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Abstract

The Middle East and North Africa (MENA) region has realized significant advances toward improving women's well-being and social status over the last few decades. However, women's employment rate in the MENA region remains one of the lowest in the world. This paper examines the implications of firm-related and national factors for female employment rates in manufacturing firms located in the MENA region. The empirical analysis is implemented for firm-level data derived from the World Bank's Enterprise Surveys database. It uses fractional logit and alternative models to carry out the estimations for female overall employment rates and for female non-production employment rates. The results reveal significant implications of firm-related factors, such as private foreign ownership, exporting activities, firm size, and labor composition for female employment rates. They also show that national factors, such as economic development and gender equality, promote female employment rates. There are considerable differences between the estimated marginal effects for female overall employment rates and those for female non-production employment rates. This paper provides policy-makers with important directions to design strategies aiming at enhancing women's economic opportunities and employment rates.

JEL Classification: J16, J21,J23, J82

Keywords: Female employment, fractional logit model, manufacturing firms, MENA region

ملخص

شهدت منطقة الشرق الأوسط وشمال أفريقيا تقدما كبيرا نحو تحسين رفاه المرأة ووضعها الاجتماعي على مدى العقود القليلة الماضية. ومع ذلك، لا يزال معدل توظيف المرأة في منطقة الشرق الأوسط واحد من أدنى المعدلات في العالم. وتبحث هذه الورقة الآثار المترتبة على العوامل ذات الصلة بالمؤسسات وبأخرى ذات صلة بالمؤشرات القومية لمعدلات العمالة النسائية في الشركات الصناعية والتى تقع في منطقة الشرق الأوسط. ويتم تنفيذ التحليل التجريبي للبيانات على مستوى الشركات المستمدة من قاعدة بيانات دراسة المشاريع التابعة للبنك الدولي. ويستخدم نموذج logit كسور ونماذج بديلة لتنفيذ تقديرات لمعدلات توظيف الإناث الشاملة ومعدلات التوظيف فى قطاعات غير انتاجية. تكشف النتائج عن آثار كبيرة للعوامل ذات الصلة بالمؤسسات، مثل الملكية الأجنبية الخاصة ، وأنشطة التصدير، حجم الشركة، وتكوين اليد العاملة لمعدلات العمالة النسائية. وتبين أيضا أن العوامل القومية، مثل التنمية الاقتصادية والمساواة بين الجنسين، تسهم فى تعزيز معدلات العمالة النسائية. هناك اختلافات كبيرة بين الآثار الهامشية المقدرة للإناث ومعدلات التوظيف الشاملة وتلك لمعدلات العمالة غير الإنتاجية للإناث. وتقدم هذه الورقة لصانعي السياسات بعض التوجهات الهامة لوضع استراتيجيات تهدف إلى تعزيز فرص المرأة الاقتصادية ومعدلات التوظيف.

1. Introduction

Increasing female employment rates remains an essential item on the labor policy agenda of the Middle East and North Africa (MENA) region.[1] Even though MENA countries have realized important achievements in promoting women's well-being and social status over the past few decades[2], MENA's record in terms of female employment is still lagging behind many geo-economic regions and remains one of the lowest in the world (Morrison et al., 2008; The World Bank, 2011; International Labor Organization, 2012). Table 1 presents some comparative statistics that illustrate labor force characteristics of the MENA region, sub-grouped into Middle East (ME) and North Africa (NA), and those of other geo-economic regions through recent years. It shows that the MENA region is generally characterized by higher annual employment growth rates compared to other geo-economic regions. However, the MENA region also has the highest unemployment rates for youth and women, and the lowest employment-to-population ratio for women. The World Bank's (2011) report shows that around 50% of women in developing countries are either employed or actively looking for jobs, compared to 25.2% in the MENA region. In addition, it notes that this relatively low female labor force participation rate[3] mainly reflects the implications of social and cultural norms that restrict women from actively contributing to the labor market outside their homes.[4] Rauch and Kostyshak (2009) indicate that MENA's Arab countries have laws that prohibit labor discrimination in the workplace. They argue that the low levels of female participation in MENA's labor markets have to stem from *de facto* discrimination rather than from *de jure* discrimination. Klasen and Lamanna (2009) note that women in the MENA region face structural barriers in employment, in addition to social and cultural impediments that limit their contribution to the labor market.

It is important to understand the reasons behind the prevailing low female employment and workforce participation rates in MENA countries and the various factors that could contribute in raising these rates. This is because the prevalence of gender inequality in the labor market restrains economic growth and results in under-exploited production resources (Klasen and Lamanna, 2009; Cuberes and Teignier-Baqué, 2011; International Labour Organization, 2012). Hence, examining the factors that determine female employment and workforce participation rates would provide important information to policy-makers to develop relevant labor-market strategies aiming at increasing women's economic opportunities.

There is a wide strand of empirical literature that examines the determining factors of female participation in the labor market (e.g., Mincer, 1962; Gronau, 1973; Heckman, 1974; Killingworth and Heckman, 1986; Prieto-Rodríguez and Rodríguez-Guitiérrez, 2003; Greenwood et al., 2005; Kohara, 2010; Esfahani and Shajari, 2012; Karaoglan and Okten, 2012; Klasen and Pieters, 2012). This strand of literature has primarily focused on the supply-side factors, such as demographic, socio-economic, and household-related characteristics, using household survey data. Meanwhile, firm-related factors, which also influence female employment and workforce participation rates, have received less attention in the literature. In this context, Bratti et al. (2005) find that demand-side and job-related factors provide explanations for new mothers' participation in the labor market in Italy. Pissarides et al.

[1] Female employment rate is commonly determined as the proportion of women employed in the private and public sectors (Stevenson, 2010; The World Bank, 2013).

[2] Several countries in the MENA region have dedicated significant resources to women's education over the past few decades. For example, since the 1990s, MENA countries have enjoyed substantial growth in female enrolment in primary and secondary education, and have benefited from some progress in female enrolment in tertiary education (Morrison et al., 2008).

[3] Female labor force (workforce) participation rate is usually measured as the proportion of women aged 15 years and older who are economically active (i.e., employed or looking for jobs) (Stevenson, 2010; World Bank, 2013).

[4] Also, see Chamlou et al. (2011) who find that traditional social norms reduce the participation of women in the labor market in Jordan.

(2005) note that low female employment and workforce participation rates could be explained by demand-side factors because firms may not offer enough jobs that attract women to contribute to the labor market. Thus, low female employment and workforce participation rates could be associated with employers' preferences and characteristics. Lee et al. (2008) find that low female labor force participation rates among married women are driven by demand-side factors in South Korea. Buchanan et al. (2010) underline the importance of demand-side factors that affect female employment and workforce participation rates, focusing on the demand for skilled workers. Abe (2013) concludes that a combination of supply-side and demand-side factors contributes in explaining female labor force participation rates in Japan.

In recent years, there has been an increasing amount of empirical research on the various aspects of women's lab our market in the MENA region. For instance, Chamlou (2008) explores women entrepreneurs' contribution to the social and economic development of the MENA region, and reviews the factors that promote women's entrepreneurship. Also, Chamlou et al. (2011) examine the determinants of female labor force participation rates in Jordan, focusing on the role of social norms in reducing these rates. Hayo and Caris (2013) look into the role of identity, specifically religion and cultural traditions, in explaining the low rates of female labor force participation in the MENA region. The Organization for Economic Cooperation and Development's (2012) report investigates women entrepreneurs' access to finance in the MENA region, describing significant gender-related obstacles. Contessi et al. (2013) examine the relationship between female ownership and entrepreneurship of manufacturing firms in the MENA region and trade openness. They also look into the effects of female employment on exporting activities. They find that trade openness has disproportionate implications for industries characterized by comparative advantage in terms of female ownership, entrepreneurship, and employment.

The primary objective of this paper is to examine the implications of firm-related and national factors for female employment rates in manufacturing firms located in the MENA region. The results would assist policy-makers in understanding the demand-side factors that influence female employment rates, and in designing strategies that enhance women's economic opportunities. We use firm-level data rather than household characteristics data to analyze the determinants of female employment rates in the MENA labor market. The data come from the World Bank's Enterprise Surveys database, which is a comprehensive and comparable source of firm-level data through many MENA countries. We also account for the role of macro-factors, such as national economic development level and national gender inequality indicator, in determining female employment rates through the empirical analysis. Given the fractional nature of the dependent variables, we use the fractional logit model developed by Papke and Wooldridge (1996) to carry out the benchmark estimations. We also apply alternative empirical models through the analysis. The remainder of this paper is organized as follows. Section 2 describes the data sources and variables used through the empirical analysis. Section 3 presents the empirical methodology. Section 4 discusses the empirical results. Section 5 provides concluding remarks.

2. Data and Variables

The dataset used through the empirical investigation is derived from the World Bank's Enterprise Surveys database. The latter represents a comprehensive source of firm-level data in emerging and developing countries, and it covers various indicators of the business environment. The dataset includes manufacturing firms located in eight Arab countries in the

MENA region: Algeria, Egypt, Jordan, Lebanon, Morocco, Oman, Syria, and Yemen.[5] It covers the following manufacturing industries: chemicals and pharmaceuticals, electronics, food, garments, leather, metals and machinery, non-metallic and plastic materials, textiles, wood and furniture, and other manufacturing. Firms with missing observations on female employment rates and essential explanatory variables are removed from the original dataset. The final dataset comprises 3,619 firm observations.

In this paper, female employment is depicted by: 1) the fraction of female full-time workers in total full-time employment and, 2) the fraction of female non-production full-time workers in total non-production full-time workers.[6] The explanatory variables related to firm characteristics include: 1) firm size measured by the number of employees; 2) firm age since establishment, 3) a binary variable that takes the value of one for an exporting firm and zero otherwise; 4) firm ownership variables depicted through the fraction of private foreign ownership in total ownership and through the fraction of government ownership in total ownership with a reference being the fraction of private domestic ownership in total ownership; 5) a binary variable representing the use of Information and Communication Technology (ICT) that takes the value of one for firm use of own Internet website and zero otherwise; and 6) firm labor composition variables represented through the fraction of skilled production workers in total production workers and through the fraction of non-production workers in total employment. Country variables include Gender Inequality Index (GII) sourced from the United Nations Development Program's (UNDP's) Human Development Reports,[7] Gross Domestic Product per Capita (GDPC) depicting national economic development level, and a national business freedom indicator. The last two variables are derived from the World Development Indicators (WDI) database of the World Bank.[8]

Table 2 provides descriptive statistics for the dependent and explanatory variables used through the empirical investigation. These statistics indicate that the percentage of female full-time workers in total full-time employment has a mean of 14.8% (with a standard deviation of 22.8%), whereas the percentage of female non-production full-time workers in total non-production full-time workers has a considerably lower mean of 2.9% (with a standard deviation of 6.6%). The statistics also show that private foreign ownership has a mean of 4.3% (with a standard deviation of 18.8%), whereas government ownership has a mean of 2.6% (with a standard deviation of 15.4%). The surveyed manufacturing firms in our dataset have an average of 135 full-time workers (with a standard deviation of 323 full-time workers). We find that around 36% of manufacturing firms in the sample use their own Internet websites to communicate with clients, and to source and provide information. Alternative statistics indicate that around 49% of firms use E-mail as a form of business communication. The mean of the percentage of skilled production workers in total production workers and the mean of the percentage of non-production workers in total employment are 61.1% (with a standard deviation of 27.0%) and 23.2% (with a standard deviation of 16.7%), respectively.

[5]The survey year/fiscal year are: 2002/2001 and 2007/2006 for Algeria's firms, 2007/2005 and 2008/2007 for Egypt's firms, 2006/2006 for Jordan's firms, 2009/2008 for Lebanon's firms, 2007/2005 for Morocco's firms, 2003/2002 for Oman's firms, 2003/2002 and 2009/2008 for Syria's firms, and 2010/2009 for Yemen's firms.

[6]The World Bank's Enterprise Surveys database includes information on the number of part-time workers, but it does not report representative statistics on female part-time employment rates.

[7]The UNDP's GII is an indicator designed for the measurement of gender disparity. It covers female disadvantages through three dimensions: reproductive health, empowerment, and economic activities. It ranges from zero (full gender equality) to one (extreme gender inequality).

[8] The WDI's ease of doing business indicator is a ranking score of countries according to the quality of regulatory environment in enhancing business. We inversely rank the MENA countries in our dataset, giving higher scores to more business-conducive regulatory environments. Hence, a positive coefficient on this variable would indicate a positive effect of business freedom on the dependent female employment variable.

3. Empirical Methodology

The empirical analysis examines the determinants of female employment rates in manufacturing firms located in the MENA region. Female employment variables are represented as fractions from total employment. Given the fractional nature of the dependent variables, we use the seminal fractional logit model of Papke and Wooldridge (1996) to carry out the empirical investigation. The estimation model of Papke and Wooldridge (1996) is designed to take into account the bounded nature of fractional dependent variables between zero and one. These boundaries are established by definition and not by censoring (Wagner, 2001). Papke and Wooldridge (1996) model is a one-step approach where limited observations (i.e., zero female workers) and strictly positive fractions of female workers are estimated in one equation. Comparatively, the Heckman selection model is a two-step approach where the first step estimates the decision to employ female workers using the whole dataset, and the second step estimates the fraction of female workers equation. The latter estimation is carried out for firms with strictly positive fractions of female workers and it takes into account the probability of employing female workers from the first step estimation. One critical disadvantage of using the Heckman selection model is that there should be at least one variable in the selection equation that does not affect the outcome equation to get precise estimates (Puhani, 2000; Sartori, 2003). However, it is difficult to find variables that are important for the decision to employ female workers but not relevant for the employment volume of female workers (and vice versa).[9]

Let $F_{ic} \in [0,1]$ denote a fractional variable of female employment for a manufacturing firm "i" located in a country "c" in the MENA region. The fractional logit model is represented by:

$$E\left(F_{ic} \middle| X_i, Z_c\right) = G\left(X_i\alpha + Z_c\beta\right) = \exp\left(X_i\alpha + Z_c\beta\right) \Big/ \left[1 + \exp\left(X_i\alpha + Z_c\beta\right)\right] \quad (1)$$

where X_i is a vector of firm-related variables with a corresponding vector of coefficients depicted by α, Z_c is a vector of country-related variables with a corresponding vector of coefficients depicted by β, and $0 \le G(\cdot) \le 1$ is the cumulative distribution function of the logistic distribution.

The marginal effects are determined using the estimated coefficients at the mean values of the explanatory variables. For a continuous explanatory variable represented by $x_i \in X_i$ with a corresponding coefficient $a \in \alpha$, we get $\partial E\left(F_{ic} \middle| X_i, Z_c\right) \Big/ \partial x_i = a g\left(X_i\alpha + Z_c\beta\right)$, where $g\left(X_i\alpha + Z_c\beta\right) = \exp\left(X_i\alpha + Z_c\beta\right) \Big/ \left[1 + \exp\left(X_i\alpha + Z_c\beta\right)\right]^2$. For a binary variable depicted by $w_i \in X_i$ (discrete change), we get $E\left(F_{ic} \middle| \tilde{X}_i, Z_c, w_i = 1\right) - E\left(F_{ic} \middle| \tilde{X}_i, Z_c, w_i = 0\right)$, where $\tilde{X}_i$ equals X_i excluding w_i. The marginal effects of country variables can be similarly determined.

Equation (1) is estimated through a Quasi-Maximum Likelihood Estimator (QMLE) that maximizes the following Bernoulli log-likelihood function:

$$l_{ic}\left(\alpha, \beta\right) = F_{ic} \ln\left[G\left(X_i\alpha + Z_c\beta\right)\right] + \left(1 - F_{ic}\right) \ln\left[1 - G\left(X_i\alpha + Z_c\beta\right)\right] \quad (2)$$

[9] See Wagner (2001) for an equivalent argument in the case of firm export decision and volume, and for a discussion on the critical disadvantages of using two-step approach vis-à-vis one-step approach in the case of fractional dependent variables.

where the coefficients are estimated by solving the maximization problem $\underset{\alpha,\beta}{Max}\sum_{i,c} l_{ic}(\alpha,\beta)$.

The estimated coefficients through the QMLE are consistent regardless of the distribution of F_{ic} conditional on X_i and Z_c (provided that equation (1) holds), and they have satisfactory efficiency properties. The "sandwich" formula of the variance-covariance matrix sets robustness to arbitrary heteroskedasticity and correlation between residuals (Gourieroux et al., 1984; Papke and Wooldridge, 1996). The estimations can be alternatively carried out through a fractional probit model, where $G(.)$ in equation (1) is specified as cumulative normal distribution function.

4. Empirical Results

4.1 Fraction of female workers in total employment

The empirical results from the fractional logit model for the fraction of female full-time workers in total full-time employment are presented in Table 3. Column (1) shows that MENA's manufacturing firms with higher levels of private foreign ownership have higher rates of female employment. The corresponding marginal effect implies that an increase in private foreign ownership by 10 percentage points induces an increase in the proportion of female workers in total employment by 1.4 percentage points. This result can be related to other findings in the literature showing positive effects of multinational activities and Foreign Direct Investment(FDI) on female employment rates (e.g., Curd et al., 2007; Siegel et al., 2011). Several studies indicate that multinational firms tend to employ female workers at higher rates than domestic firms to benefit from their under-exploited skills and/or gender wage gaps stemming from the implications of national gender inequality (Hewlett and Rashid, 2010; Siegel et al., 2011). Furthermore, multinational enterprises, particularly those headquartered in countries with higher records of national gender equality than those prevailing in MENA countries, are arguably more resistant to the implications of social gender inequality in MENA countries. Hence, they would transfer this relative immunity into the business culture and hiring practices of their affiliated firms in MENA countries, resulting in higher female employment rates.

The results also show that government ownership does not exhibit a statistically significant effect on female employment rates relative to private domestic ownership. The World Bank's (2011) report indicates that the public sector tends to employ more female (particularly skilled and non-production) workers than the private sector through MENA countries. For instance, the public sector generally offers more jobs that are considered to be "female-friendly" such as administration jobs. The results show that this tendency does not prevail for overall female employment rates through MENA's manufacturing firms with government ownership.

We find that MENA's manufacturing firms engaged in exporting activities have higher proportions of female workers by an average of 3.2 percentage points compared to non-exporting firms. This result is consistent with several empirical studies that show positive effects of exporting activities and trade openness on female employment rates in developing countries (e.g., International Labor Organization, 1985; Kabeer and Mahmud, 2004; Moghadam, 2005; Bussmann, 2009; Gaddis and Pieters, 2012). It complements Moghadam's (2005) observation which indicates that female employment rates tend be higher in MENA countries characterized by export-oriented manufacturing industries. Manufacturing industries in developing countries are expected to have comparative advantage in labor-intensive production. Exporting activities would further emphasize this comparative advantage, leading to increases in the proportions of female workers. Moreover, exporting firms facing higher competition levels in foreign markets would be compelled to employ

under-exploited female labor resources.[10] In this context, Kabeer and Mahmud (2004) argue that, in labor-intensive exporting sectors facing important levels of market competition, the demand for women labor force is generally higher. This is because women tend to accept lower wages.

Some studies explain that larger firms use more complex technologies and tend to have more unpleasant working environment due to increasing labor divisions and impersonal working atmosphere (Masters, 1969; Schmidt and Zimmerman, 1991). These factors could disproportionally affect female employment rates in larger firms. Meanwhile, larger firms have tendencies to offer more benefits (Mitchell and Andrews, 1981; Brown et al., 1996; Currie and Madrian, 1999) and higher wages compared to smaller firms (Masters, 1969; Schmidt and Zimmermann, 1991).[11] Hence, these factors could promote female employment. The estimates reveal an inverse U-shaped relationship between firm size and female employment rates. This outcome suggests that the implications of enhancing firm-size-related factors (e.g., benefits, higher wages) for female employment prevail over a medium range of firm size. The subsequent decreasing implications of firm size for female employment rates could reflect the consequences of complex and repulsive working environments in larger firms.

It is commonly argued in the literature that firms in developing countries tend to employ relatively more female workers for light (primarily unskilled) occupations and tasks that do not require extensive training (Çağatay and Berik, 1991; Çağatay and Özler, 1995). Accordingly, firms that are more unskilled-labor intensive in production would be expected to have higher fractions of female workers. The results do not support this hypothesis since the estimated coefficient on the skilled-labor ratio is not statistically significant. The results also show that the ratio of non-production workers negatively impacts the proportion of female workers. An increase in this ratio by 10 percentage points reduces the proportion of female workers by 0.7 percentage points. This effect implies that female workers are employed at higher rates in manufacturing firms that use production labor more intensively. The marginal effect of the ICT variable is negative and statistically significant at the 5% level. It implies that firms using own internet websites have lower female employment rates by 2.1 percentage points on average. Hence, there is some gender bias in the effects of firm ICT use on overall employment outcomes.[12, 13]

The national variables exercise significant effects on the female employment variable. We find that a 10% increase in GDPC raises the female employment rates by 0.8 percentage points. This result reveals important differences in female employment rates across MENA countries. For example, Algeria's GDPC is around four times higher than Yemen's GDPC in our dataset. The implications of economic development implies that manufacturing firms at Algeria's GDPC have, on average, higher rates of female workers than those at Yemen's

[10] Bussmann (2009) indicates that the positive effects of exporting activities on female employment rates could enhance women's welfare through increases in personal income. The latter would help women, for example, to pursue education and to have better access to health services. She also argues that women could suffer from work-related stress and could continue to bear most of household-related labor beside firm-related labor. Such circumstances could negatively impact their well-being. She finds that trade openness has positive influences on female employment rates. However, the results do not offer clear evidence that implies higher increases in women's welfare than men's welfare.

[11] Larger firms tend to pay higher wages because they are normally expected to earn higher profits and to be more innovative and capital-intensive compared to smaller firms. They also tend to pay higher wages to compensate for disutilities in the working atmosphere (Masters, 1969; Schmidt and Zimmermann, 1991).

[12] There are few studies that examine the relationship between female employment and ICT. In this context, Dettling (2012) finds that the use of the Internet at home has positive implications for married women's labor supply rates.

[13] The regressions are alternatively implemented with a binary variable that equals one for firms using E-mail as a form of business communication and zero otherwise. The results are similar to those obtained through the benchmark regressions.

GDPC by around 32.0 percentage points, *ceteris paribus*.[14,15] The results also show that an improvement in national business freedom indicator by one point leads to an increase in female employment rates by 1.0 percentage point.

Column (2) of Table 3 presents the results from an empirical specification that includes industry-specific effects. The results are generally comparable to those presented in the previous column with few differences. The marginal effect of private foreign ownership on female employment rates remains positive and statistically significant at the 1% level, but it becomes smaller in magnitude compared to the one presented in the previous column. Some industries have higher levels of private foreign ownership than other industries in our dataset. For example, the average private foreign ownership is 13.3% (with a standard deviation of 31.8%) for the chemicals and pharmaceutical industry. Comparatively, the average private foreign ownership for the non-metallic and plastic materials industry is 0.8% (with a standard deviation of 7.2%), and there are no firms with private foreign ownership in the leather industry and in the wood and furniture industry. Hence, the inclusion of industry-specific effect would absorb some of these inter-industrial variations, resulting in a lower marginal effect of private foreign ownership on female employment rates.

The marginal effect of firm size on overall female employment rates remains characterized by an inverse U-shaped relationship. However, compared to the previous column, the magnitude of this effect has moderately decreased. The inclusion of industry-specific effects naturally captures inter-industrial variations in firm size, leading to lower estimates. The marginal effects still suggest that female workers have higher propensities to be employed in medium-size firms, but lower propensities to work in large firms with more stressful and impersonal working atmosphere. Also, the marginal effect of skilled production workers ratio becomes negative and gains statistical significance at the 5% level. It implies that an increase in the skilled production workers ratio by 10 percentage points reduces female employment rates by 0.2 percentage points. Finally, the marginal effect of non-production workers ratio remains negative and statistically significant, but it becomes moderately smaller in magnitude (i.e., in absolute terms) compared to the one presented in the previous column. We note that the estimations are also implemented using the alternative fractional probit model. The corresponding marginal effects are presented in columns (1) and (2) of Table A.1 of the Appendix. They are found to be equivalent to the results obtained through the fractional logit model.

Column (3) of Table 3 presents the estimation results when substituting GDPC with the GII variable.[16] It is commonly argued that decreases in national gender inequality can be translated into higher female employment rates (Mammen and Paxson, 2000).[17] The results

[14]The percentage of female workers in total employment for manufacturing firms located in Algeria has a mean of 22.9% and a standard deviation of 28.0% in our dataset. The corresponding statistics for manufacturing firms located in Yemen show a considerably lower mean of 5.4% with a standard deviation of 6.8%.

[15]A number of studies examine the implications of economic growth for female workforce participation rates (e.g., Goldin, 1995; Mammen and Paxson, 2000; Tansel, 2001; Tam, 2011). These studies often show that increases in GDPC would initially result in reductions in female workforce participation rates as economic activities shift from family farms to industrial firms. Continuing increases in GDPC would promote female educational attainments and would lessen the stigma of women joining the labor force and, hence, they would positively influence female workforce participation rates. Empirical evidence on such U-shaped relationships is typically realized using panel datasets characterized by considerable cross-country variations and evolving GDPC patterns over time. In this study, we examine firm-level rather than national female employment rates using a dataset covering manufacturing firms in the MENA region for a specific time period.

[16] The correlation coefficient between the GII and the GDPC variables is around -0.9. Consequently, these variables are not included together in the same regression due to multicollinearity. We note that positive relationships are commonly documented in the literature between economic development and national gender equality (e.g., Weiss et al., 1976; Clark et al., 1991; Abu Ghaida and Klasen, 2002; Klasen and Lamanna, 2009; Cuberes and Teignier-Baqué, 2011).

[17]Increases in female employment and workforce participation rates *per se* may not be necessarily a sign of a decline in gender inequality (Standing, 1999; Klasen and Pieters, 2012).

are comparable to those presented in column (1). The marginal effect indicates that a decrease in GII by 0.1 points raises the female employment rates in manufacturing firms by 3.3 percentage points. This result implies some important cross-country differences. For example, Yemen's GII is higher than Algeria's GII by around 0.4 points. Hence, the estimated effect of GII suggests that manufacturing firms at Algeria's GII have, on average, higher proportions of female workers than those at Yemen's GII by around 13.2 percentage points, *ceteris paribus*. Column (4) of Table 3 presents the results from the corresponding empirical specification that includes industry-specific effects. The marginal effects of firm-related variables are similar to those presented in column (2) of Table 3. The marginal effect of GII becomes smaller, in absolute terms, compared to the one reported in the previous column. Also, the marginal effect of the business freedom indicator is larger than the one presented in the previous column.

The marginal effects from estimating an alternative empirical specification that includes country-specific and industry-specific effects are displayed in column (5) of Table 3. They are generally similar to the corresponding benchmark results. The marginal effect of private foreign ownership on female employment rate becomes moderately lower through this specification. This outcome is anticipated given the inter-national variations in inward FDI conditions across MENA countries. The inclusion of country-specific effects naturally absorbs the implications of these inter-national variations, resulting in lower estimates for the marginal effects of private foreign ownership. As shown in column (6) of Table 3, the estimation of an empirical specification that includes a national inward FDI index beside the other basic national variables yields lower marginal effects of private foreign ownership.[18]

4.2 Fraction of female non-production workers in total non-production workers

Table 4 presents the empirical results from the fractional logit model for the fraction of female non-production full-time workers in total non-production full-time workers. The empirical results from the benchmark empirical specifications are presented in columns (1) and (3) using GDPC and GII, respectively. The effect of private foreign ownership is positive and statistically significant. The magnitude of this effect is considerably lower compared to the one reported in Table 3 for the overall fraction of female workers in total employment. The corresponding marginal effect indicates that an increase in private foreign ownership by 10 percentage points leads to an increase in the proportion of female non-production workers by less than 0.2 percentage points. This result suggests that multinational manufacturing firms in the MENA region have a somewhat higher tendency to employ non-production female workers than domestic manufacturing firms. Also, the review of the results in Table 3 and Table 4 reveals that these multinational manufacturing firms have a higher propensity to employ female workers in production positions than in non-production occupations. The effect of government ownership is not statistically significant. This result suggests that the documented higher tendency of the public sector to employ female workers (The World Bank, 2011) does not cover non-production positions through MENA's manufacturing firms with government ownership.

We find that the effect of exporting activities is not statistically significant. The review of the results in Table 3 and Table 4 suggests that exporting activities of manufacturing firms generate a higher propensity to employ female labor in production positions, but not in non-production positions. This outcome can be related to Kabeer and Mahmud's (2004) argument, being indicative of a higher tendency of production female workers to accept lower wages than non-production female workers. As in the previous case of overall female employment rates, we find an inverse U-shaped relationship between firm size and female non-production

[18]The national inward FDI index is derived from the United Nations Conference on Trade and Development (UNCTAD) database, and is determined as the ratio of total inward FDI stock to gross fixed capital formation.

employment rates. The marginal effects are, however, lower in magnitudes compared to those prevailing in the case of overall female employment rates. Also, the results show that manufacturing firms with higher ratios of non-production workers have higher rates of female non-production employment. Specifically, an increase in the ratio of non-production workers by 10 percentage points raises the proportion of female non-production workers in total non-production employment by around 0.7 percentage points. The marginal effect of the ICT variable implies that firms using their own internet websites have somewhat higher rates of female non-production workers by around 0.4 percentage points on average. It suggests that the internet only slightly facilitates the employment of under-utilized non-production female labor force.

National variables have considerably lower effects on the fraction of female non-production workers in total non-production employment compared to their effects on the overall fraction of female workers in total employment as reported in Table 3. We find that a 10% increase in GDPC raises the proportion of female non-production workers by 0.3 percentage points, whereas a decrease in GII by 0.1 points raises this proportion by 1.0 percentage point. These results are reminiscent of some earlier findings in the literature that report significant enhancing effects of economic development on female production employment, but relatively small effects on female non-production employment (e.g., Weiss et al., 1976). Also, we find that the business freedom indicator does not exhibit a statistically significant effect on the fraction of female non-production workers. The results from the empirical specifications that include industry-specific effects are presented in columns (2) and (4) of Table 4. They are found to be comparable to the previous results. We note that the marginal effects from estimating fractional probit models are displayed in columns (3) and (4) of Table A.1 of the Appendix. They are found to be equivalent to the estimates obtained from the fractional logit models.

The estimation results from an empirical specification that includes country-specific and industry-specific effects are presented in column (5) of Table 4. The marginal effects are generally consistent with the benchmark estimates. The marginal effect of foreign ownership slightly decreases. As discussed earlier, country-specific effects absorb inter-national variations in FDI conditions across MENA countries, resulting in lower marginal effects of private foreign ownership. Also, column (6) of Table 4 shows that estimating an empirical specification that includes national inward FDI index beside the initial national variables leads to a lower marginal effect of private foreign ownership.

4.3 Empirical results from alternative models

The empirical analysis investigates next the factors influencing firm's decision to employ female workers using a probit model. The dependent variable is specified to equal one when firms decide to employ female workers and zero otherwise.[19] The marginal effects are presented in columns (1) and (3) of Table 5 for overall female workers and for non-production female workers, respectively. They indicate that foreign-owned firms and government-owned firms have higher propensities to have women in their workforce by 35.5 and 19.0 percentage points, respectively, compared to private domestic-owned firms. The corresponding estimates for non-production female workers are 31.3 and 13.9 percentage points, respectively. Exporting firms have higher propensities to have women in the overall workforce and in the non-production workforce by 7.8 and 6.5 percentage points,

[19] Let D_{ic}^{*} depict firm benefits derived from employing female workers. We have $D_{ic}^{*} = X_i\delta + Z_c\gamma + \upsilon_{ic}$, where υ_{ic} is a stochastic error term. The latent variable D_{ic}^{*} is not observed. Instead, we observe firm's decision to employ female workers. Define the probit rule as $D_{ic} = \left\{1 \text{ for } D_{ic}^{*} \geq 0; 0 \text{ for } D_{ic}^{*} < 0\right\}$. Then, the probit regression model is given as $E\left(D_{ic} \middle| X_i, Z_c\right) = \Phi\left(X_i\delta + Z_c\gamma\right)$, where $\Phi(\cdot)$ is the normal standard cumulative distribution function (cdf).

respectively, compared to non-exporting firms. The results reveal an inverse U-shaped relationship between the decision to employ female workers and firm size. Also, the decisions to employ overall and non-production female workers are promoted through firm use of ICT by 9.8 and 12.5 percentage points, respectively. National development factors positively influence the decision to employ female workers. For instance, a 10% increase in GPDC raises the likelihood to employ overall and non-production female workers by 2.1 and 3.5 percentage points, respectively. The marginal effects from the corresponding empirical specifications that include industry-specific effects are presented in columns (2) and (4) for overall and non-production female workers, respectively. They remain generally consistent with the initial probit results. Also, we present the results from estimating linear probability models in columns (5) through (8) of Table A.1 of the Appendix. The results correspond to those obtained from the probit model.

Finally, the empirical analysis examines the factors influencing female employment intensity using the Heckman two-step selection model. The first step is a probit model applied to the decision to employ female workers. The second step estimates the outcome equation which depicts the intensity of female employment for firms with strictly positive female workers.[20] The estimates from the outcome equations for overall female workers are presented in columns (5) and (6) of Table 5. The estimated coefficient on the inverse Mills' ratio is statistically significant at only the 10% level. The results show that foreign-owned and exporting firms are characterized by higher female employment intensities. The results also underline positive influences of national development variables on overall female employment intensities. The estimates from the outcome equations for non-production female workers are presented in columns (7) and (8) of Table 5. The estimated coefficient on the inverse Mills' ratio is not statistically significant, suggesting that there is no sample selection bias and that the estimation should be carried out through a one-step approach.

5. Conclusion

MENA countries have realized significant advances toward improving women's well-being and social status over the last few decades. However, women's employment rate in the MENA region remains one of the lowest in the world. This paper examines the implications of firm-related and national factors for female employment rates in manufacturing firms located in the MENA region. The empirical investigation uses data derived from the World Bank's Enterprise Surveys database and implements the fractional logit model of Papke and Wooldridge (1996) and other empirical models through the estimations.

The benchmark empirical results show significant implications of firm-related and national factors for overall female employment rates in MENA's manufacturing firms. They reveal positive influences of private foreign ownership and exporting activities on overall female employment rates. The relative labor composition of firms in terms of non-production workers is found to exert negative effects on these rates. The results also underscore positive implications of national economic development and gender equality for these rates.

The empirical investigation implemented for female non-production employment rates shows positive effects of private foreign ownership. However, these effects are considerably smaller in magnitude compared to the corresponding effects on overall female employment rates.

[20] Let ε_{ic} and u_{ic} denote the stochastic error terms in the outcome and selection equations through the Heckman two-step procedure, respectively. The outcome equation is determined as $E\left[F_{ic}\middle|D_{ic}^{*}>0\right]=X_i\eta+Z_c\mu+\beta_\lambda\lambda\left(W_i\theta+V_c\vartheta\right)$, where W_i and V_c respectively denote vectors of firm-related and national variables in the selection equation, $\beta_\lambda=\rho\sigma_\varepsilon$ with $\begin{pmatrix}\varepsilon_{ic}\\ u_{ic}\end{pmatrix} \sim N\left\{\begin{pmatrix}0\\0\end{pmatrix},\begin{pmatrix}\sigma_\varepsilon^2 & \rho\sigma_\varepsilon\\ \rho\sigma_\varepsilon & 1\end{pmatrix}\right\}$, and $\lambda(\cdot)=\phi(\cdot)/\Phi(\cdot)$ is the inverse Mills' ratio with $\phi(\cdot)$ and $\Phi(\cdot)$ denoting the standard normal density and cdf functions, respectively.

Unlike in the case of female overall employment rates, exporting activities do not show statistically significant effects on female non-production employment rates. These findings suggest that the implications of private foreign ownership and exporting activities are primarily prevailing for female production employment rates. The results also show considerable positive effects of labor composition in terms of non-production workers on female non-production employment rates. We find positive effects of national economic development and gender equality on female non-production employment rates. However, these effects are smaller in magnitude compared to those exercised on overall female employment rates. These findings simply suggest that the implications of the national economic and socio-economic development factors are more important for women's production employment rates than for women's non-production employment rates through the MENA's manufacturing sector. The results obtained from alternative estimation models are found to be generally consistent with the benchmark results obtained through the fractional logit model.

This paper provides policy-makers and analysts with directions to design strategies aiming at improving women's employment rates through the manufacturing sector in the MENA region. For instance, the positive implications of private foreign ownership and exporting activities for female employment rates underline the benefits of policies that promote inward FDI and facilitate exports. Nevertheless, the differing implications of these factors for women's production and non-production employment rates should be accounted for when forming and implementing such policies. Furthermore, the estimates imply that policies should encompass the characteristics of firms in terms of labor compositions and size through their designs. Finally, the results depicting the positive effects of national economic development and gender equality on female employment rates suggest that MENA governments should continue to adopt policies that enhance economic growth and support women's well-being, social status, and education to realize higher female employment rates.

References

Abe, Y. 2013. "Regional Variations in Labor Force Behavior of Women in Japan." *Japan and the World Economy*, 28(1): 112–124.

AbuGhaida, D., and S. Klasen. 2002. *The Costs of Missing the Millennium Development Goal on Gender Equity*. The World Bank, Washington, DC.

Bratti, M., E. Del Bono, and D. Vuri. 2005. "New Mothers' Labour Force Participation in Italy: The Role of Job Characteristics." *Labour*, 19(s1): 79–121.

Brown, C., J. Hamilton, and J. Medoff. 1996. *Employers Large and Small*. Harvard University Press, Cambridge, MA.

Buchanan, J., L. Scott, S. Yu, H. Schutz, and M. Jakubauskas. 2010. "Skills Demand and Utilization: An International Review of Approaches to Measurement and Policy Development." Local Economic and Employment Development (LEED) Working Paper No. 2010/04, Organization for Economic Cooperation and Development (OECD) Publishing, Paris, France.

Bussmann, M. 2009. "The Effect of Trade Openness on Women's Welfare and Work Life." *World Development*, 37(6): 1027–1038.

Çağatay, N., and G. Berik. 1991. "Transition to Export-led Growth in Turkey: Is There a Feminization of Employment?" *Capital and Class*, 15(1): 153–177.

Çağatay, N., and S. Özler. 1995. "Feminization of the Labour Force: The Effects of Long-Term Development and Structural Adjustment." *World Development*, 23(11): 1883–1894.

Chamlou, N. 2008. *The Environment for Women Entrepreneurship in the Middle East and North Africa*. The World Bank, Washington, DC.

Chamlou, N., S. Muzi, and H. Ahmed. 2011. "Understanding the Determinants of Female Labor Force Participation in the Middle East and North Africa Region: The Role of Education and Social Norms in Amman." Working Paper No. 31, AlmaLaurea Inter-University Consortium, Bologna, Italy.

Clark, R., T.W. Ramsbey, and E.S. Adler. 1991. "Culture, Gender, and Labor Force Participation: A Cross-National Study." *Gender and Society*,5(1): 47–66.

Contessi, S., F. de Nicola, and L. Li. 2013. "International Trade, Female Labor, and Entrepreneurship in MENA Countries." *Federal Reserve Bank of St. Louis Review*, 94(3): 197–220.

Cuberes, D., and M. Teignier-Baqué. 2011. "Gender Inequality and Economic Growth." Background Paper for *World Development Report 2012: Gender Equality and Development*. The World Bank, Washington, DC.

Curd, A., A. Julian, A. Sabow, and L. Seligman. 2007. "The Impact of Foreign Direct Investment on Chinese Women." In A. Dayal-Gulati, M. Finn, and D. Diermeier (Eds.), *Global Corporate Citizenship*. Northwestern University Press, Evanston, IL.

Currie, J., and B.C. Madrian. 1999. "Health, Health Insurance and the Labor Market." In O. Ashenfelter and D. Card (Eds.), *Handbook of Labor Economics*, vol. 3C. Elsevier, Amsterdam, the Netherlands.

Dettling, L.J. 2012. "Opting Back In: Home Internet Use and Female Labor Supply." Working Paper, Department of Economics, University of Maryland, College Park, MD.

Esfahani, H.S., and P. Shajari. 2012. “Gender, Education, Family Structure, and the Allocation of Labor in Iran.” *Middle East Development Journal*, 4(2): 1–40.

Gaddis, I., and J. Pieters. 2012. “Trade Liberalization and Female Labor Force Participation. Evidence from Brazil.” IZA Discussion Paper No. 6809, Institute for the Study of Labor, Bonn, Germany.

Goldin, C. 1995. “The U-Shaped Female Labor Force Function in Economic Development and Economic History.” In T.P. Schultz (Ed.), *Investment in Women’s Human Capital and Economic Development*. University of Chicago Press, Chicago, IL.

Gourieroux, C., A. Monfort, and A. Trognon. 1984. “Pseudo-Maximum Likelihood Methods: Theory.” *Econometrica*, 52(3): 681–700.

Greenwood, J., A. Seshadri,and M. Yorukoglu. 2005. “Engines of Liberation.” *Review of Economic Studies*, 72(1): 109–133.

Gronau, R. 1973. “The Effect of Children on the Housewife’s Value of Time.” *Journal of Political Economy*, 81(2):S168–S199.

Hayo, B.,and T. Caris. 2013. “Female Labour Force Participation in the MENA Region: The Role of Identity.” *Review of Middle East Economics and Finance*, 9(3): 271–292.

Heckman, J.J. 1974. “Shadow Prices, Market Wages and Labor Supply.” *Econometrica*, 42(4): 679–694.

Hewlett, S.A., and R. Rashid. 2010. “The Battle for Female Talent in Emerging Markets.” *Harvard Business Review*, 88(5): 101–106.

International Labor Organization (ILO). 1985. *Women Workers in Multinational Enterprises in Developing Countries*. International Labor Organization, Geneva, Switzerland.

International Labor Organization (ILO). 2012.*Global Employment Trends 2012: Preventing a Deeper Jobs Crisis*. International Labor Organization, Geneva, Switzerland.

Kabeer, N., and S. Mahmud. 2004. “Globalization, Gender and Poverty: Bangladeshi Women Workers in Export and Local Markets.” *Journal of International Development*, 16(1): 93–109.

Karaoglan, D., and C. Okten. 2012.“Labor Force Participation of Married Women in Turkey: Is There an Added or a Discouraged Worker Effect?” IZA Discussion Paper No. 6616, Institute for the Study of Labor, Bonn, Germany.

Killingworth, M.R., and J.J. Heckman. 1986. “Female Labor Supply: A Survey.” In O. Ashenfelter and R. Laynard (Eds.), *Handbook of Labor Economics*. Elsevier Science Publishers, New York, NY.

Klasen, S., and F. Lamanna. 2009. “The Impact of Gender Inequality in Education and Employment on Economic Growth: New Evidence for a Panel of Countries.” *Feminist Economics*, 15(3): 91–132.

Klasen, S., and J. Pieters. 2012.“Push or Pull? Drivers of Female Labor Force Participation during India's Economic Boom.” IZA Discussion Paper No. 6395, Institute for the Study of Labor, Bonn, Germany.

Kohara, M. 2010. “The Response of Japanese Wives’ Labor Supply to Husbands’ Job Loss.”*Journal of Population Economics*, 23(4): 1133–1149.

Lee, B.S., S. Jang, and J. Sarkar. 2008. “Women Labor Force Participation and Marriage: The Case of Korea.” *Journal of Asian Economics*, 19(2): 138–154.

Mammen, K., and C. Paxson. 2000. “Women’s Work and Economic Development.” *Journal of Economic Perspectives*, 14(4): 141–164.

Masters, S.H. 1969. “An Interindustry Analysis of Wages and Plant Size.” *Review of Economics and Statistics*, 51(3): 341–345.

Mincer, J. 1962. “Labor Force Participation of Married Women: A Study of Labor Supply.” In H.G. Lewis(Ed.), *Aspects of Labor Economics*. Princeton University Press, Princeton, NJ.

Mitchell, O.S., and E. Andrews. 1981. “Scale Economies in Private Multi-Employer Pension Systems.” *Industrial and Labor Relations Review*, 34(4): 522–530.

Moghadam, V. 2005.*Globalizing Women: Transnational Feminist Networks*. The Johns Hopkins University Press, Baltimore, MD.

Morrison, A.R., S. Sabarwal, and M. Sjöblom. 2008.“The State of World Progress, 1990–2007.” In M. Buvinić, A.R. Morrison, A.W. Ofosu-Amaah, and M. Sjöblom (Eds.), *Equality for Women: Where Do We Stand on the Millennium Development Goals 3?*. The International Bank for Reconstruction and Development/The World Bank, Washington, DC.

Papke, L.E., and J.M. Wooldridge. 1996. “Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation Rates.” *Journal of Applied Econometrics*,11(4): 619–632.

Pissarides, C., P. Garibaldi, C. Olivetti, B. Petrongolo, and E. Wasmer. 2005. “Women in the Labor Force: How Well is Europe Doing?” In T. Boeri, D. Del Boca, and C. Pissarides (Eds.), *Women at Work: An Economic Perspective*. Oxford University Press, London, UK.

Prieto-Rodríguez, J., and C. Rodríguez-Guitiérrez. 2003. “Participation of Married Women in the European Labor Markets and the Added Worker Effect.” *Journal of Socio-Economics*,32(4): 429–446.

Puhani, P. 2000. “The Heckman Correction for Sample Selection and its Critique.” *Journal of Economic Surveys*,14(1): 53–68.

Rauch, J.E., and S. Kostyshak. 2009. “The Three Arab Worlds.” *Journal of Economic Perspectives*, 23(2): 165–188.

Sartori, A. 2003. “An Estimator for Some Binary-Outcome Selection Models without Exclusion Restrictions.”*Political Analysis*,11(2):111–138.

Schmidt, C.M., and K.F. Zimmermann. 1991. “Work Characteristics, Firm Size and Wages.” *Review of Economics and Statistics*, 73(4): 705–710.

Siegel, J., L. Pyun, and B.Y. Cheon. 2011. “Multinational Firms, Labor Market Discrimination, and the Capture of Competitive Advantage by Exploiting the Social Divide.” Working Paper No. 11-011, Harvard Business School, Boston, MA.

Standing, G. 1999. “Global Feminization Through Flexible Labor: A Theme Revisited.” *World Development*, 27(3): 583–602.

Stevenson, L. 2010. *Private Sector and Enterprise Development: Fostering Growth in the Middle East and North Africa*. International Development Research Center (IDRC), Ottawa, Canada.

Tam, H. 2011. “U-Shaped Female Labor Participation with Economic Development: Some Panel Data Evidence.” *Economic Letters*, 110(2):140–142.

Tansel, A. 2001. “Economic Development and Female Labor Force Participation in Turkey: Time-Series Evidence and Cross-Province Estimates.” Economic Research Forum Working No. 01/05, Department of Economics, Middle East Technical University, Ankara, Turkey.

The Organization for Economic Cooperation and Development (OECD). 2012. “MENA Women Entrepreneurs’ Access to Credit and Financial Services.” In OECD, *Women in Business: Policies to Support Women's Entrepreneurship Development in the MENA Region*. OECD Publishing, Paris, France.

The World Bank. 2011. *Capabilities, Opportunities and Participation: Gender Equality and Development in the Middle East and North Africa Region*. The World Bank, Washington, DC.

The World Bank. 2013. *World Development Indicators, Gender Statistics.* The World Bank, Washington, DC.

Wagner, J. 2001. “A Note on the Firm Size – Export Relationship.” *Small Business Economics*, 17(4): 229–237.

Weiss, J.A., F.O. Ramirez, and T. Tracy. 1976. “Female Participation in the Occupational System: A Comparative Institutional Analysis.” *Social Problems*, 23(5): 525–534.

Table 1: Labor Market Indicators by Geo-Economic Region

	Annual real GDP growth rate (%)	Unemployment rate (%)		Employment-to-population ratio (%)	Annual employment growth rate (%)
		Youth	Female	Female	
Year: 2006					
ME	6.0	25.5	19.3	15.1	4.6
NA	5.9	25.2	18.0	18.6	3.4
World	5.3	12.4	6.2	48.9	1.8
DE and EU	3.0	13.3	6.7	49.0	0.9
EA	10.9	8.3	3.3	65.6	1.2
SEAP	6.2	17.0	6.6	54.4	1.7
SA	8.9	9.3	4.4	34.7	2.5
LAC	5.6	15.3	9.8	46.5	2.5
SSA	6.5	12.8	8.9	58.5	3.1
Year: 2009					
ME	2.2	25.2	18.7	14.5	4.0
NA	3.5	23.6	16.5	19.8	2.2
World	–0.7	12.8	6.4	48.1	0.5
DE and EU	–3.9	17.3	7.9	48.9	-2.2
EA	7.1	9.0	3.6	64.6	0.7
SEAP	1.6	13.9	5.2	55.5	1.7
SA	6.2	9.1	4.4	31.4	0.6
LAC	–1.7	15.7	9.6	47.5	0.7
SSA	2.8	12.9	8.7	58.8	2.7
Year: 2010					
ME	4.4	25.4	18.5	14.8	3.8
NA	4.4	23.0	16.4	20.0	2.2
World	5.1	12.8	6.5	47.8	1.3
DE and EU	2.6	18.1	8.4	48.6	-0.2
EA	9.8	8.8	3.5	64.6	0.9
SEAP	7.5	13.6	5.2	55.5	2.2
SA	9.2	10.2	5.0	30.1	0.7
LAC	6.1	14.6	9.1	48.4	2.8
SSA	5.4	12.8	8.7	58.7	2.7

Notes: ME=Middle East; NA=North Africa; DE=Developed Economies; EU=European Union; EA=East Asia; SEAP=South-East Asia and the Pacific; SA=South Asia; LAC=Latin America and the Caribbean; SSA=Sub-Saharan Africa; GDP=Gross Domestic Product. The annual employment growth rates for 2006 are reported as averages over 2001–2006.
Source: International Labor Organization (2012).

Table 2: Descriptive Statistics

	Mean	Standard deviation
Dependent variables		
Female full-time workers (fraction in total full-time employment)	0.148	0.228
Female non-production full-time workers (fraction in total non-production full-time workers)	0.029	0.066
Explanatory variables		
Foreign ownership (fraction in total ownership)	0.043	0.188
Government ownership (fraction in total ownership)	0.026	0.154
Exporting firm (binary variable)	0.308	0.461
Firm size (total employment)	134.811	322.594
Firm age (years)	21.038	16.436
Skilled/Total production workers	0.611	0.270
Non-production/Total employment	0.232	0.167
Firm use of ICT, Internet website (binary variable)	0.359	0.479
Firm use of ICT, E-mail (binary variable)	0.489	0.500
GDPC (current USD)	2,198.275	932.863
Gender inequality index (national indicator)	0.554	0.073
Business freedom (national indicator)	5.337	1.643
Number of observations	**3,619**	

Table 3: Fraction of Female Full-Time Workers (Fractional Logit Model)

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign ownership	0.138***	0.076***	0.145***	0.090***	0.047***	0.058***
	(0.014)	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)
Government ownership	-0.039	-0.002	-0.044*	-0.011	-0.004	-0.001
	(0.025)	(0.021)	(0.026)	(0.021)	(0.020)	(0.022)
Exporting firm	0.032***	0.031***	0.026***	0.023***	0.034***	0.032***
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Firm size	0.012***	0.005*	0.012***	0.005*	0.003	0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Firm size squared	-0.0008***	-0.0006***	-0.0008***	-0.0006***	-0.0004***	-0.0007***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)
Firm age	-0.0002	0.0002	-0.0002	0.0002	0.0001	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Skilled workers ratio	0.006	-0.022*	0.005	-0.021*	-0.024*	-0.020*
	(0.014)	(0.012)	(0.014)	(0.012)	(0.013)	(0.012)
Non-production workers ratio	-0.072***	-0.040**	-0.076***	-0.042**	-0.036**	-0.042**
	(0.022)	(0.020)	(0.022)	(0.020)	(0.017)	(0.020)
Firm use of ICT	-0.021**	-0.003	-0.018**	0.001	0.005	-0.004
	(0.008)	(0.007)	(0.009)	(0.008)	(0.008)	(0.007)
Ln(GDPC)	0.083***	0.090***				0.074***
	(0.010)	(0.009)				(0.010)
Gender inequality index (GII)			-0.329***	-0.167***		
			(0.066)	(0.061)		
Business freedom	0.010***	0.013***	0.006**	0.013***		0.004**
	(0.002)	(0.002)	(0.003)	(0.003)		(0.002)
Inward FDI index						0.010***
						(0.003)
National variables	Yes	Yes	Yes	Yes	No	Yes
Industry-specific effects	No	Yes	No	Yes	Yes	Yes
Country-specific effects	No	No	No	No	Yes	No
Number of observations	3,619	3,464	3,619	3,464	3,464	3,464
Log pseudo-likelihood	-1205.5	-1051.7	-1213.3	-1065.3	-1015.2	-1049.4

Notes: Statistical significance: *=10%; **=5%; ***=1%. Robust standard errors are in parentheses.

Table 4: Fraction of Female Full-Time Non-Production Workers (Fractional Logit Model)

	(1)	(2)	(3)	(4)	(5)	(6)
Foreign ownership	0.015***	0.011***	0.018***	0.014***	0.006**	0.008***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Government ownership	0.001	0.001	-0.003	-0.001	-0.001	0.002
	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
Exporting firm	-0.001	0.001	-0.002	-0.002	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm size	0.0015**	0.0006	0.0014**	0.0007	0.0003	0.0005
	(0.0006)	(0.0004)	(0.0007)	(0.0005)	(0.0002)	(0.0004)
Firm size squared	-0.00007**	-0.00003	-0.00006**	-0.00004	-0.00001	-0.00003
	(0.00003)	(0.00002)	(0.00003)	(0.00003)	(0.00001)	(0.00002)
Firm age	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Skilledworkers ratio	0.001	-0.001	0.001	-0.001	-0.003	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Non-production workers ratio	0.068***	0.065***	0.069***	0.067***	0.052***	0.064***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
Firm use of ICT	0.004**	0.004**	0.006***	0.005**	0.005**	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Ln(GDPC)	0.028***	0.029***				0.027***
	(0.003)	(0.002)				(0.002)
Gender inequality index (GII)			-0.102***	-0.102***		
			(0.018)	(0.013)		
Business freedom	0.001	0.001	-0.001	-0.001		-0.001
	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)
Inward FDI index						0.004**
						(0.002)
National variables	Yes	Yes	Yes	Yes	No	Yes
Industry-specific effects	No	Yes	No	Yes	Yes	Yes
Country-specific effects	No	No	No	No	Yes	No
Number of observations	3,619	3,464	3,619	3,464	3,464	3,464
Log pseudo-likelihood	-362.1	-340.8	-370.2	-348.6	-332.5	340.0

Notes: Statistical significance: *=10%; **=5%; ***=1%. Robust standard errors are in parentheses.

Table 5: Results from other Empirical Models

	Female employment decision (Probit model)				Female employment intensity (Heckman selection model, outcome equation)			
	Female workers		Female non-production workers		Female workers		Female non-production workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign ownership	0.355***	0.189***	0.313***	0.214***	0.315***	0.154***	0.039**	0.025**
	(0.063)	(0.069)	(0.052)	(0.055)	(0.081)	(0.025)	(0.020)	(0.011)
Government ownership	0.190***	0.298***	0.139**	0.184***	0.028	0.013	-0.010	-0.017
	(0.070)	(0.077)	(0.060)	(0.062)	(0.066)	(0.037)	(0.016)	(0.012)
Exporting firm	0.078***	0.151***	0.065***	0.142***	0.068**	0.039**	-0.004	-0.010
	(0.022)	(0.022)	(0.022)	(0.024)	(0.031)	(0.019)	(0.008)	(0.008)
Firm size	0.050***	0.031***	0.057***	0.045***	0.013	-0.004	0.001	-0.002
	(0.009)	(0.009)	(0.009)	(0.009)	(0.013)	(0.004)	(0.004)	(0.002)
Firm size squared	-0.0012***	-0.0008**	-0.0012***	-0.0010**	-0.0005	-0.0001	-0.0001	0.0001
	(0.004)	(0.0004)	(0.004)	(0.004)	(0.0004)	(0.0001)	(0.0001)	(0.0001)
Firm age	0.0001	0.0011*	0.0001	0.0009	-0.0004	0.0002	0.0001	0.0001
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0003)	(0.0001)	(0.0001)
Skilled workers ratio	-0.025	-0.115***	0.019	-0.035	0.010	-0.022	0.009	0.008
	(0.032)	(0.035)	(0.032)	(0.035)	(0.029)	(0.022)	(0.009)	(0.007)
Non-production workers ratio	0.237***	0.243***	0.600***	0.605***	-0.102	-0.088**	0.215***	0.203***
	(0.053)	(0.058)	(0.054)	(0.058)	(0.083)	(0.039)	(0.043)	(0.028)
Firm use of ICT	0.098***	0.153***	0.125***	0.141***	-0.012	-0.013	-0.001	-0.002
	(0.020)	(0.021)	(0.021)	(0.022)	(0.034)	(0.017)	(0.010)	(0.007)
Ln(GDPC)	0.212***	0.354***	0.387***	0.507***	0.187***	0.130***	0.077***	0.056**
	(0.027)	(0.031)	(0.030)	(0.031)	(0.065)	(0.033)	(0.028)	(0.022)
Business freedom	0.026***	0.038***	0.008	0.017***	0.020**	0.018***	-0.003	-0.001
	(0.005)	(0.006)	(0.007)	(0.006)	(0.009)	(0.005)	(0.002)	(0.002)
Inverse Mills' ratio (λ)					0.323*	0.125*	0.048	0.030
					(0.187)	(0.069)	(0.042)	(0.027)
National variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	3,619	3,464	3,619	3,464	3,619	3,464	3,619	3,464
Uncensored observations					2,042	2,034	1,385	1,382
Censored observations					1,577	1,430	2,234	2,082
Log pseudo-likelihood	-2232.8	-1856.3	-1996.6	-1819.4				
Wald χ-squared (p-value)					104.3	449.6	261.6	420.4
					(0.00)	(0.00)	(0.00)	(0.00)

Notes: Statistical significance: *=10%; **=5%; ***=1%. Robust standard errors are reported in parentheses.

Appendix

Table A1: Results from Alternative Empirical Models

	Female employment intensity (Fractional probit model)				Female employment decision (Linear probability model)			
	Female workers		Female non-production workers		Female workers		Female non-production workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign ownership	0.147***	0.088***	0.016***	0.012***	0.237***	0.082***	0.277***	0.186***
	(0.016)	(0.015)	(0.003)	(0.003)	(0.031)	(0.031)	(0.039)	(0.040)
Government ownership	-0.034	-0.003	-0.001	0.001	0.146***	0.210***	0.132**	0.160***
	(0.023)	(0.021)	(0.005)	(0.004)	(0.045)	(0.045)	(0.052)	(0.051)
Exporting firm	0.030***	0.035***	0.001	0.001	0.080***	0.136***	0.055***	0.113***
	(0.009)	(0.009)	(0.002)	(0.002)	(0.020)	(0.019)	(0.020)	(0.020)
Firm size	0.011***	0.005*	0.0014**	0.0005	0.041***	0.023***	0.052***	0.040***
	(0.003)	(0.003)	(0.0006)	(0.0005)	(0.008)	(0.007)	(0.009)	(0.008)
Firm size squared	-0.0007***	-0.0005***	-0.00006**	-0.00002	-0.0010***	-0.0006**	-0.0012***	-0.0009**
	(0.0002)	(0.0002)	(0.00003)	(0.00002)	(0.0004)	(0.0003)	(0.0004)	(0.0004)
Firm age	-0.0002	0.0002	0.0001	0.0001	0.0001	0.0010**	0.0001	0.0007
	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
Skilled workers ratio	0.005	-0.026*	0.002	0.001	-0.025	-0.099***	0.020	-0.020
	(0.014)	(0.014)	(0.003)	(0.003)	(0.029)	(0.028)	(0.026)	(0.027)
Non-production workers ratio	-0.074***	-0.039**	0.077***	0.075***	0.217***	0.215***	0.519***	0.488***
	(0.021)	(0.020)	(0.005)	(0.005)	(0.047)	(0.047)	(0.044)	(0.045)
Firm use of ICT	-0.017**	0.001	0.004**	0.005**	0.096***	0.132***	0.110***	0.117***
	(0.007)	(0.008)	(0.002)	(0.002)	(0.019)	(0.018)	(0.019)	(0.019)
Ln(GDPC)	0.088***	0.097***	0.033***	0.034***	0.197***	0.282***	0.341***	0.417***
	(0.011)	(0.010)	(0.003)	(0.002)	(0.025)	(0.024)	(0.024)	(0.024)
Business freedom	0.010***	0.014***	0.001	0.001	0.025***	0.034***	0.004	0.010**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)	(0.005)
National variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of observations	3,619	3,464	3,619	3,464	3,619	3,464	3,619	3,464
Log pseudo-likelihood	-1204.7	-1052.1	-360.6	-339.9				
R-squared					0.124	0.250	0.210	0.262

Notes: Statistical significance: *=10%; **=5%; ***=1%. Robust standard errors are reported in parentheses.