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What happened to real earnings in Egypt, 2008 to 2009?

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Abstract: Nominal earnings in Egypt did not respond to the increase in inflation between February 2008 and February 2009, resulting in a 12.3 (9) percent decline in average (median) real earnings among 25 to 60 years old workers. Changes in earnings differ significantly by groups: (i) those with higher initial earnings (reported and predicted) suffered the largest declines in earnings; (ii) men lost more than women but after controlling for initial earnings, women lost considerably more than men; (iii) those who were initially in agriculture also had greater declines despite rising food prices.

JEL classification codes: J62; J16; J42; J43; O15; O17

Keywords: Earnings mobility; Egypt; Inflation; Gender; Wage differentials; Segmented labor market

1. Introduction

The returns to labor are critical for ensuring household economic well-being in Egypt, as elsewhere. As such, government leaders are concerned if they observe more labor lying dormant when unemployment rates rise or if they see the returns to labor fall when real earnings fall. In trying to better understand the workings and outcomes of the labor market and the returns to labor a multitude of studies have analyzed the Egyptian labor market. A number of these studies have examined earnings changes using cross-sectional data, illuminating important features of the Egyptian labor market (Arabsheibani 2000; Belhaj-Hassine 2012; Datt and Olmstead 2004; Said 2009, 2012). However, comparisons of cross-sectional data from two points in time do not allow us to follow the same individual over time when trying to determine who is getting ahead and who is falling behind.

Recently, panel data has been collected that allows researchers to track the same individual over time. By following individuals over time, we can identify how an individual's earnings level in the current year compares to his or her earnings in the previous period. We can also investigate how such earnings mobility experiences vary across individuals. This allows us to map the changes in earnings to the standard covariates, such as gender and education levels, and also to include new covariates such as the poverty level of the individual's household and the earnings level of the individual in the initial period. Inclusion of these items can have an important impact on how we interpret the observed changes in the economy and resulting policy implications.

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To our knowledge, this study represents the first analysis of earnings mobility in Egypt to incorporate initial earnings into analysis of earnings changes for both wage and non-wage workers[1]. We initially viewed this project as a study designed to establish baseline statistics for "typical" earnings mobility patterns in the Egyptian labor market.

However, given the significant inflation shock that occurred between interviews, we recognize that this may be a rather unique period in the labor market and should not be thought of as "typical". Therefore we proffer this study as a window into the changes in the labor market in a time of severe stress on real wages due to an external shock of rising commodity prices.

Aggregate employment outcomes and nominal earnings or profits among prime-aged workers are shown to be fairly non-responsive despite the increased prices. Instead, inflation severely erodes the real earnings that individuals receive, implying an adjustment process that relies heavily on reduced real earnings. On average, a worker earns approximately 10 percent less than he or she did in the previous year.

The inability of workers to garner higher wages helped to keep inflation from continuing on an upward spiral[2]. The self-employed and employers also experienced declines in real profits suggesting that they either did not try or were not able to raise the prices of their goods and services in order to keep their real earnings constant or growing[3].

The lack of labor market response to inflation in aggregate employment and nominal earnings outcomes should not be construed as a signal of rigidity of experiences at the individual level. As is typical in such studies, there is a large degree of heterogeneity in the earnings changes experienced by individuals. We identify key determinants associated with earnings mobility using a variety of descriptive regression techniques.

There is a strong association between initial earnings and subsequent earnings changes, with those initially earning more experiencing larger declines than their counterparts. As such changes can be caused by temporary fluctuations in earnings and/or measurement errors; this effect is taken with some caution. Nonetheless, we find these results generally robust to methods that address measurement error concerns, such as using predicted earnings in place of actual earnings. Additionally, other determinants of earnings changes that one would assume would be quite powerful predictors of earnings change—such as workers changing the sector of employment (agriculture, industry, or services)—have a limited ability to predict earnings mobility.

Changes in earnings also differ significantly by gender. On average, the earnings changes are far *more* negative for men than for women. However, this gender effect is completely reversed if one controls for initial earnings; i.e. for men and women who have the same initial earnings (and otherwise similar job characteristics), the earnings changes tend to be *less* negative for men than for women. In contrast, the average difference in log earnings is relatively similar across gender, with men having a slight advantage. This advantage for males is dramatically magnified if one controls for initial log earnings.

The rest of the paper is organized as follows. Section 2 first describes the context of our study, and explains the context of the Egyptian economy during this time, including a review of the rise in inflation. Section 3 depicts the panel data used in this study. Section 4 portrays the empirical approach. Section 5 introduces the results. Section 6

provides a discussion of these results and presents the relevance to policy and future research.

2. Background discussion of the Egyptian economy

The World Bank study, "Poverty in Egypt 2008–2009: Withstanding the global economic crisis," includes a substantive review of the Egyptian economy leading up to 2008 (World Bank 2011). In this section, we review some of its critical findings relevant to our study.

From 2004 to mid-2008, Egypt experienced a period of steady economic growth with an average real GDP annual growth of 6.4 percent. This growth period was followed by a series of economic shocks starting in the second half of 2008 and continuing for most of 2009, namely:

(i) the slowdown in economic growth, which followed the global downturn in the world economy;
(ii) a simultaneous and related fall in remittances; and
(iii) a sudden acceleration in prices, mostly driven by exogenous factors such as the commodities price shock.

The economic developments over the period 2004–2009 are summarized in Figure 1. Note that the table begins in the last quarter of 2004 using the calendar year (second quarter of the fiscal year). For reference, the panel data analyzed in this study were collected in the first quarter of 2008 and the first quarter of 2009. They are denoted by the vertical strips at the third quarter of fiscal year 2008 and 2009, respectively.

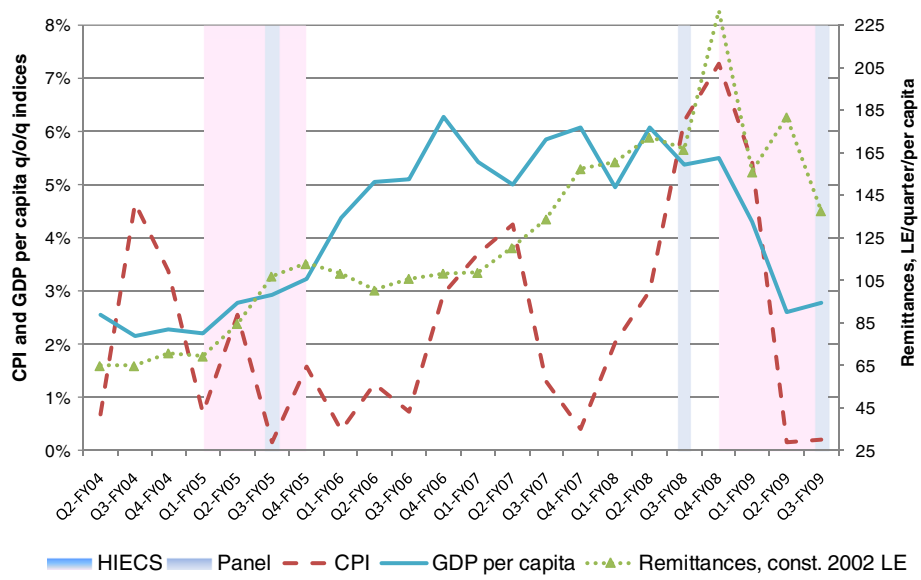

Figure 1 Quarterly GDP growth, inflation rate and remittances in Egypt, 2004–2009. Reprinted from The World Bank (2011). Data from CAPMAS and Ministry of Economic Development. *Note:* The quarterly GDP per capita data were annualized before determining the percent increase or decrease in the quarter-on-quarter index. CPI data were not annualized.

At first glance, Egypt weathered the global crisis relatively well. Despite an abrupt economic slowdown, from seven percent growth in 2008 to 4.7 percent in 2009, growth remained positive. However, employment growth stalled in absolute terms (employment was flat during 2008 and the first quarter of 2009), and unemployment started to rise again (to 9.4 percent in the first quarter of 2009). According to the Labor Force Sample Survey (LFSS) conducted by the Central Agency for Public Mobilization and Statistics (CAPMAS), there was a seven percent reduction in employment in manufacturing in the first quarter of 2009 (compared to the first quarter of 2008), and a 15 percent drop in the restaurants and hotel sectors. Meaning that, both sectors are most exposed to global trends and thus more susceptible to global shocks.

These changes came during a period of accelerating inflation, which peaked at 20 percent (annual average) in the summer of 2008. After peaking to an unprecedented level in August 2008 (23.7 percent), inflation remained exceptionally high for two quarters, only to stabilize at 9.9 percent between May and July-09. Inflation was almost completely imported, as a result of the sharp acceleration in global commodities prices (mostly fuel and food, including fruits and vegetables). Some components of the inflation basket, such as food and non-alcoholic beverages, remained high (up by 13.4 percent y-to-y in July-09) even after and despite the steep fall in international prices since mid-2008.

By the last quarter of 2009, the Egyptian economy showed signs of rebounding, and since then has been growing at five percent and higher each quarter. The employment losses were soon recovered (at least in absolute figures). Thus, our earnings mobility analysis may overestimate some of the long term decline in earnings that individuals faced from this period.

3. Data

The data used in this analysis come from the Household Income, Expenditure and Consumption Panel Survey (HIECPS), which is a subcomponent of the Household Income, Expenditure and Consumption Survey (HIECS). This is a nationally representative panel survey. However, as there were relatively few observations from the frontier governorates, we exclude the border region from our analysis.

Households were interviewed in February 2008 and those same households were interviewed again in February 2009. Information gathered included individual labor market outcomes, wages and profits from enterprises run by household members, as well as standard demographic information such as age, gender, and education level of all household members.

Earnings were constructed at the individual level. Earnings from household enterprises were split among all household members engaged in the enterprise, including those typically referred to as "unpaid workers[4]". Unless clearly denoted as nominal earnings, all earnings are deflated over both time and space and represent the purchasing power of the 2005 Egyptian pound (EGP) spent in the metropolitan area.

The analysis is limited to those who were 25 to 58 years old in 2008, unless explicitly stated. We are most interested in the changes in earnings of those actively engaged in the labor market and do not want large earnings changes by those retiring or moving to part time jobs in a pseudo-retirement phase to cloud our analysis. Additionally, large

gains from recent entrants (or entrants into full time work) can disrupt our analysis. This is not to say that we are not interested in the important issues of youth (15–24 years) unemployment or earnings. We simply feel they should be analyzed separately. We will discuss how the inclusion of these younger workers affects some of our key results below.

Additionally, we limit earnings mobility analysis to those who are employed in both periods[5]. We use 3,481 observations of dual employed individuals with valid data.

One concern of such panel studies is that not every person interviewed in 2008 can be found again (or is willing to be re-interviewed) in 2009. This can have a particularly pernicious effect on our analysis if those who were not re-interviewed tend to have (extremely) positive or (extremely) negative earnings changes compared to those who are similar to them but were re-interviewed. There is some empirical evidence that such movers, particularly those that move farther away, tend to have more positive earnings changes than those left behind (Beegle et al. 2011). However, the existing evidence is quite limited and not from Egypt. Additionally, there are some common sense theoretical arguments that suggest that such missing individuals could be worse off. This question remains open as we do not have enough evidence to answer it in one direction or the other.

The fact that attrition rates in this panel are relatively low (just three percent of 2008 households are not re-interviewed in 2009) is therefore reassuring. As is typical in such studies, the individual attrition rate, 9.1 percent, is higher than the household attrition rate. Among 25 to 58 year olds, the individual attrition rate is 8.7 percent.

Overall, attrition appears to be driven more by who a person is and general life-cycle effects than by an individual's productive characteristics or outcomes. The first column of Table 1 shows the results of a linear probability model (LPM) predicting individual attrition. The dependent variable is 1 if the individual is not re-interviewed and 0 if the individual is re-interviewed. Those who were not married, were either very young or very old, were male and lived in the Metropolitan region were more likely to be missing at the 2009 interview. Meanwhile, joint significance tests on education level, initial sector of work, and relationship with employer categories were not found to have a significant effect at the ten percent level. An exception to this general trend is the fact that those who had higher initial earnings were found to be more likely to attrite. This was statistically significant at the five percent level, with change of one standard deviation in real earnings in 2008 resulting in a change in the predicted probability of attrition of 0.009 percentage points, ceteris paribus. A probit model was also run (see rightmost column of Table 1). The results of the probit model generally corroborate the LPM findings. One potential exception is that individuals working in the manufacturing and construction and trades and services sectors are less likely to attrite than those working in agriculture[6].

4. Empirical approach

We identify the typical change in earnings experienced by different types of Egyptian workers using empirical approaches that are common in the earnings and income mobility literature. We start by reporting mean and median earnings changes and move on to control for an increasing set of covariates. Techniques are similar to some of

Table 1 Determinants of attrition

	Dep. Var. (Attrition = 1)	
	Linear Prob. Model	Probit dF/dx
Metropolitan (omitted)		
Lower Urban	−0.061***	−0.039***
Lower Rural	−0.056***	−0.043***
Upper Urban	−0.045**	−0.029**
Upper Rural	−0.063***	−0.046***
Male	0.041***	0.030***
Working Housewife	−0.024	−0.029*
Married	−0.091***	−0.059***
Age	−0.022***	−0.017***
Age-squared	0.000***	0.0001***
Illiterate/no formal schooling (omitted)		
Basic education/literacy	0.008	0.010
Completed Primary	0.004	0.006
Secondary education	−0.005	−0.003
University degree	0.025	0.022
wage worker public (omitted)		
wage worker private	0.018	0.015
employer	−0.019	−0.015
self employed	−0.002	−0.001
unpaid worker	0.007	0.002
Agriculture (omitted)		
Manu/Const	−0.032*	−0.025**
Trade/Services	−0.021	−0.022*
Log per capita consumption	0.008	0.009
Earnings in 2008	−0.000**	0.000
Constant	0.635***	
n	4160	4160
R-squared / Pseudo R-squared	0.076	0.112

Notes: legend: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Probit dF/dx evaluated at the mean of all other variables. Dummy variables show difference from 0 to 1.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

those used in Cichello et al. (2005), Fields et al. (2003a/2003b), and Fields and Sanchez-Puerta (2010). Fields (2008) provides a literature review of such micro-mobility studies and provides a description of methods. There is a particular emphasis on controlling for initial earnings.

The goal of this empirical approach is to identify who has experienced the most severe declines in earnings, who has been able to avoid such severe declines in earnings, and which variables are consistently associated with the changes in earnings experienced by Egyptian workers. While all of the analysis, even the multivariate regression analysis, is descriptive rather than causal, one can confidently identify which groups of workers have been most or least adversely affected[7]. One can also piece together strong circumstantial evidence regarding some of the major drivers of earnings change.

Theories of what caused the changes in earnings should, at a minimum, be consistent with these descriptive results.

Our analysis will use both the change in earnings and the change in log earnings as the outcome variables of interest. The former is self-explanatory while the latter conforms roughly to the percentage change in earnings. Given that utility functions are concave, determining that earnings have fallen more on average for those who started with higher earnings may not necessarily suggest a lower welfare loss[8]. Also, in the context of an inflation shock, one may not be overly surprised if those with higher initial earnings have greater earnings declines. However, if the log earnings falls more for those with higher initial earnings, this goes beyond just the changes due to inflation.

We assess the change in earnings across a variety of characteristics. These include demographic variables (gender, age, marital status), location/region (urban and rural), and education level. We take these variables as exogenous variables that individuals bring to the labor market[9]. We also include a number of 2008 outcomes which may well be co-determined with the earnings change process. These include an individual's sector of employment (agriculture, industry or construction, trade or services); relationship with employer (public wage worker, private wage worker, employer, self-employed, unpaid worker); and formal or informal worker status, with formal workers defined as those covered by the social insurance system. We also include whether one lives in a poor household, defined as having consumption levels below the household specific poverty line[10]. In our multivariate analysis, these variables will be right hand side determinants of the change in log earnings.

Additionally, the relationship between the change in earnings and initial earnings is explored using flexible estimation approaches. The non-parametric lowess estimator estimates a smoothed change in log earnings value, y_i^s, for each observation by running n observation specific regressions of the change in log earnings (y_i) on initial log earnings (x_i) and calculating the predicted value of y_i. Weights for each observation in the regression are determined based on the distance from the x_i value of the current observation. More emphasis is placed on observations that are close to the current observation, even going so far as to give a zero weight to observations outside the bandwidth. The lowess estimator in STATA uses the tri-cube weight of Cleveland (1979) and we apply a bandwidth of 0.8 throughout these figures[11].

Measurement error can be particularly problematic when determining the change in earnings to initial earnings. For example, assume the relationship between these variables is linear and we would like to run a simple regression of change in reported earnings Δy_i^r, on initial reported earnings $y_{08,i}^r$.

$$\Delta y^r{}_i = \beta_0 + \beta_1 y^r{}_{08,i} + \varepsilon_i, \tag{1}$$

This can be re-written incorporating the potential for measurement error, signified by μ. We use y_k to represent the true level of earnings in year k.

$$\Delta y_i + \left(\mu_{09,i} - \mu_{08,i}\right) = \beta_0 + \beta_1\left(y_{08,i} + \mu_{08,i}\right) + \varepsilon_i, \tag{2}$$

Even if measurement error is assumed to be mean zero, independent across individuals, independent across time for a given individual and independent of an individual's earnings level, the problems are more than the standard attenuation concerns that

typically accompany a classical measurement error. The realized measurement error in year 2008 turns up on both the left hand and right hand sides of this equation causing a spurious negative correlation. To the extent that the measurement error is not perfectly auto-correlated, this can lead to a problem identical in nature to Galton's Fallacy. A negative relationship between initial earnings and the change in earnings *might* simply be due to random reporting errors.

Running the above regression will not give us the desired regression coefficient,

$$\hat{\beta}* = \frac{Cov(\Delta y, y_{08})}{Var(y_{08})} \tag{3}$$

Instead, as shown in a more general form in Fields et al. (2003a), we obtain:

$$\hat{\beta} = \hat{\beta} * \frac{Var(y_{08})}{Var(y_{08}) + Var(\mu_{08})} - \frac{Var(\mu_{08})}{Var(y_{08}) + Var(\mu_{08})} \tag{4}$$

The first term identifies the standard attenuation bias issue while the second term accounts for the spurious negative correlation caused by the measurement error being on both the right and left side of the equation.

A simple example will illustrate why addressing this issue is of fundamental importance to our analysis. Suppose $\hat{\beta}* = 0.50$, implying that for each additional pound of earnings in 2008, on average, the individuals experiences a change in earnings that is a half a pound more (i.e. less negative). Also, suppose that the variance in measurement error is exactly equal to the variance in initial earnings. In this case, the attenuation bias would shrink the estimate from 0.5 to 0.25 and the second term would take away another 0.50. In other words, we would observe a coefficient of −0.25 in our analysis. Our story would be one of converging earnings, but the reality would be significant divergence of earnings in this sample. This example, while extreme, shows how powerful the impact of these biases can be on our results. It also highlights that the extent of the problem is driven in part by our assumption of how large the variance of the measurement error is relative to the variance of the initial earnings. For example, if we assumed the variance of μ was ten percent of the variance of initial earnings, the coefficient would observe would be 0.35 rather than 0.50[12].

In order to assess the robustness of our results given this potential problem, two approaches will be applied. First, initial earnings will be substituted by predicted initial earnings on the right hand side of equation (1) in the simple regression above (as well as in other methods). This process, i.e., the use of predicted values of initial values, should rid the right hand side of equation (1) of the spurious measurement error[13]. Of course, if our ability to predict initial earnings is weak, we may lose more than we gain from this approach. It should be noted that the key variables used to predict initial earnings are gender, age, education, place of residence, relationship with employer, sector of work, and log per capita consumption in the household.

The prediction regression results are shown in Table 2. When predicting initial earnings, the R-squared is 0.32. When predicting initial log earnings, the R-squared is .612. Thus, there is a relatively strong ability to predict initial earnings in levels and logs. The coefficient estimates are entirely reasonable; they are what we would expect in Egypt. Ceteris paribus, men have a strong initial advantage, earnings are concave with respect to age (turning point at roughly 45 years of age), those with higher education

Table 2 Regressions used to predict 2008 earnings and log earnings

	2008 earnings	2008 log earnings
Male	4517***	0.580***
Age	723***	0.090***
Age-squared	−8***	−0.001***
Working Housewife	603	−0.207***
Married	2873***	0.366***
Illiterate/no formal schooling (omitted)		
Basic education/literacy	414	0.094***
Completed Primary	1700***	0.155***
Secondary education	636*	0.115***
University degree	1406***	0.194***
Metropolitan (omitted)		
Lower Urban	−1035**	−0.007
Lower Rural	−1495***	−0.049*
Upper Urban	−563	0.033
Upper Rural	−439	−0.021
wage worker public (omitted)		
wage worker private	−356	−0.032
employer	3724***	0.388***
self employed	152	−0.114***
unpaid worker	−882	−0.509***
Agriculture (omitted)		
Manu/Const	1021**	0.148***
Trade/Services	775*	0.126***
log per capita consumption (08)	5748***	0.520***
Constant	−60681***	1.682***
n	3481	3481
R-squared	0.32	0.612

Notes: legend: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

are earning considerably more than those with less education, wage workers outperform the self-employed and unpaid workers, but not employers, and agricultural workers earn less than others.

We will also assess whether such a classical measurement error can explain the results we observe in this dataset using a second approach. We assess the amount of measurement error that must be present, defined in terms of the variance, for measurement error to explain our observed regression coefficient if the true β coefficient is positive; i.e. if those higher initial earners experienced greater earnings gains. This is similar to a subset of simulations found in Fields et al. (Fields et al. 2003a). Additionally, in the annex, we use a simple simulation to demonstrate what our lowess graphs would look like given certain assumed levels of classical measurement error.

Under these assumptions, we consider it implausible that the negative coefficient on initial earnings from the simple regression was driven solely by classical measurement error. In order for this to be true, the variance of measurement error must be at least 1.56 times the variance of the true earnings level.

5. Findings

5.1 Transitions into and out of employment

Employment participation held steady and even increased slightly (68.2 to 69.6 percent), between February 2008 and February 2009 among panel members who were 25 to 58 years old in 2008. Thus, this is not a period where job losses were a dominant feature in the labor market for prime-aged workers[14].

Table 3 reveals that the aggregate participation rate masks strikingly different participation rates by gender, 94.5 percent for men versus 44.4 percent for women in 2008. The difference is largely due to many more women remaining outside the labor force.

Given the decline in real earnings between 2008 and 2009 (which is discussed in much more detail below), one might expect households to offset the erosion of real earnings by increasing the number of earners in the households. Since most men are already participating, this would require an influx of women into the labor market.

The "added worker effect" is discussed in the labor literature primarily with regard to married women entering the labor market in response to unemployment of the male (Lundberg 1985; Serneels 2002). The empirical evidence has been relatively weak for any large scale effects on employment rates in other countries, and often weak for even *desiring* more employment (Serneels 2002). Our situation differs from the often cited situation in that the male is not unemployed and therefore not necessarily "freely" available to substitute for the wife in the production of goods and services at the home. Additionally, the wife's real wage has also been reduced. Thus, we are not necessarily expecting a large change in female participation in response to the reduced earnings power of the male.

We find that the employment participation rates increase slightly for both males and females in 2009, to 94.9 percent and 46.7 percent respectively. These numbers do not suggest that households are adding workers as a major strategy for coping with inflation. Nor does the data suggest that firms fired large numbers of workers as a result of inflation[15]. These finding are consistent with findings of Roushdy and Gadallah (2011) which finds relatively little change in employment outcomes despite the economic downturn and large real earnings declines in 2009.

Table 4 takes advantage of the longitudinal nature of the data to allow us to see the flows into and out of each labor market status. The tables show the percentage of men (women) in each transition possibility, with the sum of all cells equaling 100 percent.

Most interesting is the large flow of women moving into and out of employment from the 'out of the labor force' category. Approximately one in six of women employed in 2008 are classified as out of the labor force in 2009, with roughly similar percentages of those out of the labor force in 2008 moving into employment in 2009. It is possible

Table 3 Labor force status of 25 to 58 year olds in 2008 and 2009, by gender

	All		Male		Female	
	2008	2009	2008	2009	2008	2009
Employed	68.2	69.6	94.5	94.9	44.4	46.7
Unemployed	1.9	1.6	1.7	1.5	2.1	1.7
Out of Labor Force	29.9	28.8	3.8	3.6	53.6	51.6

Notes: n = 5702.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

Table 4 Labor force transitions of 25 to 58 year olds in 2008 and 2009, by gender

Male			
		2009	
Status in 2008	**Employed**	**Unemp**	**OLF**
Employed	92.4	0.6	1.5
Unemployed	1.0	0.5	0.2
Out of Labor Force	1.6	0.3	1.9
Female			
		2009	
Status in 2008	**Employed**	**Unemp**	**OLF**
Employed	36.2	0.4	7.8
Unemployed	0.4	0.7	1.0
Out of Labor Force	10.1	0.7	42.7

Notes: n = 2702 and 2995, respectively.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

that some of this apparent flow is due to mis-measurement as women may not be declared employed in one period. However, it suggests that there are a large number of women who are capable of entering the labor force, at least for some time, if the household desires additional earnings. The story is similar if the data is restricted to only married women (not shown). Thus, there appears to be some scope culturally for many houses to add women workers to the labor force if needed. Finally, there is actually a slight decline in the unemployment rate for women, from 4.5 percent in 2008 to 3.5 percent in 2009.

While the bulk of men are employed in both periods, there is some evidence that the limited set of men who are unemployed may remain unemployed for some time. Thirty percent of those men who were unemployed in 2008 were unemployed again when interviewed in 2009 (as compared to just 0.7 percent who were employed at the time of the interview in 2008). The unemployment issue is similar for females as 31 percent of females who were unemployed in 2008 were unemployed again in 2009. However, in Egypt, unemployment is generally considered a luxury, where highly educated workers wait for a high paying job. For example, 85 percent of those unemployed in 2008 have secondary or university education, as compared to 45 percent of the entire prime-age working population.

5.2 A period of declining real earnings

Restricting our attention to the dual employed, the mean earnings change was a loss of 950 EGP, with the median change being a loss of 446 EGP. As will be detailed below, this decline in mean and median earnings was experienced by almost every type of worker. This is consistent with the erosion in real pay found by Said using the quarterly Egypt Labor Force Survey (ELFS) from 2007–2009 (Said 2012). The decline in real earnings is the dominant story of the labor market during this time period.

This decline in real earnings appears directly related to the increase in inflation. The mean (median) change in nominal earnings is just 107(330) EGP compared to a mean (median) of 9,858 (7,890) EGP in 2008 nominal earnings. Alternatively, if we apply the 2009 deflators to the 2008 nominal earnings, we project the average earnings fall from

7,755 EGP in 2008 to 6,727 EGP in 2009. In fact, the average real earnings in 2009 are 6,804 suggesting that workers earnings basically stagnated while inflation took away its buying power.

The improvement when comparing the median earnings level in each year is considerably better. The 6,237 EGP median earnings in 2008 would equate to 5,424 EGP using the 2009 deflators while the real median earnings in 2009 was 5,832EGP. Thus, comparing median earnings levels across distributions, workers were able to get back approximately 50 percent of the loss in earnings due to inflation. However, this seems to be an unusual point in the distribution of earnings. Corresponding values at the 25th and 75th percentiles are 16 percent and 23 percent. Figure 2 depicts the percentage of earnings lost to inflation that earners were able to recover due to increased nominal earnings for each percentile. At the top and bottom of the distributions, earnings appear to fall even in nominal terms. Overall, nominal earnings don't seem to increase much in response to the rapid rise in inflation, resulting in a significant loss of earnings power.

This result is in keeping with other findings from the Egyptian labor market. For example, Datt and Olmsted suggest that the rise and fall of real wages in Egypt between the mid-1970s and the early 1990s "masks a complex dynamic process by which nominal wages adjust in response to changes in food prices" (Datt and Olmsted 2004). The authors show a slow adjustment of nominal wages, with "a significant negative initial impact of rising food prices on real wages, though wages do catch up in the long run" (ibid).

Figure 3 depicts the real earnings changes using a density function of the change in log earnings for all but the top and bottom 2.5 percent of changes. The distribution is

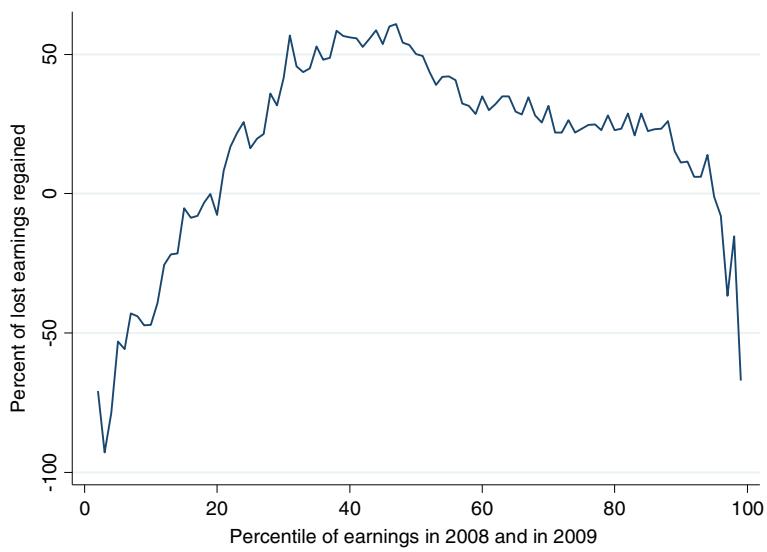

Figure 2 Percent of real earnings lost to inflation that was regained due to increased nominal pay, Egypt 2008 to 2009. *Source*: Authors' compilation from HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes*: This figure shows the change in nominal earnings for a given percentile in the earnings distribution as a percentage of the loss in real earnings that would have been experienced due to increased inflation if nominal earnings were the same in 2008 and 2009. The first percentile value (−161) has not been shown as it distorts the scale. Negative percentages imply that nominal earnings have declined between 2008 and 2009 for that percentile of the earnings distribution.

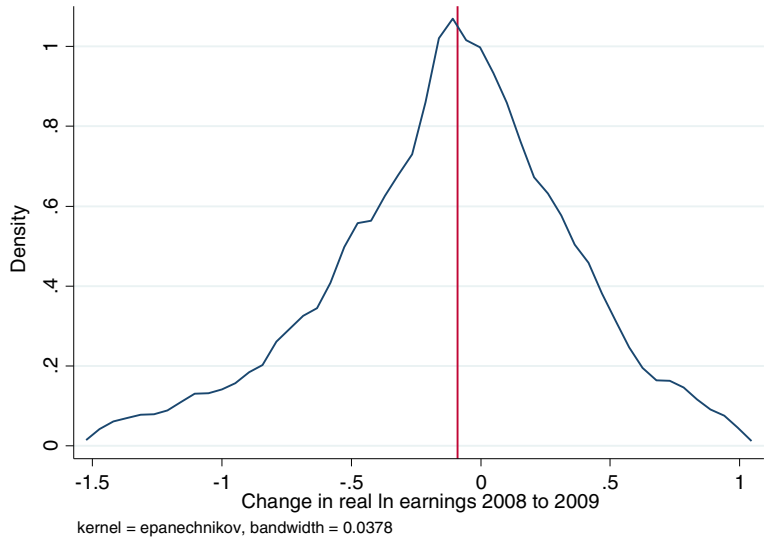

Figure 3 Changes in log earnings in Egypt, 2008 to 2009. *Source:* HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Density function excludes top and bottom 2.5 percent of changes. The vertical line depicts the median change in log earnings.

centered below zero, with a median change in log earnings of negative 0.09 and a mean of negative 0.123.

Despite the substantial decline in earnings for measures of central tendency, the picture is indeed more complex than one where every individual earns 12 percent less than the year before: 41 percent of individuals experienced a gain in earnings over the time period; many individuals experienced positive and negative changes that were quite sizeable relative to their initial earnings; 31 percent of the changes in the density function above are greater than 0.5 or less than −0.5. While we would expect some differential across years due solely to the measurement error, we would expect that differentials of 50 percent in reported earnings would be extremely rare if an individual had the same earnings in both years[16].

As this is the first earnings mobility study in Egypt, we cannot say if this is more or less volatility in earnings than is the norm. What is clear is the following: while the aggregate employment numbers suggest a stagnant situation overall—with little change in employment status and average and median nominal wages—individuals are experiencing substantial fluctuations in their earnings. The rest of this paper seeks to explore which characteristics are associated with changes in earnings at the individual level.

5.3 The influence of initial earnings

There is a strong negative relationship between initial earnings and the ensuing earnings change. Using simple regression, Table 5 shows a statistically significant relationship. The coefficient estimate implies that the predicted earnings change is 0.61 EGP less for every additional Egyptian pound of reported initial earnings.

Table 5 shows that the negative relationship between earnings change and initial earnings holds up even if one replaces reported initial earnings with predicted initial earnings, although the coefficient falls to −0.29. Predicted initial earnings should not be

Table 5 Simple regression of change in earnings on initial earnings

Regression	Coeff.	st. error	p-value
Δy on y	−0.61	0.097	0.000
Δy on predicted y	−0.29	0.052	0.000
Δln(y) on ln(y)	−0.23	0.017	0.000
Δln(y) on predicted ln(y)	−0.04	0.026	0.131

Notes: Standard errors account for strata and clusters in sample survey design. Standard errors are bootstrapped when using predicted earnings or predicted log earnings.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

correlated with the measurement error term under standard classical measurement error assumptions, although the random error in the predicted value of initial earnings may result in attenuation bias.

We consider it implausible that the negative coefficient on initial reported earnings from the simple regression was driven solely by classical measurement error. In order for this to be true, under the assumptions outlined above and the resulting equation (4), the variance of measurement error must be at least 1.54 times the variance of the true earnings level.

The analysis is repeated using log earnings. For every one percent increase in initial earnings, the predicted change in earnings decreases by approximately 0.23 percent. This result is statistically significant at the 1 percent level. In this case, again using equation (4), the variance of measurement error need only be 30 percent of the variance of the true earnings level for it to entirely explain the observed negative coefficient[17]. Additionally, we find that the predicted change in earnings decreases by 0.04 percent for every 1 percent increase in predicted initial log earnings. However, the p-value for this coefficient lies slightly outside the ten percent range for statistical significance. Thus, we are not confident that the true coefficient is negative.

This analysis assumes a linear relationship between initial earnings and earnings change. Next we allow more flexible approaches of establishing this relationship. Table 6 presents the mean and median change in earnings for each quintile of initial earnings.

Table 6 Change in earnings by initial earnings quintile

Initial reported earnings quintile	*Change in earnings*			*Change in log earnings*		
	Mean	**Median**	**% positive**	**Mean**	**Median**	**% positive**
1st (Lowest)	567	122	56%	0.086	0.071	56%
2nd	502	142	54%	−0.045	0.035	54%
3rd	119	−245	45%	−0.080	−0.040	45%
4th	−914	−1,148	31%	−0.200	−0.143	31%
5th	−5,026	−3,825	19%	−0.375	−0.294	19%
Initial Predicted (Log) Earnings Quintile						
	Mean	**Median**	**% positive**	**Mean**	**Median**	**% positive**
1st (Lowest)	20	−45	48%	−0.124	−0.073	45%
2nd	−290	−295	44%	−0.103	−0.039	47%
3rd	−417	−306	45%	−0.062	−0.055	45%
4th	−867	−939	36%	−0.133	−0.111	37%
5th	−3,199	−1,880	32%	−0.193	−0.161	32%
TOTAL	−950	−446	41%	−0.123	−0.090	41%

It also documents the percent of individuals in each group that experienced positive changes in earnings.

The results clearly demonstrate a downward trend in the change in earnings as initial earnings quintile increases each step. The change between the first and second quintiles is rather limited, but other changes are quite large. This result is fairly consistent when comparing the change in earnings across predicted earnings quintiles. There is a clear downward trend in mean, median and percent positive earnings change across initial predicted earning quintile, except some bunching or minor reversal at the second and third quintiles.

When comparing the change in log earnings across initial log earnings quintiles, the results demonstrate a clear downward trend by initial earnings quintile. When comparing the change in log earnings across initial predicted log earnings, however, the data shows some potential for an inverted U shape, where those in the middle earnings category were able to buffer their losses (in percentage terms) as compared to those in the lowest earnings quintiles. Overall, however, the typical decline is far worse for those at the highest earnings levels as compared to those initially at the lowest earnings levels.

The severe decline in earnings experienced by those in the highest quintile is consistent across all four models. Just 19 percent of those in the highest initial earnings category experienced positive earnings changes. The mean decline in earnings for this group was 5,026 EGP as compared to the average of 950 EGP across the full sample. The median decline in earnings was 3,825 EGP and the median difference in log earnings was −0.29.

Figure 4 presents a more flexible method for assessing the relation between changes in log earnings and initial log earnings using a locally weighted regression. The vertical lines denote the different quintiles of initial log earnings. These results confirm the

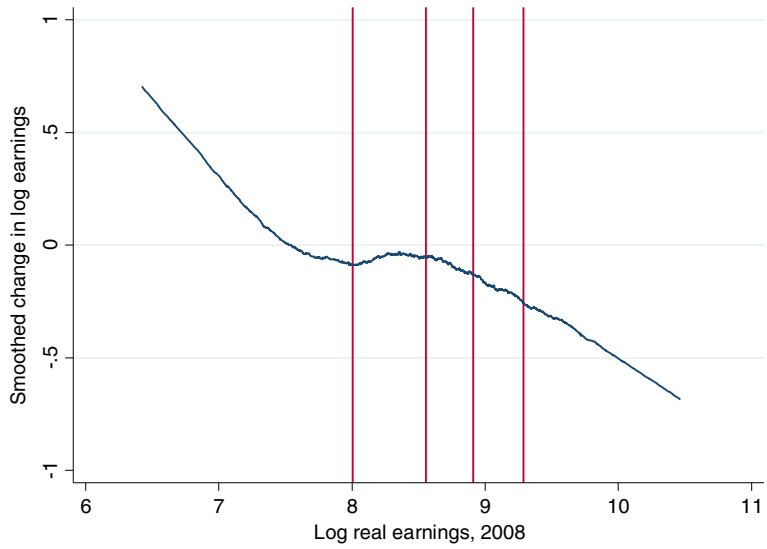

Figure 4 Change in log earnings based on initial log earnings, Egypt 2008–2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. The top and bottom one percent of changes in log earnings are excluded. Vertical lines denote the 20th, 40th, 60th and 80th percentiles for 2008 log real earnings.

downward sloping relationship between the change in log earnings and initial log earnings, with bunching at the second and third quintile.

This result is consistent with previous examinations of real earnings that show declining inequality in periods when real earnings are falling in Egypt (Said 2009).

5.4 The role of characteristics besides initial earnings

Table 7 presents the mean and median earnings change and the percent of positive earnings changes for a series of additional characteristics that may be useful for either understanding more about the underlying process that drove the earnings changes during this time period and/or for understanding who was most adversely affected for the purpose of targeting assistance. This information is presented in columns (3) through (5), respectively. Columns (6) and (7) present the mean and median change in log earnings. Columns (1) and (2) are provided solely to assist the reader in understanding the composition of the labor force and relative earnings standings of each type of worker in the initial period.

Men had larger mean and median declines in real earnings than women, with an average decline of 1,189 EGP versus 391 EGP, respectively. This is not entirely unexpected in a period of rising inflation as men were initially earning more. Column (6) and (7) show a cloudier picture when it comes to differences across gender in terms of the average change in log earnings, or the percentage change in earnings. Men had a slightly larger median decline, but a slightly lower average decline. Thus, the story is less clear when it comes to the difference in log earnings.

Column (1) of Table 8 provides a simple regression of earnings change on each variable alone. This allows an easy way to identify the difference between groups relative to the omitted category (denoted by a 0) and whether this differential is statistically significant. The 798 EGP difference between average earnings for men and women is statistically significant.

Before reading too much into these average changes, one should consider controlling for initial earnings. Column (2) of Table 8 presents the regression results with initial earnings included as the sole additional right hand side variable. Compared to a female with the same initial earnings, a male is expected to have an earnings change that is 2,751 EGP better than his female counterpart. Thus, whether one considers this period a particularly bad period for male or female earners depends on whether we choose to consider male and female earners who are alike in their initial labor market outcomes or simply compare typical outcomes for each gender irrespective of their initial starting point. Similar analysis of the change in log earnings is presented in column (3), which has the average difference from the omitted group, and column (4) which includes log initial earnings on the right hand side. The minimal advantage that men had relative to women in the average change in log earnings expands dramatically (from 6 percent to 36 percent) once we control for initial log earnings.

Reviewing the results of Table 7 and columns (1) and (2) of Table 8, earnings declines were often larger for those groups who started with higher initial earnings, just as they were for men versus women. Examples include older workers, those in urban areas and the Metropolitan region, those who were employers in 2008, those who weren't unpaid workers in 2008, and those who lived in poor households in 2008. Consistent with this,

Table 7 Change in earnings and log earnings by individual characteristics, Egypt 2008 to 2009

2008			Change in earnings			Change in ln earnings	
(1)	(2)		(3)	(4)	(5)	(6)	(7)
Percent of panel workers	Median earnings	Individual characteristics	Mean	Median	Percent positive	Mean	Median
		TOTAL					
100%	6,237		-950	-446	41%	-0.12	-0.09
		Gender					
30%	2,964	Female	-391	-206	44%	-0.16	-0.08
70%	7,627	Male	-1,189	-628	40%	-0.11	-0.10
		Age					
31%	4,648	25-34	-459	-317	43%	-0.09	-0.08
34%	6,778	35-44	-803	-421	42%	-0.10	-0.07
35%	7,478	45-58	-1,518	-639	38%	-0.18	-0.12
		Education					
30%	4,047	Illiterate/no formal schooling	-781	-471	39%	-0.19	-0.14
12%	7,010	Basic education/ literacy	-1,534	-815	34%	-0.17	-0.16
10%	7,072	Completed Primary	-2,070	-699	41%	-0.14	-0.10
32%	6,503	Secondary education	-610	-287	43%	-0.07	-0.06
16%	8,490	University degree	-850	-349	46%	-0.04	-0.05
		Urban					
62%	5,316	Rural	-648	-404	41%	-0.14	-0.10
38%	7,783	Urban	-1,437	-516	42%	-0.10	-0.08
		Region					
17%	8,272	Metropolitan	-2,318	-817	39%	-0.13	-0.14
11%	8,481	Lower Urban	-413	-214	46%	-0.03	-0.03
38%	5,421	Lower Rural	-534	-287	43%	-0.11	-0.08
10%	6,859	Upper Urban	-1,053	-620	42%	-0.14	-0.08
24%	5,068	Upper Rural	-827	-522	37%	-0.18	-0.14
		Type of worker					
33%	7,400	wage worker public	-633	-117	47%	-0.03	-0.02
25%	5,914	wage worker private	-628	-504	41%	-0.10	-0.10
15%	9,324	employer	-2,809	-1,803	28%	-0.30	-0.21
16%	4,054	self employed	-1,077	-522	38%	-0.25	-0.16
10%	1,925	unpaid worker	214	-70	47%	-0.01	-0.04
		Informal worker					
53%	4,603	Informal	-838	-471	40%	-0.16	-0.13
47%	7,827	Formal	-1,074	-395	42%	-0.08	-0.06
		Industry					
31%	3,411	Agriculture	-829	-427	39%	-0.20	-0.17
19%	7,010	Manu/Const	-1,200	-645	37%	-0.12	-0.10
51%	7,151	Trade/Services	-931	-361	44%	-0.08	-0.06

Table 7 Change in earnings and log earnings by individual characteristics, Egypt 2008 to 2009 *(Continued)*

		Poor household in 2008					
84%	6,893	Non-poor	-1,171	-601	39%	-0.15	-0.11
16%	3,924	Poor	214	28	52%	0.00	0.01

Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

but to a lesser degree, those who were formal workers and those who started outside of agriculture also had smaller mean and median changes. Working against this general trend, those with university education experienced smaller average losses than those with some primary schooling or complete primary schooling and those in the lower urban area seemed to withstand large losses relative to others despite high initial earnings. Yet, this relationship generally flips once one controls for initial earnings (or expands further in favor of the initially favored).

Columns (3) and (4) of Table 8 re-affirm this relationship with log earnings. The main difference is that the initial comparison between the favored and less favored groups is not as consistent. Besides the mixed results by gender, there are some notable exceptions where the log earnings changes of those who have low initial earnings are higher —such as for agricultural workers, informal workers, and those in rural regions. Results for age, education, employer relationship, and poor/non-poor household in 2008 generally conform to our previous analysis. Yet in almost all these cases, the initially favored group has much better average earnings changes once we control for initial log earnings is controlled.

With this in mind, we return to the flexible estimation approach of locally weighted regressions, mapping the relationship between earnings changes and initial earnings for particular groups of individuals.

Figure 5 shows that men consistently have *better* earnings change experiences than women who started at the same initial earnings[18]. The reason men had worse average and median earnings overall is because they started at higher initial earnings in 2008. This is clear through the fact that the area of support is pushed further to the right for men as compared to women. Thus, although men had larger declines on average, one might suspect that they actually had an advantage in responding to the surge in inflation.

Figure 6 assesses the change in log earnings based on the initial sector of work. Again, the negative relationship between log earnings change and initial log earnings is relatively consistent across all groups. In this case, the relationship in Table 7 is not overturned when controlling for initial earnings. Those who started out working in agriculture have consistently worse earnings changes than those working in other sectors.

Figure 7 suggests that there is no consistent differential for those who were in poor households in 2008 compared to those in non-poor households once one controls for initial earnings. There may be some gap at the lower and upper initial earnings, but those in poor households have a slight advantage in the middle range of shared initial earnings. Thus, the earnings mobility disadvantages that some individuals face do not appear rooted in initial year poverty status.

Column (7) in Table 7 shows the regression coefficient from bivariate regressions of earnings change on the category of interest, controlling for initial earnings. By looking across columns (6) and (7), we can see that there are multiple cases where our

Table 8 Earnings changes by individual characteristics, with relation to initial earnings

Dependent variable	Change in earnings		Change in log earnings	
	(1)	(2)	(3)	(4)
Individual Characteristics	no controls	with income as a control	no controls	with log income as a control
Gender				
Male	−798***	2,751***	0.06**	0.38***
Age				
35-44	−344	1,218***	−0.01	0.06**
45-58	−1,059***	1,018***	−0.09***	0.01
Education				
Basic education/literacy	−754*	1,181***	0.02	0.17***
Completed Primary	−1,290	1,155***	0.04	0.20***
Secondary education	171	1,709***	0.11***	0.25***
University degree	−70	3,513***	0.14***	0.37***
Urban				
Urban	−789*	1,624***	0.03	0.16***
Region				
Lower Urban	1,905**	1,096	0.10*	0.09*
Lower Rural	1,784**	−1,355***	0.02	−0.12***
Upper Urban	1,265	−560	−0.01	−0.07
Upper Rural	1,491*	−1,651***	−0.05	−0.20***
Type of worker				
wage worker private	5	−1,263***	−0.07**	−0.14***
employer	−2,175***	−516	−0.27***	−0.19***
self employed	−444	−2,495***	−0.22***	−0.42***
unpaid worker	848**	−3,657***	0.02	−0.44***
Informal Worker				
Formal	−236	2,279***	0.08***	0.27***
Industry				
Manu/Const	−371	1,967***	0.09**	0.31***
Trade/Services	−102	2,335***	0.13***	0.35***
Poor household in 2008				
Poor	1,385***	−1,053***	0.15***	0.01
Initial earnings quintile				
2	−65	1,778***	−0.13***	0.29***
3	−448***	3,106***	−0.17***	0.45***
4	−1,481***	4,162***	−0.29***	0.49***
5 = highest	−5,593***	6,988***	−0.46***	0.59***
Predicted initial earnings quintile				
2	−311**	1,306***	−0.07**	0.18***
3	−437**	2,887***	−0.03	0.40***
4	−887***	3,561***	−0.08**	0.42***
5 = highest	−3,219***	5,511***	−0.14***	0.52***

Notes: legend: * p < 0.10; ** p < 0.05; *** p < 0.01. Standard errors account for strata and clusters in sample survey design. Omitted categories are female, 25-34 year olds, illiterates/no schooling, rural area, metropolitan area, wage worker public, informal workers, agricultural workers, non-poor households, and lowest 20% quintile of initial earnings or predicted earnings.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

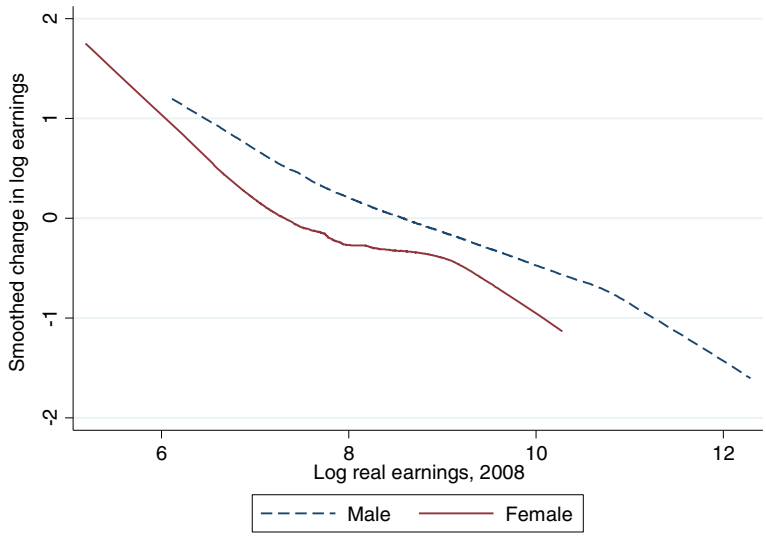

Figure 5 Change in log earnings based on initial log earnings by gender, Egypt 2008–2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. Analysis was done separately by gender and then plotted on the same graph.

impression of whether a group (such as males) has had better average outcomes than another (women), is overturned when we compare the two groups conditional on the same initial earnings. This overturning effect generally holds for females, younger workers, those living in rural areas, or in regions with lower initial earnings, unpaid workers, informal workers, those working in agriculture and those living in poor households. While mean and median earnings changes for these groups were better than those of their counterparts, they performed worse on average than their counterparts who had similar initial earnings.

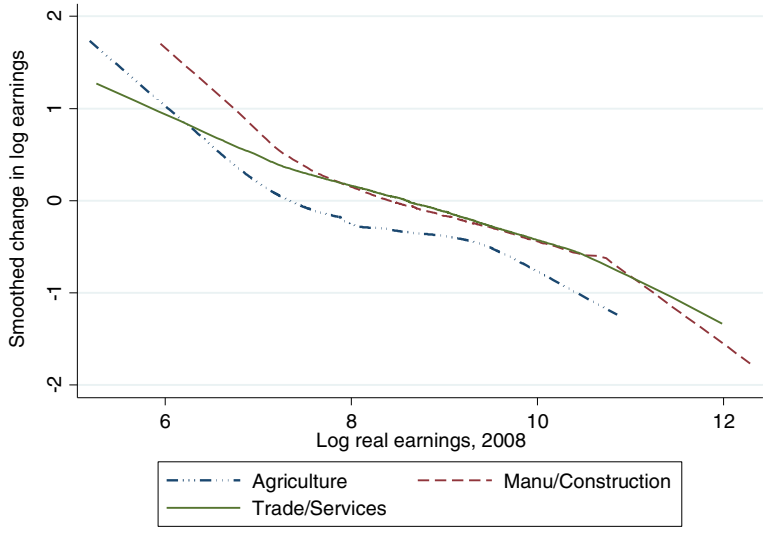

Figure 6 Change in log earnings based on initial log earnings by industry in 2008, Egypt 2008–2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. Analysis was done separately by industry and then plotted on the same graph.

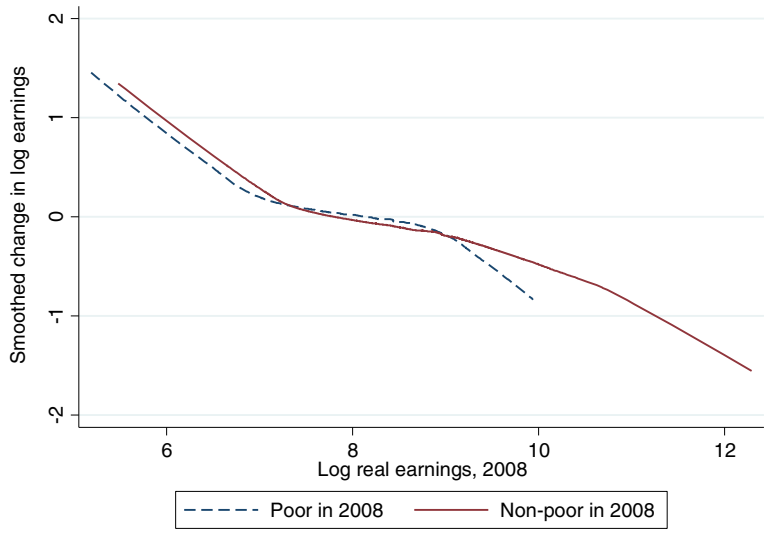

Figure 7 Change in log earnings based on initial log earnings by 2008 poverty status, Egypt 2008–2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. Analysis was done separately by 2008 poverty status and then plotted on the same graph.

In short, it is very important to consider the impact of initial earnings when evaluating how certain types of individuals were able to succeed and advance during the period. This type of evaluation generally requires panel data.

5.5 The role of transitions across types of work

Next we examine the systematic earnings changes associated with moving to a different sector of employment or to a job with a different employer relationship. First, we assess how often these transitions take place.

Table 9a shows that just more than half (51 percent) of all panel workers are employed in trade and services in 2008. Ninety-two percent of these workers are employed there again in 2009, while five percent are in manufacturing or construction and three percent are in agriculture. Agriculture also retains the vast majority (88 percent) of its workers in 2009 while manufacturing and construction work appears a bit less stable, with the sector retaining just 78 percent of 2008 workers in 2009. Overall the flows result in a slight loss of employment in agriculture and manufacturing/construction and movements into trade and services, which now employ 53 percent of workers. Overall, 12 percent of panel members were in a different sector in 2009 than in 2008.

Table 9b demonstrates the strength of tie to public wage employment. Ninety-five percent of public wage workers in the panel remained in public wage employment in 2009 as compared to just 66 percent of those in private wage work, 69 percent of employers, 55 percent of the self-employed and 75 percent of the unpaid workers. Flows from private to public wage work were particularly plentiful, helping to explain the three percent increase in public wage employment and the corresponding three percent loss in private wage employment in 2009, even though flows into public employment came from all other types of employment.

Table 9 Employment transitions by type of work or worker, Egypt 2008 to 2009

a: Sector of work

	Sector in 2009		
Sector in 2008	Agriculture	Ind/Const	Trade/Services
Agriculture (31%)	87.8%	3.8%	8.4%
Industry/Construction (19%)	5.0%	78.2%	16.7%
Trade/Services (51%)	2.7%	5.0%	92.3%
Total	29%	18%	53%

b: Employer Relationship

	Employer Relationship in 2009				
Employer Relationship in 2008	Public Wage	Private Wage	Employer	Self-employed	Unpaid
Public Wage (33%)	94.9%	3.6%	0.8%	0.5%	0.1%
Private Wage (25%)	15.4%	66.0%	8.3%	8.1%	2.1%
Employer (15%)	2.8%	11.8%	69.3%	12.5%	3.5%
Self-employed (16%)	2.5%	11.4%	16.1%	55.3%	14.6%
Unpaid (10%)	2.2%	5.8%	3.5%	13.9%	74.7%
Total	36%	22%	16%	15%	11%

c: Formality

	Status in 2009	
Status in 2008	Informal	Formal
Informal (53%)	88.2%	11.8%
Formal (47%)	14.8%	85.2%
Total	53%	47%

Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

The transient nature of self-employment is also apparent as just 55 percent of 2008 workers were self-employed in 2009. More than ten percent of these individuals ended up as private wage employees (11 percent), as employers (16 percent), and as unpaid workers (15 percent). While moving to employer status might be thought of as a successful outcome for a self-employed individual, other outcomes may be less certain. Movement to private wage employment may often occur by choice and may often be the result of business failure. Movement to unpaid worker status might result from more family members working in a successful household enterprise or it might be a result of failure of the business that the individual was running and falling back into another household enterprise. The earnings mobility outcomes may help us form opinions on these.

Tables 10a-b and 11 should be interpreted bearing in mind the mean (−950) and median (−446) earnings losses for the population of workers as a whole.

Those who left agricultural work were generally better able to stem the earnings losses. The median change and the percent experiencing positive earnings gains were higher for those who switched sectors, though the average decline in earnings for those who moved to trade/services was actually larger than those who stayed in agriculture. Meanwhile, those who moved into agricultural work were experiencing larger than average earnings losses. This evidence is consistent with what one might expect if there is significant labor market segmentation, with agriculture representing the least preferred free entry sector and the differential pay being offered to the same individual

Table 10 Mean and median earnings change by employment transition, Egypt 2008 to 2009

a: Sector of work

		Sector in 2009		
Sector in 2008		Agriculture	Ind/Const	Trade/Services
Agriculture	Mean	−852	−97	−921
	Median	−456	−115	−222
% positive		38%	48%	45%
	n obs	1,002	38	92
Industry/Construction	Mean	−1,342	−1,411	−154
	Median	−963	−641	−258
% positive		32%	37%	42%
	n obs	37	507	104
Trade/Services	Mean	−3,878	−966	−842
	Median	−1,148	−947	−349
% positive		39%	42%	44%
	n obs	54	87	1,559

b: Employer Relationship

		Employer Relationship in 2009				
Relationship in 2008		Public Wage	Private Wage	Employer	Self-employed	Unpaid
Public Wage	Mean	−614	−116			
	Median	−109	210			
% positive		47%	51%			
	n obs	1,053	39			
Private Wage	Mean	−640	−846	984	−178	−1,815
	Median	−188	−641	808	−235	−1,661
% positive		47%	37%	61%	46%	12%
	n obs	124	566	78	71	20
Employer	Mean		−2,956	−2,481	−3,441	
	Median		−2,364	−1,482	−1,744	
% positive			15%	32%	23%	
	n obs		61	390	68	
Self-employed	Mean		−3,388	19	−953	−1,116
	Median		−1,719	−205	−471	−603
% positive			22%	47%	38%	33%
	n obs		65	93	331	95
Unpaid	Mean		2,047		305	−277
	Median		1,644		245	−230
% positive			93%		59%	39%
	n obs		20		47	274

Notes: Cells with less than 20 observations not shown.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

working in different sectors. However, a much more detailed analysis would be needed to assess this hypothesis more fully.

The earnings decline for those remaining in the industry/construction sector was large. Combined with the previous information of workers flowing out of this sector, a

Table 11 Formality

		Status in 2009	
Status in 2008		Informal	Formal
Informal	Mean	−865	−640
	Median	−479	−222
% positive		39%	46%
	n obs	1,690	212
Formal	Mean	−2,848	−765
	Median	−1,160	−267
% positive		29%	45%
	n obs	239	1,340

Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

consistent picture emerges that this sector was under stress during the 2008 to 2009 period. The only group of individuals that started in industry/construction and ended with less than average earnings losses was the group that moved to trade/services. Correspondingly, those who started in trade/services suffered high median losses if they moved to industry/construction, but the mean earnings loss for this group and the percent experiencing positive gains were basically the same as the overall average. Thus, the data is less clearly consistent with what we would expect if there was segmentation across industry/construction and trade/services sectors. It does appear that the industry/construction sector was under strain. It is a bit surprising that those who transitioned from industry/construction to trade/services had such relatively positive earnings changes. This seems to be driven by those coming from construction or electrical utilities rather than manufacturing sectors, but the estimates are too variable to find the differences to be statistically significant.

Public wage workers who stayed on in public wage employment did better than average in stemming the loss in real earnings. This is surprising given their high initial earnings levels and our earlier results regarding high initial earnings. Those who moved from public to private wage employment did even better. This suggests that such moves were likely voluntary moves.

In fact, with the exception of movements into unpaid worker status, wage workers who moved to new work categories consistently had better earnings changes than those who stayed within their same worker category. Thus, a generalization might be to assume that most observed changes of wage workers were voluntary, while those moving to unpaid worker status were involuntary. It does not appear that this was a period of substantial labor shedding of wage workers, public or private. Instead, workers absorbed losses in their real wage.

In contrast to this, the employed and self-employed who moved to private wage experienced even worse mean and median changes than those who stayed in their respective categories, consistent with a notion of being involuntarily pushed out of business rather than finding a better job.

Those who started as employers took large losses whether they moved sectors or tried to ride out the storm remaining as an employer. The self-employed also had relatively large losses. This might seem to be surprising given that such individuals have the opportunity to immediately change their product prices in response to inflation

Table 12 Determinants of change in log earnings, Egypt 2008 to 2009

	(1)	(2)	(3)	(4)	(5)
Log earnings in 2008	−0.4655***	−0.5226***	−0.5352***	−0.5359***	
Predicted log earnings in 2008					−0.2818***
Male	0.4423***	0.3258***	0.2734***	0.2828***	0.1474***
Age	0.0510***	0.0423***	0.0412***	0.0408***	0.0235**
Age-squared	−0.0006***	−0.0005***	−0.0005***	−0.0005***	−0.0003**
Married	0.1082**	0.1461***	0.1441***	0.1475***	0.0798**
Illiterate/no formal schooling (omitted)					
Basic education/literacy	0.1130***	0.0417	0.0204	0.0214	0.0058
Completed Primary	0.1471***	0.0761**	0.0653*	0.0693*	0.039
Secondary education	0.2298***	0.1056***	0.0860***	0.0877***	0.0677**
University degree	0.4033***	0.2518***	0.2189***	0.2243***	0.1486***
Metropolitan (omitted)					
Lower Urban	0.0723	0.0673	0.0627	0.064	0.0882
Lower Rural	−0.0764*	−0.0501	−0.0515	−0.0613	−0.0146
Upper Urban	−0.0754	−0.0722	−0.0861	−0.0898	−0.0623
Upper Rural	−0.1771***	−0.1417***	−0.1183**	−0.1327**	−0.0999**
Working Housewife		−0.2626***	−0.1251*	−0.1387**	−0.0996
wage worker public (omitted)					
wage worker private		−0.0574**	−0.013	−0.0029	−0.0384
employer		0.0381	−0.0922	−0.0602	−0.1909***
self employed		−0.1214***	−0.0781	−0.0558	−0.0976
unpaid worker		−0.0447	0.2694***	0.2966***	0.3550***
Formal worker		0.0852***			
Agriculture (omitted)					
Manu/Const		0.0877**		0.0944***	0.060*
Trade/Services		0.0943**		0.0934**	0.068**
Poor in 2008		−0.0051	0.0053	0.0036	0.1438***
wage wkr public in 09 (omitted)					
wage wkr private in 09			−0.0225	−0.0336	−0.0482
employer in 09			0.3171***	0.2557***	0.1958***
self employed in 09			−0.0619	−0.092	−0.0675
unpaid worker in 09			−0.4984***	−0.5534***	−0.5460***
Informal-informal (omitted)					
Informal-formal			0.1049**	0.1210***	0.1135***
Formal-informal			−0.007	−0.0027	−0.0762*
Formal-formal			0.1470***	0.1559***	0.0517*
Agri - Agri (omitted)					
Agri - Manu/Const			0.2356***		
Agri - Trade/Services			0.1099		
Manu/Const - Agri			−0.1032		
Manu/Const - Manu/Const			0.1575***		
Manu/Const - Trade/Services			0.1642**		
Trade/Services - Agri			−0.1306		
Trade/Services - Manu/Const			0.1405**		

Table 12 Determinants of change in log earnings, Egypt 2008 to 2009 *(Continued)*

Trade/Services - Trade/Services			0.1548***		
Constant	2.3032***	3.0926***	3.1953***	3.2530***	1.6737***
n	3481	3481	3480	3481	3481
R-squared	0.2358	0.2728	0.3471	0.3411	0.1297

Notes: legend: * p < 0.10; ** p < 0.05; *** p < 0.01. Standard errors account for strata and clusters in sample survey design. Column (5) uses bootstrapped standard errors.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

(and have their earnings rise) whereas workers may be locked into longer term contracts. This will be discussed more fully in Section 6.

Movements from formal to informal employment tended to result in very large losses. They were also quite numerous. This could signal labor shedding, where individuals are being forced to change jobs and losing out on pay. However, there was an inflow from informal to formal employment that was similar in size as the above outflow. This inflow did not result in earnings gains on par with the losses noted above. Therefore, it was not simply a case of individuals changing positions with similar earnings. An alternative explanation could be that employers under duress are opting out of the social pension system (and simultaneously giving workers reduced earnings). One might expect a certain flow from both of these causes in any time period. Without a baseline to know the typical flows and earnings changes from such transitions in Egypt, it is difficult to pinpoint an explanation.

Interestingly, those who moved from informal to formal sectors had earnings changes that were significantly but not so dramatically better than those who stayed informal. The changes were similar to those experienced by those who started and remained in the formal sector.

5.6 Multivariate analysis

We turn to multivariate analysis to better understand the determinants of earnings mobility. Table 12 presents a series of regressions that have the change in log earnings as the dependent variable. Results are presented using only exogenous base year characteristics and initial earnings (column 1) and then adding endogenous variables from the base year (column 2)[19]. Columns (3) and (4) include employment transition variables, with column (4) being the preferred specification (discussed below). In column (5), we replace initial log earnings with predicted initial log earnings and include all previous variables. In this specification, the effect of predicted initial log earnings is identified by fluctuations in log per capita consumption in the household in the base period.

Initial earnings are a powerful predictor of earnings change across all specifications. The coefficients imply that the predicted change in log earnings decreases by between 0.47 and 0.54 for each additional unit in reported log income. When using predicted initial log income, the coefficient drops to −0.28, which is still highly significant from an economic perspective. The coefficient is statistically significant at the one percent level for all specifications.

Another characteristic exhibiting a consistently important influence on predictions is gender. Males experience approximately 27 percent to 44 percent higher earnings changes than females, ceteris paribus, in columns (1)-(4)[20]. When using predicted

initial earnings, this falls to about 15 percent higher, ceteris paribus, but remains both statistically significant and important in terms of economic loss. In contrast, re-running column (4) without including initial earnings, leads to a negative though statistically insignificant gender effect (see Table 13).

Higher education levels also seem to be associated with higher earnings changes when controlling for initial earnings. Focusing on column (4), those with secondary education and university education had statistically significant differences in earnings changes compared to those who were illiterate/had no schooling, with gains of approximately 8.8, and 22.4 percent respectively. If one does not control for initial earnings, the estimated differences by education level are neither individually nor jointly statistically significant.

Age is also statistically significant, with earnings changes increasing and then decreasing with age. In column (4) the turning point is 43 years of age, while in column (5) it is 39 years of age (not shown in the table). Being married raises predicted earnings change by approximately 15 percent in the preferred specification, although, in column (5), the point estimate is less than half the size and it is only statistically significant at the ten percent significance level. These effects were also considerably different when running regression analysis without initial earnings[21].

Using the preferred specification, the upper rural region had statistically lower earnings changes, ceteris paribus, than the Metropolitan region. Returning to Table 7, one may notice that the highest median pay in 2008 was in the Lower Urban region, followed by the Metropolitan region and the lowest pay was in Upper Rural region.

Looking at the employment transition variables, there are some surprising results. First, after controlling for other characteristics and initial earnings, the variables identifying transitions across industry in column (3) are not jointly statistically significant. The data did not reject the null hypothesis that only the initial sector of employment was needed for predicting earnings changes. This is surprising, but does allow a simpler form to be used as our preferred specification in column (4).

Using just initial industry characteristics we determine that those who started in agriculture experienced approximately nine percent lower earnings changes than others. The results are statistically significant. This result might seem surprising since the inflation was driven in part by rising food prices. One might assume that food producers would be able to increase their prices at least at the rate of inflation.

There are some potential explanations behind this unexpected result. We begin with some explanations that justify why farmers' gains from rising food prices might be less than expected for those unfamiliar with the Egyptian setting. First, for most of the small farmers, the agricultural production makes up only up to 40 percent of their incomes, and they simultaneously sell their labor to other farmers/enterprises. Since higher food prices only benefit farmers on the share they sell, and agricultural wages may be slow to adjust, particularly if the food price shocks come too late to adjust the production size, the overall gains may be less than expected. Second, many farmers in Egypt are net consumers of food. Egypt is a very large importer of grains (mostly wheat), oil, and sugar—three main items in the consumption basket. Meat production relies heavily on imported grains as well. Therefore, it's possible that the prices for the main consumption items and input costs were going up substantially faster than the production items. Finally, even assuming that farmers could benefit from higher prices, it did not seem

Table 13 Determinants of change in log earnings, with and without initial earnings

	(1)	(2)
	with initial earnings	without initial earnings
Log earnings in 2008	−0.5359***	
Male	0.2828***	−0.0076
Age	0.0408***	0.0022
Age-squared	−0.0005***	−0.0001
Married	0.1475***	0.0001
Illiterate/no formal schooling (omitted)		
Basic education/literacy	0.0214	−0.0308
Completed Primary	0.0693*	−0.0126
Secondary education	0.0877***	0.0203
University degree	0.2243***	0.0326
Metropolitan (omitted)		
Lower Urban	0.064	0.1136*
Lower Rural	−0.0613	0.0461
Upper Urban	−0.0898	−0.0238
Upper Rural	−0.1327**	−0.0368
Working Housewife	−0.1387**	−0.0457
wage worker public (omitted)		
wage worker private	−0.0029	−0.033
employer	−0.0602	−0.3161***
self employed	−0.0558	−0.0734
unpaid worker	0.2966***	0.4930***
wage wkr public in 09 (omitted)		
wage wkr private in 09	−0.0336	−0.0455
employer in 09	0.2557***	0.1889***
self employed in 09	−0.092	−0.0678
unpaid worker in 09	−0.5534***	−0.5493***
Informal-informal (omitted)		
Informal-formal	0.1210***	0.1174**
Formal-informal	−0.0027	−0.0812**
Formal-formal	0.1559***	0.0414
Agriculture (omitted)		
Manu/Const	0.0944***	0.0117
Trade/Services	0.0934**	0.0277
Poor in 2008	0.0036	0.2309***
Constant	3.2530***	−0.0816
n	3481	3481
R-squared	0.3411	0.1228

Notes: legend: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Standard errors account for strata and clusters in sample survey design.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

the case for most of the domestic prices on food items, which increase in a very different way from international prices, as shown in Figure 8.

These explanations are admittedly lacking. While they offer ideas on why the relative gains for those engaged in agriculture may be weaker than expected, they

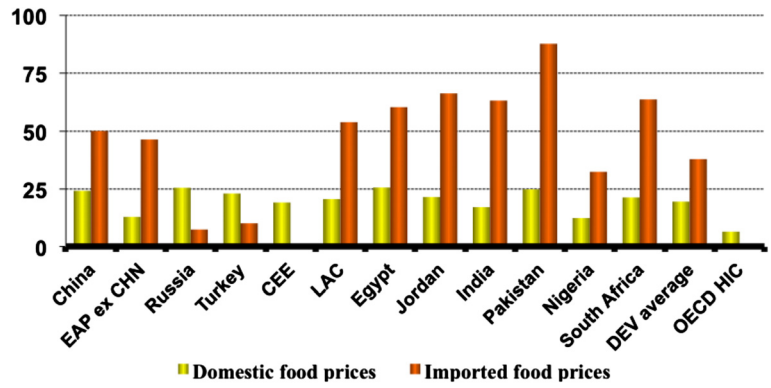

Figure 8 Prices of imported and domestic food (percentage change January 2006-January 2008). Reprinted from World Bank, DECPG (2008)

do not explain why those in agriculture had outcomes that were actually worse than others.

An alternative explanation suggests that farmers faced rising input costs and suppressed gains in output prices. The rising input costs are primarily attributed to steeply rising fertilizer costs. On the other hand, a ban on rice exports caused the domestic price of rice to be lower than expected. These storylines are presented here as one possible explanation that warrants much further examination. We do not provide supplemental evidence other than to say this proposed explanation is somewhat consistent with the fact that the large earnings declines for those initially in agriculture are predominantly driven by changes for those initial employers or self-employed rather than for those who are working in agriculture as wage workers. Future work will allow us to offer more concrete evidence to support or dispute this storyline[22].

Those who ended up in the formal sector in 2009 (whether or not they were in the formal sector in 2008) had statistically significant changes in earnings, 12 to 16 percent greater than those who started informal and remained informal. Those who started in the formal sector and moved to informal sector did no worse than those who were informal throughout.

For employer relationship transitions, we did not include all possibilities as there were many cells with very few observations. Instead, we include category dummies in the base and final year. The data suggests that, ceteris paribus, there was no statistically significant advantage to where one came from, but that those who were employers in 2009 experienced significant higher earnings changes and those who were unpaid in 2009 had significantly lower earnings changes.

Overall, individuals from initially advantaged groups tended to suffer smaller losses in log earnings than their counterparts after we control for initial earnings. This result holds for such critical variables as gender, education, and region as well as for the married dummy variable and one's industry of employment in 2008. If we do not control for initial earnings, these relationships are often reversed or statistically insignificant. With regard to employment transitions, there is evidence that those ending in the better employer relationship positions or in the formal sector in 2009, tended to end up with a higher predicted change in earnings. An individual's transition across industries offers surprisingly little ability to help estimate his/her earnings change.

5.7 A review of changes by initial poverty status

Individuals from initially poor households fared as well or better than others. They do not appear to be more vulnerable to earnings declines during this period. Those initially from poor households had substantially better average and median earnings changes than those from non-poor households. While this relationship was reversed when conditioning on initial earnings alone, non-parametric analysis showed limited differences for individuals from poor rather than non-poor households (see Figure 7). More importantly, the initially poor variable showed no statistical significance in the multivariate analysis (see Table 12), except for the positive coefficient in the specification using predicted earnings (column 5). This was significant at the one percent level and suggested a 14 percent advantage in earnings changes for those from poor households, ceteris paribus.

5.8 A more detailed examination by gender

Table 14 offers separate regression analysis by gender. Some interesting differences emerge. First, while the importance of initial earnings is apparent for all three groups,

Table 14 Determinants of change in log earnings, by gender

	Male	Female
Log earnings in 2008	−0.4879***	−0.6533***
Age	0.0354***	0.0351
Age-squared	−0.0004***	−0.0004
Married	0.2429***	−0.1033*
Illiterate/no formal schooling (omitted)		
Basic education/literacy	0.0192	0.0206
Completed Primary	0.0515	0.1422
Secondary education	0.0747**	0.1005
University degree	0.2301***	0.2564***
Metropolitan (omitted)		
Lower Urban	0.0744	0.0793
Lower Rural	−0.0448	−0.0411
Upper Urban	−0.0384	−0.1535
Upper Rural	−0.1243**	−0.1631*
wage worker public (omitted)		
wage worker private	−0.0403	−0.1930*
employer	0.0024	−0.0382
self employed	−0.0206	−0.3898**
unpaid worker	−0.0503	−0.2502
Formal worker	0.0703**	0.2116**
Agriculture (omitted)		
Manu/Const	0.0337	0.1795
Trade/Services	0.0260	0.2113**
Poor in 2008	−0.0160	−0.0198
Constant	3.2490***	4.4566***
n	2439	1042
R-squared	0.2672	0.3311

Notes: legend: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Standard errors account for strata and clusters in sample survey design.
Source: HIECPS, Feb 2008 to Feb 2009 (CAPMAS 2009).

the impact is greater for women as compared to men. This could be due to a variety of reasons. For example, women may have a higher degree of transitory income as a general norm. Or, it could result from period-specific changes. Suppose, for example, successful women had a disproportionate decline in earnings because households had to spend more on food and had less left to spend on stock for the female run enterprises. Simultaneously, women with low earnings may have had disproportionate gains in earnings as they worked more aggressively in the labor market in an attempt to make up for inflation reducing the buying power associated with the male breadwinner's take home pay. We do not examine these points fully here, but leave them as open questions.

Additional differences exist between males and females. For example, while married men had 24 percent higher earnings gains than an otherwise similar non-married men, married women had 10 percent lower earnings than an otherwise similar non-married woman. However, the effect for females was not statistically significant. Additionally, females saw much greater differentials in earnings change experiences based on formal work status in 2008; employment type in 2008, specifically in comparison to public wage workers; and sector of employment in 2008, specifically non-agricultural versus agricultural workers.

While these differences are present, other aspects of the earnings change experience are quite similar across gender. Both groups were estimated to have earnings changes that increase and then decrease with age, with nearly identical turning points (at 43 years). Additionally, there were nearly identical gains for those with a University degree compared to those with no education. Other results across education levels were quite similar for males and females or were statistically insignificant. Results were also similar across gender when looking at changes experienced in different regions of Egypt.

6. Conclusions and areas of further research

Using panel data from February 2008 to February 2009, we observe changes in earnings experienced by workers in Egypt during a period of high inflation. In aggregate, the data shows that the labor market reacted to this rapid inflation by inducing a rapid decline in real earnings. There was no major reduction in employment levels, at least not for prime-aged workers. Average nominal earnings remained relatively unchanged. The mean and median changes in real earnings were almost universally negative across a wide spectrum of individual and regional characteristics.

At the individual level, however, the earnings change experience exhibited substantial heterogeneity, with 27 percent of the workers with employment in both periods reporting pay at least fifty percent higher or fifty percent lower than their reported 2008 earnings. Additionally, many individuals transitioned to new sectors of work or employer relationships during this period. Thus, for many individuals, this was a period of considerable fluidity and complexity compared to the rather simple aggregate story. As this is the first panel dataset in Egypt that captures such movements, we cannot determine the extent to which these earnings changes and employment transitions differ from what is typically found in a more stable economic period.

However, using this panel data and a descriptive regression approach, we are able to identify key covariates that have a significant association with earnings change. The descriptive regression approach cannot give us causal interpretations, but it does provide

statistical determinants of earnings change. It gives circumstantial evidence that favors particular items as driving forces. It also leaves us with many new questions to explore in the future.

We found that initial earnings had a powerful negative association with earnings change. Those with higher earnings in 2008 had a greater average (and median) decline in earnings. This might be expected in a time period where inflation is driving the change in real earnings. Yet, the data also shows that those with higher reported log earnings in 2008 had a greater average decline in reported log earnings as well.

Such results may be driven by a spurious correlation resulting from classical measurement error. Thus, we re-computed the analysis using predicted earnings in place of initial earnings. The levels result was robust to this approach. The log result was not robust, although the coefficient was still negative. Thus, the data suggests that those with lower initial earnings experienced percentage declines that were, at worst, similar to those with higher initial earnings and there is some evidence that the percentage declines were lower for those with lower initial earnings.

The importance of controlling for initial earnings was evident when examining the relationship between earnings change and gender. On average, men experienced a much larger average decline in earnings than women. However, for men and women with the same initial earnings, women had a greater average fall in earnings.

For a number of other covariates, the story was similar. The disadvantaged groups—such as young workers, those living in rural areas or those living in low-earning regions—experienced smaller average declines in earnings than their advantaged counterparts. However, if individuals started with the same initial earnings, it was members of the disadvantaged group that experienced greater average declines. One exception to this was that those from poor households did not generally show themselves to be more vulnerable to earnings declines even after conditioning on initial earnings.

When controlling for a larger host of covariates, higher initial earnings remained negatively related to earnings change. This association is statistically significant and has large economic significance as well whether controlling for reported or predicted initial log earnings.

The inevitable question is, why? What is it about having high initial earnings in 2008 that causes individuals to fall further relative to similar individuals with lower initial earnings? Did these individuals possess some unobservable characteristics that are no longer being rewarded as well as before? Is it capturing a dynamic adjustment process where individuals with positive or negative shocks gradually return to their conditional mean? To begin to address these questions, we would need panel data with more than two periods. Thus, it remains an open question for future work.

One consequence of this negative relationship between earnings change and initial earnings is that individuals are often changing position in the earnings distribution. Thus, when assessing income inequality over time using cross-sectional data, one should recognize that there are likely different people in different earnings positions over time (see Fields and Sanchez-Puerta (2010) for a clear graphical example).

There is also more work to be done in understanding why women had worse earnings change experiences than men who started at the same initial earnings level. This result was robust to excluding women who were listed as working housewives. Yet, it is worth

investigating whether these changes were brought on by lower investment in female businesses, firms offering lower pay or holding pay fixed for women or other possible reasons. Additionally, understanding why earnings changes were more responsive to initial earnings for women than men may help us better understand how initial earnings impact earnings change.

This influence of initial earnings leads to a situation where various groups might see themselves as disproportionately affected by the inflation shock and ensuing decline in earnings. For example, men might recognize the absolute value and even percentage value of their losses were greater than that of females. On the other hand, women might notice that their losses and percentage losses were far greater than men who started with the same initial earnings (and had otherwise similar characteristics as them). It is an open question whether such settings give rise to more social discontent than settings where aggregate differences and differences conditioning on those like oneself allows only one group to claim relative disadvantage. The absolute decline in earnings experienced by so many different types of individuals was undoubtedly a source of widespread social discontent in this period. But a hypothesis worth considering is that such discontent becomes even greater in situations where all groups could also consider themselves relatively worse off depending on whether they focus on aggregate effects or effects conditional on personal characteristics.

Finally, earnings changes for those initially engaged in agriculture were unexpected, given that the changes in inflation were driven in part by rising food prices. Those who started in agriculture had the biggest average decline in earnings, holding all else constant. A number of possible explanations have been raised. In our view the most plausible revolve around rising fertilizer costs with relatively stagnant farm-gate prices for at least some crops. A more complete explanation would require a detailed examination of the agricultural sector and is left for future work.

Endnotes

[1]Concurrent analysis of earnings mobility using this data has been undertaken by Silva as part of the World Bank investigation into informality. Earlier, Assad and Roushdy (2007) also used the panel data from the Egyptian labor market conditions surveys (ELMPS) conducted in 1998 and 2006 together with the 2005 HIECS to provide very detailed information on employment status, earnings, and poverty. The work was descriptive using transition matrices and focused on wage workers. Their results reveal that between 1998 and 2006 there was a notable improvement in labor-market conditions in Egypt. New jobs were created at a faster rate than the growth of the labor force, leading to a reduction in the unemployment rate. They also found an uneven increase in earnings where only few of the poor had benefited from these gains. However, both studies did not take into account the relationship between the initial earnings and earnings changes that is central to this paper.

[2]This statement is not meant to be a central thesis for what kept inflation from continuing to increase. The lack of adjustment of wages, itself, was likely driven by many underlying factors.

[3]An alternative hypothesis would be that they did raise prices but that demand for their product fell as buyers had less of their constant nominal earnings to spend on domestic services and products due to increased prices of the imported goods that they were buying.

[4]This process divides enterprise gains solely among residents engaged in a home enterprise. Such a division can lead to measurement error. Fortunately, more than half of those engaged in household enterprise work are the only ones in the household engaged in such activity (and thus do not need to split profit). In multiple person enterprises (often two person activities), there may be some concern in this regard.

[5]We also discard 9 observations in 2008 and 12 observations in 2009 that had zero earnings despite being listed as employed. These were primarily unpaid workers and we believe the values to be erroneous.

[6]We can reject the hypothesis that each dummy variable equals zero when testing them separately. Surprisingly, using a ten percent significance level, we cannot reject the joint hypothesis test that both of these dummy variables simultaneously equal zero.

[7]Such descriptive regressions do not attempt to eliminate or fix endogenous right hand side variables that can conflate causal interpretations of regression coefficients. This approach is useful in predicting *who* was affected by a given change, without explaining *why*. In other words, we may be able to say that individuals who transitioned from sector A to sector B experienced higher average earnings changes than those of similar age, education level, etc. who stayed in sector A. We cannot say that they earn more *because* they switched sectors or that anyone else who had made a similar switch would have enjoyed the same gain.

[8]Here, we ignore the fact that there is not a direct correspondence between earnings and consumption per capita.

[9]There may be some concern about marital status being considered exogenous. This will be discussed in the results section.

[10]The construction of the poverty lines is explained in The World Bank (2011).

[11]Cameron and Trivedi (2005) also offer a useful discussion of the lowess estimator. However, the previous paragraph paraphrases from the STATA manual, which also includes the basic formula for the tri-cube weighting scheme: $w_j =$ and $\Delta = 1.0001*\max(x_{i+} - x_i, x_i - x_{i-})$ where x_{i+} and x_{i-} are edges of the usable observations. As our bandwidth is 0.8, this is limited to be no more than 40% of the observations above and no more than 40% of the observations below the current observation when observations are lined up according to value of x. Put another way, an observation at the median level of x would use the middle 80% of the sample in its regression, while an observation at the upper extreme of x would use just the observations with the highest 40% of values of x. In our case x is initial earnings level. One negative feature of this approach is that it does not incorporate the probability weights in the underlying sample.

[12]In the case where we start with a negative coefficient, the attenuation bias will help mitigate the overall bias. For example, if the actual value is −0.50 rather than 0.50, we would find −0.55.

[13]Note: The measurement error, μ_{08}, will no longer be present in the predicted earnings from 2008, thus eliminating the spurious correlation. The new equation will be: $\Delta y_i + (\mu_{09,i} - \mu_{08,i}) = \beta_0 + \beta_1(yhat_{08,i}) + \varepsilon_i$. As the long as the measurement error in 2008, $\mu_{08,i}$ is not correlated with any of the variables used to predict initial earnings, which is a standard assumption of classical measurement error, it will not be present in our predicted earnings for 2008, here denoted by $yhat_{08,i}$.

[14]Employment participation rates were also increasing from 48% to 53% among those 18 to 24 year olds in 2008 and the rate for those 18 to 24 years old in 2009 was also

higher at 49%. These conclusions assume that those who lost their jobs were not more likely to be missing from the sample in 2009.

[15]Our data does not allow us to know if the individual is in the same job in both periods. We will also review changes in sectors and relationship with employer later in this paper.

[16]The difference in logs of (+ or -) 0.5 is a very rough approximation of a 50% change in earnings. Twenty seven percent of the weighted sample had reported earnings in 2009 that were 50% greater or less than reported 2008 earnings.

[17]In our data the variance of initial log earnings is roughly 0.68. Thus, if the variance of μ is .204 or greater, it would imply that the true coefficient is non-negative. Given a Normality assumption on our classical measurement error term and a standard deviation of $0.204^{0.5}$, this implies that 32 percent of respondents would be giving answers that were at least 45 percent above or below their true earnings level.

[18]See Figure 9 for the lowess model of the change in earnings after trimming the data of the lowest and top five percent of observations for each gender. Figure 10 shows the diagram using a local mean rather than local regression.

[19]As mentioned earlier, we take exogenous to mean characteristics that these 25 to 58 year olds brought to the labor market in 2008. One might reasonably question whether the married variable is exogenous. We ran this specification without the married variable and found results on all other coefficients and corresponding standard errors to be extremely similar to the model presented in Table 12.

[20]A more accurate approximation would be between 35 and 63 percent (Ex. $e^{0.30}$ - 1 = .35). However, we will follow convention and use the log approximation for all values in this paper.

[21]The age turning point was roughly 13 years old and being married had a zero coefficient.

[22]The authors would like to thank Ruslan Yemtsov, Julian Lampietti, and Maurice Saade for offering us some starting points in this area which we hope to follow in the future.

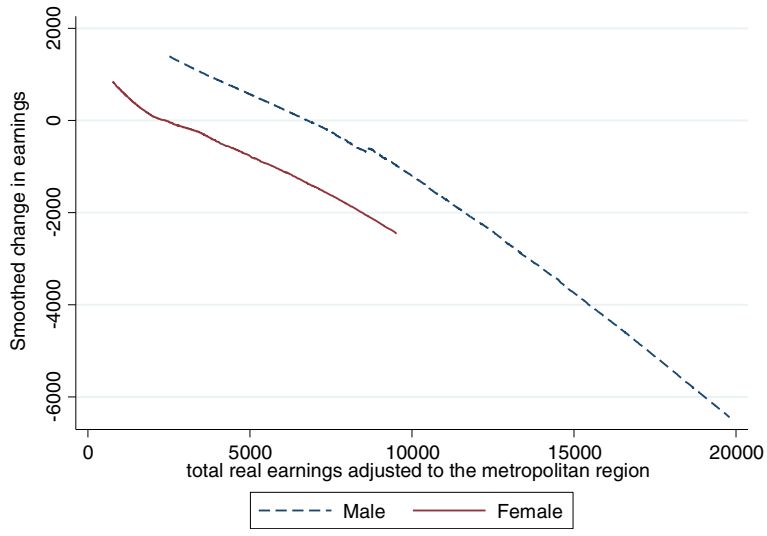

Figure 9 Change in earnings based on initial earnings by gender, Egypt 2008 to 2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Locally weighted regression was used to determine the predicted change in earnings based on real earnings in 2008. Analysis was done separately by gender and then plotted on the same graph**.** The top and bottom 5 percent of initial earnings were excluded for each gender.

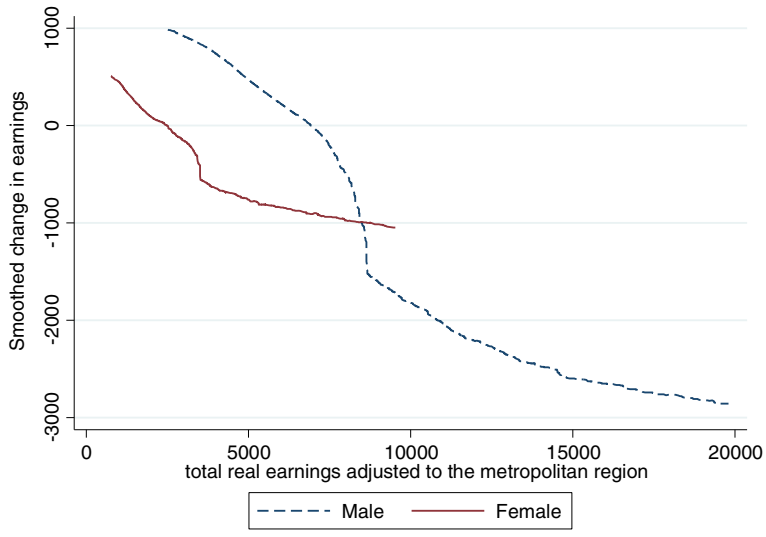

Figure 10 Change in earnings based on initial earnings, by gender, Egypt 2008 to 2009. *Source*: HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes:* Local mean constructed using tri-cube weight using *lowess* command with *mean* option. Top and bottom 5 percent of initial earnings are excluded for each gender.

Annex 1: measurement error simulation

In order to demonstrate how our lowess simulations are affected by classical measurement error, we conducted a simulation. For simplicity we treat the observed values of log 2008 earnings as true values. In order to create our simulated values of log 2008 reported earnings, we add a simulated measurement error realization to each

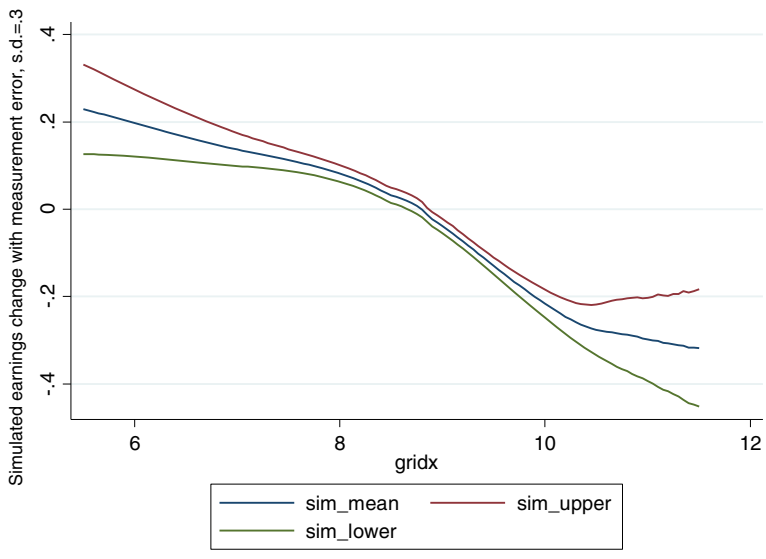

Figure 11 Simulated change in log earnings based on initial log earnings, Egypt 2008 to 2009. *Source*: Authors' compilation from HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Notes*: Simulated earnings values for 2008 and 2009 were both based on reported log 2008 earnings plus some random measurement error, which was drawn from a Normal distribution with mean zero and variance of 0.3. A change in earnings was then constructed directly from these simulated values. Finally, locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. Upper and lower confidence intervals are shown as well.

observation. These realizations are drawn randomly from a Normal distribution with a mean of zero and a standard deviation of 0.3. This standard deviation is admittedly arbitrary, but we feel it offers a significant amount of measurement error. Under this distribution, 32 percent of the sample would receive a random measurement error term with a magnitude greater than approximately 30 percent of the value of their 'true' earnings level. Five percent of the sample would receive measurement error that was more than approximately 60 percent of their 'true' earnings level.

We then constructed a second set of values in the exact same manner and called them log 2009 reported earnings. We take the difference and run a lowess regression of the simulated difference on the simulated 2008 data. This simulation thus represents what the lowess graph would look like if individuals had no real change in earnings but a fairly significant amount of measurement error. The result, shown in Figure 11 below, is initially disturbing as it shares many feature with our observed lowess results of the change in earnings on initial earnings. It is distinctly downward sloping.

However, this level of measurement error definitely cannot explain the results observed in our data. Figure 12 graphs the simulation again, this time also graphing the lowess graph using the change in log reported earnings and log initial reported earnings observed in our dataset. The simulation was downward sloping but the magnitude of the changes is tiny compared to the magnitude using our observed data. Thus, we are reassured that our lowess results are not driven solely by classical measurement error. Others may not feel as confident in this conclusion if they feel measurement error has a much larger variance or is otherwise different from our maintained assumptions. In this sense, this validation approach is similar to the approach of Fields et al. (Fields et al. 2003a).

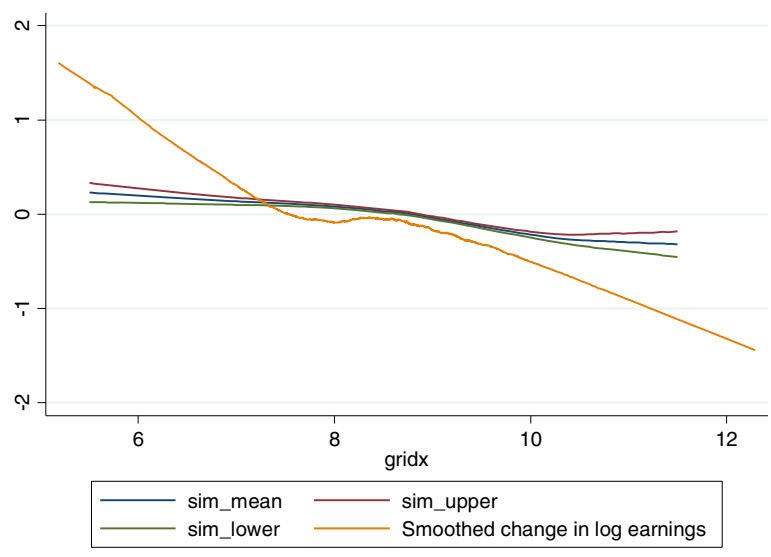

Figure 12 Simulated and reported change in log earnings based on initial log earnings, Egypt 2008 to 2009. *Source*: Authors' compilation from HIECPS (Feb 2008 to Feb 2009 (CAPMAS 2009)). *Note*: Simulated earnings values for 2008 and 2009 were both based on reported log 2008 earnings plus some random measurement error, which was drawn from a Normal distribution with mean zero and variance of 0.3. A change in earnings was then constructed directly from these simulated values. Finally, locally weighted regression was used to determine the predicted change in log earnings based on log real earnings in 2008. Upper and lower confidence intervals are shown as well.

Abbreviations
CAPMAS: Central Agency for Public Mobilization and Statistics; EGP: Egyptian Pound; HIECPS: Household Income, Expenditure and Consumption Panel Survey; HIECS: Household Income, Expenditure and Consumption Survey; LFSS: Labor Force Sample Survey; LPM: Linear Probability Model.

Competing interests
The IZA Journal of Labor & Development is committed to the IZA Guiding Principles of Research Integrity. The authors declare that they have observed these principles.

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