1.452**	-1.341**
		(0.598)	(0.508)	(0.769)	(0.636)	(0.603)
Age dependency ratio, young			0.003		-0.002	-0.002
			(0.010)		(0.016)	(0.016)
Age dependency ratio, old			-0.031***		-0.039***	-0.043***
			(0.007)		(0.013)	(0.013)
Gini				0.027	0.020	0.026
				(0.022)	(0.023)	(0.025)
Constant	0.670	0.515	-1.096	0.027	-1.489	-0.809
	(2.270)	(2.003)	(3.027)	(2.296)	(3.399)	(3.421)
Observations	192	192	190	155	155	155
Number of countries	54	54	53	48	48	48
Country FE	No	No	No	No	No	No

Robust standard errors clustered by country in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Basic specification with public sector employment

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log of Population	-0.118***	-0.086**	-0.098**	-0.050	-0.076	-0.061
	(0.037)	(0.037)	(0.043)	(0.059)	(0.054)	(0.057)
Log of GDP per capita	-0.181**	-0.262***	-0.263**	-0.245**	-0.276**	-0.292**
	(0.088)	(0.091)	(0.109)	(0.105)	(0.136)	(0.134)
Openness	-0.062	-0.176	-0.169	-0.131	-0.144	-0.160
	(0.081)	(0.195)	(0.202)	(0.224)	(0.224)	(0.225)
Ethnic fractionalization	-1.328***	-0.762*	-0.752*	-0.872*		-0.858*
	(0.379)	(0.399)	(0.409)	(0.513)		(0.506)
High Income		0.608**	0.601**	0.747**	0.873***	0.723**
		(0.242)	(0.254)	(0.314)	(0.315)	(0.311)
High Income * Openness		0.158	0.139	0.082	0.092	0.126

	(1)	(2)	(3)	(4)	(5)	(6)
		(0.200)	(0.208)	(0.284)	(0.285)	(0.290)
Age dependency ratio, young			-0.001		-0.004	-0.004
			(0.004)		(0.006)	(0.006)
Age dependency ratio, old			-0.001		-0.003	-0.004
			(0.005)		(0.008)	(0.009)
Gini				0.006	0.007	0.007
				(0.007)	(0.007)	(0.007)
Constant	2.191**	2.005**	2.276*	0.992	1.527	1.823
	(0.940)	(0.864)	(1.206)	(1.100)	(1.337)	(1.385)
Observations	305	305	301	239	240	239
Number of countries	97	97	95	82	83	82
Country FE	No	No	No	No	No	No

Robust standard errors clustered by country in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Yearly estimates of the basic specification

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Log of Population	-0.138***	-0.124***	-0.127***	-0.068	-0.044	-0.059
	(0.030)	(0.029)	(0.034)	(0.050)	(0.054)	(0.051)
Log GDP per capita	0.150	0.149	0.108	-0.027	0.065	0.091
	(0.094)	(0.110)	(0.192)	(0.095)	(0.082)	(0.079)
Trade openness	-0.117	0.221*	0.187**	0.064	0.047	0.114
	(0.072)	(0.124)	(0.091)	(0.077)	(0.115)	(0.077)
Ethnic fragmentation	-0.852***	-0.600**	-0.589**	-0.965***		-1.073***
	(0.295)	(0.268)	(0.275)	(0.365)		(0.402)
High income		0.534**	0.516**	0.398**	0.625***	0.418**
		(0.239)	(0.222)	(0.195)	(0.214)	(0.196)
*High income * openness*		-0.405***	-0.352***	-0.165*	-0.179	-0.229**
		(0.109)	(0.095)	(0.092)	(0.129)	(0.095)
Age dependency ratio, young			-0.005		0.007	0.010
			(0.009)		(0.006)	(0.007)
Age dependency ratio, old			-0.006		0.005	0.005
			(0.007)		(0.007)	(0.007)
Gini				-0.005	-0.006*	-0.006*
				(0.003)	(0.003)	(0.003)
Constant	-0.983	-1.648*	-0.925	-0.422	-2.443***	-2.124**
	(0.931)	(0.880)	(1.936)	(1.147)	(0.914)	(0.979)
Observations	936	936	934	505	506	505
Number of countries	80	80	79	61	62	61
Country FE	No	No	No	No	No	No

Robust standard errors clustered by country in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Determinants of general government employment (basic specification). Dependent variable: Log of general government employment as share of labor force

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Log of Population	-0.125***	-0.127***	-0.126***	-0.120***	-0.125***	-0.121***
	(0.029)	(0.031)	(0.033)	(0.036)	(0.036)	(0.037)
Log of GDP per capita	0.146**	0.139	0.133	0.161	0.139	0.113
	(0.074)	(0.102)	(0.152)	(0.118)	(0.207)	(0.208)
External risk	-0.003	0.020	0.020	0.022	0.023	0.020
	(0.013)	(0.019)	(0.017)	(0.023)	(0.019)	(0.019)
Ethnic fractionalization	-0.849***	-0.592**	-0.590*	-0.507		-0.485
	(0.299)	(0.301)	(0.311)	(0.340)		(0.337)
High income		0.428*	0.427**	0.461	0.556	0.463
		(0.220)	(0.215)	(0.337)	(0.343)	(0.344)
High income * External risk		-0.071*	-0.069*	-0.083*	-0.100**	-0.083*
		(0.036)	(0.039)	(0.049)	(0.050)	(0.050)
Age dependency ratio, young			-0.001		-0.003	-0.003
			(0.005)		(0.008)	(0.008)
Age dependency ratio, old			-0.001		0.003	0.002
			(0.006)		(0.008)	(0.008)
Gini				0.006	0.007	0.008
				(0.010)	(0.013)	(0.013)
Constant	1.627**	1.391	1.487	0.915	0.979	1.379
	(0.754)	(0.907)	(1.545)	(0.880)	(1.732)	(1.755)
Observations	275	275	275	220	220	220
Number of countries	73	73	73	69	69	69
Country FE	No	No	No	No	No	No

Robust standard errors clustered by country in parentheses

*** p<0.01, ** p<0.05, * p<0.1

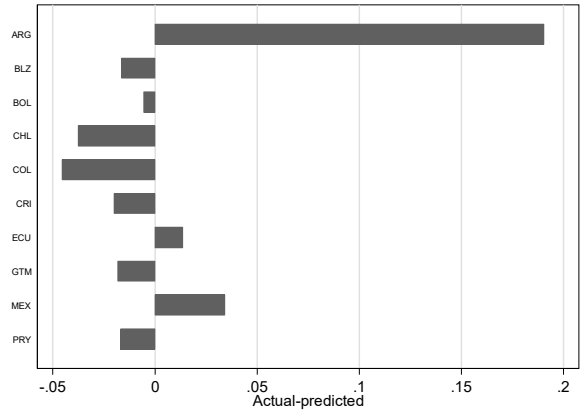*Figure 16: Actual versus predicted, last 5-year window*
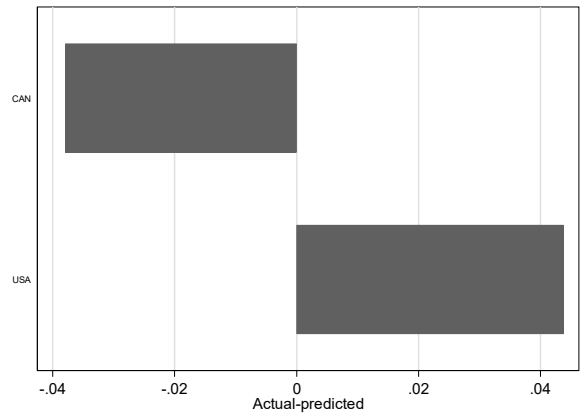
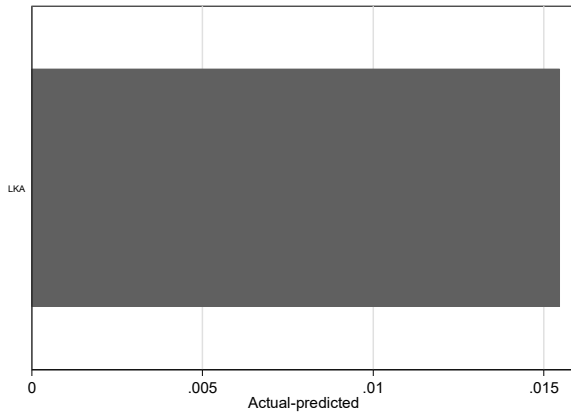a) EAP   b) LAC
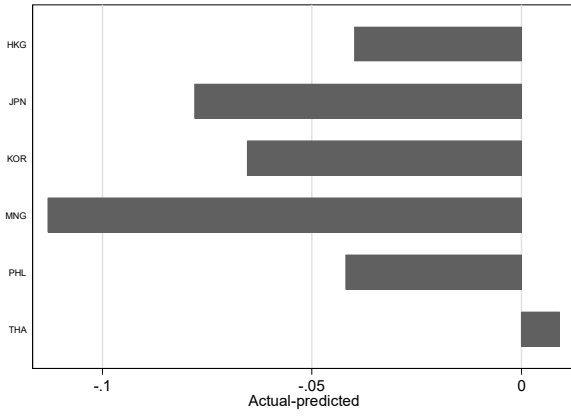
c) MENA

d) NA
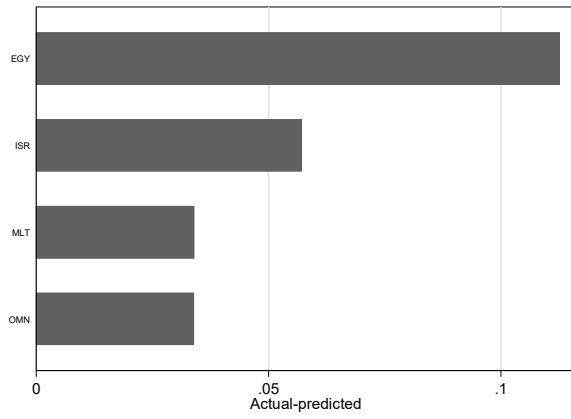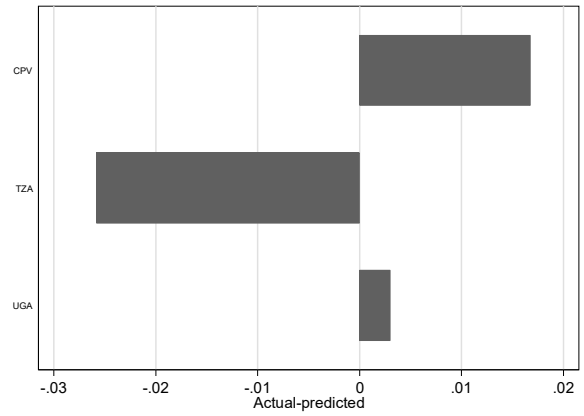

e) SA
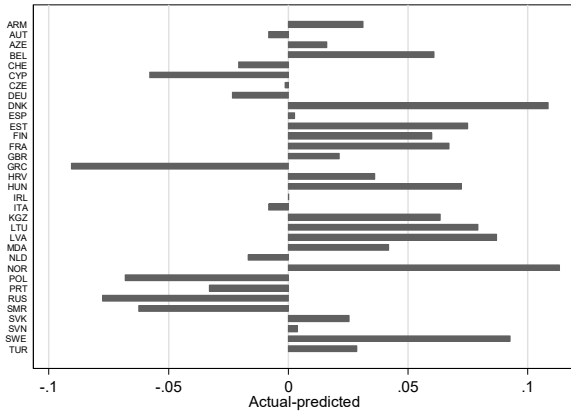

f) SSA
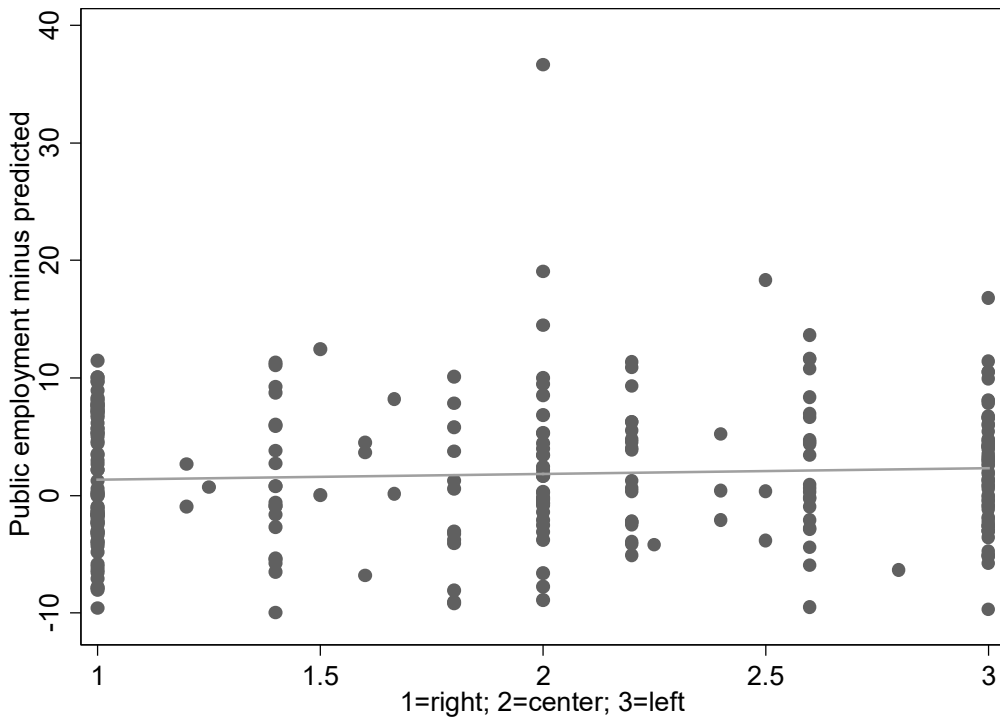

g) ECA

Notes: The prediction model is log(E/LF) = -1.38 - .11*log(Population) + .10*log(GDPPC) + .11*Openness - .56*Ethnic + .47*HighIncome - .27*HighIncome*Openness

Figure 17: Political ideology and public employment in excess of the predicted level

Note: Correlation coefficient is 0.06 with p-value=0.3