

# Jobless Growth?

## Okun's Law in East Asia

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## Abstract

Was economic growth in East Asia jobless? This paper addresses this question using data from eight East Asian countries during the period between 1997 and 2011 to estimate the Okun's Law Coefficient, which captures the relationship between growth and employment. The analysis suggests that growth was not jobless. However, there is considerable variation across countries. Generally, the effect of growth on employment tends to magnify under more flexible hiring and firing rules. Yet even where labor markets are more tightly regulated, economic

growth affects employment, not necessarily in the aggregate but in its composition. There is evidence that agricultural employment moves counter-cyclically, as opposed to non-agricultural employment. The effect is particularly pronounced in periods of economic crisis, suggesting that agriculture may serve as a shock-absorber for workers laid off in the industrial sector. Isolating non-agricultural employment reveals a stronger relationship between growth and job creation.

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# Jobless Growth? Okun's Law in East Asia

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## Introduction

Okun's Law, based on the seminal work of Okun (1962), captures the relationship between unemployment and economic performance, and the responsiveness of one to the other is captured by the Okun's Law Coefficient (OLC). Okun's Law is a crude approach to analyzing the transmission of economic growth into employment as it does not pay close attention to the multiple structural mechanisms that account for job creation and job destruction. Perman and Tavera (2005:2502) thus suggest interpreting the OLC as 'the net effect of several macroeconomic structural parameters representative of the macroeconomic behavior of the country under examination and of the characteristics of the adjustment mechanisms lying behind the [...] relationship between output gaps and employment gaps over the business cycle.'

This paper explores the 'net effect' of growth on jobs by estimating the OLC for eight East Asian countries between 1997 and 2011. To date, the literature on Okun's Law has been largely limited to developed countries (Perman and Tavera 2005; Balakrishnan *et al.* 2009; Cazes *et al.* 2011), with few studies on developing countries (see Bhalotra 1998 and Roy 2004 for India and Lal *et al.* 2010 for the South Asia region). At first sight, East Asia does not appear as an obvious priority region to study the effect of growth on employment. For one, it is well known that mobilizing factors of production, including labor, was the key driver of the 'East Asian miracle' (Kim and Lau 1994; Krugman 1994; Mankiw 1995; Young 1992, 1994). Moreover, unemployment levels in most East Asian countries have been almost notoriously low.

However in recent years, interest in the Okun effect in East Asia has intensified. One reason is that the Lewis transformation, where rural-urban migration fuels the growth of industry (Lewis 1954), appears complete in many East Asian countries (see, e.g. Young 1994, Fields 2004). Growth is thus increasingly driven through capital and productivity (World Bank 2011). Moreover, some East Asian countries, such as Indonesia or the Philippines, experience relatively elevated unemployment levels – which are aggravated considerably when including underemployment. Given that East Asia has for many years been the most economically dynamic region (it remains the top performer globally, even during the ongoing global economic crisis) the question has been raised whether growth has been jobless (e. g. World Bank 2010). This paper attempts to provide an answer to this question.

The analysis suggests that growth in East Asia was not jobless as economic growth had a statistically detectable effect on jobs. Yet strength of the relationship between growth and employment varies considerably across countries. In particular, countries with more liberal hiring and firing rules exhibit a stronger transmission of growth into jobs.<sup>1</sup> Thus there is evidence that labor market institutions exert significant influence over the potential of employers to respond to economic signals, consistent with similar studies for developed countries (e.g. Balakrishnan *et al.* 2009 and Cazes *et al.* 2011).

Moreover, in the aggregate the evidence does not unambiguously suggest that the strength of the Okun effect differs between economic expansions and contractions. However, breaking down employment in

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<sup>1</sup> This paper limits itself to the short-run and medium-run (one year) – estimating the effect for considerably longer periods required longer data series which are currently not available.

agricultural and non-agricultural employment reveals that Okun's Law holds particularly well for non-agricultural jobs.<sup>2</sup> For agricultural jobs Okun's Law is reversed, i.e. a negative shock to growth results in more jobs in agriculture and vice versa. This effect seems limited to times of economic downturn which suggests that agriculture serves as a shock-absorber for labor made redundant in the industrial sector.

The paper develops these results as follows. The following section discusses the data that were obtained for the analysis while section three presents the statistical methodology that was applied for analyzing the data. The fourth section focuses on deriving the aggregate results for the OLC in the eight countries under study and puts them into context by discussing how variation in labor market regimes can explain the difference in the strength of Okun's Law across countries. The fifth section focuses entirely on times of economic crisis to discern whether the OLC differs across the business cycle. It also discusses the effect agricultural jobs play in economic downturns. The last section reviews the results and concludes.

## Data

Obtaining the relevant data for this study was difficult, which may explain the relative dearth of empirical research published on this issue, especially for developing countries. Two key variables have to be collected: real GDP and the employment rate. To fine-tune the analysis further, data were collected for agricultural employment, where available. Table 1 below lists the variables and the sources they were selected from for this study. The table shows that the data come from a number of sources and real GDP is anchored in different years. However, this does not necessarily pose a challenge to the analysis as it is the relative magnitude that matters for the analysis.

All data in Table 1 were collected on a quarterly basis. This means that countries in East Asia that do not report quarterly employment and GDP data cannot be included in the analysis. Unfortunately, this includes all low and some middle income countries in the region. Some difficult decisions have to be made. For example, Indonesia reports semiannual employment data, however only from the late 2000s. Reducing the estimation to semiannual data for all countries from the mid-2000s would imply forfeiting too many data for a meaningful statistical analysis. China, on the other hand, does not report quarterly real GDP data – however, it does report quarterly real GDP growth data. From this, China's quarterly GDP data were constructed allowing for China to be included in the analysis.

Overall, the sample includes the four most developed countries in East Asia (South Korea, Singapore, and the two Chinese autonomous territories Hong Kong SAR, China, and Taiwan, China) and four solidly middle income countries (China, Malaysia, the Philippines, Thailand). Data are available for all countries between the years 2000 and 2011 and for some countries (South Korea, the Philippines, and Taiwan, China) they reach back to 1996. All data were seasonally adjusted in order to remove transitory variation from the series that could obstruct the underlying relationship between economic and employment growth.

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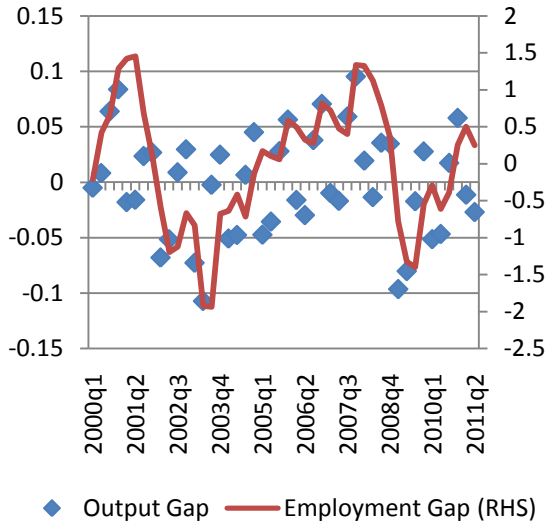
<sup>2</sup> See World Bank (2010) for a similar finding for Indonesia.

**Table 1:** Data and sources

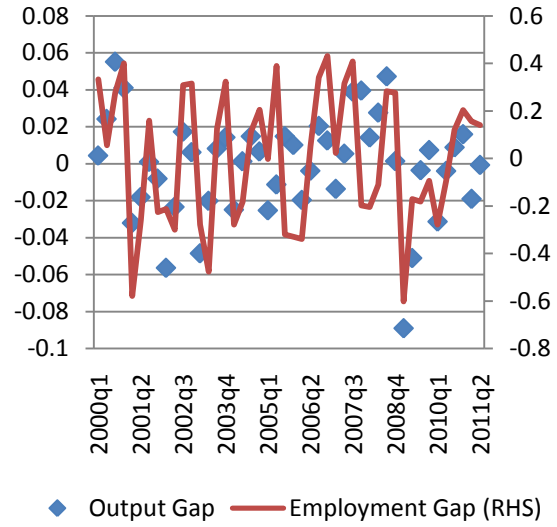
Country	Variable	Source
China	Employment (%)	Ministry of Human Resources and Social Security/ CEIC
	GDP (2000 prices, RM)	World Bank
Hong Kong SAR, China	Employment (%)	IMF/ CEIC
	GDP (2009 Chained HKD)	Haver
Korea, Rep.	Employment (%)	IMF/ CEIC/ Haver
	<i>Agri. employment (%)</i>	Haver
	GDP (2000 Prices, KRW)	IMF/ CEIC
Malaysia	Employment (%)	IMF/ CEIC
	GDP (2000 Prices, MYR)	IMF/ CEIC
Philippines	Employment (%)	IMF/ CEIC/ Haver
	<i>Agri. employment (%)</i>	Haver
	GDP (2000 Prices, PHP)	National Office of Statistics/ World Bank
Singapore	Employment (%)	IMF/ CEIC
	GDP (2005 Prices, SGD)	Haver
Taiwan, China	Employment (%)	DG of Budget, Accounting and Statistics/ CEIC/ Haver
	<i>Agri. employment (%)</i>	Haver
	GDP (2006 Prices, NTD)	DG of Budget, Accounting and Statistics/ CEIC
Thailand	Employment (%)	Haver
	GDP (1988 Prices, BHT)	Haver

In line with other research on this topic, the OLC will be estimated as a function of the output gap and the employment gap (e.g. Perman and Tavera 2005). These variables are calculated as the difference between observed values and potential GDP and the ‘natural rate of employment’ (mirroring the more commonly used natural rate of unemployment) respectively. These two unobserved measures have to be estimated. One common method is using the Hodrick and Prescott filter which decomposes integrated series (such as GDP and employment) into a stochastic trend and a cyclical component (Hodrick and Prescott 1980, 1997). This method is applied here, using a smoothing parameter of 1600 which is recommended for quarterly data (Rven and Uhlig 2002). The output gap is then calculated by subtracting the logged GDP trend from the logged GDP values. Similarly, the employment gap is calculated – for total employment and agricultural/non-agricultural employment where data are available – by subtracting the estimated employment trend from the observed employment data. For illustration, Figures 1 and 2 plot the output and employment gaps for Hong Kong SAR, China and Malaysia respectively.

**Figure 1: Output and Employment Gap: Hong Kong SAR, China**



**Figure 2: Output and Employment Gap: Malaysia**



## Methodology

To account for both short run and medium run dynamics, the empirical analysis is based on an Autoregressive Distributive Lag model which can be expressed as follows (Hendry *et al.* 1984):

$$E_t = \sum_{s=0}^p a_{0,s} Y_{t-s} + \sum_{s=1}^q a_{1,s} E_{t-s} + \varepsilon_t \quad (2)$$

where  $E$  is the employment gap and  $Y$  is the output gap at time  $t$ ; The  $a$ 's are the parameters and  $\varepsilon$  is the overall error term. The number of lags is determined for the output gap by  $p$  and for the employment gap by  $q$ . Given the small number of observations, the maximum lag number for all variables is restricted to four. It is important to note that since for the most part four quarter are used as lags, the actual estimation will lose the first year in the sample, so the time period under consideration is 2000 to 2011 for the whole sample and 1997 to 2011 where data are available from 1996.

The short run OCL is given by the parameter  $a_0$  in equation (2). The medium run effect can be calculated by taking into account the information from all four lags. It can be calculated as follows:

$$a_{MR} = \frac{a_{0,0} + \dots + a_{0,p}}{1 - (a_{1,1} + \dots + a_{1,q})} \quad (3)$$

Given that East Asian countries are highly connected economically, the individual equations in (2) for each country are correlated. To account for, and indeed exploit, the correlation of the errors among countries, the appropriate method to estimate equation (2) is by Seemingly Unrelated Regression. SUR takes into account correlations such as common shocks (e.g. the global economic crisis of 2008).

## Results 1: Okun's Law and labor markets

This section presents the results of the statistical analysis and puts them into context by focusing on the role of labor market institutions in linking economic growth to jobs. At first, however, it is sensible to take a rough look at the Okun effect by examining the growth elasticity of employment. This method is less sophisticated as it does not take into account dynamics and only focuses on short-run effects. It also is agnostic of the state of the economy – yet as Okun (1962) has shown, the relationship between employment and output depends on deviations from their potential levels rather than mere growth rates.<sup>3</sup> Yet it is a method commonly used among economists and it has the advantage of having an intuitive interpretation: it is the percentage change in employment associated with a 1-percent change in economic growth.

Table 2 presents the results, based on a simple regression of the log of the employment rate on the log of real GDP. The results show that, for the eight countries in the 2001-2011 sample, the effect of growth on the employment rate was about 0.3 percent (median: 0.32). If one accepts the assumption that the economies were generally at their potential levels during the time of the study, the effect can cautiously be compared to the effect Okun detected in 1962 for the United States, which also associated a 1 percent increase in growth with a 0.3 percent increase in employment.

**Table 2:** Growth elasticities of employment 2001-2011

Country	Elasticity
China	0.30
Hong Kong SAR, China	0.36
Korea, Rep.	0.24
Malaysia	0.39
Philippines	0.22
Singapore	0.42
Thailand	0.33
Taiwan, China	0.31

Having taken a rough look at the elasticity of employment in East Asia, the remainder of this paper will focus on Okun's Law calculated based on output and employment gaps, in congruence with much of the academic literature. Table 2 presents the estimated short run and medium run OLC's for the eight countries in the sample. It is prudent to first look at the Chi-squared statistic which examines whether the error terms are correlated across countries. The fact that the statistic is significant provides a powerful justification for using SUR for the statistical estimation.

Table 3 suggests that there has been a statistically significant relationship between employment and economic growth in most East Asian countries between 2001 and 2011 – which is consistent with the basic message arising from analyzing the growth elasticities of employment.<sup>4</sup> Especially in the medium run (i.e. over the course of a year), the effect is significant at the 10 percent level or higher for all

<sup>3</sup> Okun's (1962) original article examines relationship of growth and an unemployment rate in excess of 4 percent which was then considered the natural rate of unemployment in the United States.

<sup>4</sup> In fact, the growth elasticities of employment in Table 2 and the coefficients estimated in Table 3 are highly correlated ( $r=0.7$ ).



countries in the sample, except the Philippines and Taiwan, China. Yet there is considerable variation in the magnitude of OLCs across countries.

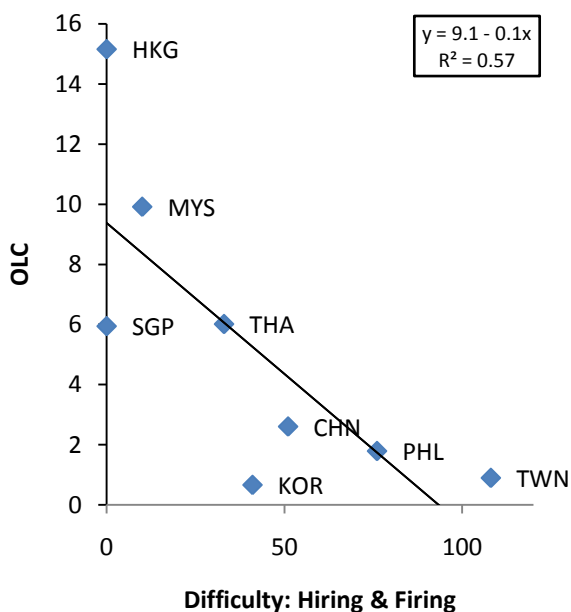
**Table 3:** Total employment, 2001-2011

	Obs.	Short Run				Medium Run	
		OLC	S.E.	R2	Chi Sq	OLC	S.E.
China	44	2.61***	0.53	0.94	697.74***	3.19***	1.49
Hong Kong SAR, China	44	15.15***	1.72	0.95	929.63***	30.49***	2.54
Korea, Rep.	44	0.66	2.19	0.73	119.34***	11.22*	6.34
Malaysia	44	9.91***	3.09	0.37	32.83***	6.76***	1.35
Philippines	44	1.79	12.06	0.43	40.4***	38.90	35.40
Singapore	44	5.94*	2.36	0.75	135.6***	17.04***	1.84
Thailand	44	6.01***	1.00	0.96	1834.45**	12.92***	5.63
Taiwan, China	44	0.90	1.06	0.59	74.39***	0.63	2.74

\*\*\* p<0.01; \*\* p<0.05; \* p<0.1

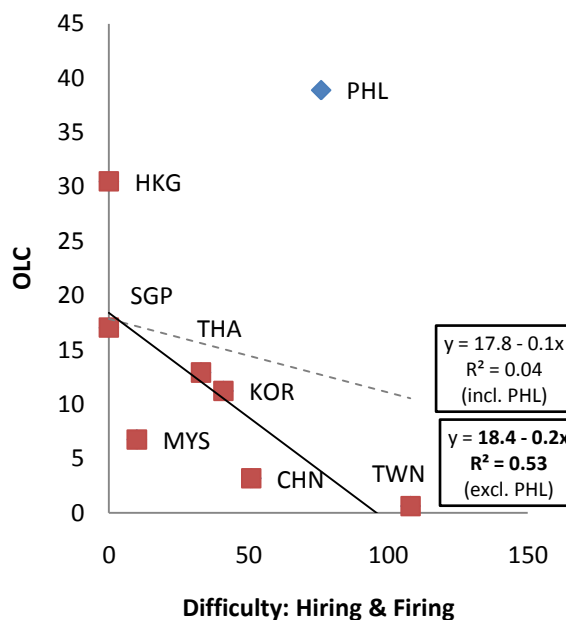
A common explanation for such variation in the literature is that the magnitude of the OLC depends on labor market institutions, and in particular the ease of hiring and firing workers (e.g. Moosa 1997, Sögner and Stiasny 2002, Balakrishnan *et al.* 2009, and Cazes *et al.* 2011). Regulations that protect workers from being laid off will surely make adjustments in the labor market less smooth and more drawn out, as employers cannot recruit and dismiss workers as is strictly demanded by their business

**Figure 3:** Growth, employment generation and labor market rigidity: short run



Source: See table 1 and Doing Business Report.

**Figure 4:** Growth, employment generation and labor market rigidity: medium run



Source: See table 1 and Doing Business Report.

needs. Indeed, there is evidence that such inertia in the labor market reduces the responsiveness of employment to growth. Plotting the estimated OLC against hiring and firing scores from the Doing Business Report reveals an interesting relationship: more rigid labor market regulations result in a lower OLC. This holds for the short-run, yielding a considerable R-squared of 0.6 (Figure 3). Considering the Philippines an outlier (since its OLC is statistically insignificant), the effect is similarly pronounced in the medium run (Figure 4).

East Asia generally has comparatively flexible labor market regulations. Singapore and Hong Kong SAR, China have the most flexible hiring and firing rules in the world. In the medium run, employment has responded most sensitively to economic growth in these countries, while the effect was weaker in more strongly regulated countries like China and Taiwan, China.

## Results 2: Okun's Law and economic crises

Having established that the strength of Okun's Law varies across countries, it is interesting to explore if it varies across time. This is important especially to establish if the effect only works in one direction; in other words, does an economic expansion create jobs in the same way that an economic contraction destroys jobs? Just looking at the association captured by the OLC does not answer this question. Thus, the sample was split to isolate times of crisis – the Great Recession of 2008-2011 – from a period of calm between 2001 and 2007. Table 4 presents the short-run results.<sup>5</sup>

**Table 4:** Total employment, 2001-2007, 2008-2011, Short Run

	2001-2007				2008-2011			
	OLC	S.E.	R2	Obs.	OLC	S.E.	R2	Obs.
China	1.62 <sup>***</sup>	0.56	0.96	28	7.70 <sup>***</sup>	1.47	0.95	14
Hong Kong SAR, China	15.93 <sup>***</sup>	2.30	0.96	28	12.18 <sup>***</sup>	1.72	0.99	14
Korea, Rep.	1.66	2.64	0.86	28	4.33 <sup>*</sup>	2.43	0.69	14
Malaysia	6.36	6.73	0.34	28	12.94 <sup>***</sup>	1.00	0.94	14
Philippines	3.29	25.76	0.51	28	-2.16	5.87	0.52	14
Singapore	-4.53	3.24	0.85	28	7.63 <sup>*</sup>	4.24	0.78	14
Thailand	2.33 <sup>*</sup>	1.21	0.97	28	9.01 <sup>***</sup>	0.98	0.99	14
Taiwan, China	2.68	3.00	0.73	28	1.33	1.34	0.71	14

\*\*\* p<0.01; \*\* p<0.05; \* p<0.1; ChiSq significant at 5% level or higher for all countries.

Table 4 does not convey a clear message. On average, there appears to be a somewhat stronger relationship between growth and employment creation in the crisis period, as more coefficients reach statistical significance and tend to be larger in magnitude. Especially in China, the coefficient increased from 1.62 between 2001 and 2007 to 7.7 between 2008 and 2011. Yet in Hong Kong SAR, China, the OLC

<sup>5</sup> Estimating the medium-run OLC in times of turbulence with considerable variation in the variables makes the coefficients more difficult to interpret.

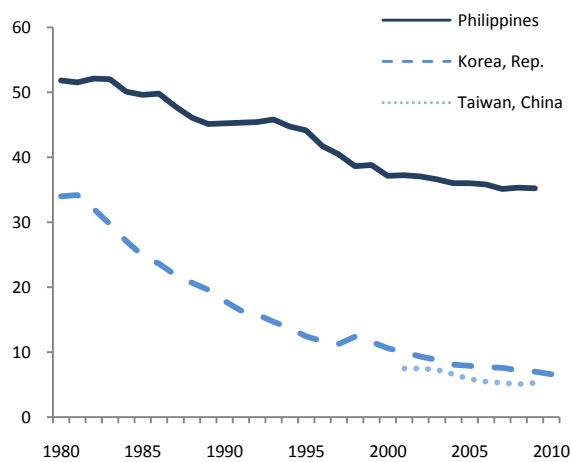
during the crisis is smaller than during the period of calm. Generally, for most countries the difference in coefficients between the two periods under study is not statistically significant. Thus, no definitive conclusions should be drawn from the results in Table 4.

To gain more conclusive insights on the effect of growth on employment generation in times of crisis, the analysis was refined to focus on a sub-set of the sample: the Philippines, Korea, and Taiwan, China. These are the countries with particularly weak OLC estimates in Table 4. They are also countries for which more fine-grained data are available for a more thorough analysis.

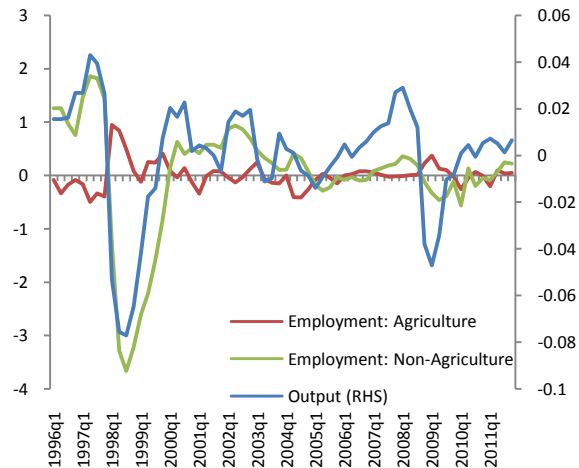
One factor that may conceal the overall effect of growth on employment is that jobs in agriculture may respond to growth differently. For one, to the extent that agriculture is not commercial, overall economic activity in a country affects farm employment less. Moreover, accordingly to the Lewis model, farmers move away from their land for job opportunities and higher wages in the ‘modern’ sectors (Lewis 1954). Yet when the economy slows or contracts, the opposite may happen where workers move back to the rural areas when they are laid off in the modern sector.

In all of East Asia, the percent of the labor force employed in agriculture has fallen. Yet there still exists considerable variation across the region. In the Philippines, around 40 percent of employment is still in the primary sector, while it is less than ten percent in Korea and Taiwan, China (Figure 5). Just inspecting growth and employment data – separated by employment in agriculture and non-agriculture visually, reveals an interesting relationship. Indeed, non-agricultural employment tends to be more in sync with growth than agricultural employment (Figure 5 through 8). There also appears evidence that agricultural employment is countercyclical, especially in times of crisis.

**Figure 5: Employment in agriculture as a percentage of total employment**

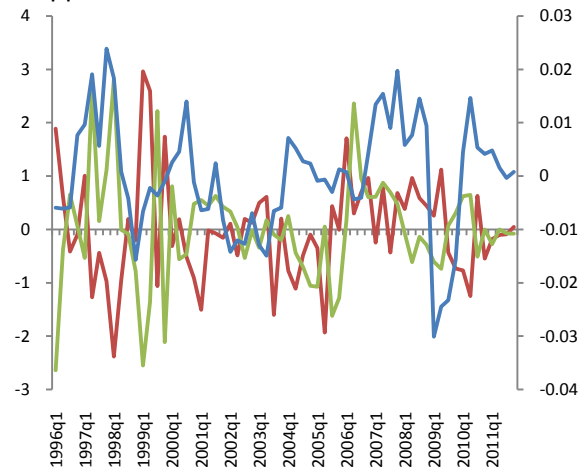


**Figure 6: Employment gap and output gap: South Korea**



Source: Figure 5: WDI; Figure 6 Figure 1: See Table 1.

**Figure 7: Employment gap and output gap: Philippines**



**Figure 8: Employment gap and output gap: Taiwan, China**



Source: See Table 1.

To investigate whether this visual relationship upholds empirical testing, the analyses above were re-run for the sub-sample of countries using data for agricultural and non-agricultural employment. In fact, for these countries, the data are available from 1996. This means that two crises can be included: the economic crisis of 2008-2011, but also the East Asian crisis of 1997 to 2000. It should be noted that the OLC's presented in Table 5 include two quarters. They thus differ slightly from the short-run effects in the tables above. The corresponding one-period effects convey a similar same message though the estimates are murkier given the high variation during economic crises – for this reason the two-period estimates are presented in the table.

Table 5 conveys a number of interesting messages. First, by removing agricultural employment from total employment the OLC estimates are pronounced for both Korea and Taiwan, China. This contrasts with Table 4 and suggests that, when refining the analysis, there is a relationship between growth and jobs even in countries where the overall OLC is weak. Second, Table 5 conveys no convincing evidence that the OLC differs considerably in times of crisis and times of calm – at least with respect to non-agricultural employment: in Korea, the magnitude of the non-agricultural OLC fell consistently over the periods of study; in the Philippines it was pronounced in the Asian crisis but not detectable in other periods; and in Taiwan, China the OLC was most pronounced in the period of calm. This supports the message from Table 4 that there is no compelling evidence that the OLC differs substantially across the business cycle.

Finally, Table 5 provides some evidence for the argument that agricultural employment functions as a shock-absorber in East Asia. In times of crisis, the agricultural OCL is negatively signed, suggesting that agricultural employment responds to growth counter-cyclically. The effect is visible in all three countries in times of crisis but not during periods of clam. Thus, agriculture appears to be a fall-back option for some workers who lose their jobs in the 'modern' sector during an economic contraction. To the extent that the data on agricultural employment can be understood as a proxy for informal employment, the results suggest that a similar counter-cyclical relationship may hold in the informal sector, which presents an interesting avenue for future research.

**Table 5:** Agricultural/ Non-Agricultural employment

	<b>1997-2000 (Asian Crisis)</b>		<b>2001-2007</b>		<b>2008-2011 (Global Crisis)</b>	
	<b>OLC</b>	<b>S.E.</b>	<b>OLC</b>	<b>S.E.</b>	<b>OLC</b>	<b>S.E.</b>
Korea, Rep.	53.50 <sup>***</sup>	3.42	34.40 <sup>***</sup>	12.78	10.97 <sup>***</sup>	2.05
Philippines	79.38 <sup>***</sup>	16.27	-0.11	23.03	-1.97	16.27
Taiwan, China	0.18	26.44	67.09 <sup>**</sup>	28.40	30.52 <sup>***</sup>	7.19
<b>Agricultural</b>						
Korea, Rep.	-6.35 <sup>***</sup>	1.75	-0.90	2.94	-3.83 <sup>***</sup>	1.37
Philippines	-60.57 <sup>**</sup>	24.58	12.66	22.42	-14.66 <sup>*</sup>	8.26
Taiwan, China	0.90	1.24	-27.17	20.84	-3.03 <sup>**</sup>	1.35

\*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Note: Based on separate SUR's using data on non-agricultural and agricultural employment. The statistical model is the short-run model plus the first lag of the independent variables.

## Conclusion

Was growth in East Asia jobless? The evidence suggests that it was not. All countries included in the analysis for this paper grew under the period of study, with minor – though pronounced – exceptions during the Asian and global financial crises. Looking at Okun's Law as the net effect of growth on employment suggests that, at least in the short run, growth has created jobs. However, the extent to which this relationship holds differs across countries. The analysis revealed that, especially where hiring and firing rules are more flexible, growth translates into job gains. In addition, the analysis suggests that Okun's Law holds both during economic expansions and contractions. It does thus not have a discernible bias toward creating or destroying jobs in the aggregate. Finally, the analysis has documented a counter-cyclical relationship between growth and jobs in agriculture, in other words a 'reverse Okun's Law', which is particularly pronounced during times of economic crisis. This suggests that agriculture may serve as a shock-absorber for employees who are laid off in an economic downturn.

The results from the analysis raise a number of interesting questions for future research. For one, in terms of statistical estimation, the analysis has been inconclusive on systematic differences between the OLC during economic expansions and contractions. Other research (e.g. Balakrishnan *et al.*, 2009) finds the OLC coefficient tends to be stronger in times of crisis, which does not come out clearly in the analysis in this paper – which may be due to the small sample size or something specific to East Asia. More research should be devoted to testing the robustness of this finding. In addition, the analysis in this paper is restricted to estimating short-run and medium-run effects of growth on employment. The medium-run in this paper encompasses four quarters only. As more data and longer time series become available, more long-term effects, stretching beyond one year, should be examined.

With respect to agriculture, the results raise additional questions. First, it would be interesting to examine whether the 'reverse Okun's Law' can be observed in a larger sample of country, going beyond the limited sample of three in this paper. Second, the notion of agriculture as a shock-absorber need not be limited to agriculture but can extend into informal work more generally. East Asia generally has low unemployment, even in times of crisis. This finding could be explained by the fact that in times of crisis laid-off workers do not register as unemployed but rather pursue work opportunities in the informal sector.

Finally, it would be interesting to break down employment further and take the analysis beyond the agriculture/non-agriculture dichotomy. While Okun's Law captures the 'net effect' of growth on employment it ignores shifts within the labor market. For example, 'creative destruction' may create more high-skilled jobs in the 'modern' sector at the expense of jobs in more 'obsolete' industries (Schumpeter 1942). Workers made redundant in the process may either find jobs requiring similar qualifications elsewhere, enter the informal economy, or register as unemployed. By focusing on more specific employment categories, more light could be shed on the effect of growth and 'creative destruction.'

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