The Wage Penalty for Motherhood in Developing Countries

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Motivation

- The last 30 years have shown a remarkable increase in the labor force participation of women worldwide. In developing countries, women now represent almost 40% of the employed population (United Nations 2011).
- Our paper: the "motherhood penalty" in developing economies.
  - Explanations for the motherhood penalty include: selection/different attitudes towards work, unbalanced division of labor within the household/lower productivity, reduced labor force activity, occupational sorting, and discrimination.

Motherhood penalty in developing countries: empirics

- There is also an established literature about children and female labor supply in the developing world (e.g., Agüero and Marks 2011; Cruces and Galiani 2007).
- However there are few papers on the "motherhood penalty."
- The existing papers focus on one country or region and fail to account for the endogeny of fertility.
- The limited evidence from developing countries is mixed
  - Piras and Ripani (2005, urban only): no effect for Peru but positive in Brazil and negative in Bolivia and Ecuador.
  - Adair et al (2002): Philippines.
  - Olarte and Peña (2010): Colombia.

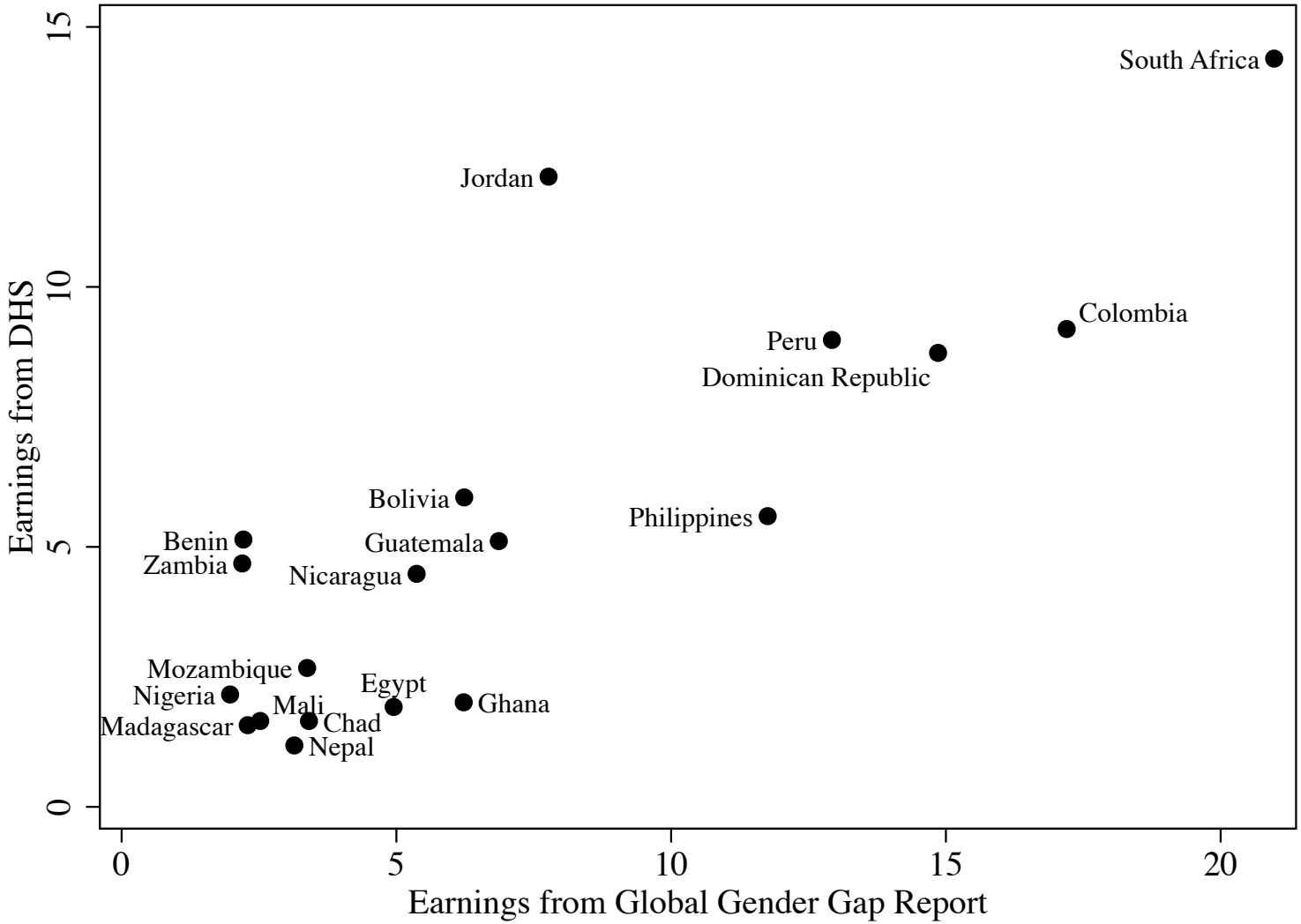
Demographic and Health Surveys (DHS)

- DHS are standardized cross-sectional household surveys from developing countries.
- Their main goal is to collect information about women aged 15 and 49 at the time of survey. (We focus on women aged 20-44.)
- We selected all available DHS III surveys with earnings information and homogeneous questions about labor supply.
- We exclude women who are currently enrolled in school and those with missing labor force information as well as mothers with children over the age of 18.
- We have a sample of 55,552 working women in 21 developing countries.

Earnings in the DHS

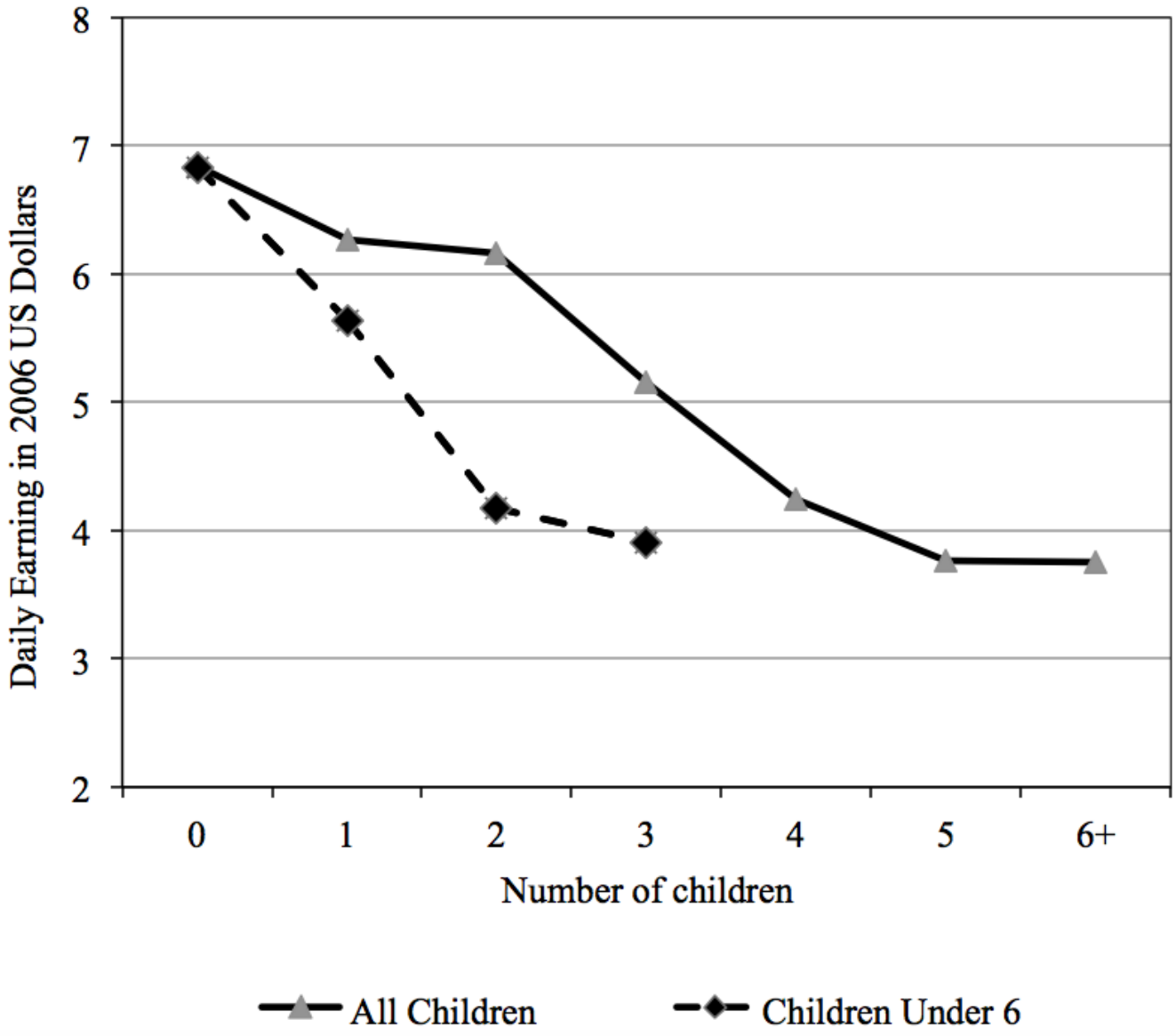
- Women were asked if they were working at the time of the survey or had worked in the previous 12 months.
- Respondents who answered in the affirmative were asked whether they were paid in cash and if so what was the frequency of pay (daily, weekly, annual etc.) and their earnings.
- We compute *daily* earnings for all women employed at the time of the survey or in the previous 12 months.
- Outliers were dropped (lowest and highest percentiles) as well as data from Zimbabwe.
- (Log) Earnings are transformed into US dollars using the exchange rates published by the IMF and converted into real dollars of 2006 using the US CPI.

Validity of the DHS Earnings Data



- correlation coefficient .82

Earnings Gap by Number of Children



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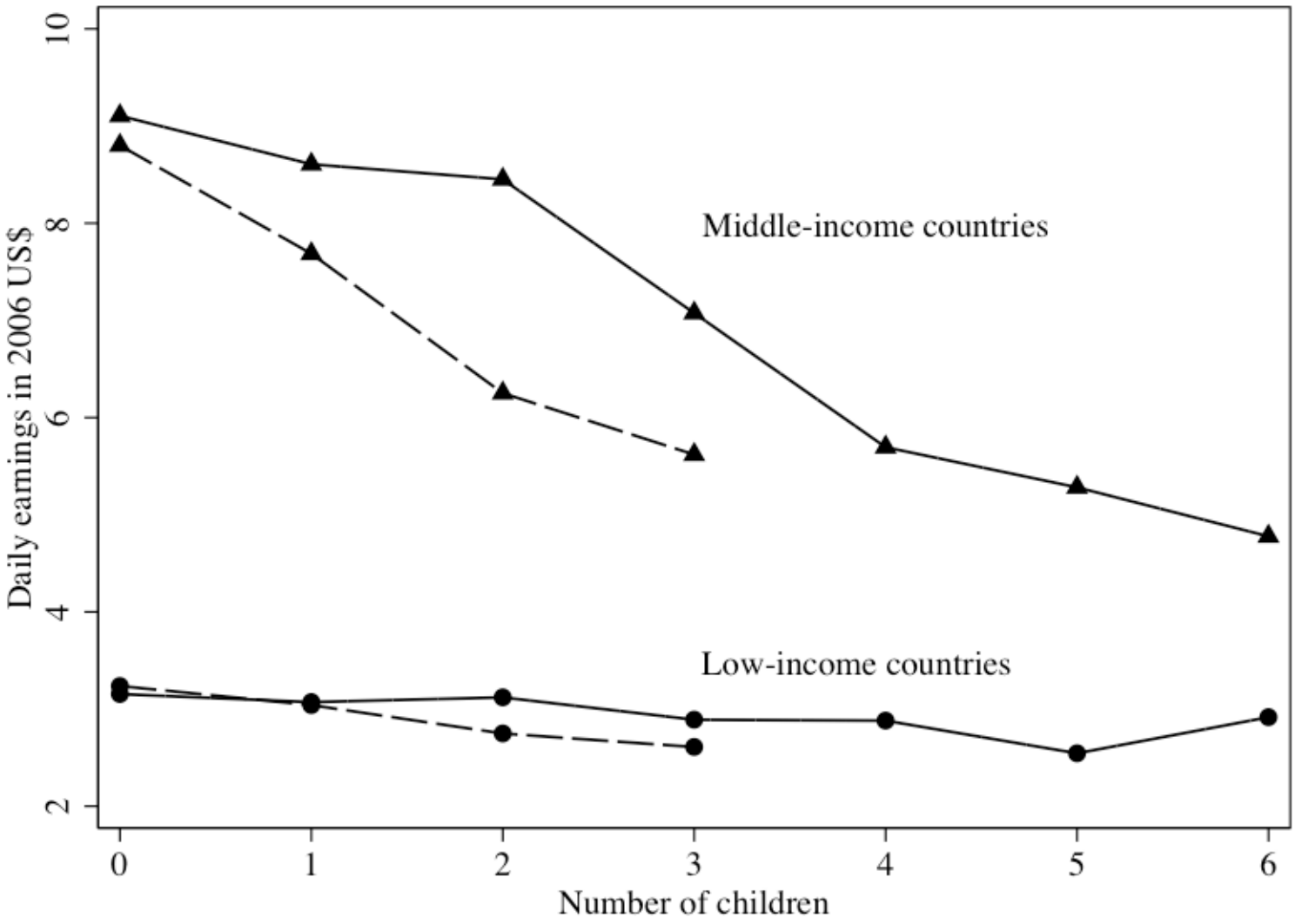

Methodology

- Main specification.

$$\text{Log(Daily Earnings)}_{ij} = \alpha_j + \beta K_{ij} + X'_{ij}\delta + e_{ij} \qquad (1)$$

- K_i: number of children living at home for women i living in country j.
- Country fixed-effects: α_j
- Alternative models (X_{ij}):
  - Model 1: survey/country fixed effects and 24 age dummies.
  - Model 2: Model 1 + education, age-education interactions, marital status and 4 indicators for current location size.
- Robust standard errors are clustered at sub-national levels (primary sample units).

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	-0.099***	-0.044***	-0.147***
	[0.017]	[0.006]	[0.030]
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]	[0.010]
Observations	55,552	24,471	31,051
R-squared	0.521	0.451	0.382

Notes: 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 womens 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.

Is the observed relation causal?

- OLS estimates of β are likely to be biased due to unobserved heterogeneity and reverse causality.
- We use infertility/subfucunditiy to generate exogenous variation in family size.
- For a subsample of women, the DHS collects information about self-reported infertility in two ways
  1. Women mention infertility as the reason for not taking contraceptives.
  2. Non-sterilized women say they cannot have children when asked about their desire for future children.
- Our infertility indicator is the union of these two measures.
- We use it to create an exogenous variation in K_i.
- Agüero and Marks (2008, 2011) and Jensen (2012) provide evidence on the exclusion restriction.

Number of Children and Earnings: Model 2

Dependent variable: Log Daily earnings	OLS	2SLS
	(1)	(2)
Panel A. Low-income countries		
Number of children	-0.012	-0.041
	[0.005]***	[0.027]
Observations[a]	24,471	24,435
R-squared	0.451	
First stage		-1.211
		[0.085]***
F-statistic (1st stage)		205.0
Hausman (p-value)		0.287

Notes: 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. 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.

Number of Children and Earnings: Model 2

Dependent variable: Log Daily earnings	OLS	2SLS
	(1)	(2)
Panel B. Middle-income countries		
Number of children	-0.045	-0.073
	[0.011]***	[0.032]**
Observations[a]	31,051	30,916
R-squared	0.382	
First stage		-1.108
		[0.052]***
F-statistic (1st stage)		452.9
Hausman (p-value)		0.347

Notes: 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. 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.

Is the penalty larger for younger children?

- New model:

$$\text{Log(Earnings)}_{ij} = \alpha_j + \sum_s \beta_s K_{ijs} + X'_{ij}\delta + e_{ij} \qquad (2)$$

- Now K_{ijs} represents the number of children of age s (for woman i in country j).
- Estimate parameters for β_s with $s = \{< 3, 3-5, 6-10, 11-13, 14-18\}$
- All regressions use Model 2.
- Expect larger penalties for younger children if the demands of household production reduces market effort.

Effect by Age of the Child

		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

Notes: 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.

Effects by age and gender

- It is well documented that the difference in gender roles becomes more pronounced as children age, with daughters (but not sons) contributing to household tasks as they enter adolescence (Ilahi, 2000; World Bank, 2001).
- To account for the gender of the child (and age) we transformed the equation

$$\text{Log(Earnings)}_{ij} = \alpha_j + \sum_s \pi_j B_{ijs} + \sum_s \theta_s G_{ijs} + X'_{ij}\delta + e_{ij} \tag{3}$$

- B_{ijs} and G_{ijs} represent the number of boys and girls of age s, respectively.

Effects by age and gender: results

	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	

Effects by age and gender: results

	By gender	
	Sons	Daughters
Age of the child	(1)	(2)
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	

Mechanisms

- We investigate the underlying mechanisms that generate the family penalty by income level.
- We focus on how much of the wage penalty can be attributed to differences between mothers and non-mothers with respect to:
  - type of employment (self-employment and working from home)
  - occupation (374 categories)
  - intensity of work (as proxied by seasonal work and currently working)

Discussion

- For low-income countries, occupational sorting accounts for very little of the motherhood penalty.
- At best, occupation, work intensity and type of work explain around 5% - 10% of the penalty for the least developed countries.
- For more developed economies, occupational sorting accounts for 20% of the penalty and work intensity accounts for 10%.
- Overall we can explain one-third of the motherhood penalty in middle-income countries.

Conclusions

- We use a unique collection of standardized household surveys from 21 countries and document a family penalty.
- Ours is the first paper to document that the motherhood wage penalty varies by stage of economic development and is larger in middle-income countries.
- The gender of the child matters. Older daughters *increase* their mother's earnings in low-income countries.
- As work leaves the home and field, occupational sorting and work intensity account for some of the family gap in more advanced economies.

Conclusions

- Our finding of a sizable family penalty highlights an additional channel of the demographic dividend.
- Smaller family sizes translate into higher earnings and potentially increased empowerment for women.
- Further gains in women's economic well-being are expected as the fertility rate in developing countries converges to the rate of developed countries.
  - Role of policies that work and family balance.
  - However, should differ by level of development as the penalty has different age and gender patterns among this set of countries.

Explaining the Family Penalty

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]***	[0.010]**	[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	-0.010	-0.010	-0.009	-0.009
	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
11 to 13	0.021	0.020	0.018	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		0.018			0.032
		[0.040]			[0.037]
Work from home		-0.241			-0.251
		[-0.037]***			[0.035]***
Occupation[a]			X		
Seasonal[b]				X	X
R-squared	0.453	0.459	0.477	0.456	0.487

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

Explaining the Family Penalty

Panel B. Middle income countries (N=31,051)					
Under 3	-0.069	-0.067	-0.062	-0.058	-0.050
	[0.018]***	[0.016]***	[0.014]***	[0.017]***	[0.012]***
3 to 5	-0.070	-0.068	-0.060	-0.065	-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]***	[0.010]***	[0.010]***
11 to 13	-0.027	-0.030	-0.018	-0.023	-0.019
	[0.014]*	[0.014]	[0.013]	[0.014]	[0.014]
14 to 18	-0.023	-0.019	-0.008	-0.022	-0.007
	[0.013]*	[0.013]	[0.010]	[0.013]*	[0.011]
Self Employed		-0.183			-0.089
		[0.090]**			[.065]
Work from home		-0.294			-0.273
		[0.024]***			[0.023]***
Occupation[a]			X		
Seasonal[b]				X	X
R-squared	0.383	0.403	0.460	0.400	0.481

Validity of the instrument

- Infertility is a valid instrument if it (strongly) correlates with the number of children.
  - Infertile women have one fewer than their fertile counterparts
- . . . and if it satisfies the exclusion restriction (untestable).
- Agüero and Marks (2008, 2011) and Jensen (2012) show that
  - Medical literature: ages matters. Everything else is less clear.
    - Medical studies on risk factors suffer from sample selection bias.
  - Infertility is uncorrelated with background characteristics (number of siblings, age at 1st intercourse).
  - No evidence of non-classical measurement error in infertility.
  - Adding controls for health (height and visits to medical clinic) do not affect the results.
- We conducted the same tests in our earnings sample and found similar results.