Economic Development and Female Labor Participation in the Middle East and North Africa

A Test of the U-Shape Hypothesis

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Abstract

The Middle East and North Africa region is known for having low female labor market participation rates as compared with its level of economic development. A possible explanation is that these countries find themselves at the turning point of the U-shape hypothesis when countries transition from declining to rising female participation rates. This paper tests the U-shape hypothesis in countries in the Middle East and North Africa. It finds that the region has outperformed other world regions in terms of the main drivers of the U-shape hypothesis, including gross domestic product per capita, economic transformation away from the agricultural sector, female education, and fertility rates. These facts are consistent with nonparametric evidence that shows countries in the region are distributed over a U-shaped curve. However, parametric tests of the hypothesis point in a different direction. The region shows an inverted U-shape overall and great heterogeneity across countries and age cohorts that defies any law on the relation between gross domestic product and female participation rate. The explanation behind these findings may be economic and cultural. Jobless growth and the lack of growth in employment sectors such as manufacturing and services, which proved critical for female employment in other countries, weaken labor demand and strengthen the role of institutions that may discourage female participation, such as marriage, legislation, and gender norms.

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Economic Development and Female Labor Participation in the Middle East and North Africa:

A Test of the U-Shape Hypothesis

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Introduction

Studies on Female Labor market Participation (FLP) can be broadly divided into two groups: studies that look at the long-term factors that drive FLP over periods spanning decades and focusing on epochal transformation of societies such as structural changes in the economy, and studies that use shorter time periods or simply cross-section information to derive associations between FLP and other factors that can vary over the short-term such as education or marriage. To the first group belong studies that have been largely pioneered by Ester Boserup and Claudia Goldin. To the second group belong a wide variety of studies on female labor supply and participation. This paper will focus on the first body of literature.

The prevalent hypothesis about the long-term relationship between economic development and FLP is the U-shape hypothesis (Boserup, 1970, Durand, 1975; Goldin, 1995, Psacharopoulos and Tzannatos, 1989). This broadly states that during the early stages of economic development FLP declines due to the initial structural changes of the economy and the transition from an agricultural to an industrialized society while it increases in later stages when countries mature into modern economies, fertility rates decline and female education rates increase. The literature points to essentially five factors explaining the U-shape hypothesis: 1) the economic transformation of societies from agriculture to industry 2) the increasing share of the female educated population; 3) long-term demographic changes including falls in fertility rates; 4) cohorts effects; and 5) evolving gender norms and culture. Thanks to the increasing availability of long time-series, these factors and their role in explaining FPR can now be tested for a wide variety of countries.

The purpose of this paper is to test the U-shape hypothesis in the context of Middle East and North African (MENA) countries following the leads that the literature has provided cross-country and within countries over the past thirty years. In our knowledge, there is only one short paper that recently tested the U-shape hypothesis in MENA countries (Tsani et al, 2013). This paper exploits the FPR statistical difference of this group of countries vis-à-vis other world countries to simulate with a CGE model the outcome of alternative GDP growth and FPRs scenarios. It finds potential beneficial effects on growth of removing region specific barriers to female participation. The present paper follows the more standard approach of testing the U-shape hypothesis with parametric and nonparametric methods and assesses each of the main factors behind the U-shape hypothesis one at a time.

FLPs remain one of the puzzles in the development process of MENA countries. The 20 years that preceded the Arab spring were characterized by tremendous structural transformation of the economies with stabilization, liberalization and privatization reforms starting in the 1990s and delivering sustained growth throughout the first decade of the 2000s. This same period also saw unprecedented gains in female education accompanied by sharp falls in fertility rates. Yet, this period has also been characterized by moderate growth in terms of employment and FLPs with women and youth being the two groups benefitting the least from the growth process. It is therefore compelling to take a long-term view of FPRs and the factors that help explaining FPRs to better understand the roots of the anomaly represented by the MENA region. As we explore MENA countries as a group and individually, we will also follow Morocco more closely. This is one of the countries where the anomaly represented by the MENA region is more evident and also the country that offers more and better quality data in the region.

The paper is organized as follows. The next section reviews theory and evidence of the U-shape hypothesis. The following two sections describe models and data respectively. Section four presents results and section five concludes.
Theory and evidence

The prevalent hypothesis about the long-term relationship between economic development and FLP is the U-shaped hypothesis (Boserup, 1970, Durand, 1975; Goldin, 1995, Psacharopoulos and Tzannatos, 1989). This broadly states that during the early stages of economic development FLP declines due to the initial structural changes of the economy and the transition from an agricultural to an industrialized society while it increases in later stages when countries mature into modern economies, fertility rates decline and female education rates increase. This is how Goldin (1995) states the hypothesis:

“Across the process of economic development the adult women's labor force participation rate is u-shaped. When incomes are extremely low and when certain types of agriculture dominate (…), women are in the labor force to a great extent. They are sometimes paid laborers but more often unpaid workers on family farms and in household businesses, often doing home workshop production. As incomes rise in most societies, often because of an expansion of the market or the introduction of new technology, women's labor force participation rates fall. Women's work is often implicitly bought by the family, and women then retreat into the home, although their hours of work may not materially change. (…) But as female education improves and as the value of women's time in the market increases still further, relative to the price of goods, they move back into the paid labor force, as reflected in the move along the rising portion of the U-shaped curve. The process suggests an initially strong income effect combined with a small own-substitution effect. At some point the substitution effect increases while the income effect may decline. During the falling portion of the U the income effect dominates, but during the rising portion of the U the substitution effect dominates.” (p. 62)

The U-shaped hypothesis has found consistent support in data and analyses since it was first proposed and this applies to cross-country studies as well as to time-series and panel studies. Among cross-country studies, Goldin (1995) found this relationship to hold for 1980 and 1985 across a group of more than one hundred countries. Mammen and Paxson (2000) replicated Goldin’s results for 1980 and 1985 and extended the test to 1970 and 1975 reaching the same conclusion. This paper also pinpointed that the lowest participation rate is found for countries with annual per capita income around $2,500, essentially middle-income countries according to the World Bank classification of the time. Similar results have also been found by Tam (2011) for a panel of 134 countries and for the period 1950-1980 and by Tsani et al. (2013) for South Mediterranean countries.

Results from time-series studies in developed economies also support the U-shaped hypothesis. Goldin found initial evidence of the U-shape relation in a study on the US (Goldin, 1995). These results were confirmed in more recent studies (Goldin, 2004, 2006, Olivetti, 2013) that were also able to pinpoint five distinct phases characterizing the evolution of FLP in the US. The first phase (“The independent female worker”, up to the 1920s) saw the entrance of young and low educated women into the labor force mostly in poorly paid or non-paid occupations with a subsequent exit from the labor force explained by marriage and the shift to home work. In a second phase (1930s-1950) married women start to join the labor force due to the increased demand in clerical jobs and the increased level in female education. In the third phase (1950s-1970s), FLP goes through a real revolution with rapid increases explained by better education of women, rising wages and the introduction of more flexible working arrangements such as part-time work.

Time-series evidence for countries other than the US are still scarce but similar results to the US have been found by Tilly and Scott (1987) for England and France. The U-shaped hypothesis has also been studied in developing economies with time-series data, although these series are typically much shorter than in developed economies. Mammen and Paxson (2000) provide some evidence for the U-shaped hypothesis in Thailand and India. Using cross-country longitudinal data with country fixed effects, these
authors found the U-shaped relation to hold for the period 1970-1985 (although the turning point of the U curve lowers to $1,600).

Only one recent paper has questioned the U-shaped hypothesis (Gaddis and Klasen, 2013). This paper used cross-country data for the period 1980-2005 and found that results related to the U-shape hypothesis are very sensitive to the data source used and that they tend to disappear with the use of panel data. The paper also finds a great heterogeneity of results across countries, little support for the structural change hypothesis from agriculture to industry as an important factor in driving declining FLP rates and a more relevant role for sector specific growth rates as opposed to GDP growth. It recognizes, however, the role of fertility and education in explaining rising FLP on the positive side of the U curve.

While the declining portion of the U curve is mainly explained in terms of structural transformation of the economy from agriculture to industry, the explanation of the rising part of the curve relies on a more complex combination of factors. Fertility has been among the first factors to be identified (Golding, 1995) a factor that found consistent evidence in subsequent studies (Angrist and Evans, 1998; Bloom et al., 2009). Similarly, female education was detected early on as a major factor of rising FLP rates (Goldin, 1995) and found matching evidence over the years across countries. These two factors are also related to each other (female education delays marriage and pregnancies) so that identifying the specific contribution of each factor on FLP is not straightforward but the evidence is rather solid in determining a correlation between fertility and education and FLP cross-country and longitudinally.

A more controversial set of factors relates to culture, gender norms and identity. Akerlof and Kranton (2000) made a convincing case of identity as being a major drive in female labor participation: “Similarly women’s assumed lower desire for labor force participation (...) can be understood as the result of their identity as homemakers.” (p. 732). Goldin (2006) indicated two major factors that could explain the gains in female labor participation in the US during the 1970s and 1980s described as “expanded horizons” (an increase in women’s expectations that leads to a change in educational choices) and “altered identities” (an increase in women’s decisional power in relation to labor market choices within the family). These changes were largely the product of a cultural revolution that revolutionized female marriage age, college graduation rates and professional school enrollments, all factors occurring in the 1970s. US data clearly show a turning point around 1970 followed by the fast increase in FLP rates between 1970 and 2000. The factors that led to the cultural revolution of the 1960s may be debatable but the effect of this revolution on FLP rates is clearly evident in the US data.

A recent World Bank report on gender equality in the Middle East and North Africa (World Bank, 2013) found FLP to be low in the region and the gap between male and female labor force participation to be the highest by world standards. The report did not test the U-shape hypothesis but finds some of its drivers to have developed in the expected direction during the past few decades. The performance of the MENA countries in terms of education and health has been outstanding with major achievements in terms of declining fertility and mortality rates and in terms of steep improvements in female education. This makes low FPR in the MENA region the most puzzling unless these countries find themselves at the turning point of the U curve.

This paper returns to the U-shape hypothesis by focusing on MENA countries. In our knowledge, the only paper that tested the U-shape hypothesis in the MENA region is Tsani et al. (2013). This paper uses a pooled regression on 160 countries with the South-Mediterranean countries as control and then uses the coefficient for these countries to carry out CGE simulations of alternative scenarios. In this paper, we follow a different approach using cross-country panel equations and within countries time-series
equations and testing separately for cohorts effects, fertility rates and structural transformation of the economy away from agriculture. We will also test for the role of specific sectors as opposed to GDP in raising FLP.

Models

We follow here the three most recent contributions to the literature of the U-shape hypothesis (Tam, 2011, Gaddis and Klasen, 2013 and Tsani et al., 2013). The standard equation used to test this hypothesis since the first paper by Goldin (1995) is as follows:

\[ FLP_i = \alpha + \beta_1 \ln y_i + \beta_2 (\ln y_i)^2 + \epsilon_i \]  

(1)

where \( y_i \) is typically GDP per capita at Purchasing Power Parity (PPP) and \( i \) is a subscript for countries. The U-shape hypothesis evidently holds if \( \hat{\beta}_1 < 0 \) and \( \hat{\beta}_2 > 0 \). This is a cross-country equation that is normally applied to one point in time and sometimes replicated over several points in time to test the robustness of the results.

Recent data and the availability of longer time-series within countries have allowed adding a longitudinal dimension to the equation turning the data into panel data where the number of observations per country and the points in time considered should preferably be the same.

\[ FLP_{it} = \alpha + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \epsilon_{it} \]  

(2)

Despite the time dimension and the panel data, Equation (2) is still a cross-section equation in that the coefficients measure the average change in FLP as GDP changes ignoring the difference between time and country effects. In this case, findings consistent with the U-shape hypothesis essentially state that countries at different levels of development distribute over a U-curve but nothing is said about the longitudinal shape of the FLP/GDP relation. To add the time dimension and, at the same time, account for time-invariant unobserved heterogeneity, one should run the equation within countries (losing the sample size advantage provided by the multiple countries approach), use country fixed effects in equation (2) or, alternatively, use the first difference equation as follows:

\[ \Delta FLP_{it} = \gamma_t + \beta_1 \Delta \ln y_{it} + \beta_2 (\Delta \ln y_{it})^2 + \epsilon_{it} \]  

(3)

Equation (3) is still not optimal because if FLP varies little, lagged FLP is correlated with the error term and the repressors become endogenous. To overcome this last problem and controlling for endogeneity, one can run a linear dynamic panel data model such as the Arellano-Bond (1991) model estimated with a Generalized Method of Moments with Instrumental Variables (AB-GMM) where the lagged FLP functions as instrument as shown below with one lag.

\[ FLP_{it} = \rho FLP_{it-1} + \beta_1 \ln y_{it} + \beta_2 (\ln y_{it})^2 + \mu_i + \vartheta_{it} \]  

(4)

where \( \mu_i \) are the fixed effects and \( \vartheta_{it} \) is the error term. The model in equation (4) accounts for endogeneity but does not account for autocorrelation. Similar estimators include the Arellano and Bover (1995) and Blundell and Bond (1998) estimators which can account also for autocorrelation. All these estimators are particularly suited for panel data where the number of points in time is smaller than the
number of countries, which is the case of our data. However, the Blundell and Bond (1998) types of estimators assume that the instruments (lagged dependent variable) are uncorrelated with the individual effects (country/year). As in Gladdis and Klasen (2013), we find this assumption too restrictive and finally opt to use primarily model (4) for the panel equations. This is also the preferred choice in the recent literature.

The shape of the FLP-GDP per capita relation may be different across group of countries and across individual countries in the MENA region. This is expected and explained by the fact that different group of countries or individual countries may find themselves transiting on different parts of the U curve during the period considered. Hence, we could expect $\hat{\beta}_1 < 0$ and $\hat{\beta}_2 > 0$ for U-shape transitions, $\hat{\beta}_1 > 0$ and $\hat{\beta}_2 > 0$ for positive transitions and $\hat{\beta}_1 < 0$ and $\hat{\beta}_2 < 0$ for negative transitions. It is also possible, of course, to find inverted U-shape transitions with $\hat{\beta}_1 > 0$ and $\hat{\beta}_2 < 0$.

We will also consider time-series models for individual MENA countries. For this purpose we will use standard OLS models, test for stationarity and correct by instrumenting with lagged dependent variables (OLS-IV). We will also use a reduced version of the Granger model to test how a number of key variables underlying the U-shape hypothesis affect FPRs. The model is as follows:

$$F_{LP_t} = \rho F_{LP_{t-1}} + \ldots + \rho F_{LP_{t-n}} + \beta_1 X_{t-1} + \delta_{it}$$  (5)

where $X$ includes fertility rates, the share of agriculture in total value added, and value added in manufacturing and services. The number of lags of the dependent variable will depend on the stationarity test. The test used is the Breusch-Godfrey test for higher-order serial correlation.

**Data**

The data on FPR are collected from the International Labor Organization Economically Active Population, Estimates and Projections (ILO-EAPEP) database. This is the same data used by the quasi totality of cross-country studies reviewed in the previous section. We use the latest edition available at the time of writing (6th edition, 2011). The rest of the data including GDP per capita, fertility rates, female education and the share of agricultural value added are taken from the World Bank open data repository. Annex 1 provides a full description of the variables used, including the corresponding codes in the World Bank open repository. We have a total of 172 countries and for all countries we have 23 annual observations for the period 1990-2012 for both FLP and GDP per capita, with the exceptions of 20 countries where the minimum amount of observations is less than 23.\(^2\) We use therefore an unbalanced panel in the cross-country models. The full list of countries and years is provided in Annex 2.

**Results**

We divide the analysis along parametric and nonparametric estimates as this distinction will be important to understand some of the misconceptions about the U-shape hypothesis. The nonparametric analysis is

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\(^2\) The full list of countries and years is in annex. The country classification used is the international two digits ISO2 classification. Note that ILO-FLP data are missing for most countries before 1990, which explains the choice of the period 1990-2012.
used to review the cross-country and regional evidence in line with much of the worldwide work on the U-shape hypothesis and to put MENA countries in the context of this type of analysis. The parametric analysis will start from the same premises but will dig further into the within countries evidence to test the consistency of the hypothesis and seek how well the U-shape hypothesis applies longitudinally to individual countries.

Nonparametric estimates

Can economic development explain low FPRs in the MENA region? Take Morocco as an example of the MENA region. If we compare female labor participation in Morocco with that of the US when this country had a similar GDP per capita to Morocco today, then the female LFPR does not look as low. According to the Maddison’s historical data, GDP per capita in Morocco in 2008 was 3,465 USD. To find the closest value for the US we have to go back to 1889 when the value was 3,413 USD. The FLP in the US in 1890 was 22.1%, which is lower than the female LFPR observed in Morocco in 2008. The current FLP in Morocco would nicely fit with the U hypothesis and the long-term trend of low and more recently declining FLP could find an explanation in the context of economic development.

Of course, the US in 1890 and Morocco in 2008 operated in a very different global context. The US, for example, did not face in 1890 the same level of competition from other countries comparable with that faced by Morocco today from countries such as India and China and global trade was not as developed in 1890 as it is today. But the level of economic development in terms of a transition from an agrarian to an industrialized society remains a distinctive feature of an economy today as it was 120 years ago. The global context has changed but some essential elements of the process of economic development remain true. As described in section two of this paper, this is a distinctive assumption of the literature that relates economic development to FLP.

If we reconsider the U-shape hypothesis cross-country using more recent data and bring MENA countries and Morocco into the picture, we find some important stylized facts (Figure 1). First, the U hypothesis holds as it did for Goldin (1994) if we consider more countries and more recent data for 1990, 2000 and 2010. The quadratic fit shown in all panels is clearly U-shaped. Second and continuing with our Morocco example, Morocco finds itself in correspondence of the bottom of the U curve in all three time periods. In the long-run of history, Morocco has not moved yet to the upward part of the curve according to the figure but it could be about to turn the corner. Third, as compared to other world countries at the same level of GDP per capita, Morocco has a lower FPR. Hence, Morocco lags behind relatively to other countries at the same level of economic development. Fourth, Morocco appears to move (very) slowly from the downward part towards the upward part if we compare the three points in time considered, although the country remains significantly below the interpolation line throughout the period.

If we plot the same graph for the MENA region only (bottom panels, Figure 1) the U curve holds despite the small number of countries (it is useful here to use Morocco as a reference point to compare the top and bottom panels of the figure). To be precise, many of the MENA countries occupy a particular space of the curve, the section where countries transit from the bottom flat part of the curve to the upward part. As compared to other MENA countries, Morocco exhibits a higher FLP indicating that Morocco is relatively more advanced among MENA countries. Assuming that MENA countries represent a more

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3 See the Maddison Project: http://www.ggdc.net/maddison/maddison-project/home.htm.
homogeneous group than the world countries as a whole, Figure 1 (bottom panel) suggests that there are regional factors that should be able to explain the low FPR in the region. Hence, the behavior of regional grouping is something we should consider more closely below.

Figure 1 - Female Labor Participation and GDP per capita (World and Mena countries, age 15 and more)

Source: ILO-EAEP database (Female LFP) and World Bank, World Development Indicators (GDP per capita).

Figure 1 depicts MENA countries as a group of countries that are transiting through the saddle point and towards the upper part of the U curve. This picture is also consistent with the level of GDP per capita. As we saw in the literature review, historically the transition from the downward to the upward slope occurs at levels of GDP per capita around 2,000-3,000 USD. If we exclude resource rich countries for which GDP per capita is a poor indicator of progress, many of the MENA countries considered found themselves around that threshold at the beginning of the period considered (1990). For example, Egypt, Morocco, Jordan, Syria, Yemen and Djibouti had all a GDP per capita in PPP 2005 terms below 4,000 USD in 1990.  

4 World Bank open data. See data section for more details.
A consistent picture also emerges if we consider the building blocks of the U-shape hypothesis, i.e. trends in the economic transformation away from agriculture, female education and fertility rates. Figure 2 shows the change of these three parameters between 1990 and 2010 for all groups of countries considered. It is immediately evident how well the MENA region has performed. The region is the best performer in terms of fertility rates, the second best performer in terms of female secondary education and performs above average also for the reduction in the share of agricultural values added. The only area where the MENA region has been below the regions’ average is GDP per capita but the MENA region is still above all other regions with the exception of South Asia and Sub-Saharan Africa. The statistics refer to relative percentage changes and the MENA region still lags behind other regions in terms of these indicators. However, the relative performance of the MENA region has been very positive as compared to other regions in the world. According to this figure, the MENA region has done most things right to turn the corner of FPRs. This largely supports results found in World Bank (2013). This last study also shows that the ratio of female to male unemployment rates is higher in the MENA region than elsewhere suggesting that labor demand for women is one of the culprits of low FPR in the region.

Figure 2 – Relative percentage changes in Fertility, Female Education and Share of Agricultural Value Added between 1990 and 2010 (mean values across countries in region).

Source: World Bank Open Data. EAS: East Asia and the Pacific; ECS: Europe and Central Asia; LCN: Latin America and the Caribbean; MEA: Middle East and North Africa; NAC: North America; SAS: South Asia; SSF: Sub-Saharan Africa.

In spite of the positive developments observed for the main drivers of the U-shape hypothesis, we saw in Figure 1 that FPRs in the MENA region are significantly lower than the world taken as a whole. Figure 3 compares FPRs by age cohort between the world, the MENA region and Morocco for three points in time, 1990, 2000 and 2010. The figure reports the average FPR for women between the age of 20 and 59 divided into five years’ cohorts. For example, point 20 represents the average FPR for age cohort 20-24 and point 25 the average FPR for age cohort 25-29. We can see that, worldwide, women have improved

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5 Note that for the share of agricultural value added we considered the average values for the two periods 1990-1999 and 2000-2010 given that agricultural output is subject to significant annual variations.
participation rates for all cohorts and that the increase has been rather consistent across cohorts. The best performing cohorts are middle-aged cohorts as compared to young or older cohorts, which is what determines the hump shape. The overall improvement worldwide is around 7-8 percentage points in terms of participation rates.

The picture changes as we move to MENA countries. On average, FPR in MENA countries have increased for all cohorts between 1990 and 2010. Improvements have been more significant in MENA countries as compared to the world with increases in the FPR around ten percentage points. However, the hump shape is no longer visible and this is replaced by a negative slope indicating that older cohorts perform always worse than younger cohorts. Essentially, the decline starts around the age of 25, which largely coincides with the marriage age in the MENA countries. It is also visible that the improvement experienced by older cohorts is smaller as compared to improvements of younger cohorts.

The picture changes once again as we move to the figure for Morocco. In this case, we see a clear improvement in FPR between 1990 and 2000. This improvement applies to all cohorts although the change is smaller as the one observed for the world or MENA countries. We can also recognize the negative slope, similarly to the one observed for MENA countries as a whole, although the curve is clearly less steep. More importantly and contrary to world and MENA countries, we can see that FPRs declined for all cohorts between 2000 and 2010. It is important to note here that the change between 1990 and 2000 may be explained by changes in data collection as the Moroccan LFS was limited to urban areas until 1998 and extended to rural areas in 1999. However, if this change affected the statistics of the Morocco graph, this would apply only to the period 1990-2000 where we observed a growth in FPR while the negative performance between 1999 and 2010 is actually validated by the fact that the Moroccan LFS has been a very consistent survey since 1999. Hence, Morocco has performed worse than the average as compared to the world and also as compared to MENA countries in terms of FPR for all age cohorts. This is at odds with the good macroeconomic performance of the country relatively to both the world and the MENA region and confirms previous findings on Morocco (Verme et al. 2014).

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6 The MENA curve could also be explained by improvements in education. In countries where female education is increasing fast, younger cohorts will always be more educated than older cohorts and this may explain higher participation rates.
One of the main arguments behind the U-shape hypothesis is the structural transformation of the economy from agriculture to industry and services. Figure 2 showed that the MENA region performed above the world average in terms of reduction of the share of agricultural output over the period 1990-2010 and this is line with the U-shape hypothesis. However, for the upward trend of the curve to occur, it is important that sectors that typically attract women such as manufacturing and services increase in output as opposed to sectors that are less likely to attract women such as heavy industry or mining. Gaddis and Klasen (2013) recently noted that it is important to break down the sectors’ shifts in GDP to understand FPRs. If we break down the development of value added shares across sectors and for the world regions, we can see that the MENA region stands out as the only region where the share of agriculture, services and manufacturing all declined between the last decade of the 1990s and the first decade of the 2000s (Table 1, see also Diop et al., 2012). Therefore, the economic restructuring away from agriculture has not favored sectors that are more likely to hire females. The table below shows that this is really a peculiarity of the MENA region as compared to other world regions.
Table 1 – Changes in Shares of Value Added (mean 1990-1999 vs. mean 2000-2010)

| Region                          | Services | Agriculture | Industry Manufacturing | Industry Others |
|---------------------------------|----------|-------------|-------------------------|-----------------|
| East Asia & Pacific             | 4.9      | -4.3        | -1.8                    | 1.2             |
| Europe & Central Asia           | 7.8      | -5.1        | -3.8                    | 1.1             |
| Latin America & Caribbean       | 2.6      | -3.0        | -1.3                    | 1.7             |
| Middle East & North Africa      | -3.0     | -2.6        | -2.2                    | 7.8             |
| North America                   | 1.8      | -0.6        | -2.2                    | 1.0             |
| South Asia                      | 7.7      | -8.1        | -0.4                    | 0.8             |
| Sub-Saharan Africa              | 2.3      | -4.2        | -1.0                    | 2.9             |

Source: World Bank Open data.

If we had to conclude our analysis at this point, our test of the U-shape hypothesis would be rather robust. The U-shape relation between GDP per capita and FPRs is evident with the cross-country data, consistent with previous evidence and visible for the MENA region. The fundamental pillars of the hypothesis including the share of agriculture in value added, female education and fertility rates are all consistent with the hypothesis to an extent that the MENA region outperforms other regions of the world. And the MENA countries seemed to have turned the corner (saddle point) in terms of FPRs in four different respects: 1) Visually (Figure 1); 2) Economically, by having passed the GDP per capita threshold and restructured away from agriculture 3) Statistically, by having experienced increases in FPRs and GDP per capita between 1990 and 2010; and 4) Socially by having increased female secondary education and reduced fertility rates.

But we also noted two aspects that make the MENA region stand out as compared to other regions and that are at odds with the U-shape hypothesis. The first is that women in the MENA region seem to exit the labor force around the age of 25, which largely coincides with the average marriage age in the region. The second aspect is that the MENA region is the only region that was not able to expand the share of both services and manufacturing as opposed to other sectors that are less likely to employ women. These are two important leads that will be further explored to understand why the MENA region lags behind in terms of FPRs despite the good performance of the fundamentals of the U-shape hypothesis.

**Parametric estimates**

We divide the parametric analysis in the panel analysis comparing the MENA’s performance with the rest of the world and the time-series analysis looking more in detail at within countries’ performance.

**Cross-country regional panels**

Results for the FPRs panel regressions are shown in Table 2 for the whole population 15 years and above and for three age cohorts, 30-34, 40-44 and 50-54. The cohort analysis is useful in that can show whether the U-hypothesis applies to different age groups or it is restricted to particular age groups and is one of the main lines of investigation of the U-shape hypothesis literature.
The first batch of equations (top panel) shows that the U hypothesis stands if we consider all countries and the full population in working age confirming the nonparametric illustration of the GDP-FPR curve shown in Figure 1. However, the breakdown by region and age cohort complicates the picture. The quadratic fit stands for only three of the eight regions and for only the older age group (50-54) but not for the 30-34 cohorts. In fact, Sub-Saharan Africa is the only region that shows a consistent U shape across all age cohorts. The age group 30-34 seems the least likely group to support the hypothesis as it shows no significance for regions that otherwise would support the hypothesis such as East Asia (EAS) or Europe and Central Asia (EAS). The non-significance of the coefficients in these cases may reveal either the non-existence of the U-shape hypothesis for world regions or the transition of these regions through the “saddle” point of the curve or even the simple stagnation on the saddle point. As already mentioned, the period considered (1990-2010) may capture only a portion of the historical evolution of the U curve in any given country or region.

For some regions, there is evidence of an inverted U-shape (IU in Table 2). This is the case of the MENA, SAS, LCN and North America regions for the population 15 and older. The MENA and SAS regions stand out because they show an inverted U shape for the population 15 and older and no significance for any of the age group when taken independently. This shows that, once we combine the longitudinal information and take endogeneity into account (as we do with the panel AB-GMM model) the simple quadratic U shape observed in the data in Figure 1 (bottom panel, MENA countries) disappears and can be reversed. Table 2 shows that the MENA and SAS regions are the regions after North-America the further away from the U-shape hypothesis as there is no evidence supporting the hypothesis either for the population of working age taken a as whole or for any of the age cohorts taken separately.

### Table 2 – FLP Panel Regressions by Region and Age Groups (AB-GMM)

| Region | Age group | L.FPR | lngdp | lngdp2 | _cons | Obs. | Shape |
|--------|-----------|-------|-------|-------|-------|------|-------|
| ALL    | 15plus    | 0.875*** | -2.357** | 0.174*** | 13.726*** | 3,472 | U     |
| EAS    | 15plus    | 0.840*** | -4.988*** | 0.314*** | 28.218*** | 492  | U     |
| ECS    | 15plus    | 0.864*** | -5.337*** | 0.325*** | 28.091*** | 975  | U     |
| LCN    | 15plus    | 0.837*** | 16.573**  | -0.752*  | -78.997**  | 553  | IU    |
| MEA    | 15plus    | 0.896*** | 10.547*** | -0.535*** | -48.203*** | 354  | IU    |
| NAC    | 15plus    | 0.801*** | 214.55*** | -10.175*** | -1,118.834*** | 42   | IU    |
| SAS    | 15plus    | 0.968*** | 10.986*   | -0.714*   | -40.309*   | 145  | IU    |
| SSF    | 15plus    | 0.904*** | -1.752*** | 0.115*** | 12.720*** | 911  | U     |
| ALL    | 30-34     | 0.933*** | -0.922    | 0.075    | 7.006     | 4,021 | U     |
| EAS    | 30-34     | 0.927*** | -1.846    | 0.124    | 11.697*   | 591  | U     |
| ECS    | 30-34     | 0.914*** | -4.401    | 0.261    | 24.593*   | 1,129 | U     |
| LCN    | 30-34     | 0.938*** | -0.045    | 0.074    | -0.950    | 662  | U     |
| MEA    | 30-34     | 0.953*** | -1.688    | 0.064    | 12.200    | 410  | U     |
| NAC    | 30-34     | 0.651*** | 390.057*** | -18.517*** | -2,026.739*** | 62   | IU    |
| SAS    | 30-34     | 0.997*** | 8.058     | -0.540   | -29.433   | 167  | U     |
| SSF    | 30-34     | 0.951*** | -1.854*** | 0.125*** | 10.615*** | 1,000 | U     |
| ALL    | 40-44     | 0.938*** | -2.227*   | 0.147*   | 12.555**  | 4,012 | U     |
| EAS    | 40-44     | 0.907*** | -4.409*** | 0.283*** | 23.199*** | 591  | U     |
In addition to the share of agriculture in output, the literature on FLP has highlighted two other factors that help explain the U shape hypothesis in the long-run. The first is the increased level of female education, especially at the secondary level. Secondary education allows women to take up non-agricultural jobs in the modern sectors and increases the bargaining capacity within the household. The second is the steady decline in fertility that frees some of the time used for household chores. It is therefore instructive to include into the U-shape hypothesis equations fertility and female secondary education and try to see whether the disappointing performance of MENA countries in terms of FLP gains can be explained at least in part by non-increasing female secondary education or fertility rates that are not declining.

However, there are two problems with including both secondary education and fertility rates in the same FLP equation. The first is that female secondary education and fertility rates are strongly inversely correlated, creating a collinearity problem in the FLP equations. This collinearity, in turn, can artificially alter the sign and significance of the GDP coefficients. The second is that, somehow surprisingly, female secondary education rates are much less available worldwide than fertility rates, FLP rates or GDP per capita. The inclusion of female secondary education would make our countries’ longitudinal equations too short to run. Forcibly, in what follows, we only use fertility rates on the assumption (widely supported by the literature) that female secondary education and fertility rates are highly inversely correlated.

Following from the above and given the results on the main pillars of the U-shape hypothesis presented in the nonparametric section, in Table 3 we re-run FPR equations using fertility rates, the share of agriculture in value added and the log of value added in services and manufacturing (constant prices, local currency) as independent variables. Here we want to test the contribution of each factor to FLP. Note that we are taking separately the share of agricultural value added as it is standard for testing the U-shape hypothesis and the value added of manufacturing and services as indicated by Gaddis and Klasen (2013) in their critique.
Results are shown in Table 3. The fertility rate has always a negative sign when significant as we should expect but it is not significant in two of the regions (EAS and ECS). The share of agriculture in value added is significant in four regions and always with the negative sign as expected. The log of manufacturing value added is significant in seven of the eight regions always with the positive sign except in the Sub-Saharan Africa region. The log of services value added is significant in five regions and always with the positive sign. We should conclude that, at the regional level, the main pillars of the U-shape hypothesis do behave as expected (when significant) and that this is true for the MENA region. If fertility rates and the share of agricultural value added decrease, FLP rates should go up. And if manufacturing and services perform well in terms of output, this should improve FLP. Hence, the drivers of FLP work as expected worldwide and also in the MENA region.

Table 3 – FLP Panel Regressions by Region, Age 15 and above (AB-GMM)

| Region   | (1) Fertility Rate | (2) Agricultural share in Value Added | (3) Manufacturing Value Added (ln, constant, local curr.) | (4) Services Value Added (ln, constant, local curr.) | Number of observations |
|----------|--------------------|--------------------------------------|----------------------------------------------------------|-----------------------------------------------------|------------------------|
| ALL      | -0.412***          | -0.024***                            | 0.416***                                                 | 0.478***                                            | 3,461                  |
| EAS      | -0.032             | 0.007                                | 0.343***                                                 | 0.010                                               | 490                    |
| ECS      | -0.109             | -0.017***                            | 0.385**                                                  | 0.331***                                            | 966                    |
| LCN      | -1.594***          | -0.100***                            | 0.804*                                                   | 3.253***                                            | 553                    |
| MEA      | -0.276***          | -0.015                               | 0.373*                                                   | 0.552***                                            | 354                    |
| NAC      | -2.044***          | -0.047                               | 2.116***                                                 | 0.345                                               | 42                     |
| SAS      | -0.334**           | -0.025                               | 0.370                                                    | 0.154                                               | 145                    |
| SSF      | -0.131***          | -0.011***                            | -0.137**                                                 | 0.148**                                             | 911                    |

Source: ILO-EAPEP database (Female LFP) and World Bank, World Development Indicators for other indicators. Significance level: ***=.01; **=.05; *=.1 - *. Standard errors, lagged variables and constants omitted. EAS: East Asia and the Pacific; ECS: Europe and Central Asia; LCN: Latin America and the Caribbean; MEA: Middle East and North Africa; NAC: North America; SAS: South Asia; SSF: Sub-Saharan Africa.

In the next section, we will turn to analyze MENA countries individually. However, what we should retain from this last regression is that the MENA region, as a whole, is not an exception in how it behaves vis-à-vis the main drivers of the U-shape hypothesis.

Within countries time-series
The MENA region is very diverse - suffice to say the division between resource rich and resource non-rich economies – and the regional performance may hide a more complex picture of countries with different and perhaps opposite performances. As already discussed, within countries longitudinal studies are few worldwide but there is some evidence supporting the U-shape hypothesis for the US, France and the UK. It is, however, more difficult to find similar evidence for emerging or developing countries for two good reasons. One is that, by definition, emerging or developing economies are more likely to show only part of the U curve (they find themselves in the early stages of the structural transformation). The curve in Figure 1 for MENA countries, for example, seemed to show that these countries were transiting through the saddle point of the curve. And the second is that LFSs in these countries are scarcer and started more recently than in the developed world. Nonetheless, we now have longitudinal data for twenty and more years for many countries and we can use these data to further assess the anomaly represented by the MENA region.
In this section, we use an OLS estimator and test for stationarity with a Breusch-Godfrey test. As we found stationarity for most countries we then corrected by instrumenting lags and finally settled for two lags as the minimum requirement to correct for stationarity in all countries. Given the short time-series available, the options of including other variables in the equations or use cohorts fixed effects were not considered.

When the population of working age is taken together (top panel), we only have seven out of 18 countries that show significant coefficients, four U-shape and three inverted U-shape. In age 30-34, only four countries have significant coefficients and only one of these shows a U-shape. In age 40-44, six countries have significant coefficients and half of these are U shapes and in age 50-54 there are three countries with significant coefficients, two of which are U-shapes. There is also no consistency within countries across cohorts indicating that none of the countries has really gone through a U-shape process for any cohorts. A period of 20 years may be too short to observe a full U-shape but these results suggest that there is no law regulating FPRs and GDPs in MENA countries. Only some age groups in some countries have experienced a U-shape process suggesting that this process is country and age specific but cannot be generalized to the population in a country or to the MENA region as a whole. There is not even dominance of U-shapes over inverted U-shapes across countries and cohorts in the MENA region. In fact, we saw in Table 2 that the apparent U-shape shown in Figure 1 for the MENA region is converted into an inverted U-shape by the parametric approach, which suggests a dominance of inverted U-shapes over U-shapes in the region.

Table 4 – FLP Time-series Regressions by Country and Age Groups (OLS-IV)

| Country          | Age Group | FPR_1   | FPR_2   | lngdp  | lngdp2  | _cons     | Obs. | U/IU |
|------------------|-----------|---------|---------|--------|---------|-----------|------|------|
| UA Emirates      | All       | 1.516***| -0.537**| 131.034*| -6.038* | -709.342* | 21   | IU   |
| Bahrain          | All       | 1.538***| -0.564**| 640.339 | -31.968 | -3,205.474| 21   | IU   |
| Djibouti         | All       | 1.075***| -0.071  | 3.577*  | -0.236* | -13.266*  | 16   | IU   |
| Algeria          | All       | 1.201***| -0.301  | -99.225*| 5.748*  | 429.504*  | 21   | U    |
| Egypt            | All       | 0.109   | -0.117  | -795.669**| 47.603**| 3,344.721**| 21   | U    |
| Israel           | All       | 1.082***| -0.158  | 12.166  | -0.577  | -59.957   | 21   | U    |
| Iraq             | All       | 0.753*  | 0.186   | -7.951**| 0.479** | 33.980**  | 11   | U    |
| Iran             | All       | 1.092***| -0.548**| 505.933**| -27.618**| -2,309.045**| 21   | IU   |
| Jordan           | All       | 0.372   | 0.145   | -250.095| 15.249  | 1,031.186 | 21   | IU   |
| Kuwait           | All       | 1.210***| -0.324  | 518.973*| -24.436*| -2,750.168*| 16   | IU   |
| Lebanon          | All       | 1.110***| -0.038  | -43.845**| 2.266*  | 210.439** | 21   | U    |
| Morocco          | All       | 0.984***| -0.665**| 115.707 | -7.235  | -443.665  | 21   | U    |
| Oman             | All       | 0.969***| -0.014  | 63.762  | -3.162  | -319.738  | 20   | U    |
| Qatar            | All       | 1.094** | -0.204  | 6,200.865| -278.371| -34,525.647| 11   | U/IU |
| Saudi Arabia     | All       | 1.355***| -0.477**| -121.098| 6.084   | 604.606   | 21   | U    |
| Syria            | All       | 1.163***| -0.374  | 159.427 | -10.186 | -617.885  | 19   | U/IU |
| Tunisia          | All       | 1.367***| -0.431* | -18.879 | 1.091   | 83.306    | 21   | U    |
| Yemen            | All       | 1.573***| -0.614**| 67.618  | -4.386  | -259.559  | 21   | U    |
| UA Emirates      | 30-34     | 1.668***| -0.667***| 20.362* | -0.911* | -113.499**| 31   | IU   |
| Bahrain          | 30-34     | 1.456***| -0.473**| 174.690 | -8.907  | -855.049  | 30   | U    |
| Djibouti         | 30-34     | 1.000***| 0.000   | 0.001   | -0.000  | 0.733***  | 16   | U    |
| Algeria          | 30-34     | 1.664***| -0.652**| 145.277 | -8.329  | -633.361  | 26   | U    |
| Egypt            | 30-34     | 0.882***| -0.078  | -213.160| 12.758  | 895.719   | 31   | U    |
| Israel           | 30-34     | 0.556** | 0.232   | 178.128 | -8.513  | -915.083  | 26   | U    |
| Country         | 1950-54 | 1960-64 | 1970-74 | 1980-84 | 1990-94 | 2000-04 | 2005-09 |
|-----------------|---------|---------|---------|---------|---------|---------|---------|
| Saudi Arabia    | 1.394***| -0.383  | 1.965   | -0.118  | -8.181  | 11      |
| Iran            | 1.362***| -0.468* | 94.517  | 5.160   | -430.304| 25      |
| Jordan          | 0.272   | 0.212   | -661.436| 40.065**| 2,740.394**| 21 U   |
| Kuwait          | 0.768***| -0.003  | 189.004 | -8.891  | -988.682| 23      |
| Lebanon         | 1.237***| -0.068  | 38.047  | 2.556   | -137.521| 21      |
| Morocco         | 0.926***| -0.599**| 459.370*| -28.156**| 1,850.294**| 21 IU  |
| Oman            | 1.365***| -0.404* | 1.659   | 0.108   | 7.562   | 20      |
| Qatar           | 1.297** | -0.406  | 7.368.108| -330.316| -410.812.273| 11      |
| Saudi Arabia    | 1.287***| -0.684**| -123.211| 6.198   | 625.188 | 21      |
| Syria           | 0.871***| 0.027   | 377.534 | -23.347*| -1,523.004| 26      |
| Tunisia         | 1.326***| -0.396  | 90.453**| -5.106**| -397.662**| 22 IU  |
| Yemen           | 1.540***| -0.565**| 31.933  | -2.074  | -121.992| 21      |
| UA Emirates     | 1.563***| -0.594***| 13.443  | -0.624  | -71.095 | 31      |
| Bahrain         | 1.395***| -0.396* | 134.795 | -7.009  | -646.751| 30      |
| Djibouti        | 1.000***| 0.000   | -0.001  | 0.000   | 0.834***| 16      |
| Algeria         | 1.585***| -0.537**| 89.083  | -5.136  | -386.568| 26      |
| Egypt           | 0.929***| -0.168  | -165.704| 10.107  | 685.151 | 31      |
| Israel          | 0.530***| 0.001   | 27.493  | -0.861  | -155.733| 26      |
| Iraq            | 0.434   | 0.119   | -83.019**| 5.006**| 353.075**| 11 U    |
| Iran            | 1.419***| -0.520**| 81.758  | -4.479  | -371.053| 25      |
| Jordan          | 0.397*  | 0.177   | -330.824**| 20.005**| 1,373.288**| 21 U   |
| Kuwait          | 0.688***| 0.041   | 348.207**| -16.317**| -1,843.708**| 23 IU  |
| Lebanon         | 1.248***| -0.375* | -34.635 | 1.974   | 154.415 | 21      |
| Morocco         | 0.997***| -0.524**| 327.045*| -19.930**| -1,324.194**| 21 IU  |
| Oman            | 2.150***| -1.166**| 64.760**| -3.271**| -320.261**| 20 IU   |
| Qatar           | 1.276** | -0.385  | 7,235.630| -324.393| -40,341.637| 11      |
| Saudi Arabia    | 0.681** | 0.126   | 225.748  | -11.165 | -1,136.664| 21      |
| Syria           | 0.856***| 0.021   | 225.210  | -13.885 | -910.333| 26      |
| Tunisia         | 1.472***| -0.482**| -17.541*| 1.010*  | 76.605* | 22 U    |
| Yemen           | 1.434***| -0.576**| 507.031  | -32.687 | -1,961.390| 21      |
| UA Emirates     | 1.598***| -0.630***| -0.512  | 0.010   | 5.151   | 31      |
| Bahrain         | 1.598***| -0.606**| -12.241 | 0.651   | 57.645  | 30      |
| Djibouti        | 1.000***| 0.000   | 0.000   | -0.000  | 0.819***| 16      |
| Algeria         | 1.571***| -0.615***| -66.665*| 3.830*  | 290.512*| 26 U    |
| Egypt           | 0.891***| -0.136  | -267.990*| 16.232*| 1,110.097*| 31 U    |
| Israel          | 0.591** | 0.162   | 313.698  | -15.142 | -1,605.953| 26      |
| Iraq            | 1.052** | -0.201  | -17.460*| 1.047   | 75.160  | 11      |
| Iran            | 1.389***| -0.536**| 86.770   | -4.737  | -395.421| 25      |
| Jordan          | 0.479*  | -0.145  | -36.407  | 2.196   | 155.542 | 21      |
| Kuwait          | 0.800***| 0.020   | -5.037   | 0.237   | 30.741  | 23      |
| Lebanon         | 1.374***| -0.447**| -23.708  | 1.308   | 108.654 | 21      |
| Morocco         | 0.484*  | -0.212  | 495.247* | -30.274*| -2,003.710*| 21 IU  |
| Oman            | 1.207***| -0.175  | -13.481  | 0.664   | 68.288  | 20      |
| Qatar           | 0.873** | -0.110  | 12,838.886| -575.424| -71,604.843| 11      |
| Saudi Arabia    | 0.804***| -0.024  | -127.275 | 6.369   | 637.421 | 21      |
| Syria           | 1.695***| -0.767***| 12.749  | -0.779  | -51.207 | 26      |
| Tunisia         | 1.679***| -0.794***| -1.344  | 0.121   | 4.200  | 31      |
| Yemen           | 1.500***| -0.524**| 36.434   | -2.365  | -139.518| 21      |

Source: ILO-EAEP database (Female LFP) and World Bank, World Development Indicators (GDP per capita in PPP values). Significance level: ***=.01; **=.05; *=.1; *. Standard errors omitted.
As a last exercise, we test the role of the share of agricultural value added, fertility rates and changes in manufacturing and services outputs in explaining FPR as we did for the regional equations. The hypothesis is of a linear relation between FPR and these variables and we will test one variable at the time (separate univariate equations). We run two models, an OLS model with two lags following the stationarity tests already described and a reduced Granger model with two lags (OLS with lagged independent variable). Countries with less than 10 annual observations were not considered. Table 5 shows the results.

The fertility rate is significant in four of the eight countries with the expected negative sign and these results are consistent across the two models. A reduction in fertility correlates with an increase in FPRs in the MENA region as observed elsewhere in the world. The agricultural share in value added is significant in three countries but the sign is not consistent in one country (Morocco) and results are not consistent in the two models. Value added in manufacturing explains FPRs in three countries and with the expected positive sign and these results are consistent across the two models while the role of services is mostly positive and significant except for Morocco where we find a consistent negative sign in the two models. In essence, fertility rates, manufacturing and services behave as expected while the role of the share of agricultural output in value added is less clear. It is also evident that Morocco performs somehow differently from the regional pattern. These results confirm the insights on the main pillars of the U-shape hypothesis in relation to MENA countries. The factors that would explain FPRs largely behave as expected and the statistics related to these factors all evolved in the right direction but FPRs in the region remain below what it should be expected from countries with these same performances.

Table 5 – FLP Time-series Regressions by Country with Share of Agricultural Value Added (AB-GMM)
Saudi Arabia

-0.645***       -0.153          1.501**        0.848

Tunisia

0.174           0.008          0.676          0.469**

Yemen

-0.429**        -0.007         -0.167         0.180

Source: ILO-EAEP database (Female LFP) and World Bank, World Development Indicators for other indicators. Significance level: ***=.01; **=.05; *=.1; *; Standard errors, lags and constants omitted. In bold, coefficient changing significance or sign in the Granger model.

Conclusions

The paper addressed the question of whether the U-shape hypothesis holds for MENA countries and for the period 1990-2010. Nonparametric estimates confirmed previous results that the U-shape hypothesis holds worldwide and cross-country and that the MENA region could fit the trend. The fundamental pillars of the hypothesis including the share of agriculture in value added, female education and fertility rates are all consistent with the hypothesis to an extent that the MENA region outperforms other regions of the world. And the MENA countries seemed to have turned the corner (saddle point) in terms of FPRs in four different respects: 1) **Visually** (Figure 1); 2) **Economically**, by having passed the GDP per capita threshold and restructured away from agriculture 3) **Statistically**, by having experienced increases in FPRs and GDP per capita between 1990 and 2010; and 4) **Socially** by having increased female secondary education and reduced fertility rates.

There are, however, two aspects that make the MENA region stand out as compared to other regions. The first is that women in the MENA region seem to exit the labor force around the age of 25, which largely coincides with the average marriage age in the region. This makes the FPR curve by cohorts downward sloped rather than hump shaped. The second aspect is that the MENA region is the only region that was not able to expand the share of both services and manufacturing as opposed to other sectors that are less likely to employ women. These are both important leads to understand why the MENA region lags behind in terms of FPRs despite the fundamentals of the U-shape hypothesis.

The parametric estimations confirm the cross-country U-shape hypothesis illustrated nonparametrically in Figure 1 but provide a more complex picture if we disaggregate results by region and age cohort. Some regions and cohort show non-significance or even an inverted U-shape. In particular, once we combine the longitudinal information and take endogeneity into account the simple quadratic U shape observed in in Figure 1 for the MENA countries disappears and is actually reversed. There is wide heterogeneity across MENA countries and it was not possible to establish a law that regulates the relation between FPRs and GDP over the period considered.

The paper also found that the fundamentals of the U-shape hypothesis are not constraining the expansion of FPRs in the MENA region. The region has outperformed other world regions in terms of reduction of the agricultural share of output, female secondary education and fertility rates. All countries have also significantly expanded in terms of GDP per capita between 1990 and 2010 and they are now well beyond the 2,000-3,000 USD per capita threshold that is considered by the literature the turning point between declining and increasing FPRs. When considering the share of agricultural output, fertility rates, manufacturing or services value added into the FLPs equations, results are largely as expected.

We have therefore to conclude that explanations for the lack of support for the U-shape hypothesis in MENA countries should be sought among two sets of factors. The first is economic and related to the lack
of expansion in sectors that we proved critical for expanding female employment like manufacturing and services. The second is cultural and related to the finding that women seem to exit the labor force around marriage age. This paper has not explored the other main pillar of the U-shape hypothesis, which is culture and gender norms. But, by exclusion and in view of the cohort analysis, this is one important lead for future research.

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Annex 1 – Key Variables

ILO-EAPEP Data

- Female Participation Rates. Employed and unemployed females as a percentage of the female working age population (15 years of age and more).

The series used is dated December 2011 and labeled “More complete datasets (1980*-2020) with detailed metadata and projections from various models”. The Stata version can be downloaded from: [http://laborsta.ilo.org/applv8/data/EAPEP/eapep_E.html](http://laborsta.ilo.org/applv8/data/EAPEP/eapep_E.html). From the 1980-2020 series, we only kept the data for the period 1990-2012.

World Bank Open Data Repository (code and description)

- NY.GDP.PCAP.PP.KD - GDP per capita, PPP (constant 2005 international $)
- NV.AGR.TOTL.ZS - Agriculture, value added (% of GDP)
- BAR.SEC.CMPT.15UP.FE.ZS - percentage of population, 15+, female, completed secondary
- SP.DYN.TFRT.IN - Fertility rate, total (births per woman)
- BAR.SEC.CMPT.15UP.FE.ZS - percentage of population, 15+, female, completed secondary
- NV.IND.MANF.KN - Manufacturing, value added (constant LCU)
- NV.SRV.TETC.KN - Services, etc., value added (constant LCU)
- SP.POP.TOTL - Population, total
- SP.POP.1564.TO - Population ages 15-64, total
### Annex 2 – Countries and Years

| East Asia and the Pacific (EAS) | N | Europe and Central Asia (ECS) | N | Latin America and Caribbean (LCN) | N | Middle East and North Africa (MEA) | N | North America (NAC) | N | South Asia (SAS) | N | Sub-Saharan Africa (SSF) | N |
|-------------------------------|---|-------------------------------|---|---------------------------------|---|---------------------------------|---|-------------------|---|-----------------|---|------------------------|---|
| Australia                     | 23 | Albania                         | 23 | Argentina                        | 17 | Algeria                          | 23 | Canada             | 23 | Afghanistan        | 11 | Angola                | 23 |
| Brunei Darussalam             | 23 | Armenia                         | 23 | Bahamas, The                     | 23 | Bahrain                          | 23 | United States      | 23 | Bangladesh         | 23 | Benin                | 23 |
| Cambodia                      | 20 | Austria                         | 23 | Barbados                         | 23 | Djibouti                         | 18 | Bhutan             | 23 | Botswana           | 23 | Burkina Faso         | 23 |
| China                         | 23 | Azerbaijan                       | 23 | Belize                           | 23 | Egypt, Arab Rep.                 | 23 | India              | 23 | Burundi           | 12 | Burundi              | 23 |
| Fiji                          | 23 | Belarus                          | 23 | Bolivia                          | 23 | Iran, Islamic Rep.               | 23 | Maldives           | 12 | Burundi           | 12 | Burundi              | 23 |
| Hong Kong SAR, China          | 23 | Belgium                          | 23 | Brazil                           | 23 | Iraq                             | 13 | Nepal              | 23 | Cabo Verde        | 23 | Cabo Verde           | 23 |
| Indonesia                     | 23 | Bosnia and Herzegovina          | 19 | Chile                            | 23 | Israel                           | 23 | Pakistan           | 23 | Cameroon          | 23 | Cameroon             | 23 |
| Japan                         | 23 | Bulgaria                        | 23 | Colombia                         | 23 | Jordan                           | 23 | Sri Lanka          | 23 | Central African Rep.| 23 | Central African Rep. | 23 |
| Korea, Rep.                   | 23 | Croatia                         | 23 | Costa Rica                       | 23 | Kuwait                           | 18 | Chad               | 23 | Chad             | 23 | Chad                 | 23 |
| Lao PDR                       | 23 | Cyprus                          | 23 | Dominican Republic               | 23 | Lebanon                          | 23 | Comoros            | 23 | Comoros          | 23 | Comoros              | 23 |
| Macao SAR, China              | 23 | Czech Republic                  | 23 | Ecuador                          | 23 | Libya                            | 11 | Congo, Dem. Rep.  | 23 | Congo, Dem. Rep.  | 23 | Congo, Dem. Rep.    | 23 |
| Malaysia                      | 23 | Denmark                         | 23 | El Salvador                      | 23 | Morocco                          | 23 | Congo, Rep.        | 23 | Congo, Rep.       | 23 | Congo, Rep.         | 23 |
| Mongolia                      | 23 | Estonia                         | 20 | Guatemala                        | 23 | Oman                             | 22 | Cote d'Ivoire      | 23 | Cote d'Ivoire     | 23 | Cote d'Ivoire       | 23 |
| New Zealand                   | 23 | Finland                         | 23 | Guyana                           | 23 | Qatar                            | 13 | Equatorial Guinea | 23 | Equatorial Guinea | 23 | Equatorial Guinea   | 23 |
| Papua New Guinea              | 23 | France                          | 23 | Haiti                            | 23 | Saudi Arabia                      | 15 | Eritrea            | 21 | Eritrea           | 21 | Eritrea             | 21 |
| Philippines                   | 23 | Georgia                         | 23 | Honduras                         | 23 | Syrian Arab Republic             | 21 | Ethiopia           | 23 | Ethiopia          | 23 | Ethiopia            | 23 |
| Samoa                         | 23 | Germany                         | 23 | Mexico                           | 23 | Tunisia                          | 23 | Gabon              | 23 | Gabon            | 23 | Gabon                | 23 |
| Singapore                     | 23 | Greece                          | 23 | Nicaragua                        | 23 | United Arab Emirates             | 23 | Gambia, The        | 23 | Gambia, The       | 23 | Gambia, The         | 23 |
| Solomon Islands               | 23 | Hungary                         | 23 | Panama                           | 23 | Yemen, Rep.                      | 23 | Ghana             | 23 | Ghana            | 23 | Ghana               | 23 |
| Thailand                      | 23 | Iceland                         | 23 | Paraguay                         | 23 | Guinea                           | 23 | Guernsey           | 23 | Guernsey          | 23 | Guernsey            | 23 |
| Timor-Leste                   | 14 | Ireland                         | 23 | Peru                             | 23 | China                            | 23 | Guinea-Bissau      | 23 | Guinea-Bissau     | 23 | Guinea-Bissau       | 23 |
| Tonga                         | 23 | Italy                           | 23 | St. Lucia                        | 23 | Kenya                            | 23 | Kenya              | 23 | Kenya            | 23 | Kenya               | 23 |
| Vanuatu                       | 23 | Kazakhstan                      | 23 | Vincent and the Grenadines       | 23 | Lesotho                          | 23 | Lesotho            | 23 | Lesotho          | 23 | Lesotho              | 23 |
| Vietnam                       | 23 | Kyrgyz Republic                 | 23 | Suriname                         | 23 | Liberia                          | 23 | Liberia            | 23 | Liberia          | 23 | Liberia             | 23 |
| Latvia                        | 23 | Latvia                          | 23 | Trinidad and Tobago              | 23 | Madagascar                       | 23 | Madagascar        | 23 | Madagascar      | 23 | Madagascar          | 23 |
| Lithuania                     | 23 | Lithuania                       | 23 | Uruguay                          | 23 | Malawi                           | 23 | Malawi             | 23 | Malawi          | 23 | Malawi              | 23 |
| Luxembourg                    | 23 | Luxembourg                      | 23 | Venezuela, RB                    | 23 | Mali                             | 23 | Mali               | 23 | Mali            | 23 | Mali                 | 23 |
| Macedonia, FYR                | 23 | Macedonia, FYR                  | 23 | Mauritania                       | 23 | Mauritania                      | 23 | Mauritania        | 23 | Mauritania      | 23 | Mauritania          | 23 |
| Moldova                       | 23 | Moldova                         | 23 | Mauritius                        | 23 | Mauritius                       | 23 | Mauritius         | 23 | Mauritius       | 23 | Mauritius           | 23 |
| Netherlands                   | 23 | Netherlands                     | 23 | Mozambique                       | 23 | Mozambique                      | 23 | Mozambique        | 23 | Mozambique      | 23 | Mozambique          | 23 |
| Norway                        | 23 | Norway                          | 23 | Namibia                          | 23 | Namibia                          | 23 | Namibia           | 23 | Namibia         | 23 | Namibia             | 23 |
| Poland                        | 23 | Poland                          | 23 | Niger                            | 23 | Niger                            | 23 | Niger             | 23 | Niger           | 23 | Niger               | 23 |
| Portugal                      | 23 | Portugal                        | 23 | Nigeria                          | 23 | Nigeria                         | 23 | Nigeria           | 23 | Nigeria        | 23 | Nigeria             | 23 |
| Romania                       | 23 | Romania                         | 23 | Rwanda                           | 23 | Rwanda                           | 23 | Rwanda            | 23 | Rwanda          | 23 | Rwanda              | 23 |
| Russian Federation            | 23 | Russian Federation              | 23 | Sao Tome and Principality        | 12 | Sao Tome and Principality        | 12 | Sao Tome and Principality | 12 | Sao Tome and Principality | 12 |
| Serbia                        | 23 | Serbia                          | 23 | Senegal                          | 23 | Senegal                          | 23 | Senegal           | 23 | Senegal         | 23 | Senegal             | 23 |
| Slovak Republic               | 23 | Slovak Republic                 | 23 | Sierra Leone                     | 23 | Sierra Leone                    | 23 | Sierra Leone      | 23 | Sierra Leone    | 23 | Sierra Leone        | 23 |
| Slovenia                      | 23 | Slovenia                        | 23 | South Africa                     | 23 | South Africa                    | 23 | South Africa      | 23 | South Africa   | 23 | South Africa        | 23 |
| Spain                         | 23 | Spain                           | 23 | Sudan                            | 23 | Sudan                            | 23 | Sudan             | 23 | Sudan          | 23 | Sudan               | 23 |
| Sweden                        | 23 | Sweden                          | 23 | Swaziland                        | 23 | Swaziland                       | 23 | Swaziland         | 23 | Swaziland     | 23 | Swaziland          | 23 |
| Switzerland                   | 23 | Switzerland                    | 23 | Tanzania                         | 23 | Tanzania                        | 23 | Tanzania          | 23 | Tanzania       | 23 | Tanzania            | 23 |
| Tajikistan                    | 23 | Tajikistan                      | 23 | Togo                             | 23 | Togo                             | 23 | Togo              | 23 | Togo           | 23 | Togo                 | 23 |
| Turkey                        | 23 | Turkey                          | 23 | Uganda                           | 23 | Uganda                          | 23 | Uganda            | 23 | Uganda         | 23 | Uganda              | 23 |
| Turkmenistan                  | 23 | Turkmenistan                    | 23 | Zambia                           | 23 | Zambia                           | 23 | Zambia            | 23 | Zambia        | 23 | Zambia              | 23 |
| Ukraine                       | 23 | Ukraine                         | 23 | United Kingdom                   | 23 | United Kingdom                   | 23 | United Kingdom    | 23 | United Kingdom | 23 | United Kingdom      | 23 |
| United Kingdom                | 23 | United Kingdom                  | 23 | Uzbekistan                       | 23 | Uzbekistan                       | 23 | Uzbekistan        | 23 | Uzbekistan     | 23 | Uzbekistan          | 23 |

Total 540  Total 1,069  Total 607  Total 392  Total 46  Total 161  Total 999