WP/17/257

IMF Working Paper

Growth and Jobs in Developing Economies:
Trends and Cycles

by Zidong An, Tayeb Ghazi, Nathalie Gonzalez Prieto, Aomar Ibourk

INTERNATIONAL MONETARY FUND

IMF Working Paper

Research Department

Growth and Jobs in Developing Economies: Trends and Cycles[1]

Prepared by Zidong An, Tayeb Ghazi, Nathalie Gonzalez Prieto, Aomar Ibourk

Authorized for distribution by Chris Papageorgiou

November 2017

> *IMF Working Papers* **describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Abstract

This paper investigates the relationship between economic growth and job creation in developing economies with a focus on low and lower middle-income countries along two dimensions: growth patterns and short-run correlations. Analysis on growth patterns shows that regime changes are quite common in both economic growth and employment growth, yet they are not synchronized with each other. Okun's Law—the short-run relationship between output and labor market—holds in half of the countries in our sample and shows considerable cross-country heterogeneity.

Content   **Page**

I. INTRODUCTION

Recently, a worldwide consensus has emerged on the need for a socially-inclusive path of economic growth, so that people can have jobs and equal opportunities to participate in the economy. However, inclusive growth remains primarily an aspiration in many developing economies, e.g., Samans, et. al (2017). Many developing economies have experienced remarkable progress in their economic performance over the past few decades, yet there is less success in translating economic growth into employment creation.

The object of this paper is to investigate the relationship between the economic growth and job creation in developing countries with a focus on low and lower middle-income countries (LLMICs). There is a large body of research which documents the patterns of economic growth. Pritchett (2000) discusses that economic growth can be thought as transitions between different regimes, and proposes a framework of systematic analysis of the growth patterns. Hausmann, Pritchett, and Rodrik (2005), Jerzmanowski (2006), Jones and Oklen (2008), and Berg, Ostry, and Zettelmeyer (2012) find that regime changes are quite common across advanced and emerging economies. Given the close theoretical link between output and labor market, regime changes in economic growth should be associated with and also reflected in the labor markets. Nevertheless, little has been done to study the regime changes in labor market or its association with economic growth patterns. Another strand of literature focuses on the short-run relationship between output and labor market. Okun's Law has been a widely studied subject in advanced and emerging economies. Ball, Leigh, and Loungani (2017) show that the Okun's Law is a reliable macroeconomic relationship in the advanced economies. Ball, Furceri, Leigh, and Loungani (2017) extend the work to a larger group of countries, and find that labor markets are less responsive to output fluctuations in emerging economies than in advanced economies.

Motivated by the literature, our analysis is along two dimensions. First, we study the growth patterns in output and total employment. To the best of our knowledge, this paper is the first to study the synchronicity in growth patterns between output and labor market in the LLMICs. Specifically, we rely on the modified multiple structural breaks test by Berg, Ostry, and Zettelmeyer (2012) to identify the regime changes in real GDP growth and total employment growth. Our results show that regime changes are quite common in both output growth and employment growth in LLMICs, but they are not synchronized with each other. Out of the 17 up-breaks in GDP

growth, only 3 cases are associated with the up-breaks in employment growth; out of the 9 down-breaks in GDP growth, only 2 cases are associated with the down-breaks in employment growth. After comparing the regime changes within individual countries, we follow the approach of Prati, Onorato, and Papageorgiou (2013) to compare the general growth patterns in real GDP and total employment. We show that employment growth decelerations are generally associated with GDP growth down-breaks, while employment growth accelerations are not associated with GDP growth up-breaks.

Second, we study the short-run relationship between output and labor market based on the Okun's Law framework. We follow the specifications in Ball, Leigh, and Loungani (2017) and study the short-run responses of total employment to real GDP. Our results show that the short-run relationship between output and total employment holds in half of the LLMICs. The Okun coefficient is 0.20 on average, and shows considerable cross-country heterogeneity. We also estimate the Okun's Law through panel regression, and find similar Okun coefficients. We further investigate the potential factors that affect the heterogenous Okun coefficients across LLIMCs through interaction variable regressions. Our results show that the short-run responsiveness of total employment to output is negatively associated with poverty rate and skill-mismatch level.

The remainder of the paper is organized as follows. Section II describes the long-run relationship between output and labor market indicators. Section III reports the growth patterns in real GDP and total employment, and discusses their consistency. Section IV investigates the short-run relationship between output and labor market through the lens of Okun's Law, and discusses the factors that affect the cross-country differences in Okun coefficients. Section V includes a closer look at the labor market in Morocco. Section VI concludes.

II. DESCRIPTION OF THE DATA

This section investigates the long-run relationship between output and labor market through descriptive exercises. Table 1 provides the averaged GDP growth, total employment growth, and unemployment change by country and different periods. Our data source is the IMF World Economic Outlook April 2017. It is evident that the LLMIC economies have grown strongly without a corresponding growth in employment and decrease in unemployment rate. This is particularly true over the past 15 years. During that period, employment growth was much lower than output growth in all countries, but Cote D'Ivoire; unemployment rate decrease was also very limited in

most of the countries. For the period between 2001 and 2015, the average economic growth rate for the LLMICs was 5.2 percent, while the average employment growth rate was 1.9 percent and the average unemployment rate change was -0.2 percent. The correlation between average employment growth and average output growth was 0.2; and the correlation between average unemployment change and average output growth was -0.1.

Table 1. Summary Statistics

Country	1981-1990			1991-2000			2001-2015		
	GDP	EMP	UR	GDP	EMP	UR	GDP	EMP	UR
Belize				5.34	4.86	-0.24	4.14	3.70	-0.17
Bolivia				3.99	7.57		4.28	2.51	-0.23
Cabo Verde	5.79	3.57	0.39	6.15	3.89	-0.30	4.35	1.33	-0.75
Cote d'Ivoire	1.24	2.00		2.47	6.68		2.63	3.33	
Egypt				4.27	1.47	-0.04	4.33	2.31	0.32
El Salvador	0.96	6.13	-1.08	4.89	3.27	-0.21	1.94	1.00	0.00
Georgia				5.90	-0.43	-0.03	5.67	0.36	-0.04
Honduras	2.51	3.43	-0.04	2.76	5.39	-0.28	4.15	3.03	0.01
India	5.54	1.61		5.73	0.60		7.09	0.61	
Indonesia	6.75	1.24	0.26	4.84	1.96	0.36	5.41	1.73	-0.01
Kenya	4.43	2.93		2.09	2.20		4.38	2.00	
Kyrgyzstan				3.47	1.41	0.62	4.41	1.82	0.02
Moldova				-7.74	-2.48	1.37	4.63	-1.29	-0.39
Mongolia	6.27	2.41		-0.31	0.65		7.24	1.94	-0.41
Morocco				4.78	5.11	-0.51	4.46	1.04	-0.26
Nicaragua	-0.77	4.02	-0.59	3.17	5.61	-0.41	3.66	3.19	-0.31
Pakistan	6.02	2.61	-0.12	4.48	1.99	0.27	4.29	2.84	0.00
Philippines	5.17	4.32	-0.48	2.75	2.51	0.06	5.11	2.46	-0.22
Sao Tome and P.	-1.27	2.57	0.16	1.25	2.10	-0.07	4.45	2.60	-0.09
Tajikistan				-5.52	-3.57		7.70	1.76	0.02
Tanzania				4.15	2.55		6.41	3.34	
Turkmenistan				-3.22	2.07		12.77	1.53	
Ukraine				-9.31	-2.51	-0.73	2.34	-1.16	-0.17
Uzbekistan				-0.49	0.93		7.11	2.08	
Vietnam				7.40	2.20	-0.62	6.54	2.33	-0.27
Average	3.55	3.07	-0.19	2.13	2.24	-0.24	5.18	1.86	-0.17
Corr.		-0.38	0.42		0.67	-0.28		0.16	-0.08

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: The table reports the average annual growth rate in real GDP and total employment and average annual change in unemployment rate by country and different periods.

Typically, if real GDP increases, then employment rises and unemployment rate falls, and vice versa. The standard Cobb-Douglas production function suggests that the relationship between output and employment should be positive. As employment increases, theory predicts that the unemployment rate would decrease. This is based on the assumption that the new positions are filled with people from the pool of unemployed and that the participation decision does not change much after the increase in employment. This implies a negative relationship between output and unemployment rate. However, this is not always true in the LLMICs. Table 2 shows the correlations among the trend components of logged real GDP, logged total employment, and unemployment rate. Real GDP and total employment are closely linked in most of the countries.

Table 2. Long Run Relationship: Output, Total Employment, and Unemployment Rate

Country	GDP-EMP	EMP-UR	GDP-UR	Country	GDP-EMP	EMP-UR	GDP-UR
Belize	1.00	-0.64	-0.68	Mongolia	0.95	-1.00	-1.00
Bolivia	0.95	-0.98	-1.00	Morocco	0.98	-0.99	-0.95
Cabo Verde	0.98	-0.72	-0.84	Nicaragua	0.90	-0.94	-0.97
Cote d'Ivoire	0.97			Pakistan	0.99	**0.47**	**0.77**
Egypt	0.99	**0.87**	**0.86**	Philippines	0.99	-0.80	-0.86
El Salvador	1.00	-0.97	-0.98	Sao Tome and P.	0.87	**0.39**	-0.04
Georgia	**-0.91**	-0.97	**0.90**	Tajikistan	0.87	**1.00**	**1.00**
Honduras	0.99	-0.87	-0.81	Tanzania	1.00		
India	0.91			Turkmenistan	0.96		
Indonesia	1.00	**0.69**	**0.80**	Ukraine	**-0.11**	**0.82**	-0.83
Kenya	0.97			Uzbekistan	0.98		
Kyrgyzstan	0.99	**0.73**	**0.69**	Vietnam	1.00	-0.98	-0.98
Moldova	**-0.90**	**1.00**	-0.90				

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: The table reports the correlations among the trend components of real GDP, total employment and unemployment after filtering with HP with a smooth parameter of 100. Bold values indicate a correlation against theory.

Out of the 25 LLMICs in our sample, all but 3 countries (Georgia, Moldova, and Ukraine) have positive long-run correlation between real GDP and total employment. Total employment and unemployment rate are mismatched. Out of the 19 countries with available unemployment data, 8 countries have positive long-run correlation between total employment and unemployment rate, and 6 countries have positive correlation between real GDP and unemployment rate. This leads us

to question the usefulness of unemployment rates as an indicator of labor market in the LLMICs. Explaining the mismatch between total employment and unemployment rate goes beyond the goal of this paper. In the following analysis of the relationship between output and labor market, we mainly focus on real GDP and total employment.

III. GROWTH PATTERNS IN OUTPUT AND TOTAL EMPLOYMENT

This section studies the growth patterns in output and total employment, and their consistency, in the LLMICs. There is a large body of research on the patterns of economic growth. Pritchett (2000) discusses that economic growth should be thought of as transitions between different regimes rather than a stable trend with modest cyclical deviations, and proposes a systematic framework for analysis of the growth patterns. Hausmann et al. (2005) and Jerzmanowski (2006) find that regime changes in economic growth are quite common across different countries. Jones and Oklen (2008) and Berg et al. (2012) investigate different growth experiences of rich and poor countries, and find that regime changes tend to be more common and sharp in poor countries.

We identify regime changes in the growth rates of output and total employment using the Berg et. al. (2012) methodology. This methodology modifies the test developed by Bai and Perron (1998, 2003) to identify the presence of multiple structural breaks in a time series when both the number and location of breaks are unknown. The Bai and Perron method estimates the following multiple linear regression model with n regimes:

$$z_t = \theta x_t + \rho y_t + \varepsilon_t \qquad (1)$$

for $t = T_{j-1} + 1, \dots, T_j$ and for $j = 1, \dots, n$. In equation (1), z_t is the time series that we test for structural breaks; x_t and y_t are the covariance vectors. The break points $(T_1, \dots T_n)$ are treated as unknow.[2]

Berg et al.'s (2012) procedure differs from the Bai and Perron (1998, 2003) test in that it uses sample specific critical values (n) adjusted for the sample size for each country. Specifically, given a time series of sample size (T) and the minimum period between two breaks (h), the maximum number of breaks is n = Integer(T/h)-1. This feature particularly suits our analysis, in which the data span
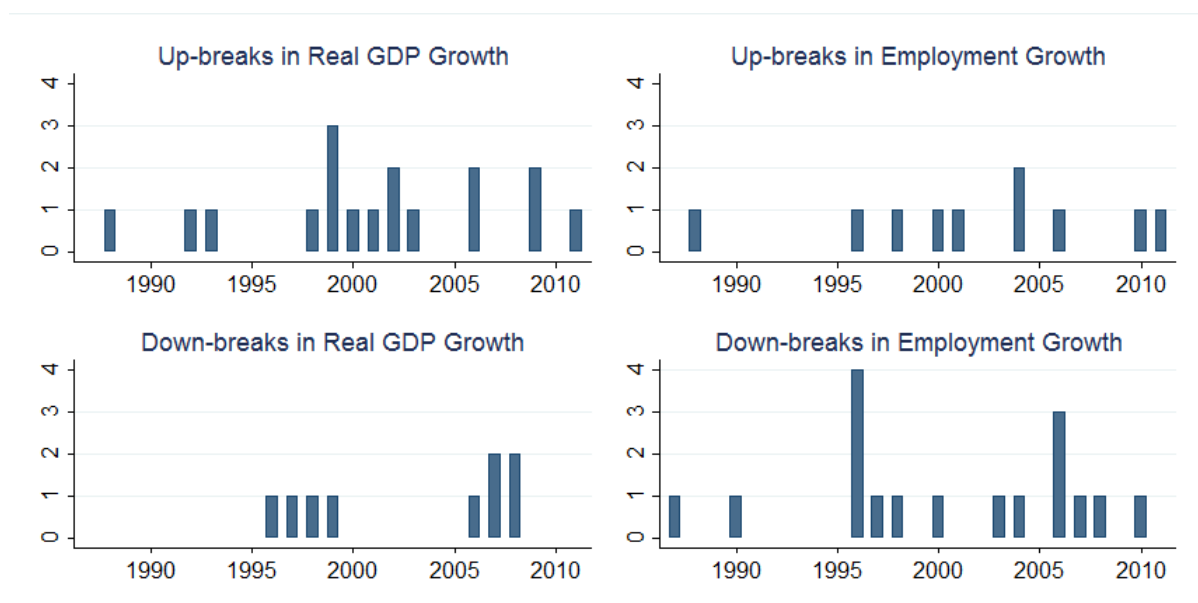
---

[2] See Bai and Perron (1998, 2003) for details about the test of multiple structural break.

in different countries varies from 16 to 36 years. Following Berg et al.'s (2012), we set the minimum period between two breaks as 8 years.[3]

Figure 1. Number of Up- and Down-breaks in GDP Growth and Employment Growth

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: Up- and down-breaks in GDP growth and employment growth are identified using Berg et. al. (2012) methodology with minimum interstitiary period of 8 years.

Figure 1 summarizes the results from applying this test to the 25 LLMICs in our sample. Regime changes are quite common not only in real GDP growth, but also in employment growth in the LLMICs. We identified 17 up-breaks and 9 down-breaks in real GDP growth, 10 up-breaks and 17 down-breaks in employment growth. Out of the 25 LLMICs, 13 countries have experienced at least one regime change in both real GDP and employment growth, 5 countries have experienced at least one regime change in real GDP growth only, and 4 countries have experienced at least one regime change in employment growth only.[4]

The commonly existence of regime changes triggers the following question: Are growth patterns in output and labor market consistent with each other in the LLMICs? Not always. Out of the 17

---

[3] See Berg, Ostry, and Zettelmeyer (2012) for detailed discussion about the critical values.
[4] See Appendix A for the complete list of up- and down-breaks in real GDP growth and total employment growth.

up-breaks in GDP growth, only 3 cases (India 2004, Tajikistan 2000, and Uzbekistan 2001) are associated with the up-breaks in employment growth; out of the 9 down-breaks in GDP growth, only 2 cases (Belize 2007 and Tajikistan 2008) are associated with the down-breaks in employment growth.

Figure 2. Synchronized Regime Changes in Tajikistan and Belize
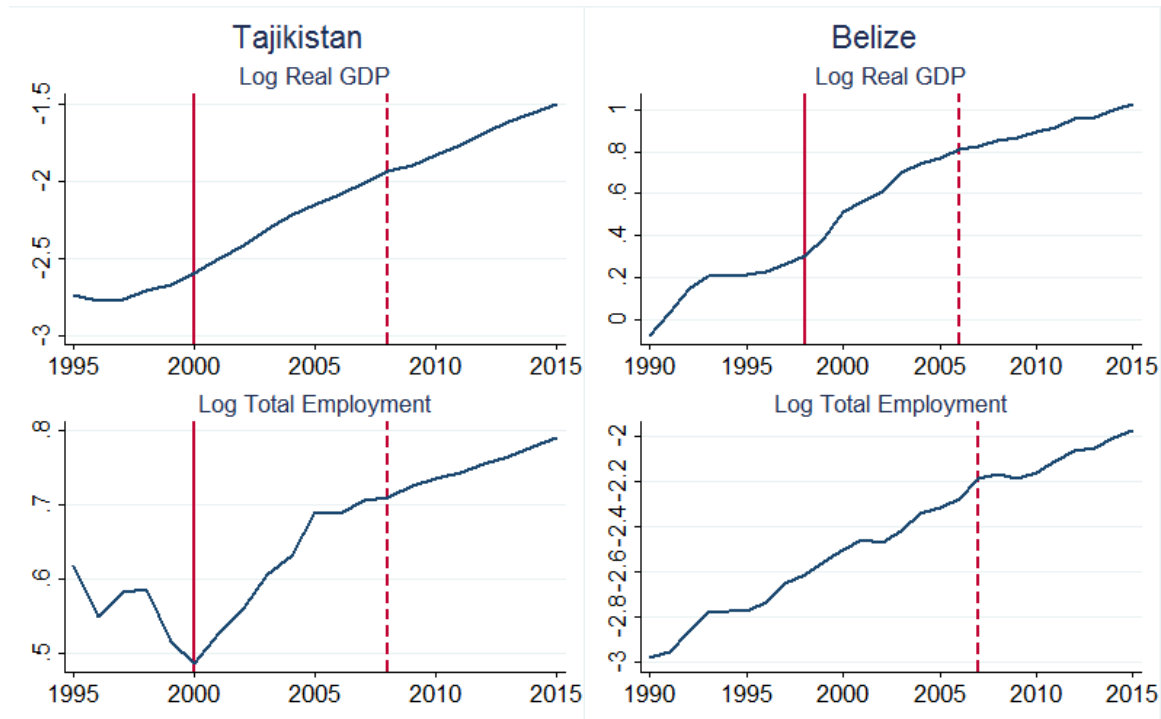
Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: Up- and down-breaks in GDP growth and employment growth are identified using Berg et. al. (2012) methodology with minimum interstitiary period of 8 years.

Figure 2 shows two country cases where the growth patterns in output and employment are consistent with each other. Each figure plots the logarithm of real GDP or total employment, with the solid and dashed vertical lines indicating up- or down-breaks, respectively. In Tajikistan, both output growth and employment growth experience an up-break in 2000 and a down-break in 2008. In Belize, output growth experiences an up-break in 1998 and a down-break in 2006; employment growth has no corresponding up-break around 1998, but it experiences a down-break in 2007 following the output growth down-break.

Figure 3 shows two cases where regime changes occurred in either output or labor market only. In Moldova, output growth experiences an up-break in 2001 after a decade of constant negative

growth. However, there is no corresponding up-break in the labor market. Total employment kept decreasing until an up-break in 2010. In Morocco, there is no regime change in output growth, but total employment growth had a down-break in 2004.

Figure 3. Unsynchronized Regime Change in Moldova and Morocco

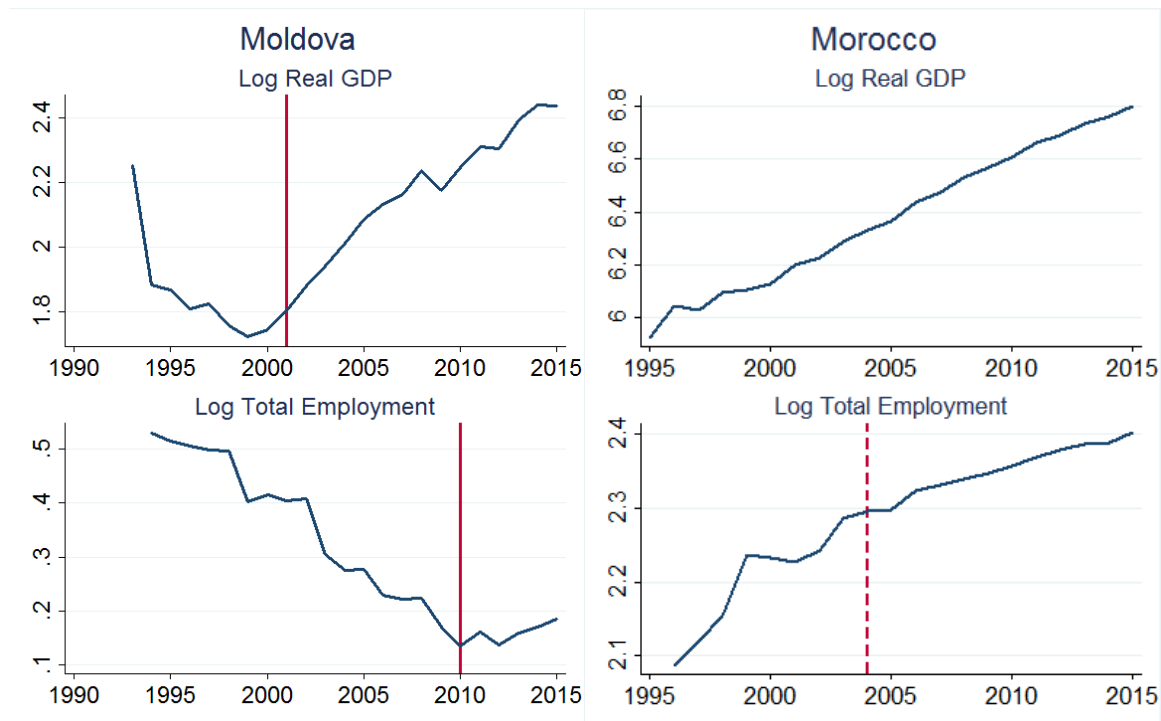Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: Up- and down-breaks in GDP growth and employment growth are identified using Berg et. al. (2012) methodology with minimum interstitiary period of 8 years.

Figure 4 plots the average employment growth for a period of five years before to five years after a structural break in GDP growth. Prati et al. (2013) use this method to study the association between economic growth acceleration and structural reforms. This method suits our analysis since we are studying the general consistency of growth patterns in output and employment. The solid and dashed lines depict the evolution of average employment growth over time around the up- and down-breaks in GDP growth, respectively. Employment growth decelerations are associated with GDP growth down-breaks, while employment growth accelerations are not associated with GDP growth up-breaks. So far, we have shown that the regime changes in both output and total

employment are quite common in the LLMICs. However, their growth patterns are generally not consistent with each other.

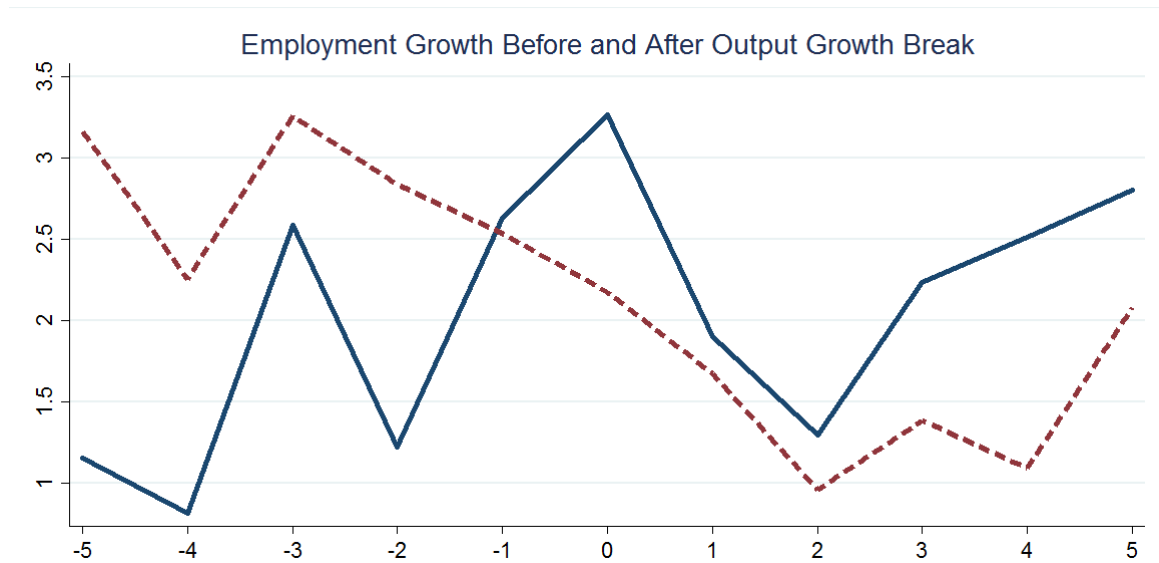**Figure 4. Growth Patterns in Output and Employment**

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: Up- and down-breaks in GDP growth and employment growth are identified using Berg et. al. (2012) methodology with minimum interstitiary period of 8 years.

IV. SHORT-RUN RELATIONSHIP BETWEEN OUTPUT AND TOTAL EMPLOYMENT

A. Okun's Law

In this section, we examine the short-run relationship between output and labor market in the LLMICs. Okun (1962) documents a negative empirical relationship between cyclical output and unemployment in the United States, which has since become famous as the Okun's Law. Several authors have explored the extent to which the law holds in numerous individual country cases and country groups. Ball, Leigh, and Loungani (2017) find that the Okun's Law is a strong and stable relationship in advanced economies. Ball et al. (2017) extends the work to a larger group of countries, and finds that labor markets are less responsive to output fluctuations in emerging economies than in the advanced economies.

Following the specifications of Ball, Leigh, and Loungani (2017), we estimate the two versions of Okun's Law based on real GDP and total employment in 25 LLMICs. With the standard gaps version:

$$e_t - e_t^* = \gamma(y_t - y_t^*) + \varepsilon_t \qquad (2)$$

where e_t is the log of the total employment, y_t is the log of real GDP, and * indicates their potential levels. The coefficient γ measures the responsiveness of the cycle component of total employment to the cycle component in output, and it is expected to be positive. The potential levels are estimated using the Hodrick and Prescott filter with a smoothing parameter of 100.

We also estimate the changes version of Okun's Law:

$$\Delta e_t = \alpha + \beta \Delta y_t + \varepsilon_t \qquad (3)$$

in which Δy_t is the change of logged real GDP and Δe_t is the change of logged total employment. The coefficient β measures the responsiveness of employment growth to output growth, and it is expected to be positive. This specification has the advantage that it does not require an estimate of the potential values, but has the underlying assumptions that the potential growth rate in output and total employment are constant. As noted above, most of these LLMICs experienced regime changes in output or labor market, hence these assumptions might not hold. Nevertheless, both specifications show some evidences that the Okun's law does not hold well and has considerable cross-country heterogeneity in LLMICs.

Table 3 reports the estimated Okun coefficients in the 25 LLMICs. The data on real GDP and total employment come from the IMF's World Economic Outlook April 2017 database. The benchmark results show that Okun's Law fits in half of the LLMICs. With the gaps version, we find positive coefficients in 19 countries, 13 of which are statistically significant. With the changes version, we find positive coefficients in 19 countries, 9 of which are statistically significant.

Table 3. Estimates of Okun's Law

Country	Gaps Specification			Changes Specification		
	Coef.	R-sq	Obs.	Coef.	R-sq	Obs.
Belize	0.23*	0.14	26	0.34*	0.15	25
Bolivia	1.52**	0.19	27	0.14	0.00	26
Cabo Verde	0.07	0.03	36	0.16*	0.08	35
Cote d'Ivoire	0.25	0.06	36	0.08	0.00	35
Egypt	0.80***	0.71	26	0.85***	0.60	25
El Salvador	0.09	0.01	23	0.31	0.07	23
Georgia	-0.14	0.02	22	0.08	0.01	21
Honduras	0.25*	0.10	36	-0.02	0.00	35
India	0.31***	0.18	36	-0.01	0.00	35
Indonesia	-0.04	0.01	28	-0.03	0.00	27
Kenya	0.35*	0.10	36	0.31	0.07	35
Kyrgyzstan	0.02	0.00	22	0.01	0.00	21
Moldova	-0.05	0.01	21	0.14	0.04	21
Mongolia	0.10*	0.07	36	0.13**	0.13	35
Morocco	-0.43**	0.22	20	-0.19	0.04	19
Nicaragua	0.41**	0.14	36	0.15	0.01	35
Pakistan	0.34	0.09	28	-0.25	0.02	27
Philippines	0.30**	0.18	31	0.09	0.01	30
Sao Tome and P.	-0.32	0.07	36	-0.01	0.00	35
Tajikistan	0.31***	0.40	21	0.81***	0.72	21
Tanzania	0.35**	0.26	21	0.27**	0.22	20
Turkmenistan	0.09***	0.40	17	0.15**	0.34	17
Ukraine	0.10	0.07	25	0.16*	0.12	24
Uzbekistan	0.11**	0.20	25	0.10***	0.34	24
Vietnam	-0.04	0.00	27	0.10	0.02	26

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: The table presents estimated Okun coefficients for each country based on the gaps specification and the changes specification. Significant at *10%, **5%, and ***1%.

There is also considerable cross-country heterogeneity. Figure 5 displays the histogram for the estimated Okun coefficients and associated R-squared. The results with the gaps version and changes version are shown in the left and right panel, respectively. With the gaps version, the estimated coefficients have an average value of 0.20 and a standard deviation of 0.37. The R-squared mostly falls below 0.30, with an average value of 0.15. Estimation with the changes version leads to similar results. The mean value of coefficients is 0.16 and standard deviation is 0.12. The average R-squared value is 0.12.

**Figure 5. Histogram of Okun's Law based on Total Employment**
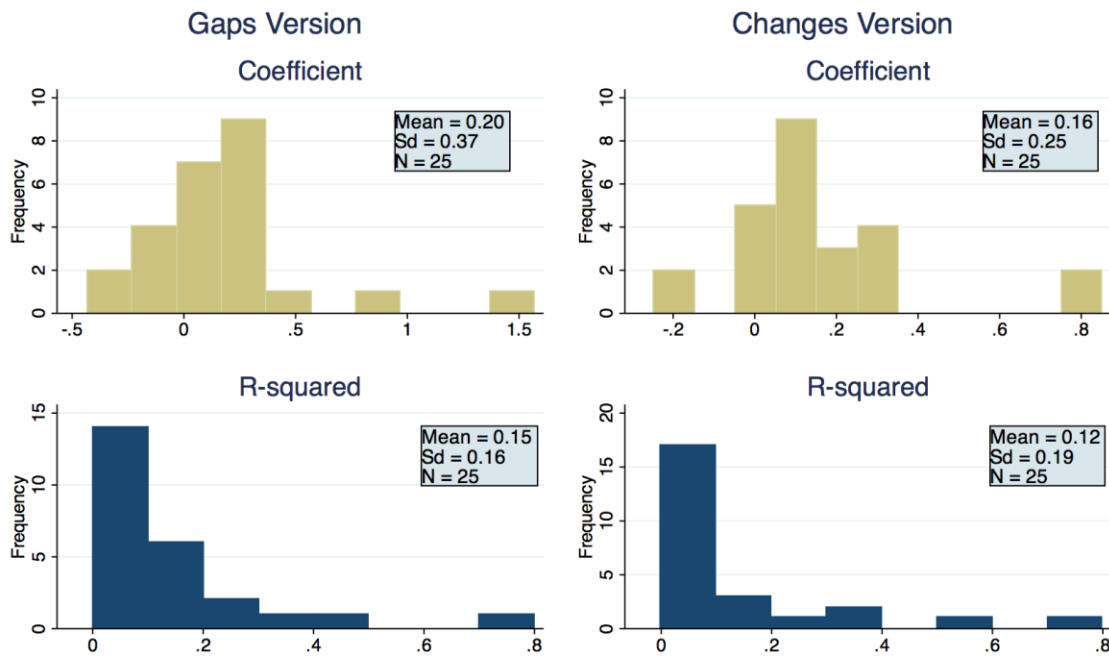
Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

B. Particularities of LLMICs

Many LLMICs are characterized by high poverty rate, low job quality -such as large informal sector and high level of skill mismatch (ILO 2013) and low business and labor market regulations (Aleksynska and Schindler, 2011). Next, we investigate if these particularities of LLMICs alter the responsiveness of total employment to output fluctuations.

Poverty rate: Those who live on subsistence income or below do not have the luxury of unemployment and would be more willing to accept a decrease in wages or benefits. According to the International Labor Organization (ILO) definition, an individual is classified as employed if during the reference week, she worked for at least one hour or made a monetary gain in a personal business. Given the need for a livable income combined with the predominance of informal activities, it is relatively common to find a job for at least an hour, which would classify an individual as employed (OECD, 2009, Dewan and Peek, 2007). Therefore, we would expect to see a negative relationship between poverty rate and Okun coefficients. As shown in Figure 6, there is a consistent pattern that higher poverty rate is associated with weaker responses of labor market. With the gaps version Okun coefficients, their correlation is -0.14; with the changes version Okun coefficients, their correlation is -0.75 and it is highly significant.

Figure 6. Okun Coefficients and Poverty Rate
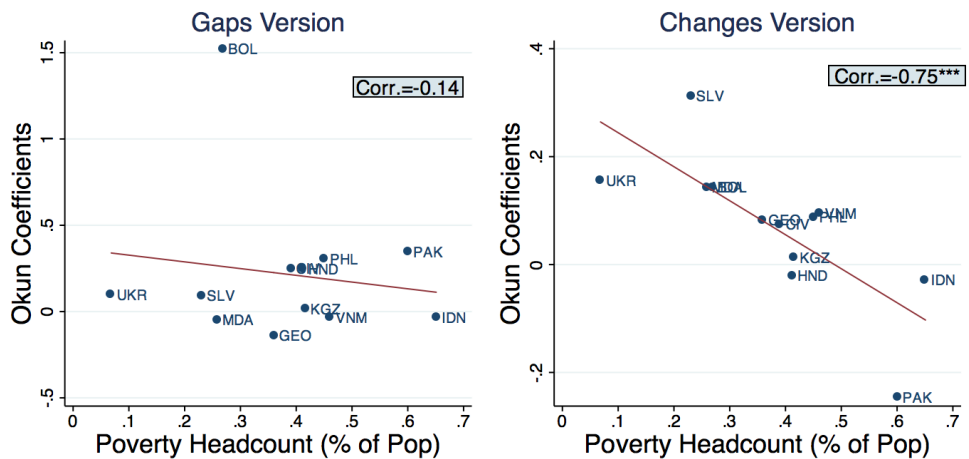
Source: Authors' estimates based on the IMF World Economic Outlook April 2017, and World Bank Poverty and Equity Database.

Skill mismatch: Estevao and Tsounta (2011) suggest that the responsiveness of labor markets could depend on the skill mismatch. Ball et al. (2017) find evidence that higher levels of skill mismatch are assorted with weaker response of labor market, particularly in emerging economies. When testing this variable in our sample we find a similar correlation for LLMICs (Figure 8).

Figure 7. Okun Coefficients and Skill Mismatch
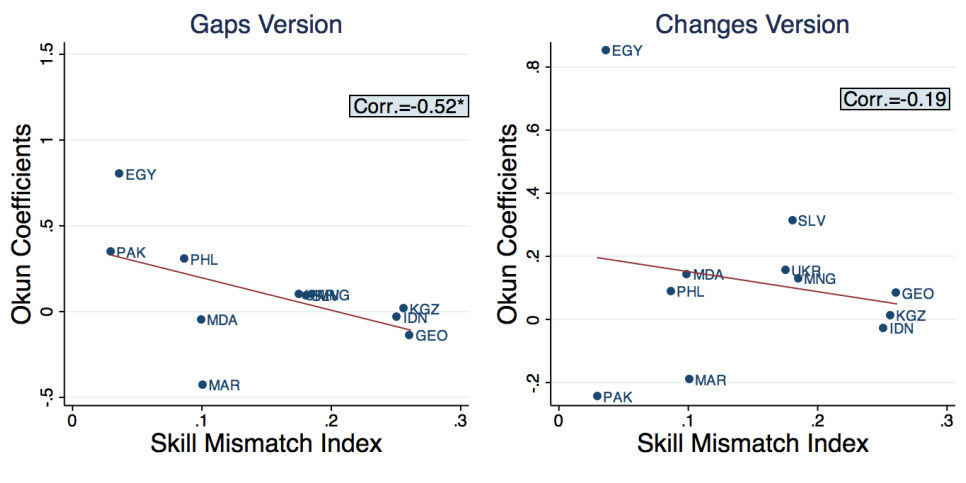
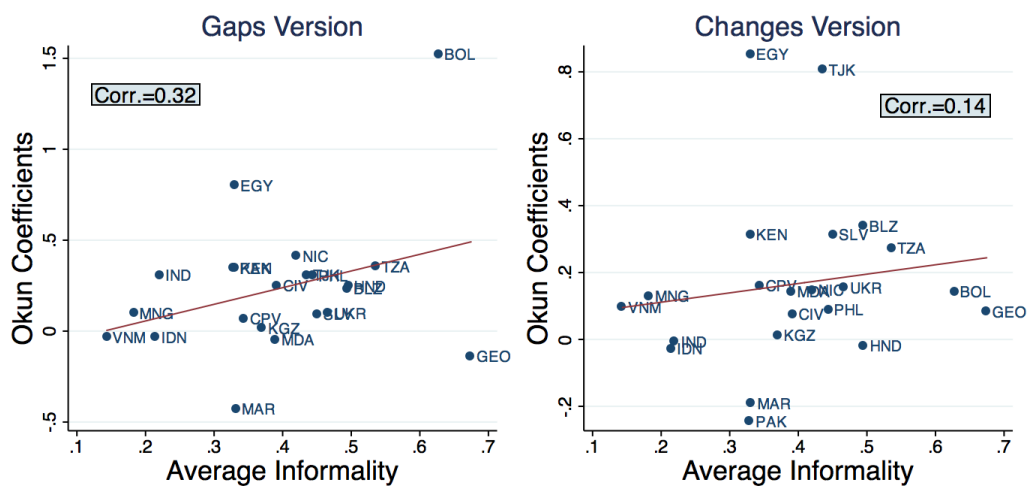Source: Authors' estimates based on the IMF World Economic Outlook April 2017, and IMF Staff estimates on skill mismatch.

Informal sector: Another variable that could alter the response of labor markets to economic growth is the size of the informal sector. On one hand, the informal sector is more flexible than the formal sector and does not have to comply with all the regulations, such as minimum wage,

social security requirements, severance pay, etc. On the other hand, LLMICs tend to have high poverty rates, as showed in Figure 6, and lacking social safety nets, this means that less people can afford being unemployed. Given this explanation and the findings by Furceri and Loungani (2012) we were expecting a negative relationship between informality and the employment response to changes in output. Figure 7 shows the relationship between informality and the Okun coefficient. However, the relationship has a positive sign, contrary to our expectations. There could be many explanations for this, but that goes beyond the scope of this paper and data availability. Though, we can say that previous papers like (Singh, Jain-Chandra, and Mohommad, 2012), have highlighted the fact that informality can obscure the relationship of output and the labor market, hence further work and data is required in order to get a better sense of this relationship.

Figure 8. Okun Coefficients and Size of Informal Sector

Source: Authors' estimates based on the IMF World Economic Outlook April 2017, and the informal economy data from Medina, Jonelis, and Cangul, 2017.

Business regulations: Ahmed, Guillaume, and Furceri (2012) argue that greater business regulation slows the hiring and firing process, and therefore reduce the responsiveness of labor market to output shocks. We retrieve data on business from the Economic Freedom of the World Index by the Fraser Institute. Figure 9 plots the Okun coefficients against the business regulation index. There is a consistent pattern that higher level of business regulation is associated with weaker responses of labor market.

Figure 9. Okun Coefficients and Business Regulation
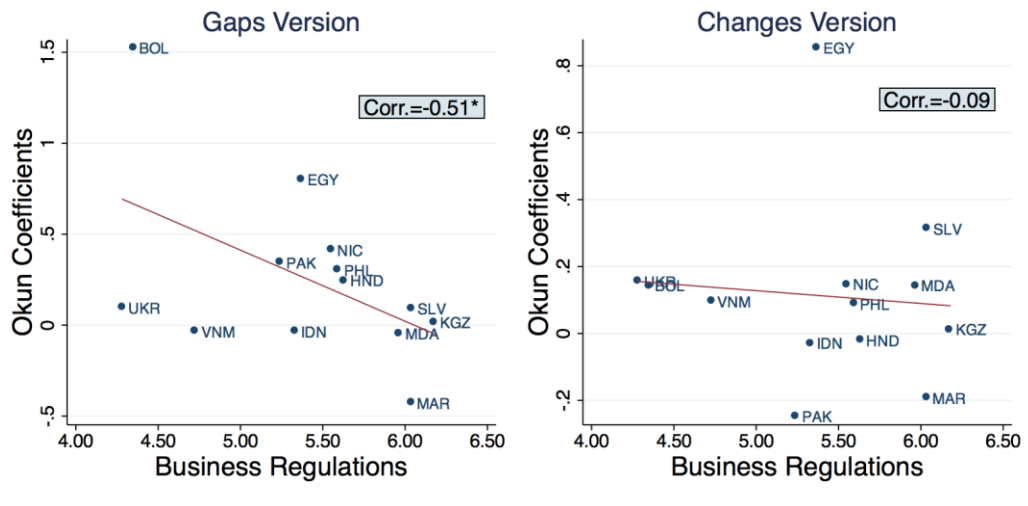
Source: Authors' estimates based on the IMF World Economic Outlook April 2017, and Economic Freedom of the World Index by the Fraser Institute.

C. Okun's Law with Panel Analysis

We also estimate the gaps and changes specifications of Okun's Law through panel regression, specified as equation (4) and (5) with all notations remaining the same. A full set of country and year fixed effects denoted by the term ω_i and μ_t, respectively, is included. A major advantage of panel regression is the increased precision due to increased sample size. However, we will have to ignore the cross-country heterogeneity and assume the same Okun coefficients in all countries.

$$e_{it} - e_{it}^* = \gamma(y_{it} - y_{it}^*) + \omega_i + \mu_t + \varepsilon_{it} \tag{4}$$

$$\Delta e_{it} = \alpha + \beta \Delta y_{it} + \omega_i + \mu_t + \varepsilon_{it} \tag{5}$$

Column 1 in Table 4 shows the panel regression results. With the gaps version, the coefficient estimate is 0.14 and statistically significant. This value is lower than the averaged country-specific Okun coefficient (0.20). With the changes version, the coefficient estimate is 0.17 and statistically significant, which is the close to the averaged country-specific Okun coefficient (0.16).

Next we investigate the potential determinants that can alter the responsiveness of total employment to output fluctuations through panel regression with interaction terms. Specifically, based on the panel specifications we include the interaction terms between the output gap or output growth with the potential determinant. With the gaps version specified in equation (6), D_i denotes the determinant variable and the coefficient γ_2 measures the impact of determinant

variable on the Okun relationship. Similar notations are used in the changes version in equation (7), and β_2 captures such impact.

$$e_{it} - e_{it}^* = \gamma_1(y_{it} - y_{it}^*) + \gamma_2(y_{it} - y_{it}^*) \cdot D_i + \omega_i + \mu_t + \varepsilon_{it} \tag{6}$$

$$\Delta e_{it} = \alpha + \beta_1 \Delta y_t + \beta_2 \Delta y_t \cdot D_i \, \omega_i + \mu_t + \varepsilon_{it} \tag{7}$$

The rest of Table 4 reports the estimation results from including the interaction term with each of the particularities of LLMICs discussed above. As shown in column (2), with both gaps and changes specifications, the coefficient estimate of the interaction term with poverty rate is negative and significant. This is consistent with the finding above that a higher poverty rate is associated with weaker responses of labor market. Column (3) shows that the coefficient estimate of the interaction term with poverty rate is negative but only significant with the gaps version. A higher level of skill mismatch is associated with a weaker relationship between labor market and output. As shown in columns (4) and (5), coefficient estimate of the interaction term is positive for informality and negative for business regulations, but not significant.

Table 4. Okun Coefficients from Panel Regression

	(1) Panel regression	(2) Poverty	(3) Skill mismatch	(4) Informality	(5) Business regulations
	Gaps version				
Output Gap	0.14***	0.15***	0.22**	0.07	0.17***
	(0.03)	(0.06)	(0.11)	(0.07)	(0.07)
Interacted term		-0.23**	-0.27*	0.16	-0.12
		(0.12)	(0.16)	(0.16)	(0.12)
R-squared	0.05	0.19	0.12	0.11	0.16
N. of Obs.	698	326	282	620	350
	Changes version				
Output Growth	0.17***	0.21***	0.22*	0.10	0.17***
	(0.05)	(0.07)	(0.14)	(0.09)	(0.06)
Interacted term		-0.36***	-0.17	0.18	-0.16
		(0.11)	(0.19)	(0.19)	(0.11)
N. of Obs.	0.26	0.34	0.29	0.27	0.32
R-squared	677	316	273	601	339

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: The table presents estimated Okun coefficients based on panel regression with country fixed effects. Robust standard errors are reported in parentheses. Significant at *10%, **5%, and ***1%.

V. A CLOSER LOOK: THE MOROCCO CASE

In the previous sections we find that the growth patterns in output and employment are inconsistent in Morocco. Furthermore, we find negative short-run relationship between output growth and total employment growth, which is significant even with the gaps version. In this section, we take a closer look at the evolution of labor market in Morocco.

Decreased participation rate and improved education level: The labor market is characterized with a downward trend participation rate. Table 5 compares the average participation rate between 1999-2002 and 2011-2014. The participation decreased by 7 percent over the 15 years. This reduction is due to progression of the education that particularly affected the participation of young people aged 15 to 24 years (decreases by 25 percent). In contrast with the declining participation rate, the education level of the labor supply has relatively improved. The percentage of working people with a higher education degree increased from 31.3 percent in 2000 to 41.4 percent in 2014.

**Table 5. Participation Rate in Morocco**

	Average (%): 1999-2002	Average (%): 2011-2014	Change (%)
National	52.2	48.6	-7%
Without diploma	51.2	49.0	-4%
With diploma	54.2	48.0	-11%
Male	78.1	73.4	-6%
Female	27.1	25.2	-7%
15 to 24 yr	44.2	33.4	-25%
25 to 34 yr	63.0	61.4	-3%
35 to 44 yr	62.9	61.4	-2%
44 yr & over	44.3	44.5	0%
Rural	60.4	57.5	-5%
Urbain	46.4	42.7	-8%

Source: Haut-commissariat au plan, Morocco, 2016.

Progression of service sector: During the past fifteen years, total employment increased by 129 thousand jobs per year on average. As shown in the Left panel of Figure 11, service sector accounts for 87 thousand jobs creation per year (67 percent of total). Among the rest of the job creation, construction sector contributes 31 thousand jobs (24 percent); agriculture, forest and fishing contribute 10 thousand jobs (8 percent); and the industrial sector (including handicrafts) creates 1

thousand jobs (1 percent). Following the progression of the services, the employment structure has changed between 2000 and 2014. The share of service sector increases from 34.7 percent in 2000 to 40.2 percent in 2014 (right panel of figure 10). This sectoral shift begins to close the gap between Morocco and Advanced economies, increasing the relevance of the standard Okun framework in this case.

**Figure 10. Evolution of Employment Share by Sector**
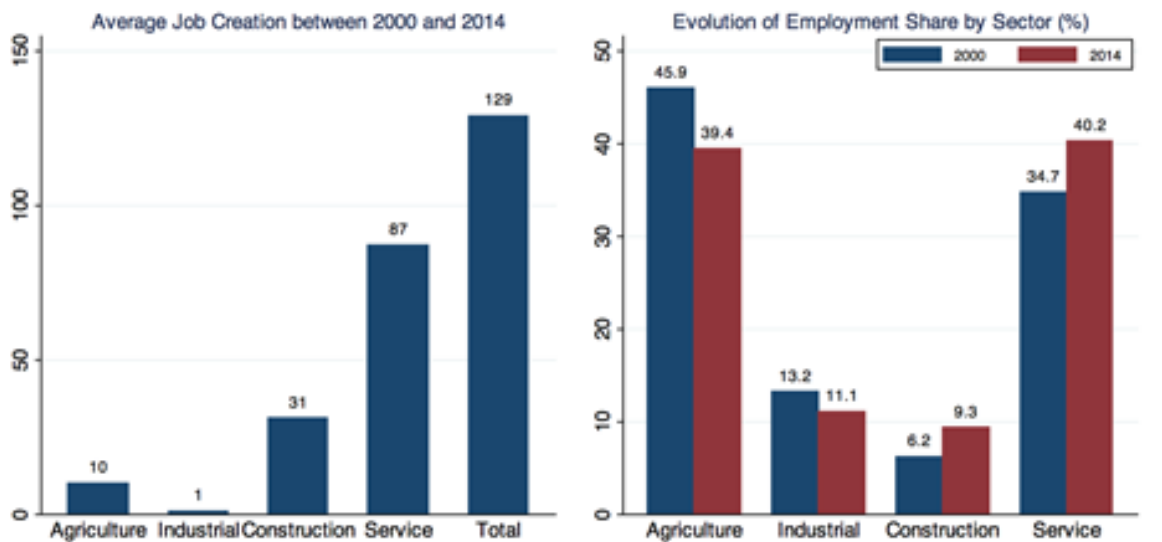
Source: Haut-commissariat au Plan, Morocco, 2016.

Importance in informal sector: Another feature of employment in Morocco is the importance of informal activities in providing non-agricultural employment. In 2013, employment in the informal sector was around 2.4 million people representing 36.3 percent of overall non-agricultural employment. The informal sphere is essentially composed of small business and microenterprises. According to a survey conducted by the Haut-commissariat au Plan, 233 thousand independent employers recruited 420 thousand employees and distributed 11.4 billion Dirham of wages in 2013. This amount of wages accounts for almost 4 percent of the national compensation and 11 percent of the overall added value of the informal sector.

Limited by the data availability, we are not able to directly examine the impact of labor market evolution of the relationship between output and labor market. As an alternative approach, we perform a rolling windows exercise. Figure 9 displays the dynamic of Okun coefficient based on a 10-year rolling window. The solid line in the left panel shows estimated Okun coefficients, and the

dash lines shows the 95 percent confidence interval. The right panel shows the corresponding R-squared. The value on the horizontal axis shows the end year of each rolling window. Take the first rolling window of 1996-2006 for example, the estimated Okun's coefficient is -0.03 and it is not statistically significant, and the R-squared is 0.03. As the rolling window moves along, there is a clear trend that the Okun coefficient becomes more negative and statistically significant. Meanwhile, the R-squared increases from around zero to above 0.7. This indicates the Okun's Law became more and more fit for Morocco. We apply the same analysis to total employment and total labor force in Morocco. Figure 10 shows the dynamic of the relationship between growth in total employment and growth in real GDP. There is a similar pattern - the relationship between employment and output becomes stronger across time: as the window evolves, the coefficient becomes greater and more significant. The R-squared increases from around zero to above 0.6.

Figure 11. Rolling Estimation in Morocco, Employment
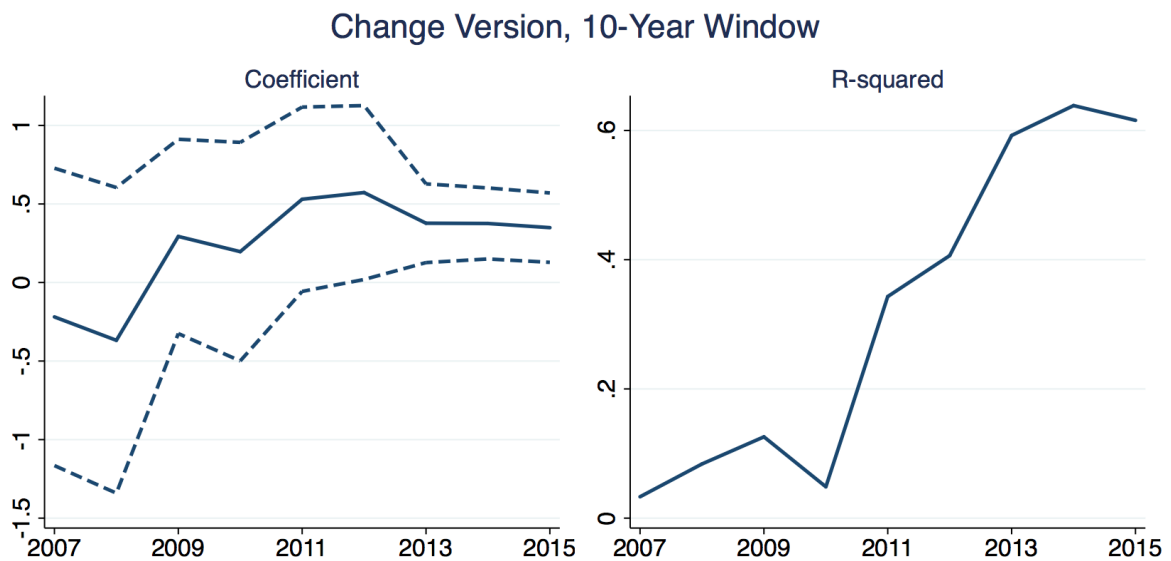
Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

If we assume that the three trends that we described at the beginning of the section are the main changes in the labor markets dynamic, then this results might indicate that the increase in the importance of the informal market was more than compensated with the sectoral shift and the tightness of the supply generated by the decrease in labor market participation.

VI. CONCLUSION

This paper investigates the relationship between economic growth and job creation in low and low middle-income countries. Our analysis focuses on real GDP and total employment and is in twofold: First, we study the growth patterns in output and labor market. We rely on multiple structural breaks test to identify the growth regime changes in output and total employment, and compare the regime changes in output growth and total employment growth in each country and on average. Second, we test the short-run relationship between output and total employment through the lens of Okun's Law, and try to explain the cross-country heterogeneity with the particularities in the LLMICs.

Our main findings are as follows. First, regime changes are quite common in both output growth and employment growth. Out of the 25 LLMICs, 13 countries have experienced at least one regime change in both output growth and employment growth, 5 countries have experienced regime change in output growth only, and 4 countries have experienced regime change in employment growth only. However, regime changes in output and total employment are not synchronized with each other. Out of the 17 up-breaks in GDP growth, only 3 cases are followed by the up-breaks in employment growth; out of the 9 down-breaks in GDP growth, only 2 cases are followed by the down-breaks in employment growth. On average, employment growth decelerations are associated with GDP growth down-breaks, while employment growth accelerations are not associated with GDP growth up-breaks. Second, Okun's Law holds in half of the countries in our sample. The Okun coefficient is 0.20 on average, and shows considerable cross-country heterogeneity. The responsiveness of total employment is negatively associated with poverty rate and skill mismatch level.

Appendix Table. Up- and Down-breaks in GDP Growth and Employment Growth

	Real GDP Growth		Total Employment Growth	
	Up-breaks	**Down-breaks**	**Up-breaks**	**Down-breaks**
Belize	1998	2006		2007
Bolivia	2006	1998		1997, 2006
Cabo Verde	1992	2008		2000
Cote d'Ivoire	2011		1988	1996
Egypt				
El Salvador		1999	2006	1998
Georgia				
Honduras	1999	2007		2006
India	2002		2004	1987, 1996
Indonesia	2006	1998		
Kenya	2009			1996
Kyrgyzstan				
Moldova	2001		2010	
Mongolia			1998	1990, 2006
Morocco				2004
Nicaragua	1993			
Pakistan			1996, 2004	
Philippines	2009			1996
Sao Tome and P.	1988, 2002			
Tajikistan	2000	2008	2000	2008
Tanzania	2003		2011	
Turkmenistan				2003
Ukraine	1999	2007		
Uzbekistan	1999		2001	2010
Vietnam		1997		

Source: Authors' estimates based on the IMF World Economic Outlook April 2017.

Note: Up- and down-breaks in GDP growth and employment growth are identified using Berg et. al. (2012) methodology with minimum interstitiary period of 8 years.

REFERENCES

Ahmed, Masood, Dominique Guillaume, and Davide Furceri, 2012, "Youth Unemployment in the MENA Region: Determinants and Challenges," World Economic Forum: *Addressing the 100 Million Youth Challenge – Perspectives on Youth Employment in the Arab World*, 8-11.

Aleksynska, Mariya and Martin Schindler (2011), "Labor Market Regulations in Low-, Middle- and High-Income Countries: A New Panel Database," IMF Working Paper, 11/154.

Bai, Jushan, and Pierre Perron, 1998, "Estimating and Testing Linear Models with Multiple Structural Changes," *Econometrica*, 66(1), 47-78.

Bai, Jushan, and Pierre Perron, 2003, "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, 18, 1-22.

Ball, Laurence M., Davide Furceri, Daniel Leigh, and Prakash Loungani, 2017, "Does One Law Fit All? Cross-Country Evidence on Okun's Law," Mimeo.

Ball, Laurence M., Daniel Leigh, and Prakash Loungani, 2017, "Okun's Law: Fit at 50?" *Journal of Money, Credit and Banking* 49(7), 1413-1441.

Berg, Andrew, Jonathan D. Ostry, and Jeromin Zettelmeyer, 2012, "What Makes Growth Sustained?" *Journal of Development Economics* 98(2), 149-166.

Dewan, Sabina and Peter Peek, 2007, "Beyond the Employment/Unemployment Dichotomy: Measuring the Quality of Employment in Low Income Countries." ILO Working Paper No 83.

Estevao, Marcello and Evridiki Tsounta, 2011, "Has the Great Recession Raised U.S. Structural Unemployment?" IMF Working Paper 11/105.

Furceri, Davide and Prakash Loungani, 2012, "Jobs and Growth: Can't Have One without the Other?" International Monetary Fund: World Economic Outlook October 2012: 179-183.

Gwartney, James, Robert Lawson, and Joshua Hall, 2016, "Economic Freedom of the World: 2016 Annual Report" The Fraser Institute.

Hausmann, Ricardo, Lant Pritchett, Dani Rodrik, 2005. "Growth Accelerations." *Journal of Economic Growth*,10, 303-329.

International Labour Organization, 2013, "Global Employment Trends for Youth 2013: A generation at risk."

Jerzmanowski, Michay, 2006, "Empirics of Hills, Plateaus, Mountains and Plains: A Markov-switching Approach to Growth," *Journal of Development Economics*, 81, 357-385.

Jones, Benjamin, and Benjamin Olken, 2008, "The Anatomy of Start-Stop Growth," *Review of Economics and Statistics*, 90(3): 582-587.

Singhm, Anoop, Join-Chandre, Sonali and Mohommad, Adil (2012). "Inclusive growth, institutions, and the Underground Economy" IMF Working paper.

Medina, Jonelis, and Cangul, 2017, "The Informal Economy in Sub-Saharan Africa: Size and Determinants", IMF Working paper 17/156.

OECD, 2009, "Is Informal Normal? Towards More and Better Jobs in Developing Countries."

Okun, Arthur M. 1962. "Potential GNP: Its Measurement and Significance." Reprinted as Cowles Foundation Paper 190.

Prati, Alessandro, Massimiliano Onorato, and Chris Papageorgiou, 2013, "Which Reforms Work and under What Institutional Environment: Evidence from a New Dataset on Structural Reforms," *Review of Economics and Statistics*, 95(3), 946-968.

Pritchett, Lant, 2000, "Understanding Patterns of Economic Growth: Searching for Hills Among Plateaus, Mountains, and Plains," *World Bank Economic Review*, 221-250.

Samans, Richard, Jennifer Blanke. Margareta Drzeniek Hanouz, and Gemma Corrigan, 2017, "The Inclusive Growth and Development Report 2017," World Economic Forum

Tejani, Sheba, 2015, "Jobless growth in India: an investigation", *Cambridge Journal of Economics*, 40(3), 843-870.