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DISCUSSION PAPER SERIES

IZA DP No. 13687

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Joan Costa-Font
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ABSTRACT

The Weight of Patriarchy? Gender Obesity Gaps in the Middle East and North Africa (MENA)

The worldwide obesity epidemic has impacted women more heavily than men. These gender-based differences are particularly pronounced in the Middle East and North Africa (MENA) region where gender obesity gaps on average exceed 10 percentage points. This paper examines one of the explanations, namely the role of female empowerment on gender gaps in obesity. We study the effect of several measures of female empowerment including female labour market participation on gender obesity gaps over a time span of 41 years (1975-2016) in a sample of 190 countries. We document that after controlling for a number of relevant controls, gender obesity gaps are only associated to measures of female empowerment in the MENA region but that this is not true worldwide. We then use an instrumental variable approach in order to illustrate that the causality runs indeed from empowerment, proxy it by both labour market and political participation to gender obesity gaps and not vice versa. Our results reveal that a one percentage point increase in female labor market participation (female MPs in national parliament) predicts a 0.2 (0.09) percentage point decrease in gender gaps in obesity in the MENA region.

JEL Classification: I18, J16

Keywords: female overweight, obesity, female empowerment, female labour market participation, Middle East and North Africa Region, female political participation

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1. Introduction

The burden of obesity worldwide falls overwhelmingly on women (Kanter and Caballero, 2012). However, in no other world region are the gender-based differences as pronounced as in the Middle East. Women in the Middle East are on average 10.3 percentage points more likely to be obese than men, compared to approximately 4 percentage points worldwide. There are a number of potential explanations for these comparatively large gender gaps in obesity, including gender-based differences in physical labour, body-type preferences, alongside cultural norms regarding the priorization of family members when calories are scarce. This paper investigates on the role of women empowerment, i.e. the decline of "patriarchic" norms, on gender obesity gaps. Women empowerment is the ability of women to access the constituents of development (Duflo, 2012), which include more prominently earning opportunities by participating in the labour market, political participation and equal rights and non-discrimination, including in the household. Empowerment can influence autonomy and agency, self-confidence and self-efficacy, which impact on health decision making, and as we show in this paper on overweight.

Gender-based differences in overweight and obesity are an important concern to policy makers interested in improving gender equality and public health in general. Overweight and obesity substantially increase the risk of several chronic diseases such as high blood pressure, high cholesterol, type II diabetes, cancer, heart disease and arthritis (Di Cesare et al. 2016, A.E. Field et al. 2001, Sturm 2002). A higher prevalence of obesity among women today will therefore almost inevitably lead to a higher prevalence of heart disease, diabetes and other obesity-related comorbidities in the future, along with adverse impacts on labour market outcomes, mortality, and general wellbeing.

Nonetheless, evidence on the gender-specific determinants of overweight and obesity is scarce. Power and Schulkin (2008) discuss biological differences in the fat metabolism between men and women which can partly explain gender obesity gaps. Kanter and Caballero (2008) cite lower levels of physical activity among women due to contextual factors as a reason for gender-based differences in overweight. Azizi et al. (2005) also refer to the importance of gender differences in diets, documenting a higher sugar and snack intake among women. Other explanations might be related to sociocultural factors and different body-type preferences. For the MENA region, a number of studies have documented preferences for plump body shapes and/or overweight among women but not among men (Rguibi and Belahse, 2006, Naigaga et al. 2018, Musaiger et al. 2004). This might result from excess weight being perceived as a positive trait linked to maternity, prosperity and good health (Ichinohe et al., 2005; Mokhtar et al., 2001).

So far there is only very limited evidence on the relationship between women empowerment and nutritional outcomes and most of the related literature focuses on undernutrition. Malapit and Quisumbing (2015), show a positive association between women's financial empowerment and nutritional diversity, but not with BMI. In Ghana. Malapit et al. (2013) find that women empowerment in agricultural households can increase both the nutritional diversity and BMI of women in Nepal (the baseline BMI of the sampled women was relatively low, suggesting that the finding reflects a decrease in undernutrition). Moreover, there is evidence that children of more empowered women are less likely to be undernourished (ibid, Cunningham et al., 2014). Regarding overnutrition, Mabry et al. (2010) argue that restrictions to the freedom of movement of women incentivizes more sedentary behaviour as it prevents women from egaging in both active and passive exercise.

The two papers which are most closely related to our study are Wells et al. (2012) and Garawi et al. (2014), which provide evidence for a negative association between women empowerment and obesity differentials between men and women in a worldwide sample of countries. However, below we document that most of such association is driven by Middle Eastern countries alone. Furthermore, they do not investigate on the mechanisms behind these associations, nor do they provide any evidence on the direction of causality, which we both aim to address in this paper.

The contribution of this paper is threefold. First, we document the rise of gender obesity gaps in the Middle East, as compared to other world regions. Secondly, we investigate to what extent the worldwide association between women empowerment and obesity gaps documented in other papers, is driven by developments in the MENA region[2]. Third, we provide an initial assessment on the direction of causality between women empowerment and gender obesity gaps, by estimating both fixed effects and IV regressions.

We use historical data on overweight and obesity over a time period of 41 years in 190 countries, 17 of which are in the MENA region, which allows us to describe trends in male and female obesity in the Middle East and benchmark them against other countries. We document that while average worldwide gender differences in obesity have remained

[2] MENA region (Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Syria, Tunisia, United Arab Emirates, West Bank and Gaza, and Yemen).

stable since 1975, female obesity in the Middle East has increased at a much faster pace than male obesity, leading to a substantial gender obesity gap.

Second, we study to what extent gender obesity gaps correlate with women empowerment, both worldwide and in the MENA region. In our study we mainly draw on two measures of women empowerment, namely female labour market participation and the share of female members of parliament (MPs). These measures are chosen as they are consistently available for a large number of countries and over a long time span, yet we show that our results also hold for composite measures of female empowerment, as e.g. the UN's Gender Development Index (GDI). Our results show that the worldwide association between female empowerment and gender obesity gaps is entirely driven by the MENA region. Within the MENA region, this association is robust to the inclusion of a number of controls including socio-economic status, education, demographic controls alongside time fixed effects. The effect is suggestive that increasing female agency (in several domains such as employment, politics and the household) affects health decision making, and more specifically the within country gender gaps in obesity.

Third, given the potential of omitted variables and/or reverse causality confounding the effect, we draw on causal inference methods to gain additional evidence on the direction of causality. In particular, we implement fixed effect regressions to control for potential omitted variables, and also implement an instrumental variable approach as a robustness check. We draw on the employment to population ratio and male labor force participation as an instrumental variable. Both the fixed effects and IV estimates indicate that causality runs from female empowerment to gender obesity gaps and suggest robust evidence of an effect of female labour market participation (female MPs in national parliament and alternative measures of female empowerment) which decreases gender obesity gaps by 0.2 (0.09) percentage points in the MENA region. The effects are mainly explained by rising obesity rates among men once the female employment rate increases.

Section 2 of this paper summarizes the previous literature relevant to our analysis of gender obesity gaps, as well as gender-specific factors which may influence such gaps. In sections 3 and 4 we discuss our data sources and methods. Next, section 5 presents three stylized facts on gender-based differences on overweight and obesity in the MENA region, and describes a phenomenon which we determine the region's "gender obesity gap". Then, sections 6 investigates a number of possible explanations of these patterns and also presents a number of robustness checks. A final section concludes.

2. Related Literature

Overweight and obesity arise when an individual's caloric intake is higher than their caloric expenditure (Cutler, Glaeser, and Shapiro 2003; Lakdawalla and Philipson 2009). The underlying factors for such an imbalance can be structural or the results of individuals choices and lifestyles. Over recent years, changing lifestyles have intensified these caloric imbalances. On the one hand, the share of individuals engaging in physical labor has been declining and more people pursue sedentary activities for living. On the other hand, the daily intake of calories has increased in most high and middle income countries (Costa-Font and Mas 2016).

There are a number of explanations for the increased consumption of calories. Technological progress in both agriculture and industrial food processing has led to a decrease in the relative prices of food. Cutler et al. (2003) show that this led to an increase in the consumption of calories, particularly through more frequent meals and snacking. Another explanation is related to the improved labour market perspectives for women. This led to an increase in the opportunity cost for cooking and hence an increase in the consumption of industrially processed food, as well as restaurant meals including fast food. As the latter options often have a higher caloric density than home cooked food, this has also contributed to rising obesity levels (Chou, Grossman and Saffer 2004).

However, it is not immediately clear why any of these factors should affect women differently than men. Evidence from biology and the medical sciences suggests that the body mass of women on average contains a higher proportion of fat than the body mass of men (Power and Schulkin 2008). These biological factors can explain why women are more affected by obesity on average, but not why these gender gaps differ between world regions.

A literature review on gender-specific explanations of obesity by Kanter and Caballero (2012) point to the possibility of gender-specific changes to physical activity patterns over recent years. In some world regions, manual tasks that were traditionally carried out by women may have been automatized more quickly, leading to a decrease of physical activity among women. Other explanations relate to culture and body type preferences in different societies. In some cultures, female weight is associated with high social status, maternity and nurturing, leading to a preference for high body weight. Moreover, cultural or religious norms may restrict the possibility for females to exercise in public (ibid.).

On a more general level, there is evidence that female empowerment is conducive to wider political participation, employment and education, and health (Mahlotra et al, 2002, World Bank, 2011, Hindin, 2000). In theory, it is therefore well conceivable that empowerment also affects nutritional outcomes. More empowered women may e.g. be less affected by a social pressure to comply with certain body type preferences. Moreover, there may be indirect effects through employment (higher incomes among more empowered women) and education which can increase "nutritional literacy".

This is also confirmed by empirical evidence. Jones et al (2020) differentiate three domains of women's empowerment namely asset ownership, intrinsic agency (power within household), and instrumental agency (power to influence in household decision-making) and show that the latter two contribute women's nutritional status in East Africa. Other studies examining women empowerment status (draw on measures of decisions making, violence attitudes and experience) find evidence of an association with women's nutritional status (Yaya, 2020). Consistently, Kunto and Bras (2018, 2019) as well as Imai et al. (2014) provide a life course explanation showing that the empowerment of mothers also improves the nutritional status of their adolescent children, in particular for girls. Patel et al (2006) show that limited empowerment is the main predictor of poor health among Indian women. Moreover, a growing body of evidence from psychology suggests that an individual's empowerment, by improving individual's agency and self-efficiency, eases the process of searching for solutions to health specific conditions such as diabetes which relate to individuals overweight and obesity (Wong *et al*, 2016; Nishita *et a*l, 2013). A study examining individuals with type II diabetes found evidence of a reduction of stress, systolic blood pressure and Body Mass Index (BMI) following empowerment interventions (Tucker et al, 2014). However, this intervention targeted both, men and women.

A recent paper by Atkin, Sihra and Shayo (2019) also underlines the importance of cultural and religious factors in shaping food consumption preferences. They show that changes in the status of a religious or ethnic group in a society have implications for both the degree to which members identify with this group, and the consumption of identity goods and adherence to consumption taboos (e.g. Hindus not consuming beef). Moreover, they find that conflict may increase the identification with one's own group and lead to a higher consumption of identity goods (e.g. Hindus consuming pork).

This paper contributes to the literature in the following way. First, we describe what we refer to as a "gender obesity gap" in the Middle East, namely a rising disparity in obesity rates between men and women. This pattern has not yet received any attention in the development and health literature so far. Therefore, we first provide a cross-country analysis of gender-based differences in obesity in the MENA region and worldwide to document such a phenomenon. Secondly, we contribute to the increasing literature on gender health gaps, and the macro-institutional determinants of health, especially empowerment theories which suggest that expanding individual agency exerts an effect on individual's health. Third, we investigate on a number of explanations for the gender obesity gap, particularly drawing on literature on women empowerment. In particular, we assess to what extent the economic and political participation of women (measured by female labour market participation and the share of female MPs in national parliaments) can explain gender obesity gaps. Finally, we investigate on the channels through which empowerment influences gender obesity gaps, and particularly the underlying changes to male and female obesity rates.

3. Data

We use country-level panel data on BMI, overweight and obesity from the World Health Organisation's (WHO) Global Health Observatory. This dataset contains complete information on nutritional outcomes by sex for 190 countries worldwide, out of them 17 countries in the Middle East, over a time span of 41 years (1975-2016).

This data has been merged with two different female empowerment measures that have been obtained from the World Bank Open Data database: the percentage of women in a country's labour force as a measure of female labour market participation, and the share of female MPs in national parliaments as a measure of women's political participation. These variables are used as the primary measures of female empowerment in our analysis, given that they have been consistently recorded for a large number of countries (176) and over a long time period (1990-2016). This large number of more than 4,000 observations gives us the necessary statistical power to investigate on the heterogeneities between MENA and other world regions, and to add a larger number of control variables.

While we acknowledge that these indicators do not reflect all dimensions of female empowerment, they are able to capture at least economic and political participation. As a robustness check, we use the more comprehensive UNDP's Gender Development Index as a measure of female empowerment. In the time period between 1990 and 2010, this index is only available in 5 year-intervals, leading a smaller sample size and therefore less precise estimates of the regression coefficients (see below).

Moreover, we draw on the *World Bank Open Data* database for constructing control variables on the socioeconomic situation of all countries, as well as the demographic composition of their populations. The World Bank data has more gaps and for some countries a number of variables are not available at all. We use linear interpolation in order to fill data gaps between two available data points for the control variables.

Overall this provides us with 4,423 observations from 181 countries for which we have data on nutritional outcomes, GDP per capita and the country's demographic composition (dummy variables for the share of different age-groups in the total population) , female labour market participation and the share of female MPs in national parliaments. For 3,183 observations we also have additional control variables such as unemployment, the size of the services sector, and the country's total fertility rate.

4. Methods

We run fixed effects regressions in order to assess the associations between obesity and overweight and two measures of female empowerment, namely a.) female labour market participation, and b.) the share of female MPs in national parliaments. In all regression models we interact the main independent variable, e.g. female employment, with a MENA region dummy variable. This allows us to disentangle the worldwide association between the independent variable and gender-obesity differences, from the region-specific association in the Middle East. The regression models take the form

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta_2 \, MENA_i + \beta_3 \, (X_{it} \, x \, MENA_i) + \gamma \, W_{it} + \vartheta_i + \varepsilon_{it}$$

where Y_{it} is a nutritional outcome for country i at time t (either the gender obesity gap, or female or male obesity), X_{it} is our independent variable (i.e. a measure of female labour market participation, or of women empowerment), $MENA_i$ is a binary variable indicating whether the country is part of the MENA region (this dummy is dropped in all fixed effect models due to de-meaning), W_{it} is a vector of control variables, ϑ_i is a country-specific fixed effect, and ε_{it} is a serially uncorrelated random error term. Our main parameters of interest are β_1 and β_3. β_1 measures the association between a certain female empowerment measure and gender-obesity differences worldwide, while β_3 measures the same association for the MENA region in particular.

Fixed effect models allow us to control for time-invariant unobservable factors, but not for unobservables which can change over time. For this reason, we also run instrumental variable regressions as a robustness check. In particular, we use two different instrumental variables: the overall employment to population ratio (defined as $\frac{Employed\ population}{Total\ population}$) and the labour market participation rate of males (defined as $\frac{male\ labour\ force}{male\ population\ aged\ 15-64}$). For an IV to be valid, it may not only affect the outcome of interest through the treatment (exclusion restriction). While both instruments are strong predictors of female labour force participation (strong first stage / Staiger criterion), we assume that they do not have any direct effect on gender obesity gaps, at least after controlling for GDP per capita, unemployment, total fertility, etc.

This strategy allows us to control for a number of potentially omitted factors, such as differences in the prevalence of chronic diseases between men and women which may affect both labour market outcomes and obesity (see e.g. Zhang, Zhao & Harris 2009, Di Cesare et al. 2016, Field et al. 2001). Moreover, it helps us to address concerns about reverse causality, given that obese individuals are less likely to participate in the labour market (Greve 2008, Johannson et al. 2009), implying that in countries with high female obesity rates, female labour market participation would also be lower. The model instruments both the main effects and the interactions (instrumented by the interaction of the instrument times the middle Eastern Interaction).

5. Stylized facts

Descriptive evidence reveals that there is indeed a negative correlation between our measures of female empowerment and gender obesity gaps. More specifically, Figure 1 shows evidence suggestive that higher levels of female male labour market participation negatively correlate with gender obesity gaps. Similarly, Figure 2 shows a negative correlation between the share of female MPs in national parliament and gender differences in obesity.

[Insert Figure 1 and 2 about here]

Figures 3 and 4 illustrate the development of gender-based inequalities in different world regions[3]. Three main conclusions can be drawn from these graphs. First, the worldwide prevalence of obesity among women is on average 4 percentage points higher than the prevalence of obesity among men. This difference has remained constant over a long time period, in spite of substantial overall increases in overweight/obesity. The results are consistent with some structural factors driving the association.

[3] We are using the WHO classification of world regions for all graphs presented in this section. For details, see: https://www.who.int/healthinfo/global_burden_disease/definition_regions/en/

Second, the constant world average masks important regional differences in the development of gender-based obesity differences. There are two world regions where obesity among women has grown much faster than obesity among men: sub-Sahara Africa and the MENA region. In the remainder of this paper we describe this pattern as the growing “gender obesity gap”. In the MENA region, gender-based differences in obesity had already surpassed the world average at the beginning of our data series in 1975 (6.4 percentage points). Since then, the gender obesity gap has grown rapidly over the 1980s and 1990s, reaching 9.6 percentage points in the year 2000. This growth also continued between the year 2000 and 2016, although at a slower pace reaching 10.3 percentage points in 2016. In sub-Sahara Africa, gender obesity gaps were still below the world average in 1975, but since then have been growing even more rapidly than in the MENA region, reaching 9.6 percentage points in 2016.

On the other hand, gender-based differences in obesity in Europe have steadily decreased over our period of interest, from 6.4 percentage points in 1975 to 2.6 percentage points in Europe. Lastly, in the Americas, Southeast Asia, and the Western Pacific region, gender obesity gaps have remained fairly constant over time.

[Insert Figure 3 about here]

Third, it is important to note that even male obesity in the MENA region grew more rapidly than the world average over the study period. This implies that the growing gender obesity gaps cannot be explained by constant or decreasing male obesity rates, but by an extraordinarily rapid increase in female obesity. This is also confirmed by Figure 3 which summarizes female obesity trends by WHO world region. It shows that today the Middle East is the region with the second highest female obesity rate worldwide, only surpassed by the Americas. Figure 4 reports the overall change in obesity prevalence in different world regions between 1975 and 2016. Although obesity in the American region was still higher than the MENA region in 2016, we document that the MENA regions exhibits the largest change in obesity (92% change compared to 53% in the American region).

[Insert Figure 4 about here]

6. Explaining the gender obesity gap

6.1 Fixed Effects estimates

Table 1 presents Fixed Effects (FE) estimates which report how the two measures of female empowerment (female labor market and the share of female MPs in the national parliaments) predict gender obesity gaps across countries. The left panel of the table (columns 1-3) suggests that female employment worldwide does not have an impact on gender-based obesity differences, after including country-level fixed effects and controlling for a number of country characteristics. In contrast, we find that, it does reduce the gender obesity gap in the MENA region. The estimates show that a 1 percentage point increase in female employment in the MENA region is associated with an average decrease of 0.22 to 0.29 percentage points in the gender obesity gap. While this effect size is quite large, it would still be very difficult to eliminate the gender obesity gap through increased employment alone. Assuming a linear relationship, an increase in the female labor force participation rate by 40 percentage points would eliminate the gender obesity gap, an increase by 25 percentage points in the labor force participation rate of women could bring the gender obesity gap down to the worldwide average of 4 percentage points (the cross-country average of female labor market participation in the MENA region amounts to 27 percent in 2016). This suggests that other factors which are unrelated to female employment or empowerment have also contributed to the existing gender obesity gap.

[Insert Table 1 about here]

The right panel of the table (columns 4-6) illustrates that female representation in parliament is associated with a higher gender obesity gap worldwide, but with a lower gender obesity gap in the MENA region. The coefficients for the MENA region range between 0.085 and 0.0986, implying that a one percentage point increase in the share of female MPs predicts a 0.09 percentage point decrease in the gender obesity gap. We interpret this as a rather small coefficient, in particular compared to the coefficients on female employment. The numbers suggest that, all else equal, an increase in the share of female MPs by 65-67 percentage points would be needed in order to reduce the MENA regions's gender obesity gap to the world average.

However, it is important to note that both the political representation of women and female employment, two measures of female empowerment do predict lower gender obesity gaps consistently with the predictions of empowerment theory. These results are consistent with studies that suggest an association between measures of gender inequality and obesity.

6.2 Channels

As a next step, we present evidence on the potential channels which affect the gender obesity gap, in particular whether the associations between female employment, female MPs and the gender obesity gap are driven by changes in male or to female obesity. Table 2 illustrates that the negative association between female employment and the gender obesity gap, is mainly to be explained by rising obesity rates among men once the female employment rate increases. Female obesity in turn is by and large unaffected by female employment.

A stronger representation of women in national parliaments is associated with both higher obesity rates among men and women. However, the growth in male obesity rates in response to female representation is stronger than for women, explaining the overall negative association between gender obesity gaps and female MPs in the MENA region. We show that both measures of empowerment have different effects on gender gaps in the Middle East than elsewhere. In the Middle East it seems that female employment increases male obesity and has no effect on obesity among women (negative but insignificant coefficient). Similarly, a larger share of female MPs increases obesity in men almost three times that of women.

[Insert table 2 about here]

6.3 Heterogeneity: Arab Spring

One potential variation in the effect of empowerment comes from shocks that increase the instability of the MENA region countries. The Arab Spring stands as a shock which influenced by social norms along the lines of traditional values amidst the temporary election of the Muslim brotherhood 2012-2013 (Gallup, 2019) which we argue it exerted an impact of health behaviours, and overweight. Weight gain can respond to psychological pain and psychological and emotional traumas insofar as food is one of the easiest means for humans to escape traumas. Consistently, table 3 presents the results of regressions with triple interaction terms of our independent variables with both a MENA dummy and a post-Arab-Spring dummy. These results illustrate that after the Arab Spring the negative association between female labour market participation and gender obesity differences have become even stronger. On the other hand, the association between female representation in national parliaments and the gender obesity gap has not been affected by the Arab spring.

[Insert Table 3 about here]

6.4 Robustness Checks

The measures of female empowerment presented above mainly reflect economic and political empowerment but may neglect other dimensions. We therefore investigate whether our results are consistent if a composite measure of woman empowerment is used. As discussed above, the main drawback of these composite measures is that they are not available for as many countries and/or time periods as our primary measures. Table 5 presents both fixed and random effect regressions, where empowerment is measured by the UNDP's Gender Development Index (GDI). This index is available in five-year intervals during our period of interest (1990-2016). The results of these regressions largely confirm our initial results, namely a negative correlation between women empowerment and gender obesity gaps. It should be acknowledged that in the specification with the full set of control variables, this association loses its statistical significance. However, we interpret this as a consequence of the lower statistical power in these models with less than a third of the original sample size, rather than as an inconsistency with the original results.

[Insert Table 4 about here]

Another concern might be a possible collinear relationship between female employment and the share of female MPs in national parliaments. In order to investigate on this concern, we run the same regressions as presented in Table 1 but including the share of female MPs as a control variable in the regressions where female employment is the main explanatory variable, and vice versa. The results of these regressions are presented in Table A2 in the appendix. The coefficients of the interaction between female employment and MENA only decrease slightly, from 0.25-0.29 to 0.22 to 0.28, suggesting that adding other measures of empowerment makes little effect on the overall effect. The coefficients on the share of female MPs in national parliaments is virtually unaffected when estimated together with measures of female labour market participation. We conclude that the results presented above are not driven by collinearity between the two explanatory variables of interest. Furthermore, they indicate that our estimates are robust measure of female empowerment.

Given that as discussed, there is a potential reverse causality and omitted variable bias, one ought to be cautious in interpreting the results are causal. Table 5 presents our IV- 2SLS estimates of different measures of female empowerment and obesity gaps. More specifically, columns 1-3 present the results drawing on the employment-to-population ratio as an instrumental variable, while columns 4-6 present the results drawing on both the employment-to-population ratio and the male labour force participation rate as instruments.

[Insert Table 5 about here]

The upper panel of the table presents the first stage estimates and test statistics on the relevance of the instruments. Given that we have two endogenous variables (female employment and (MENA x female employment), we are presenting both the Sanderson & Windmeijer F-Stats for the significance of each of the instruments, as well as the Kleibergen-Papp statistic for the joint significance of both instruments. These F-Stats show that all equations are strongly identified.

The lower panel of Table 5 presents the IV estimates on female employment and gender obesity gaps. Consistently, these IV estimates confirm the findings obtained through the random regression results. The coefficients on the interaction term of female employment and MENA region drop only slightly, now amounting to 0.20 to 0.27 (as compared to 0.25-0.29 in the RE regressions). All these results are still statistically significant at the 1% level and suggest that even when potential bias is accounted for, the effect of female empowerment is robust.

Lastly, we also present random effect estimates, instead of fixed effect estimates in table A1 in the appendix. The advantage of these random effect estimations is that they allow us to investigate on the effect of time-invariant covariates.

7. Conclusion

This paper studies the effect of female empowerment on gender gaps in obesity with a special focus on the MENA region. Drawing on fixed effect estimates, we document a robust negative effect of gender empowerment on gender obesity gaps in the MENA region. This suggests that increasing female agency in several domains including employment, political and household decision making may lower gender obesity gaps.

It is important to note that the worldwide association between women empowerment and gender obesity differences is entirely driven by the MENA region. Once the MENA region is partialled out, the worldwide association between empowerment and obesity disappears. These results are robust to the inclusion of fixed effects, as well as controls for time-varying country characteristics. In particular, we document that a one percentage point increase in female labour market participation in the MENA region reduces gender gaps in obesity by 0.2 percentage points. Similarly, an increase in the share of female MPs by one percentage point in the region reduces gender gaps by 0.09pp.

While our results indicate that female empowerment can reduce gender obesity gaps on average, it is important to note that this reduction can mainly be explained by an increase in obesity among men, rather than a decrease in obesity among women. This finding is largely unexpected and merits further investigation.

Based on our initial findings around gender obesity gaps, we outline a number of extensions. First, it would be important to establish whether the cross-country relationships which we have documented in this paper, also hold at the individual or household level. Secondly, based on our results, it would be important to test whether empowerment also influences gender gaps in other measures of health, such as diabetes, hypertension and other diseases which correlate with obesity. Similarly, it seems important to document to what extent differences in empowerment result in differences in stress, and more specifically mental conditions. Third, additional evidence on causality based on microdata will also be essential for a better understanding of gender obesity gaps.

Our results can be interpreted as revealing that progress in the empowerment of women in different domains such as the labour market, politics and the household can reduce gender-based health inequities in obesity. At the same time, it is important to note that the main driver of this effect has not been a decrease in obesity among women, but rather an increase among men. Overall, our findings illustrate that gender equality may give rise to returns beyond observable measures, such as income or employment, but also to less tangible measures such as health and nutrition.

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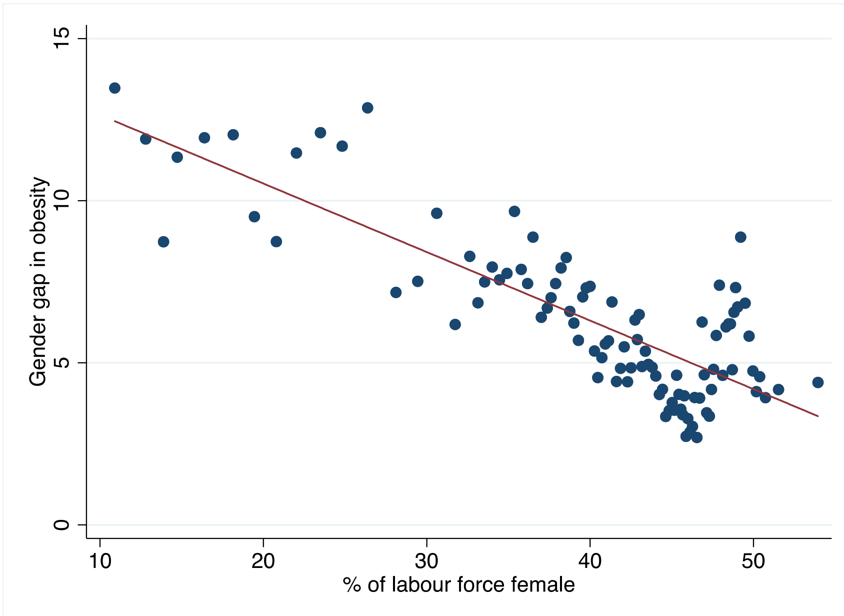
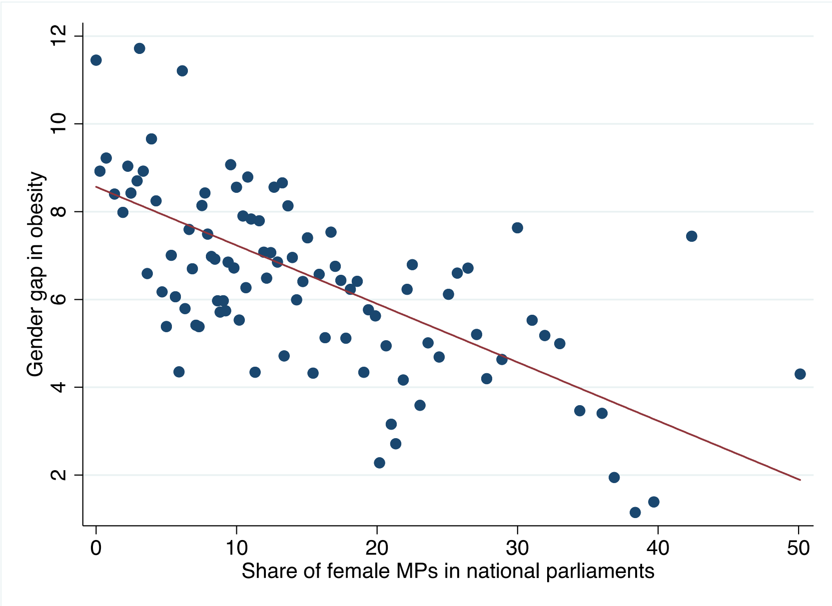
Figures and Tables

Figure 1: Gender obesity gaps and female labour force participation



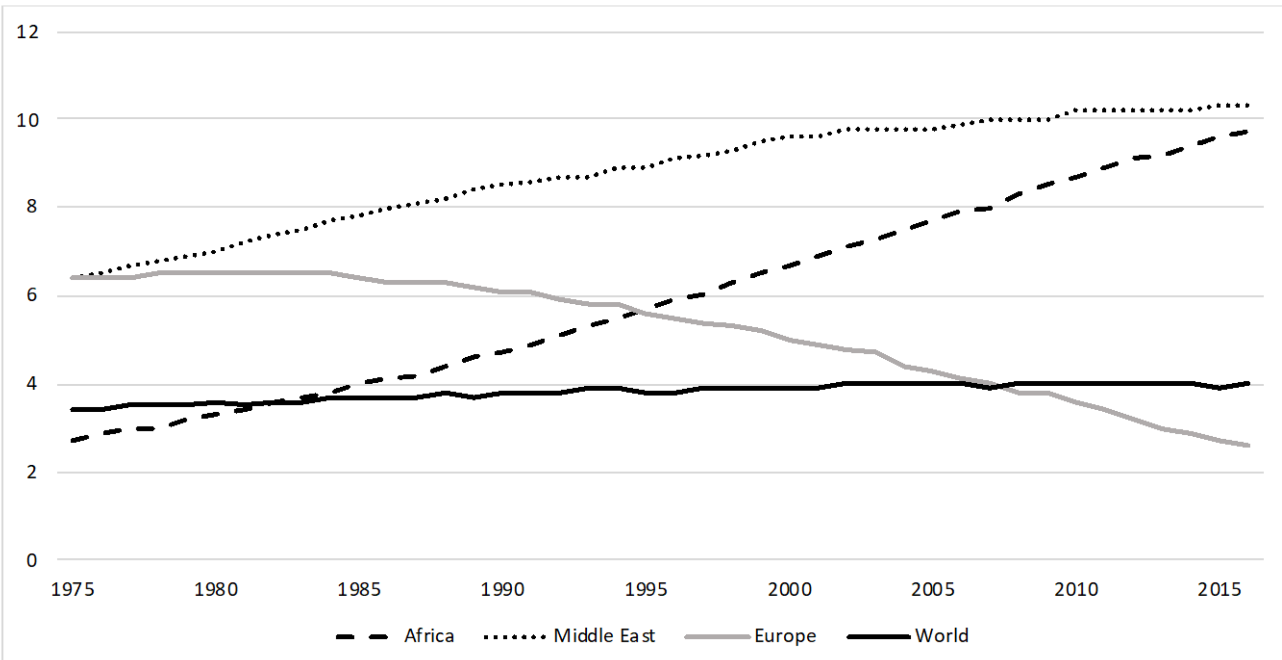
Note: This figure displays the correlation between country specific differences in obesity across genders and the proportion of women in the labour force. The figure is own elaboration based on WHO data 1975-2015. Bin scatter plot (n=100).

Figure 2: Gender obesity gaps and share of female MPs in national parliaments



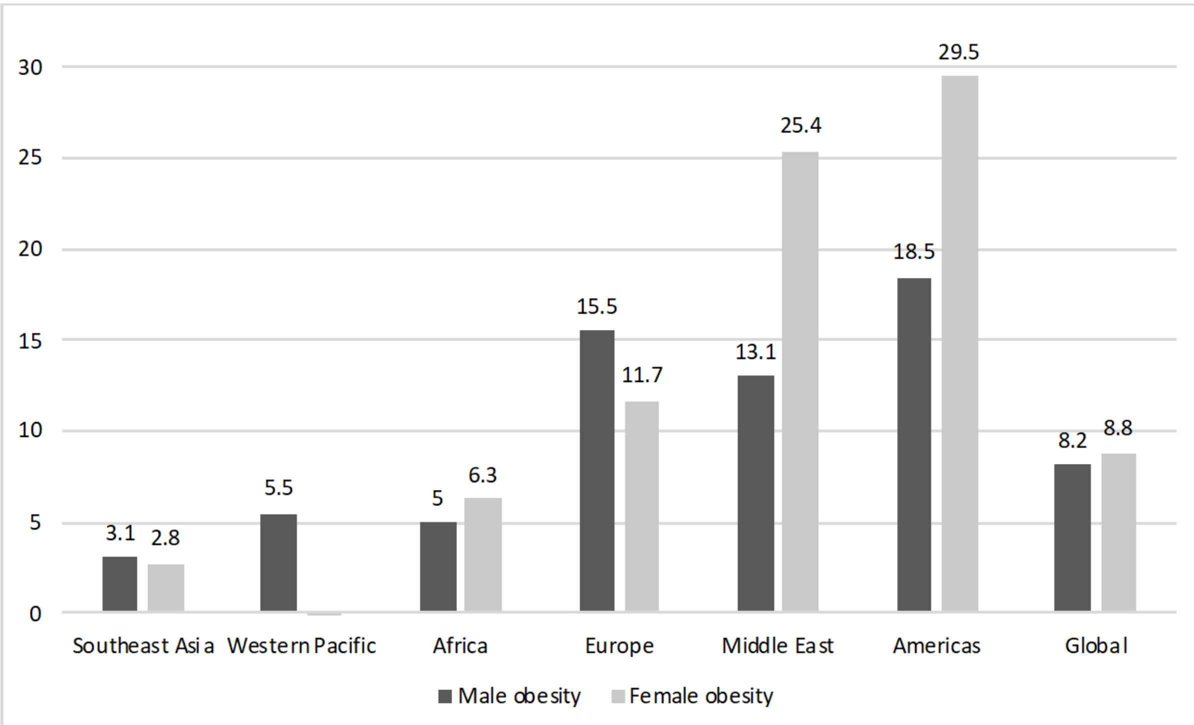
Note: This figure displays the correlation between country specific differences in obesity across genders and the proportion of female members of parliament (MP) in national parliments. The figure is own elaboration based on WHO data 1975-2015. Bin scatter plot (n=100).

Figure 3: Gender obesity gaps for selected world regions over time (% point differences between women-men)



Note: This figure displays the differences in obesity across genders across different world regions. The figure is own elaboration based on WHO data 1975-2015. Bin scatter plot (n=100).

Figure 4: Growth in male vs. female obesity across world regions (1975-2016, in percentage points)



Note: This figure displays the obesity rates across genders across different world regions in 1975 and 2016. The figure is own elaboration based on WHO data 1975-2015. Bin scatter plot (n=100).

Table 1: Gender obesity gaps and female empowerment (Fixed effects estimates)

	(1)	(2)	(3)		(4)	(5)	(6)
	Gender obesity gap				**Gender obesity gap**		
Female labour force participation	-0.0109	0.0282	0.0223	Percentage of female MPs in national parliaments	0.0256***	0.0239***	0.00383
	(0.0204)	(0.0190)	(0.0227)		(0.00924)	(0.00877)	(0.00862)
Female labour force participation x MENA	-0.297***	-0.282***	-0.243**	Percentage of female MPs x MENA	-0.0939**	-0.0980**	-0.0871**
	(0.0698)	(0.0696)	(0.1000)		(0.0398)	(0.0415)	(0.0420)
GDP per capita		-0.000142***	-0.000172***	GDP per capita		-9.95e-05*	-0.000154***
		(4.86e-05)	(4.40e-05)			(5.34e-05)	(4.70e-05)
(GDP per capita)^2		3.19e-10	5.61e-10	(GDP per capita)^2		0	5.33e-10
		(3.50e-10)	(3.42e-10)			(4.15e-10)	(3.61e-10)
Size of services sector (% of GDP)			-0.0150	Size of services sector (% of GDP)			-0.0135
			(0.0111)				(0.0112)
Unemployment rate			-0.0654***	Unemployment rate			-0.0667***
			(0.0196)				(0.0197)
Total Fertility Rate			-1.547***	Total Fertility Rate			-1.692***
			(0.357)				(0.338)
Linear and quadratic trend	x	x	x		x	x	x
Controls for demographic composition	x	x	x		x	x	x
Observations	4,747	4,482	3,326		4,747	4,482	3,326
Number of countries	176	172	161		176	172	161

Note: Cluster-robust standard errors (country-level) in parentheses. *** denotes statistical significance at the 10% level, ** significance at the 5% level, and * significance at the 1% level

Table 1: Gender obesity gaps and female empowerment (Fixed effects estimates)

	(1)	(2)	(3)		(4)	(5)	(6)
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	(0.0204)	(0.0190)	(0.0227)		(0.00924)	(0.00877)	(0.00862)
Female labour force participation x MENA	-0.297***	-0.282***	-0.243**	Percentage of female MPs x MENA	-0.0939**	-0.0980**	-0.0871**
	(0.0698)	(0.0696)	(0.1000)		(0.0398)	(0.0415)	(0.0420)
GDP per capita		-0.00014***	-0.000172***	GDP per capita		-9.95e-5*	-0.000154***
		(4.86e-05)	(4.40e-05)			(5.34e-05)	(4.70e-05)
(GDP per capita)2		3.19e-10	5.61e-10	(GDP per capita)^2		0	5.33e-10
		(3.50e-10)	(3.42e-10)			(4.15e-10)	(3.61e-10)
Size of services sector (% of GDP)			-0.0150	Size of services sector (% of GDP)			-0.0135
			(0.0111)				(0.0112)
Unemployment rate			-0.0654***	Unemployment rate			-0.0667***
			(0.0196)				(0.0197)
Total Fertility Rate			-1.547***	Total Fertility Rate			-1.692***
			(0.357)				(0.338)
Linear and quadratic trend	x	x	x		x	x	x
Controls for demographic composition	x	x	x		x	x	x
Observations	4,747	4,482	3,326		4,747	4,482	3,326
Number of countries	176	172	161		176	172	161

Note: Cluster-robust standard errors (country-level) in parentheses. *** denotes statistical significance at the 10% level, ** significance at the 5% level, and * significance at the 1% level

Table 2 - Channels: Are the findings driven by changes to female obesity, male obesity, or both?

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable: female labour force participation	**Female obesity**			**Male obesity**		
Female labour force participation	0.0525**	0.0678**	0.0518**	0.0634**	0.0396	0.0295
	(0.0259)	(0.0273)	(0.0241)	(0.0276)	(0.0266)	(0.0238)
Female labour force part. x MENA	-0.115**	-0.0566	-0.0737	0.182*	0.226**	0.170
	(0.0528)	(0.0674)	(0.0773)	(0.100)	(0.102)	(0.113)
Independent variable: percentage of female MPs in national parliaments	**Female obesity**			**Male obesity**		
Percentage of female MPs	-0.0131	-0.0130	-0.00576	-0.0387***	-0.0369***	-0.00959
	(0.0123)	(0.0123)	(0.0113)	(0.0134)	(0.0135)	(0.0109)
Percentage of female MPs x MENA	0.0836***	0.0791**	0.0736*	0.177***	0.177***	0.161***
	(0.0304)	(0.0321)	(0.0398)	(0.0297)	(0.0292)	(0.0319)

Note: The table presents the coefficients from three different fixed effects regression specifications, using female and male obesity as outcomes instead of gender gaps. Control variables across specifications are analogous to tables 1 and 2. Standard errors are clustered at the country-level.

Table 3 - Heterogeneity: Changes after the Arab Spring (fixed effects estimates)

	(1)	(2)	(3)		(4)	(5)	(6)
	Gender obesity gap				**Gender obesity gap**		
Female labour force participation	-0.0126	0.0276	0.0212	Percentage of female MPs in national parliaments	0.0255***	0.0238***	0.00378
	(0.0203)	(0.0188)	(0.0225)		(0.00927)	(0.00879)	(0.00865)
Female labour force participation x MENA	-0.233***	-0.235***	-0.201**	Percentage of female MPs in national parliaments x MENA	-0.0940**	-0.0990**	-0.0911**
	(0.0705)	(0.0768)	(0.100)		(0.0372)	(0.0434)	(0.0442)
Female labour force part. x MENA x post-Arab spring	-0.0101	-0.0954*	-0.0451	Percentage of female MPs x MENA x post-Arab spring	0.000708	0.00247	0.0196
	(0.0634)	(0.0558)	(0.0636)		(0.0162)	(0.0175)	(0.0166)
Post Arab spring (dummy)	-0.0381***	-0.0253**	-0.0312*	Post Arab spring (dummy)	-0.0468	-0.0865*	-0.0965*
	(0.0133)	(0.0125)	(0.0161)		(0.0485)	(0.0473)	(0.0579)

Note: The results in this table are bassed on separate regressions with either female labour force participation or percentage of female MPs as independent variables. Control variables across specifications are analogous to tables 1 and 2. Standard errors are clustered by country.

Table 4: Gender obesity gaps and the Gender Development Index (robustness check)

	(1)	(2)	(3)	(4)	(5)	(6)
	RE estimates			**FE estimates**		
Gender Development Index (GDI)	5.052	4.367	7.140*	4.400	3.472	4.735
	(3.852)	(3.205)	(3.984)	(3.559)	(2.567)	(4.248)
GDI * MENA	-14.52**	-8.042	-5.623	-14.7**	-9.21*	-7.17
	(6.812)	(5.530)	(6.535)	(6.840)	(5.376)	(7.208)
MENA	17.17***	14.74***	12.92**	-	-	-
	(6.070)	(4.990)	(5.634)			
GDP per capita		-0.000133***	-0.000142***		-0.000163***	-0.000168***
		(3.79e-05)	(4.28e-05)		(4.35e-05)	(5.04e-05)
(GDP per capita)2		1.21e-10	3.44e-10		2.64e-10	4.85e-10
		(2.45e-10)	(3.32e-10)		(2.70e-10)	(3.58e-10)
Size of services sector (% of GDP)			-0.0201			-0.0273**
			(0.0123)			(0.0125)
Unemployment rate			-0.0410**			-0.0515**
			(0.0204)			(0.0210)
Total Fertility Rate			-1.548***			-1.625***
			(0.318)			(0.428)
Linear and quadratic trend	x	x	x	x	x	x
Controls for demographic composition	x	x	x	x	x	x
Observations	1,498	1,472	1,190	1,498	1,472	1,190
Number of countries	159	157	148	159	157	148

Note: Cluster-robust standard errors (country-level) in parentheses. *** denotes statistical significance at the 10% level, ** significance at the 5% level, and * significance at the 1% level

Table 5: Gender obesity gaps and female employment (IV estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
First stage	**IV: Employment to population ratio**			**IV: Male labour force participation & employment to population ratio**		
Employment to population ratio	0.668***	0.622***	0.808***	0.531***	0.475***	0.843***
	(0.066)	(0.0707)	(0.0794)	(0.0962)	(0.0964)	(0.1136)
Employment to population ratio x MENA	0.924***	0.906***	0.963***	0.953***	0.935***	1.024***
	(0.1175)	(0.174)	(0.193)	(0.131)	(0.175)	(0.223)
Male labour force participation				0.314*	0.353**	-0.0443
				(0.1757)	(0.1803)	(0.130)
Male labour force participation x MENA				-0.0625	-0.0842	-0.1313
				(0.1569)	(0.1756)	(0.207)
Sanderson & Windmeijer F-Stat (female employment)	109.78	87.21	106.03	51.18	37.89	36.16
Sanderson & Windmeijer F-Stat (female employment x MENA)	128.13	79.47	83.91	45.59	30.61	33.33
Weak identification test: Kleibergen-Papp Wald F-Statistic	53.2	40.11	54.18	37.8	27.55	28.12
2SLS estimates	**Gender obesity gap**					
Female labour force participation	0.00926	0.0567*	0.0222	-0.0167	0.0108	0.0267
	(0.0269)	(0.0326)	(0.0279)	(0.0238)	(0.0260)	(0.0277)
Female labour force participation x MENA	-0.274***	-0.241***	-0.204**	-0.265***	-0.230***	-0.220***
	(0.0860)	(0.0754)	(0.0852)	(0.0888)	(0.0804)	(0.0847)
MENA	11.34***	15.07***	13.93***	10.37***	13.21***	14.48***
	(2.702)	(3.152)	(3.377)	(2.745)	(3.096)	(3.388)
GDP per capita		-0.0001***	-0.0002***		-0.0001***	-0.0002***
		(4.93e-05)	(4.40e-05)		(4.78e-05)	(4.39e-05)
(GDP per capita)2		2.67e-10	7.78e-10**		2.41e-10	7.82e-10**
		(3.38e-10)	(3.57e-10)		(3.35e-10)	(3.57e-10)
Size of services sector (% of GDP)			-0.00983			-0.00954
			(0.0113)			(0.0113)
Unemployment rate			-0.0576***			-0.0580***
			(0.0196)			(0.0195)
Linear and quadratic trend	x	x	x	x	x	x
Controls for demographic composition	x	x	x	x	x	x
Observations	4,571	4,332	3,257	4,571	4,332	3,257
Number of countries	176	172	161	176	172	161

Note: Standard errors are clustered at the country level. Following Stock and Yogo (2005), the critical value for the Kleibergen-Papp statistic in an IV regression with two endogeneous variables and two instruments is 7.03 (H0: equation is weakly identified), for four instruments it is 16.87.

Appendix

Graph A1: Male and female obesity by world region – 1975 vs. 2016

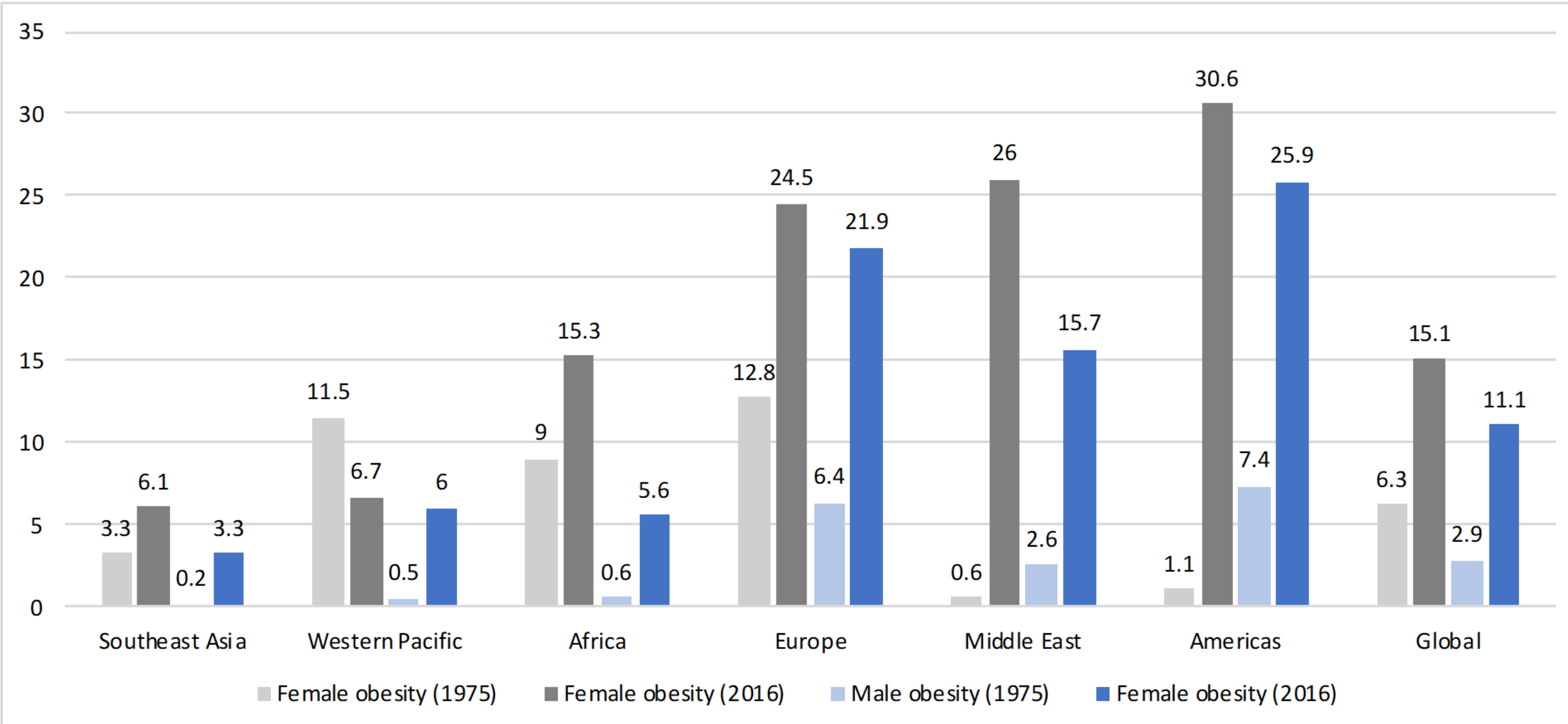

Table A1: Gender obesity gaps and female employment (Random effects estimates)

	(1)	(2)	(3)		(4)	(5)	(6)
	Gender obesity gap				**Gender obesity gap**		
Female labour force participation	-0.0153	0.0205	0.0160	Percentage of female MPs in national parliaments	0.0256***	0.0240***	0.00398
	(0.0192)	(0.0182)	(0.0210)		(0.00922)	(0.00877)	(0.00860)
Female labour force participation x MENA	-0.29***	-0.271***	-0.217**	Percentage of female MPs x MENA	-0.0930**	-0.0986**	-0.0855**
	(0.0677)	(0.0686)	(0.0970)		(0.0396)	(0.0416)	(0.0418)
MENA	10.97***	14.48***	14.12***	MENA	5.005***	7.544***	8.297***
	(2.305)	(2.785)	(3.441)		(0.880)	(1.200)	(1.155)
GDP per capita		-0.0001***	-0.000155***	GDP per capita		-9.42e-5*	-0.00015***
		(4.65e-05)	(4.14e-05)			(5.15e-05)	(4.45e-05)
(GDP per capita)2		2.72e-10	4.74e-10	(GDP per capita)2		-0	4.70e-10
		(3.37e-10)	(3.31e-10)			(4.02e-10)	(3.53e-10)
Size of services sector (% of GDP)			-0.0119	Size of services sector (% of GDP)			-0.0106
			(0.0111)				(0.0112)
Unemployment rate			-0.0607***	Unemployment rate			-0.0618***
			(0.0196)				(0.0197)
Total fertility rate			-1.654***	Total fertility rate			-1.689***
			(0.295)				(0.283)
Linear and quadratic trend	x	x	x		x	x	x
Controls for demographic composition	x	x	x		x	x	x
Observations	4,747	4,482	3,326		4,747	4,482	3,326
Number of countries	176	172	161		176	172	161

Note: Cluster-robust standard errors (country-level) in parentheses. *** denotes statistical significance at the 10% level, ** significance at the 5% level, and * significance at the 1% level

Table A2: Robustness check - partial effects holding employment / political representation of women constant

	(1)	(2)	(3)	(4)	(5)	(6)
	Gender obesity gap			**Gender obesity gap**		
Female labour force participation	-0.0140	0.0270	0.0291	-0.0314	0.00915	0.0121
	(0.0203)	(0.0191)	(0.0217)	(0.0194)	(0.0193)	(0.0220)
Percentage of female MPs	0.0224**	0.0167*	0.000248	0.0272***	0.0219**	0.00382
	(0.00911)	(0.00853)	(0.00827)	(0.00947)	(0.00895)	(0.00867)
Female labour force part. x MENA	-0.230***	-0.297***	-0.236**			
	(0.0804)	(0.0873)	(0.101)			
Percentage of female MPs x MENA				-0.0877**	-0.0902**	-0.0842**
				(0.0384)	(0.0418)	(0.0423)
GDP per capita		-0.000129**	-0.000162***		-0.000116**	-0.000159***
		(5.74e-05)	(4.62e-05)		(5.57e-05)	(4.62e-05)
(GDP per capita)^2		2.33e-10	5.64e-10		1.04e-10	5.55e-10
		(4.41e-10)	(3.57e-10)		(4.25e-10)	(3.50e-10)
Size of services sector (% of GDP)			-0.0658***			-0.0676***
			(0.0196)			(0.0200)
Unemployment rate			-0.0143			-0.0148
			(0.0115)			(0.0113)
Total Fertility Rate			-1.589***			-1.754***
			(0.330)			(0.346)
Linear and quadratic trend	x	x	x	x	x	x
Controls for demographic composition	x	x	x	x	x	x
Observations	4,302	4,137	3,138	4,302	4,137	3,138
Number of countries	176	172	159	176	172	159