The Response of Employment to Output Shocks in Egypt

Dr. Ahmed Elroukh[*]
Dr. Rania Elsharkawy[†]

Abstract

This paper examines the response of employment to its own dynamics and output fluctuations using quarterly data that span the past two decades and an ARDL regression approach. This is the first paper that search empirically for the existence of a bounce-back effect in the response of employment to output in Egypt. We also test for inertia in the Egyptian labor market. The paper accounts for structural breaks that could have resulted due to the financial crisis, the political unrest following the 2011 revolution, and Covid-19 pandemic. The findings of this paper suggest the existence of a bounce-back effect in the response of employment to output and inertia in the Egyptian labor market. Moreover, the findings of this paper suggest the existence of adverse effects on employment of the recent shocks to the Egyptian economy. The magnitude of these effects differs according to the type of shock, though.

Keywords: Employment, Output Shocks, ARDL

JEL classification: E24**,** E32, J21

[*] Lecturer – Department of Economics-Faculty of Economic Studies and Political Science- Alexandria University.
[†] Lecturer – Department of Economics-Faculty of Economic Studies and Political Science- Alexandria University.

استجابة التوظف لصدمات الناتج في مصر

ملخص

تهدف هذه الورقة إلى دراسة استجابة التوظف في مصر للتغييرات في كلاً من ديناميكاته وتقلبات الناتج باستخدام سلاسل زمنية ربع سنوية تغطى العقدين الماضيين وأسلوب نموذج الانحدار الذاتي الموزع (ARDL). تُعد هذه الورقة هي الدراسة الأولى التي تبحث بشكل تجريبي عن وجود تأثير ارتداد (bounceback) في استجابة التوظف في مصر للناتج كما تختبر فرضية العطلة (inertia) في سوق العمل المصري. يأخذ التحليل القياسي في الحسبان التغييرات الهيكلية التي قد تكون حدثت في سوق العمل المصري والناجمة عن كلاً من الأزمة المالية، والاضطرابات السياسية التي أعقبت أحداث 2011، ووباء كوفيد –19. تشير نتائج هذه الورقة إلى وجود ارتداد في استجابة التوظف لفجوة الناتج، بمعنى أنه مع تعافي الاقتصاد من فترات الركود، حيث الناتج الفعلي أقل من المحتمل، فإن معدل نمو العمالة يتزايد مما يعكس النظرة التفائلية لأرباب الأعمال. كما تشير نتائج هذه الورقة إلى وجود جمود في استجابة التوظف لديناميكاته حيث يتخذ أصحاب العمل قرارات التوظف بناءً على ظروف سوق العمل في الربع السابق، أي أن أرباب العمل يتبعون فرضية التوقعات التكيفية (Adaptive Expectations) في قراراتهم التوظيفية. علاوة على ذلك، تشير نتائج هذه الورقة إلى وجود آثار سلبية على التوظف جراء الصدمات المذكورة آنفاً للاقتصاد المصري، ولكن يختلف حجم هذه التأثيرات باختلاف نوع الصدمة.

الكلمات المفتاحية: التوظف في مصر، صدمات الناتج، التغييرات الهيكلية في سوق العمل المصري، ARDL

1. Introduction

New job creation represents a major challenge for the Egyptian economy. This has led to persistent low employment levels in Egypt for the past few decades. Moreover, the Egyptian economy was subject to multiple shocks in the past two decades, which deepened the problem and caused fluctuations in employment levels.

The labor market in Egypt was facing many challenges before the financial crisis of 2007 such as a growing wedge between the supply of labor and its demand, low participation rate of women in the labor force, over-employment in the public sector, a large informal economy, and low productivity and wage levels. The financial crisis had adverse effects on the Egyptian economy where the growth rate of real GDP had declined from 7.2% in 2007/08 to 4.1 in the second quarter of 2008/09. This led to severe consequences on the labor market such as an increase in the unemployment rate from 8.4% in June 2008 to 9.4% in June 2009. The females, in particular, suffered a substantial increase in their unemployment rate from 18.8% to 23.2% over the same period. This could be explained by decreasing employment opportunities in the public sector for females in addition to the biased preference of the private sector against females (Assad et al., 2020). These adverse effects on the labor market were due to a decline in Egyptian exports, low FDI inflows, and low remittances transfers from Egyptians who are working abroad (Klau, 2009).

The political unrest that followed the revolution of 2011 had caused a drastic fall in foreign investment. In 2010/11, economic growth rate slowed down to 1.7%, foreign investment deteriorated from 6.8 to 2 USD Billion, and tourism revenues declined by 60% (Abdou & Zaazou, 2013). The labor market reflected the adverse effects of these events with the unemployment rose to above 12%. This, in turn, had its toll on poverty with almost 50% of the Egyptian population was either under poverty line or vulnerable to becoming poor (CAPMAS, 2011).

Following the outbreak of Covid-19, employment rate fell by 8% with the fall being sharper among females. Men losing their work transitioned into unemployment while females primarily left the labor force. The heaviest employment losses were experienced by the least educated compared with those with more than a high-school diploma. Job formality played an important role in maintaining jobs with 4% fall in formal employment compared to 11% fall in informal employment (ILO, 2021). The changes in employment that are a result of this shock and previous shocks call for an analysis of the dynamic relationship between employment and output.

In his seminal work, (Hamilton, 1989) introduced asymmetry in the U.S. business cycles. That is, recessions tend to be relatively more violent than expansions. (Beau dry & Koop, 1993) documented another feature of business cycles which is output growth tend to be relatively stronger following recessions. (Kim et al., 2005) extended Hamilton's model to allow for post-recession strong recovery and they labelled this as the "bounce-back" effect. Other studies investigated the existence of the bounce-back effect in employment such as (Sinclair, 2009; Bradley & Jansen, 2018; Elroukh et al., 2020). Investigating the speed of recovery in employment after the economy is hit by a shock will provide important insights to policymakers about the dynamics of employment. [1] In particular, how employers respond to recovery in output. This is critical to policymakers since macroeconomic policies that are meant to stimulate output may not be effective in stimulating employment if a decoupling between output and employment series exists. This could result in a jobless recovery phenomenon.[2] This is the main contribution of our paper: To examine if the employment series in Egypt exhibits a bounce-back effect when output recovers after the Egyptian economy is hit by a shock.

This paper aims to study the underlying dynamic relationship between employment and output taking into account the effects of macroeconomic shocks on employment in the past two decades. We accomplish this by modeling changes in the growth rate of employment that could be explained by labor market dynamics and fluctuations in output. Using quarterly data and an ARDL regression approach, we establish a long-run relationship between employment and output. We test for an existence of a bounce-back effect in employment dynamics with respect to output fluctuations. The findings of this paper will help policymakers in designing employment strategy as part of output-stabilizing policies.

Following this introduction, we present a brief overview of the previous literature on the Egyptian labor market. Model specification is presented in section 3. Sections 4 and 5 present data and econometric methodology, respectively. Empirical results are reported in section 6. Section 7 concludes and provides policy recommendations.

[1] Dynamics of employment is being defined as changes in gross worker flows, i.e., job gains net job losses (Hyatt & Spletzer, 2013).

[2] For more on jobless recoveries, please see (Panovska, 2017)

2. Theoretical Framework and Literature Review

There has been ample research work on the labor market in Egypt. This section presents, in a chronological order, a brief overview of selected relevant literature on Egyptian labor markets.

El-Ehwany & El-Megharbel (2009) examined economic sectors that generate more jobs in Egypt over the period 1980 to 2009. They found that some sectors such as food, wooden products, and chemicals are considered promising in terms of generating more jobs. They were also able to detect a pattern of increased employment in the informal sector. They proposed adopting a strategy that targets employment-intensive sectors with a focus on export-targeted industries since these tend to increase labor productivity.

Hassan & Kandil (2011) investigated the cyclicality of the labor market in Egypt and its determinants. They found evidence in favor of procyclicality of private-sector employment. They identified key factors that positively affect private-sector employment such as the availability of credit to the private sector and exports growth. Public-sector employment was a factor that adversely affected employment in the private sector due to the crowding-out effect. As policy recommendations, they proposed increasing the credit provided to the private sector and promoting exports towards growing-jobs industries. Also, fiscal consolidation that will help reduce the crowding out effect is needed.

Mowla (2011) conducted a detailed study about vulnerable employment in Egypt. Vulnerable employees are at risk of becoming poor if the economy is subject to an adverse shock. She identified the main determinants of vulnerable employment in Egypt as education, gender, and the work sector, i.e., whether public or private. She proposed policy interventions to reduce vulnerable employment in the short run such as encouraging the well-performing self-employed to expand their business and providing subsidies to employers to hire new workers. In the long run, she suggested a policy that aims toward alleviating vulnerable employment in Egypt via improving workers education and reallocate capital to less-invested rural regions of the country.

El-Ghamrawy (2014) studied the effects of trade openness on employment and wages in Egypt. He found that in general exports increase employment while imports have no significant effect. He distinguishes between public and private employment, and between technology-intensive and low-technology sector. By doing so, he was able to find evidence that exports positively affect employment in both the public-sector technology-intensive group and the private-sector low-technology group. Therefore, policy should aim to increase the competitiveness of these two groups.

Assad & Kraft, (2015) conducted an in-depth analysis of the evolution and structure of employment in Egypt over the period 1998 to 2021. They found that labor market conditions have been deteriorating in Egypt. That is, the creation of new jobs has declined substantially while the job separation rate has increased. Also, not only the hiring of the public sector has remained flat, but the private sector hiring was precarious. They found evidence that a large portion of workers has relied upon irregular-wage employment which is vulnerable to economic shocks. Moreover, they found evidence that the 2011 revolution has represented a challenge to the stability and growth of employment. They concluded that a stable macroeconomic environment is essential to promoting employment growth.

The Egyptian Center for Economic Studies (ECES) has launched a series of studies that assess the impact of Covid-19 on the Egyptian economy. ECES (2020) has traced the impact of macroeconomic shocks on Egyptian labor market. The study, however, took a microeconomic approach where it analyzed unemployment by education, gender, and occupation. Although the study revealed that the Egyptian labor market is fragile, it did not estimate a formal econometric model to analyze the effect of macroeconomic shocks on the labor market in Egypt.

Although the summarized literature in this section has provided deep insights about the Egyptian labor market, there is still a need to study the dynamics of employment with respect to macroeconomic shocks. This paper is an attempt to fill that gap. Next section specifies a model that I utilize to tackle that research question.

3. Model specification

To examine the response of employment to labor market and output dynamics, we employ a model that is similar in spirit to the one that is used by Elroukh et al. (2020). That is, we model the response of employment growth rate with respect to two terms: one that captures the labor market dynamics and another that captures the response of employment to fluctuations in output. Then, we augment this model by terms that capture the structural breaks in the relationship between employment and output following: i) the financial crisis, ii) the political unrest in Egypt following 2011, and iii) Covid-19. More formally, the employment-output response equation could be specified as follows.

$$ge_t = c_0 + \theta_e \, gape_{t-1} + \theta_y \, gapy_t + \theta_{d,i}\boldsymbol{d} + \epsilon_t \qquad (1)$$

where ge_t is employment growth rate at time t, $gape_{t-1}$ is the employment gap at time $t-1$, computed as the difference between the actual employment and full employment, $gapy_t$ is the output gap time t, computed as the difference between actual output and potential output, $\boldsymbol{d}$ is a vector of dummy variables $[d07, d11, d20]$ such that $d07$ equals 1 between 2007Q3 and 2010Q4 and zero otherwise, $d11$ equals 1 between 2011Q1 till 2019Q4 and zero otherwise, and $d20$ equals 1 between 2020Q1 till the end of the sample and zero elsewhere. These dummy variables capture any structural change in the dynamics of employment to output in the corresponding period compared with the benchmark period, 2004Q3 to 2007Q2. $\theta_{d,i}$ Is the coefficient of the dummy variable d_i where $i \in \{d07, d11, d20\}$.

Since this paper tries to capture the behavior of employment and output over the business cycles, it is more appropriate to use the cycle component of these variables instead of their levels. A seriesX_t, such as output or employment, can be decomposed into two summable components, a trend, and a cycle. The trend captures the permanent component of X_t in the sense that any realized effects of shocks on the trend are not expected to be reversed. By contrast, the cycle captures the transitory component of X_t in the sense that any shocks to the cycle will eventually die out (Morley & Piger, 2012). The cycle component of the output series can be used to capture the output gap,gap_y while the cycle component of the employment series can be used to capture the employment gap, gap_e. Both employment and output gaps have been estimated using the very commonly used Hedrick & Prescott (1997) filter. The HP filter is popular in the literature because it is symmetric, smooth, and has large amplitude, which is consistent with the conventional idea of a cycle that fluctuates symmetrically around its mean. Although the HP filter is subject to some criticisms such as it fails to capture asymmetry in business cycles, it is still widely used by major economic government agencies around the world, such as the Bureau of Economic Analysis, to estimate the U.S. output gap (Hamilton, 2017).

On the one hand, if θ_e is positive and (i) if $gape_{t-1}$ is negative, that is employment is below full-employment level, then employment growth,ge_t will be negative; (ii) if $gape_{t-1}$ is positive, that is employment is above full-employment level, then employment growth,ge_t will be positive. If employment series exhibits such a behavior, this indicates inertia in the labor markets where employers follow adaptive expectations in their hiring decisions. That is, employers make their hiring decision in the current quarter based on the labor market conditions of the previous quarter. On the other hand, if θ_e is negative, then employment growth, ge_t responds adversely to shocks. That is, (i) if $gape_{t-1}$ is negative, that is employment below full-employment level, then a negative θ_e will make employment growth, ge_t, to be positive, i.e., employment will recover towards the full-employment level; (ii) if $gape_{t-1}$ is positive, that is employment above the full-employment level, then a negative θ_e will make employment growth, ge_t, to be negative, i.e., employment will contract towards the full-employment level. If employment series exhibit such a behavior, this indicates a bounce-back effect toward a hypothetical growth rate of employment. That is, if employers hired too many workers in one quarter, then they correct their "over hiring" in the following quarter, and vice versa. The coefficient θ_e is one of the two key parameters in this paper since it captures the existence of an inertia vs. a bounce-back effect in employment with respect to labor market conditions (DeNicco, 2015; Panovska, 2017; Elroukh et al., 2020)

The other key parameter in this paper is θ_y which captures cyclicality vs. a bounce-back effect of employment with respect to output. That is, if θ_y is positive, this indicates a procyclicality of employment. That is, if output is below its long-run potential level, then employment growth rate will decrease. If θ_y is negative, this will be consistent with the bounce-back hypothesis (Bradley & Jansen, 2018; Elroukh et al., 2020; Sinclair, 2009). The bounce-back hypothesis suggests that if output is below its long-run potential level, then employment growth rate will increase as output recovers during recessions. In other words, as the economy recovers from a recession, the growth rate of employment will increase as employers expect the economy to prosper in the future. Hence, employers increase their hiring given the optimistic view of the economy.

The expected signs for θ_d is negative for all $i = d07, d11, d20$ because these events represent adverse shocks to the Egyptian economy. That is, $d07$ captures the period following the Great Recession, $d11$ captures the political-unrest period following the 2011 revolution, and $d20$ captures the period following the Covid-19 health shock. These episodes are expected to have negative effects on the Egyptian labor markets.

4. Data and Descriptive Statistics

Quarterly data for employment has been outsourced from the International Financial Statistics (IFS) of the IMF and covers the period 2004Q3 to 2021Q2, seasonally adjusted, since local data sources, such as the Ministry of Planning and Economic Development, do not cover quarterly data for the whole period. Quarterly data for real GDP are not available at the IFS for Egypt. Quarterly real GDP series is outsourced from the Ministry of Planning and Economic Development, seasonally unadjusted though. We use X-13ARIMA-SEATS quarterly seasonal adjustment method to depersonalize real GDP. Figure (1) presents the real GDP series after it has been adjusted for seasonality versus raw seasonally unadjusted data.

Figure (2) presents the growth rates of employment and real GDP. Employment growth rate declined and hit negative rates following the financial crisis, the 2011 revolution, and Covid-19. The decline in the growth rate of employment was severe during the Covid-19 shock where growth rate of employment reached -8%. This decline, however, was followed by a bounce back in employment once the Egyptian economy started to recover. This bounce back was of a similar magnitude, but with an opposite sign.

To visualize the cyclicality of employment and output, figure (3) presents both employment and real GDP gaps, computed as the cycle of the popular Hodrick & Prescott (1997) filter. As shown in figure (3), employment seems to be more volatile than real GDP. Moreover, the amplitude of employment gap tends to be higher than the peak of the output during an expansion and lower than the trough of the output in a contraction. This indicates that the Egyptian labor market has higher sensitivity to macroeconomic shocks compared with fluctuations in output.

5. Econometric methodology

To examine the response of employment to its dynamics and to output fluctuations, this paper employs the technique that was proposed by Pesaran and Shin (1996) and Pesaran et al. (2001). They proposed the bounds test approach to establish cointegration which could be applied, when using the ARDL models, whether the underlying variables of interest are I (0), I (1), or mutually cointegrated. To apply the bounds test, it suffices that the underlying variables to be stationary at the first difference. That is, none of the included series should be integrated of order 2 or more. This feature of the bounds test made the ARDL model appealing if one chooses to be neutral about the order of integration of the underlying variables.

The first step in establishing cointegration via the bounds test is to estimate the unrestricted error correction form of the employment-output equation (equation 1) using OLS as follows.

$$\Delta ge_t = C_0 + \sum_{i=1}^{p} \gamma_{1i}\, \Delta ge_{t-1} + \sum_{i=1}^{q1} \gamma_{2i}\, \Delta gap_{e\ t-1} + \sum_{i=1}^{q2} \gamma_{3i} \Delta gap_{y_t} + \beta_1 ge_{t-1} + \beta_2 gap_{e\ t-1} + \beta_3\, gap_{y_t} + \beta_4\, d07 + \beta_5\, d11 + \beta_6 d20 + \epsilon_t \tag{2}$$

Where Δ is the first difference operator, γ_{1i}, γ_{2i}, and γ_{3i} are the coefficients of short-run dynamics of the underlying corresponding variables, with lag length $p, q1,$ and $q2$ respectively, β_1 to β_6 are the coefficients of the long-run relationship of the variables in the cointegrating set, and ϵ_t is a white-noise error term.

The errors of equation (2) must be serially uncorrelated so that the bounds test will be valid (Pesaran et al., 2001). To test for the presence of serial correlation in the error term of equation (2), we use the Breach-Godfrey test. Another key assumption in Pesaran et al. (2001) is that the errors of equation (2) must be homoskedastic since heteroskedastic errors will lead to inefficient estimation. We use the Breach-Pagan-Godfrey to test for the presence of heteroskedasticity. If there is no evidence of serial correlation or heteroskedasticity in the errors of equations (2), then the errors of equations (2) are said to be white noise. Once the white-noise assumption is satisfied, we can proceed to the next step and investigate for the presence of a long-run relationship by applying the bounds test.

The bounds test is a standard F-test that is used to test the null hypothesis of no cointegration. That is, $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ against the alternative that at least one of β_i, $i = \{1, 2, 3, 4, 5, 6\}$ is not equal to zero. The computed F-statistic is then compared to two critical values corresponding to cases of all variables are being purely I (0) or purely I (1). If the test statistic is below the lower critical value, the case of all variables is purely I (0), and then we fail to reject the null hypothesis of no cointegration. If the test statistic is above the upper critical value, the case of all variables is purely I (1), then the null hypothesis of no cointegration is rejected and hence a long-run relationship among the underlying variables exists. If the test statistic falls between the lower- and upper-critical values, then the bounds test is said to be inconclusive. Note that the asymptotic critical values which are presented in Pesaran et al. (2001) are misleading for small samples. Therefore, we use the critical values proposed by Narayan (2005) for small samples instead.

If the results of the bounds test suggest an existence of cointegration among the underlying variables, then the long-run employment-output equilibrium relationship could be estimated using the following equation:

$$ge_t = C_0 + \sum_{i=1}^{p} \gamma_{1i}\, ge_{t-1} + \sum_{i=1}^{q1} \gamma_{2i}\, gap_{e\,t-1} + \sum_{i=1}^{q2} \gamma_{3i} gap_{y_t} + \gamma_4\, d07 + \gamma_5\, d11 + \gamma_6\, d20 + \mu_t \quad (3)$$

Where μ_t is an error term? The restricted error correction model (ECM) can capture the short-run dynamics as follows:

$$\Delta ge_t = C_0 + \sum_{i=1}^{p} \gamma_{1i}\, \Delta ge_{t-1} + \sum_{i=1}^{q1} \gamma_{2i}\, \Delta gap_{e\ t-1} + \sum_{i=1}^{q2} \gamma_{3i} \Delta gap_{y_t} + \psi\, EC_{t-1} + \mu_t \quad (4)$$

Where ψ captures the speed of adjustment to long-run equilibrium, following a shock to the system.

5. Empirical results

This section presents the empirical results of the econometric model.

5.1 Stationary tests

We begin our analysis by making sure that none of the included series is integrated of order 2 or higher. To do so, we run the augmented Dickey-Fuller unit-root test on the level and first difference of each series. The null hypothesis is that the series has a unit root. Table (1) reports the estimates of the ADF test statistic where none of the included series is integrated of order (2).

5.2 Deterministic specifications

Two popular criteria are used to determine the order of lags which will be included in the estimation, the AIC and the BIC. The latter tends to produce a more parsimonious specification, which will save some degrees of freedom and improve the estimates precision. However, the BIC comes at the expense of a potential under fit of the estimated model. That is, including less lags than what is needed to capture the model dynamics. Therefore, this paper will use AIC criterion to determine the order of lags that will be included in all our regressions and tests. Table (2) shows the number of lags (p, q1, q2, q3) that are included in the estimated ARDL regression.

To test for possible structural breaks in the relationship between employment and output, we include three dummy variables that capture the period following major shocks to the Egyptian economy: $d07, d11,$ and $d20$ which capture the periods following the financial crisis, 2011 revolution, and Covid-19, respectively. These dummy variables will enter the estimated cointegration equation to examine the effect of these shocks on the employment growth rate.

5.3 Diagnostic testing

Before establishing cointegration among the study variables, we need to check for a key assumption in Pesaran et al. (2001), the errors of equation (2) must be white noise. Table (3) reports the F-statistic of the Breach-Godfrey test with the null hypothesis of no serial correlation in the error term of equation (2). It also reports the F-statistic of the Breach-Pagan-Godfrey test with the null hypothesis of homoskedastic error terms.

Given that none of these test statistics is significant at 10% level of significance, we conclude that no evidence of serial correlation or heterskedasticity is present in the error term of equation (2). Given that the error term of the unrestricted error correction form of the employment-output function is well behaved, the bounds test of cointegration could be applied next.

5.4 The bounds test for cointegration

The bounds test for cointegration can be applied now on the estimated equation (2). The result of this test is reported in table (4). Like we noted above, the asymptotic critical values that are reported by Views cannot be used to make a test decision since they will produce incorrect conclusion with finite samples. Therefore, table (4) also presents the critical values for samples between 60 and 65 observations.

Since the F-statistic of the bounds test exceeds the upper critical value I (1) at 1% level of significance, we conclude that there exist long-run cointegration relationships between employment growth rate, employment gap, and output gap.

5.5 Estimation of LR relationship

Table (5) reports the estimated long-run coefficients for equation (3). The coefficient of the employment gap, computed using the HP filter, is positive and significant. This suggests the existence of inertia in the Egyptian labor markets. That is, employers make their hiring decision in the current quarter based on the labor market conditions on the previous quarter. This coefficient is consistent with the adaptive expectations' hypothesis.

The coefficient of the HP output gap is negative and significant. This suggests the existence of the "bounce back" effect in the Egyptian labor market. That is, given the symmetry of the Hodrick & Prescott (1997) filter, if output is below its long-run potential level, then employment growth rate will increase as output recovers from a recession. Put differently, as the economy recovers from a recession, the growth rate of employment will increase as employers expect the economy to prosper in the future. Hence, employers increase their hiring given the optimistic view of the economy. By the same logic, if the output is above its long-run potential level, then employment growth rate will decrease as output starts to contract from its expansion peak.

The estimated coefficients of the three dummy variables are all negative and significant, as expected. The difference in their magnitude reflects the depth of the macroeconomy shock at that time. That is, the political unrest following the 2011 revolution caused the most severe effect on the Egyptian labor market with a slowdown of the growth rate of employment about 0.94 percentage point. The health shock of Covid-19 caused the second most severe effect on the Egyptian labor market with a slowdown of the growth rate of employment about 0.79 percentage point. The financial crisis also affected the labor market in Egypt adversely with a slowdown of the growth rate of employment about 0.63 percentage point.

5.6 Estimation of short-term dynamics

The results of short-term dynamics are summarized in Table (5). The estimated error-correction (EC) coefficients measure the speed of adjustment of long-run growth rate of employment, if disturbed by changes in their explanatory variables. The significance of the negative EC coefficients for all the estimated regressions supports the existence of a long-run relationship between growth rate of employment and the included explanatory variables: employment gap and output gap.

5.7 Stability of the long-run relationship

To test for the stability of the estimated long-run relations, I plot the Brown et al. (1975) CUSUM and CUSUM2 tests in figure 4. Since the plots of the CUSUM and CUSUM2 do not cross the two 5% significance level critical lines, we conclude that the coefficients of long-run growth rate of employment regressions are stable.

5.8 Goodness of fit

Table 5 also reports the adjusted R^2 for the estimated ARDL regression. We believe the fit of our model, $Adjusted\ R^2 = 0.59$ is reasonable given the number of economic and political shocks that the Egyptian economy had experienced.

6. Conclusion and policy recommendations

This paper examines the response of employment to labor market conditions and output dynamics. It does so by modeling changes in employment growth rate with respect to its own dynamics, employment gap, and output gap. Using quarterly data for the last two decades and an ARDL lag approach, we find evidence of the existence of a long run cointegrated relationship between employment growth rate, employment gap, and output gap. Our results suggest that there is inertia in labor markets, where employers base their hiring decisions in line with the adaptive expectations hypothesis. This is the first paper that finds evidence of a bounce-back effect in the Egyptian labor market. This will have important policy implications as is explained below. Finally, the paper establishes empirical evidence of how adversely the labor market was affected following the recent shocks to the Egyptian economy.

The paper's findings have profound policy implications in terms of developing an employment strategy at the macroeconomic level. That is, given the existence of inertia in the Egyptian labor markets, a good strategy to boost employment during economic slowdown is to enhance employers' expectations. This could be accomplished by providing tax incentives to employers to increase their hiring's. Also, extending credit for small and medium sized enterprises that could absorb the excess supply of workers at that time. On the other hand, a good strategy to boost employment during expansion periods is to sustain that increase in economic growth and adopt a policy to prevent a pessimistic view of the macroeconomy to avoid any potential decrease in employment. In sum, an employment strategy that takes into account the response of employment to output dynamics should be an integral part of macroeconomic policies. Analysis of the heterogeneous response of employment in different economic sectors is a fruitful ground for future research.

References

- Abdou, D., & Zaazou, Z. (2013). The Egyptian revolution and post socio-economic impact. *Topics in Middle Eastern and African Economies*, *15*(1), 92–115.
- Assad, R., Hendy, R., Assassin, M., & Yassin, S. (2020). Explaining the MENA Paradox: Rising Educational Attainment, Yet Stagnant Female Labor Force Participation. *Demographic Research*, *43*, 817–850. https://doi.org/10.4054/demres.2020.43.28
- Assad, R., & Kraft, C. (2015). The Structure and Evolution of Employment in Egypt. In R. Assad & C. Kraft (Eds.), *the Egyptian Labor Market in an Era of Revolution* (pp. 27–51). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198737254.003.0002
- Beau dry, P., & Koop, G. (1993). Do recessions permanently change output? *Journal of Monetary Economics*, *31*(2), 149–163. https://doi.org/10.1016/0304-3932 (93)90042-E
- Bradley, M. D., & Jansen, D. W. (2018). Nonlinear evidence on the existence of jobless recoveries. *Studies in Nonlinear Dynamics & Econometrics*, *22*(1), 20160081. https://doi.org/10.1515/snde-2016-0081
- Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society. Series B (Methodological)*, *37*(2), 149–192.
- CAPMAS. (2011). *Labor Force Survey, Central Agency for Public Mobilization and Statistics*.
- DeNicco, J. P. (2015). Employment-At-Will Exceptions and jobless recovery. *Journal of Macroeconomics*, *45*, 245–257. https://doi.org/10.1016/j.jmacro.2015.05.003
- ECES. (2020). *Views on the Crisis: Egypt's Labor Market*. The Egyptian Center for Economic Study.
- El-Ehwany, N., & El-Megharbel, N. (2009). Employment intensity of growth in Egypt with a focus on manufacturing industries. *Egyptian Center for Economic Studies (ECES), Working Paper Series*.
- El-Ghamrawy, T. (2014). The Impact of Trade Openness on Employment and Wages in Egypt's Manufacturing Sector. *ECES Working Papers. No. 176*.
- Abdou, D., & Zaazou, Z. (2013). The Egyptian revolution and post socio-economic impact. *Topics in Middle Eastern and African Economies*, *15*(1), 92–115.
- Assad, R., Hendy, R., Lassassi, M., & Yassin, S. (2020). Explaining the MENA Paradox: Rising Educational Attainment, Yet Stagnant Female Labor Force Participation. *Demographic Research*, *43*, 817–850. https://doi.org/10.4054/demres.2020.43.28
- Assad, R., & Kraft, C. (2015). The Structure and Evolution of Employment in Egypt. In R. Assad & C. Kraft (Eds.), *the Egyptian Labor Market in an Era of Revolution* (pp. 27–51). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198737254.003.0002
- Beau dry, P., & Koop, G. (1993). Do recessions permanently change output? *Journal of Monetary Economics*, *31*(2), 149–163. https://doi.org/10.1016/0304-3932 (93)90042-E
- Bradley, M. D., & Jansen, D. W. (2018). Nonlinear evidence on the existence of jobless recoveries. *Studies in Nonlinear Dynamics & Econometrics*, *22*(1), 20160081. https://doi.org/10.1515/snde-2016-0081
- Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for Testing the Constancy of Regression Relationships over Time. *Journal of the Royal Statistical Society. Series B (Methodological)*, *37*(2), 149–192.

- CAPMAS. (2011). *Labor Force Survey, Central Agency for Public Mobilization and Statistics*.
- DeNicco, J. P. (2015). Employment-At-Will Exceptions and jobless recovery. *Journal of Macroeconomics*, *45*, 245–257. https://doi.org/10.1016/j.jmacro.2015.05.003
- ECES. (2020). *Views on the Crisis: Egypt's Labor Market*. The Egyptian Center for Economic Study.
- El-Ehwany, N., & El-Megharbel, N. (2009). Employment intensity of growth in Egypt with a focus on manufacturing industries. *Egyptian Center for Economic Studies (ECES), Working Paper Series*.
- El-Ghamrawy, T. (2014). The Impact of Trade Openness on Employment and Wages in Egypt's Manufacturing Sector. *ECES Working Papers. No. 176*.
- Elroukh, A. W., Nikolsko-Rzhevskyy, A., & Panovska, I. (2020). A look at jobless recoveries in G7 countries. *Journal of Macroeconomics*, *64*, 103206. https://doi.org/10.1016/j.jmacro.2020.103206
- Hamilton, J. D. (1989). A New Approach to the Economic Analysis of No stationary Time Series and the Business Cycle. *Econometrical*, *57*(2), 357–384. https://doi.org/10.2307/1912559
- Hamilton, J. D. (2017). *Why You Should Never Use the Hodrick-Prescott Filter* (Working Paper No. 23429). National Bureau of Economic Research. https://doi.org/10.3386/w23429
- Hassan, M., & Kandil, M. (2011). The Relation between Public and Private Employment in Egypt: Evidence and Implications. *Egyptian Center for Economic Studies.*
- Hodrick, R. J., & Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking*, *29*(1), 1. https://doi.org/10.2307/2953682
- Hyatt, H. R., & Spletzer, J. R. (2013). The recent decline in employment dynamics. *IZA Journal of Labor Economics*, *2*(1), 5. https://doi.org/10.1186/2193-8997-2-5
- ILO. (2021). *the Impact of COVID-19 on Employment and Wages in Egypt*. International Labor Organization.
- Kim, C.-J., Morley, J., & Piger, J. (2005). Nonlinearity and the permanent effects of recessions. *Journal of Applied Econometrics*, *20*(2), 291–309. https://doi.org/10.1002/jae.831
- Klau, A. (2009). *Impact of the economic crisis on trade, foreign investment, and employment in Egypt*. International Labor Organization. https://www.ilo.org/employment/Whatwedo/Eventsandmeetings/WCMS_124443/lang--en/index.htm
- Morley, J., & Piger, J. (2012). The Asymmetric Business Cycle. *The Review of Economics and Statistics*, *94*(1), 208–221.
- Mowla, S. (2011). Vulnerable employment in Egypt. *The Egyptian Centre for Economic Studies (ECES). Working Paper No. 165*.
- Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*, *37*(17), 1979–1990. https://doi.org/10.1080/00036840500278103
- Newey, W. K., & West, K. D. (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrical*, *55*(3), 703. https://doi.org/10.2307/1913610
- Panovska, I. B. (2017). WHAT EXPLAINS THE RECENT JOBLESS RECOVERIES? *Macroeconomic Dynamics*, *21*(3), 708–732. https://doi.org/10.1017/S1365100515000656
- Pesaran, M. H., & Shin, Y. (1996). Cointegration and speed of convergence to equilibrium. *Journal of Econometrics*, *71*(1–2), 117–143. https://doi.org/10.1016/0304-4076 (94)01697-6

- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616
- Sinclair, T. M. (2009). Asymmetry in the Business Cycle: Friedman's Plucking Model with Correlated Innovations. *Studies in Nonlinear Dynamics & Econometrics*, *14*(1). https://doi.org/10.2202/1558-3708.1688

Appendix 1: Figures

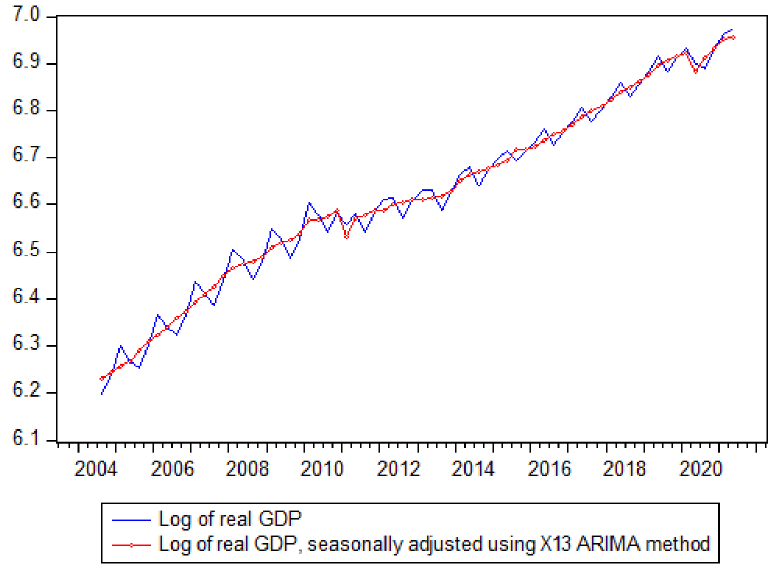

Figure No (1): log of real GDP, seasonally adjusted vs. unseasonally adjusted

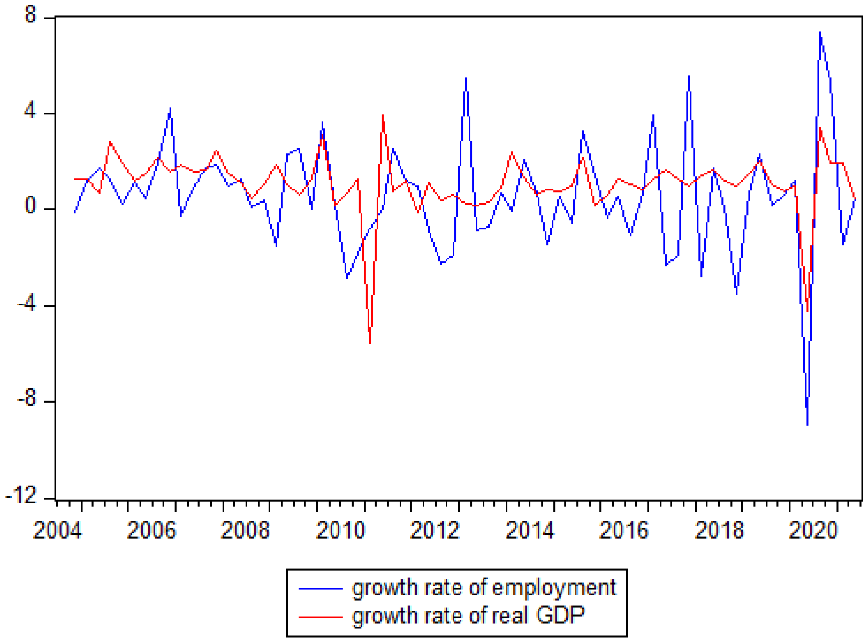

Figure No (2): growth rate of real GDP versus growth rate of employment

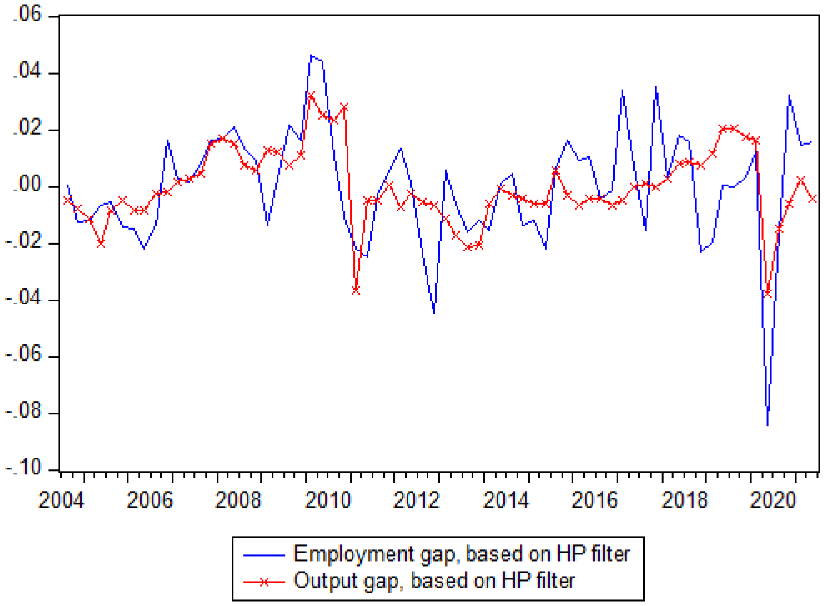

Figure No (3): the output gap and employment gap, using the HP filter

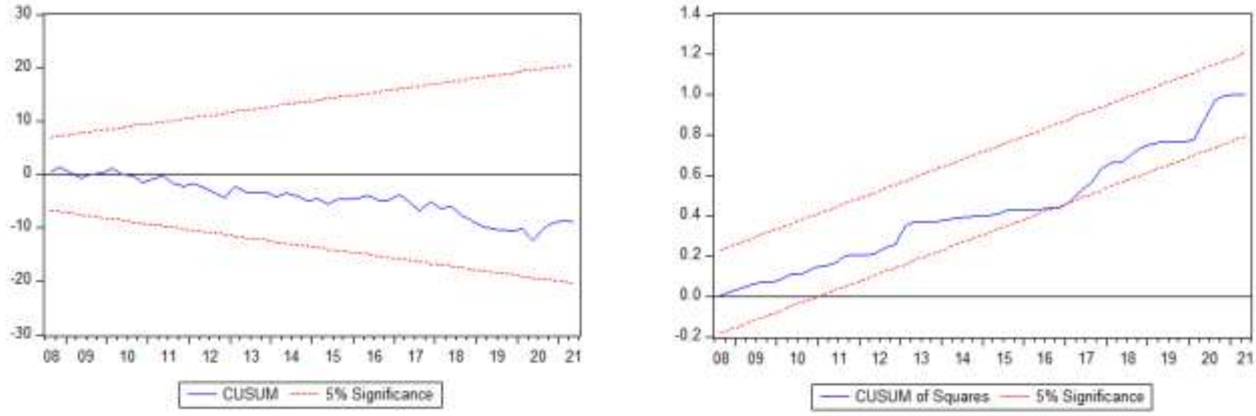

Figure No (4): Plots of CUSUM and CUSUMSQ statistics for coefficient stability.

Appendix 2: Tables

Table (1): Unit root test

Variable	ADF t-statistic	
	Level	First difference
Gee	-2.86*	-5.23***
Gape	-2.58	-6.69***
Gapy	-4.37***	-10.97***
Notes: ***, **, and * indicate that the estimated coefficient is statistically significant at the 1%, 5%, and 10%, respectively.		

Table (2): Order of lags included based on the AIC criterion.

Variable	ge	gape	gapy
Number of lags	3	2	0

Table (3): Diagnostic tests of the error term

ARDL (3, 2, 0, 0, 0, 0)	F-statistic
Serial correlation[1]	1.44
Heteroskedasticity[2]	1.41
No. of Observations	64
[1] The *F* statistics of the Breusch-Godfrey test of no serial correlation are reported. [2] The *F* statistics of the Breusch-Pagan-Godfrey test of homoskedasticity are reported	

Table (4): Bounds test for cointegration with Narayan (2005) critical values.

F-Bounds Test		Null Hypothesis: No levels relationship				
			n=60		n=65	
Test Statistic	Value	Significance	I (0)	I (1)	I (0)	I (1)
		10%	2.323	3.273	2.335	3.252
		5%	2.743	3.792	2.75	3.755
F-statistic	9.24***	1%	3.71	4.965	3.725	4.94

*** indicates significance at the 1% level based on Narayan (2005) bounds test's critical values for finite samples.

Table (5): Results of long-run relationships.

Variable	Coefficient
gape (-1)	29.6* (1.7)
Gapy	-17.82* (-1.8)
d07	-0.63** (-2.56)
d11	-0.94*** (-8.42)
d20	-0.79*** (-5.51)
Constant	1.30*** (11.39)
Adjusted R2	0.59
Durbin-Watson statistic	1.84
F-statistics	9.88
No. of Observations	64
Notes: ***, **, and * indicate that the estimated coefficient is statistically significant at the 1%, 5%, and 10%, respectively. The number in parentheses is t-ratios. Newey and West (1987) standard errors are used.	

Table (6): Error correction representation of estimated ARDL model

Variable	Coefficient
$\Delta\ ge(-1)$	1.83*** (5.35)
$\Delta\ ge(-2)$	1.19*** (4.19)
$\Delta\ gape\ (-1)$	0.82** (2.04)
$\Delta\ gape\ (-1)$	0.28* (1.7)
EC_{t-1}	-3.42*** (-7.96)
Notes: ***, **, and * indicate that the estimated coefficient is statistically significant at the 1%, 5%, and 10%, respectively. The number in parentheses is t-ratios. Newey and West (1987) standard errors are used.	