CSAE Working Paper WPS/2013-20

# Does Public-Sector Employment Fully Crowd Out Private-Sector Employment?

Prepared by **Alberto Behar and Junghwan Mok**[1]

October 2013

**Abstract**

We quantify the extent to which public-sector employment crowds out private-sector employment using specially assembled datasets for a large cross-section of developing and advanced countries. Regressions of either private-sector employment rates or unemployment rates on two measures of public-sector employment point to full crowding out. This means that high rates of public employment, which incur substantial fiscal costs, have a large negative impact on private employment rates and do not reduce overall unemployment rates.

JEL Classification Numbers: J21, J23, J68, H59

Keywords: Employment, Crowding out

Authors' E-Mail Addresses: abehar@imf.org, junghwan.mok@gmail.com

[1] The authors thank Gohar Abajyan, Kathleen Beegle, Paul Cashin, Allan Dizioli, Sanaa Farid, Prakash Loungani, Kia Penso, Mai Dao, participants in the Middle East and Central Asia Department Discussion Forum, as well as attendees at the World Bank Middle East and North Africa Office of the Chief Economist Seminar and the IMF Research Department's Jobs and Inclusive Growth Seminar. This work was conducted while Mr. Mok was a summer intern in the Middle East and Central Asia Department, IMF. This Working Paper should not be reported as representing the views of the IMF. The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

Contents Page

# I. INTRODUCTION

Unemployment fell over much of the first decade of the 21st century, but those gains are being reversed in the aftermath of the great recession of 2008. Employment rates are at their lowest levels in two decades. As noted by Layard, Nickell, and Jackman (2005), unemployment matters because it generally reduces output and income, increases inequality, erodes human capital, and has immeasurable psychic costs.

Furthermore, unemployment decreases the chances that a young democracy will survive (Kapstein and Converse, 2008). As shown by the recent experiences of many of the North African countries now undergoing political transitions, and as a warning to governments elsewhere, unemployment often goes hand in hand with political and macroeconomic instability. As the IMF warned well before the events of Tahrir Square,[2] and as Campante and Chor (2012) argued thereafter, high unemployment may have contributed to the onset of an unprecedented wave of popular revolutions in the Arab world. The primacy of this issue is evidenced by its being the topic of the World Bank flagship *World Development Report 2013: Jobs* (World Bank, 2012a).

While many of the recent moves in unemployment have been related to the business cycle, structural unemployment remains a major component. There is an established literature investigating the importance of labor market institutions and other factors in explaining unemployment patterns.[3] Within the realm of fiscal policy, lower tax wedges, wage subsidies, and active labor market programs could boost labor demand, while targeted tax relief, together with benefit and pension reform, could increase labor supply in advanced countries. These measures could complement more important structural reforms in the labor, capital, and product markets (IMF, 2012a).

The contribution of this paper is to investigate the effects of public hiring of workers on labor market outcomes, specifically unemployment and private employment. In particular, does public hiring increase ("crowd in") private employment or decrease ("crowd out") private employment? If the latter, is the effect "partial crowding out," such that the net effect is a fall in unemployment; "full crowding out", such that overall unemployment is unchanged; or "more than full crowding out," such that unemployment rises?

Many would agree that crowding in would be a good outcome of government hiring and that a net rise in unemployment would be a bad outcome of government hiring. It is arguably the case that a private-sector job is more desirable than a public-sector job from a public policy point of view, because no change in unemployment means government resources could have been allocated elsewhere. Furthermore, there is evidence that a large government share in economic activity can be negative for long-term growth because of the distortionary effects of

[2] See IMF (2010). Furthermore, the IMF Managing Director warned in Morocco in the summer of 2010 that the youth unemployment problem in the region was a "ticking time bomb".

[3] An extensive list includes Freeman (2005), Nickell (1997), and Blanchard and Wolfers (2000).

taxation, inefficient government spending due in part to rent-seeking or lower worker productivity, and the crowding out of private investment.[4] As a result, it's questionable whether partial crowding out—a fall in both unemployment and private-sector employment—would be worth the potential long-term growth impacts.

Crowding out could occur through a number of channels. Derived labor demand can be affected through crowding out of the product market, possibly via higher taxes, higher interest rates, and competition from state-owned enterprises. It can occur through the labor market, where higher wages, more job security, or a higher probability of finding a public-sector job can make an individual more likely to seek or wait for public-sector employment rather than search for or accept a job in the private sector (Feldmann, 2009a, 2009b; Espinoza, forthcoming). Finally, it can occur in the education market, where individuals seek qualifications appropriate for entering the public sector rather than skills needed for productive employment in the private sector (Salehi-isfahani and Dhillon, 2008).

For these reasons, a number of policy documents suggest that public-sector hiring is inhibiting private-sector employment (World Bank, 2012b; IMF, 2012a). As discussed in Section II, there is prior evidence that crowding-out effects are sufficiently large to increase unemployment in a number of advanced countries. However, there has hitherto not been a thorough investigation of how public employment affects labor market outcomes in developing countries. We fill this gap in the literature by investigating the effects of public employment on both private employment and on unemployment.

An important part of our contribution lies in the assembly of the dataset to expand the number of non-OECD countries, as is described in Section III. Our dataset contains two measures of public employment. The first is a narrow measure corresponding to employment in the public administration based on occupation type, while the broader measure can also include other forms of public employment, including state-owned enterprises. In Section IV, we present the descriptive statistics including the relative importance of public employment across regions.

Our core empirical analysis in Section V relies on four sets of regression specifications, namely regressions of unemployment on public employment and of private employment on public employment, using both broad and narrow measures of public employment. We use a variety of estimation approaches and tackle potential endogeneity both analytically and empirically. Overall, the results point to full crowding out; that is, every public job comes at the cost of a private-sector job, and does not reduce overall unemployment. In reverse, the results imply that public restraint does not exacerbate unemployment.

As a result, Section VI suggests that public-sector hiring at best offers no employment benefit and should be replaced with more socially beneficial fiscal expenditure. It also offers suggestions for further research.

[4] See Easterly and Rebelo (1993), Barro and Sala-i-Martin (2004), and Aschauer (1989).

## II. LITERATURE REVIEW

While there has been extensive research on government crowding out of private investment (Aschauer, 1989), and on the importance of public employment in fiscal policy, few studies have explored the crowding-out effects of public-sector employment on private-sector employment and, hence, unemployment. The most related and relevant work to this paper is by Algan et al. (2002), who explore the consequences of public-sector employment for labor market performance. Using pooled cross-section and annual time-series data for 17 OECD countries from 1960 to 2000, they run regressions of the unemployment rate and/or the private-sector employment rate on the public-sector employment rate. Empirical evidence from the employment equation suggests that the creation of 100 public jobs crowds out 150 private-sector jobs. The unemployment equation estimates suggest that 100 public jobs add 33 unemployed workers overall. Either equation points to more than full crowding out. Combining the two results, the authors infer that 17 individuals would leave the labor force.

Malley and Moutos (1996) find evidence of full crowding out in Sweden by applying Vector Error Correction Model estimation to time series data on public and private employment. Crowding out can occur through the product market if government activity replaces products that would have been provided by the private sector. They theoretically point out that the substitutability of public and private goods is the key determinant of the size of the crowding-out effect. The increase in public jobs to produce highly substitutable products can directly displace private jobs. However, if public and private products are complements, there's the possibility of crowding in if the public service improves the marginal product of labor in the private sector. Algan et al. (2002) also find stronger crowding-out effects in countries where the share of public spending in substitutable activities is high.

In addition to the above papers, which emphasize crowding out through the product market, some studies try to isolate crowding out through the labor market. For example, public-sector employment practices can drive up wages in the private sector. Demekas and Kontolemis (2000) emphasize the different objective of the government from that of the private sector as an employer. Thus, its decision directly impacts labor market performance through the wage determination channel. They test their argument empirically using unemployment, public employment, and public and private wage data for Greece. VAR estimation shows that an increase in public wages leads to a more than proportional increase in private wages such that there is an increase in the private to public wage differential. It also shows that unemployment is positively correlated with the private to public wage differential, which implies public-sector crowding out of private-sector employment through wages.[5]

Faggio and Overman (2012) emphasize wage effects and the tradability of goods in the local economy. In their theoretical framework, an increase in local employment in the public sector leads to an increase in local wages, which reduces private employment; but it also leads to a subsequent increase in local demand for goods. The increased local demand for nontradable goods leads to higher employment, while demand for tradable goods has no employment

[5] Lamo, Perez, and Schuknecht (2012) find that the private sector appears to have a stronger influence on the public sector than the reverse, but Perez and Sanchez (2010) find the opposite.

effect if local demand is negligible relative to total demand. As a result, public-sector employment crowds out employment in the tradable sector but crowds in employment in the nontradable sector. Using UK regional survey data, they find that the size of crowding out in the tradable sector is about the same as the crowding-in effect in the nontradable sector, so there is no crowding-out effect overall in the short run. However, they find that crowding out occurs over a longer time period.

All the papers above treat advanced countries. To the best of our knowledge, very little empirical work in this area has been extended to developing countries. Feldmann (2009a, 2009b) analyzes the effect of government size on the unemployment rate in developing countries. Regressions on panel data show that a larger public sector is correlated with higher overall unemployment rates, as well as with unemployment among women and youth. Moreover, a larger public sector increases the share of long-term unemployed in the total number of unemployed. However, in the Feldmann studies, the overall size of government is measured by the sub-index 'size of government' from the 'Economic Freedom of the World' index. This sub-index[6] includes high income taxes, high interest rates due to government investment, and a number of other potential channels through which unemployment can be increased.

However, the aforementioned study is not about crowding out effects of public sector employment and does not make any use of public and private employment data. The next section describes how we build a panel data set of private and public employment that includes both advanced and developing countries.

## III. DATA SOURCES

We have collected data for up to 194 countries over the period 1988–2011. The primary sources for standard labor market data, including unemployment rates and the labor force, are the Key Indicators of the Labor Market (KILM) and LABORSTA databases provided by the International Labor Organization (ILO) as well as the IMF *World Economic Outlook* (WEO).

Our contribution to the literature includes the assembly of data on public and private employment and other indicators for a wide range of developing and advanced countries. Definitions of "public sector" are different across countries and organizations, so we choose two definitions and generate corresponding public employment datasets, namely a "narrow" measure also referred to as "public administration" and a "broad" measure.

1. When the national authorities report their labor force statistics to the ILO and other sources, they categorize all occupations according to United Nations' International Standard Industrial Classification of economic activity (ISIC). Among these occupations, "Public administration and defense; compulsory social security" is the one related to the public sector.

[6] This index consists of general government consumption (as a percentage of total consumption), transfers and subsidies (as a percentage of GDP), the role of state-owned enterprises in the economy, government investment (as a percentage of total investment), and income/payroll taxes.

We use this as the 'narrow' measure of public employment, which we also refer to as 'public administration' employment, which excludes other public investment or business activities.[7]

2. Meanwhile, in addition to the public employment data above, the ILO LABORSTA dataset provides its own collection of public sector employment data, "Public Sector Employment". This dataset includes not only governmental agencies but also state-owned enterprises (SOEs).[8] We call this the 'broad' measure of public employment, preserving the term 'public sector'.

Since many countries do not report private-sector employment separately, we calculate private-sector employment by subtracting public employment from total employment where necessary. Thus, the "narrow" and "broad" measures produce two corresponding private-sector employment datasets. We will refer to both series as "private-sector employment" or just "private employment" regardless of whether these correspond to the broad or narrow measures of public employment. When calculating public and private employment rates, we divide private and public employment by the labor force, which is primarily obtained from the ILO and supplemented with data from other sources. Similarly, the ILO is the principal source of unemployment data.

For regression purposes, we construct another dataset consisting of control variables. Real GDP growth, the urbanization rate, and trade openness are drawn from the IMF WEO database. In addition, we extract the labor rigidity indicators from the "Economic Freedom of the World (EFW)" index. We will discuss control variables when we describe our specification of regression models.

## IV. DESCRIPTIVE ANALYSIS

This section lays out key descriptive statistics on unemployment, private employment and public employment from our sample. We group the countries following the country classification in the IMF's *World Economic Outlook*: Advanced Economies (ADV), Developing Asia (Asia), Central and Eastern Europe (CEE), Latin America and the Caribbean (LAC), and sub-Saharan Africa (SSA)[9]. We also divide the IMF's Middle East and Central

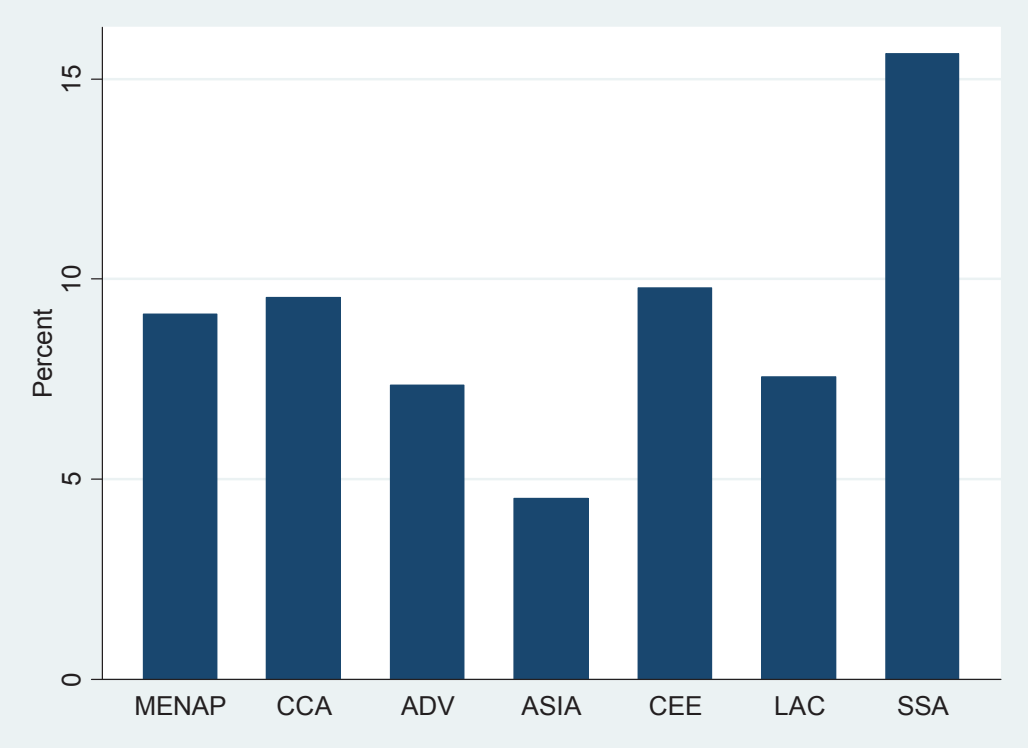
[7] Detailed definitions can be found at the United Nations Statistics Division homepage (http://unstats.un.org), which states: "This section includes activities of a governmental nature, normally carried out by the public administration. This includes the enactment and judicial interpretation of laws and their pursuant regulation, as well as the administration of programs based on them, legislative activities, taxation, national defense, public order and safety, immigration services, foreign affairs and the administration of government programs. This section also includes compulsory social security activities."

[8] Detailed definitions can be found on the ILO homepage (http://laborsta.ilo.org). The following forms part of the explanation: "The total public sector employment covers all employment of general government sector as defined in 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 particular type of employment contract."

[9] Data availability is unfortunately limited for this region.

Asia Department (MCD) countries[10] into two groups: the Middle East and North Africa (MENAP)[11] countries and the Caucasus and Central Asia (CCA)[12] countries. In order to maintain a consistent sample despite numerous gaps in data availability, and to remove the effect of cyclical fluctuation, we average the variables over four-year periods.

Figure 1: Unemployment Rate, weighted by labor force, 2008-11 average




Sources: Country authorities; and International Labor Organization.

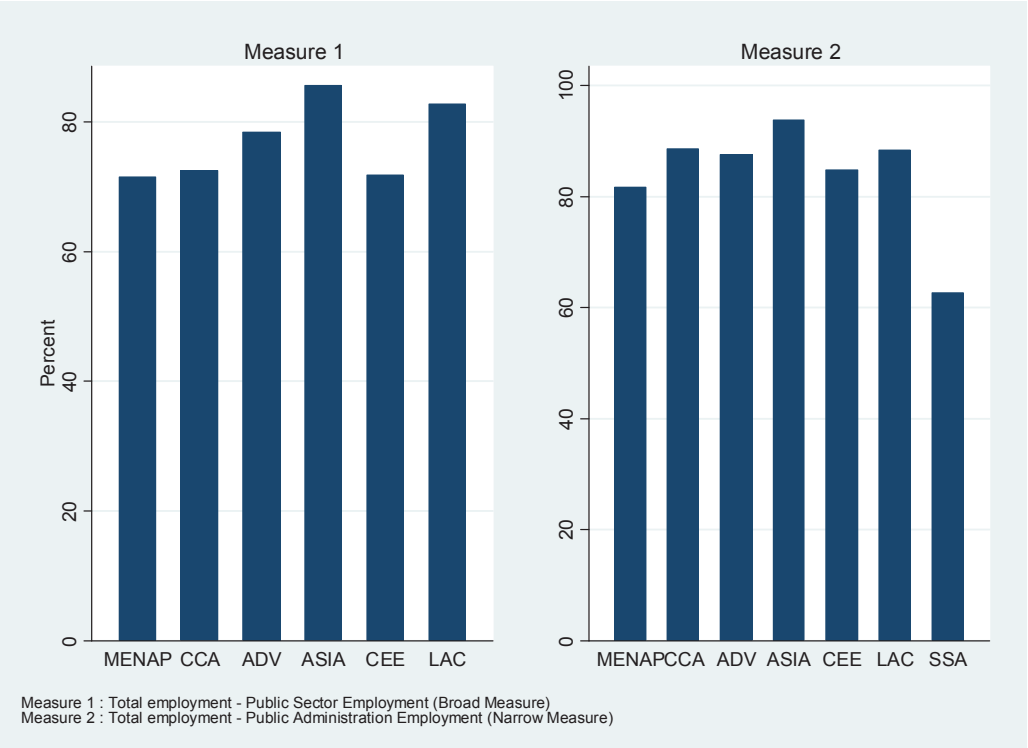
Figure 1 presents data on unemployment. The regional average is weighted by the size of the labor force in each country. Sub-Saharan Africa appears to have high unemployment, but this is likely dominated by high unemployment rates in South Africa, Namibia and Lesotho among only six countries in the descriptive sample with available data. A fuller sample would yield a lower unemployment rate, although this likely includes a number of underemployed people. The MENAP, CCA and CEE countries have higher unemployment rates than the advanced economies and those in Asia and Latin America.

[10] These countries refer to IMF members in the IMF's Middle East and Central Asia Department, plus Turkey and West Bank and Gaza.

[11] Subject to data availability, MENAP refers to the countries of the Middle East and North Africa, and includes Afghanistan and Pakistan, which are IMF members in the Middle East and Central Asia Department, as well as Turkey and the West Bank and Gaza. See also IMF (2012b) for additional information.

[12] Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan.

Figure 2: Private-Sector Employment Rate, 2008-11 average

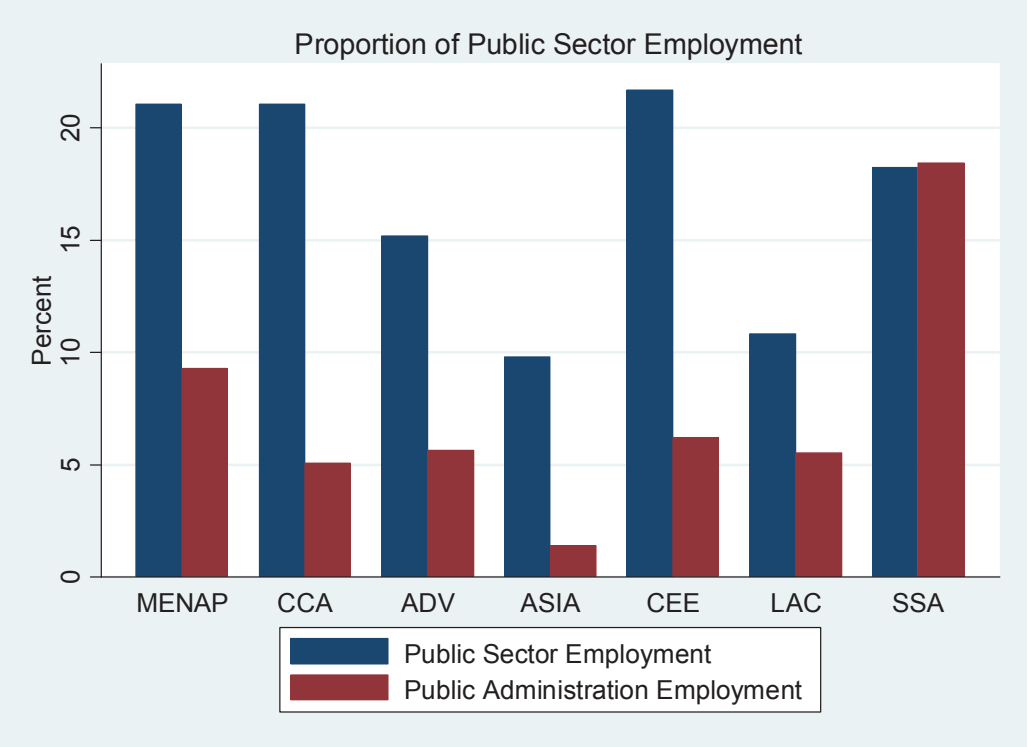



Sources: Country authorities; and International Labor Organization.

Figure 2 presents the regional averages of private-sector employment rates weighted by the labor force. The left panel shows the private-sector employment rate that corresponds to the broad definition of public-sector employment. We see that private employment rates are lowest for MENAP countries but closely followed by the CCA and CEE countries. Only one sub-Saharan African country has private employment data by this measure so the region is excluded. The right panel shows the private-sector employment rate that corresponds to the broad definition of public-sector employment. Here, based on a sample of only three countries, private employment is lowest in sub-Saharan Africa.[13]

[13] The three countries are Mauritius, Namibia and South Africa. Using averages from 2004-7, data from eleven countries still indicate low private employment rates relative to peers. The multiperiod regression sample draws on data from 17 sub-Saharan countries.

Figure 3: The Importance of Public-Sector Employment, 2008–11 average




Sources: Country authorities; and International Labor Organization.

Figure 3 presents the proportion of public employment across regions, which is public employment as a percentage of total employment (the sum of private and public employment). The blue bars refer to the broad measure of public employment, where it is very clear that government is a large employer in the MENAP, CCA, and CEE countries including Algeria and Egypt. In sub-Saharan Africa (Namibia, Mauritius and South Africa), public administration employment is high by global standards. In MENAP countries, including Algeria, Morocco and some Gulf Cooperation Council (GCC) countries, the public administration is also an important employer.[14]

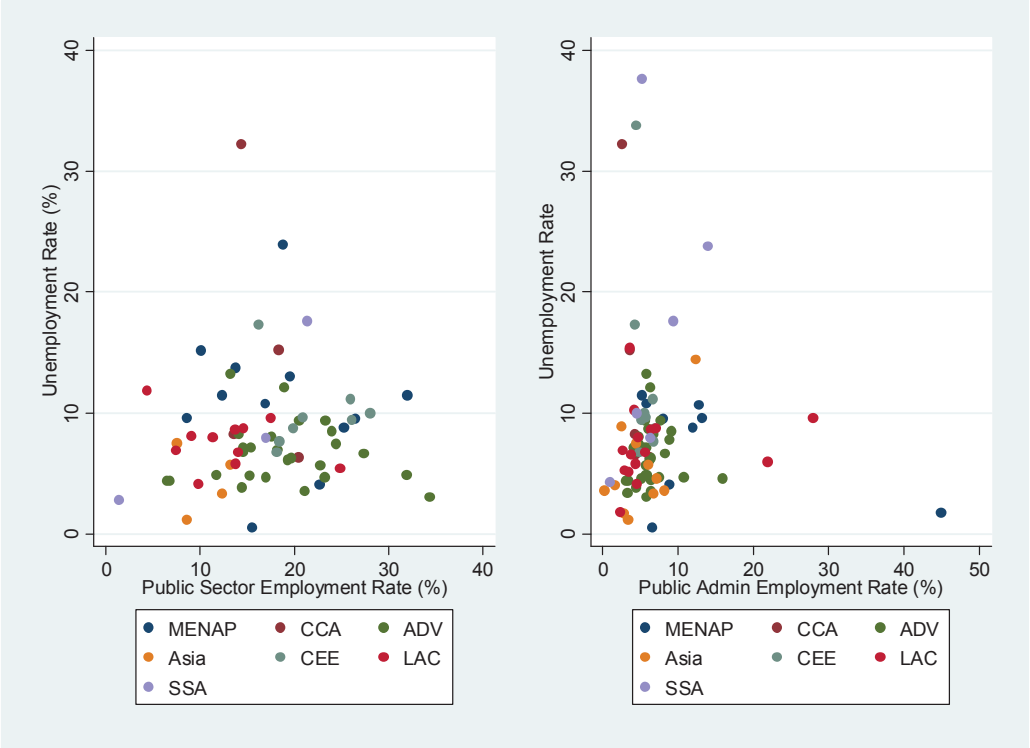
Having described the characteristics of the key variables, we begin to investigate if they are correlated. Figure 4 shows the relationship between the unemployment rate[15] and public-sector employment rates with different measures. Whether we use the broad definition (left panel) or the narrow definition (right panel), there is no clear relationship between unemployment and public employment. Variations in unemployment in the MCD region and

[14] For more country-specific analysis on North African and other MCD countries, please see Behar and Mok (2013).

[15] Armenia has high unemployment rates according to the ILO data, which we use for its broader coverage, but the more limited unemployment data available on the WEO database indicates unemployment rates of nearly 20 percent.

elsewhere could be due to a number of structural factors. See for example Freeman (2005), Nickell (1997), Blanchard and Wolfers (2000), Baker, Glynn, Howell and Schmitt (2007) as well as Bernal-Verdugo, Furceri and Guillaume (2012) for differing views

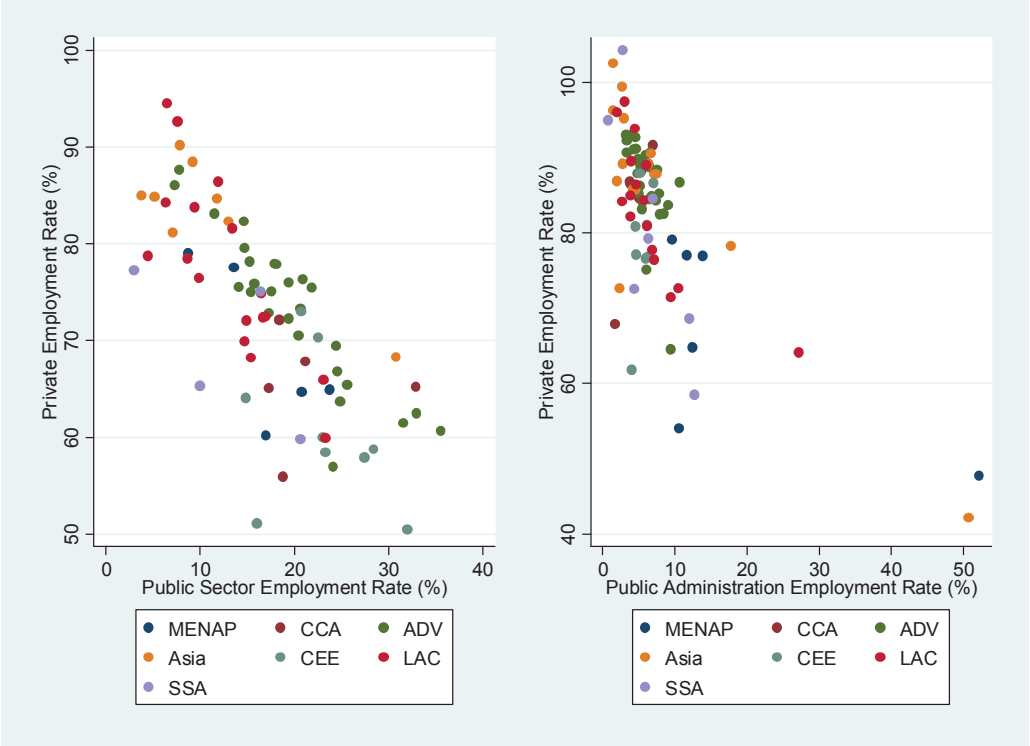
Figure 4: Unemployment and Public Employment, 2008–11 average




Sources: Country authorities; and International Labor Organization.

While there is no obvious relationship between public employment and overall unemployment, Figure 5 shows a striking result. Both graphs show clear negative correlations between the public employment rate and the private-sector employment rate. The left panel, with the broad measure, implies a strong negative relationship. The graphical evidence suggests that this negative relationship applies across the world and within the MCD region in particular.

Figure 5: Correlation between Public- and Private-Sector Employment, 2008–11 average




Sources: Country authorities; and International Labor Organization.
Note: Public employment rate + private employment rate + unemployment rate ≡ 1

Both the unemployment and private-sector employment graphs are consistent with crowding out taking place. This section has provided preliminary evidence that public-sector employment is crowding out private-sector employment. The next section uses econometric analysis to estimate the relationship more thoroughly.

## V. Econometric Analysis

### A. Specification and Estimation

In order to explore the existence of crowding out, we estimate specifications for the unemployment rate and the private-sector employment rate. Since we use two measures for public and corresponding private-sector employment, there are four equations in total. All rates are expressed as a percentage of the total labor force.[16]

[16] The normalization of employment and unemployment across countries are important in order to reduce the potential heteroskedasticity in the residuals due to the difference in size across countries.

$$Unemp_{it} = \beta_u Pub_{it} + \gamma_u X_{it} + \nu_i + \theta_t + \varepsilon_{it}$$
$$Prv_{it} = \beta_p Pub_{it} + \gamma_p X_{it} + \nu_i + \theta_t + \varepsilon_{it}$$

The subscripts $i$ and $t$ identify the country and the period, respectively. $Unemp$ is the unemployment rate, $Pub$ is the public employment rate, $Prv$ is the private employment rate, $X$ is the vector of control variables which we will discuss below, $\nu$ is the potential country fixed effect, $\theta$ is the coefficient on the period dummy, and $\varepsilon$ is the residual term. For convenience, we will refer to the equations as "unemployment equation" and "employment equation."

We have six periods of data ranging from 1988 to 2011. Since not all variables are available for each country and each period, the coverage of countries falls as we move on to regression analysis. Depending on specification and estimation method, we have up to 139 countries and 454 observations.

We have a number of control variables based on what is standard in the literature (Algan et al, 2000; Feldmann, 2009a, 2009b). We control for the potential impact of labor market rigidities with a measure drawn from the EFW database, specifically the "Hiring and firing regulations" index used as part of their labor regulations index. The index ranges from 0 to 10, with higher ratings indicating freer labor markets. We use the GDP growth rate with time dummies to control for business cycle fluctuations. Additionally, the urbanization rate of the population and openness, which is the ratio of trade to GDP, is included.

We use several estimation methods that will yield consistent results. For simplicity and uniformity, the discussion in the body of the paper focuses on the fixed effect (FE) within-groups estimation method. The right-hand side of our regressions has public employment rates that are likely to be correlated with country-specific but time-invariant unobservable characteristics. If those characteristics affect the unemployment rate or private-sector employment rate, it is important to eliminate those sources of bias. In particular, although we took considerable care to use definitions that were consistent across countries, the fixed effects also control for slight differences in measurement, which by definition would be correlated with the explanatory variables.

One potential concern is that public hiring may respond to labor market conditions over time, for example increasing during periods of slack private-sector labor demand. Therefore, any negative relationship between public and private hiring may reflect a rise in the former taking place in response to a fall in the latter. In a statistical sense, this can lead to biased estimates of the causal effect of public employment on private employment (and, analogously, unemployment). To the extent that private employment is low because of long-term structural factors, this source of endogeneity is expunged by the use of fixed effects. To the extent that private-sector labor demand is lower during periods of weak economic activity, this is controlled for by the GDP growth rate. To the extent that changes in labor legislation over time may affect private-sector hiring for a given level of economic activity, this is controlled for by the hiring and firing regulations index.

Nonetheless, there may be a residual source of endogeneity due to unobservable time-varying country-specific factors. It is not automatic that the source of endogeneity would lead to an

overestimate of crowding out. For example, a demographics-driven rise in the labor force in a demand-constrained environment could lead to a rise in unemployment. Government could plausibly increase the pace of hiring in response, but this would only lead to upward bias if hiring increased sufficiently to increase the public employment *rate* as a share of the labor force. A small increase that does not match the increase in the labor force in percentage terms would in fact lead to a downward bias and an underestimate of crowding out. Equivalently, a large increase in the labor force may not be matched by a rise in private hiring in a demand-constrained environment, such that the private employment rate falls. The number of government hires could well rise in response, but it is the rate relative to the labor force that determines whether crowding out is over- or underestimated.[17]

We have presented examples where government employment increases in response to weak private labor demand, but it is also possible that slack in the labor market is associated with lower government revenues, which would tend to reduce government hiring. Therefore, while treating public employment as exogenous can cause bias, there is no a priori reason to suspect bias of a particular direction that exaggerates crowding out.

Many studies attempt to address endogeneity using long lags of multiple government size measures directly (Feldman, 2009a) or as instruments (Feldman, 2009b), three-stage-least squares (Algan et al, 2002), cointegration analysis that allows for multiple cointegrating vectors (Malley and Moutos, 1996), or time-series causality analysis (Christopoulos and Tsionas, 2002). Regardless of the method used, their results indicate unidirectional employment effects from the public to the private sector.

In this paper, we investigate the potential bias in either direction by using Generalized Method of Moments (GMM) estimations.[18]Also known as Generalized Instrumental Variables (GIV), additional moment conditions are provided by means of instruments, if valid. We apply GMM/GIV in a static framework (Cameron and Trivedi, 2006), taking advantage of advances in the field of dynamic panel data estimation[19] to estimate each specification as a system using multiple additional moment conditions. In particular, we can use potentially multiple lags of the endogenous variables (public employment and GDP growth) in levels as instruments for

[17] Following standard analysis (Wooldridge, 2002:62), depending on the nature of the correlation between the variables of interest and the error term, the bias of the estimate for the unemployment coefficient is shown by: $\hat{\beta}_U = \beta_U + \lambda_U \frac{Cov[Pub,L]}{Var[Pub]}$. $\hat{\beta}_U$ is the estimate of the coefficient $\beta_U$ on the public employment rate (*Pub*) in the equation for unemployment. *L* is the omitted factor in the error term. If we have a development that, ceteris paribus, increases the unemployment rate, ($\lambda_U$>0), $\hat{\beta}_U$will be upward biased if that factor is positively correlated with the public hiring *rate*. Similarly, the bias of the estimate for the private employment coefficient is given by: $\hat{\beta}_P = \beta_P + \lambda_P \frac{Cov[Pub,L]}{Var[Pub]}$. $\lambda_U$>0 would generally imply $\lambda_P$ <0. There is an underestimate of $\hat{\beta}_P$ if the development is positively correlated with the public hiring rate.

[18] We also attempted specifications in which public-sector/administration employment is regressed on either private-sector employment or overall unemployment. We found that the coefficients were close to zero in three of the four specifications.

[19] See for example Arellano and Bond (1991), Ahn and Schmidt (1995), and Blundell and Bond (1998). The Appendices contains estimates of dynamic panels.

first-differenced estimation of the specifications together with potentially multiple lags of the differences as instruments for the levels equations. An advantage of this approach over traditional 2SLS is that the additional instruments can yield potentially large efficiency gains.[20]

For further robustness checks, results from other estimation methods are reported in the Appendices. To control for possible autocorrelation within each country or common across the panel, we run the fixed-effect (FE) estimation with autoregressive disturbances. In addition to FE estimators, we also use random effects (RE) estimation methods, with and without autoregressive disturbances. To check for possible persistence in a dynamic panel framework, we run regressions with one or two lags of the dependent variable. Because this, by construction, generates endogeneity bias, we make use of dynamic systems GMM estimation, which we also deploy to account for the possible endogeneity of public employment and GDP.

## B. Unemployment and Public Employment

Before presenting the estimation results, we pause to clarify how to interpret the coefficients on the public employment rate. If the coefficient, $\beta_u$, is close to -1, we can say the additional public jobs are purely accounted for by a fall in unemployment, which means there is no net flow of workers from the private sector to the public sector and, hence, no crowding out. If $\beta_u$ is more negative than -1, then public employment also generates private-sector jobs, or crowding in. If $\beta_u$ is between 0 and -1, it means some private-sector jobs are lost, but fewer than the public jobs created, so there is partial crowding out. If $\beta_u$ is close to 0, it means there is no change in unemployment because job creation in the public sector is completely cancelled by private-sector job losses, which means full crowding out. If it is larger than 0, then crowding-out effects are so strong that overall unemployment rises and there is more than full crowding out.

Table 1 reports estimated coefficients for the unemployment equations. "Public-Sector Employment Rates" in the first three columns are measured by the broad definition and "Public Administration Employment Rates" in the last three columns by the narrow definition. For each measure, we report fixed effects (within-groups) results with control variables and without them,[21] as well as the static GMM results (with endogenous public hiring, endogenous GDP, and exogenous other controls).

---

[20] Our use of internal instruments is dictated by data availability. External instruments are not available for a panel of developing countries and their validity, as in the case of the fiscal multipliers literature, is still a topic of debate.

[21] Control variables account for observable time-varying country factors that may be correlated with the variable of interest, but can diminish the sample size due to data availability.

As shown in columns (1) to (3), the impact of the broad public-sector employment rate on the unemployment rate is close to zero. The *p*-values reject the hypothesis that there is no crowding out. In other words, there is at least partial crowding out. Furthermore, the coefficients are insignificantly different from 0, which is consistent with a full crowding-out effect.[22] The narrow measure gives the same results without controls in column (4). However, the results are slightly different with control variables in column (5), where the public administration employment rate increases the unemployment rate significantly; a 1 percentage point increase in the public administration employment rate leads to a ¼ percentage point higher unemployment rate, i.e., there is more than full crowding out. The GMM estimates from column (6) imply that there is significantly less than full crowding out for public administration employment, but the extent is still large. The effects in Table 1 are representative of those observed in Appendix I.

Table 1: Regression of Unemployment Rate on Public Employment Rate

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| VARIABLES | UnempRt | UnempRt | UnempRt | UnempRt | UnempRt | UnempRt |
| Public- Sector Employment Rate | -0.050 | -0.027 | 0.066 | | | |
| | (0.052) | (0.062) | (0.09) | | | |
| Public-Administration Employment Rate | | | | -0.060 | 0.242* | -0.167** |
| | | | | (0.101) | (0.138) | (0.08) |
| GDP Growth Rate | | -0.062 | -0.079 | | -0.120 | -0.428*** |
| | | (0.086) | (0.12) | | (0.075) | (0.13) |
| Urbanization Rate | | 0.016 | 0.098 | | 0.083 | -0.009 |
| | | (0.083) | (0.11) | | (0.136) | (0.06) |
| Hiring and Firing Regulations | | -0.402 | -0.022 | | 0.106 | 0.451* |
| | | (0.280) | (0.28) | | (0.237) | (0.27) |
| Openness | | -0.000*** | 0 | | 0.010 | 0.005 |
| | | (0.000) | 0.00 | | (0.012) | (0.02) |
| Observations | 419 | 292 | 292 | 441 | 314 | 314 |
| R-squared | 0.070 | 0.126 | | 0.045 | 0.107 | |
| Number of countries | 116 | 82 | 82 | 133 | 94 | 94 |
| *p*-value ($H_0$: b=-1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Instruments | | | 20 | | | 18 |
| GMM difference | | | >= 3 lags | | | 2 lags |
| GMM levels | | | No | | | >=4 lags |
| Sargan *p*-value | | | 0.185 | | | 0.298 |

Robust standard errors in parentheses

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

All regressions contain a constant term and are estimated with period-specific effects using the within-groups estimator (columns 1, 2, 4 and 5) or systems GMM (columns 3 and 6) with instruments for the difference and levels equations, where public employment and GDP growth are treated as endogenous.

[22] Failure to reject a hypothesis of full crowding out is not the same as accepting the hypothesis. Practically, this is an important distinction when point estimates are far from 0 but large standard errors prevent statistically-significant differences.

## C. Private-Sector Employment and Public Employment

If the coefficient, $\beta_p$, is positive, it means public employment generates private-sector employment; that is, it crowds in private-sector employment. If $\beta_p$ is close to zero, we find no evidence of crowding out, because the increase of public employment has no effect on private employment. If $\beta_p$ lies between -1 and 0, this implies partial crowding out. If the value of $\beta_p$ is -1, it means one private job is exactly substituted with one new public job, showing full crowding out. $\beta_p$ lower than -1 means private-sector job losses exceed public sector job increments and there is more than full crowding out.

Estimated coefficients from the employment equations are reported in Table 2. Columns (1) to (3) refer to the broad measure of public employment (and the corresponding definition of private employment), while columns (4) to (6) correspond to the narrow measure of public employment (and the corresponding definition of private employment).

Table 2 : Regression of Private-Sector Employment Rate on Public Employment Rate

| VARIABLES | (1) PrvEmpRt | (2) PrvEmpRt | (3) PrvEmpRt | (4) PrvEmpRt | (5) PrvEmpRt | (6) PrvEmpRt |
|---|---|---|---|---|---|---|
| Public Sector Employment Rate | -0.849*** | -0.979*** | -1.271*** | | | |
| | (0.060) | (0.052) | (0.12) | | | |
| Public Adm Employment Rate | | | | -1.007*** | -1.059*** | -0.795*** |
| | | | | (0.168) | (0.204) | (0.14) |
| GDP Growth Rate | | -0.059 | -0.115 | | 0.086 | 0.193 |
| | | (0.108) | (0.13) | | (0.147) | (0.18) |
| Urbanization Rate | | -0.248* | -0.102 | | -0.143 | -0.008 |
| | | (0.126) | (0.09) | | (0.195) | (0.10) |
| Hiring and Firing Regulations | | 0.204 | -0.416 | | -0.255 | -0.504 |
| | | (0.326) | (0.41) | | (0.343) | (0.43) |
| Openness | | 0.000*** | 0.000 | | 0.026 | 0.036 |
| | | (0.000) | 0.00 | | (0.022) | (0.02) |
| Observations | 396 | 282 | 282 | 454 | 315 | 315 |
| R-squared | 0.488 | 0.644 | | 0.139 | 0.148 | |
| Number of id | 110 | 80 | 80 | 139 | 94 | 94 |
| p-value (H0: b=-1) | 0.014 | 0.680 | 0.027 | 0.968 | 0.772 | 0.129 |
| Instruments | | | 22 | | | 30 |
| GMM difference | | | 2 lags | | | >= 2 lags |
| GMM levels | | | >= 2 lags | | | >= 4 lags |
| Sargan p-value | | | 0.218 | | | 0.385 |

Robust standard errors in parentheses

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

All regressions contain a constant term and are estimated with period-specific effects using the within-groups estimator (columns 1,2, 4 and 5) or systems GMM (columns 3 and 6) with instruments for the difference and levels equations, where public employment and GDP growth are treated as endogenous.

Consistent with the two scatter plots of public and private employment rates in Figure 5, all coefficients indicate a very strong negative relationship between public- and private-sector employment rates. For example, 100 new public jobs crowd out 98 private jobs (column (2)). Generally, the coefficients are close to -1 and are not significantly different from that value despite being precisely estimated. Any deviations from this value are not systematic. Crowding out is estimated to be lower when public administration is endogenous than when it is exogenous—as was the case in Table 1—but crowding out is estimated to be higher when the broadly defined public sector is endogenous than when it is exogenous. The coefficient estimates in Appendix II mostly have an absolute value that is slightly but insignificantly less than 1.

Using different data sources, the unemployment and employment regressions are consistent. Public employment just about fully crowds out private-sector employment regardless of the definition, such that a rise in government hiring would be offset by decreases in private employment, resulting in no change in overall unemployment. Of course, these results apply symmetrically to decreases in government hiring, so that reduced government hiring would be almost completely offset by additional private-sector jobs.[23]

## VI. Conclusion

Regressions of unemployment on public employment and of private employment on public employment, each of which is based on two definitions of public employment, find robust evidence that public employment crowds out private employment. The magnitude is statistically indistinguishable from full crowding out. Therefore, for our complete sample of developing and advanced countries, a public job typically comes at the cost of a private-sector job and therefore does not reduce unemployment.

At a time when many countries find themselves having to improve their fiscal positions, identifying and curtailing inefficient expenditures that have unintended consequences is paramount. Public-sector hiring: (i) does not reduce unemployment, (ii) increases the fiscal burden, and (iii) inhibits long-term growth through reductions in private-sector employment. Together, this would imply that public hiring is detrimental to long term fiscal sustainability with limited benefit, so that scarce resources could be better spent on other social needs, including protecting the most vulnerable.

Our results have drawn on evidence based on various measures of employment. While there are many plausible mechanisms, further work would be needed to identify which of these may operate. For example, complementary analysis of the relationship between wages in the private and public sectors would shed light on whether crowding out occurs through the labor market by increasing reservation wages. Analysis based on the relationship between government wage shares, tax rates, and private-sector employment could also be useful.

[23] We investigated the possibility of asymmetries between increases and decreases in government hiring but found no evidence of differential effects. Results are available on request.

Further work could be undertaken to analyze the interactions between public employment and labor force participation. Algan et al (2002) estimate a net decrease in employment as a share of the working age population that exceeds the net increase in unemployment as a share of the labor force. They interpret this as an increase in public employment leading to a net decrease in labor force participation. An extension of this analysis to developing countries based on the working-age population or a study of the direct relationship between labor force participation and public hiring would be a welcome contribution.

## References

Algan, Y. Cahuc and A. Zylberberg, 2002, "Public Employment and Labour Market Performance," *Economic Policy*, 34, pp.7–65.

Arellano, M. and S. Bond, 1992, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58(2), pp.277–97.

Aschauer, D., 1989, "Does Public Capital Crowd Out Private Capital?" *Journal of Monetary Economics*, 24(2), pp.171–88.

Baker, D., D. Glynn, A. Howell and J. Schmitt, 2007, "Are Protective Labor Market Institutions at the Root of Unemployment? A Critical Review of the Evidence," *Capitalism and Society*, 2(1), pp.1–71.

Baltagi, B. and P. Wu, 1999, "Unequally Spaced Panel Data Regressions With AR(1) Disturbances," *Econometric Theory*, 15(06), pp.814–23.

Barro, R. and X. Sala-i-Martin, 2004, "Economic Growth," 2nd edition, (London: MIT Press).

Bahar, a. and J Mok, 2013, "Does Public-Sector Employment Fully Crowd Out Private-Sector Employment?", *IMF Working Paper WP/13/146*

Bernal-Verdugo, L., D. Furceri and D. Guillaume, 2012, "Labor market Flexibility and Unemployment; New Empirical Evidence of Static and Dynamic Effects," *IMF Working Paper WP/12/64*.

Blanchard, O and J Wolfers, 2000, "The Role Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence," *The Economic Journal*, 110, C1–C33.

Campante, F. and D. Chor, 2012, "Why was the Arab World Poised for Revolution? Schooling, Economic Opportunities, and the Arab Spring," *Journal of Economic Perspectives*, 26(2), pp. 167–88.

Demekas, D. and Z. Kontolemis, 2000, "Government Employment, Wages and Labour Market Performance," *Oxford Bulletin of Economics and Statistics*, 62, 391–414.

Easterly, W. and S. Rebelo, 1993, "Fiscal Policy and Economic Growth: An Empirical Investigation," *Journal of Monetary Economics*, 32(3), pp.417–58.

Espinoza, R. (forthcoming), "Government Spending, Subsidies and Economic Efficiency in the GCC," in R. Espinoza, G. Fayad and A. Prasad (eds.), *The Macroeconomics of the Arab States of the Gulf*, Oxford University Press.

Faggio, G. and H. Overman, 2012, "The Effect of Public Sector Employment on Local Labour Markets,"*SERC Discussion Paper*, 111.

Feldmann, H. 2009a, "Government Size and Unemployment: Evidence from Developing Countries," *The Journal of Developing Areas,* 43(1), pp.315–30.

Feldmann, H, 2009b, "Government Size and Unemployment in Developing Countries," *Applied Economics Letters*, 17, pp.289–92.

Freeman, R. 2005, "Labor Market Institutions without Blinders: The Debate over Flexibility and Labor Market Performance," *International Economic Journal*, 19(2), pp.129–45.

Frankel, J, C Vegh and G. Vuletin, 2012, "On Graduation from Procyclicality,"*Journal of Development Economics*.

IMF, 2010, *Middle East and Central Asia Regional Economic Outlook*: October 2010 (Washington)

IMF, 2011a, *Middle East and Central Asia Regional Economic Outlook*: May 2011 (Washington).

IMF, 2011b, *Middle East and Central Asia Regional Economic Outlook*: October 2011 (Washington).

IMF, 2012a, Fiscal Policy and Employment in Advanced and Emerging Economies, *Fiscal Affairs Department* Policy Paper (Washington).

IMF, 2012b, *Middle East and Central Asia Regional Economic Outlook*: November 2012.

Kapstein, E. and N. Converse, 2008, "*The Fate of Young Democracies*," (Cambridge: Cambridge University Press).

Layard, R., S. Nickell and R. Jackman, 2005, "*Unemployment: Macroeconomic Performance and the Labor Market," 2nd Edition* (Oxford: Oxford University Press).

Lamo, A, J. Perez, and L. Schuknecht, 2012, "Public or Private Sector Wage Leadership? An International Perspective," *Scandinavian Journal of Economics*, 114(1), pp.228-244.

Malley, J. and T. Moutos, 1996, "Does Government Employment "Crowd-out" Private Employment? Evidence from Sweden," *Scandinavian Journal of Economics*, 98(2), pp.289-302.

Nickell, S., 1997, "Unemployment and Labor Market Rigidities: Europe vs North America," *Journal of Economic Perspectives*, 11(3), pp.55–74.

Perez, J. and A. Sanchez, 2010, "Is There a Signaling Role for Public Wages?" *European Central Bank Working Paper 1148* (January).

Salehi-isfahani, D. and N. Dhillon, 2008, "Stalled Youth Transitions in the Middle East, A Framework for Policy Reform," *Dubai School of Government Working Paper 8*.

The Economist, 2012, *Parsing Public Payrolls*, October 27th U.S. edition.

Wooldridge, J., 2002, "*Econometric Analysis of Cross-Section and Panel Data*," (Cambridge: MIT Press).

World Bank, 2012a, *World Development Report 2013: Jobs*, World Bank (Washington).

World Bank, 2012b, *Free to Prosper: Jobs in the Middle East and North Africa- Overview* (Washington).

World Bank, 2012c, *Enabling Employment Miracles*, Middle East and North Africa Regional Economic Update: Spring 2012 (Washington).

## APPENDIX I. REGRESSIONS OF UNEMPLOYMENT RATE ON PUBLIC EMPLOYMENT

In this section, we present the results of the unemployment equation estimated by other estimation methods.

Table A.1 reports results with the Fixed Effects (FE) estimation method of panel models with AR(1) disturbances by Baltagi and Wu (1999). We test for serial correlation discussed by Wooldridge (2002) and report the *p*-value in the bottom of the table. All coefficients are insignificant and very close to our main results in Table 1, suggesting that the public employment rate has no clear relationship with unemployment rate.

Table A.1 : Impact of Public Employment on Unemployment Rate, FE with AR(1)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| VARIABLES | UnempRt | UnempRt | UnempRt | UnempRt |
| Public-Sector Employment Rate | 0.031 | -0.004 | | |
| | (0.076) | (0.091) | | |
| Public-Administration Employment Rate | | | -0.228 | 0.079 |
| | | | (0.167) | (0.237) |
| GDP Growth Rate | | -0.309*** | | -0.386*** |
| | | (0.081) | | (0.093) |
| Urbanization Rate | | 0.244 | | 0.293 |
| | | (0.147) | | (0.204) |
| Hiring and Firing Regulations | | -0.396 | | 0.162 |
| | | (0.364) | | (0.345) |
| Openness | | 0.001* | | 0.024* |
| | | (0.000) | | (0.014) |
| Observations | 303 | 210 | 308 | 220 |
| R-squared | 0.153 | 0.219 | 0.075 | 0.323 |
| Number of countries | 99 | 74 | 106 | 81 |
| *p*-value($H_0$: b=-1) | 0.000 | 0.000 | 0.000 | 0.000 |
| Autocorr Test | 0.000 | 0.000 | 0.000 | 0.000 |

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
All regressions contain a constant term and are estimated with country-specific and period-specific fixed effects.

The next two tables report coefficients estimated by Random Effects (RE) (Table A.2) and RE estimation with AR(1) disturbances (Table A.3). The results are quite similar in that the coefficients are close to zero but, unlike Table , there is no significantly positive coefficient. We add a row for the *p*-values of the Hausman Test, which offers mixed results regarding the choice between FE and RE approaches.

Table A.2 : Impact of Public Employment on Unemployment Rate, RE

| VARIABLES | (1) UnempRt | (2) UnempRt | (3) UnempRt | (4) UnempRt |
|---|---|---|---|---|
| Public-Sector Employment Rate | -0.035 | -0.027 | | |
| | (0.040) | (0.054) | | |
| Public-Administration Employment Rate | | | -0.022 | 0.069 |
| | | | (0.078) | (0.132) |
| GDP Growth Rate | | -0.053 | | -0.082 |
| | | (0.086) | | (0.078) |
| Urbanization Rate | | 0.030 | | 0.028 |
| | | (0.038) | | (0.035) |
| Hiring and Firing Regulations | | -0.516** | | -0.183 |
| | | (0.249) | | (0.235) |
| Openness | | -0.000*** | | -0.003 |
| | | (0.000) | | (0.011) |
| Observations | 419 | 292 | 441 | 314 |
| Number of countries | 116 | 82 | 133 | 94 |
| Hausman Test | 0.861 | 0.073 | 0.039 | 0.086 |
| $p$-value($H_0$: b=-1) | 0.000 | 0.000 | 0.000 | 0.000 |

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
All regressions contain a constant term and are estimated with region-specific and period-specific fixed effects.

Table A.3 : Impact of Public Employment on Unemployment Rate, RE with AR(1)

| VARIABLES | (1) UnempRt | (2) UnempRt | (3) UnempRt | (4) UnempRt |
|---|---|---|---|---|
| Public-Sector Employment Rate | -0.029 | -0.051 | | |
| | (0.028) | (0.048) | | |
| Public Administration Employment Rate | | | -0.034 | 0.022 |
| | | | (0.069) | (0.097) |
| GDP Growth Rate | | -0.092 | | -0.093 |
| | | (0.063) | | (0.072) |
| Urbanization Rate | | 0.036 | | 0.033 |
| | | (0.032) | | (0.037) |
| Hiring and Firing Regulations | | -0.468** | | -0.248 |
| | | (0.224) | | (0.222) |
| Openness | | -0.000 | | -0.007 |
| | | (0.000) | | (0.009) |
| Observations | 419 | 292 | 441 | 314 |
| Number of countries | 116 | 82 | 133 | 94 |
| Hausman Test | 0.000 | 0.001 | 0.000 | 1.000 |
| $p$-value($H_0$: b=-1) | 0.000 | 0.000 | 0.000 | 0.000 |
| Autocorr Test | 0.000 | 0.000 | 0.000 | 0.000 |

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

All regressions contain a constant term and are estimated with region-specific and period-specific fixed effects

Table A.4 : Impact of Public Employment on Unemployment Rate, Systems GMM

| VARIABLES | (1) UnempRt | (2) UnempRt | (3) UnempRt | (4) UnempRt |
|---|---|---|---|---|
| Unemployment Rate (-1) | 0.404*** | 0.278* | 0.641*** | 0.751*** |
| | [0.126] | [0.143] | [0.119] | [0.141] |
| Unemployment Rate (-2) | | | -0.130* | -0.076 |
| | | | [0.073] | [0.049] |
| Public-Sector Employment Rate | 0.129 | | 0.197*** | |
| | [0.091] | | [0.069] | |
| Public Administration Employment Rate | | -0.064 | | -0.062 |
| | | [0.148] | | [0.179] |
| GDP Growth Rate | -0.187 | -0.232 | -0.411** | -0.659*** |
| | [0.126] | [0.145] | [0.198] | [0.200] |
| Openness | -0.000** | -0.029* | -0.006 | 0.016 |
| | [0.000] | [0.016] | [0.057] | [0.049] |
| Urbanization Rate | 0.01 | -0.077 | -0.187 | 0.24 |
| | [0.070] | [0.051] | [0.251] | [0.213] |
| Hiring and Firing Regulations | 0.249 | 0.306 | 0 | -0.021 |
| | [0.263] | [0.237] | [0.000] | [0.027] |
| Observations | 260 | 285 | 216 | 241 |
| Number of countries | 79 | 88 | 75 | 84 |
| LR coefficient | 0.217 | -0.089 | 0.404 | -0.192 |
| $p$-value($H_0$: LR = 0) | 0.164 | 0.662 | 0.023 | 0.721 |
| $p$-value($H_0$: LR = -1) | 0.000 | 0.000 | 0.000 | 0.133 |
| Instruments | 43 | 46 | 39 | 39 |
| GMM difference (lagged dependent variable) | >=3 | >=2 | >=2 | >=2 |
| GMM difference (endogenous variables) | >=2 | >=2 | 2;3 | 2;3 |
| GMM levels (lagged dependent variable) | >=2 | >=3 | >=1 | >=1 |
| GMM levels (endogenous variables) | >=2 | >=2 | >=1 | >=1 |
| AR(1) $p$-value | 0.128 | 0.748 | 0.076 | 0.197 |
| AR(2) $p$-value | 0.022 | 0.079 | 0.309 | 0.416 |
| AR(3) $p$-value | 0.452 | 0.155 | | |
| Sargan $p$-value | 0.258 | 0.218 | 0.216 | 0.515 |

GMM Standard errors in brackets;
*** $p$<0.01, ** $p$<0.05, * $p$<0.1
All regressions contain a constant term and are estimated with period-specific effects using systems GMM with instruments for the difference and levels equations.

Table A.4 reports the Systems GMM estimates. The long run coefficients for each are robust to the precise specification of the instrument set, which was chosen to reduce standard errors subject to the Sargan overidentification test and the Arellano and Bond (1991) tests of autocorrelation in the first differenced residuals. Specifications with one lag of the dependent variable[24] are in the first two columns; they indicate significant second-order autocorrelation,

[24] Specifications with lags of the explanatory variables are available on request. These yielded similar long run results but with much larger standard errors. The short run coefficients tended to indicate an initial short run

(continued…)

which would render many moment conditions invalid and requires the instrument set to be limited to longer lags, depending on the order of correlation (Arellano and Bond, 1991:279; Ahn and Schmidt, 1995:9). Given second-order autocorrelation, an alternative approach is to introduce an additional lag of the dependent variable, as done in columns (3) and (4). The long run effect is less precisely estimated because it comprises three coefficients. Nonetheless, the results point to more than full crowding out for public employment (significantly so in column (3)) and (insignificantly) less than full crowding out for public administration employment.

---

positive effect of public sector hiring on labor markets (higher employment or lower unemployment) but a subsequent negative effect, resulting in full long run crowding out.

## APPENDIX II. REGRESSIONS OF PRIVATE-SECTOR EMPLOYMENT ON PUBLIC EMPLOYMENT

Table A.5 reports results with the FE AR(1) results. The crowding out effects reported here are lower than elsewhere in the paper.

Table A.5 : Impact of Public on Private-Sector Employment Rate, FE with AR(1)

| VARIABLES | (1) PrvEmpRt | (2) PrvEmpRt | (3) PrvEmpRt | (4) PrvEmpRt |
|---|---|---|---|---|
| Public-Sector Employment Rate | -0.343** | -0.930*** | | |
| | (0.142) | (0.125) | | |
| Public Administration Employment Rate | | | -0.243 | -0.175 |
| | | | (0.254) | (0.354) |
| GDP Growth Rate | | 0.187 | | 0.382*** |
| | | (0.115) | | (0.134) |
| Urbanization Rate | | -0.330 | | -0.264 |
| | | (0.223) | | (0.313) |
| Hiring and Firing Regulations | | 0.118 | | -0.637 |
| | | (0.509) | | (0.480) |
| Openness | | -0.001 | | 0.012 |
| | | (0.000) | | (0.022) |
| Observations | 286 | 202 | 315 | 221 |
| R-squared | 0.134 | 0.473 | 0.291 | 0.112 |
| Number of countries | 91 | 71 | 105 | 82 |
| $p$-value($H_{0:}$ b=-1) | 0.000 | 0.575 | 0.003 | 0.021 |
| Autocorr Test | 0.000 | 0.000 | 0.000 | 0.000 |

Robust standard errors in parentheses

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

All regressions contain a constant term and are estimated with country-specific and period-specific fixed effects.

The next two tables report coefficients estimated by RE estimation (Table A.6) and RE estimation with AR(1) disturbances (Table A.7). The coefficients have an absolute value of slightly less than unity, but almost always to an insignificantly different extent.

Table A.6 : Impact of Public on Private-Sector Employment Rate, RE

| VARIABLES | (1) PrvEmpRt | (2) PrvEmpRt | (3) PrvEmpRt | (4) PrvEmpRt |
|---|---|---|---|---|
| Public-Sector Employment Rate | -0.896*** | -0.978*** | | |
| | (0.063) | (0.048) | | |
| Public Administration Employment Rate | | | -0.971*** | -0.897*** |
| | | | (0.109) | (0.150) |
| GDP Growth Rate | | -0.084 | | -0.000 |
| | | (0.108) | | (0.150) |
| Urbanization Rate | | -0.021 | | -0.051 |
| | | (0.089) | | (0.068) |
| Hiring and Firing Regulations | | 0.393 | | -0.025 |
| | | (0.330) | | (0.322) |
| Openness | | 0.000*** | | 0.027 |
| | | (0.000) | | (0.018) |
| Observations | 396 | 282 | 454 | 315 |
| Number of countries | 110 | 80 | 139 | 94 |
| Hausman Test | 0.010 | 0.740 | 0.952 | 0.070 |
| $p$-value($H_0$: b=-1) | 0.098 | 0.646 | 0.787 | 0.493 |

Robust standard errors in parentheses

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

All regressions contain a constant term and are estimated with region-specific and period-specific fixed effects.

Table A.7 : Impact of Public on Private-sector Employment Rate, RE with AR(1)

| VARIABLES | (1) PrvEmpRt | (2) PrvEmpRt | (3) PrvEmpRt | (4) PrvEmpRt |
|---|---|---|---|---|
| Public-Sector Employment Rate | -0.839*** | -0.959*** | | |
| | (0.061) | (0.069) | | |
| Public Administration Employment Rate | | | -0.874*** | -0.778*** |
| | | | (0.108) | (0.181) |
| GDP Growth Rate | | -0.096 | | -0.063 |
| | | (0.106) | | (0.127) |
| Urbanization Rate | | 0.010 | | -0.065 |
| | | (0.058) | | (0.070) |
| Hiring and Firing Regulations | | 0.369 | | 0.065 |
| | | (0.365) | | (0.390) |
| Openness | | 0.000 | | 0.026 |
| | | (0.000) | | (0.017) |
| Observations | 396 | 282 | 454 | 315 |
| Number of countries | 110 | 80 | 139 | 94 |
| Hausman Test | 0.000 | 0.000 | 0.000 | 0.164 |
| $p$-value($H_0$: b=-1) | 0.008 | 0.551 | 0.245 | 0.221 |
| Autocorr Test | 0.000 | 0.000 | 0.000 | 0.000 |

Robust standard errors in parentheses

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

All regressions contain a constant term and are estimated with region-specific and period-specific fixed effects.

Table A.8 : Impact of Public on Private-Sector Employment Rate, System GMM

| VARIABLES | (1) PrvempRt | (2) PrvempRt | (3) PrvempRt | (4) PrvempRt |
|---|---|---|---|---|
| Private-Employment Rate (-1) | 0.406* | 0.386 | 0.415 | 0.427*** |
| | (0.23) | (0.28) | (1.82) | (0.02) |
| Private-Employment Rate (-2) | | | -0.048 | 0.031 |
| | | | (0.05) | (0.03) |
| Public-Sector Employment Rate | -0.463 | | -0.599 | |
| | (0.30) | | (3.27) | |
| Public Administration Employment Rate | | -0.506 | | -0.619*** |
| | | (0.32) | | (0.07) |
| GDP Growth Rate | 0.185 | 0.059 | 0.21 | 0.710*** |
| | (0.33) | (0.19) | (0.51) | (0.08) |
| Openness | 0 | 0.027 | 0 | 0.030*** |
| | 0.00 | (0.05) | 0.00 | (0.01) |
| Urbanization Rate | 0.056 | 0.01 | -0.057 | -0.076** |
| | (0.10) | (0.07) | (0.19) | (0.03) |
| Hiring and Firing Regulations | -0.009 | -0.439 | 0.04 | -2.145*** |
| | (0.47) | (0.37) | (4.99) | (0.18) |
| Observations | 223 | 244 | 158 | 171 |
| Number of countries | 73 | 83 | 60 | 71 |
| LR coefficient | -0.78 | -0.825 | -0.945 | -1.143 |
| *p* -value($H_0$: LR = 0) | 0.001 | 0.003 | 0.698 | 0.000 |
| *p* -value($H_0$: LR = -1) | 0.337 | 0.522 | 0.982 | 0.306 |
| Instruments | 32 | 32 | 45 | 45 |
| GMM difference (lagged dependent variable) | >=3 | >=3 | >=2 | >=2 |
| GMM difference (endogenous variables) | >=3 | >=3 | >=2 | >=2 |
| GMM levels (lagged dependent variable) | >=3 | >=3 | >=1 | >=1 |
| GMM levels (endogenous variables) | >=3 | >=3 | >=1 | >=1 |
| AR(1) *p* -value | 0.285 | 0.405 | 0.801 | 0.171 |
| AR(2) *p* -value | 0.037 | 0.041 | 0.182 | 0.238 |
| AR(3) *p* -value | 0.457 | 0.19 | | |
| Sargan *p* -value | 0.349 | 0.155 | 0.326 | 0.168 |

GMM Standard errors in brackets;
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
All regressions contain a constant term and are estimated with period-specific effects using systems GMM with instruments for the difference and levels equations.

Table A.8 reports the Systems GMM estimation for employment, as done in Table A.4. The short run coefficients indicate substantially less than full crowding out, for example column 2 indicates a 1 percentage point rise in public administration employment would reduce private employment by ½ percentage point in that period. Many short run coefficients are insignificantly different from zero. In the long run, all estimates are insignificantly different from -1, which is consistent with full crowding out. For broadly defined public sector employment – columns (1) and (3) – the coefficients are less than one in absolute value. For public administration employment one coefficient is less than -1 and one is more than -1.

| VARIABLES | (1) RE PrvEmpRt | (2) RE PrvEmpRt | (3) FE PrvEmpRt | (4) FE PrvEmpRt | (5) RE PrvEmpRt | (6) RE PrvEmpRt |
|---|---|---|---|---|---|---|
| Public-Sector Employment Rate | -0.891*** | | -0.963*** | | -0.980*** | |
| | (0.074) | | (0.077) | | (0.070) | |
| Public Employment X MENAP | -0.213 | | -0.070 | | -0.025 | |
| | (0.135) | | (0.117) | | (0.102) | |
| Public Employment X CCA | 0.125 | | 4.944*** | | 3.761*** | |
| | (0.097) | | (1.338) | | (1.361) | |
| Public Administration Employment Rate | | -0.897*** | | -0.843*** | | -0.778*** |
| | | (0.114) | | (0.284) | | (0.284) |
| Public Administration Employment X MENAP | | 0.079 | | -0.413 | | -0.449 |
| | | (0.212) | | (0.317) | | (0.297) |
| Public Administration Employment X CCA | | 0.315*** | | 5.165*** | | 3.514*** |
| | | (0.075) | | (1.394) | | (1.284) |
| GDP Growth Rate | | | -0.027 | 0.007 | -0.078 | -0.092 |
| | | | (0.091) | (0.110) | (0.092) | (0.125) |
| Urbanization Rate | | | -0.248* | -0.148 | -0.020 | -0.050 |
| | | | (0.133) | (0.225) | (0.090) | (0.087) |
| Hiring and Firing Regulations | | | 0.279 | 0.073 | 0.420 | 0.345 |
| | | | (0.360) | (0.408) | (0.362) | (0.385) |
| Openness | | | 0.000*** | 0.006 | 0.000*** | 0.014 |
| | | | (0.000) | (0.021) | (0.000) | (0.017) |
| Observations | 396 | 293 | 282 | 225 | 282 | 225 |
| R-squared | | | 0.670 | 0.233 | | |
| Number of countries | 110 | 89 | 80 | 73 | 80 | 73 |
| *p*-value($H_0$: b+bM=0) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *p*-value($H_0$: b+bM=-1) | 0.288 | 0.320 | 0.532 | 0.001 | 0.919 | 0.009 |
| *p*-value($H_0$: b+bC=0) | 0.000 | 0.000 | 0.004 | 0.003 | 0.040 | 0.033 |
| *p*-value($H_0$: b+bC=-1) | 0.011 | 0.003 | 0.000 | 0.000 | 0.005 | 0.004 |
| Hausman Test | 0.024 | 0.001 | | | 1.000 | 1.000 |

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

All regressions contain a constant term and are estimated with country-specific, region-specific and period-specific fixed effects.