Returns to Education in the Marriage Market: Bride Price and School Reform in Egypt

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Abstract

This paper posits marriage market returns as a contributing factor to stagnant female labor force participation despite increasing female education. We examine the marriage market returns of female education exploiting a very direct measure of returns: bride price, a significant amount of resources transferred by the groom at the time of marriage. We also look at current and future husband's wages as additional sources of returns. We address endogeneity and identification issues by exploiting a school reform in Egypt that reduced the number of years required to complete primary education from six to five. The staggered rollout of the reform generates exogenous sources of variation in female schooling both across and within cohorts and administrative units. We implement an IV estimator with fixed effects at the cohort and at the administrative unit level. We estimate the return to bride's compulsory education to be about 100% for bride price, about 14% for husband's wage at the time of marriage and about 16% for a measure of husband's permanent income. Importantly, these returns to education in the marriage market are much higher than the returns to education that Egyptian women experience in the labor market. Additional empirical evidence suggests that educational assortative mating could be an important mechanism through which the marriage market returns are taking place.

Keywords: education, marriage market, bride price, Egypt.
JEL codes: J12, J21, J24.

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1 Introduction

Two seemingly contradictory female labor market phenomena have emerged in a number of developing countries. On one hand, women have made important strides in terms of human capital accumulation, as female education has improved substantially over the past decades. On the other hand, female labor force participation hardly budged and remained low.

The Middle East and North Africa (MENA) region is a case in point. The gender gap in tertiary education enrollment has completely reversed with more women than men enrolled in tertiary education. According to the World Development Indicators in 2020, gross tertiary enrollment ratio stood at 43% for women versus 39% for men (World Bank, 2020). On the other hand, according to ILO estimates, in 2021, female labor force participation rates in MENA are the lowest in the world with only a fifth of working age women in the labor force—less than half the world average at 46% (World Bank, 2021). These twin phenomena are not unique to the MENA region. In South Asia (Afridi, Dinkelman, & Mahajan, 2018; Klasen & Pieters, 2015) and in Latin America, progress in female labor force participation has slowed considerably since the 2000s (Serrano, Gasparini, Marchionni, & Gluzmann, 2018), despite a still widening gender gap in education in favor of women (Duryea, Galiani, Nopo, & Piras, 2007).

Two classic theories offer explanations to this paradox. The first points to standard textbook labor supply models. As countries develop, education improves for both women and men and rising education increases women's earnings capacity. Substitution effect should draw more women into the labor force. However, the income effect of both the women's own wages and the unearned income from their husbands' wages exerts the opposite tendency, depressing work hours for women and possibly resulting in withdrawal from the labor market (Mammen & Paxson, 2000).

The second theory is the feminization U hypothesis of female labor force participation[1] according to which female labor force participation would first decline as countries develop, as male-dominated industrialization would leave female subsistence farmers out of work. Only when education and gender norms improve, combined with an enlargement in the tertiary sector, will female labor force participation rise again. Our aforementioned puzzle is explained by these countries being on the left-hand side of the U-shaped curve.

While both theories provide insightful explanations, neither is entirely satisfactory. Both theories assume improvements in women's education prior to increases in female employment and participation. They do not quite explain the economic motivations underlying the education investment decisions taken by girls and their parents in the first place. Education is costly for both parties. If neither expect realized returns in

[1]First proposed by Boserup (1970) and later discussed by Goldin (1994) and Gaddis and Klasen (2014), among others.

the labor market, then investing in wage-enhancing education would make little sense. In short, the two stylized facts taken together are hard to explain if we only consider labor market returns.

This paper argues that looking at marriage market returns *in addition to* labor market returns provides a more convincing explanation of the stagnant female labor force participation despite the increase in female education. Relying on a quasi-experimental setting that provides an exogenous variation in women's education, we estimate the returns to education in the marriage market in Egypt using data from the Egypt Labor Market Panel Surveys (ELMPS).

Egypt is a good case studies for two reasons. First, it is an exemplar case of the aforementioned puzzle (Assaad, Hendy, Lassassi, & Yassin, 2020; Hertog, 2020). More university graduates born after 1990 are women than are men.[2] In 2020, girls already overtook boys in learning-adjusted years of schooling.[3] Yet by 2018 female labor force participation had fallen to an all-time low since ELMPS records began in 1998, to a miserly 25% for the 20-59 age group (Deng, Elmallakh, Flabbi, & Gatti, 2022). Second, in Egypt it is common for the groom to transfer a significant amount of resources in the new household at the time of marriage (the "bride price"[4]). This is a direct and informative measure of monetary gains that women may obtain through the marriage market, and usefully allows us to quantify marriage market returns, which can otherwise be difficult to gauge. We will use it in conjunction with more conventional measures such as the husband's wage at the time of marriage and a measure of the husband's permanent income.

The identification of any return to schooling in a regression framework is challenged by the endogeneity of the schooling decisions. In our specific setting, the usual omission of individual unobserved heterogeneity (such as an individual ability component) is further complicated by the sorting of spouses over unobservables (for example, a high-ability groom liking more a high-ability bride). To solve the identification problem, we rely on a quasi-experimental setting that provides an exogenous variation in women's education. We exploit a school reform introduced in Egypt in school year 1988/1989 that consisted in reducing the number of years necessary to complete primary education from six to five years. This reform therefore reduced the number of years necessary to complete compulsory education (primary and preparatory education) from nine to eight years. The actual implementation of the reform led to a staggered rollout (Elsayed & Marie, 2020) so that some administrative units implemented the reform prior to others. This implementation led to variations across birth

[2]From authors' computation using ELMPS 2018.

[3]See data from the World Bank's Human Capital Project: `https://genderdata.worldbank.org/indicators/hd-hci-lays/`

[4]Contrary to what the term suggests, bride price is not a payment for the bride as if she is an object to be purchased and transferred. The misnomer is a legacy of misinterpretation by early anthropologists (Ashraf, Bau, Nunn, & Voena, 2020). See Section 3 for further details on the institution in Egypt.

cohorts and districts that allows for identification once fixed effects for birth cohort and district are introduced. Yet in addition, the reform led to arguably exogenous assignments of individuals to the five-years and six-years regime even within district-cohort cells. We use this additional source of identification to implement an IV estimator in a specification with cohorts and districts fixed effects.

Our estimates imply that women who completed at least compulsory education have significant marriage market returns, translating into a gain of about 100% on bride price, about 14% on husband's wage at the time of marriage and about 16% on our measure of husband's permanent income. The bride price return is mainly driven by the value of housing: brides with compulsory education have approximately EGP 119,000 (which is equivalent to USD 6,215) higher value of housing paid by the groom than brides without compulsory education. While an exhaustive investigation of the sources of these returns is beyond the scope of the paper, we find evidence of an important mechanism: assortative mating in education.

The paper builds on and contributes to three strands of literature. The first relates to that on female labor force participation. The long-term increase in female labor force participation has been explained in terms of changes in employment, as jobs become less physical in nature (Goldin, 2006), domestic production technology, such as household appliances and baby formula (Albanesi & Olivetti, 2007), fertility control technology (Goldin & Katz, 2002), and reduced discrimination in employment (Goldin, 2006). Fogli and Veldkamp (2011) and Fernández (2013) posit cultural shifts as a driver in the long-term increase of female labor force participation in developed countries in the past century, while Alesina, Giuliano, and Nunn (2013) use culture to explain large cross-country differences in female labor force participation. Our paper provides evidence that marriage institutions can result in a belief that marriage returns are superior to labor market returns for women.

In the regional context, Assaad, Hendy, Lassassi, and Yassin (2020) argue that the main culprit behind low and stagnating female labor force participation in MENA is the declining demand for female labor due to public sector downsizing in the region. This important work highlights demand side factors. However, their arguments do not explain the coexistence of women's education investment and falling labor market returns. Indeed, as noted by Assaad (2019), public sector jobs for educated labor market entrants in MENA had been dwindling since the 1980s.

The second relates to the literature on education and marriage outcomes. A large existing literature has examined marriage as a dimension in the returns to education, within which a relatively small subset has estimated the magnitude of marriage market returns. This literature is unanimous in suggesting marriage outcomes to be an important channel through which improved education leads to better well-being, especially for women (Ge, 2011). Even in developed countries, the returns to education in the marriage and labor markets are similar in magnitude for women (Bruze, 2015;

Goldin, 1992; Lefgren & McIntyre, 2006). Chang (2019) noted that women's marriage returns are especially important in countries where gender wage gaps are large, using evidence from Japan, Korea and Taiwan. Vogl (2013) argued that marriage can be a highly strategic affair in countries where women's livelihoods depend heavily on it.

In the more general literature on marriage and education, Chiappori, Iyigun, and Weiss (2009) developed a general equilibrium model for the joint determination of schooling and marriage patterns of men and women. In this model, returns to pre-marital investments in education can be decomposed into labor market returns and marriage market returns. Men and women acquire education in equal proportion if the market returns to education and household roles are gender-neutral, which results in a strictly positive assortative matching equilibrium (i.e. educated men only marry educated women, while uneducated men only marry uneducated women). However, a mixed equilibrium arises—with inter-education level marriages—if the market returns to education or household roles are not gender-neutral. Similar models have been developed by Chiappori, Dias, and Meghir (2018) and Chiappori, Salanié, and Weiss (2017), while Chiappori, Fortin, and Lacroix (2002), Choo and Siow (2006), and Hitsch, Hortaçsu, and Ariely (2010) provide insightful theoretical and empirical analyses on assortative matching.

Finally, the third strand of the literature relates to bride price, which has been shown to have important effects on both marriage and education decisions. Ashraf, Bau, Nunn, and Voena (2020) developed a theoretical model showing that the existence of the bride price custom itself incentivizes parental investment in female education, as parents expect a better-educated daughter to bring more bride price to her parents—an added incentive absent for ethnicities without the bride price tradition. Corno, Hildebrandt, and Voena (2020) and Corno and Voena (2021) show that a bride's parents can strategically time marriages in anticipation of bride price payments in order to smooth consumption in the face of adverse income shocks. Other studies have also shown that bride price has post-marital implications. Drawing evidence from rural Senegal, Mbaye and Wagner (2017) show that a higher bride price reduces fertility pressures on the wife. Lowes and Nunn (2018) found evidence from the Democratic Republic of Congo that a higher bride price is associated with lower uxorial acceptance of domestic violence, higher self-reported happiness of the wife but not of the husband, and higher cohesiveness of the marriage. However, in Nigeria, (Rexer, 2022) found that as bride price increases the cost of marriage for men, the custom can contribute to driving men with low marital prospects to join militant groups.

The rest of this paper is organized as follows. Section 2 describes the data and Section 3 provides background information on marriage and bride price in Egypt and an overview of the 1988 school reform. Section 4 discusses the methodology and identification strategy. Section 5 presents the main regression results and investigates heterogeneous effects. Section 6 provides robustness checks, while Section 7 discusses

the underlying mechanisms. Finally, we provide concluding remarks in Section 8.

2 Data

The paper utilizes the 2006, 2012, and 2018 rounds of the Egypt Labor Market Survey (ELMPS). The ELMPS is a nationally representative survey conducted by the Economic Research Forum (ERF) in collaboration with Egypt's Central Agency for Mobilization and Statistics (CAPMAS). As in a typical labor market survey, the ELMPS covers topics such as employment, unemployment, job dynamics, and earnings. It also provides rich information on education, household demographics, migration, and socio-economic characteristics.

Importantly, for the purpose of our analysis, the ELMPS data contain unique and rich information on bride price payments in each round of the survey. The specific survey module covers detailed information on different bride price components (which include *mahr*, *shabka*, *afsh*, *gihaz*, and housing), as well as the respective contributions made by the groom's and the bride's families to each bride price component, in percentage.[5] This allows us to calculate the exact payments made by and only by the groom and his family. We define bride price as the sum of the respective values of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family. In our benchmark definition of bride price, we rely on the value of bride price components as reported by the bride since she is the recipient. In case the information on bride price payments is only reported by the groom, we therefore rely on bride price payments as reported by the groom.[6] If information on any single component is not available from either the bride or the groom, bride price for that marriage is considered missing. Since bride price refers to payments made at the time of marriage, we use the World Bank's Consumer Price Index (CPI) in Egypt in order to calculate the value of each bride price component in constant 2018 Egyptian Pounds (EGP). Finally, to exclude extreme outliers, usually due to high value of real estate, we winsorize bride price at 1%. Our bride price variable is therefore the winsorized sum of all bride price components, made by the groom and his family, in constant 2018 EGP.

As presented in the introduction, we also examine the effect of female education on other marriage market returns, such as husbands' wages at the time of marriage, as well as husbands' permanent income. Given the absence of retrospective information on grooms' wages, we rely on an augmented Mincer model to impute the groom's wage

[5]The definition of each of these components is provided in Section 3, which presents background information on marriage and bride price in Egypt. Note that in the ELMPS, whenever a respondent reports that she or he does not receive any sum in a component, the response is recorded as zero rather than missing.

[6]We rely on information on bride price as reported by the groom only when the bride does not report bride price payments since men might have the incentive to aggrandize their contributions to bride price. Our results are robust to using the average of the groom and the bride's reports, as reported in the robustness checks Section sec:section63.

at the time of marriage in constant 2018 EGP. To do so, we utilize all wage data for men aged 20 to 59 years old from all rounds of the ELMPS. As for the imputation of husbands' permanent income, we sum their imputed annual wages up to the age of 59 discounted to the year of marriage. [7] Appendix A.1 provides detailed information on the imputation exercise.

We would ideally like to observe the characteristics of each couple at the time of marriage. However, since the ELMPS surveys are conducted at set intervals—which do not obviously coincide with the time of marriage for all couples—we rely on retrospective information to identify couples' year of marriage and compute their age at the time of marriage. We rely on the location of individuals at birth (which is available to the level of *shyakha*, or commune, the smallest administrative unit in Egypt) and the rurality status of residence at birth, since we do not have information on individuals' location at the time of marriage in the ELMPS data. As for the bride's education, which corresponds to our main independent variable of interest, we take advantage of the panel structure of the data to collect this information from the first round of the ELMPS observed after marriage. [8]

As discussed earlier and articulated in greater detail in Section 4, we exploit a quasi-experiment induced by the 1988 education reform in Egypt—which reduced the number of years of primary school from six to five years—in order to obtain an exogenous variation in women's education. This is made possible by a unique question in the 2012 round of ELMPS asking whether the individual attended a five- or six-year primary school. [9]

The first cohort affected by the 1988 reform corresponds to individuals who were born in the year 1977 (Ali & Elsayed, 2018; Assaad, Aydemir, Dayioglu, & Kirdar, 2016). Our sample is therefore restricted to married women born between 1964 and 1990, inclusive, which corresponds to 13 years before and after 1977.[10] Furthermore, we restrict our analysis to Muslim women, excluding the Christian minority. [11] The reason why we exclude Christian women is that they do not receive *mahr*, a uniquely Muslim tradition whereby the groom must contractually provide a monetary sum or

[7] 59 is chosen as a cutoff as the retirement age in Egypt is 60.

[8] Our results are robust to using whether the individual has ever completed a certain degree completion as reported from the three rounds of ELMPS. Results are reported in Section 6 on robustness checks.

[9] The survey questionnaire asks "[w]ere you pursuing primary education under the five-year or six-year system?", to which the respondent can answer either "five-year", "six-year" or "don't know".

[10] It is important to note that in 1999 another school reform occurred in Egypt, which reversed the 1988 reform. The 1999 reform once again increased the duration of primary school from five to six years. The first school cohort that was affected by the reform includes individuals who were born on or after October 1st, 1992 (Elsayed, 2019). To make sure that we are capturing exclusively the impact of the 1988 cohort, we therefore included individuals who were born prior between 1964 and 1990.

[11] Egypt's population is split between a Muslim majority and a Christian minority. According to the most recent Egypt Census in 2006, 94.7% of individuals are Muslims and 5.29% of individuals are Christians. The population following religious denominations and atheists are negligible (0.01%).

in-kind transfer to the bride for a marriage to be valid. The ELMPS does not directly solicit demographic information on religion but rather includes a binary choice of whether a person is Muslim or Christian in the marriage section.

Table 1: Descriptive Statistics on Married Muslim Women Born 1964-1990

	Birth location available	Bride location and bride price available		In the estimation sample		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Mean	Mean	Difference	Mean	Difference	Difference
	SD	SD	(2)-(1)	SD	(4)-(2)	(4)-(1)
	N	N		N		
Years of schooling	8.668	9.163	0.495***	9.201	0.038	0.533***
	(5.487)	(5.242)		(5.208)		
	8,024	5,448		4,900		
Compulsory education	0.613	0.666	0.053***	0.669	0.003	0.056***
	(0.487)	(0.472)		(0.471)		
	8,024	5,448		4,900		
Household size	5.959	5.905	-0.054**	5.924	0.019	-0.035
	(3.024)	(3.010)		(3.054)		
	8,024	5,448		4,900		
Father's years of schooling	5.04	5.297	0.257***	5.261	-0.036	0.221***
	(5.193)	(5.239)		(5.229)		
	8,024	5,448		4,900		
Wealth	0.403	0.402	-0.001	0.401	-0.001*	-0.002**
	(0.104)	(0.102)		(0.101)		
	8,024	5,448		4,900		
Rural at birth	0.701	0.698	-0.003	0.700	0.002	-0.001
	(2.203)	(1.906)		(2.002)		
	8,019	5,446		4,900		
Employed	0.212	0.198	-0.014***	0.196	-0.002	-0.016***
	(0.409)	(0.398)		(0.397)		
	8,021	5,447		4,900		
Out of labor force	0.740	0.746	0.006*	0.748	0.002	0.008**
	(0.439)	(0.435)		(0.434)		
	8,021	5,447		4,900		
Age of marriage	21.29	21.55	0.260***	21.446	-0.104***	0.156***
	(4.389)	(4.098)		(3.951)		
	7,998	5,448		4,900		
Log husband's imputed wage	7.435	7.438	0.004***	7.438	-0.001**	0.003***
	(0.171)	(0.168)		(0.169)		
	6,052	4,984		4,900		
Log husband's permanent income	10.48	10.486	0.006***	10.486	-0.001*	0.005***
	(0.172)	(0.170)		(0.171)		
	6,052	4,984		4,900		
husband's years of schooling	9.084	9.459	0.375***	9.470	0.011	0.385***
	(5.227)	(5.053)		(5.047)		
	7,335	5,086		4,900		
Father-in-law's years of schooling	4.166	4.422	0.256***	4.450	0.028**	0.283***
	(4.829)	(4.909)		(4.928)		
	7,335	5,086		4,900		

Notes: The analysis is restricted to married Muslim women born between 1964 and 1990. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Household size refers corresponds to the size of the household in the earliest wave the individual appears in the ELMPS. Father's years of schooling are imputed from the father's highest level of educational attainment (split in seven categories), as reported by the individual. Fathers with no formal degree attainment and are illiterate are assigned 0 years of schooling; those with no formal education but can read and write are assigned 4; those with less than intermediate education 8; those with intermediate education 12; those with above intermediate education 14; those with university degree 16; those with post-graduate degree 18. Wealth refers to that in the earliest wave the individual appears in the ELMPS. The ELMPS computes a wealth score by performing a Principal Component Analysis (PCA) on a series of indicators of asset ownership, including of real estate, vehicles, and household appliances. We then normalized the score to a scale between 0 and 1. Employed and out of labor force are binary variables computed from the latest wave of the ELMPS in which the individual was observed. Details on the computation of the husband's imputed wages and permanent income are provided in Appendix A.1. To compute husband's years of schooling, we match husbands in the dataset through the spouse code reported by each individual, provided that the person is married and her (his) spouse is present in the household in at least one round of the ELMPS. The husband's years of schooling is computed in the same manner as the wife's, through summation of grades. After matching the husbands, we impute the father-in-law's years of schooling in the same manner as the wife's own father's years of schooling.

To identify Muslim households, we exclude all individuals (1) who have at least one Christian household member, as inter-faith marriages are extremely rare in the country, or (2) whose religion is unknown. Just over 5% of all individuals ever surveyed in ELMPS have at least one Christian household member. This figure is very similar to the one we obtain from the most recent publicly available Egyptian Population Census, where 5.29% of individuals are Christians. Table 1 presents some descriptive statistics on key outcomes and regressors. The table is divided in three panels and in all three, the analysis is restricted to ever-married Muslim women born between 1964 and 1990. The leftmost panel additionally restricts the sample to women with known birth location, the middle panel additionally conditions on the availability of bride price data, while the rightmost panel corresponds to the estimation sample. The latter is additionally restricted to the sample of women whose treatment status of the 1988 education reform is either known or can be assigned and for whom all regressors and outcomes of interest are available (including bride price, husband's imputed wages, husband's imputed permanent income, husband's years of schooling, and father-in-law's years of schooling).

The average bride in the sample married at the age of 21 and completed around nine years of school, roughly coinciding with the years required to complete compulsory education prior to the reform. However, it is important to note the very large standard deviations in bride's schooling. The average years of schooling of the husbands seem to also oscillate around nine years, while the father of the bride and the father-in-law are found to be much less educated, reflecting the generational progress in education. Approximately, 70% of the brides are born in rural areas. Columns (3), (5) and (6) show that selection over observables is minimal in the estimation sample.

3 Background Information

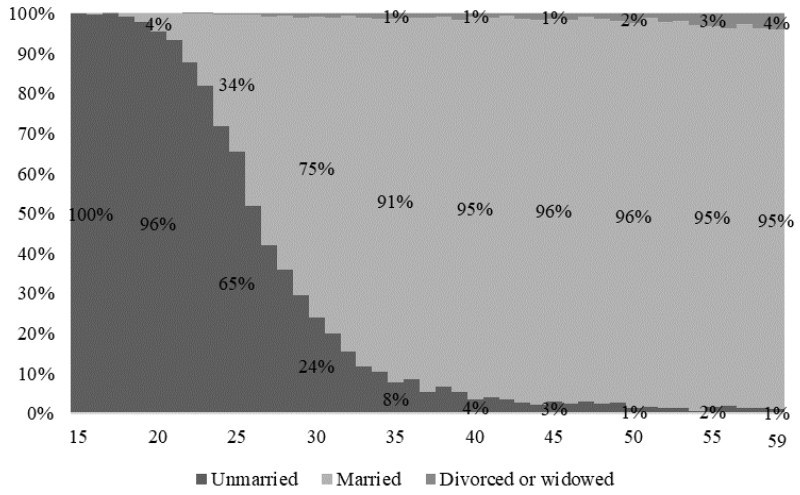
3.1 Marriage and Bride Price in Egypt

Marriage is almost universal in Egypt. As shown in Figure 1, by the age of 45, 97% of men and 98% of women have been married. Individuals also marry relatively young. In 2018, over 90% of women and almost three quarters of men were married before they turned 30. The timing of marriage is closely linked to education and employment, especially for men. Of those marrying in 2018, only 3% of men and 11% of women were still students, suggesting most have completed education before marriage. Social norms regulating gender roles made employment an important precondition for men when they marry. For instance, 93% of men who married in 2018 were employed in that year. Meanwhile, the evidence suggests women tend to withdraw from work upon marriage in the region (Assaad, Krafft, & Selwaness, 2022).

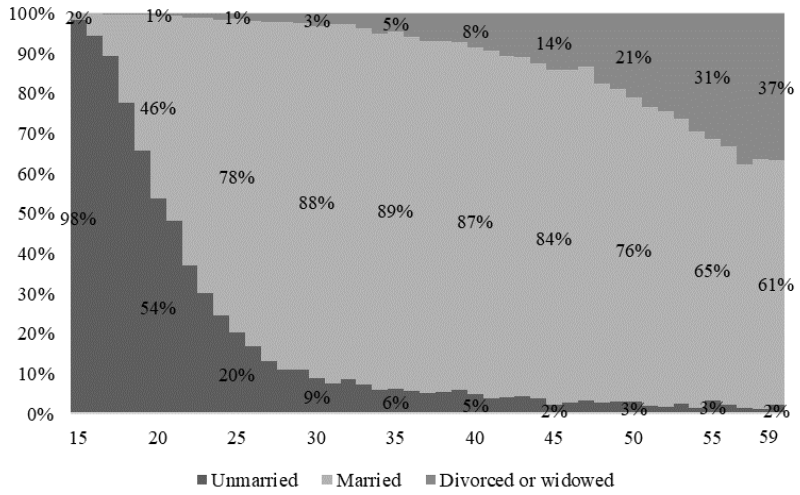
Marriage in Egypt is explicitly market-driven, with all of the attending implications

of demand, supply, and prices determining outcomes for an individual (Amin & Al-Bassusi, 2004). Marriage is highly expensive in Egypt, so much so that its cost causes couples to delay marriage. Between 2000 and 2018, the median marriage ceremony alone cost EGP 7,206 in 2018 prices, almost four times the median monthly wage of EGP 1,857 in 2018. Additionally, the to-be-wed couple is expected to secure a neolocal residence prior to marriage. Assaad, Krafft, and Rolando (2017) and Ramadan and Assaad (2008) find evidence that housing reforms in Egypt halted the trend of rising age of marriage in Egypt, while persistently unaffordable housing in Tunisia delayed marriage.

Figure 1: Marriage Rates by Age



(a) Sample of men



(b) Sample of women

Notes: The descriptive statistics on marriage rates in Egypt are computed using data from the 2018 ELMPS. Each graph shows, at each age (from 15 to 59), the respective share of each marital status. The âmarriedâ category includes to those contractually married, as well as those presently married.

There is a further series of traditional marriage cost items more idiosyncratic to the

region. The transfer of these itemsâin addition to the aforementioned housingâforms bride price payments in Egypt. Bride price is not merely a customary formality but an important institution regulating marriage, so much so that the details of these financial or in-kind transfers are often registered in marriage contracts.

Moreover, the bride and her family can legally enforce their claim on registered bride price items in courts in the event of a divorce (Bühler, 2021). Such items can include costly and essential household appliances and furniture. In a societal setting where the husband can easily initiate divorce, whose consequences are highly asymmetrical for the two partners, this institution deters the husband from such a course of action and offers the wife more bargaining power within the marriage. The practice of bride price in Egypt is therefore female-empowering (Salem, 2018), as the wife receives assets associated with her own person. This stands in contrast to bride price practices where the bride's family is expected to return the bride price upon divorce, seen for example in Uganda until the arrangement was outlawed explicitly to prevent women from being trapped in marriage (Lowes & Nunn, 2018).

Table 2: Settlement of Bride Price in the Event of a Divorce

F \ M	Not initiating divorce	Fault-based divorce	Non-fault-based divorce
Not initiating divorce	$((1-\alpha)P, \alpha P - P)$	$(0,0)$	$(P,-P)$
Fault-based divorce	$(P,-P)$		
Non-fault-based divorce	$(0,0)$		

Notes: Cases where both parties simultaneously (consensually) initiate divorce are not considered. P refers to the in-kind transfer provided by the male partner to the female partner upon marriage that is registered in marriage contract. αP refers to the linear utility derived by the male partner from having access to the bride price items, while $(1-\alpha)P$ refers to the utility derived by the female partner. The matrix is a highly simplified representation of family codes in Egypt. Corradini and Buccione (2023) provide a detailed view of non-fault-based divorce initiated by the wife (*khul*).

In Table 2, we present a simplified payoff matrix. We assume marriage by itself does not produce a surplus and we abstract from labor market income generated by either partner to isolate the incentive effects from bride price. The male partner provides an in-kind transfer of P to the female partner upon marriage and derives a linear utility of αP from having access to the bride price items. The female derives $1 - \alpha P$. In a fault-based divorce initiated by the wife (husband), she (he) retains the entirety of the bride price; in a non-fault-based divorce initiated by the wife (husband), she (he) forfeits any claim to the bride price. This gives strong incentives for women to behave strategically to secure a higher bride price.

In addition to housing, there are four other transfers. *Mahr* is a traditional compulsory gift by the groom to the bride. In theory, Muslim marriages are legitimate only after the payment of *mahr*, without which the bride can reject all conjugal duties, such as cohabitation or marriage consummation (Bühler, 2021). This is the most traditional form of bride price, yet its popularity has fallen into decline, especially among the better educated who find the implied gender norms too conservative. Within our estimation sample, 65% of women report receiving a *mahr* of zero.

Shabka is the wedding jewelry; like *mahr*, it is paid for exclusively by the groom

and his family. *Gihaz*—borne by both the groom's and bride's families—includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, rugs, mats, crockery, pots, pans, food supplies, and clothes and fabric for the couple. *Afsh*, whose costs are also shared, refers to the furniture and electrical appliances purchased for the newlyweds.

In our benchmark definition of bride price payments, we consider all the contributions made by the groom and his family to each of these components. All bride price components are either assets or durable goods transferred from the groom and his family to the bride and hers. It is also important to note that the ELMPS data also provide information on the cost of marriage ceremonies, with the respective contributions made by the groom's and the bride's families. However, we do not include the cost of ceremonies incurred by the groom and his family in our benchmark definition of bride price since neither the bride nor her family can gain financially from marriage ceremonies or use them as an asset. Hence, our definition of bride price includes the sum of *mahr*, *shabka*, and the shares of *gihaz*, *afsh*, and housing paid for by the groom and his family. [12].

The total bride price places a hefty burden on the groom. This is the reason why the groom's family provides substantial support in the provision of bride price. Between 2000 and 2018, the median bride price cost the groom and his family EGP 103,774, or 56 times the median monthly wage in 2018. This is consistent with findings of the sociology literature, which documents that on average bride price is roughly equal to four years' worth of earnings (Sieverding, 2012). Furthermore, our back-of-the-envelope calculation shows that bride price stands on a similar order of magnitude as median wealth in Egypt. Indeed, at the end of 2018, Credit Suisse estimates the average household wealth in Egypt to be USD 15,595 (EGP 278,482), with the median at USD 5,055 (EGP 98,304) (*Global Wealth Databook*, 2021). [13]

3.2 Associations Between Bride Price and Bride's Education

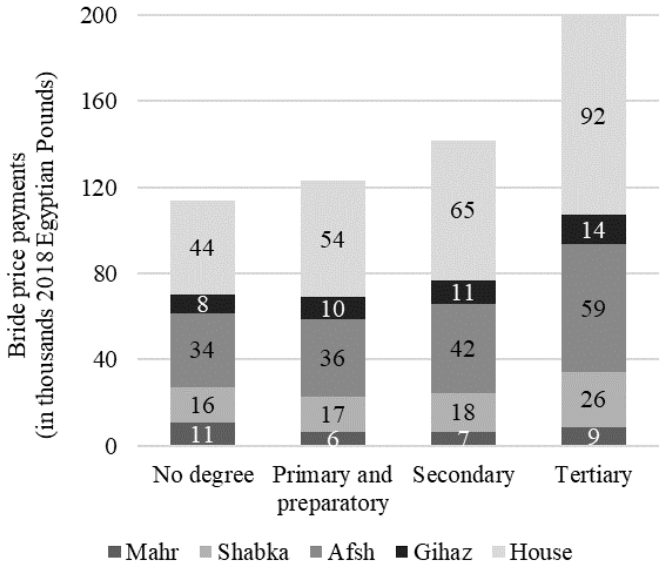
Figure 2 shows the average value and relative proportions of each bride price component by the level of education of the bride. As shown in Figure 2 (a), housing takes up the lion share of bride price, especially as brides move up the educational ladder. *Mahr*, the most traditional form of bride price, constitutes the smallest component of bride price (both in levels and in percentage), except among the least educated for whom the value of the *mahr* is higher than *gihaz*. Figure 2(b) suggests that the makeup

[12]Nonetheless, we also tested the robustness of our results to the inclusion of the cost of the wedding ceremony (paid for by the groom and his family) in our bride price variable. The results are robust to this check and are reported in Section 6.3

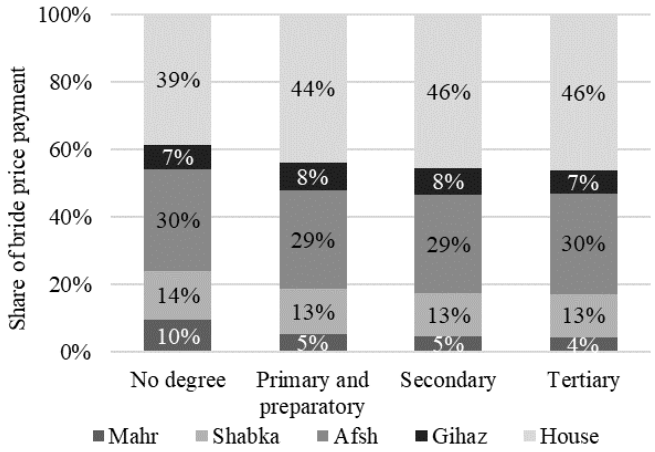
[13]Credit Suisse defines wealth as the marketable value of financial assets plus non-financial assets (principally housing and land) less debts. The estimate is obtained by way of regression. Further details can be found in the aforesaid reference. Credit Suisse classifies the quality of its data on Egypt as "poor".

of bride price does not vary by much across brides with different educational levels, except that the share of the house steadily gains while that of *mahr* falls. However, there are large and substantive level differences in bride price, with each additional level of education being associated with a gain in bride price, as seen in Figure 2(a) above. In log terms, the standard deviation of bride price is 1.43 in the estimation sample.

Figure 2: Bride Price Components by Education



(a) Bride price payments made by the groom and his family by components (in thousands EGP)



(b) Bride price components (% of total)

Notes: For each highest level of education attained by the bride, we compute the average bride price component paid by the groom and his family. Both the bride and the groom report the value of bride price in a marriage. We rely primarily on bride price as reported by the bride since she is the recipient of bride price. We use the groom's reported bride price when the bride's is unavailable. Bride price payments are in constant 2018 Egyptian Pounds, using Consumer Price Indices published by the World Bank. Figures are shown in thousands EGP.

These descriptive statistics provide early evidence on the presence of important returns to education in the form of bride price. Before turning to our methodology

and identification strategy, we start from a simple OLS model to investigate the association between bride price payments and brides' education. We estimate the following specification focusing on married Muslim women born between 1964 and 1990:

$$y = \alpha_1 + \alpha_2 s_{icd} + X_{icd}\Gamma + \mu_c + \theta_d + \epsilon_{icd} \quad (1)$$

In Equation (1), y_{icd} corresponds to the outcome of interest for woman i who belongs to birth cohort c born in district d. Our main variable of interest is s_{icq} which is a dummy variable indicator of whether the bride has completed compulsory education (which includes both primary and preparatory education). We focus on this education level for two main reasons. First, compulsory degree completion is not universal in Egypt, creating meaningful variation which is not present at the primary school level. [14] Second, it is the next schooling level right after the one directly affected by the 1988 reform. As we will explain in Section 4, this is useful for our identification strategy. X_{icd} is a vector of individual control variables consisting of the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The regressions also include birth cohort fixed effects (μ_c), as well as district (*qism*) at birth fixed effects (θ_q).[15]

Table 3: OLS Associations between Bride's Education and Bride Price

	(1) Log bride price	**(2)** Mahr	**(3)** Shabka	**(4)** Afsh	**(5)** Gihaz	**(6)** House
Compulsory education	0.499***	2,964.049***	7,585.399***	15,155.717***	2,301.659***	30,238.970***
	(0.026)	(926.026)	(760.815)	(1211.990)	(691.363)	(2601.611)
Observations	4,900	4,900	4,900	4,900	4,900	4,900
R-squared	0.231	0.127	0.119	0.193	0.096	0.212
Individual controls	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

[14] In our ELMPS survey, 33% of women did not complete compulsory education (see Table 1). These women either have no formal educational degree, can read and write without formal education, or have just attended primary education.

[15] The first administrative level in Egypt—which corresponds to the largest geographical division—is the governorate. The second largest administrative division is the district level (*qism* or *markaz*), while the third largest administrative division is the commune level (*shyakha*). Egypt is divided into 27 governorates, which are divided into approximately 350 districts. It is important to note that the ELMPS does not interview individuals who reside in the five frontier governorates: Red Sea, New Valley, Marsa Matruh, North Sinai, and South Sinai. According to the most recent Egypt Population Census in 2006, no more than 2% of the Egyptian population lived in Egypt's border governorates. The number of districts covered in our analysis is 233.

Table 3 reports the results from OLS regressions. Columns (1) to (6) all suggest a positive association between compulsory degree completion and the value of bride price. Column (1) suggests that completion of compulsory education is associated with an approximately 65% higher bride price. In level terms, we find that women who completed compulsory education consistently have higher values for the different components of bride price. [16]

For instance, the value of the *mahr*—which corresponds to the traditional compulsory gift paid by the groom to the future wife—is approximately EGP 3,000 (USD 155) higher among compulsory educated women relative to women who did not complete compulsory education. The value of *shabka* (jewelry) and the value of *gihaz*, which includes all wedding preparation items, are likewise higher among brides who completed compulsory education. Moreover, we find that the highest gains in bride price payments, associated with higher education, are attributed to *afsh* (furniture) and house. For instance, we find that having compulsory education is associated with EGP 15,000 (USD 790) and EGP 30,000 (USD 1,580) higher values of *afsh* and house, respectively.

However, it is important to note that one cannot interpret these associations as causal. Several endogeneity issues might be inherent in this analysis. On the one hand, a series of omitted variables would tend to bias the OLS estimates upwards. In our benchmark model, we control for an extensive set of individual covariates and fixed effects, capturing unobserved time-invariant heterogeneity across birth cohorts and birth districts. However, unobserved, individually varying characteristics such as the bride's ability and the prevailing social norms of the families would in general be positively correlated with both the bride's education and her bride price. On the other hand, strategic behaviors may bias OLS estimate downwards. Better educated women may value traditions such as bride price less, and the quality of the husbands more. That is, they may be more willing to forgo the former to secure more of the latter, if confronted with a marriage possibility frontier along these two axes. Empirically, we observe that the most customary and least practical component of bride price, termed *Mahr*, is negatively associated with the bride's education. Further, better educated women are substantially more likely to participate in the labor force (Deng, Elmallakh, Flabbi, & Gatti, 2022). Hence these women would care less about striking a hard bargain for a good bride price, compared with the numerous less educated women who never planned to work. Thereby in conjunction, the net direction of the bias is unclear from *a priori* analyses.

[16] It is important to note that our indicator of compulsory degree completion also includes women who completed higher levels of education (such as high-school or university degrees).

4 Methodology and Identification

4.1 Background on the School Reform

To get around the endogeneity of the education choice, this paper exploits a school reform that took place in Egypt in 1988. The reform reduced the number of years required to complete primary school from six to five, introducing quasi-experimental variations in years of schooling and degrees' completion. The reform was dictated by Law No. 233 for 1988 and the implementation started with the fourth and fifth graders in school year 1988/1989. *De jure*, fifth graders enrolling in fifth grade in school year 1988/1989 would study the same curriculum as those enrolling in the sixth grade under the old system and would sit for the final exam of the primary stage with the sixth graders. Meanwhile, fourth graders in school year 1988/1989 would be given the fourth-grade curriculum, as well as the abridged version of the fifth-grade curriculum. They would advance to the fifth grade in school year 1989/1990 and would sit for the final exam of the primary stage, after which they would advance to the first year of the preparatory school (Assaad, Aydemir, Dayioglu, & Kirdar, 2016). Hence, those treated by the reform would *ceteris paribus* have had one less year of schooling compared to those who did not.

Figure 3 presents the education system in Egypt before and after the 1988 reform. As shown in the figure, prior to the reform, the formal schooling system in Egypt was built on six years of primary school, followed by three years of preparatory schooling, and another three years of secondary schooling. Like children in most countries, children in Egypt would enroll in primary school at the age of six and, after twelve years of schooling, be ready for tertiary education at the age of 18. After the reform, as primary school was shortened and no other change was made to the schooling system, children would begin and finish each degree of education one year younger than those unaffected by the reform. It is also important to note that the reform led to a reduction in the number of years of compulsory education (primary and preparatory) from 9 years to 8 years.

Figure 3: Education System in Egypt Before and After the 1988 Reform

Age	Years of schooling completed	Education level	Grade enrolled	Education level	Grade enrolled
		Before 1988 Reform		After 1988 Reform	
22	16				
21	15	University	4		
20	14		3	University	4
19	13		2		3
18	12		1		2
17	11	Secondary	3		1
16	10		2	Secondary	3
15	9		1		2
14	8	Preparatory	3		1
13	7		2	Preparatory	3
12	6		1		2
11	5		6		1
10	4	Primary	5	Primary	5
9	3		4		4
8	2		3		3
7	1		2		2
6	0		1		1
5	0	Preschool	2	Preschool	2
4	0		1		1

Notes: This figure shows the education system in Egypt before and after the 1988 school reform, which led to a reduction in the number of years required to complete primary education from six to five years and affected individuals who were born in 1977 onwards.

The reform could therefore impact schooling decisions in two ways. On one hand, students could decide to complete primary and subsequent educational levels at higher rates because the cost of completing education is lower since fewer years are needed to complete primary. On the other hand, students may end up completing primary and subsequent educational levels at lower rates because the reform might have introduced learning losses since the curriculum that was studied and explained over three years is now compressed into two years. Our paper does not aim to discuss the direction of the reform's effects, but only to use it as a source of external variation.

The 1988 reform was eventually reversed by Law No. 23 enacted in 1999, which came into force in 2003. The effects of the second, 1999 reform are not exploited for instrumentation in this paper, for the following two reasons. Firstly, the latest wave of ELMPS was only conducted in 2018, at which time even the oldest cohort affected by the 1999 reform was just 24. This censors our observations selectively. By 2018, we observe only the outcomes of those individuals who marry young and complete education early. Future studies using later surveys will be able to exploit this reform. Secondly, the 1999 reform was rolled out differently from the 1988 one â the former a national rollout, and the latter geographically staggered, as will be discussed further in Section 4.2. Only a geographically staggered roll-out generates exogenous variation in schooling levels within cohorts.

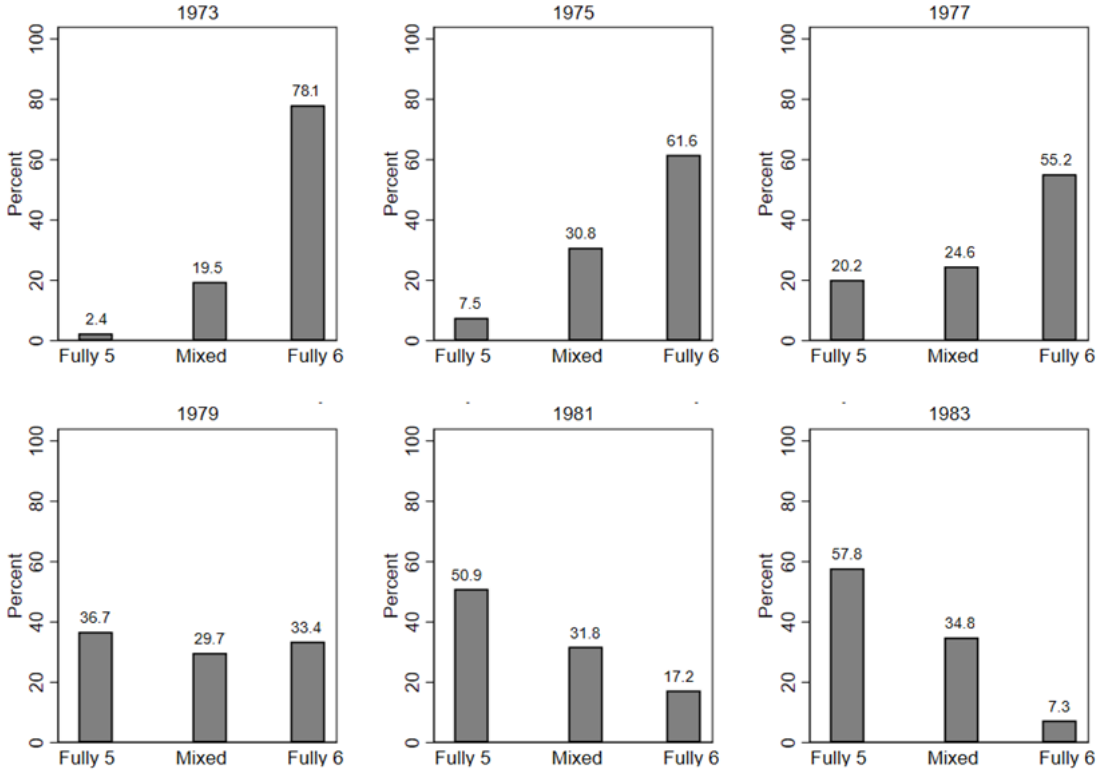
4.2 Identification Strategy

The identification of any return to schooling in a regression framework is challenged by the endogeneity of the schooling decisions. In short, unobserved individual-level characteristics may be directly correlated both with the level of schooling completed and with the dependent variable of interest. In our context, the dependent variable is bride price or groom wages and therefore an additional source of bias arises: the sorting of spouses over unobservables. Not only relevant variables responsible for the sorting are unobserved (for example, beauty or intelligence) but the direction of the sorting is ambiguous (for example, individuals may like more individual more similar to them or different from them.) We use the 1988 reform as source of endogenous variation in brides' schooling to solve the identification problem. Before proposing the formal identification strategy, we document the extent and location of the relevant variation.

As noted above, the implementation of the 1988 reform was a staggered rollout. Some administrative units implemented the reform prior to others, introducing variations both across cohorts and districts. In addition, different administrative units within the same district implemented the reform at different points in time. As a result, we can use in identification both variation over districts and birth cohorts and variation within district/cohort cells.

We present the extent of this variation using the 2012 round of ELMPS, the only ELMPS survey round that provides direct individual-level information on whether the respondent attended a five- or six-year primary school. In the survey, a specific question asked all individuals if they attended a five-year or a six-year primary school regime. The question was answered by more than 80% of the relevant sample. Based on answers to this question, Figure 4 features the share of districts, by primary school regime, over birth cohorts. We define three categories: districts where all individuals reported exclusively following a five-year regime, districts where some reported following a five-year regime and others six-year, and districts where all individuals reported exclusively following a six-year regime.

Figure 4: Share of Districts by Primary School Regime over Birth Cohorts



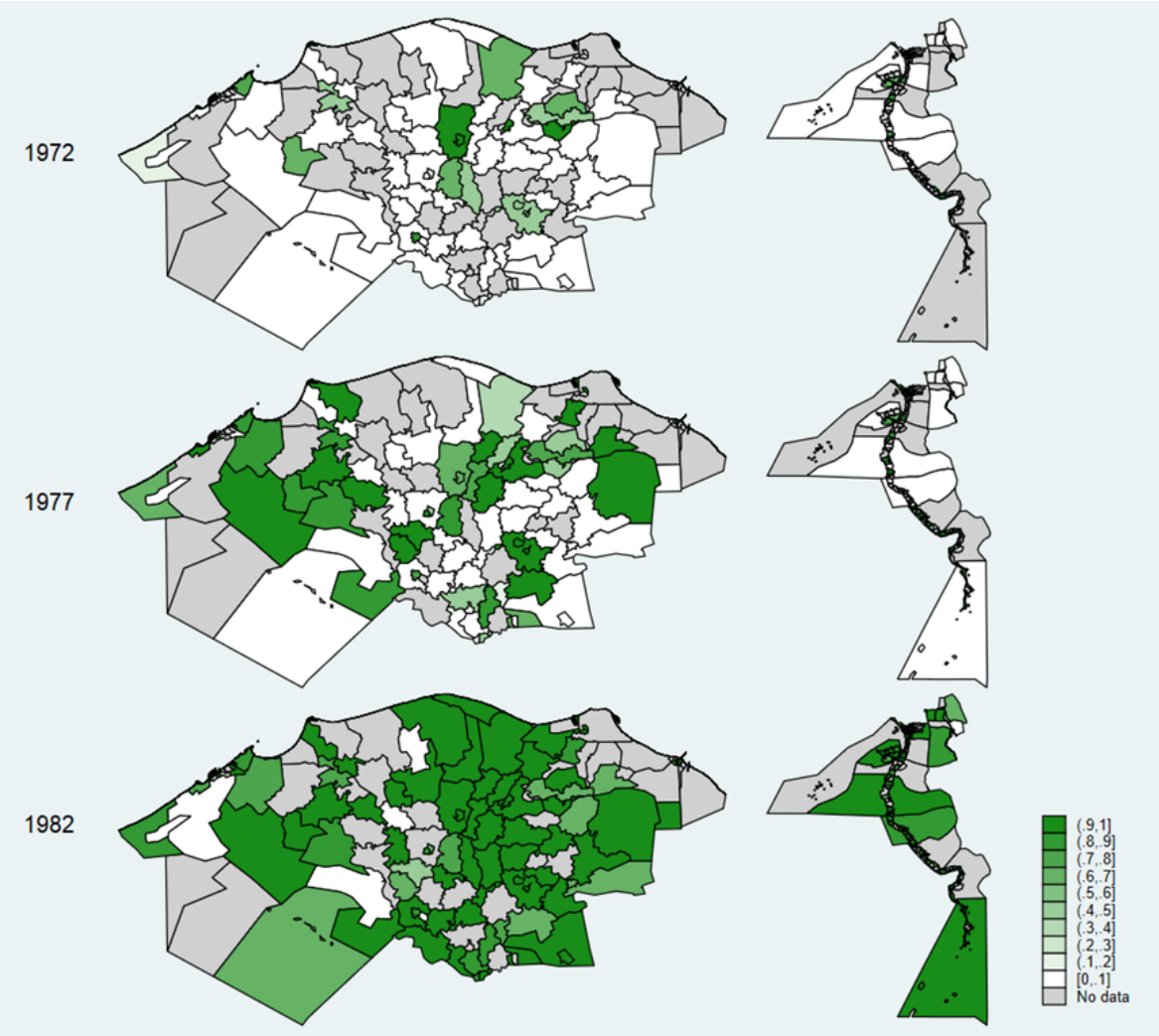
Notes: This figure shows, for each birth cohort, the respective shares of districts in Egypt where either (1) all individuals in the district self-reported attended five-year primary schools, (2) some individuals in the district reported five-year and others six-year, and (3) all individuals in the district reported attended six-year primary schools. 1977 is the first birth cohort to be affected by the reform by institutional design.

As highlighted before, the reform was implemented in school year 1988/1989, which means that the 1977 birth cohort was the first affected by the reform. However, in line with Elsayed and Marie (2020), we find empirical evidence that the reform had already been rolling out earlier. While the vast majority of districts were indeed following the six-year primary regime for individuals born before 1977, we also identify a fraction of districts that were either exclusively following a five-year primary schooling system (2% and 8% for the 1973 and 1975 cohorts, respectively) or that followed a mixed regime (20% and 31% for the 1973 and 1975 cohorts, respectively). From the 1977 birth cohort onwards, we observe a steady increase in the share of districts following a five-year as opposed to a six-year primary school regime.

Figure 5 shows the progress of the reform across districts by comparing three cohorts: individuals born in 1972, i.e. five years before those first affected by the reform; individuals born in 1977, i.e. those first affected by the reform; and individuals born in 1982, i.e. five years after those first affected by the reform. For a given district and birth cohort, we report the percentage of pupils who reported attending a five-year primary school. The figure therefore shows the state of reform penetration over time. We zoom in on the Nile Delta region as this relatively small region contains around half of Egypt's population, while the rest is scattered across the Nile Valley, though with

another concentration in Greater Cairo. On the whole, it is clear that the reform was not fully implemented one year to the next but progressed over time by both spreading to more districts and by penetrating more deeply within each district. In 1972 just a handful of districts contained individuals who reported following the five-year primary system, while in 1982 we observe a more universal pattern of reform adoption. More densely populated and more urban districts tended to take up the reform earlier than the sparsely populated, peripheral ones. This is in line with Elsayed and Marie (2020) and the general background of the reform (Abdel Karim, 2009).

Figure 5: Share of Individuals Reporting 5-Year Regime by District over Birth Cohort in the Nile Delta and the Nile Valley

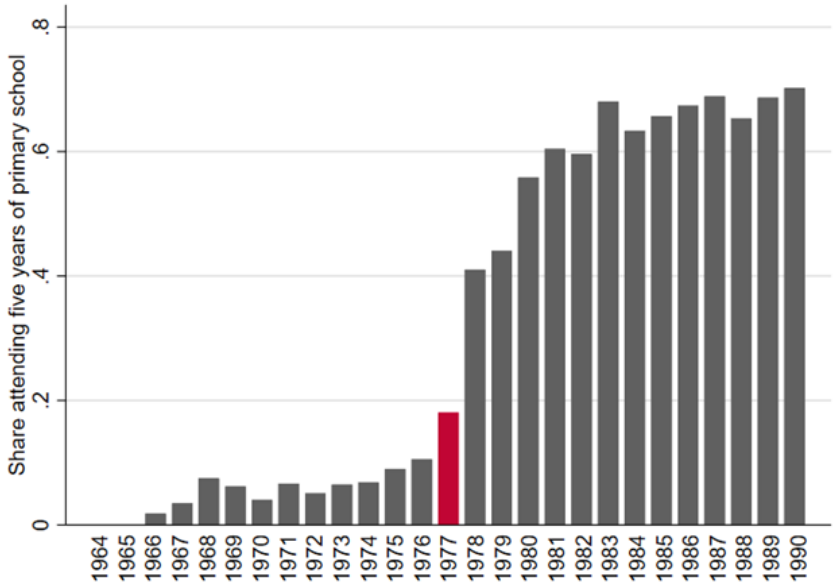


Notes: This figure shows the progress of the 1988 reform across districts by birth cohort, five years before and after 1977, the first birth cohort treated by the reform. A darker shade of green indicates a higher percentage of pupils reported attending a five-year primary school. Districts with no observations from a particular birth cohort are colored in gray. Districts of the Nile delta are shown on the left and those of the Nile valley on the right. Nile Delta governorates include: Dakahlia, Beheira, Gharbia, Alexandria, Monufia, Qalyubia, Sharqia, Port-Said, Damietta, and Kafr El-Sheikh. Nile Valley governorates include: Faiyum, Ismailia, Giza, Minia, Cairo, Luxor, Suez, Aswan, Asyut, Beni Suef, Qena, and Sohag.

Finally, Figure 6 presents the roll-out of the reform by reporting the share of

individuals in a given cohort who reported attending the five-year regime. The gradual increase over time from the late 1970s' birth cohorts onwards once again reflects the staggered nature of the reform. The proportion jumps about 10 percentage points in the first year of the reform, another 20 points in the second year and then gradually increases until about 70% of individuals born in 1990 report attending a five-year regime. We do not consider subsequent cohorts because, as mentioned, the reform was reversed 1999, starting to affect individuals born in 1992. To avoid anticipation effects of the second reform, the youngest individuals in our estimation sample are born in 1990.

Figure 6: Share of Individuals Reporting 5-Year Primary Regime



Notes: This figure shows the respective shares of individuals born in each year who reported attending six-year primary schools. The cohort of 1977, by design the first cohort to be treated by the reform, is highlighted.

Exploiting these variations, we rely on an instrumental variable approach combined with two fixed effects—controlling for birth cohort and district at birth fixed effects—to quantify the effect of bride's education on marriage market returns using data from the 2006, 2012, and 2018 rounds of the ELMPS. We use each individual's treatment status by this reform as an instrument for compulsory education completion. Hence, we exploit both variations in the timing of the reform across administrative units and birth cohorts, as well as variations in treatment status within the same cohort and administrative unit. We implement a Two-Stage Least Squares (2SLS) estimator where the second stage is given by Equation (1) presented in Section 3.2, and the first stage is specified as:

$$s_{icd} = \beta_1 + \beta_2 T_{icd} + X_{icd}\Pi + \mu_c + \theta_d + u_{icd} \tag{2}$$

where: s_{icd} is an indicator variable equal 1 if woman i who belongs to birth cohort c and district d has completed compulsory education; T_{icd} an indicator variable equal 1 if the woman attended a six-year primary school; X_{icd} is a vector of individual control variables consisting of the woman's age at the time of marriage and an indicator for rural residence at birth. In addition, the regression includes year of birth fixed effects (μ_c) and district ($qism$) at birth fixed effects (θ_d). [17]

With this notation, it is easy to see the arguably exogenous sources of variation that allow for the identification of α_2 in Equation (1). T varies over i, c and d. Possibly endogenous cohort effects are controlled for by μ_c; possibly endogenous district effects are controlled for by θ_d. Consider individual, i-level variations within each cohort-district cell. Such variations in roll-out are documented in Figures 4 and 5. We check for systematic association between this variation and individual characteristics by estimating a linear probability model of selection into the six-year primary school regime. The results, reported in Table A.2.1 of the Appendix, do not show any systematic association between attending a six-year regime and family characteristics, once we condition on cohort and district. [18] Of course, we cannot fully rule out that some association with unobserved individual heterogeneity exists. However, the history of the program implementation seems to suggest that a significant association at this level is not very likely (Abdel Karim, 2009).

As noted above and in Section 2, only the 2012 round of the survey contains a direct question about the primary school regime attended. Therefore, we can only directly observe a value for T_{icd} among those individuals interviewed in the 2012 round. However, relying only on this round (i.e. discarding individuals present only in the 2006 and 2018 rounds) significantly reduces the estimation sample. While this is not a problem for our main specification, it becomes important when attempting to identify heterogeneous effects. We have therefore decided to introduce the following assignment rule to keep in the estimation sample also women who did not answer the school regime question. Each woman i belongs to a birth cohort c and a district d. We can therefore divide the entire sample in $c \times d$ cells. In each cell, we have a number of individuals who answered the school regime question in the 2012 survey round: we label them the *respondents*; we label the rest the *non-respondents*. Our problem is to assign a value of T_{icd} *to the* non-respondents. Our choice has been to assign them to the regime that the majority of the respondents in that specific cell belongs to. For example, if for a cohort c' in district d', 80% of the respondents assert that they attended a five-year primary school, then all non-respondents in cell (c', d') are assumed to have attended

[17] We assume that the district at birth is also the district in which the woman attended primary school. Information on school district is directly available only for the 2018 round, where we find that 85% of individuals attended primary school in the same districts as they were born in; over 95% did in the same governorates they were born in.

[18] See column (3) in Table A.2.1where we condition on the same fixed effects we use in Equations (1) and (2).

a five-year primary school. Consistently, all the non-respondents in district d' born in later cohorts will also be assigned to the five-year regime.

Before turning to our benchmark results in Section 5.1, Table 4 reports the first stage results from our 2SLS estimator. In this table, we use five different definitions for the dependent variable s_{icd} and we only report point estimates and standard errors of β_2, the coefficient corresponding to *not* being affected by the reform, i.e. attending a six-year primary school. Column (3) reports the specification defined in Equation (2), where the dependent variable is an indicator variable equal 1 if the woman has completed compulsory education. Columns (4) and (5) look at more advanced schooling degree, column (2) only at primary school completion and column (1) at the overall number of years of schooling completed. Results show that individuals who attended a six-year primary school regime acquire more education than those affected by reform. The positive impact is not limited to the degree most closely related to the reform (primary and preparatory) but spills over to more advanced degree and to the overall years of schooling completed. Among the two channels through which the reform impacts schooling completion that we describe at the end of Section 4.1, it is then the second that seems to dominate. Students attending a five-year regime have to cover in two years the same curriculum that students attending a six-year regime cover in three years, possibly inducing learnings losses or simply discouraging student to acquire more education.

As shown in Table 4, our instrument is very well-correlated with all the relevant schooling variables (see the Kleibergen-Paap Wald F statistic reported in the last row). The only schooling level for which the instrument would be weak is university degree completion, a not surprisingly results given how removed university is from the application of the reform. In our empirical analysis, we rely on compulsory degree completion (primary and preparatory degrees) as our main independent variable of interest. In the robustness checks section, we also show estimation results using years of schooling or secondary degree completion.

Table 4: First Stage Results—Impact of the 1988 School Reform on Education

	(1) Years of schooling	(2) Primary school completion	(3) Preparatory school completion	(4) Secondary school completion	(5) University completion
School reform	1.160***	0.078***	0.079***	0.066***	0.036**
	(0.179)	(0.015)	(0.016)	(0.017)	(0.016)
Observations	4,900	4,900	4,900	4,900	4,900
R-squared	0.338	0.273	0.265	0.286	0.236
Individual controls	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES
Kleibergen-Paap Wald F statistic	41.93	26.47	23.67	15.20	4.85

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: This table shows the regression output of equation (2). All outcome variables are extracted from the first wave of ELMPS after the individual was married. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Primary, preparatory, secondary and university completion are dummies that are 1 if the individual has completed said stage of education. Hence, individuals with education level above each stage in question will be considered as having completed that stage. Primary school curriculum in Egypt lasts 6 years (before the 1988 reform) or 5 years (after the 1988 reform), preparatory school curriculum 3 years, secondary school 3 years, and university 4 years. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

5 Estimation Results

5.1 Benchmark Results: How Does Schooling Affect Marriage Market Returns?

Table 5 presents point estimates and standard errors for α_2 in Equation (1). It is the coefficient corresponding to s_{icq}, the indicator variable equal 1 if the woman has completed compulsory education. The table follows exactly the same structure and specification of Table 3 in Section 3 but we now use a different estimator: the 2SLS estimator defined in Section 4 instead of the OLS estimator used in Section 3. In line with the OLS estimates in Table 3, we consistently find that women who completed compulsory education receive higher bride price payments but the magnitude of the 2SLS estimates is much larger than the one found for the OLS estimates. We estimate that compulsory education completion doubles the bride price, compare with the 50% increase we found in Table 3. By examining the different components of bride price in columns (2) to (6), we find that the results are primarily driven by housing, as contributed by the groom and his family. Indeed, having compulsory education is associated with approximately EGP 119,000 higher value of housing (which is equivalent to USD 6,650 in 2018).

Table 5: Impact of Bride's Education on Bride Price Using IV Regressions

	(1) Log bride price	(2) Mahr	(3) Shabka	(4) Afsh	(5) Gihaz	(6) House
Compulsory education	1.061**	11.600	0.579	22.854	2.479	118.899***
	(0.424)	(1.402)	(11.629)	(20.141)	(9.578)	(43.990)
Observations	4,900	4,900	4,900	4,900	4,900	4,900
Individual controls	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: This table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

By comparison, completing compulsory education is only associated with a 0.399 rise in log wages for women of this age group, controlling for district and cohort fixed effects; estimated in absolute terms, the average gain is about EGP 6,431 a year, in constant 2018 prices. Returns in the marriage market are therefore much more substantial than returns in the labor market. Even if we assume the woman works continuously from 21, the median age of marriage, to 59, just before the age of retirement, the present discounted value of wage returns to completing compulsory education is EGP 114,924,[19] less than the average return in bride price from the housing component alone. For comparison, Bruze (2015) found that in Denmark, returns to education in the labor and marriage markets are about equal in size. A word of caution is necessary in this comparison. Female labor force participation in Egypt is low, hovering between 20% and 25% from 1998 to 2018. The returns to schooling in the labor market used in the comparison are therefore affected by a large amount of sample selection and they may be higher or lower than the true return in the population. Still, the bias needs to be of an unprecedent extent to make the labor market returns comparable to the bride price returns we estimate.

The magnitude of bride price returns to education we estimated is similar to that seen in Indonesia. Ashraf, Bau, Nunn, and Voena (2020) find that completing junior

[19]We calculate the present discounted value of wage returns in the same manner as we calculate the present discounted value of the husband's imputed lifetime income in Appendix A.1. This calculation here relies solely on the average return in constant 2018 EGP.

secondary school is associated with an increase of 0.672 in log bride price, under a comparable specification. The same paper finds a much smaller return to junior secondary school completion in Zambia at 0.255, and there the returns are only robust to specification at the higher secondary level. Lowes and Nunn (2018) find an additional year of education is associated with a 0.091 increase in a bride price score on a 1 to 9 scale. Bride price is but one component of marriage market returns. In Table 6, we further investigate the effect of bride education on another marriage market returns: husband's income. Of course, this measure is different from the bride price we reported in Table 6 since husband's labor income is inherently endogenous to the woman's behavior also after marriage. It therefore includes the effects of both returns to marriage and subsequent household interactions.

Ideally, we would like to isolate a measure of the potential lifetime income that the husband can deliver to the future wife at the time of marriage. We build two crude approximations to this measure. First, we focus simply on the husband's wage at the time of marriage: under the assumption that employment risks and wage growth are relatively homogenous across individuals and that men marry at a relative mature point of their labor market career, this is an informative measure of marriage return. Second, we attempt to improve on this measure by computing an approximation of the husband's permanent labor income, as explained in Appendix A.1. We then estimate the same specification reported in Equation (1) but using these two labor income measure as dependent variable.

In columns (1) and (2) we use the OLS estimator, in columns (3) and (4) the 2SLS estimator. Both sets of estimates show that bride's compulsory education completion is associated with higher husband's income. In line with the results in Table 5, we also find that the magnitude of the 2SLS estimates is much larger than the one of the OLS estimates. Using our preferred 2SLS estimates, we find that women who completed at least compulsory education marry husbands with 43% higher wages at the time of marriage and who are projected to earn 36% higher income through their lifetime than husbands of less educated women.

Direct comparisons of magnitude with the literature cannot be easily made, as most existing work focuses on developed economies and hence the education level of interest is often university completion. For example, Lefgren and McIntyre (2006) found that the husbands of women who completed university are expected to earn $20,000 more per year than husbands of women who only attended some university. Using a quarter of birth instrumentation strategy, the paper found an additional year of schooling of the wife is associated with an increase in the husband's annual wages worth 18% of the sample average. Using a sample of women from Japan, Korea and Taiwan, Chang (2019) found that an additional year of schooling of a woman is associated with an increase of around 12% in the husband's wages in all three countries.

However, the existence of such association is well documented across countries both

developed and developing (Jepsen, 2005). It should be noted that the coefficient cannot be interpreted as entirely due to assortative matching, as part of the effect is presumably due to cross-productivity gains. Becker (1973) posits a degree of intra-household specialization whereby the partner with higher labor market productivity can bring in more wage returns. Similar results can be found in the models of Chiappori, Iyigun, and Weiss (2009).

Table 6: Impact of Bride's Education on Other Marriage Returns Using OLS and IV Regressions

	OLS		**IV**	
	(1)	(2)	(3)	(4)
	Log husband's imputed wage at marriage	Log husband's imputed permanent income	Log husband's imputed wage at marriage	Log husband's imputed permanent income
Compulsory education	0.141***	0.158***	0.356***	0.282***
	(0.005)	(0.005)	(0.083)	(0.076)
Observations	4,900	4,900	4,900	4,900
R-squared	0.397	0.319		
Individual controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: The left panel shows the regression output of equation (1). The right panel shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix (A.1). Compulsory education is a dummy variable for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Data for this variable are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

5.2 Investigating Heterogenous Effects

In this section, we investigate heterogeneous effects along two dimensions: the urban/rural residence status at birth and the age of marriage of the bride. First, in Table 7, we investigate whether the results differ according to the urban/rural residence status at birth. In Panel A, we report the results using OLS regressions, while Panel B those from IV regressions. The OLS results show that the magnitude of the marriage market returns is higher among women who were born in rural areas relative to women who were born in urban areas. However, for both groups, we find that bride's compulsory degree completion is associated with higher marriage market returns, be it in the form of bride price, husband's imputed wage at the time of marriage, or husband's imputed permanent income. The IV results in Panel B show that the results are exclusively driven by women who were born in rural areas. Indeed, we find that among women who were born in rural areas, having a compulsory degree is associated with 1.5 times higher bride price payments, 31% higher husband's wage at the time of marriage, and 26% higher husband's permanent income. It is important to note that the vast majority of women in our estimation sample (70%) are indeed

born in rural areas, as shown in the descriptive statistics in Table 1, and it is therefore expected that this group should have a high impact on the population estimates.

Table 7: Impact of Bride's Education on Bride Price and Other Marriage Returns by Rural Residence at Birth

	Log Bride Price		Log imputed husband's wage at marriage		Log imputed husband's permanent income	
	(1)	(2)	(3)	(4)	(5)	(6)
	Urban	Rural	Urban	Rural	Urban	Rural
Panel A: OLS Regressions						
Compulsory education	0.481***	0.500***	0.112***	0.149***	0.130***	0.163***
	(0.053)	(0.031)	(0.010)	(0.006)	(0.011)	(0.006)
R-squared	0.258	0.246	0.375	0.387	0.302	0.328
Panel B: IV Regressions						
Compulsory education	5.633	0.922***	1.892	0.269***	1.579	0.231***
	(15.583)	(0.350)	(5.159)	(0.066)	(4.195)	(0.064)
Observations	1,640	3,223	1,640	3,223	1,640	3,223
Individual controls	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: Panel A shows the regression output of equation (1), split by whether the bride is born in a rural area. Panel B shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion, split by whether the bride is born in a rural area. ELMPS contains retrospective information on whether the individual was born in a rural area. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

Second, we perform heterogeneity analysis with respect to the age of marriage of the bride. In Table 8, we split our sample by whether the bride married before the age of 20 or after the age of 20. Interestingly, we generally find that younger brides (those that married before the age of 20) have higher marriage market returns associated with compulsory education completion compared to brides who married at the age of 20 or later. But we find one exception in Panel B, which relies on IV regressions, where compulsory degree completion does not exert any significant impact on bride price payments among brides who married before the age of 20. Otherwise, we find that compulsory degree completion leads to 52% higher husband's wages at the time of marriage and 35% higher husband's permanent income among brides who married

before the age of 20 (as opposed to 24% and 30% among brides who married at the age of 20 or later, respectively).

Table 8: Impact of Bride's Education on Bride Price and Other Marriage Returns by Age at Marriage

	Log Bride Price		Log imputed husband's wage at marriage		Log imputed husband's permanent income	
	(1)	(2)	(3)	(4)	(5)	(6)
	Married < 20	Married ≥ 20	Married < 20	Married ≥ 20	Married < 20	Married ≥ 20
Panel A: OLS Regressions						
Compulsory education	0.565***	0.442***	0.155***	0.129***	0.173***	0.130***
	(0.040)	(0.043)	(0.008)	(0.009)	(0.007)	(0.009)
R-squared	0.235	0.356	0.335	0.354	0.329	0.340
Panel B: IV Regressions						
Compulsory education	0.588	1.423**	0.422***	0.213**	0.299***	0.259**
	(0.562)	(0.594)	(0.117)	(0.104)	(0.105)	(0.125)
Observations	1,648	3,200	1,648	3,200	1,648	3,200
Individual controls	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: Panel A shows the regression output of equation (1), split by whether the bride married before the age of 20. Panel B shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion, split by whether the bride married before the age of 20. In the 2018 cross-section of ELMPS, 20 is the median age of marriage among all women born between 1964 and 1990. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

6 Robustness Checks

6.1 Assignment Rule Into Treatment

In this section, we perform a number of checks in order to test the robustness of our results. The first battery of robustness checks refers to our assignment rule into treatment. As emphasized in our empirical strategy, we exploit the staggered rollout of the 1988 school reform across administrative units and birth cohorts. In our benchmark model, we rely on the district level (the second largest administrative unit in Egypt) to

build our instrument. The number of districts covered in our analysis is 233 districts, allowing for a granular analysis of the reform rollout across the Egyptian territory.

Table 9: Robustness to Assignment Level—Impact of Bride Education on Marriage Returns

	(1) Log Bride Price	(2) Log husband's imputed wage at marriage	(3) Log husband's imputed permanent income
Panel A: Assignment at the governorate level			
Compulsory education	0.873**	0.380***	0.285***
	(0.381)	(0.080)	(0.070)
Observations	4,900	4,900	4,900
Governorate FE	YES	YES	YES
Panel B: Assignment at the commune (*shyakha level*)			
Compulsory education	1.081	0.349**	0.405***
	(0.725)	(0.141)	(0.150)
Observations	4,277	4,277	4,277
Commune FE	YES	YES	YES
Individual controls	YES	YES	YES
Birth cohort FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: This table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. The table differs from the main specification in the instrument. In Panel A, those missing treatment status are assigned the status of the *governorate*-cohort majority; in Panel B, the *commune*-cohort majority. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

In Table 9, we check the robustness of our results to using alternative assignment levels. In Panel A, we rely on the governorate level, which corresponds to the first and largest administrative division in Egypt, while in Panel B, we rely on the commune (shyakha) level, which corresponds to the third and smallest administrative division. Our results are generally robust to relying on different administrative units to define our assignment rule. The governorate level yields consistently robust results across all three marriage market returns, while the commune level assignment yields to robust estimates across two out of the three marriage market returns under consideration. Nonetheless, it is important to note that the number of communes in our analysis is very large (1,022 communes). This means that the number of observations within each cell (cohort-by- birth commune) is small, leading to noisier estimates.

Table 10: Robustness to Assignment Threshold—Impact of Bride Education on Marriage Returns

	(1) Log Bride Price	(2) Log husband's imputed wage at marriage	(3) Log husband's imputed permanent income
Panel A: Using a 60% threshold			
Compulsory education	1.220**	0.427***	0.299***
	(0.602)	(0.129)	(0.107)
Panel B: Using a 75% threshold			
Compulsory education	1.058**	0.361***	0.287***
	(0.467)	(0.093)	(0.084)
Observations	4,377	4,377	4,377
Commune FE	YES	YES	YES
Individual controls	YES	YES	YES
Birth cohort FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: This table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. The table differs from the main specification in the instrument. In Panel A, those missing treatment status are assigned the status of the 60%, rather than simple, majority of their district-cohort cells; in Panel B, the 75% majority. When there are insufficient number of observations within each cell, assignments cannot be made. Hence the sample size is smaller than that of the estimation sample. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

A related check is the robustness of our results with respect to the assignment threshold. In our benchmark model, for each cohort-by-birth district cell, we assign non-responding individuals with the treatment status of the majority who reported treatment status within that cell, using a 50% threshold. In Table 10, we check the robustness of our results to using alternative thresholds to determine majority rule. We use a threshold of 60% in Panel A and a threshold of 75% in Panel B. Our results are robust to these two additional checks.

6.2 Fixed-Effect Level and Choice of the Education Variable

In Table 11, we check whether our results are robust to using governorate fixed effects instead of district fixed effects in Panel A. Our assignment level is at the district level as in our benchmark model, however, the results in Panel A differ from the benchmark model in the fixed effect level. Relying on governorate fixed effects instead of district

fixed effects allows for inter-district variations within a governorate. As shown in Panel A, our results are also robust to this additional check.

Table 11: Robustness to Fixed Effect Level and the Choice of the Education Variable—Impact of Bride Education on Marriage Returns

	(1) Log Bride Price	(2) Log husband's imputed wage at marriage	(3) Log husband's imputed permanent income
Panel A: Using governorate FE instead of district FE			
Compulsory education	1.142**	0.363***	0.274***
	(0.494)	(0.098)	(0.087)
Governorate FE	YES	YES	YES
Panel B: Using secondary education completion instead of compulsory			
Secondary education	1.286**	0.356***	0.282***
	(0.530)	(0.083)	(0.076)
District FE	YES	YES	YES
Panel C: Using years of schooling instead of compulsory			
Years of schooling	0.073***	0.025***	0.019***
	(0.028)	(0.005)	(0.005)
District FE	YES	YES	YES
Panel D: Using whether the individual has ever completed compulsory education			
Compulsory education	1.011**	0.339***	0.268***
	(0.401)	(0.076)	(0.070)
District FE	YES	YES	YES
Observations	4,900	4,900	4,900
Individual controls	YES	YES	YES
Birth cohort FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: This table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. Panel A uses governorate instead of district. We use secondary education and years of schooling in Panel B and Panel C, respectively, instead of compulsory. In Panel D, we rely on whether the bride has ever completed compulsory education in place of whether she completed it in the first round after marriage. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Imputation methods can be found in Appendix A.1. Compulsory education is a dummy variable indicator for bride compulsory education completion. It consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Secondary education follows compulsory education with an additional 3 years of schooling. Years of schooling corresponds to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. Data for education variables are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

Another set of robustness checks relate to the choice of the schooling variable. In our main specification, we instrument for bride's compulsory degree completion. In Table 11, we also check the robustness of our IV results to using secondary degree

completion (Panel B) and total number of years of schooling (Panel C). As we have shown in Table 4, which features first-stage regressions, our instrument is very well-correlated with all these endogenous variables. Furthermore, in Panel D, our main endogenous variable is a dummy variable indicator for whether the bride has ever completed compulsory education instead of whether she completed it in the first round after marriage. Our results are consistently robust to using all of these definitions.

6.3 Definition of Bride Price

As highlighted in Section 3.1, our bride price definition is asset-based, meaning that we only consider bride price components that are either assets or durable goods. Our benchmark definition therefore includes the sum of *mahr*, *shabka*, and the shares of *gihaz*, *afsh*, and housing paid for by the groom and his family.

Table 12: Robustness to the Definition of Bride Price—Impact of Bride Education on Marriage Returns

	(1) Including ceremonies	**(2)** Bride-groom average	**(3)** Allow missing components
Compulsory education	1.083***	1.071**	1.100***
	(0.419)	(0.436)	(0.395)
Observations	4,841	4,900	5,626
Individual controls	YES	YES	YES
District FE	YES	YES	YES
Birth cohort FE	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: This table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. Column (1) differs from the main specification in the calculation of bride price. Here bride price is the sum of mahr, shabka, afsh, gihaz, house, and, additionally, the cost of marriage ceremonies as contributed by the husband and his family (in constant 2018 EGP). Column (2) differs from the main specification in the treatment of the husband's report of bride price. The main specification uses the bride's report as the primary and only use the husband's when the former is unavailable. Here, when both reports are available, the average of the two reports are used as long as the difference between the two is less than 10% of the lesser reported value; otherwise, we use the bride's report. When only one report is available, we use that report regardless of whether the report came from the husband or the wife. Column (3) calculates bride price in the same manner as in the main specification, but allows for possible missing components, in which case bride price is the sum of available components. The sample in column (3) still requires other outcomes and covariates to be available, with the only change being that of bride price. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

In Table 12, column (1), we additionally include the contributions of the husband and his family to the wedding ceremonies as part of the bride price. In columns (2) and (3), we also rely on alternative definitions of bride price. As highlighted earlier, in our benchmark model, we rely on bride price information, as reported by the bride, since she is the recipient of the bride price and only rely on bride price, as reported by the groom, when this information is not reported by the bride. In column (2), we opt for an alternative definition, according to which we use the average of bride price

between the bride and the groom when both of them report bride price information. [20] When bride price information is only reported by one of the two partners, then we rely on the information reported by the corresponding member of the couple. Finally, column (3) calculates bride price in the same manner as in the main specification, but allows for possible missing components, in which case bride price is the sum of available components. Our results reported in Table 12 are robust to these three alternative bride price definitions.

6.4 Imputing Husband's Labor Market Outcomes

A final battery of robustness checks relates to the imputation of the husband's labor market outcomes. As noted previously, the imputation of the husband's wages and permanent income can be found in Appendix A.1. The benchmark imputations are minimalist by design to preserve as many matched husbands as possible. In this section, we opt for a more sophisticated method of imputation, at the cost of sample size and potential introduction of selection.

We introduce two improvements to the benchmark model. Firstly, to the structural equation (A1), we add the husband's cohort and district of birth fixed effects, respectively θ_d and μ_c, and obtain structural equation (A1'):

$$\ln w_{icd} = \beta_0 + \beta_1 s_{icd} + \beta_2 x_{icd} + \beta_3 x_{icd}^2 + \mu_c + \theta_d + \epsilon_{icd} \tag{A1'}$$

where, as before, i denotes the husband, w_i is an individual's total monthly wage from all jobs, s_i corresponds to the total years of schooling, and x_i corresponds to the potential years of experience and μ_c and θ_d cohort and district fixed effects respectively.

Secondly, since schooling is highly likely to be endogenous, we redeploy the school reform as the exogenous source of variation to instrument for the husband's schooling. More formally, we instrument for s_{icd} with equation (A2') below. Here T_{icd} is the treatment status of the husband$i$.

$$s_{icd} = \delta_0 + \delta_1 T_{icd} + \delta_2 x_{icd} + \delta_3 x_{icd}^2 + \mu_c + \theta_d + u_{icd} \tag{A2'}$$

We then repeat the procedures outlined in Appendix A.1 to obtain the husband's imputed wages and permanent income. The results, shown in Table 13 below, demonstrate the robustness of our model to a more sophisticated imputation method of spouse labor market returns. Note that the coefficients in Table 13 are very similar in magnitude to the benchmark results in Table 6.

[20] We do so as long as the difference between the reported information by the bride and the reported information by the groom is less than 10% of the lesser reported value. This is to exclude inflated values of bride price reported by grooms, who have the incentive to aggrandize bride price payments. When the difference is greater than 10%, we rely on bride price information as reported by the bride.

Table 13: Robustness to the Imputation Method of Husband's Labor Market Outcomes—Impact of Bride Education on Marriage Returns

	(1) Log husband's imputed wage at marriage	(2) Log husband's imputed permanent income
Compulsory education	0.308***	0.208**
	(0.108)	(0.084)
Observations	4,653	4,653
Individual controls	YES	YES
District FE	YES	YES
Birth cohort FE	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: The panel shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. The husband's imputed wage at marriage is the annual wage in constant 2018 EGP the husband is expected to earn in the year of marriage. The husband's permanent income is the present value of the husband's lifetime income from the time of marriage to the age of 59 discounted to the time of marriage in constant 2018 EGP. The retirement age in Egypt is 60. Compulsory education is a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Data for this variable are extracted from the first wave of ELMPS after the individual was married. Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

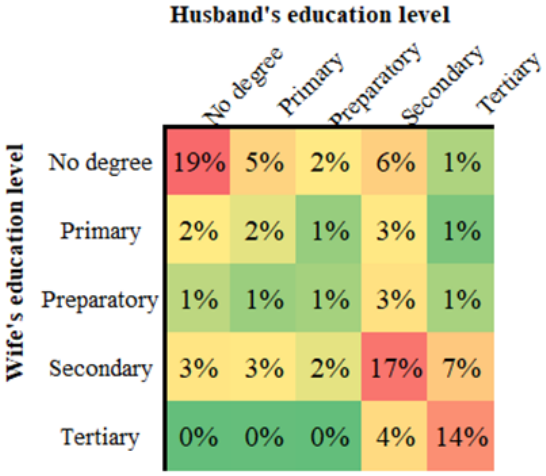
7 Underlying Mechanisms: Assortative Matching

Our results show that bride education leads to important marriage market returns in terms of higher bride price, but also in the form of higher husbands' earnings both at the time of marriage and throughout their lifetime. Many channels may lead to these relations: for example, productivity in the market and at home, demand-side preferences and signaling. Among these, one channel has been particularly emphasized in the literature: assortative mating in education. [21] According to this view, an important part of the return to schooling in the marriage market is due to the fact that the better a woman's education, the better the education of the man she is able to marry, and vice versa.

Without entering in any discussion about the sources and reasons of assortative mating, in this section, we document if assortative mating in education is indeed present in our sample. We start by examining the association between the wife's educational level and the husband's educational level in Figure 7.

[21] See Breen and Salazar (2011) and Eika, Mogstad, and Zafar (2019) for empirical evidence on high-income countries. See Greenwood, Guner, Kocharkov, and Santos (2014, 2016) for both empirical evidence and theoretical foundations. See Agarwal Goel and Barua (2021) and Kollamparambil (2020) for evidence on developing countries.

Figure 7: Assortative Matching in Education, by Educational Degree



Notes: Each cell of this figure shows the overall percentage share of couples with the corresponding highest level of education. The information is retrieved from matched husbands in the ELMPS dataset, which is feasible through self-reported spouse code within the household. Husbands who are not present in the household in any of the ELMPS waves will thereby be excluded. The two axes indicate the highest level of education ever reported in the ELMPS of each spouse. Those with no degree did not complete any formal education level. Primary and preparatory education refers to the corresponding school levels. Secondary education consists of general and technical secondary school. Tertiary education consists of post-secondary, university and post-graduate education.

This heat map provides suggestive evidence on positive assortative matching at both the lower and upper ends of the educational distribution, which means that educated women are more likely to marry educated men and uneducated women are more likely to uneducated men. 19% of couples are made of spouses who are both without a degree, 17% of spouses who are both with a secondary degree and 14% of spouses who are both with a tertiary degree. This means that 50% of couple are made of spouses with exactly the same degree. In such context, investing in education has the benefit of increasing the probability of marrying someone with a higher educational attainment. [22]

This evidence is further corroborated in Table 14, in which we directly estimate the impact of bride education on husband's years of schooling. Both the OLS and IV regressions show that compulsory degree completion for brides is associated with higher levels of educational attainment of the husband. They also marry into highly educated families in general, as reflected by the educational level of the father-in-law. Relying on the IV estimates, we find that a bride who completed at least compulsory education marries a husband with nine additional years of schooling compared to a bride who did not complete compulsory education. The results are comparable to what previously found on Egypt (Elbadawy, 2007). In conclusion, the evidence supports assortative matching in education as one of the potentially important channels through which

[22]In Figure A.2.1, we also provide a heat map featuring the association between the wife's educational level and the husband's educational level by years of schooling. The results of Figure 7 are confirmed.

returns to education in the marriage market are taking place.

Table 14: Impact of Bride Education on Assortative Matching

	OLS Regressions		IV Regressions	
	(1) Years of schooling of husband	(2) Years of schooling of father-in-law	(3) Years of schooling of husband	(4) Years of schooling of father-in-law
Compulsory education	5.195***	2.105***	8.827***	4.525*
	(0.159)	(0.142)	(2.382)	(2.450)
Observations	4,900	4,900	4,900	4,900
R-squared	0.354	0.266		
Individual controls	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.
Notes: Years of schooling of the husband is the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. The information is retrieved from matched husbands in the ELMPS dataset, which is feasible through self-reported spouse code within the household. Husbands not present in the household in any of the ELMPS waves will thereby be excluded. After matching the husbands, we impute the father-in-law's years of schooling. Father-in-law's years of schooling are imputed from his highest level of educational attainment (split in seven categories), as reported by the individual. Fathers with no formal degree attainment and are illiterate are assigned 0 years of schooling; those with no formal education but can read and write are assigned 4; those with less than intermediate education 8; those with intermediate education 12; those with above intermediate education 14; those with university degree 16; those with post-graduate degree 18. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.

8 Concluding Remarks

This paper examines the effect of bride education on marriage market returns in Egypt. Given the endogeneity of education choices, we exploit a unique schooling reform to identify the effect. Introduced in 1988, the reform consisted in reducing the number of years of primary education from six years to five years. The exogenous variation is introduced by the staggered rollout of the reform over administrative units and birth cohorts and by the arguably exogenous assignment of different six-years or five-years regime within cohort-district cells. We also focus on a very direct measure to compute the returns, the so-called bride price, i.e. the groom's transfer of a significant amount of resources at time of marriage. We also use more conventional measures of returns such as the current and future husband's wages.

We implement an IV estimator with fixed effects both at the cohort and administrative unit level. Since the reform mechanically changed the number of years of schooling, we focus on degree-level completion as our favorite education measure. Since primary education completion is very common in Egypt, we focus on the next crucial education level: compulsory schooling (primary plus preparatory education). The resulting variable of interest to describe bride education is a dummy equal 1 if the woman has completed compulsory school. We estimate the return to compulsory education to be about 100% on bride price, about 14% on husband's wage at the time of marriage and about 16% on a measure of husband's permanent income.

These returns include important heterogeneous effects. First, most of the return on bride price is driven by one component of the price: housing. Second, women born in rural areas (the majority of our sample) experience higher returns: 150% on bride price, 31% on husband's wage, and 26% on husband's permanent income. Third, women who marry young (younger than 20 years old) experience lower returns to bride price but higher returns to husband's wage.

An exhaustive investigation of the sources of these returns is beyond the scope of the paper and it would require a much richer dataset. However, we can provide some evidence on an important channel through which these returns are taking place: assortative mating in education. We find that 50% of couples are made of spouses with exactly the same degree. We estimate that a bride who completed at least compulsory education marries a husband with nine additional years of schooling compared to a bride who did not complete compulsory education. Both pieces of evidence point to educational assortative mating as an important mechanism to generate the returns that we observe.

This paper provides important insights on non-labor market returns to female education in Egypt, suggesting that there is more to women's educational investment choices than the standard labor market returns. Indeed, we argue that significant returns to women's education are instead realized in the marriage market and that one cannot rationalize schooling decisions in Egypt by solely considering labor markets.

Despite these significant marriage market returns, female education in Egypt still has great untapped potential. Indeed, the opportunity costs of higher educational investment in terms of economic output are enormous (Dollar & Gatti, 1999). The IMF estimates that GDP growth in MENA countries would have doubled over the past decadeâa gain of US$1 trillion in cumulative outputâhad the gender gap in labor force participation been the double, rather than triple, the average for emerging market and developing economies (Stepanyan et al., 2018). These findings therefore underscore the necessity to design and promote policies that ensure higher women representation in economic activities. Furthermore, they suggest that policies that aim at improving women's education should not be implemented in isolation, but rather in conjunction with others that address gender norms and attitudes to better align women's incentives in favor of higher female labor force participation and work.

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A Online Appendix

A.1 Imputation of the Husband's Wages and Permanent Income

The ELMPS does not contain retrospective information on wages. We therefore only observe wages at the time of marriage for individuals whose marriage year coincide with the years of ELMPS surveys. Hence, we instead impute the husbands' wages at the time of marriage by running a Mincer model and then using it to predict their wages at the time of marriage. We transform the combined four waves of ELMPS (1998, 2006, 2012, and 2018) into a long-format dataset. We wish to estimate the following structural model from a sample of working-age men:

$$\ln w_{icd} = \beta_0 + \beta_1 s_{icd} + \beta_2 x_{icd} + \beta_3 x_{icd}^2 + \epsilon_{icd} \tag{A1}$$

where i denotes the husband, w_i is an individual's total monthly wage from all jobs, s_i corresponds to the total years of schooling, and x_i corresponds to the potential years of experience. We rely on information on husbands' years of schooling from the closest survey round to the time of marriage. We then predict the husband's wages using potential experience at the time of marriage. We assume the husband has completed his education and is employed when he marries.

Using this model, we then impute the husband's lifetime income by imputing his wage in each year following his marriage. Here, we assume the husband is always employed from the time of marriage to retirement. We calculate the present value of all future wages from the time of marriage up to the age of 59 (retirement age in Egypt is 60) discounted to the time of marriage. The present value is calculated as follows:

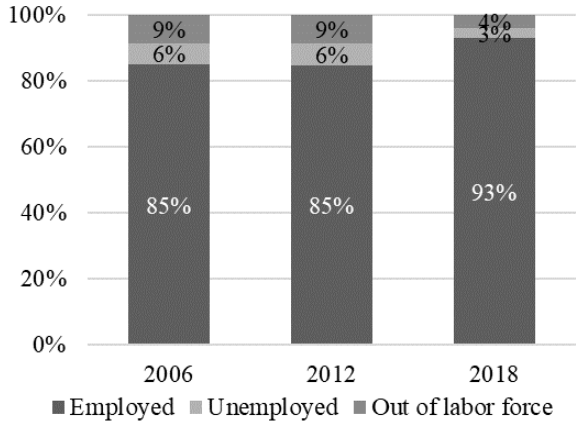
$$Y_{i,m_i} = \sum_{t=m_i}^{59-m_i} \frac{12\ \widehat{w}_{i,t}}{(1+r)^{t-m_i}} \tag{A2}$$

where m_i corresponds to the husband at the age of marriage, $\widehat{w}_{i,t}$ *is the imputed monthly wage of the husband at each age* t, and $1+r$ is the discount rate. The discount rate is calculated following equation (A4) below, where the average inflation rate refers to the geometric average of price levels between 1971 and 2021. 10 years are the longest term to maturity of Egyptian government bonds.

$$1 + r = \frac{1+\text{10Y treasury bond yield}}{1+\text{inflation rate}} \tag{A3}$$

Discussing the husband's wages at the time of marriage is meaningful only if we assume the husband is employed at the time. To examine how appropriate the assumption is, we tabulate the employment status of all men who married in the years when the ELMPS was conducted. Around 90% of all grooms were already employed in the year of marriage.

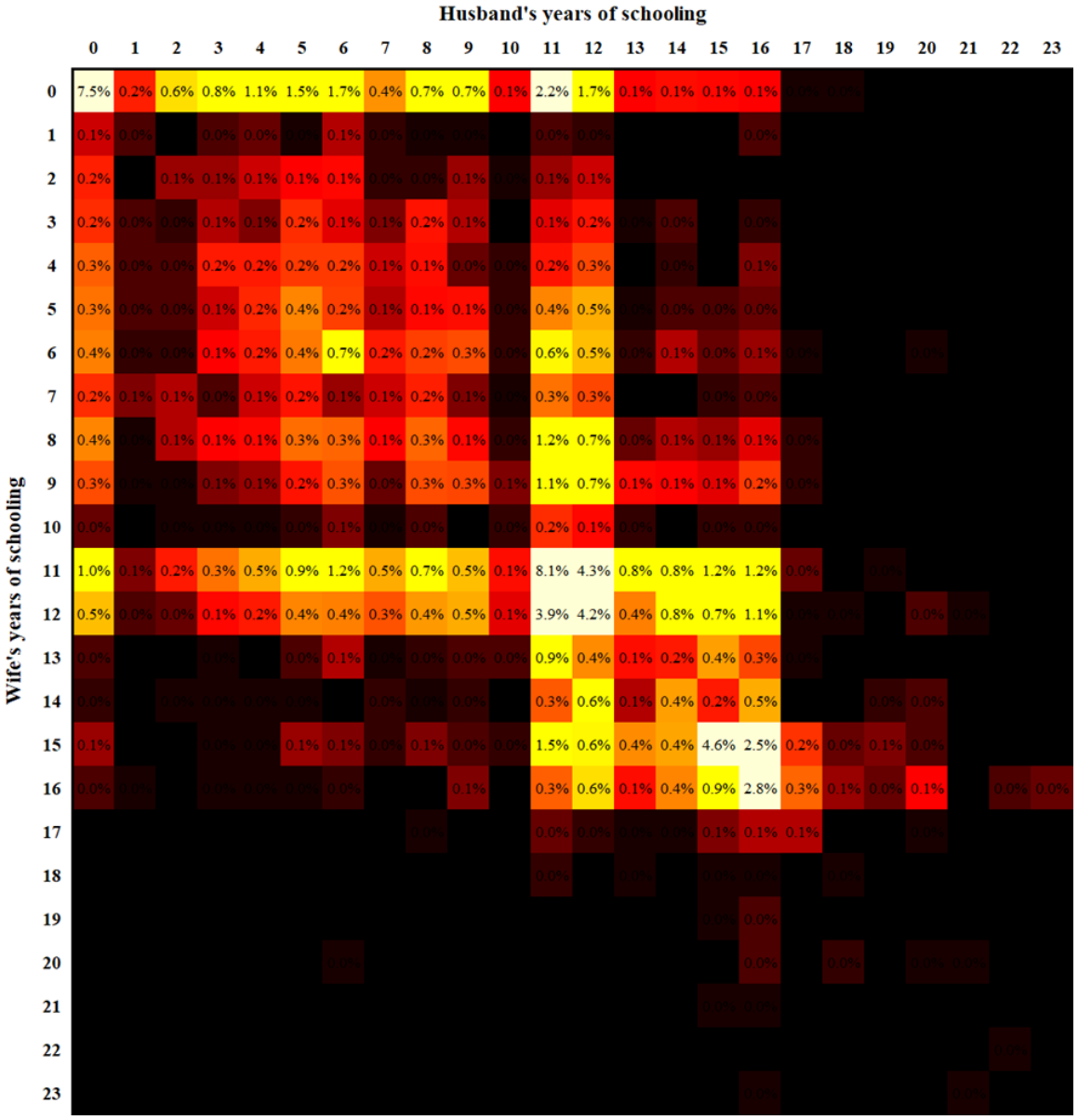
Figure A.1: Male Employment Status in the Year of Marriage



Notes: Current employment status, observed at the time of survey, of the subsample of men who married in each of the three survey years.

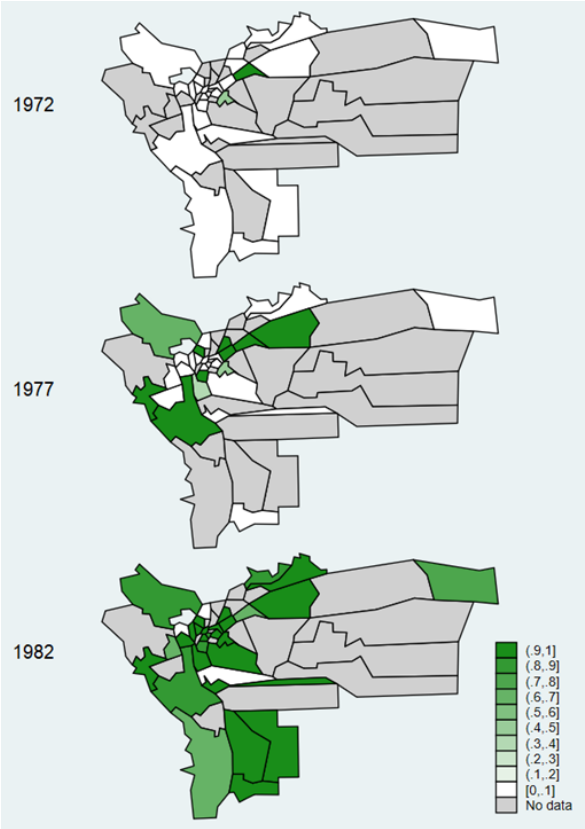
A.2 Additional Tables and Figures

Figure A.2.1: Assortative Mating in Education, by Years of Schooling



Notes: Each cell of this figure shows the share of couples with the corresponding years of schooling amongst all couples. Years of schooling refers to the sum of all completed grades starting from primary school. Hence, repeated grades are not counted as additional years of schooling. The information is retrieved from matched husbands in the ELMPS dataset, which is feasible through self-reported spouse code within the household. Husbands not present in the household in any of the ELMPS waves will thereby be excluded. Information on years of schooling is extracted from the first round of survey after marriage.

Figure A.2.2: Share of Individuals Reporting 5-Year Regime by District over Birth Cohort in Greater Cairo



Notes: This figure shows the progress of the 1988 reform across districts by birth cohort, five years before and after 1977, the first birth cohort treated by the reform. A darker shade of green indicates a higher percentage of pupils reported attending a five-year primary school. Districts with no observations from a particular birth cohort are colored in gray.

Table A.2.1: Selection into Treatment by Observable Characteristics

	Linear Probability Model on Six-Year Treatment Status		
	(1)	**(2)**	**(3)**
Number of siblings	0.008***	0.009***	-0.001
	(0.003)	(0.003)	(0.002)
Father's years of schooling	-0.001	-0.003	0.001
	(0.002)	(0.002)	(0.001)
Mother's years of schooling	-0.003	-0.003*	0.000
	(0.002)	(0.002)	(0.002)
Observations	4,900	4,900	4,900
Structural equation controls	NO	YES	YES
District FE	NO	NO	YES
Birth cohort FE	NO	NO	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: Number of siblings includes both living and deceased siblings. Information is collected from the earliest round of survey for which data are available. Father (mother)'s years of schooling are imputed from the father's highest level of educational attainment (split in seven categories), as reported by the individual. Fathers (mothers) with no formal degree attainment and are illiterate are assigned 0 years of schooling; those with no formal education but can read and write are assigned 4; those with less than intermediate education 8; those with intermediate education 12; those with above intermediate education 14; those with university degree 16; those with post-graduate degree 18.

Table A.2.2: Robustness to Expanding the Sample with Assignments

	(1) Log bride price	**(2)** Mahr	**(3)** Shabka	**(4)** Afsh	**(5)** Gihaz	**(6)** House
Compulsory education	2.391**	6.327	60.373**	76.710*	19.567	122.850
	(1.023)	(33.410)	(29.500)	(45.592)	(20.203)	(88.294)
Observations	2,031	2,031	2,031	2,031	2,031	2,031
Individual controls	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES
Birth cohort FE	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors are reported in brackets.

Notes: This table is the counterpart to the benchmark result in Table 5, but without expanding the sample with assignments of treatment status using the rules discussed in Section 4. The table shows the regression output of a 2SLS with equation (1) as the structural equation and equation (2) as the first stage, instrumenting for compulsory education completion. Bride price corresponds to the sum of *mahr*, *shabka*, *afsh*, *gihaz*, and house as contributed by the husband and his family (in constant 2018 EGP). Bride price is log transformed. *Mahr* is the traditional compulsory gift by the groom to the bride. *Shabka* is the wedding jewelry. *Gihaz* includes wedding preparation items, such as china, cutlery, kitchen, utensils, pillows, mattresses, blankets, linens, carpets, among others. *Afsh* refers to the furniture and electrical appliances. The main independent variable of interest corresponds to a dummy variable indicator for bride compulsory education completion. Compulsory education in Egypt consists of primary and preparatory school, which is equivalent to 9 years of schooling (before the 1988 reform) and 8 years (after the 1988 reform). Individual controls include the bride's age at the time of marriage and a dummy variable indicator for rural residence at birth.