Economic Development and The Motherhood Wage Penalty

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Abstract

Despite the growing importance of female employment worldwide, there have been limited efforts to explore the relationship between family size and female earnings in developing countries. Using data from 21 of these countries we find a sizable motherhood wage penalty. To address the endogeneity issues, we instrument for the number of children with infecundity shocks and show that the negative relationship is causal. A key finding is that the motherhood wage penalty is larger in middle-income countries compared to low-income ones. We uncover two possible explanations for this difference. First, the penalty declines with child age but in low-income countries adolescent children generate a *premium*. Second, employment type and occupational segregation account for very little of the family penalty in low-income countries but these variables explain around one-third of the penalty in middle-income countries.

Keywords: Female earnings, family size, family penalty, fertility, occupational segregation

JEL codes: J13, J22, J31.

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1. Introduction

Since the mid 1980s, over half a billion women have joined the world's labor force as paid work has increased in most developing countries (World Bank 2012). Women now represent nearly 40 percent of the employed population in these countries (World Bank 2017). Thus, identifying what facilitates or limits their earnings is an increasingly important question.

In this paper, we focus on the role of motherhood as a possible key constraint on women's earnings as a large body of literature from developed countries has found that children have a sizable negative impact on their mother's earnings (e.g. Davies and Pierre, 2005; Waldfogel, 1998). However, there have been limited efforts to explore the size and causes of motherhood penalties in the developing world and the evidence that exists is mixed, it is usually limited to a single country and in most cases, it has not addressed the endogeneity of fertility.[1] Thus, our paper seeks to addresses this important gap in the literature.[2]

[1] For example, Adair et al. (2002) find evidence of a negative impact of childbearing on women's cash earnings and work hours in the Philippines. Orbeta (2005) estimates the impact of children on labor force participation and earnings of parents in the Philippines. This paper finds a negative impact of children on women's labor force participation rates for the bottom three-income quintiles and a positive impact for the top two quintiles; in case of earnings, additional children have a regressive effect on women's earnings for the bottom two-income quintiles and a positive effect for the upper three quintiles. Olarte and Peña (2010) use Colombian data and find a wage gap of around nine percent and 18 percent for mothers with children aged five or less. Explaining the mechanism for this gap, they show that motherhood increases the probability of being employed in the informal market but only for those who have young children. Piras and Ripani (2005) consider a sample of salaried women in Latin America (Bolivia, Ecuador, Peru and Brazil) between the ages of 14 and 45 who reside in urban areas. Their results are mixed. In some countries, they find no relationship between children and log earnings, for Peru they find the expected negative relationship, in Brazil, mothers appear to earn more than non-mothers.

[2] A related topic that has received much academic attention in developing countries is the gender wage gap. For example, Appleton, Hoddinott and Krishna (1999) and Fafchamps et al (2009) have studied the gender wage gap in Africa; Psacharopoulos and Tzannatos (1992) and more recently Ñopo and Hoyos (2010) covered several Latin American countries. Horton (1996) collects several studies for Asian countries. Tzannatos (1998) and Ñopo, Daza and Ramos (2011) studied the gender gap in wages for several countries in all regions.

Arguably, the lack of convincing evidence on the size and causes of the motherhood wage penalty in the developing world can be attributed to the lack of standardized, reliable and representative earnings data across a large number of these countries. We compile a dataset of 55,522 working women representing 21 developing countries. To the best of our knowledge this is the most comprehensive investigation of the impact of children on women's earnings in these nations. We document a sizable family penalty among these countries.[3] Each additional child is associated with a 10 percent decrease in daily cash earnings, which falls to 3 percent after conditioning on location, education and marital status.

Furthermore, unlike most previous studies in less developed nations, we can test if the family penalty is causal. Specifically, following Agüero and Marks (2008, 2011), we use infertility/infecundity shocks as an instrument for family size and find no evidence that the family penalty is a byproduct of selection into larger families and therefore conclude that the penalty is causal.

Given our comprehensive sample of countries, we further contribute to the labor economics literature by testing whether the magnitude of the family penalty varies with the stages of economic development. We find robust evidence that the negative impact of an additional child on his/her mother's wage is much larger in middle-income than in low-income countries.

What accounts for the differential family penalty? Our data allow us to explore several mechanisms. First, a common explanation for the penalty is that women face reproductive and productive roles that compete against each other. Children, especially

[3] As our analysis focuses on the effect of the number of children and not just on the mothers vs. non-mothers comparison, we use these terms (motherhood and family penalty) interchangeably.

very young children, imply greater constraints on women's productive economic activity away from home. This results in less effort at work since mothers must devote time to child-rearing responsibilities and the reduced effort at work results in lowered earnings (Becker 1985). As children grow older, the time their mothers allocate to child-rearing decreases, which in turn allows for a better balance between work and family responsibilities.

We find support for this explanation. The family penalty is largest when a woman's child is young and declines with the child's age. However, in low-income countries we find that adolescent children provide a wage *premium* – consistent with substituting for their mothers in household tasks. We find no such wage premium for middle-income countries, which partially accounts for the difference in family penalty by stage of economic development.

As a corollary to the effort hypothesis, we investigate if the penalty differs by the gender of the child. A large development literature documents a difference in gender roles that become more pronounced as children get older, with daughters, but not sons, contributing to household and child-rearing tasks as they age. We find support for this as well. There is a significant gender difference in the impact of older children on their mother's earnings with older daughters having a more beneficial effect than sons on their mother's earnings. Altogether, this evidence is consistent with the change in social norms and policies regarding school attendance in such a way that children, especially daughters, assume fewer household responsibilities as countries develop.

Additionally, as countries develop, the nature of the labor market changes in a way that should increase the family penalty (Mammen and Paxson, 2000). The decline of

the agricultural sector and the rise of the service sector could affect the earnings of mothers if non-agricultural jobs provide less flexibility in terms of work hours and are conducted away from home. We show that the complexity of the labor market can account for part of the differential motherhood wage penalties by level of development. In particular, we find that self-employment, working from home, occupational segregation and seasonal work account for very little of the family penalty in low-income countries. However, these variables explain one-third of the family penalty for more developed countries. We conclude by discussing the implications of our findings for public policy.

2. Data and Econometric Model

A. Data and Construction of the Daily Earnings Measure

To document and understand the motherhood wage penalty in the developing world we use cross-sectional data from the third round of the Demographic and Health Surveys (DHS) collected between 1994 and 1999. The DHS are standardized nationally representative household surveys conducted in developing countries in which women between the ages of 15 and 49 provide information about their demographic traits, birth history, socio-economic and marital status, as well as their employment status, and occupation.

Relevant to our study, only the third round of DHS contain a unique set of additional standardized questions in the employment module. In the round, all women were asked if they work or have worked in the past 12 months. Any respondent that

answered in the affirmative was then asked if she was paid in cash for her employment.[4] Respondents were then asked a follow-up question about their frequency of pay period (e.g. hourly, daily, weekly, bi-weekly, monthly or annually) and how much they usually earn for their work per pay period. Thus, we have information on earnings of respondents who were working for cash at the time of the survey as well as earnings of those who were *not currently* working but who had worked for cash within the last twelve months.[5]

Depending on the stated pay period, the DHS also collects data on the intensity of work (e.g., days per week, months per year, and days in the last year). We use the information about intensity of work and pay period to impute *daily* earnings for all women in the sample.[6] Note that since we lack information on hours worked per day,

[4] One feature of the labor market in developing countries is the fact that some workers receive in-kind compensation for their labor. 24 percent of the working women in the DHS were paid in-kind and are excluded from our analysis. This aspect of the labor market varies by the stage of development. Only 12 percent of those in middle-income countries are paid in-kind, whereas the corresponding figure for low-income countries is 35 percent. The data provide no satisfactory way to impute the monetary compensation for these workers. However, as mothers are overrepresented among in-kind workers (25 percent compared to 16 percent for non-mothers), if in-kind work is less remunerative then our estimate of the motherhood wage penalty is a lower bound.

[5] Nine percent of the women in our estimation sample are not currently working but reported having worked sometime in the twelve months prior to survey. Given the ambiguity in the timing of work for those who only report working in the last twelve months, there is the potential for measurement error in the family size variable (since the family size information is recorded at the time of the survey). We have estimated all models where we only assign positive earnings to those women that are currently working. These estimates mirror the findings of our main analysis. For instance, we find that each additional child in a low-income country reduces earnings by 1.2 percent, which is identical to our estimate in the main analysis. For middle-income countries, we find that each additional child reduces earnings by 4.3 percent whereas the main analysis suggests that each child reduces earnings by 4.5 percent. We have also tried an alternative specification including a control for currently working in equation 2 to see if it explains any of the family gap. It does not.

[6] We restrict our sample to observations that provide sufficient information about earnings and the intensity of work. Specifically, we exclude 173 observations with missing earnings information, 322 women who reported cash earnings and a pay period above daily but provided no information about the intensity of work, and 28 women with a pay period above weekly and no information about the number of days or months worked per year. To compute daily earnings, we assumed workers who reported hourly pay worked 8 hours a day and that those who reported monthly pay worked 4.2 (=30/7) weeks a month. When not reported, we assumed workers that reported weekly pay worked 5.6 days a week (the sample average) and those that reported annual pay worked 250 days a year (the sample median). We include indicators for pay period in all regressions to mitigate the measurement error associated with the imputation of daily wages.

daily earnings are as narrow as we can define earnings.[7] However, we think that daily earnings are a more accurate reflection of the nature of pay in developing countries than hourly earnings. For example, while 12,997 women report that they are paid a daily wage only 82 women in our sample report being paid hourly. Daily earnings are expressed in constant 2006 US dollars by transforming them from local currency into US dollars, using the nominal exchange rates available from the International Financial Statistics of the International Monetary Fund, and then brought to 2006 prices using the US Consumer Price Index (from the Financial Statistics of the Federal Reserve Board).[8] To minimize measurement error, for each survey, we drop outliers whose real daily earnings belong to the lowest or highest percentile of the distribution.

We argue for the validity of our daily earnings variable in two ways. First, Young (2012) also uses the DHS earnings data in a paper that proposes alternative and more reliable measures of economic growth in Africa. As an indicator of the DHS quality, he finds that the estimated Mincerian returns to education using the DHS data are close to the ones observed from Labor Force Surveys for developing countries.

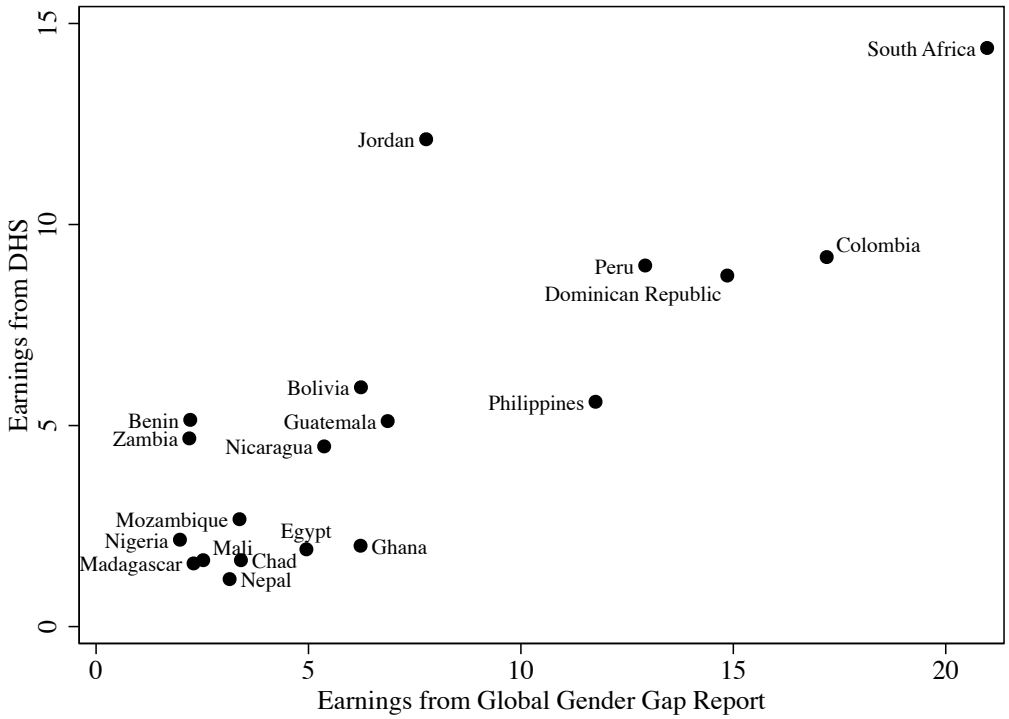
Second, we compare our daily wage measure with an alternative estimate of women's earnings obtained from the World Economic Forum's Global Gender Gap Report 2008. The Report records, among other socio-economic indicators, estimated

[7] A possible concern with using daily earnings is that daily earning captures both wage per hour worked and hours worked per day. Information on hours worked per day is not available in the survey but for a subsample of working women we have data on the number of days worked per year. To investigate whether mothers and non-mothers differ along the intensive margin we estimate a regression where the outcome variable is the number of days worked per year for the subset of workers who provided this information. The magnitude of the 2SLS coefficient on number of children is very small (about 1 day) and the coefficient is not statistically different from zero, suggesting there is little to no difference along the intensive margin.

[8] The cross-sectional nature of our survey implies that including country fixed effect variables in the regressions would control for PPP transformation since all earnings from the same country will be scaled up or down with PPP.

annual earned income of women in 2007 PPP US dollars for all countries included in our sample (with the exception of Central African Republic and Comoros).[9] We construct daily earnings of women for these countries assuming 250 working days a year for a comparable measure of real daily earnings. We then compare the Global Gender Gap earnings estimates to our DHS measure of real daily earnings for female wage earners and find a strong positive correlation between the earnings data from the two distinct sources.

Figure 1. Validity of DHS earnings data



Note: Daily earnings from Global Gender Gap Report 2008 are expressed in 2007 PPP US$. These are imputed from the estimated annual earnings of women by assuming 250 working days. Average daily earnings from the DHS are expressed in 2006 US$.

[9] The earnings figures reported in The Global Gender Gap Report 2008 are sourced by the United Nations Development Programme (UNDP) *Human Development Report 2007/2008*. According to UNDP, because of the lack of gender-disaggregated income data, female and male earned income figures are crudely estimated on the basis of the data on the ratio of the female non-agricultural wage to the male non-agricultural wage, the female and male shares of the economically active population, the total female and male population and the GDP per capita in PPP US$ (Hausmann et al, 2008).

Figure 1 presents, for each country, the average daily earnings from the DHS and the Global Gender Gap Report in the form of a scatter plot. The correlation coefficient is 0.82 (0.90 when Jordan is excluded),[10] therefore we conclude that the earnings data in the DHS as well as our construction of the measure of real daily earnings are reliable for the purpose of our analysis.

B. Sample Construction and Representativeness

Our sample contains all DHS surveys that meet the following three criteria: (1) the survey had to include detailed information on earnings[11] (2) the data had to be publicly available and (3) to address endogeneity concerns, as will be explained later, the survey had to include the questions that we use to identify infertile women. This leads to a total of 22 surveys representing 21 countries. Table 1 contains information about the 21 countries included in our sample by income level as defined by World Bank classification in 2006, the year of the global report.[12] Our sample contains 12 low-income countries, 8 lower middle-income countries and 1 upper middle-income country.[13]

[10] All of our results are robust to the exclusion of Jordan from the sample.

[11] We omit Zimbabwe from our sample because of implausibly high real daily earnings.

[12] The same classification of countries is obtained if instead of the World Bank's GNI per capita (Atlas method) we use the UN's Human Development Index or alternative measures such as infant mortality rates, life expectancy or literacy rates. The minimum pair-wise spearman correlation coefficient between GNI per capita and these other measures is around 0.79.

[13] See Appendix Table A for the list of countries by stage of development. We combine the one upper middle-income country (South African) with the lower middle-income countries in our analysis. We refer to these countries as "middle-income."

Table 1. Representativeness of DHS countries and selected indicators, by income level

Country	Total Fertility Rate[a]	Share in the labor force[b]	Share working for wage[c]	Above primary education (share)[d]
	(1)	(2)	(3)	(4)
Panel A: Low-income countries				
DHS countries	5.3	0.67	0.65	0.20
All countries	5.1	0.69	0.68	0.28
Panel B: Middle-income countries				
DHS countries	3.8	0.51	0.88	0.56
All countries[e]	3.1	0.53	0.87	0.49

Note: *DHS countries* include all the surveys in our analysis but with all women (working or not) aged 20-44 not enrolled in school using sample weights.

[a] Estimates for *DHS countries* were obtained from the online tool of the DHS program (http://www.statcompiler.com/en/). For *All countries*, the average was computed using data from all countries included in the World Bank's 1997 World Development Indicators.

[b] For DHS countries, this represents women currently working or reported working in the last 12 months. The aggregate data comes from the Hausmann et al (2008).

[c] In the DHS, this is the percentage of women working who report being paid in cash. For the aggregate, data come from Women's Indicators and Statistics Database (version 4, WISTAT 4). We compute the *share working for wage* as [number of female employees + employers and own-account workers + unclassifiable by status]/[number of female employees + employers and own-account workers + unpaid family workers + unclassifiable by status].

[d] Data for *all countries* comes from Barro and Lee (2013) for the year of 1995.

[e] We restrict the countries to lower middle-income to match our DHS sample.

Our 21 countries are a representative sample of the developing world at large. Table 1, Panel A, compares our subsample of low-income countries to data from external sources for all low-income countries, matched as close as possible in time. We find small differences with respect to fertility rates and human capital measures between the data sources. For instance, the DHS countries have a total fertility rate of 5.3 compared to the 5.1 of all low-income countries. For this income group, human capital in our sample is slightly lower as the share of women with education above primary schooling is 20 percent in the DHS sample of low income countries relative to 28 percent in all low-income countries. A similar pattern is observed in Panel B, when comparing our DHS

sample of lower middle-income countries with all lower middle-income countries. Our DHS sample of lower middle-income countries is slightly more educated and has a higher fertility rate. Note that our data also support the fertility transition that accompanies economic development as total fertility rate in our data falls from 5.3 to 3.8 with rising levels of income.

Similar to Mammen and Paxson (2000), we find evidence consistent with a "U-Shaped" female labor supply. As per the 2008 Global Gender Gap Report, labor force participation rate in low-income countries is 69 percent whereas only 53 percent of women in middle-income countries work. For the nations in our sample we find very similar numbers; 67 percent of the women in low-income nations worked in the past 12 months relative to 51 percent in middle-income countries. As labor markets develop, work becomes more formal. This too is borne out in our data. Only 65 percent of the female workers in low-income countries in our sample earn a wage for their work whereas 88 percent of their middle-income counterparts do. Estimates from Women's Indicators and Statistics Database (WISTAT) suggest that 68 percent and 87 percent of working women in low and middle-income countries respectively earn a wage for their labor. Thus, the 21 countries in our sample provide a valid representation of low-income and lower middle-income nations.

Within this set of countries and to be consistent with the literature, we restrict the sample to wage earning women between 20 and 44 years of age at the time of the survey and exclude mothers with all children over the age of 18 years from the sample.[14] We

[14] A common alternative approach is to include all women in the sample and use annual earnings as the dependent variable assigning zeros to those women who do not work (e.g., Angrist and Evans, 1998; Bronas and Grogger, 1994; and Jacobsen et al., 1999). Our data is not well suited for the construction of an annual earnings measure as over 1,000 women report a daily wage but do not provide information on the

also exclude women who are currently enrolled in school. Our final estimation sample contains 55,552 working women.[15]

Summary statistics for our estimation sample are shown in Table 2. The average woman in our sample is 30 years old with two children, one of whom is under the age of six. The average daily earnings for the women in our sample are $6.11 a day. Twenty-two percent of our sample is childless. In Table 2, columns (2) and (3) contain summary statistics for non-mothers and mothers, respectively. A comparison of these columns suggests a family penalty. The average mother earns $5.70 while her childless counterpart earns $7.42 daily. However, non-mothers are much more educated, far more likely to be unmarried, more likely to work year-round and more likely to reside in urban areas. There is also a difference in the occupational distribution between mothers and non-mothers; mothers are over-represented in agricultural and sales work and under-represented in office work (professional, managerial and clerical positions) and services. Mothers are also more likely to be self-employed and to work from home.

number of days worked a year. Using a similar sample, Agüero and Marks (2011) document no casual impact of motherhood on participation in the paid labor force in the developing world, but a small negative impact for the low-income countries subsample. However, Cruces and Gallani (2007) find that having more than two children reduces participation in the paid labor force in Mexico and Argentina. As a robustness check we exclude the countries with very low levels of female participation in the paid labor market where selection into the labor force may be particularly strong (Mozambique, Nepal, Egypt and Jordan). The estimated impact of children on earnings is unchanged in low-income countries and increases to 5.2 percent for middle-income countries, when we exclude these countries.

[15] Summary statistics by country are shown in in Appendix Table A.

Table 2: Descriptive statistics

Variable	Full Sample	Non-mothers	Mothers	Mothers with kids under 6	Low income countries	Mid income countries
	(1)	(2)	(3)	(4)	(5)	(6)
Number of children	1.98	-	2.59	2.72	2.22	1.80
	(1.70)		(1.48)	(1.57)	(1.76)	(1.63)
Number of kids under 6	0.85	-	1.11	1.51	1.05	0.70
	(0.90)		(0.87)	(0.66)	(0.93)	(0.84)
Working at time of survey	0.91	0.89	0.91	0.90	0.95	0.87
	(0.29)	(0.31)	(0.29)	(0.30)	(0.21)	(0.33)
Office Work[a]	0.21	0.28	0.18	0.17	0.10	0.29
	(0.41)	(0.45)	(0.39)	(0.37)	(0.30)	(0.29)
Services[a]	0.10	0.13	0.09	0.08	0.04	0.14
	(.30)	(.34)	(.28)	(.27)	(.19)	(.35)
Sales[a]	0.33	0.26	0.35	0.36	0.40	0.27
	(0.47)	(0.44)	(0.48)	(0.48)	(0.49)	(0.44)
Agricultural[a]	0.15	0.09	0.17	0.19	0.26	0.06
	(0.36)	(0.29)	(0.37)	(0.39)	(0.44)	(0.24)
Works at home[b]	0.25	0.22	0.26	0.27	0.27	0.24
	(0.44)	(0.41)	(0.44)	(0.44)	(0.44)	(0.43)
Self employed[b]	0.54	0.45	0.56	0.59	0.73	0.40
	(0.50)	(0.50)	(0.50)	(0.49)	(0.45)	(0.49)
Worked year-round	0.73	0.77	0.72	0.70	0.68	0.77
	(0.44)	(0.42)	(0.45)	(0.46)	0.47	0.42
Daily earnings	6.11	7.42	5.70	5.18	3.12	8.31
	(8.00)	(8.96)	(7.63)	(7.14)	(4.70)	(9.14)
Age	30.47	27.98	31.24	29.73	29.93	30.87
	(6.38)	(6.54)	(6.24)	(5.86)	(6.31)	(6.40)
Above primary	0.51	0.65	0.47	0.45	0.29	0.68
	(0.50)	(0.48)	(0.50)	(0.50)	(0.45)	(0.47)
Currently married[c]	0.79	0.41	0.91	0.93	0.87	0.74
	(0.40)	(0.49)	(0.28)	(0.26)	(0.34)	(0.44)
Urban	0.62	0.72	0.59	0.55	0.43	0.76
	(0.49)	(0.45)	(0.50)	(0.50)	(0.50)	(0.43)
Observations	55,522	12,446	43,076	31,867	24,471	31,051

Note: Sample weights are used. Standard deviations are in parenthesis.

a. Office work includes professional, technical, managerial and clerical positions. Agricultural work includes both self-employed and contractual agricultural work. The omitted occupation group is manual labor.

b. Missing for 2,604 respondents.

c. Egypt, Jordan, and Nepal restrict the sample to currently married women.

Columns (3) and (4) compare all mothers to those with young children. The demographic characteristics between these groups are very similar; however, mothers with young children earn significantly less ($5.18 vs. $5.70) and are slightly more likely to work in agricultural jobs and less likely to have an office job. In addition, mothers with young children are less likely to work year-around.

In Columns (5) and (6) we split the sample by level of economic development. As previously shown, women in low-income countries have more children than their counterparts in middle-income countries. The former is also more likely to be currently working but less likely to work year around. There are sizable differences in earnings and educational attainment. There are also differences in the occupation mix; women in low-income countries are more likely to be in "child friendly" occupations. Sales and agricultural work account for fully two-third of all work in the low-income countries whereas only a third of female wage earners work in these two occupational categories in the more developed countries. The decline of agriculture and the rise of the services documented in our data are consistent with the pattern observed for a broader set of countries (ILO 2010).

Preliminary evidence of a motherhood wage penalty is presented in Figure 2a. The solid line represents average daily earnings for women with children of any age. Earnings clearly fall with family size. The average woman with one child earns $6.27 whereas her counterpart with five children earns only $3.77 a day. For women with young children, represented by the dashed line, the effects are more pronounced. Each additional young child (under the age of six) is associated with a sizable decrease in daily earnings. The first young child is associated with a $1.20 decrease in earnings from a

base of $6.83, while the second young child is associated with an additional $1.45 decrease in daily earnings. Additionally, the average woman with younger children earns less than her counterpart with older children regardless of the number of children.

Figure 2a. Average daily earnings by number of children

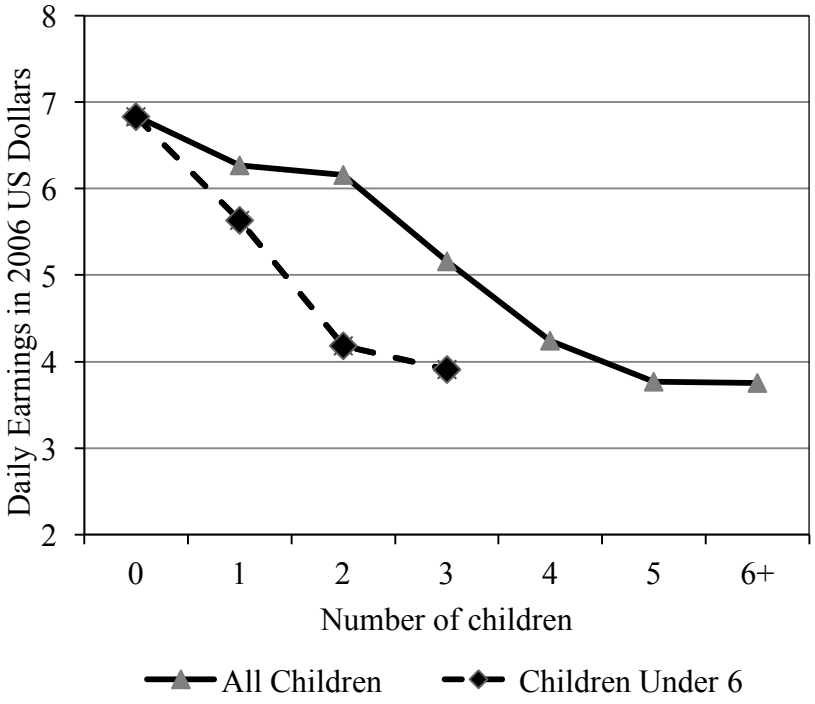
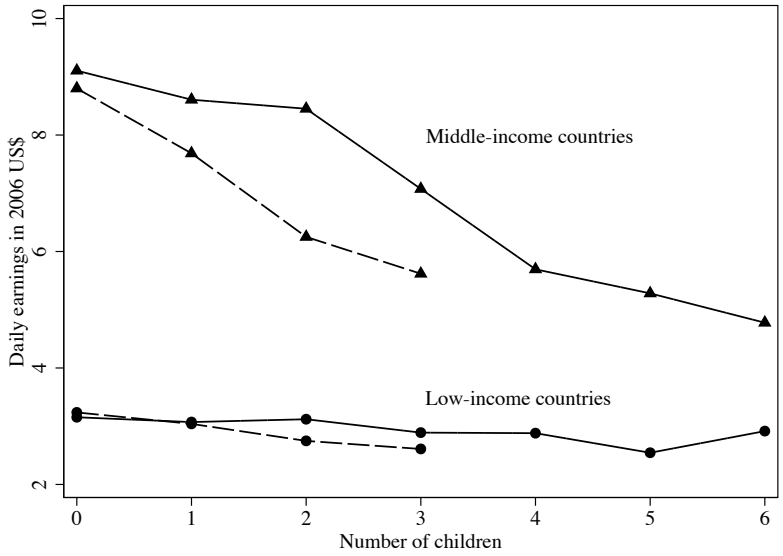


Figure 2b. Average daily earnings by number of children and level of development



Note: Each point corresponds to the average daily earnings of women with the given number of children. The solid lines are for all children regardless of age. Women with 6 or more children were combined for the last data point. The dashed lines are for women with varying numbers of children under the age of six years. Women with more than three children under the age of 6 were combined in the final data point.

In Figure 2b we split the sample into (lower) middle- and low-income countries. The pattern for middle-income countries looks very similar to Figure 2a. Average earnings fall starkly as the number of children increases and the effect is more pronounced for children under the age of six. For low-income countries, however, we see little preliminary evidence of a family penalty. Average daily earnings hover around $3.00 over the entire family size distribution. Earnings do appear to be slightly lower for mothers with multiple young children at home. In the next section, we present the econometric model we use to explore this issue in more detail.

C. Econometric Model

For the sample described above, our general specification is given by equation (1):

$$(1) \qquad \text{Log}(\text{Earnings}_{ij}) = \beta K_{ij} + \Sigma_s \gamma_s \text{Age}_{ijs} + P_{ij}'\theta + \alpha_j + X_{ij}'\delta + e_{ij}$$

where $Earnings_{ij}$ is daily earning for women i in country j expressed in 2006 US dollars as described above. Our main variable of interest, K_{ij}, indicates the number of children under the age of 19 living at home.[16] Thus, β is the parameter of interest. We include dummies for women's age in single years denoted by $s= \{20,...,44\}$ and country fixed effects (α_j). The inclusion of country fixed effects allows us to control for the possibility that unobserved country-level characteristics are jointly correlated with the number of

[16] As some countries have high child mortality rates, we re-estimate all the models in our paper using the number children ever born. We find a slightly larger estimated family penalty and continue to find larger per child penalty in middle as opposed to low-income countries.

children a woman has and her earnings, such as differences in attitudes toward women and motherhood across countries. Furthermore, while all surveys employ a standardized questionnaire, minor changes in the survey design could also affect our results. Country fixed effects permit us to control for this possibility as well. Similarly, the model includes indicators for reported pay period to subsume measurement error in the construction of the daily wage variable (vector P_{ij}). This is our Model 1.

In Model 2 we expand the set of variables to include those commonly present in the literature studying the family penalty (vector X_{ij}). These are variables that likely influence female earnings potential and family size. We include in X_{ij} six indicators for educational attainment (i.e., none, as the omitted category, incomplete primary, complete primary, incomplete secondary, complete secondary, and higher), six indicators for current marital status (i.e., never married as the omitted category, married, living together, widowed, divorced, and not living together), and four indicators for the size of the current place of residence (large city, small city, town and countryside). All results include robust standard errors clustered using the 189 sub-national sampling clusters (for example, departments, provinces, or districts depending on the country) and all estimates include sample weights**.**

3. Results

A. Documenting the Family Penalty

Table 3 presents the results of estimating Models 1 and 2. We start by discussing the results for all countries in our sample as shown in column (1). When all countries are pulled together, each additional child is associated with a decrease in daily earnings of 10

percent on average (Panel A). When controls for education, marital status and size of current location are added (Panel B), these variables account for a substantial share of the motherhood penalty. Nonetheless, there is still a sizable negative relationship between children and their mothers' daily earnings. Each additional child is associated with a decrease in earnings of almost three percent (0.028). For the average mother (with 2.6 children) this penalty translates into about a 7.3 percent decline in daily earnings relative to women without children. This estimate is in the range of findings from developed countries. For instance, using a sample of seven industrialized countries, a similar set of controls, and a similar time period, Harkness and Waldfogel (2003) estimate the family penalties for a mother of two children that range between 2-24 percent. Davies and Pierre (2005) using data from the late 1990s find very small (and statistically insignificant) two-child wage penalties in Denmark, Belgium, France, and Ireland but penalties of 9 percent in the Netherlands and around 22 percent in Germany and the UK in a model similar to ours except they include labor market experience.

There are differences in labor markets and in institutions between low- and middle-income countries that affect labor market outcomes of women. In this paper, we argue that the observed family penalty for developing countries hides patterns that vary by the country's level of economic development. Specifically, there are, at least three reasons to observe a higher penalty as countries develop. First, economic development is accompanied by a shift from agriculture to service and office jobs, which implies that the new labor opportunities for women are less "mother-friendly" as these new jobs require working away from home and tend to be less flexible (Goldin, 1994; Mammen and Paxson, 2000 and Gaddis and Klasen, 2014). Second, multigenerational households are

less common in more developed countries increasing the childcare burden on working mothers (Duflo, 2003 and Hamoudi and Thomas, 2014). Third, policies regarding school attendance imply that children are more likely to be in school in more advanced economies and this reduces their ability to substitute for their mothers in household tasks and rearing of their younger siblings.

Table 3: Documenting the family penalty

Dependent variable: Log daily earnings	All (1)	Low-income countries (2)	Middle-income countries (3)
Panel A: Model 1			
Number of children	-0.100***	-0.044***	-0.147***
	[0.017]	[0.007]	[0.028]
Observations	55,552	24,471	31,051
R-squared	0.405	0.387	0.176
Panel B: Model 2			
Number of children	-0.028***	-0.012**	-0.045***
	[0.006]	[0.005]	[0.011]
Observations	55,552	24,471	31,051
R-squared	0.522	0.451	0.382

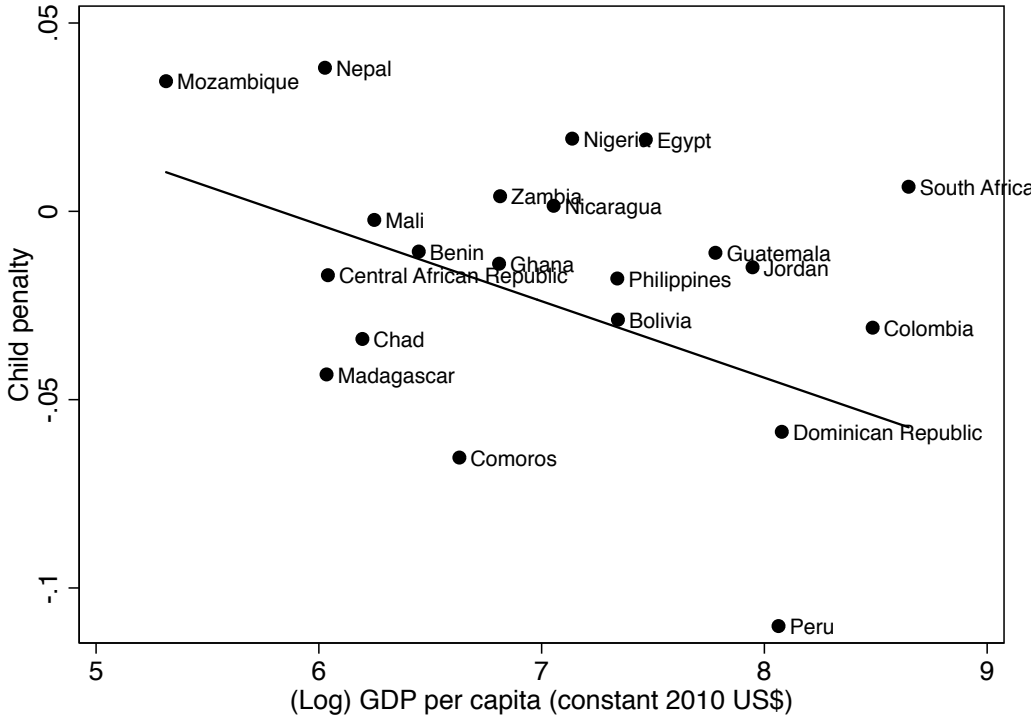
Note: Robust standard errors (in brackets) are clustered at the sub-national level.
* denotes significance at 10 percent; ** at 5 percent and *** significance at 1 percent. All regressions include women's age and survey fixed effects, indicators for pay period, Model 2 adds to Model 1 indicators for education, marital status, and the size of current location.
All models include sample weights.

Columns (2) and (3) of Table 3 explore this issue by splitting the sample by level of economic development according to the World Bank classification. As is clear in both panels, the family gap is over three times larger in middle-income countries than in low-income countries. In the model with a limited set of controls (Panel A), each child is associated with a 14.7 percent reduction in earnings in middle-income countries but only

with a 4.4 percent reduction in low-income countries. The results in Panel B suggest that education, marital status and location account for over two-thirds of the family gap in both low and middle-income countries. Once we condition on a standard set of controls, there remains a small family gap of 1.2 percent per child in the low-income countries and a family penalty of 4.5 percent per child in the middle-income countries.

Further suggestive evidence that the family penalty increases with economic development is shown in Figure 3. We estimate Equation 1, Model 2, separately for each country in our sample and plot the β parameter against GDP per capita (measured as the average between 1994 and 1999) taken from the World Bank's World Development Indicators. The figure displays that the wage penalty associated with an additional child is larger in countries with higher levels of GDP per capita.

Figure 3. Family penalty by level of development



Note: Each circle represents the estimated coefficient for the number of children from equation 1, Model 2, obtained for each country separately. The best-fit line is weighted using the sample size

for each country. GDP per capita is the average from 1994-1999 taken from the World Bank's World Development Indicators.

B. Selection into Motherhood

It is possible that the difference in the size of the family penalty by stage of economic development reflects different patterns of selection into motherhood and parity. To address the endogeneity of family size, we adopt the infertility/infecundity instrument first proposed in Agüero and Marks (2008) and recently used by Agüero and Marks (2011), Jensen (2012), Rondinelli and Zizza (2011) and Schott (2012). The key idea is that infecundity creates a "natural experiment" in which some women are biologically limited in the number of children they can have (either no children at all or no further children after parity n). The DHS datasets allow us to identify self-reported infertility in two ways. The first way is when the subset of women, who are not using any form of contraceptives (including traditional methods) at the time of the survey, mentioned sub-fertility or infertility as their reason for not currently using contraceptives. The second way is when non-sterilized women responded as being unable to have more children when asked about their desire for future children. The infertility indicator is the union of these two measures. We will use infertility to instrument for K_{ij} in equation (1) to address the potential selection concern.[17]

[17] See Agüero and Marks (2011) for more details about the infertility instrument. For instance, they show that for a similar set of countries the onset of infertility is not associated with a large set of pre-determined characteristics. We replicate this exercise for the set of countries used in this paper and the subsample of women who work for pay split by stage of development. The results suggest that infertility is unrelated to observable traits of the women in our estimation sample. Agüero and Marks (2011) also rule out the possibility that measurement errors (classical or not) in the self-reported infecundity variables might bias the results upwards. They also show that the presence of other household members does not affect the reporting of the infertility status when using DHS data. Jensen (2012) finds that infertility is not associated with women's education or household expenditure.

The results of using infertility as an instrument for family size are shown in Table 4. For column (1) we re-estimate Equation (1), Model 2, for the subsample of women for whom we can measure infertility. The OLS estimates again suggest that each additional child decreases daily earnings by 1.2 percent for women in the least developed countries and 4.5 percent for women in middle-income countries. Column (2) reports the estimates that use infertility as an instrument for family size. We have very strong first stage estimates; on average, infertility reduces family size by 1.2 children in low-income countries and 1.1 children in middle-income countries. Also, for both samples the F-statistic is very high. The 2SLS result suggests that the effect of children on earnings, using the variation in the number of children that comes through the infertility channel, is indeed causal.[18] For both subsamples, the 2SLS estimate is larger in absolute value than the corresponding OLS, but one cannot reject the hypothesis that the two point estimates are the same (the reported Hausman tests have a p-value of 0.287 and 0.347 respectively). Thus, there is no evidence of a downward bias in the OLS parameter.[19] We conclude that differential selection into childbirth cannot account for the family penalty and the 2SLS estimates support the fact that the family penalty grows as countries develop.

Having established a causal link between children and their mother's earning and confirmed that the family penalty increases as a country develops; the remainder of the

[18] For the entire sample, the corresponding 2SLS estimate for number of children is 5.2 percent ($p<0.05$).

[19] The persistence of a motherhood wage penalty when unobserved heterogeneity is accounted for is consistent with the results from fixed effect models over long time horizons. Using US data, Budig and England (2001) and Waldfolgel (1997) estimate penalty with fixed effects that are almost identical to those estimated in a cross-section. Using the PSID, Lundberg and Rose (2000) find significant causal penalty for the full sample but no penalties for women who work continuously. Simonsen and Skipper (2012) compare the earning of twin sisters –one of whom is a mother- and finds no evidence of selection. The limited studies in the developing world that focus on earnings and address the endogeneity of family size find mixed effects. Orbeta (2005) uses variation in family size caused by twinning in a sample of women in the Philippines women and concludes that children are exogenous. Adair et al. (2002) employ also data from the Philippines and use mother's fixed effects to account for selection and find a high level of endogeneity in models that estimate the effect of childbearing on women's earnings.

paper explores the nuances of the observed family gap. To do so, we will first explore how the age and gender of children matter and, therefore, no longer use the 2SLS.

Table 4. Number of children and daily earnings of women

Dependent variable: Log daily earnings	OLS (1)	2SLS (2)
Panel A. Low-income countries		
Number of children	-0.012**	-0.041
	[0.005]	[0.027]
Observations[a]	24,435	24,435
R-squared	0.451	0.450
First stage		-1.211***
		[0.085]
F-statistic (1st stage)		205.0
Hausman (p-value)		0.287
Panel B. Middle-income countries		
Number of children	-0.045***	-0.073**
	[0.011]	[0.032]
Observations[a]	30,916	30,916
R-squared	0.380	0.379
First stage		-1.108***
		[0.052]
F-statistic (1st stage)		452.9
Hausman (p-value)		0.347

Note: Robust standard errors (in brackets) are clustered at the sub-national level. * denotes significance at 10 percent; ** at 5 percent and *** significance at 1 percent. The 2SLS instrument for the number of children uses the union of the infertility measures. All models include the control variables listed in Table 3. The F-statistic refers to the first stage results. The Hausman p-value refers to the test where the null hypothesis equals the efficient and the consistent estimators. a. We can only identify infertility for non-sterilized women. Thus, sterilized women are excluded from the sample.

C. Understanding the Motherhood Wage Penalty: The Effort Hypothesis

Based on Becker's (1985) model of effort (and time) allocation within the household, the literature has hypothesized that at-home responsibilities play a key role in explaining the family penalty. According to this theory, motherhood adds an "effort requirement" that is absent for non-mothers: namely childcare. Thus, even if both mothers and childless

women spent the same amount of time working, mothers would allocate *less* effort toward market work than childless women. As a result, mothers will have lower productivities and lower daily earnings than non-mothers with similar characteristics. If childcare responsibilities are lower in less developed countries, say because multigenerational households are more prevalent or because children assume household responsibilities at an earlier age, this could account for the relatively small family penalty in low-income countries.

To investigate the effort hypothesis, we follow the literature and explore whether the family penalty is largest for younger children, as they demand more childcare (see for example, Anderson et al., 2003 and Jacobsen et al., 1999). Thus, we modify equation (1) as follows:

$$(2) \qquad \text{Log}(\text{Earnings}_{ij}) = + \Sigma_a \beta_a K_{ija} + \Sigma_s \gamma_s \text{Age}_{ijs} + X_{ij}'\delta + \alpha_j + e_{ij}$$

where now K_{ija} is number of children by age group, indexed by *a*. Following Anderson et al. (2003), we grouped children into developmental and schooling stages and formed the following age groups: under 3, 3 to 5, 6 to 10, 11 to 13 and 14 to 18. We use the full sample and restrict our focus to Model 2, which includes controls for education, marital status, and current location in addition to controls for age, survey and pay period.

Table 5 shows the estimation of Equation (2) for all countries (column 1) as well as dividing the countries by stage of economic development (columns 2 and 3.) Column 1 provides evidence consistent with the effort hypothesis. The family penalty is largest for the youngest children, declines with age, and disappears for adolescent children. Each additional child under the age of three is associated with a daily earnings penalty of seven percent. However, an additional child between 11 and 13 years of age is linked to a

decline of only 0.5 percent that is not statistically different from zero. For the oldest children (between 14-18 years) the coefficient is positive and small (0.3 percent) but not statistically significant. This pattern of declining penalty by child age is also observed in richer countries (Anderson et al., 2003 and Jacobsen et al., 1999).

Table 5. Family penalty by age of child and stage of development

		By level of development	
	All	Low-income	Middle-income
Age of child	(1)	(2)	(3)
Under 3	-0.068***	-0.082***	-0.069***
	[0.010]	[0.011]	[0.018]
3 to 5	-0.043***	-0.020*	-0.070***
	[0.011]	[0.010]	[0.019]
6 to 10	-0.027***	-0.009	-0.042***
	[0.007]	[0.010]	[0.011]
11 to 13	-0.005	0.021	-0.027*
	[0.010]	[0.013]	[0.014]
14 to 18	0.003	0.038***	-0.023*
	[0.010]	[0.015]	[0.013]
Observations	55,522	24,471	31,051
R-squared	0.52	0.45	0.38

Note: Robust standard errors (in brackets) are clustered at the sub-national level. Significance at 10 percent denoted by *, ** significant at 5 percent and *** significant at 1 percent. All regressions include women's age, survey fixed effects, and indictors for education, marital status, the size of current location, pay period. All models include sample weights.

However, aggregating countries with different levels of development masks interesting patterns. Consider the estimates in column 3 when we restrict the sample to middle-income countries. The penalty declines with the age of the child as predicted by the effort hypothesis: seven percent for each child under five, four percent for a child between 6 and 10 years and around 2.5 percent for older children. Note however, that the child penalty remains statistically different from zero (at least at the ten percent significance) for all ages.

For low-income countries the patterns are different, especially for older children. In Column 2, we show that the largest penalty is found, once again, for the youngest children. However, while the penalty for a child between 3-5 years remains around seven percent for the middle-income countries, in low-income ones the penalty shrinks to two percent. Furthermore, in these poorer countries, the earnings penalty disappears for children of primary-school age and it turns into a *premium* for adolescents. Having an additional child between 14-18 years *increases* his/her mother's daily earnings by almost four percent. The premium is also observed, although less precisely estimated, for children between 11-13 years of age. This is consistent with the fact that many adolescent children in low-income countries are not in school and could substitute for their mothers' effort at home.

Thus, the overall lower aggregate family penalty observed in low-income countries is explained, in part, by the differential role that older children have on their mother's earnings. In low-income countries, very young children are associated with the largest penalty on earnings and the size of the penalty is similar to the one estimated for middle-income countries. However, while older children are associated with a decline in earnings in the richer countries, these children provide an earning *premium* in poorer economies. Thus, averaging these effects across children's age to generate a single estimate of family penalty lowers the penalty in low-income countries.

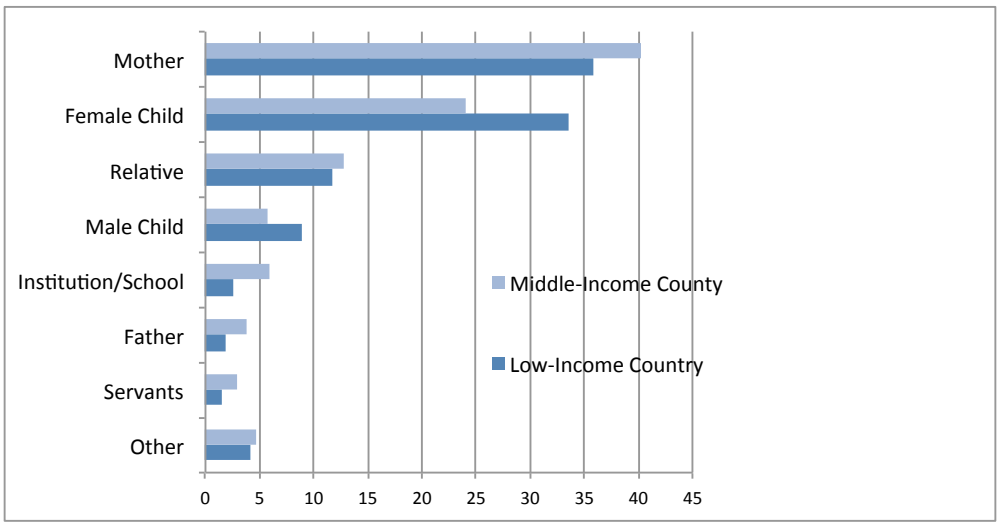
We now investigate if the impact of children on wages varies with the gender of the child. A large body of literature in developing countries documents that the difference in gender roles becomes more pronounced as children age, with daughters (but not sons)

contributing to childrearing and household tasks as they enter adolescence (Ilahi, 2000; World Bank, 2001; Zapata, Contreras and Krueger, 2011).

The DHS ask women with at least one child under the age of six about who "minds" that child. We then further restrict the sample to those women with an additional child over the age of 10 so that Female/Male Child is a possible response. Figure 4 presents the answers to the child-minding question for the 1/6 of the sample that meet the above criteria by frequency of the response. Consistent with the findings in Table 5, the likelihood that an adolescent child provides care for his/her younger sibling is larger in low-income countries compared to more advanced economies. Furthermore, the figure presents evidence that, relative to boys, adolescent girls assume a disproportional child-caring role for their younger siblings.[20] As shown, older daughters are the second most likely person to care for younger children (slightly less than the respondent herself). This is observed in both low- and middle-income countries.

Figure 4. Primary source of childcare by stage of development

[20] Mueller (1984) examines time allocation and finds a newborn in the household increases the time his/her older sister would spend in nonmarket work but has no effect on the time allocation of an older brother. Pitt and Rosenzweig (1990) documents that 25 percent of girls aged 14 to 18 in households with infants report household care as their significant activity compared to only three percent for teenage boys. They also find that it is older daughters that care for their younger siblings when they take ill.



Note: The question on who minds the child is only asked to women with a child under the age of 6. We further restrict the sample to those women with an additional child over the age of 10 so that Female/Male Child is a possible answer. This leaves us with a sample of 6,864 observations for low-income countries and 5,507 observations for middle-income countries.

Based on these findings, we explore differences in the family gap by age and gender of the child. Equation (2) is modified by replacing $\Sigma_a \beta_a K_{ija}$ with $\Sigma_a \pi_a S_{ija} + \Sigma_a \theta_a D_{ija}$, where S_{ija} and D_{ija} refer to the number of sons and daughters in age group a, respectively. Panel A of Table 6 shows the estimates of this modified equation for low-income countries. Column (1) presents the coefficient estimates for the variables that capture the number of sons (π_a) while the estimates for daughters (θ_a) are shown in column (2). There are no differences in the effect of a child by gender when they are young (under 10 years). We formally test whether all parameters for boys and girls under 10 years are jointly similar and cannot reject the null hypothesis (p-value=0.352.) However, while having an older son has no effect on earnings in low-income countries, older daughters are associated with an earnings premium of around 5 percent. We reject

the hypothesis of equal parameters by gender for children older than 10 with a p-value of 0.066.[21]

For middle-income countries, Panel B of Table 6 shows similar patterns. For younger children, we do not observe a difference by gender. However, an older son continues to be negatively associated with his mothers' earnings while an older daughter has no effect on earnings. The differential impact on mother's earning by gender of the child likely reflects strong gender norms in developing countries, whereas adolescent girls are responsible for time-intensive households and child rearing tasks (e.g., Tiefenthaler, 1997). The substitution between mothers' and adolescent daughters' responsibilities in the household has important implications when designing programs that keep adolescent girls in school, as mother's wage will likely fall as a consequence.

Table 6. Family penalty by age and gender of the child and stage of development

	By gender	
	Sons	Daughters
Age of the child	(1)	(2)
Panel A: Low-income countries		
Under 3	-0.092***	-0.073***
	[0.013]	[0.014]
3 to 5	-0.034***	-0.007
	[0.013]	[0.014]
6 to 10	-0.006	-0.012
	[0.013]	[0.012]
11 to 13	-0.004	0.046***
	[0.017]	[0.016]
14 to 18	0.031	0.047**
	[0.022]	[0.019]
H_0: $Boys_{0-10}=Girls_{0-10}$	0.352	
H_0: $Boys_{11-18}=Girls_{11-18}$	0.066	
Observations	24,471	
R-squared	0.45	

[21] In Bolivia, Piras and Ripani (2005) find that having a girl between 13 and 18 has a positive effect on her mother's wages but boys in this age range have no impact.

Panel B: Middle-income countries

Under 3	-0.073***	-0.064***
	[0.022]	[0.020]
3 to 5	-0.073***	-0.067**
	[0.018]	[0.025]
6 to 10	-0.030***	-0.054***
	[0.011]	[0.016]
11 to 13	-0.040*	-0.013
	[0.021]	[0.018]
14 to 18	-0.042***	-0.004
	[0.016]	[0.022]
P-value: $Boys_{0-10}=Girls_{0-10}$	0.185	
P-value: $Boys_{11-18}=Girls_{11-18}$	0.169	
Observations	31,051	
R-squared	0.38	

Note: The model controls for boys and girls simultaneously. Robust standard errors (in brackets) are clustered at the sub-national level. Significance at 10 percent denoted by *, ** significant at 5 percent and *** significant at 1 percent. The p-value corresponds to an F-test for the equality of parameters across gender by age group. All regressions include women's age, survey fixed effects, and indictors for education, marital status, the size of current location, pay period.

D. Other Mechanisms: Employment Type and Occupational Segregation

In this section, we investigate how much of the family penalty, if any, can be attributed to differences in the type of work, occupation and intensity --broadly defined-- and whether the explanatory power of these factors varies by the stages of economic development of countries. In particular, as labor markets become more complex with economic advancement, we expect these factors to play a more prominent role in determining the size of the family penalty for women.

It is possible that mothers earn less than non-mothers because they sort into types of work that are more compatible with child rearing. For example, as shown by Maloney (2004), women are disproportionally represented in the informal self-employment sector in developing countries. He argues that certain desirable characteristics of the sector, such as compatibility with family responsibilities, explain women's participation in this sector.

In contrast, work in the formal sector offers greater stability, and higher earnings, but generally longer hours and a work location typically away from home (Anker and Hein, 1986). Both self-employment and working out of the home is quite common for the women in our sample: slightly more than half of them report to be self-employed and one quarter report working from home.

In Panel A of Table 7, column (1) replicates the results from Panel A of Table 3 for ease of comparison, for the sample of women in low-income countries. Column (2) of Table 7 investigates the role of the *type of work* in explaining the family penalty. In column (2), we add to Equation (2) two variables: one that denotes whether the woman is self-employed and another that indicates that the woman reports working from home to approximate less formal types of work. While there is a 24 percent earnings penalty attached to working at home, the comparisons of columns (1) and (2) indicate that the family penalty cannot be attributed to the fact that working mothers sort out of the "formal" labor market.

Mothers may also sort into "mother-friendly" occupations. The theory of compensating wage differentials predicts that the features of these occupations that make them easier to combine with motherhood will in turn result in lower earnings (Anderson et al, 2003; Budig and England, 2001). For example, mothers may choose occupations that are located near the home (such as agriculture), that have parent-friendly characteristics, such as flexible hours, the ability to have your child at the work site and/or fewer demands for commuting. Column (3) adds 275 detailed occupational controls to Equation (2). Mothers in low-income countries are over-represented in agriculture and sales and slightly under-represented in professional, technical, and

managerial occupations as well as clerical and service occupations. However, differences in occupations between mothers and non-mothers do not explain the family penalty for women in the least developed countries. The point estimates are almost identical to the estimates in column (1), when these occupation controls were not included.

Column (4) adds the only measures of work intensity available for all women in our sample. The survey asks respondents if they work year-round, seasonally, or occasionally. Additionally, we can determine if the respondent is currently working as opposed to having worked sometime in the past 12 months. Mothers are slightly less likely to work year-round than non-mothers, however, mothers are more slightly more likely to be currently working. Differences in attachment to the labor force between mothers and non-mothers can account for little of the remaining family penalty in low-income nations.

Table 7: Employment type, occupational segregation and the family penalty

	(1)	(2)	(3)	(4)	(5)
Panel A. Low income countries (N=24,471)					
Under 3	-0.082**	-0.078**	-0.082**	-0.079**	-0.074**
	[0.011]	[0.011]	[0.010]	[0.011]	[0.011]
3 to 5	-0.020*	-0.022*	-0.021*	-0.022*	-0.022*
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
6 to 10	-0.009	-0.009	-0.011	-0.009	-0.010
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
11 to 13	0.021	0.020	0.019	0.023†	0.022†
	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]
14 to 18	0.038*	0.039*	0.037**	0.037**	0.035**
	[0.015]	[0.015]	[0.015]	[0.014]	[0.015]
Self Employed[a]		0.003			0.011
		[0.046]			[0.044]
Work from home[a]		-0.243**			-0.254**
		[-0.037]			[0.035]
Occupation[b]			X		X
Seasonal[c]				X	X
Currently working				0.067†	0.084
				[0.034]	[0.035]
R-squared	0.453	0.459	0.477	0.456	0.487
Panel B. Middle income countries (N=31,051)					
Under 3	-0.069**	-0.067**	-0.061**	-0.059**	-0.050**
	[0.018]	[0.016]	[0.014]	[0.017]	[0.012]
3 to 5	-0.070**	-0.068*	-0.060**	-0.064**	-0.054*
	[0.019]	[0.018]	[0.016]	[0.018]	[0.015]
6 to 10	-0.042**	-0.044**	-0.032**	-0.038**	-0.030**
	[0.011]	[0.010]	[0.010]	[0.011]	[0.009]
11 to 13	-0.027†	-0.030*	-0.018	-0.023	-0.019
	[0.014]	[0.013]	[0.013]	[0.014]	[0.013]
14 to 18	-0.023†	-0.019	-0.008	-0.022†	-0.007
	[0.013]	[0.014]	[0.010]	[0.013]	[0.011]
Self Employed[a]		-0.193*			-0.098
		[0.090]			[.065]
Work from home[a]		-0.301**			-0.279**
		[0.024]			[0.024]
Occupation[b]			X		X
Seasonal[c]				X	X
Currently working				-0.060*	0.003
				[0.030]	[0.020]
R-squared	0.383	0.404	0.460	0.400	0.481

Note: Robust standard errors (in brackets) are clustered at the sub-national level.† denotes significance at 10%; * at 5% and ** significance at 1%. All regressions include women's age and survey fixed effects, indicators for pay period, education, marital status, and the size of current location.

a. 2,604 respondents did not report and are coded as missing.
b. Occupation denotes 275 detailed occupational categories. Note that 146 respondents did not list an occupation and are coded as missing.
c. Seasonal refers to indicators if employment is all year, seasonal or occasional.

The final column in Table 7, Panel A, includes all of the above controls. Despite the inclusion of numerous channels through which the motherhood wage penalty may operate, we are able to explain only 10 percent of the family penalty for women with children under the age of 3 and none of the family penalty for women with toddlers or school-aged children in low-income countries. The remaining sizable penalty for young children and premium for adolescents is consistent with the effort hypothesis. Very young children are time intensive while adolescent children, especially daughters, can substitute for their mothers' time in household production. [22]

In Panel B of Table 7, we repeat this exercise for the subsample of women in middle-income countries. As countries develop, labor markets become more sophisticated, potentially increasing the role of job type, occupation and intensity in explaining wages differences across groups. As shown in the comparison of columns (1) and (2) in Panel B, despite the wage penalties attached to self-employment and working from home, differences in the type of work between mothers and non-mothers account for little of the family penalty in more developed countries.

Unlike their less-developed counterparts, occupation sorting accounts for a significant portion of the family penalty in middle-income countries. The inclusion of detailed occupational controls (comparing column 3 to column 1 in Panel B) explains close to 20 percent of the family penalty. Furthermore, occupational sorting accounts for

[22] In results not shown that include the full set of controls but split by age and gender of the child, we continue to find that older daughters increase their mother's earnings while older sons have no impact.

one-third of the penalty for mothers with adolescent children and almost two thirds of family penalty for mothers with teenage children in middle-income countries. The fact that occupational sorting can explain a larger share of the family penalty for women in more developed countries is consistent with the fact that in the data for middle-income countries, only one third of the women work in sales and agriculture, broadly defined. In contrast, around two-third of the women in low-income nations work in these two sectors.[23] Additionally, these occupations are (more) compatible with motherhood. Almost half of the women with children under the age of 6 who work in sales and agriculture report that they are the primary care giver for young children whereas only around 30 percent of mothers in other occupations report being the primary care giver of their young children. The heterogeneity in the nature of work that occurs as countries develop creates a tradeoff between jobs that are more family friendly (such as agriculture and sales) and those that are less family friendly (such as clerical and professional positions).

Column (4) includes our measures of work intensity. In middle-income countries, differences in labor force attachment (the likelihood of working year-round and the odds of currently working) account for a portion of the family penalty. The estimated coefficients in column (4) are 5-15% smaller than those in column (1).

As shown in the final column of Table 7, Panel B, after we condition on type of work, detailed occupation categories and labor force attachment we can explain over 30 percent of the family penalty for women in middle-income countries. In Appendix B, when we use the total number of children as in Equation 1, after conditioning on all of the

[23] In middle-income countries, 36 percent of mothers are employed in sales or agriculture vs. 24 percent of non-mothers. The corresponding figures for low-income countries are 69 percent and 61 percent.

above variables, each additional child is associated with a 3.1 percent decrease in daily earnings, in contrast to the 4.5 percent per child estimate without the job type, occupation and work intensity controls.

4. Conclusion

This paper provides a comprehensive assessment of the motherhood wage penalty in developing countries. We compile a unique collection of standardized household surveys from 21 developing countries and document a sizable family penalty in women's earnings. The unconditional penalty indicates that women with children earn 10 percent less per day for each additional child compared to their childless counterparts. The penalty reduces to 3 percent per child when conditioning on age, education, marital status, and size of the current location. Using infertility shocks as an instrument for the number of children, this finding is confirmed in the 2SLS estimates.

Given the dramatic decline in fertility in the developing world, our results highlight an additional channel of the demographic dividend. In particular, smaller family sizes translate into higher earnings and increased empowerment for women. According to our preferred estimate, the decline in the total fertility rate in developing countries from 5.41 in the early seventies to 2.75 in 2005-2010 (United Nations, World Population Prospects) translates to increase of daily wages of around 7.5 percent (=2.8*(5.41-2.75)). Further gains in women's economic well-being are expected as the fertility rate in developing countries converges to the rate of high-income countries.

Ours is the first paper to document that the motherhood wage penalty varies by stage of economic development and shows a much larger penalty in middle-income countries compared to less developed nations. We provide two reasons that explain this

difference. First, in low-income countries women can combine work and family responsibilities relatively easily because most work is conducted from or near home. We find that almost one-third of the family penalty in middle-income countries is driven by mothers being overrepresented in low-paying occupations and working at a lower intensity than their childless counterparts. This stands in stark contrast to the poorest nations in our sample where weaker labor markets imply that these factors play almost no role in the family penalty.

Second, we find that the family penalty is larger for younger children and is especially large for children under three years of age. However, in low-income countries we find that adolescent children, especially daughters, provide a wage premium – consistent with substituting for their mothers in household tasks. We find no such wage premium for middle-countries, which also accounts for the difference in family penalty by stage of economic development.

As economies develop, our results highlight the need to focus on policies that support working mothers. Most developing countries lack institutions and policies such as preschool, on-site childcare, school buses, and labor-saving household technologies, which facilitate the balance of work and family. As more women participate in the formal labor market, the demand for such institutions is likely to grow and the family penalty should reduce.

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Appendix A. Sample summary statistics by survey/country

Country (Abbreviation)	Survey year	Number of children	Above primary	Daily Earning	Obs.
Low-income countries					
Benin (BJ)	1996	2.34	0.08	5.38	3,108
Cen. Afr. Rep. (CF)	1995	2.04	0.11	2.74	2,804
Chad (TD)	1997	2.63	0.05	1.47	1,763
Comoros (KM)	1996	2.29	0.21	4.23	542
Ghana (GH)	1999	1.89	0.52	2.05	2,364
Madagascar (MD)	1997	2.12	0.34	1.45	2,360
Mali (ML)	1996	2.57	0.09	1.73	2,589
Mozambique (MZ)	1997	1.96	0.27	2.63	649
Nepal (NP)	1997	2.53	0.16	1.12	607
Nicaragua (NC)	1998	2.07	0.56	4.78	3,170
Nigeria (NG)	1999	2.31	0.43	2.14	2,323
Zambia (ZM)	1997	2.22	0.36	4.97	2,192
Middle-income countries					
Bolivia (BO)	1994	2.18	0.56	5.25	2,434
Bolivia (BO)	1998	2.01	0.64	7.10	3,093
Colombia (CO)	1995	1.55	0.65	9.54	3,834
Dom. Republic (DR)	1996	1.55	0.54	9.56	2,246
Egypt (EG)	1996	2.40	0.74	1.89	1,822
Guatemala (GU)	1999	2.24	0.33	5.48	1,094
Jordan (JO)	1997	3.06	0.93	12.16	557
Peru (PE)	1996	1.72	0.74	9.46	8,740
Philippines (PH)	1998	1.70	0.77	5.81	4,549
South Africa (ZA)	1998	1.34	0.73	15.13	2,682

Notes: Sample weights are used.

Appendix B. Employment type, occupational segregation and the family penalty

	(1)	(2)	(3)	(4)	(5)
Panel A. Low income countries (N=24,471)					
Number of children	-0.012*	-0.012*	-0.014*	-0.012*	-0.012*
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
Self Employed[a]		0.002			0.011
		[0.046]			[0.043]
Work from home[a]		-0.245***			-0.256**
		[-0.037]			[0.035]
Occupation[b]			X		X
Seasonal[c]				X	X
Currently Working				0.069*	0.087*
				[0.034]	[0.035]
R-squared	0.451	0.458	0.476	0.454	0.486
Panel B. Middle income countries (N=31,051)					
Number of children	-0.045**	-0.045**	-0.035**	-0.040**	-0.031**
	[0.010]	[0.010]	[0.008]	[0.010]	[0.008]
Self Employed[a]		-0.193*			-0.098
		[0.092]			[0.066]
Work from home[a]		-0.301**			-0.281**
		[0.024]			[0.024]
Occupation[b]			X		X
Seasonal[c]				X	X
Currently Working				-0.059*	0.004
				[0.029]	[0.020]
R-squared	0.387	0.404	0.461	0.396	0.481

Note: Robust standard errors (in brackets) are clustered at the sub-national level. † denotes significance at 10%; * at 5% and ** significance at 1%.

All regressions include women's age and survey fixed effects, indicators for pay period, education, marital status, and the size of current location.

a. 2,604 respondents did not report and are coded as missing.

b. Occupation denotes 275 detailed occupational categories. Note that 146 respondents did not list an occupation and are coded as missing.

c. Seasonal refers to indicators if the respondent has worked all year, seasonally or occasionally.