# Social Barriers to Female Migration: Theory and Evidence from Bangladesh*

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**Abstract**

Traditional gender norms can restrict independent migration by women, thus preventing them from taking advantage of economic opportunities in urban areas. To explore this phenomenon, we develop a model in which women make marriage and migration decisions jointly. The model shows that, in response to a decline in the economic cost of migration, women may use marital migration to circumvent social barriers to female independent migration. To test this and related hypotheses, we use the construction of a major bridge in Bangladesh – which dramatically reduced travel times between the economically deprived north-western region and the capital city Dhaka – as a source of variation in migration costs. Consistent with the predictions of the model, we find that, among rural women from wealthier families, the bridge increased marital migration, schooling, dowry payments, and work in the manufacturing sector, but had no effect on economic migration.

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# 1 Introduction

Large-scale rural-urban migration coupled with a shift in employment from agriculture to manufacturing and services have long been at the heart of development theory (Lewis, 1954; Harris and Todaro, 1970) and are ubiquitous in countries in the process of economic development. Most of the past theoretical and empirical work in this area has focused exclusively on understanding the migration and work patterns of men, so that relatively little is known about the potential for and drivers of female migration in developing economies.[1] For patrilocal societies, it is well-documented that marriage is an important vehicle for female long-distance migration (e.g. Rosenzweig and Stark, 1989). But whether and how rural women in developing countries respond to economic opportunities in an expanding urban sector remains an open question. Traditional gender norms can restrict female work participation and independent (i.e. without a family) migration (Thadani and Todaro, 1984). Marriage may serve as a means by which women circumvent restrictions on their mobility to access economic opportunities in urban areas, but marriage market frictions can introduce distortions in this process leading to inequity and inefficiency.

In this paper, we explore these issues both theoretically and empirically. First, we develop a theoretical model of migration and marriage that combines elements of Harris and Todaro (1970)'s model of rural-urban migration with a model of marriage markets with endogenous property rights over marriage-related transfers based on Anderson and Bidner (2015). Market frictions take three possible forms: a standard economic cost of migration, search costs involved in marriages away from the place of birth and, crucially, an additional cost associated with pre-marital female migration due to insecurity or social disapproval. We show theoretically that, in the presence of such social barriers to female migration, rural-born women who choose to migrate to the city match with rural-born migrating grooms and pay a premium – over the groom price on the urban marriage market – to attract them. This groom price premium is inefficient – because investing it in the human capital of rural-born migrating women would reap higher economic returns – but necessary, as the alternative routes to urban migration (pre-marriage female migration or finding a marriage partner on the urban marriage market) entail additional costs. By contrast, if social barriers to female independent migration are absent, there is no price difference between

[1] For example, Lagakos, 2020 and Selod and Shilpi, 2021, two recent reviews of the literature on rural-urban migration in developing countries, focus primarily on studies on male migration.

rural-born migrating grooms and urban-born grooms (with the same level of human capital).

In the second half of the paper, we test some of the predictions of the model empirically, by taking advantage of a natural experiment. In 1998, a major bridge was built over the Jamuna river in Bangladesh, dramatically reducing travel times between the economically deprived north-western region and the manufacturing belt located around the capital city Dhaka.[2] We argue that the bridge led to a reduction in the economic costs of long-distance migration (inclusive of the migrant's cost of maintaining ties with the village of origin) - but only for those born in the north-western region. While such a decline in migration costs should unambiguously increase rural-urban long distance migration for men, the effects on female migration are less clear. Our theoretical model predicts that, in the absence of the aforementioned social barriers, the event would also lead to increased female independent migration. If such barriers are present, our model predicts that there will still be an increase in female migration - but it will occur primarily through marriage with rural-born migrating men. To test the model predictions, we use a purposefully designed nationally representative survey of women (the 2014 Women's Life Choices and Attitudes Survey or WiLCAS) to estimate the effects of a drop in the cost of migration to the manufacturing belt on (i) female economic migration and (ii) female marriage-related migration from the north-western region to the manufacturing belt. We also investigate the effects on (iii) marriage payments to the groom; (iv) female labour force participation; (v) female educational attainment.

Detailed information on the migration history, employment history and marriage outcomes of women in the 2014 WiLCAS allow us to estimate these effects with a difference in differences methodology. For our identification strategy we rely on the following facts: (i) the bridge reduced travel times to the manufacturing belt around Dhaka for people situated on the western side of the river but not for those situated on the eastern side or in other parts of Bangladesh; (ii) the reduction in travel time varied across locations on the western side of the river, depending on whether accessing the bridge involved a long detour or not; (iii) the practice of early marriage and the absence of a remarriage market meant that younger cohorts in our sample could make marriage and other decisions in response to the bridge opening but older cohorts could not. These

[2]For example, travel time to/from the city of Bogra in north-western Bangladesh to Dhaka decreased from 12-36 hours to 4 hours (Ahmad et al. (2003)) after the bridge opening.

facts allow us to define as 'treated' all individuals born in regions that benefited greatly from the reduced travel times and in cohorts young enough to come of marriage age after the construction of the bridge.

The theoretical model implies that the offspring of better-off rural families will engage in rural-urban migration while those from poorer families settle in the rural location. Therefore, for the empirical analysis, we divide the sample between those women whose fathers owned half an acre or more of farmland (a threshold commonly used for poverty-targeted programmes in Bangladesh) and those whose fathers owned less than half an acre. We find that women who are exposed to the treatment and are from families above the land threshold are affected in a range of outcomes, consistent with the hypotheses stated above: they are more likely to migrate towards Dhaka (by 5.3 percentage points), work in the urban manufacturing sector, and pay a higher dowry. There is a statistically significant effect on marriage-related migration (3.8 ppt) but not on economic migration. There is no effect on the probability of a woman matching with a groom born around Dhaka, but there is an increase in the probability that the groom migrates to Dhaka from the other side of the river (3.5 ppt). By contrast, we find no effects for women whose fathers had less than half an acre of land. We also find that women exposed to the treatment obtain more years of schooling and are more likely to attend secondary school. In addition to the difference-in-difference analysis, we conduct an event-study analysis in which the effect of treatment exposure is allowed to vary cohort by cohort. The directions, magnitudes and timing of estimated effects obtained from the event-study analysis are in line with the difference-in-difference estimates.

These empirical findings shed light on both the constraints to and the linkages between the marriage, work and migration decisions of women and men in developing countries. In particular, the findings are consistent with the hypothesis that social norms restricting female mobility prevented women from north-western Bangladesh from engaging in independent migration in response to the reduction in migration costs produced by the bridge construction. Nevertheless, a subset of women were able to migrate to the manufacturing belt – and thus take up employment in the manufacturing sector – by marrying male migrants from the local marriage market. Although we put emphasis on social barriers to female independent migration in our theoretical model, it is important to recognise there are other types of market frictions that can potentially account for the pattern of outcomes we obtain, such as location-specific human capital formation and gender-specific marriage search costs.[3] We consider these alternative explanations after presenting our empirical findings.

The paper contributes to a number of different strands in the literature. First, we theoretically analyse the marriage market implications of social barriers to female independent migration, a notion that has long been discussed in the literature (Boserup, 1970; Thadani and Todaro, 1984), but not, to our knowledge, formally analysed. Relatedly, we contribute to the empirical literature on the negative consequences of social norms that restrict women's freedom of movement in developing countries.[4] Second, our work is related to the recent literature on how cultural factors and informal institutions interact with shocks in developing countries (e.g. Munshi and Rosenzweig, 2006, 2016; Corno et al., 2020). Third, our large, nationally representative dataset on the migration history of women in Bangladesh allows us to contribute to the limited empirical literature on female migration in developing countries (Rosenzweig and Stark, 1989; Fan and Huang, 1998; Fulford, 2015; Rao and Finnoff, 2015).

Fourth, our empirical analysis of the effects of the bridge over the Jamuna river on female migration and marriage markets contributes to the literature on the economic impact of road and transport infrastructure in developing countries. Recent examples in this literature include Adukia, Asher, and Novosad (2017) and Asher and Novosad (2016) which examine the effects of a nationwide road programme in India – connecting villages to the major road network – on educational investments and employment outcomes, respectively; and Khandker, Bakht, and Koolwal (2009), and Khandker and Koolwal (2011) which estimate the effects of a similar road improvement programme in Bangladesh. Unlike our work, these studies do not focus on long-distance migration or deal specifically with female responses to infrastructure development.[5]

The study is also closely related to a number of recent papers on migration, labour and infrastructure in Bangladesh. Bryan, Chowdhury, and Mobarak (2014) use an experimental design to investigate how impoverished households located in the same part of Bangladesh respond to

[3]We thank the editor and an anonymous referee for this insight.

[4]For a survey of recent studies on cultural norms and women's labor market participation, see Jayachandran (2020).

[5]A number of recent studies have also looked at the economic effects of major road and rail infrastructure on economic development, including Donaldson and Hornbeck (2016) for the USA; Donaldson (2018) for India; Banerjee et al. (2012) for China; and Morten and Oliveira (2014) and Bird and Straub (2014) for Brazil. However, these studies focus on economic growth, trade flows and prices, as opposed to household responses via labour choices and migration.

monetary incentives for seasonal migration. Heath and Mobarak (2015) study the growth of female manufacturing jobs around Dhaka and its effect on the marriage, education and employment outcomes of women situated in nearby villages. Blankespoor, Emran, Shilpi, and Xu (2018) investigate how the Jamuna Bridge affected economic activities in north-western Bangladesh, specifically population density, economic density, inter-sectoral labour allocation and agricultural productivity, using south-western Bangladesh – separated from the country's major growth centres by a different river – as the control group. Unlike our study, these papers do not deal specifically with female long-distance migration. In this respect, our work comes closer to Rosenzweig and Stark (1989) who argue, using data from rural India from 1976-1985, that female marriage-migration decisions formed part of a risk-sharing strategy between bride-sending and bride-receiving households. We investigate female marriage-migrations in a more dynamic economy, characterised by rapidly expanding opportunities for female employment in manufacturing and growing integration between the capital and an impoverished region of a developing country.

The remainder of the paper proceeds as follows. In the next section, we present a theoretical model of marriage and migration in which we formalise the notion of social barriers to female independent migration. In section 3, we describe the context of the empirical analysis, including basic information on female labour force participation in Bangladesh and details regarding the bridge construction – our main source of exogenous variation in migration costs. Next, in Section 4, we describe the data and provide basic descriptive statistics. Then, guided by the model set out in Section 2, we test the model predictions in two different ways: in Section 5 we test for the existence of a dowry premium for rural-born migrating grooms, while in Sections 6 and 7 we conduct an empirical investigation of the effects of a reduction in migration costs (we describe the empirical methodology in Section 6 and our results in Section 7). We conclude with a discussion in Section 8.

# 2 A Theoretical Model of Migration, Labour and Marriage Markets

In this section, we develop a model of rural-urban migration in which we explicitly model both labour markets and marriage markets in rural and urban locations. The purpose of the model is to highlight how social constraints on the long-distance migration of single women can produce interlinkages between labour and marriage markets, such that economic shocks or policy changes that affect the cost of migration impact not only labour markets but also marriage market outcomes. For this purpose, we combine Harris and Todaro (1970)'s model of rural-urban migration with a model of marriage markets based on Anderson and Bidner (2015).

## 2.1 Setup

Each agent in the model is a 'family'. A family has three attributes: (i) an offspring with gender $g \in \{m, f\}$, an origin $o \in \{R, U\}$ and wealth $W$. Here, $m$ stands for 'male' and $f$ for 'female'; $R$ stands for 'rural' and $U$ stands for 'urban'. There is a unit mass of families for each gender-origin combination. For a specific $(g, o)$, wealth is distributed according to the c.d.f. $\Gamma_{go}(.)$. A family makes three decisions: (i) the human capital of its offspring, $h \in [0, h_{\max}]$, the offspring's labour market choice, $P_L \in \{R, U\}$ and the offspring's marriage market choice $P_M \in \{R, U\}$. In each marriage, the bride and groom must choose the same marriage and labour markets.[6] For ease of analysis, we abstract away from the option of choosing singlehood.[7]

For an offspring of type $g$, human capital $h$ entails a cost $h/\theta_g$ for $g \in \{m, f\}$. Participation in the different marriage and labour markets may entail an additional cost $c$ depending on the

[6]Thus, we do not allow a husband and a wife to participate in different labour markets.

[7]If the gains from marriage are sufficiently large, then individuals would always prefer to enter a marriage market over singlehood. This is a reasonable assumption in the context of Bangladesh where almost all men and women marry before reaching the age of 30.

origin of the family and the gender of the offspring as follows:

$$\begin{aligned} P_M &= P_L = o : c = 0 \\ P_M &= o \neq P_L : c = \mu \\ P_M &\neq o = P_L : c = \sigma \\ P_M &= P_L \neq o : c = \mu + \zeta_g \sigma \end{aligned}$$

where $\mu, \sigma > 0$ and $\zeta_g \in [0,1]$ for $g \in \{m, f\}$. Thus, we assume that if both market choices correspond to the origin location of the family, then there are no costs involved. However, if the labour market does not match the origin location, there is a migration cost $\mu$ and if the marriage market does not match the origin location, there is a 'matching cost' $\sigma$. If the marriage market does not match the origin location but does correspond to the location of the labour market, the matching cost equals $\zeta_g \sigma$ where $\zeta_g$ is a gender-specific parameter.

The parameter $\mu$ represents not just the cost of travel to a new location but the monetary equivalent of the lifetime disutility incurred from moving to a new location while one retains family ties and economic interests in the place of origin. It is well-documented that, in developing countries, urban migrants typically retain strong ties with their extended family members in rural areas, sending and receiving transfers, and making regular trips to their village of origin. Thus, if it is difficult to travel to the city from rural areas because of, for example, poor infrastructure, then this has a multiplicative effect on the cost of permanent migration.

We interpret $\sigma$ and $\zeta_g$ as follows. When a family opts to marry the offspring in a marriage market away from the origin ($P_M \neq o$), this involves a spouse search cost $\sigma$ because of lack of social ties at the marriage market location. If the offspring participates in the labour market at the same location as the marriage market ($P_L = P_M$), there may be no marriage search costs (case captured by $\zeta_g = 0$), because the offspring can migrate first, begin employment, and form social ties that facilitates a subsequent marriage market search. However, such a strategy is costly if migration before marriage by an offspring of type $g$ meets with social disapproval, or poses a risk to personal safety due to prevailing gender-related norms. In these cases, $\zeta_g > 0$ and $\sigma$ represents the disutilty from undertaking an action that is socially disapproved or deemed unsafe (independent migration prior to marriage), or searching for a spouse in a distant marriage market prior to migration.[8] [9] The costs associated with each combination of market choices and the origin of the family are summarised in Table 1 for convenience.

**Payoffs:** The payoff to a family is given by $U(C_p, C_o)$ where $C_p$ is the consumption of the parents and $C_o$ is the consumption of the offspring. We assume that the utility function is increasing and strictly concave in each argument. We also assume that both types of consumption are normal and ordinary goods. We have

$$\begin{aligned} C_p &= \begin{cases} W - h_m/\theta_m \text{ in male families} \\ W - h_f/\theta_f - \tau \text{ in female families} \end{cases} \\ C_o &= C_g(z_f, z_m) \text{ for } g = m, f \end{aligned}$$

where $\tau$ represents transfers made by the bride's family to the groom at the time of marriage (we discuss these transfers in more detail below), $z_f$ and $z_m$ represent the earnings of the bride and groom respectively following marriage (including any marriage-related transfers received). Thus, $z_f = h_f w$ and $z_m = h_m w + \tau$ where $w$ is the wage rate offered in the labour market of choice. We assume that intra-household allocation is determined by the separate spheres model of the household (Lundberg and Pollak, 1993; Chen and Woolley, 2001): in the absence of cooperation, the bride and the groom each receive their earnings and the sum of individual earnings are multiplied by a factor $\alpha > 1$ under cooperation. For ease of notation, we further assume bargaining power is symmetric between the bride and the groom (our theoretical results do not hinge on this assumption). Following Anderson and Bidner (2015), we obtain

$$C_f(z_f, z_m) = a_f z_f + b_f z_m \tag{1}$$

$$C_m(z_f, z_m) = a_m z_f + b_m z_m \tag{2}$$

where $a_f = b_m = 1 + \frac{1}{2}\alpha$ and $b_f = a_m = \frac{1}{2}\alpha$.

**Production and Labour Market Wages:** We denote by $X_M$ and $X_A$ output in the manu-

[8] For ease of notation, we use $\sigma$ to represent any of these costs. Allowing them to differ from one another would not affect our main theoretical results.

[9] Note that if the family opts to marry the offspring in the marriage market at the origin ($P_M = o$) and the newly-weds subsequently migrates ($P_L \neq o$), by assumption there is no social disutility associated with this action although the couple pays the economic cost of migration $\mu$.

facturing sector and agricultural sector respectively:

$$X_M = f(K, H_M)$$
$$X_A = q(T, H_A)$$

where $K$ is physical capital stock, $T$ is agricultural land, and $H_M$ and $H_A$ are the levels of human capital employed in manufacturing and agriculture respectively. We assume that $\frac{\partial f}{\partial H_M}, \frac{\partial q}{\partial H_A} > 0$ and $\frac{\partial^2 f}{\partial (H_M)^2}, \frac{\partial^2 q}{\partial (H_A)^2} < 0$.

We fix the price of the manufacturing good to be equal to $1$ (the numeraire good) and denote by $P$ the price of the agricultural good. We assume that $P$ is a function of relative outputs in the two sectors:[10]

$$P = \rho\left(\frac{X_M}{X_A}\right) \tag{3}$$

For our analysis, we take the stock of physical capital and agricultural land to be fixed. Within each sector, the market for human capital is competitive and the wage rate is equal to the value of the marginal product of human capital. Thus, we have

$$w_U = \frac{\partial f(K, H_M)}{\partial H_M}, w_R = P \times \frac{\partial q(T, H_A)}{\partial H_A}$$

where $w_U$ is the urban wage and $w_R$ is the rural wage. An alternative to labour market participation is home production which yields output

$$y = \phi_0 + \phi_1 h \tag{4}$$

where $\phi_0, \phi_1 > 0$ and $h$ is the individual's level of human capital.

**Marriage Markets:** As noted above, we allow transfers from the bride's family to the groom at the time that a marriage is contracted. As in Anderson and Bidner (2015), these transfers represent the part of the dowry that is given directly to the groom by the family of the bride

[10]Equation 3 is a statement of the assumption, adopted from Harris and Todaro (1970), that the ratio of the price of the agricultural good to that of the manufacturing good (terms of trade) is a decreasing function of the relative outputs in these two sectors. The basic intuition behind this assumption is that if output of the agricultural good is high (low) relative to that of the manufacturing good, then the price ratio has to be low (high) so that the resulting consumer demand for the two goods clear the corresponding markets.

(called *joutuk* in the context of Bangladesh). These transfers will depend on the human capital of the bride and groom as these affect their potential to generate earnings following marriage. We define $\tau_k : \mathcal{H}^2 \longrightarrow \mathbb{R}$ as the 'marriage price schedule' in market $k$. Specifically, the function $\tau_k(h_m, h_f)$ specifies, for market $k$, the transfer from the bride's family to the groom when the groom has human capital $h_m$ and the bride has human capital $h_f$. Because the marriage market is segmented by location, the marriage price schedule may vary by the location of the marriage; the price schedule may also depend on the couple's labour market choice since the value of human capital depends on the wage rate in the chosen labour market. Therefore, $k$ can take four different values: $k \in \{RR, RU, UR, UU\}$, where the first letter indicates the labour market chosen by the couple and the second letter indicates the location of the marriage. Henceforth, we refer to a choice of $k$ simply as an individual's 'market choice'.

## 2.2 Equilibrium Analysis

**Labour Market Participation:** As per equation (4), an individual in market $k$ generates more income through labour market participation compared to home production if and only if $w_k h > \phi_0 + \phi_1 h$, i.e. $h > \frac{\phi_0}{w_k - \phi_1}$. If $w_k > \phi_1$ and $\phi_0 > 0$, then there is a threshold level of human capital at which an individual is indifferent between the two choices given by $\bar{h}(w_k) = \frac{\phi_0}{w_k - \phi_1}$. Therefore, individuals opt for home production at low levels of human capital ($h < \bar{h}(w_k)$) and labour market participation at high levels of human capital ($h \geq \bar{h}(w_k)$). For the subsequent analysis we make a number of simplifying assumptions. First, the cost of male human capital, as captured by the parameter $\theta_m$ is sufficiently low that all men participate in the labour market rather than engaging in home production. Second, the cost of female human capital $\theta_f$ and the rural-urban wage gap are such that all women in urban areas participate in the labour market while all women in rural areas engage in home production. While these assumptions are not essential, they facilitate the exposition of the key insights from the model.

Next, we investigate migration decisions by families, i.e. whether the offspring participates in the labour market at the location where he/she is born, or migrates and participate in the labour market at the alternative location. The migration choice will depend on marriage search costs. We consider two cases based on alternative assumptions about matching costs in the local marriage market for migrants. The first case is where there are no such costs: $\zeta_f = \zeta_m = 0$.

The second case is where there are no matching costs for male migrants but there are positive matching costs for female migrants: $\zeta_f > \zeta_m = 0$. As per Table 1, we assume throughout that there are no marriage matching costs for non-migrants. In the remaining analysis, we assume that the model parameters are such that expendiures on urban-born male offspring is increasing in the urban wage rate. The precise condition on the model parameters are given by Condition 1 in Appendix 0.

**Case I: No Marriage Search Costs for Migrants:** When there are no marriage search costs for migrants, a prospective migrant is indifferent between choosing a marriage partner at his/her origin location and choosing a partner at the destination location. The reason is as follows. The marriage price schedule for market choices $UR$ and $UU$ (the two choices involve participation in the urban labour market but searches in different marriage markets) are identical up to a constant term (see Proposition 6 in Appendix 0). If there are no marriage matching costs, this constant term must equal zero to ensure that the marriage markets clear. Therefore, an individual of rural origin who plans to migrate to the urban location will encounter the same marriage price schedule at both locations. Similarly, an individual of urban origin who plans to migrate to the rural location will encounter the same marriage price schedule at both locations. Consequently, we have the following results.

**Proposition 1.** *Suppose $\zeta_m = \zeta_f = 0$. For any level of human capital of the bride and groom, dowry payments are identical in markets $UR$ and $UU$. At a given wealth level of the rural female family and human capital of the groom, a bride in market $UR$ has the same level of human capital as a bride in market $UU$. The same results hold for markets $RR$ and $RU$.*

If there is a cost of migration, i.e. $\mu > 0$, then there may be a rural-urban wage differential in equilibrium as in Harris and Todaro (1970). As an example, suppose that the urban wage rate is higher than the rural wage rate. Then, we can show that sons and daughters from wealthier rural families migrate to urban areas (i.e. choose market $UU$ or $UR$) while those from poorer rural families remain in rural areas (i.e. choose market $RR$). We provide the formal result below.

Let $V(W, w, g)$ be the indirect utility function for the level of utility derived by a family of type $g$ with wealth $W$ at a location with wage rate $w$ from the optimal choice of parental consumption and child-related expenditures. By construction, if the offspring from a rural family remains at the origin, the family attains a utility of $V(W, w_R, g)$ and if the offspring migrates, the family attains a utility of $V(W-\mu, w_U, g)$. For any family – type $g$, wealth $W$ and origin $o$ – we can define a critical value of the migration cost $\mu = \mu(W, o, g; w_U, w_R)$, such that the family attains the same utility from the two alternatives: $V(W-\mu, w_U, g) = V(W, w_R, g)$. Then, we obtain the following:

**Proposition 2.** *Suppose $\zeta_m = \zeta_f = 0$. Then, if the wage is higher at the market away from the origin and Condition 1 holds, the threshold migration cost $\mu(W, o, g; w_U, w_R)$ below which an offspring migrates is monotonically increasing in $W$. Consequently, for any $\mu > 0$, offspring from wealthier families migrate while those from poorer families remain at the origin.*

[11]

**Case 2: Positive Marriage Search Costs for Female Migrants:** Next, we consider the case where there are positive marriage matching costs for female migrants and no marriage matching costs for male migrants, i.e. $\zeta_f > \zeta_m = 0$. Therefore, migrating men who participate in the marriage market at their destination incurs no extra cost (beyond the cost of migration). However, migrating women who participate in the marriage market at their destination incurs an additional cost $\zeta_f \sigma$. This cost has two possible interpretations: (i) the strategy involves a marriage market search at the destination prior to migration which is costly; (ii) the strategy involves migration before marriage, a type of behaviour that meets with social disapproval or poses a risk to safety and thus incurs disutility.

Because, for female migrants, finding a marriage partner at the destination location entails higher search costs, they would prefer, *ceteris paribus*, to find a groom in the marriage market at their origin location. Therefore, if there is migration from rural areas to urban areas due to a rural-urban wage differential, this causes an excess demand in the rural marriage market for migrating men. This leads to an increase in the price of migrating men in the form of a shift in the price schedule, to ensure marriage market clearing. In particular, rural women who marry

[11]It is important to note that if there are additional social costs or risks associated specifically with continued living in rural areas, then these will lower the threshold value of $\mu$ for the individuals and families who face them. For example, there is qualitative evidence indicating that separation, divorce and the risk of early marriage are important migration push factors for rural women and girls (see footnote 34). As a consequence, the migrants will be composed of both individuals from wealther families and those who are socially vulnerable. For ease of exposition, we do not include the latter in the model, but it is straightforward to show this result by extending the model to include location-specific social costs and risks.

rural migrating men pay a higher price than women who marry urban-born men with the same level of human capital. Note that *this groom price differential occurs in spite of the fact that both types of men participate in the urban labour market.* Formally, we have the following results.

**Proposition 3.** *Suppose $\zeta_f > \zeta_m = 0$. Then, in any equilibrium with rural-urban migration, all rural families whose offspring participate in the urban labour market choose $UR$ and none choose $UU$. For any level of human capital of the bride and groom, dowry payments are higher in market $UR$ compared to market $UU$. At a given wealth level of the rural female family and human capital of the groom, a bride in market $UR$ has less human capital than a bride in market $UU$.*

Note that, according to Proposition 3, an equilibrium with rural-urban migration *can* support marriage price schedules in which the marriage price schedules for urban-born men and migrating rural-born men are identical. But these are 'unstable' in the sense that if any rural-born male switches from $UR$ to $UU$ (being indifferent between the two), then the marriage markets will not clear. More formally, we have the following result using an equilibrium refinement called 'positive mixed strategy equilibrium' defined in Appendix 0:

**Corollary 1.** *to Proposition 3: Suppose $\zeta_f > \zeta_m = 0$. In any positive mixed strategy equilibria with rural-urban migration, dowry payments in market $UR$ are strictly higher than that in market $UU$ for a given level of human capital of the bride and groom.*

As in Case 1, if there is a cost of migration and a rural-urban wage differential, the offspring from wealthier families migrate while those from poorer families stay at the origin location. We obtain this result as a corollary to Proposition 2. To state the corollary, we define $\tilde{\mu}\,(W, o, g; w_U, w_R, \varphi_0)$ as the cost of migration for which a family with wealth $W$, type $g$ and origin $o$ is indifferent between the rural and urban labour markets, given urban and rural wages $w_U$ and $w_R$ respectively.

**Corollary 2.** *to Proposition 2: Suppose $\zeta_f > \zeta_m = 0$. If the wage is higher in the labour market away from the origin and Condition 1 holds, then $\tilde{\mu}\,(W, o, g; w_U, w_R, \varphi_0)$ is monotonically increasing in $W$. Consequently, for any $\mu > 0$, offspring from wealthier families migrate while those from poorer families remain at the origin.*

## 2.3 Effect of a Decline in Migration Costs

In this section, we provide theoretical predictions for how prices, marriage and labour decisions respond to an exogenous decline in migration costs. Suppose that, initially, there is a positive cost of migration and the urban wage is higher than the rural wage. If $\zeta_f = \zeta_m = 0$, then by Proposition 2, there exist threshold wealth levels such that the offspring of all rural families of type $g$ above the wealth threshold migrate to the urban location while those below the threshold remain at the rural location. A decline in the cost of migration will, as per Proposition 2, lower the threshold wealth levels that trigger migration. This will increase the supply of urban labour and reduce the supply of rural labour, thus driving down the urban wage rate and increasing the rural wage rate. If $\zeta_f > \zeta_m = 0$, we can show similar effects of a decline in the cost of migration using the corollary of Proposition 2. We can also show that the increase in the rural wage rate will increase (education) expenditures on rural-born male offspring and decrease expenditures on urban-born male offspring. It will also result in increased rural-urban male migration. In the case of women, the increase in the rural wage rate has no direct effect on expenditures on rural-born female offspring because, by assumption, women in rural areas engage in home production. But there is an increase in the proportion of rural-born female offspring who migrate and participate in the urban labour market and this will lead to increased female expenditures in rural areas. These increased expenditures will involve some combination of increased female education, and higher dowries to pay for more educated grooms.[12] By contrast, the decline in the urban wage rate leads to a decrease in expenditures on urban women. Formally, we have the following results.

**Proposition 4.** *Consider positive mixed strategy equilibria of the economy. If the urban wage exceeds the rural wage in the initial equilibrium and Condition 1 holds then, a decline in the cost of migration (i) increases rural-urban migration; (ii) increases the rural wage and decreases the urban wage.*

*Among rural families who opt for $RR$ and among those who opted for $RR$ in the old equilibrium and $UR$ in the new equilibrium, there is (iii) an increase in male education; (iv) an increase in ex-*

[12]The equilibrium expendidutes on male and female offspring are given by lemma 1 in Appendix 0. The lemma implies that female families are indifferent between t different combinations of education and dowry expenditures for a given level of total expenditures on the offspring. The assumption of mixed strategies made in this section means that female families that are otherwise identical will choose different combinations of education expenditures and dowry payments, summing to the same total expenditures, in equilibrium.

*penditures on daughters – in the form of increased dowry payments and increased female education; and an increase in female labour force participation (among rural migrating women only).*

*Among urban families, there is (v) a decrease in male education; (vi) a decrease in expenditures on daughters – in the form of decreased dowry payments and decreased female education; (vii) no change in female labour force participation.*

The results on female labour force participation in Proposition 4 is driven by our assumption that women in rural areas engage in home production while those in urban areas participate in the labour market. But we obtain the same qualitative results as long as female labour force participation is higher in urban areas in the initial equilibrium.[13] The above results apply both for Case 1 (no marriage search costs for migrants) and Case 2 (positive marriage search costs for female migrants and zero marriage search costs for male migrants) described in the preceding section. The following results show how a decline in migration costs will lead to different behaviour in the two cases, thus providing a means of distinguishing between them empirically.

**Proposition 5.** *Consider positive mixed strategy equilibria of the economy. Suppose that there is a positive cost of migration and a rural-urban wage differential in the initial equilibrium and Condition 1 holds. (i) If $\zeta_f > \zeta_m = 0$, then a decline in the cost of migration will increase participation in market $UR$ with no change in participation in market $UU$ by rural families. (ii) If $\zeta_f = \zeta_m = 0$, then a decline in the cost of migration will increase participation in both markets $UR$ and $UU$ by rural families.*

# 3 Study Context

## 3.1 Female Work Participation

In the last few decades, the lives of Bangladeshi women have undergone some dramatic changes. Since the 1970s, the fertility rate has seen a sharp drop – from 6.3 in 1975 to 2.3 in 2011 (NIPORT, Mitra and Associates, and ICF International, 2013)[14] – commonly attributed to family planning programmes launched in the 1970s (see, for example, Joshi and Schultz, 2007). And, since the

[13]This will hold true whenever the urban wage rate is sufficiently high to elicit positive female labour market participation in urban areas, and higher than that in rural areas.

[14]These figures refer to the total fertility rate.

1990s, when a number of government-led initiatives were introduced to improve female access to schooling, there have been large increases in female primary and secondary school enrollment (Asadullah and Chaudhury, 2009; Schurmann, 2009).

The same period saw an expansion in access to credit and increased participation in small enterprises among rural women, alongside the emergence and growth of the export-oriented ready-made garments (RMG) sector which employed large numbers of women. Growing from just 40,000 workers in 1993, about 4 million workers[15] were employed in this sector in 2014, 80% of the workforce being female (Khatun, Rahman, Bhattacharya, and Moazzem, 2008). Despite the large numbers of women employed in the RMG sector, female labour force participation in Bangladesh has seen only modest increases in the last three decades. Recent data shows female participation in paid work at around 10% (Mahmud and Tasneem, 2011). Trends based on the Labor Force Survey data indicate that the female participation rate increased from 23.9% in 1990 to 36.0% in 2010 (Rahman and Islam, 2013).

The low rate of participation among women is puzzling given the decline in fertility and increase in schooling. One potential barrier is social restriction on the outside movement of women. In their study on the Matlab area using data from mid 1990s, Anderson and Eswaran (2009) noted that the majority of female respondents had never been to the local market and visited outside of their homes at most once a week. Surveys conducted almost two decades later also confirm considerable restrictions on female mobility outside the home and persistence of traditional attitudes towards women. Heintz, Kabeer, and Mahmud (2018) note that more than 85% of the women in their study were either engaged in a home-based economic activity or were economically inactive, which they attributed to cultural restrictions on women's outside mobility. According to research using WiLCAS 2014 data (the same data used in this study), at least part of the gender gap in paid work participation in rural Bangladesh can be explained by social norms restricting women's mobility outside of the home (Asadullah and Wahhaj, 2017).

[15] Figures obtained from the Bangladesh Garment Manufacturers and Exporters Association at http://www.bgmea.com.bd/ .

## 3.2 Female Migration and Marriage Norms

Given the social restrictions in rural Bangladesh on women's mobility outside of the home, migration decisions play a key role in shaping their access to outside work. Historically, while men reported migrating for economic reasons, most women reported migrating for familial reasons (Alam and e Khuda (2011)). Even among urban factory workers, a survey conducted in 1990 revealed that only 17% of female workers had migrated on their own, without a family member (Zohir and Paul-Majumder (1996), cited in Paul-Majumdar and Begum (2000)).

In her qualitative study of women employed in the RMG sector in Bangladesh, Kabeer (2000) attributed instances of independent urban-ward migration among rural-born workers to destitution, experience of social ostracism due to divorce or separation, and restrictions on female outside work imposed by village elites.Thus, women who undertook independent urban-ward migration were driven to it by desperate circumstances and already subject to social ostracism, a pattern which suggests that the move was costly in social terms. In recent years, the previously documented gendered migration pattern appears to be undergoing some change. In the 2011 Population Census, among recent, young migrants in Dhaka metropolitan area and Chittagong district, there were over 160 females for every 100 males (Jones (2020)), a pattern to which the recent growth of the RMG sector is likely to have contributed.

Nonetheless, marriage remains the primary driver of women's migration out of her place of birth (we present evidence on this in the next section). The reason is that, with the exception of a small number of tribal groups, post-marital residence in rural Bangladesh is patrilocal (Cain (1978)), a custom that has persisted through significant economic and demographic changes (Amin (1998)). In the past, a significant portion of marriages were with a close kin and/or consanguineous in nature (Mobarak et al. (2013)). These marriages took the form of village endogamy, limiting scope for long-distance marriage migration. Over time, kin marriages have declined (Do et al. (2013)) and village exogamy and non-kin marriage have become the norm (Schuler (2010)). Although this has resulted in more women moving out of their village, post-marital migration is still limited to within-district movements (Jones (2020)) unless it involves marrying an urban male migrant. Traditionally, women had limited autonomy in making this major decision in their lives: as they face strong social pressures to marry from the onset of puberty (Field and Ambrus

(2008); Asadullah and Wahhaj (2019)) and most marriages are arranged by parents or members of the extended family (White (1992); Dube (1997); Asadullah and Wahhaj (2016)). Historically, marriages among Muslim Bangladeshis were marked by customary bride price (or "mehr"). Dowry practice emerged in the 1970s, initially among the urban middle class, and then spread to rural communities for grooms who had prospects outside of agriculture and consequently deemed more desirable on the marriage market (Lindenbaum (1981)). Today, the practice is prevalent in all parts of the country, albeit not universal (Asadullah et al. (2020)).

We are not aware of previous work on the drivers of marriage migration in the context of Bangladesh. But a number of studies have studied the phenomenon in the wider region. In India, the vast majority of permanent migrants are women and they state their reason for moving as marriage. Rao and Finnoff (2015) argue that recent increases in marriage migration in India is not due to "disguised economic migration" by women but rather because of growing marriage migration among poorer households. In China, both men and women have, historically, faced significant institutional barriers to long-distance (domestic) migration due to the household registration or hukou system. In this context, Fan and Huang (1998) argue that, since the law allows women to change their hukou location (formal place of residence) through marriage, peasant women from poor areas used marriage to migrate to, and take advantage of economic opportunities in, more developed rural regions.

### 3.3 Jamuna Multi-Purpose Bridge

We provide some background information about the Jamuna Multi-Purpose Bridge[16] in northern Bangladesh, which we use in our analysis as a source of exogenous change in rural-urban migration costs in Bangladesh.

The bridge spans the Jamuna river, one of the three major rivers in Bangladesh, which separates its north-western regions from the rest of the country. The construction of the bridge was the largest ever infrastructure development project to be undertaken in Bangladesh. Construction of the bridge was first proposed in the East Pakistan Assembly (the provincial assembly for the country prior to independence) in 1966 (Ahmad, P.E., Azhar, and Ahmed, 2003). But given the

[16] While it is commonly referred to as the Jamuna Multi-Purpose Bridge, its official name is Bangabondhu Bridge. In the following, we refer to it simply as the 'Jamuna Bridge' for ease of discussion.

technical and financial challenges involved, the project received a green light only in 1993 (Oostinga and Daemen 1997). Construction began in October 1994 and the project was completed in November 1997. The bridge opened to the public in June 1998. Its opening dramatically reduced journey times between the capital Dhaka and the poorer regions in the northwest. Crossing the river by ferry – the most common mode of transport across the river prior to the opening of the bridge – took more than 3 hours; while average waiting time for a ferry during periods of heavy traffic, such as the period of the Eid festivities, has been estimated at 36 hours. By contrast, crossing the river using the Jamuna Bridge, including waiting time, takes less than an hour (Blankespoor, Emran, Shilpi, and Xu, 2018). According to some estimates, the travel time between Dhaka and the city of Bogra in Rajshahi division declined from 12-36 hours to 4 hours (Ahmad, P.E., Azhar, and Ahmed, 2003) following the opening of the bridge.

Some recent studies have attempted to estimate the socio-economic impact of the bridge. Adopting a difference-in-differences approach using districts immediately adjacent to the bridge, Mahmud and Sawada (2015) estimate that it led to a decrease in household unemployment and a shift from farm to non-farm employment.

Blankespoor, Emran, Shilpi, and Xu (2018) estimate the effects of the bridge on population density, economic density (as measured by nightlight luminosity), inter-sectoral labour allocation and agricultural productivity, using a difference-in-difference approach where sub-districts in the Padma region (also separated from Dhaka by a river with no connecting bridge) serve as the control group. They find that, in the long-term (beyond 7 years after the bridge construction) the Jamuna region experienced an increase in population and economic density, a decline in the labour share of manufacturing, and an increase in the labour share of services. They also find positive effects on agricultural productivity as measured by rice yields.

At the site of the bridge, the river flows in a relatively narrow belt which made it amenable for the construction of the bridge. In particular, it has been argued that the site was chosen for engineering rather than socio-economic reasons (Mahmud and Sawada, 2015). As discussed in Section 6, we use the site of the bridge as a source of exogenous variation in the decline in travel times to Dhaka from the western side of the river, following its opening. Given the complexity of the project and long period of planning and construction, there was, arguably, a high level of uncertainty about when the bridge would open to the public and whether it would prove to be a reliable transport link, at least in the minds of ordinary people. Therefore, anticipation effects on household behaviour prior to the completion of the bridge are likely to have been small.

# 4 Description of the Data & Descriptive Statistics

## 4.1 Description of the Survey

The analysis in this paper is based on data from the 2014 Women's Life Choices and Attitudes Survey (WiLCAS), a survey of Bangladeshi women purposefully designed by the authors for the present study. The survey included individual interviews with a nationally representative sample of women born between 1975 and 1994, and recorded their full migration history from birth onwards. It also includes information on their personal background (place and date of birth, parental characteristics), marital history (including background information of the groom, and pre-marital transfers), employment (including history of work in the manufacturing sector), and education (enrollment history, highest level of education completed).

Recall data on parental landholdings during one's childhood and dowry payments play an important role in our empirical analysis. Therefore, we comment briefly on the possibility of recall bias in this data. Parental landholdings during one's childhood and the dowry paid during one's marriage are important determining factors in the lives of women in rural Bangladesh. Therefore, they are likely to have very good recall about them. Recent analysis of recall data on dowry payments from India indicates that both recall bias and classical measurement error are low in this type of data (Anukriti et al., 2020; Chiplunkar and Weaver, 2021). We are not aware of similar work in the case of parental landholdings but believe there are similar reasons for good recall.

The survey was conducted between May and July 2014 based on a sample consisting of (i) all rural households in the 2010 Bangladesh Household Income and Expenditures Survey (HIES) which had at least one female household member in the age-group 16-35 years;[17] (ii) a stratified sample of urban households based on a full household census in 87 non-metropolitan urban pri-

[17]Three districts in the Chittagong Hill Tracts were not covered in the survey as a long-standing civil conflict made it difficult to access the region. About 15% of the original HIES rural households could not be traced and these were replaced with randomly selected households with comparable demographic characteristics within the same primary sampling unit.

mary sampling units, followed by a random selection of 20 households from each unit.[18] The 87 primary sampling units were randomly selected from those included in the 2010 HIES, with at least one unit from each district. This procedure yielded a sample of 6,293 individual interviews with women in the age group 20-39 years (1,557 in urban areas) from 61 districts and 493 unique sub-districts.[19]

### 4.2 Descriptive Statistics

Table 2 shows the descriptive statistics for the women in our sample. They have a median age of 29 years, and the median education is 5 years of schooling. About 94% of the respondents have experienced marriage and the median age of first marriage is 16 years. One in four were born in the north-western regions, separated from Dhaka by the Jamuna river; and 16.9% were born in these regions and aged 15 or less when the bridge opened in 1998. At the time of the survey, about 14% of all respondents lived in the manufacturing belt around Dhaka (specifically towns in the districts of Dhaka, Narayanganj, Tangail, Gazipur). This may be because they married someone born in this region (5.5% of the full sample), married someone who migrated to this region (4% of the full sample), or migrated to the region on their own.

The dataset contains information on each migration episode for each respondent from birth till the survey date, categorised by type: "economic", "education", "marriage or family-related", "river erosion" and "other". A migration episode is defined as moving (at least) out of the village or urban "ward" for a period of 6 months or more. The mean number of migration episodes is 0.98 per women, which includes women who have never experienced any migration (16%) and women who have migrated on multiple occasions (11.3%).

Table 3 shows the frequency of "marriage or family-related" migration and "economic migration" for married and unmarried women. About 79% of the respondents have experienced "marriage or family-related" migration. About 83% of married women have experienced at least one such migration episode in their lives, and 86% of these episodes occur in the year of the

[18] The rationale for conducting a household census in the urban areas to construct a sample rather than revisiting HIES households (as was done in rural areas) was to avoid the risk of high attrition, given that urban households in Bangladesh are typically much more mobile than rural households.

[19] The survey included interviews in households in the 2010 HIES with no women in the targeted age cohorts, and a second phase in which sisters of the original female respondents were traced and interviewed. We do not provide further details about these components of the data as they were not used for the present analysis.

marriage or the following year. By contrast, only 11% of unmarried women have experienced migration in this category. Therefore, although the data does not provide additional information about the nature of "family-related migration", these patterns suggest that most of the episodes in this category involve a bride leaving the parental household to join the groom.

About 6.5% of the respondents have experienced one or more episodes of "economic migration", which we define as moving to a different location for one's own work. In Table 38 of Appendix I, we compare the characteristics of women who have experienced at least one episode of economic migration with those who have not. On average, the economic migrants are younger. They are also less likely to be in a marriage (51.7% versus 91.7% for women who have never experienced economic migration) and nearly 15 times more likely to be divorced or separated (24.5% versus 1.7%). They report significantly lower parental ownership of cultivable land (mean of 0.67 acres versus 1.44 acres) and are more likely to report a 'low-paid occupation' for the father (28.7% versus 21%) (both variables specific to the time when the respondent was 12). Thus, while female economic migration is not uncommon, these statistics suggest that the migrants are more likely to have a background of economic deprivation compared to non-migrants.

# 5 Dowry Payments for Rural-Born Migrant Grooms

In this section, we conduct an empirical test of the prediction of the theoretical model in Section 2 regarding the dowry payments made to migrant grooms: if pre-marital female migration is costly due to insecurity or social disapproval then grooms originating in rural areas who migrated to an urban location following marriage would have received higher dowry payments[20] than grooms originating in the urban location whose marriages involved no migration, holding constant the human capital of the bride and the groom (Proposition 3 and its corollary). In the absence of social barriers, there will be no such 'dowry premium' for migrant grooms (Proposition 1).[21]

Testing this prediction empirically is complicated by the presence of possible differences in

[20]More precisely, this refers to the part of the dowry that is paid directly to the groom (called *joutuk* in Bangladesh) and not the part of the dowry over which the bride retains control.

[21]Note that the theoretical model also implies that rural-born migrating men would receive a higher dowry than rural-born men who do not migrate. But, in theory, this difference occurs even in the absence of market frictions. Therefore, empirical evidence of such a difference would neither support nor contradict the assumption that market frictions limit or distort female independent migration.

characteristics between migrant and non-migrant couples in urban areas that affect dowry payments. To mitigate this concern, we control for a rich set of information in the WiLCAS dataset about the bride and the groom at the time of marriage, including not only their education levels, but also parental occupations and landholdings, education of the bride's parents, the type of marriage (whether arranged by the family, initiated by the couple, consanguineous) and the age difference between the bride and the groom. Using these characteristics, we estimate hedonic dowry equations following Rao (1993). To test the theoretical predictions, we use only the subsample of couples in urban areas and include a binary variable indicating whether the couple migrated to their current location following marriage. We introduce subdistrict fixed-effects to account for level differences in the marriage price schedule across urban locations. We exclude from the analysis women who migrated to the urban location prior to marriage as these women did not engage in marriage-migration.

The estimates are shown in Table 4. In column (1), we report estimates from a linear probability model with a binary dependent variable (indicating whether the marriage involved a dowry). The estimates indicate that, controlling for the characteristics of the couple and the parents, marriages which involved migration to the urban area were more likely to involve a dowry payment to the groom (by about 12%). In column 2, we report OLS estimates using the natural logarithm of the dowry amount as the dependent variable. The estimates imply that the dowry payment was, on average, about 20 percent higher for marriages which involved migration to the urban area.

Note however that only about 39% of marriages in the WiLCAS dataset involve dowry payments to the groom (see Table 2) and the estimates in column 2 are based on this selected sample. To correct for possible selection bias, we estimate a Heckman Selection Model using a two-step consistent estimator. For the selection equation, we use binary variables indicating whether the bride's mother was employed outside of the household and whether the couple is Hindu.[22] The second step estimates, shown in column 3, indicate that dowry payments to the groom are higher

[22]Dowry practice is more likely among Hindus and those with working mothers, as indicated by the selection equation estimates in column 3. However, if the size of the dowry is determined primarily by the productive characteristics of the bride and groom, it is unlikely that – conditional on paying a dowry – either of these binary characteristics affects the value of the dowry paid. Separately, we verify that both variables have little effect on the conditional mean of the log of the dowry amount in the selected sample.

by 14.7% when marriage-migration is involved (statistically significant at the 10% level).[23] As an additional robustness check, we repeat the exercise using the inverse hyberbolic sine transformation of the dowry amount and the natural logarithm of (1 + dowry amount) in Appendix I. These additional estimations yield similar results.

In Table 39 of Appendix I, we repeat the exercise for the subsample of couples living in the manufacturing belt around Dhaka. The estimated effects of marriage-migration on dowry payments are still positive but are much smaller and no longer statistically significant (albeit not significantly different from the estimated effects for the main sample). This suggests that social barriers to female independent migration to the manufacturing belt may be weaker. Alternatively, it is possible that in industrialised areas, where wealth is more likely to take the form of urban real estate, our measures of parental farmland holdings do not capture parental wealth heterogeneity well enough.

The sizeable difference in expected dowry payments, controlling for observed characteristics, between urban-born couples and couples who migrated to the same location, as shown in Table 4, can be explained using the theoretical model in Section 2. In the absence of social barriers to female independent migration, dowry payments between these two sets of couples should be identical (Proposition 1). But when there are such social barriers, the model predicts that migrant grooms receive higher dowry payments (Proposition 3), consistent with our empirical finding.

# 6 Exploring the Effects of a Reduction in the Cost of Migration

In this section, we test a number of the model's main predictions relating to a reduction in the economic cost of migration. First, from Proposition 4, we predict that a reduction in the cost of migration will increase rural-urban migration, male education, expenditures on daughters (in the form of educational investment and dowry payments) and female labour force participation – among migrating women. Proposition 5 implies that *if there are no social barriers to inhibit the independent migration of women*, a reduction in the cost of migration will lead to increased

[23] The estimated coefficient on the Inverse Mills Ratio is negative and statistically significant, implying a negative selection effect.

participation in both markets 'UR' and 'UU' by rural-born women. In practice, the latter can take the form of (i) increased female (independent) migration for economic reasons (i.e. to take up employment in the urban area) and/or (ii) increased propensity among rural-born women to marry men *from* urban areas. If such social barriers do exist, however, we would instead expect to see an increased participation in market 'UR' only; in other words, marriage-related migration *only,* involving marriage to rural-born migrating men, with no change in economic migration, and no change in the propensity to marry men from urban areas.

## 6.1 Identification Strategy

To test the model's predictions, we take advantage of the construction of the Jamuna Bridge in 1998 (described in Subsection 3.3) as a source of variation in the cost of migration, as the bridge dramatically reduced the time needed to travel between the north-western region of the country (i.e. the Rajshahi and Rangpur Divisions) and the manufacturing belt around Dhaka. Because Bangladesh is effectively partitioned into segments by a river system, the reduction in travel time afforded by the Jamuna Bridge did not affect travel to Dhaka from other parts of the country. We thus consider the north-western region (i.e. the "Jamuna region") to be "treated" with a reduction in migration costs, while taking the rest of the country - except the Dhaka manufacturing belt - to be untreated. We distinguish the Dhaka manufacturing belt from the rest of the non-Jamuna regions because, according to Proposition 4 of the model, a decline in the cost of rural-urban migration is expected to affect urban families in the areas of in-migration as well as rural families in the areas of out-migration. Thus, we attempt to study the evolution of outcomes in both the Jamuna region (where migration costs have changed) and the Dhaka manufacturing belt *relative to* outcomes in other rural regions of Bangladesh.[24]

For ease of exposition, we have not included the other rural regions in the theoretical model presented in Section 2. Here, we discuss briefly how these regions would be affected by the

[24]In addition to lowering migration costs, the Jamuna Bridge may have impacted real incomes in the Jamuna region and the Dhaka manufacturing belt relative to other parts of the country. Propositions 4 and 5 take into account the general equilibrium effects on wages due to a reduction in migration costs. In the theoretical analysis in Section 2, we do not show the effects on migration of an increase in real income due, for example, to a fall in consumer prices. However, it is straightforward to show that such a change in real income would have the same qualitative effect as that described in Propositions 4 and 5; in particular, an increase in all types of female migration if there are no social barriers but an increase in marriage-related migration only if there are social barriers to female migration.

Jamuna bridge. As these other regions (the divisions of Khulna, Barisal, Sylhet and Chittagong) are separated from both the Jamuna region and Dhaka by other major rivers (see Figure 2), the cost of travel to and from these regions was unaffected by the construction of the Jamuna bridge. Moreover, as the Jamuna region is one of the poorest regions of the country, it is unlikely that outmigration from the region would attract in-migration from other regions. Nevertheless, there would be second-order effects on education, outward migration, etc. in these regions due to a decline in urban wages. Note that these second-order effects are experienced in the Jamuna region as well. Thus, our empirical approach is designed to capture the direct effects of the bridge on women born in the Jamuna region on top of these second-order effects.

Our empirical strategy is to use a difference-in-differences methodology by comparing outcomes (i) between individuals born in the treated regions versus untreated regions, and (ii) between younger cohorts and older cohorts – on the assumption that some younger cohorts were born late enough to have been affected by the bridge when making their decisions regarding marriage/migration while older cohorts had already made these decisions before the bridge was constructed. In particular, we assume that the bridge only affected individuals if they were 15 years of age or younger in 1998 – the year in which the bridge opened to the public. The rationale for this age cut-off is as follows: Most of our outcomes of interest are related to marriage or shaped by marriage. The marriage norm in Bangladesh is such that it is extremely rare for girls to marry before the onset of puberty but there are strong pressures to marry from the moment that puberty is attained (Field and Ambrus, 2008, Asadullah and Wahhaj, 2019). In our dataset, the median age of onset of puberty is 13 (mean of 12.6). In 1998, the marriage rate was 81% among those born before 1983 and 10% among those born in 1983 or later. The same rationale does not work so well for men – who tend to marry at a later age and also have greater flexibility in their migration decisions. Therefore, we restrict this analysis to women.

Our strategy is captured by the following regression equation:[25]

$$Y_{irt} = \delta MB_r + \lambda Post_t + \theta_1 (Post_t \times JM_r) + \theta_2 (Post_t \times MB_r) + \gamma_r + \mathbf{X_{irt}} \beta + \varepsilon_{irt} \quad (5)$$

[25]Our identification strategy is standard, so we provide only a brief and informal description below. However, a more formal description of the problem and our identification assumptions can be found in Appendix H for interested readers.

where $Y_{irt}$ denotes an observed outcome of interest for individual $i$ in region $r$ and cohort $t$, $JM_r$ is a dummy which indicates whether an individual was born in the region that the Jamuna Bridge connects to Dhaka, $MB_r$ indicates whether the individual was born in the Dhaka manufacturing belt, and $Post_t$ is a dummy indicating whether an individual born in year $t$ (i.e. in cohort $t$) was aged 15 or less in 1998. For specifications involving educational attainment, we use an age cutoff of 10 years or less in 1998, because decisions to drop out or remain in school may have been taken prior to age 15 but unlikely before age 10.[26] We denote by $\gamma_r$ a full set of Division fixed effects, with Dhaka Division being the excluded category. As the variable $JM_r$ corresponds exactly with the Rangpur and Rajshahi Divisions, and the equation includes division fixed effects, we do not include $JM_r$ on its own in equation (5).[27] The rationale for including controls for birth in the Dhaka manufacturing belt and its interaction with the variable $Post_t$ is based on Proposition 4 which predicts that a decline in the cost of rural-urban migration will affect urban families in addition to rural families. We include the dummy variable $MB_r$ on its own in the specification as "Dhaka manufacturing belt" consists of a smaller area than Dhaka Division.[28] Finally, $\mathbf{X}_{irt}$ is a vector of individual $i$'s observable, predetermined characteristics[29] (i.e. they are not affected by the treatment) and $\varepsilon_{irt}$ is the error term. In our primary specifications standard errors are clustered at the sub-district ('upazila') level, using the sub-district where the individual was born.[30]

In addition to the basic pre-post difference-in-difference regression model, we also conduct an event-study analysis in which the difference in outcomes between the Jamuna Region and other rural areas is allowed to vary more flexibly - cohort by cohort. In particular, we run the following regression:

[26] In the WiLCAS data, among women who enrolled in school, just 6% drop out before age 10 while 76% drop out by age 15.

[27] Although some parts of Rangpur Division lie east of the Jamuna river, all the WiLCAS respondents born in north-western Bangladesh (Rangpur and Rajshahi Divisions) were born west of the river.

[28] In our sample, "Dhaka Manufacturing Belt" consists of towns located in the districts of Dhaka, Gazipur, Narayanganj and Tangail, while "Dhaka Division" includes both urban and rural locations in all 17 districts located within the Division.

[29] These include the following: age, age squared, religion, parental education, parental landholdings, distance from the place of birth to the manufacturing belt, whether the respondent's place of birth is separated from Dhaka by a river, and whether the respondent's father's occupation was low-paying. These characteristics were chosen because they are measurable factors that are 1) likely to influence respondents' potential outcomes (regarding marriage, work or migration) and 2) may be changing over time at different rates between the treated and untreated regions.

[30] Most of our results are robust to clustering at the broader district-level.

$$Y_{irt} = \delta MB_r + \sum_{t=1}^{T} \alpha_t \eta_t + \sum_{t=1}^{T} \theta_{1t} \left( \eta_t \times JM_r \right) + \theta_2 (Post_t \times MB_r) + \gamma_r + \mathbf{X_{irt}} \beta + \varepsilon_{irt} \quad (6)$$

where $JM_r$, $MB_r$, $Post_t$, $\gamma_r$ and $\boldsymbol{X_{irt}}$ are defined as above, while $\eta_t$ is a dummy variable for cohort $t$ (in practice, we combine birth years into 3 year bins to improve the precision of our estimates). The set of coefficients of the form $\theta_{1t}$ provides the estimated difference in outcomes between individuals born in cohort $t$ in the Jamuna Region versus those in the same cohort born in other rural regions.[31] We graph the coefficients to observe how this difference in outcomes varies over time in a more flexible way.

## 6.2 Measure of Treatment Intensity

In our base specification (described above), $JM_r$ is a dummy variable. In an alternative specification we use a continuous version of the $JM_r$ variable that captures treatment intensity and is based on the fact that the reduction in travel time varied across locations on the western side of the river, depending on whether accessing the bridge involved a long detour or not.

This alternative measure, denoted $JM_{intensity}$, still takes a value of 0 for all individuals born outside the north-western region of Bangladesh, as they would not need to cross the Jamuna bridge to travel to Dhaka. For individuals born in north-western Bangladesh, it is constructed according to the following formula, which aims to capture the percentage reduction in travel time to Dhaka due to the construction of the bridge:

$$JM_{intensity} = max \left\{ 0, 1 - \frac{(a+b)}{(c+300)} \right\} \quad (7)$$

where $a$ = the geographic distance (in kilometres) from the respondent's place of birth in north-western Bangladesh to the site of the Jamuna Bridge, $b$ = the geographic distance from the Jamuna bridge to Dhaka, and $c$ = the geographic distance from the place of birth to Dhaka. The number 300 appears in the formula as we assume that crossing the Jamuna river in the absence of a bridge – e.g. on a ferry – would take, on average, the same amount of time as traveling

[31] The omitted cohort consists of those born just *before* 1983 (i.e. the last "untreated" cohort).

300 kilometers.[32] Figure 1 illustrates how the treatment intensity is constructed, using the towns of Bogra and Pabna in north-western Bangladesh as examples. The distribution of values of the treatment intensity in all the WiLCAS clusters in north-western Bangladesh is shown in Figure 2.

For women 'treated' by the Jamuna Bridge, the treatment intensity variable has a median value of 0.575 and a range of 0.447 to 0.736. In other words, the reduction in travel time varies from 44.7% for women born in villages very distant from the bridge to 73.6% for women born in villages close to the bridge or villages from which traveling to Dhaka via the bridge would not involve a long detour.[33]

# 7 Results

According to the theoretical analysis in Section 2, rural-born women from better-off families migrate to urban areas while those from poorer families remain in rural areas (Corollary 2 to Proposition 2). We argue that, empirically, the marginal household lies above the median of the wealth distribution because, in the data, only about 10% of women born in rural areas have migrated to Dhaka. Although there are female migrants from below the median wealth, they are likely to include women who migrated due to desperate circumstances – e.g. widowhood, separation, threat of early/forced marriage – and unlikely to respond to relatively small changes in the economic cost of migration.[34] Therefore, if there is a decline in migration costs, the women who respond should be in the top half of the wealth distribution. Correspondingly, in the empirical analysis that follows, we split the sample of women into two according to their parental land-

[32] To arrive at this equivalence we assume that the average time to cross the Jamuna river prior the bridge construction to be 10 hours (including time queuing for the ferry) and that the average travel speed on roads is 30 kilometers per hour. Our estimates are robust to variations in these assumptions.

[33] We use the geographic distance rather than the road distance for the treatment intensity variable. Although we have information about the respondent's place of residence in her adolescence (around the time of her marriage and migration decisions), we use her place of birth in the formula as it is more likely to be exogenous to the construction of the bridge.

[34] In a qualitative study of women working in the RMG sector during the 1990s, Kabeer (2002) find that a significant number arrived in the city after being separated or divorced. The WiLCAS data shows that women who engaged in (independent) economic migration are about 14 times more likely to be divorced than those who have not (Table 38 in Appendix I). Qualitative interviews conducted in the Dhaka manufacturing belt in conjunction with the WiLCAS survey revealed that escaping early and/or forced marriage is a common push factor behind female independent migration to the city.

holdings. Specifically, we distinguish between women whose parents had half an acre or more of cultivable land when the daughter in question was aged 12 (54% of the sample), and women whose parents had less than this threshold.[35] Then, we estimate equation 5 separately in both samples.

## 7.1 Preexisting Levels and Trends

Our main identification assumption is that, conditional on the selected covariates, outcomes in the Rajshahi and Rangpur Divisions would have continued on a common trend with outcomes in other rural areas *if* the bridge had not been built. Thus, any deviations from the trend after 1998 are due to the construction of the bridge. Although this assumption is untestable (because we cannot observe counterfactual realisations), we can observe whether the trends in our outcomes of interest in the treated and untreated regions appeared to be moving in parallel for older cohorts (i.e. those old enough such that their marriage decisions were likely to be made prior to the bridge opening).

Figures 3 and 4 show, for each of our outcome variables, yearly averages (along with a locally smoothed non-parametric approximation[36]) for cohorts born between 1975 and 1994, grouped according to whether or not they were born in the 'Jamuna Region' (Rajshahi and Rangpur Divisions) or the 'non-Jamuna Region' (other Divisions excluding the Dhaka manufacturing belt). The outcomes include binary variables indicating whether the respondent (i) currently resides in the Dhaka manufacturing belt; (ii) has ever engaged in marriage-related migration to the manufacturing belt; (iii) has ever engaged in economic migration to the manufacturing belt; (iv) has a husband who has migrated to the manufacturing belt; (v) has ever been employed in the readymade garments sector; (vii) has attended secondary school; (viii) paid a dowry; as well as continuous variables indicating (vi) the respondents' years of schooling; and (ix) the natural log of dowry payments made by the respondent (or her family). Figure 3 shows the trends for respondents

[35] Half an acre of land is a criterion widely used for poverty-targeted programmes, including a number of well-known initiatives in Bangladesh such as Grameen Bank's original microcredit programme (Pitt and Khandker (1998)) and the Bangladesh Government's Food for Education programme (Meng and Ryan (2010)).

[36] Specifically, we perform kernel-weighted local mean smoothing using an Epanechnikov kernel function. The bandwidth is chosen via a rule of thumb bandwidth estimator - but the general results are not sensitive to reasonable alternative choices of bandwidth. The results are also not sensitive to smoothing with kernel-weighted local polynomial regressions of higher order.

whose fathers had less than half an acre of land, while Figure 4 shows corresponding trends for respondents above this threshold. A dashed vertical line in each graph separates the older cohorts (born before 1983) and the younger cohorts.

For the older cohorts, for the most part, we do not observe any clear differences in trends between the two regions in either Figure 3 or Figure 4. Moreover, even level differences in variables across the two regions are typically small for older cohorts – with the exception of the binary indicator for dowry marriages which historically had much higher prevalence in northern Bangladesh compared to other parts of the country. For younger cohorts (i.e. those making marriage and migration decisions after the bridge was built), Figure 4 does suggest some divergence in trends among respondents from better-off families, especially in the following outcomes: residence in Dhaka, marriage migration, work in readymade garments and dowry payments. This is suggestive that the opening of the bridge did affect certain outcomes for *some* women born in north-western Bangladesh.

In addition to plotting pre-trends in outcomes, we can also ask how the distribution of predetermined individual characteristics (e.g. respondents' schooling, religion and parental characteristics) varied across regions. Table 37 of the Appendix presents mean values of these characteristics for all cohorts by region, together with normalised differences between group pairs. In all instances, the normalised differences are below the threshold of 0.25 which indicates good balance across the corresponding groups.[37] The fact that respondents in the non-Jamuna Region are similar to those in the Jamuna Region in 1) their levels of predetermined covariates, 2) outcome levels prior to the bridge construction, and 3) outcome trends prior to the bridge construction, provides some measure of confidence that the non-Jamuna Region is a useful comparator group for this exercise, although of course it does not prove that our identification assumption holds (Kahn-Lang and Lang (2020)).

[37]The normalised difference is the difference in means between two groups, divided by the square root of half the sum of the group variances. Imbens and Rubin (2015) show that differences below 0.25 indicate good balance - in the sense that non-experimental methods, such as propensity score matching, are more likely to replicate experimental treatment effects on such samples - while differences of 1 or more suggest poor balance.

## 7.2 Regression Results

The graphical results from the previous subsection suggest that women from better-off families were affected by the decline in the economic costs of migration induced by the construction of Jamuna Bridge while those from poorer families were not. This is consistent with the theoretical model if, in the initial equilibrium, the threshold level of family wealth at which female migration occurs is relatively high. We will continue to make this distinction as we turn to a formal statistical analysis of the effects of the Jamuna Bridge on the outcomes described above.

We begin by discussing the results for women from relatively poorer families, as presented in Panel A of Tables 5 through 9. The tables depict the effect of the bridge on the available measures of these women's migration, work, marriage, dowry and educational outcomes. The odd columns contain estimates using the binary treatment indicator ("JM bridge X post") while even columns present estimates using the continuous version of the treatment ("JM bridge intensity X post"). Each specification also includes an indicator for birth in the Dhaka manufacturing belt and the corresponding interaction term ("Born Dhaka manf. belt" and "Born Dhaka X post", although only the latter is reported), as well as all of the variables discussed in the previous section – including Division fixed effects – but these are not shown for convenience. Finally, to address the problem of multiple hypothesis testing, we report sharpened q-values to control the false discovery rate (FDR) among all tested hypotheses.[38]

The results fail to find an effect of the bridge on the migration or work outcomes for women from poorer families in the north-western Divisions (Panel A of Tables 5 and 6). The bridge does, however, appear to have had an impact on these women's marriage outcomes: they are now 12.7% points more likely to pay a dowry than before (Panel A of Table 8).[39] The bridge also appears to have affected incentives to invest in human capital: Panel A of Table 9 shows that poor women aged 10 or younger when the bridge was completed obtain an extra year of schooling after the bridge construction, although this is not enough to affect their propensity to enroll in secondary

[38] Sharpened q-values are computed using the technique of Anderson (2008).

[39] Conditional on paying a dowry, the amount of dowry paid is 20.4% points higher (in the case of the binary treatment indicator), although this effect just misses the standard threshold for statistical significance. However, since the dowry amount is only observed for those who paid a dowry as a part of their marriage arrangement, this result (and that for richer women reported below) may be affected by selection bias – if the bridge changed the nature of selection into dowry marriages. In Section D of the Appendix, we attempt to correct for such selection patterns using a Heckman selection model. The result of that analysis confirms that selection into dowry marriage is not driving the effects in Table 8.

school.

The results for women from better-off families (Panel B of Tables 5 through 9) tell a different story. These women are more likely to migrate and reside in the Dhaka manufacturing belt after the construction of the bridge (Panel B of Table 5). The size of this effect (5.3% points) is extremely large relative to the rate of migration among the older cohorts in the Jamuna region (4.0%). The effect on migration is due to an increase in family-related migration towards Dhaka, with no evidence that economic migration responds to the opening of the bridge (Panel B of Table 5, columns 5-8). The estimates in Panel B of Table 7 provide further insights about the nature of this family-related migration: we do not find an effect on the respondents' probability of marrying a man born in the Dhaka manufacturing belt, but there is increased probability (3.5% points) of marrying someone who has migrated to Dhaka.[40] We also find a strong effect on the intensive margin for marriage-related payments (Panel B of Table 8), with the opening of the bridge producing a roughly 30% increase in the value of the dowry (in real terms) conditional on a dowry payment being made during the marriage.[41] Interestingly, the bridge seems to have no effect on the extensive margin, as the likelihood of paying a dowry is not significantly different in the Jamuna region after the bridge is constructed.

Although we find no effect of the bridge on economic migration, the women from better-off families are, in fact, more likely – by 4.7% points – to have worked in the readymade garments sector (Panel B of Table 6).[42] For comparison, the presence of a river between the individual's place of birth and the Dhaka manufacturing belt is associated with a lower probability of having worked in the RMG sector by 6.3% points (not reported). Last, we see that the women from the better-off families – like the women from the poorer families – in the north-western Divisions of Bangladesh also obtain an extra year of schooling after the bridge was completed, and in their case this increase in the intensive margin of educational attainment is coupled with an increased propensity (by 13.3% points) to enroll in secondary school (Panel B of Table 9).

[40]Note that here and in the following discussion we use "Dhaka" as a shorthand for the Dhaka manufacturing belt rather than the Dhaka Division.

[41]Again, this effect on dowry size is robust to selection bias (see Appendix D), and all of these estimated effects are sizable in magnitude relative to the mean values reported in Table 2.

[42]The results in this Table are based on a subset of WiLCAS respondents who answered a phone survey on their work history. In Appendix C, we attempt to use a Heckman selection model to explore whether selection into the phone sample may bias our results. We also re-run the analysis with an alternative outcome (currently employed in the RMG sector) which is available for all respondents, and find very similar results.

The estimates obtained with the treatment intensity variable, "JM bridge intensity X post", are in line with those obtained with the binary treatment indicator. But the former estimates also take account of the variation of the effects of the bridge for women born in different parts of north-western Bangladesh. For example, the estimated coefficient of 0.095 in Panel B, Table 5, column 4 implies that effect of the bridge on the probability to migrate to Dhaka varied between 4.22 (=0.095 x 0.445) and 6.99% points (=0.095 x 0.736) for women born in villages (in north-western Bangladesh) exposed, respectively, to the lowest and highest levels of treatment intensity. Similarly, the probability of having worked in the RMG sector varies between 3.60 and 5.96% points and the probability of marriage with a groom who migrates to Dhaka varies between 2.71 to 4.49% points.

The estimates in Tables 5 to 9 suggest that, for the most part, the Jamuna bridge had no effect on outcomes for women born in the Dhaka manufacturing belt (captured by "Born Dhaka X post"). Two notable exceptions are that (i) women born in poorer families in the manufacturing belt were less likely to have dowry marriages (Panel A, Table 8), and (ii) that women born in richer families were less likely to reside in the Dhaka manufacturing belt, following the bridge construction.

## 7.3 Event Study Results

Finally, we report the results of an event-study analysis. The analysis is described in Section 6.1 and allows us to explore regional differences in relevant outcome variables by birth cohort in a more flexible way. In particular, the results are based on equation 6 and are depicted graphically in Figures 5 and 6. The figures report the estimated coefficients on interaction terms between the Jamuna Region dummy variable and cohort dummy variables, where cohorts are collapsed into 3 year bins in order to increase the sample size in each bin and improve the precision of the estimated coefficients (e.g. individuals born in years 1983, 1984 or 1985 are grouped together under the cohorot "1984"). The omitted cohort is the 1981 cohort (i.e. those born in 1980, 1981 or 1982), which we take to be the last cohort consisting mostly of individuals who will have made their marriage and migration decisions before the Jamuna Bridge was completed.

Figure 5 displays the results for individuals from poorer families (i.e. those whose fathers own less than half an acre of land) while Figure 6 provides the results for those from richer families.

First, the graphical results show that the estimated differences in outcomes were not statistically significant for cohorts who came of age before the bridge was built. In other words, outcomes in the northwestern region were similar in levels - *and* on a similar trend - with outcomes in other rural areas prior to the construction of the bridge (as suggested by the less formal analysis in Section 7.1). Next we turn our attention to the post-bridge coefficients. In all cases, the graphical results here echo the findings from the standard difference-in-difference analysis: the bridge seems to have affected outcomes little for those from poorer families, while affecting all outcomes of interest - except economic migration - significantly for those from richer families. The directions, magnitudes and timing are all in line with the results from the difference-in-difference analysis.

### 7.4 Discussion

Next, we compare the estimated effects of the opening of the Jamuna Bridge with the predictions of the theoretical model in Section 2. The key empirical finding is that the bridge had no discernible effect on female economic migration, but it did lead to an increase in female family- and marriage-related migration from north-western Bangladesh to the Dhaka manufacturing belt. Additionally, women 'exposed to the treatment' were more likely to marry men who migrated to the Dhaka manufacturing belt but they were not more likely to marry men born in the manufacturing belt. As per Proposition 5, if there are no barriers to female independent migration, then a decline in the economic cost of migration would increase participation in both markets 'UR' and 'UU' from rural-born women. Empirically, the latter would take the form of increased female economic migration and/or marriage with urban-born men. But our estimates imply that there are no changes along these two dimensions following the opening of the Jamuna Bridge. Rather, we observe increased marriage-related migration and marriage with migrating men, i.e. increased participation in market 'UR' only. According to Proposition 5, these effects are consistent with the theoretical case in which there are social barriers to female independent migration.

The empirical estimates also indicate that the bridge construction increased investment in human capital among men and women and increased employment in the RMG sector by women. These effects are in line with the predictions in Proposition 4. It is worth noting, however, that the estimates obtained for poorer families imply that the bridge increased schooling even among rural-born women who did not migrate to urban areas, an effect that the theoretical model does not account for.[43]

The empirical estimates also imply that the bridge construction increased the proportion of women from poorer families who had dowry marriages and the average size of dowry payments for women from better-off families (conditional on a dowry being paid). As summarised in Proposition 4, we can account for these effects within the theoretical model. Specifically, there are three distinct channels through which the bridge construction leads to a higher price for rural-born grooms: (i) higher incidence of rural-urban migration among these grooms, and higher value of male human capital in the urban labour market; (ii) higher rural wages, which increases the value of male human capital on the rural marriage market; (iii) higher levels of human capital among rural-born men. Thus, an exogenous decline in the economic costs of migration affects dowry payments not only among rural-born women who engage in marriage-migration but also among those who remain in rural areas. If the incidence of dowry marriages increases with wealth, then the effects are likely to take the form of higher incidence of dowry marriages among women from poorer families and higher dowry payments for women from better-off families, as implied by the empirical estimates.

In comparison with the effects obtained for rural-born women, the empirical estimates suggest that the bridge had little effect on women born in the Dhaka manufacturing belt. An important exception is the incidence of dowry marriages among women from poorer families, where we see a sharp decline; for women from better-off families, the point estimates are also negative albeit statistically insignificant. These estimated effects are in line with the predicted effects described in Proposition 4, specifically that an exogenous decrease in rural-urban migration costs will lead to lower expenditures on urban-born daughters due to the downward pressure on urban wages.

[43] If the bridge increased the returns to human capital in agriculture, and the education of the mother – via home schooling – is an input in the human capital production of children, this mechanism would account for the increased schooling among rural-born women who do not migrate to urban areas. For ease of exposition, we do not include this mechanism in our theoretical model; but it can be formalised as an increase to returns to female human capital in home production in rural areas. Behrman et al. (1999) make a similar argument in the context of the green revolution in India. We thank the editor for suggesting this potential explanation.

### 7.5 Alternative Explanations

Next, we consider whether and to what extent some alternative theoretical explanations can account for the estimated effects of the Jamuna bridge: a local component of human capital; homophilic preferences regarding spousal choice; other changes in the economy contemporaneous with the bridge construction; consanguineous marriages; and censoring of outcomes for the youngest cohorts.

Human capital production may have a local component. If so, two women who grew up in different localities may have qualitatively different human capital even if they have attained the same level of schooling. In particular, this would make it difficult for rural-born women to compete with urban-born women on the urban marriage market and, thus, explain why rural-born women marry rural-born men prior to migrating to an urban location.

Second, if rural-born men and women prefer rural-born spouses and/or urban-born men and women prefer urban-born spouses, this could explain why a decline in the economic cost of migration leads to increased marriage migration among rural-born women. But such preferences would not prevent rural-born women from migrating on their own and finding rural-born marriage partners in urban areas. Yet, we find no effect of the bridge opening on female (independent) economic migration.

If there are fewer potential grooms than potential brides on the marriage market, then the former can make take-it-or-leave-it offers on the marriage market. This would allow grooms to extract all the surplus generated by migration marriages through higher dowry payments. In this case, a reduction in the economic cost of migration would lead to both an increase in marriage migration and an increase in dowries. Alternatively, if rural-born migrating women face search costs on the urban marriage market but rural-born migrating grooms do not, then the prospective grooms can make take-it-or-leave-it offers to the prospective brides, leading to a similar effect to that described above.

Another possible explanation is that the patterns we observe are driven by other changes in the economy contemporaneous with the bridge opening. As discussed in Section 3.1, since the early 1990s, there have been a number of government-led initiatives to improve female access to schooling, as well as a rapid expansion of employment opportunities for women in the RMG sector. However, the government initiatives and employment opportunities would affect women born on both sides of the Jamuna river and, consequently, cannot on their own account for the differential patterns we observe across the regions. It is possible to argue that the stipend programme and the growth in the RMG sector had a larger impact in north-western Bangladesh than in other parts of the country because it is a relatively poorer region and that our estimates are picking up these differential effects. But if this were the case, we should see a larger impact in the poorer segments of the population. In fact, we find the opposite. Nevertheless, we cannot rule out the possibility that improved access to education and employment opportunities in the manufacturing sector for women since the 1990s were important *preconditions* for the effects we observe, in the sense the Jamuna bridge would likely have had a smaller effect on our outcomes in their absence.

The effects on dowry payments may be due to a change in the contractual terms in consanguineous marriages. Do et al., 2013 and Mobarak et al., 2013 have argued that the pre-existing ties between the families of the bride and groom enable them to make credible commitments to future marriage-related transfers. If marriage migration weakens this commitment mechanism, this would compel the families to bring forward marriage transfers, and this change can translate into higher observed marriage payments. However, the proportion of marriages that are consanguineous in our sample is too small to account for the estimated effects of the bridge on dowry payments: less than 8% of our sample of women experienced consanguineous marriages (Table 2) and the proportion that experienced both consanguineous marriages and rural-urban marriage migration is less than 1%. On the other hand, our base estimates in Panel A, Table 8 indicate that the bridge led to a 12% increase in dowry marriages. In addition, the contractual arrangement in consanguineous marriages is between the families (and within the rural-based extended family). Migration by the couple should not affect the enforceability of these contracts.

The youngest women in our sample may not yet have made important life choices (relating, for example, to marriage, education and employment). If the Jamuna bridge (or other factors) induces women in the region to make these choices earlier than in other parts of the country, this may account for at least some of our results. To investigate this possibility, we repeat our DID analysis using only those aged 24 and older. Within this subsample, 98% are married (compared to 94% in the full sample). These alternative estimates, reported in Appendix G, show that most of our main results are qualitatively unchanged from the primary specifications, albeit with some loss of statistical power. In the case of two outcomes – 'worked in RMG' and 'husband migrated to Dhaka' – the estimated effect sizes are half of those in the original specifications and no longer statistically significant. This suggests that our estimated effects on these two outcomes may diminish over time as the youngest cohorts outside of the Jamuna region 'catch-up'. But we believe this to be unlikely as the difference between the Jamuna region and the rest of the country in the marriage rate among female 20-23 year olds in the data is very small (79.9% versus 78.6%).

In summary, while we can rule out some alternative explanations for the observed outcomes following the construction of the bridge, certain types of market frictions can account for at least some of the estimated effects and, thus, are plausible alternatives to the theoretical mechanism we formally develop in the paper.

# 8 Conclusion

In this paper, we developed a theoretical model of migration and marriage which incorporates social barriers to female independent migration, and empirically tested the predictions of the model regarding the effects of a reduction of economic costs of migration.

We show theoretically that when there are social barriers to female independent migration, rural-born women who choose to migrate to the city match with rural-born migrating grooms and pay a premium – over the groom price on the urban marriage market – to attract them. This groom price premium is inefficient – because investing it in the human capital of rural-born migrating women instead would reap higher economic returns; by contrast, there is no such price differential when social barriers to female independent migration are absent. Using a nationally representative survey of women in Bangladesh, we test these theoretical predictions by estimating hedonic dowry equations and find evidence of a groom price premium for rural men who migrate to urban areas, relative to men with similar observable characteristics who are born in those same urban locations.

The theoretical model also predicts that, in the presence of the afore-mentioned social barriers, a decline in the economic costs of long-distance migration would increase female migration primarily through marriage to rural-born migrating men. We use the construction of a major bridge in Bangladesh that dramatically reduced travel time between the economically deprived north-western region and the Dhaka manufacturing belt to test the predictions of the model. Using a differences-in-differences strategy that exploits the location of households and the year in which women made their coupled marriage/migration decisions, we find that the bridge had no effect on female independent migration towards Dhaka but increased marriage-related urban migration for women from better-off families. Using an event-study analysis in which the effect of treatment exposure is allowed to vary cohort by cohort, we obtain effects broadly in line with the difference-in-difference estimates (in terms of directions, magnitudes and timing of effects).

Thus, the empirical results are consistent with the predictions of a theoretical model in which there are social barriers to female independent migration. The immediate implication of social barriers to female migration is that rural families pay higher dowries to marry their daughters to migrating men (relative to the groom price for the same groom characteristics in urban areas), depressing female human capital investments in rural areas. Additionally, if the development of major infrastructure lowers the economic costs of migration and increases rural-urban migration, this can perversely increase the extent of such under-investments relative to the first-best scenario. The fact that women do not migrate except by marrying a male migrant – and that even this behaviour is limited to the least well-off – is suggestive of significant and uneven labour market frictions.

The Jamuna bridge was constructed to reduce transportation costs and ease the flow of people and goods into and out of the north-western region of Bangladesh. The broad implication of our findings is that lowering the economic costs of migration is not sufficient to eradicate existing constraints to female migration. Addressing gender-related norms that underlie existing social barriers must remain part of a broader development policy.

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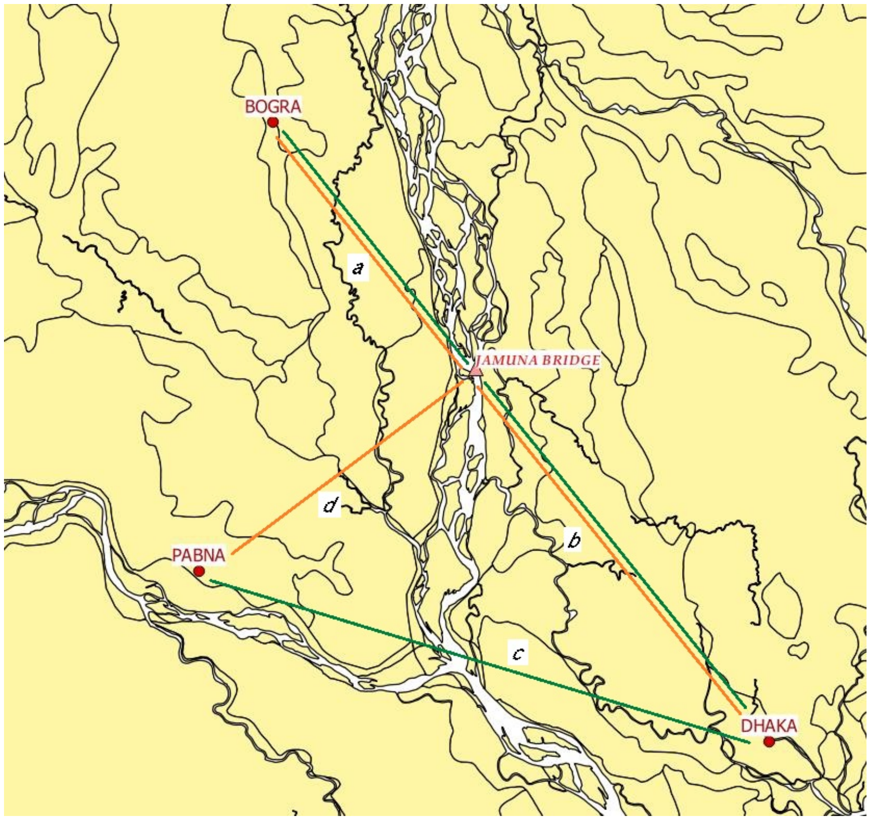
# Figures

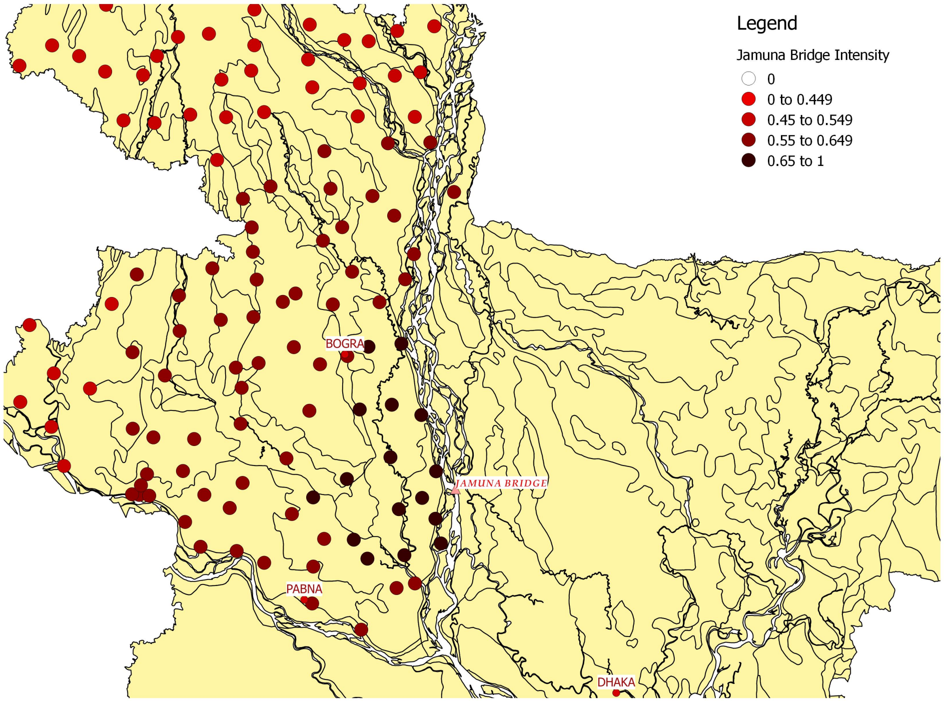
Figure 1: Measure of Treatment Intensity




| Town | Treatment Intensity |
|---|---|
| Bogra | $\max\left\{0, 1 - \frac{a+b}{a+b+300}\right\}$ |
| Pabna | $\max\left\{0, 1 - \frac{d+b}{c+300}\right\}$ |

Note: this figure illustrates the construction of a continuous measure of the treatment variable which aims to capture treatment intensity for individuals born in the northwestern region of the country. The figure illustrates how the measure is constructed for two exemplary districts, Bogra and Pabna. Individuals from Pabna (relative to those from Bogra) require a more significant detour if they wish to travel to Dhaka via the Jamuna Bridge, and hence their treatment intensity is lower. See Section 6.2 for a further discussion of this measure. Source: 2014 WiLCAS Survey.

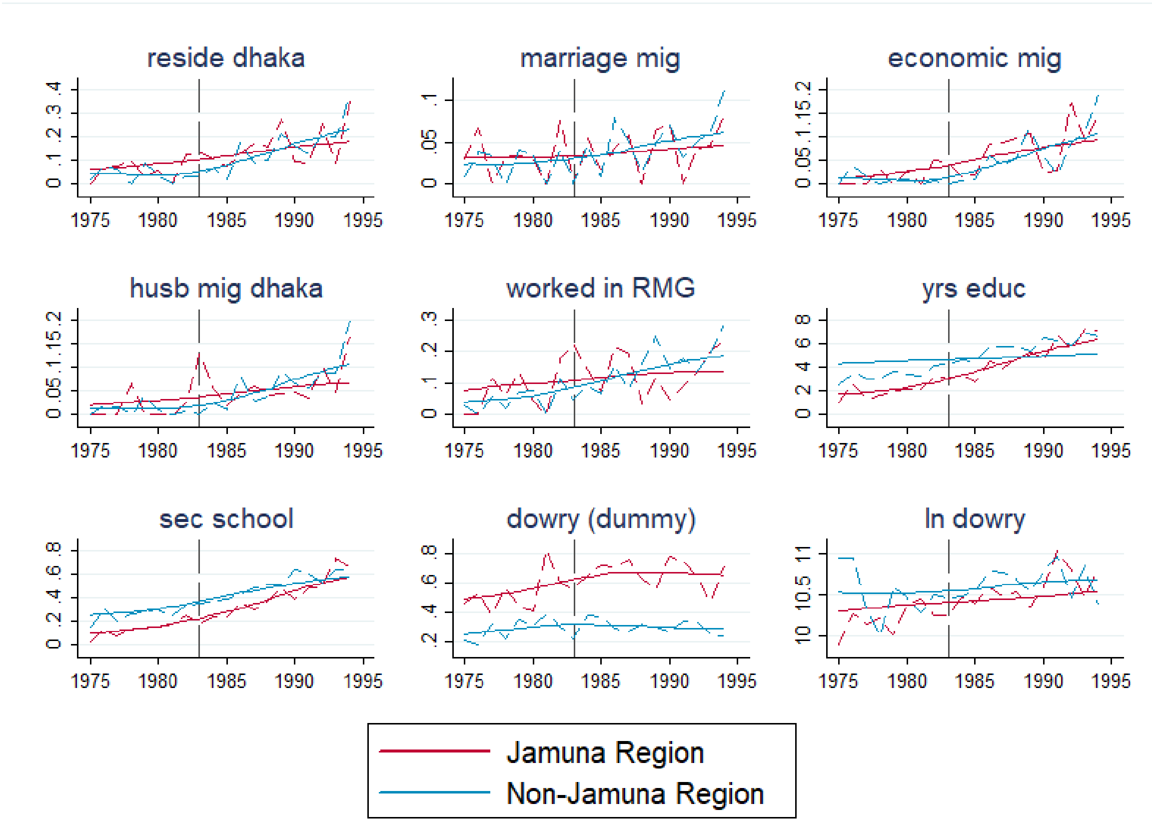
Figure 2: Jamuna Bridge Treatment Intensity in Northwestern Bangladesh




Note: This figure illustrates the distribution of the treatment intensity measure described in Section 6.2. Source: 2014 WiLCAS Survey.

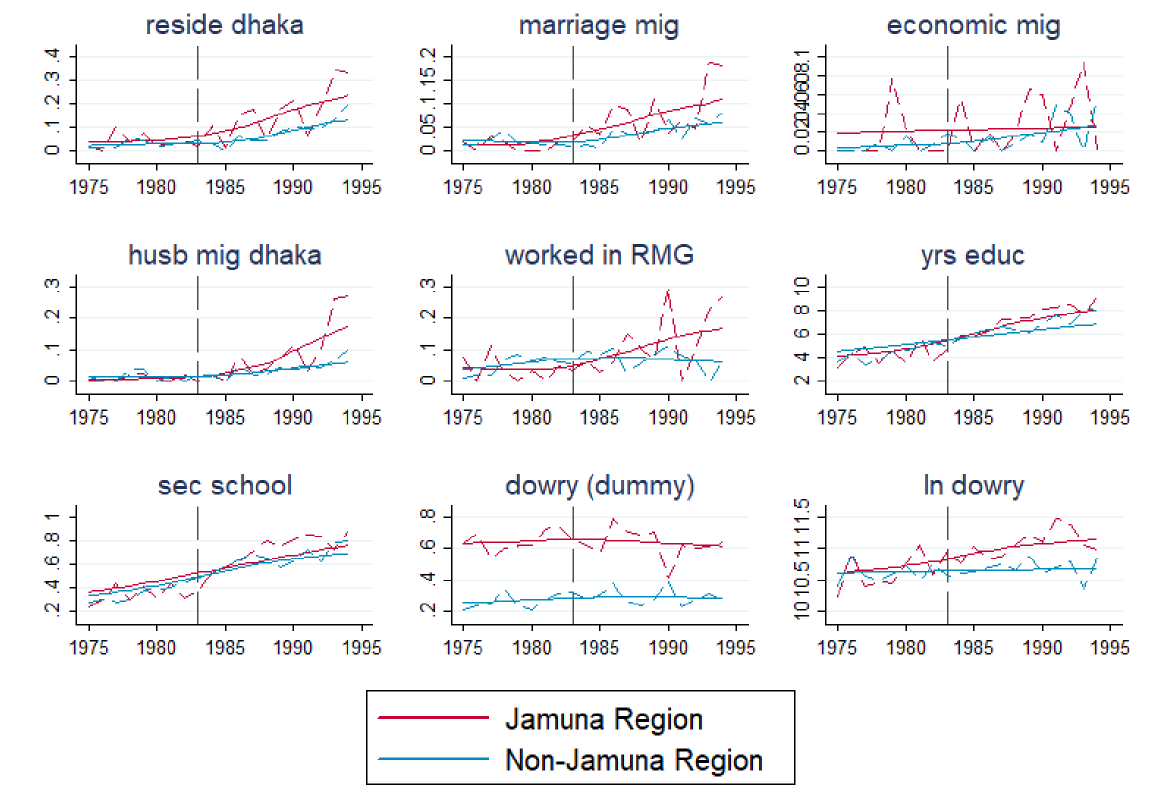
## Mean Outcomes Over Time

Figure 3: All Outcomes (by Jamuna status for respondents with < half acre)




Note: This figure graphs mean outcomes by birth cohort for respondents whose fathers owned less than half an acre of land. Outcomes for respondents who were born in the Jamuna region (Rajshahi and Rangpur Divisions) are depicted with a dashed red line, while outcomes for the non-Jamuna region (other Divisions except for those born in the Dhaka manufacturing belt) are shown in a dashed blue line. Solid lines depict a local mean smoothing non-parametric approximation. Source: 2014 WiLCAS Survey.

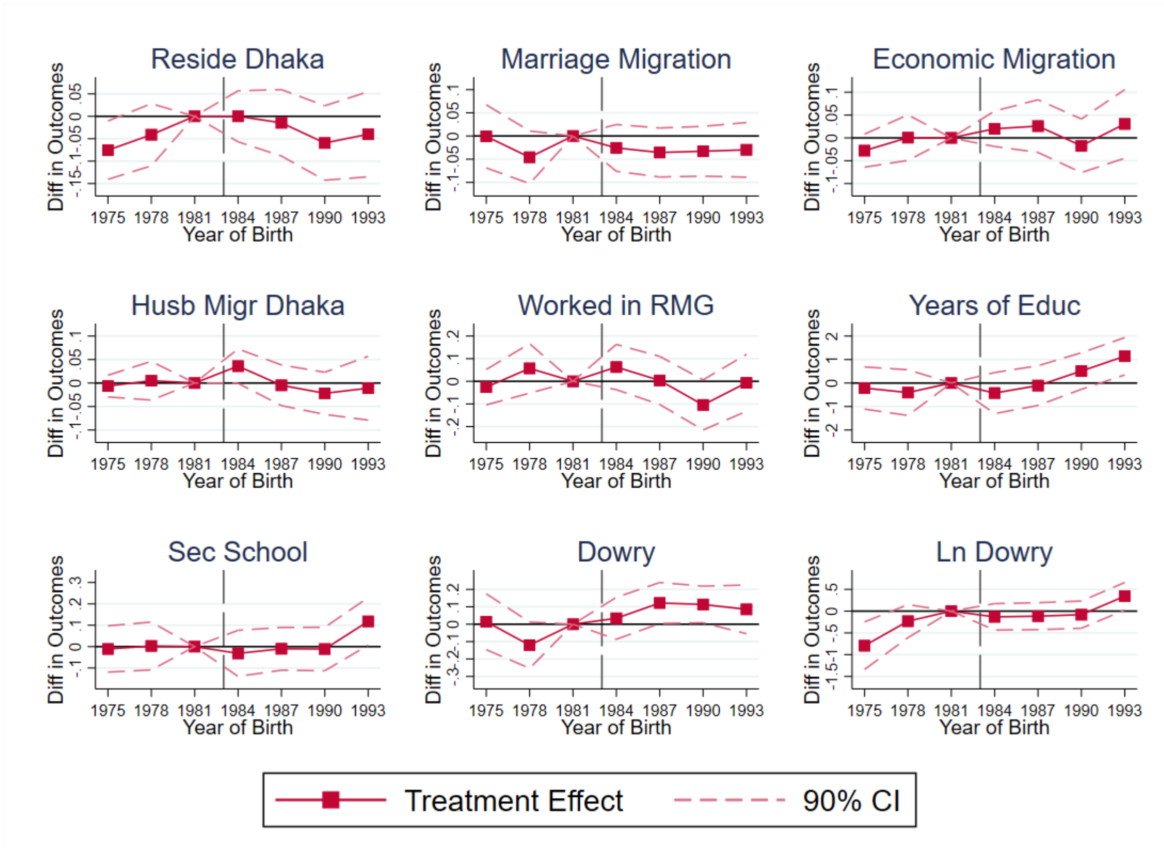
Figure 4: All Outcomes (by Jamuna status for respondents with > half acre)




Note: This figure graphs mean outcomes by birth cohort for respondents whose fathers owned more than half an acre of land. Outcomes for respondents who were born in the Jamuna region (Rajshahi and Rangpur Divisions) are depicted with a dashed red line, while outcomes for the non-Jamuna region (other Divisions except for those born in the Dhaka manufacturing belt) are shown in a dashed blue line. Solid lines depict a local mean smoothing non-parametric approximation. Source: 2014 WiLCAS Survey.

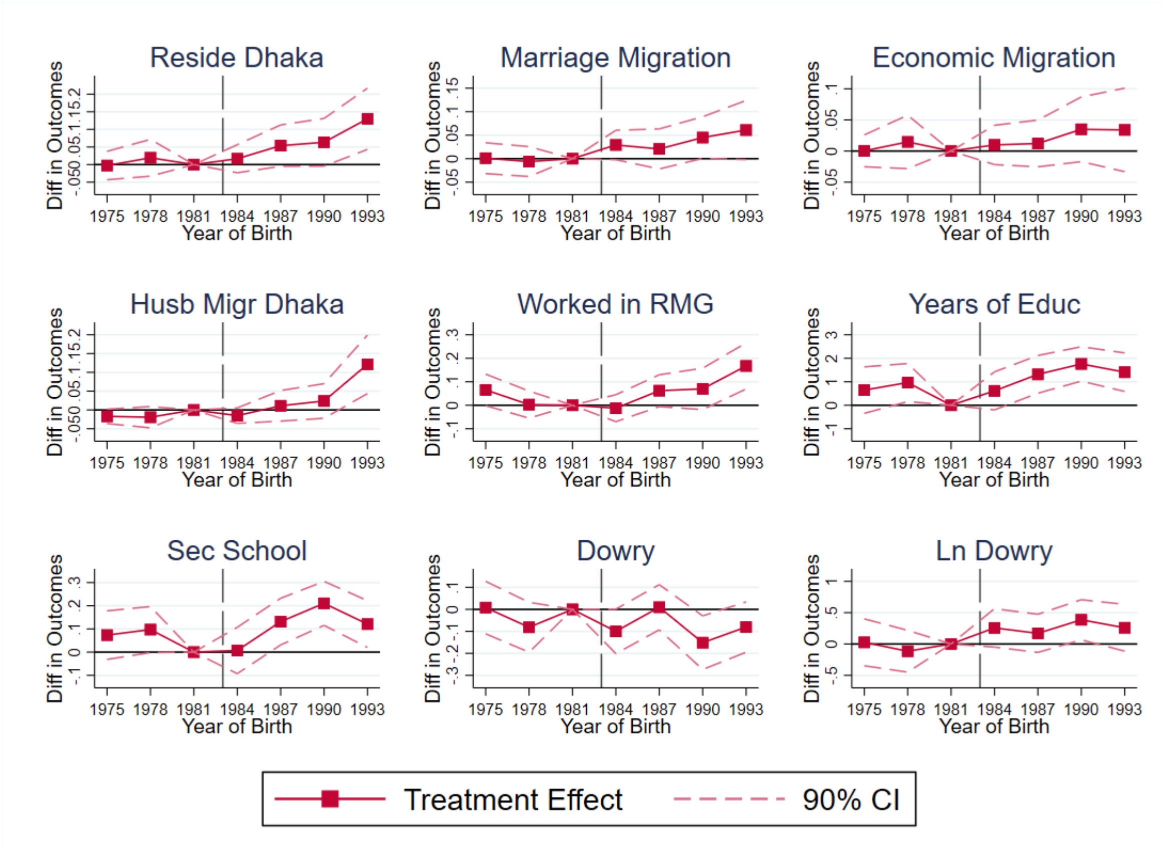
## Event Study (3 year average)

Figure 5: All Outcomes (by Jamuna status for respondents with < half acre)




Note: This figure depicts the results of an event-study analysis of the effect of the bridge on various outcomes for respondents whose fathers owned less than half an acre of land. The specification is analagous to the one described in Section 6, in which outcomes are regressed against a binary Jamuna region birth indicator interacted with birth cohort dummies along with the usual controls (including parental background and division FEs). The coefficients on the interaction terms are graphed, along with 90% confidence interval bands. The base category is the birth cohort corresponding to years 1980, 1981 and 1982 (respondents are grouped into cohorts spanning 3 birth years to increase power). Source: 2014 WiLCAS Survey.

Figure 6: All Outcomes (by Jamuna status for respondents with > half acre)




Note: This figure depicts the results of an event-study analysis of the effect of the bridge on various outcomes for respondents whose fathers owned more than half an acre of land. The specification is analagous to the one described in Section 6, in which outcomes are regressed against a binary Jamuna region birth indicator interacted with birth cohort dummies along with the usual controls (including parental background and division FEs). The coefficients on the interaction terms are graphed, along with 90% confidence interval bands. The base category is the birth cohort corresponding to years 1980, 1981 and 1982 (respondents are grouped into cohorts spanning 3 birth years to increase power). Source: 2014 WiLCAS Survey.

# Tables

Table 1: Migration and Marriage Search Costs

| Origin | Market Participation: | $(R,R)$ | $(U,R)$ | $(R,U)$ | $(U,U)$ |
|---|---|---|---|---|---|
| Rural | Migration Cost | 0 | $\mu$ | 0 | $\mu$ |
| Rural | Partner Search Cost | 0 | 0 | $\sigma$ | $\zeta_g\sigma$ |
| Urban | Migration Cost | $\mu$ | 0 | $\mu$ | 0 |
| Urban | Partner Search Cost | $\zeta_g\sigma$ | $\sigma$ | 0 | 0 |

## Summary Statistics

Table 2: Summary Statistics

| | count | mean | sd | min | p50 | max |
|---|---|---|---|---|---|---|
| Resp. Age | 6237 | 29.003 | 5.575 | 20 | 29 | 39 |
| Schooling (Yrs) | 6237 | 5.267 | 3.794 | 0 | 5 | 12 |
| Non-Muslim | 6237 | 0.116 | 0.320 | 0 | 0 | 1 |
| Father Educ. | 6237 | 2.953 | 3.873 | 0 | 0 | 12 |
| Mother Educ. | 6237 | 1.629 | 2.787 | 0 | 0 | 12 |
| Parental Land (acres) | 6237 | 1.389 | 2.752 | 0 | 1 | 60 |
| Parents Landless | 6237 | 0.053 | 0.225 | 0 | 0 | 1 |
| Father Low Pay | 6237 | 0.215 | 0.411 | 0 | 0 | 1 |
| River crossing to Dhaka | 6237 | 0.795 | 0.404 | 0 | 1 | 1 |
| Jamuna crossing | 6237 | 0.256 | 0.436 | 0 | 0 | 1 |
| Jamuna Bridge | 6237 | 0.169 | 0.375 | 0 | 0 | 1 |
| Jamuna Bridge (intensity) | 6237 | 0.160 | 0.357 | 0 | 0 | 1 |
| Dhaka residence | 6237 | 0.141 | 0.348 | 0 | 0 | 1 |
| Marriage Migr. to Dhaka | 6237 | 0.069 | 0.253 | 0 | 0 | 1 |
| Economic Migr. to Dhaka | 6237 | 0.034 | 0.182 | 0 | 0 | 1 |
| Worked in RMG | 6237 | 0.053 | 0.223 | 0 | 0 | 1 |
| Ever Married | 6237 | 0.940 | 0.238 | 0 | 1 | 1 |
| Consang. Marriage | 6237 | 0.078 | 0.268 | 0 | 0 | 1 |
| Own Choice Marriage | 6237 | 0.068 | 0.251 | 0 | 0 | 1 |
| Dowry Marriage | 5862 | 0.386 | 0.487 | 0 | 0 | 1 |
| Same District Marr. | 5862 | 0.775 | 0.418 | 0 | 1 | 1 |
| Husband Educ. | 5853 | 4.668 | 4.177 | 0 | 5 | 12 |
| Husband Age | 5726 | 36.751 | 7.159 | 19 | 36 | 66 |
| Husband from Dhaka | 5862 | 0.059 | 0.236 | 0 | 0 | 1 |
| Husband migr. to Dhaka | 5862 | 0.040 | 0.197 | 0 | 0 | 1 |

Note: This table presents summary statistics for the female respondents in the 2014 WiLCAS. Note that marriage-related outcomes are available for 5,862 out of 6,237 respondents only as the remaining women were unmarried at the time of the survey. For all relations, education is reported in years. 'Parental Land' and 'Father Low Pay' indicate, respectively, cultivable land in acres owned by the parents and whether the respondent's father was employed in a low paid occupation, when she was 12. 'River crossing to Dhaka' indicates whether a major river has to be crossed to travel to Dhaka from the respondent's birthplace, and 'Jamuna crossing' indicates whether the Jamuna river has to be crossed to make this journey. 'Dhaka residence' indicates whether the respondent lives in the Dhaka manufacturing belt. 'Husband from Dhaka' and 'Husband migr. to Dhaka' indicate, respectively, whether the husband was born in or migrated to this region. 'Worked in RMG' indicates whether the respondent has ever worked in the ready-made garments sector. The table also includes variables on whether the respondent's first marriage involved a groom from the same district (Same District Marr.), whether it was consanguineous (Consang. Marr), and whether she initiated the marriage (Own Choice Marriage). The construction of 'Jamuna Bride (Intensity)' is described in Section 6.2 . Other variables are self-explanatory.

Table 3: Incidence of Female Long-Distance Migration

| | Married Women | | Unmarried Women | |
|---|---|---|---|---|
| # of Episodes | Economic Migration (%) | Family-related Migration (%) | Economic Migration (%) | Family-related Migration (%) |
| 0 | **94.41** | 16.98 | 78.93 | **88.80** |
| 1 | 4.93 | **78.30** | **19.73** | 9.87 |
| 2 | 0.59 | 3.93 | 1.33 | 1.33 |
| 3 | 0.05 | 0.65 | 0 | 0 |
| 4 | 0.02 | 0.15 | 0 | 0 |
| # Obs | 5,885 | 5,885 | 375 | 375 |

Note: This table presents data on migration episodes of different types for married and unmarried women. A 'migration episode' means moving, at least, out of the village/ward for a period of 6 months or more. Source: 2014 WiLCAS Survey.

Table 4: Hedonic Equations for Dowries - All Urban Clusters

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | Joutuk Paid | Ln(Joutuk) | Ln(Joutuk) | |
| | _ | _ | Ln(Joutuk) | Joutuk Paid |
| Marriage Migration to Urban Area | 0.115*** (0.0302) | 0.221** (0.0865) | 0.147* (0.0879) | |
| Own Initiated Marriage | -0.197*** (0.0407) | 0.109 (0.156) | 0.475** (0.184) | -0.571*** (0.127) |
| Consang. Marriage | -0.105** (0.0475) | 0.0550 (0.141) | 0.234 (0.169) | -0.298** (0.141) |
| Marriage Age Gap | -0.0102*** (0.00354) | 0.00979 (0.00894) | 0.0270** (0.0128) | -0.0385*** (0.0108) |
| Bride Schooling | -0.00555 (0.00496) | 0.0978*** (0.0147) | 0.106*** (0.0148) | -0.0186 (0.0140) |
| Groom Schooling | -0.00715* (0.00417) | 0.0487*** (0.0106) | 0.0595*** (0.0131) | -0.0237** (0.0118) |
| Bride's Mother Worked | | | | 0.167* (0.0964) |
| Hindu | | | | 1.009*** (0.145) |
| Constant | 0.589*** (0.0453) | 9.822*** (0.114) | 11.09*** (0.543) | -0.232 (0.386) |
| Observations | 1326 | 529 | 1326 | |
| Inverse Mills Ratio | | | -0.925 | |
| Inverse Mills Ratio (se) | | | 0.226 | |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in all urban clusters. In column 1, a binary indicator for whether 'joutuk' was paid (the part of dowry given directly to the groom) is regressed against marriage migration status and a set of covariates. Other covariates (not shown) include subdistrict fixed effects and parental characteristics. In column 2, ln(joutuk payment) is regressed against the same variables. Column 3 reports the results from a Heckman two-step estimator to account for selection bias (the second step is reported in the first sub-column of column 3). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Main Results from Difference in Difference Analysis

Table 5: Migration Outcomes

| | (1) Reside Dhaka | (2) Reside Dhaka | (3) Migr Dhaka | (4) Migr Dhaka | (5) Family Migr | (6) Family Migr | (7) Economic Migr | (8) Economic Migr |
|---|---|---|---|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | | | | | |
| JM bridge X post | 0.003 | | 0.009 | | -0.015 | | 0.007 | |
| | (0.026) | | (0.024) | | (0.018) | | (0.016) | |
| JM bridge intensity X post | | 0.011 | | 0.022 | | -0.019 | | 0.014 |
| | | (0.044) | | (0.041) | | (0.030) | | (0.028) |
| Born Dhaka X post | 0.036 | 0.038 | -0.072 | -0.070 | -0.096 | -0.095 | 0.007 | 0.007 |
| | (0.050) | (0.050) | (0.075) | (0.075) | (0.075) | (0.075) | (0.046) | (0.046) |
| Observations | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 |
| Dep Variable Mean (Jamuna pre '83) | 0.060 | 0.060 | 0.055 | 0.055 | 0.037 | 0.037 | 0.018 | 0.018 |
| q-value | 0.619 | 0.589 | 0.507 | 0.479 | 0.379 | 0.479 | 0.479 | 0.479 |
| *Panel B: Above land threshold* | | | | | | | | |
| JM bridge X post | 0.053** | | 0.052** | | 0.038*** | | 0.002 | |
| | (0.021) | | (0.021) | | (0.014) | | (0.012) | |
| JM bridge intensity X post | | 0.093** | | 0.095*** | | 0.070*** | | 0.002 |
| | | (0.036) | | (0.036) | | (0.025) | | (0.020) |
| Born Dhaka X post | -0.117** | -0.115** | -0.029 | -0.027 | -0.032 | -0.031 | 0.034 | 0.035 |
| | (0.052) | (0.052) | (0.072) | (0.073) | (0.075) | (0.075) | (0.022) | (0.022) |
| Observations | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 |
| Dep Variable Mean (Jamuna pre '83) | 0.040 | 0.040 | 0.034 | 0.034 | 0.012 | 0.012 | 0.012 | 0.012 |
| q-value | 0.039 | 0.039 | 0.039 | 0.039 | 0.039 | 0.035 | 0.601 | 0.619 |

Note: This table presents the results of OLS regressions of migration-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates (not shown) include division fixed effects, respondent characteristics (age, age squared, religion, distance from place of birth to Dhaka, and a dummy indicating whether a river separates place of birth from Dhaka) and parental characteristics (mother's education, father's education, parental landholdings, status of father's occupation). Robust standard errors clustered by subdistrict are in parentheses. In the final row of each panel we report sharpened q-values to control the false discovery rate (FDR) among all tested hypotheses in this section. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 6: Work Outcomes

| | (1)<br>Worked in RMG | (2)<br>Worked in RMG |
|---|---|---|
| *Panel A:*<br>*Below land threshold* | | |
| JM bridge X post | -0.019<br>(0.036) | |
| JM bridge intensity X post | | -0.034<br>(0.062) |
| Born Dhaka X post | 0.037<br>(0.087) | 0.039<br>(0.087) |
| Observations | 1639 | 1639 |
| Dep Variable Mean (Jamuna pre '83) | 0.065 | 0.065 |
| q-value | 0.479 | 0.479 |
| *Panel B:*<br>*Above land threshold* | | |
| JM bridge X post | 0.047**<br>(0.023) | |
| JM bridge intensity X post | | 0.081**<br>(0.041) |
| Born Dhaka X post | 0.006<br>(0.066) | 0.006<br>(0.066) |
| Observations | 2108 | 2108 |
| Dep Variable Mean (Jamuna pre '83) | 0.039 | 0.039 |
| q-value | 0.069 | 0.075 |

Note: This table presents the results of OLS regressions of work-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification (including treatment variables and covariates) is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses, and sharpened q-values are reported in the final row of each panel. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 7: Marriage Outcomes

| | (1)<br>Husb Dhaka | (2)<br>Husb Dhaka | (3)<br>Husb Migr Dhaka | (4)<br>Husb Migr Dhaka |
|---|---|---|---|---|
| *Panel A:*<br>*Below land threshold* | | | | |
| JM bridge X post | -0.005 | | 0.001 | |
| | (0.008) | | (0.015) | |
| JM bridge intensity X post | | -0.008 | | 0.000 |
| | | (0.014) | | (0.026) |
| Born Dhaka X post | -0.001 | -0.001 | 0.036 | 0.036 |
| | (0.058) | (0.058) | (0.027) | (0.027) |
| Observations | 2696 | 2696 | 2696 | 2696 |
| Dep Variable Mean (Jamuna pre '83) | 0.005 | 0.005 | 0.014 | 0.014 |
| q-value | 0.479 | 0.479 | 0.637 | 0.637 |
| *Panel B:*<br>*Above land threshold* | | | | |
| JM bridge X post | -0.002 | | $0.035^{**}$ | |
| | (0.009) | | (0.014) | |
| JM bridge intensity X post | | -0.008 | | $0.061^{**}$ |
| | | (0.017) | | (0.024) |
| Born Dhaka X post | -0.068 | -0.068 | -0.049 | -0.049 |
| | (0.059) | (0.059) | (0.031) | (0.031) |
| Observations | 3166 | 3166 | 3166 | 3166 |
| Dep Variable Mean (Jamuna pre '83) | 0.012 | 0.012 | 0.009 | 0.009 |
| q-value | 0.601 | 0.479 | 0.039 | 0.039 |

Note: This table presents the results of OLS regressions of marriage-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses, and sharpened q-values are reported in the final row of each panel. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 8: Dowry Outcomes

| | (1) Joutuk Paid | (2) Joutuk Paid | (3) Ln(Joutuk) | (4) Ln(Joutuk) |
|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | |
| JM bridge X post | 0.127** | | 0.204 | |
| | (0.049) | | (0.124) | |
| JM bridge intensity X post | | 0.188** | | 0.326 |
| | | (0.083) | | (0.217) |
| Born Dhaka X post | -0.223*** | -0.225*** | 0.132 | 0.123 |
| | (0.061) | (0.061) | (0.224) | (0.224) |
| Observations | 2696 | 2696 | 1043 | 1043 |
| Dep Variable Mean (Jamuna pre '83) | 0.528 | 0.528 | 10.211 | 10.211 |
| q-value | 0.039 | 0.045 | 0.146 | 0.161 |
| *Panel B: Above land threshold* | | | | |
| JM bridge X post | -0.052 | | 0.287** | |
| | (0.040) | | (0.119) | |
| JM bridge intensity X post | | -0.104 | | 0.505** |
| | | (0.069) | | (0.199) |
| Born Dhaka X post | -0.088 | -0.088 | 0.001 | 0.002 |
| | (0.054) | (0.054) | (0.222) | (0.222) |
| Observations | 3166 | 3166 | 1209 | 1209 |
| Dep Variable Mean (Jamuna pre '83) | 0.644 | 0.644 | 10.598 | 10.598 |
| q-value | 0.221 | 0.161 | 0.045 | 0.039 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses, and sharpened q-values are reported in the final row of each panel. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 9: Education Outcomes

| | (1) Educ (yrs) | (2) Educ (yrs) | (3) Educ (yrs) | (4) Educ (yrs) | (5) Sec School | (6) Sec School | (7) Sec School | (8) Sec School |
|---|---|---|---|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | | | | | |
| JM bridge X post | 0.456 | | | | 0.018 | | | |
| | (0.292) | | | | (0.035) | | | |
| JM bridge intensity X post | | 0.967* | | | | 0.053 | | |
| | | (0.519) | | | | (0.062) | | |
| JM bridge X post '87 | | | 0.967*** | | | | 0.046 | |
| | | | (0.282) | | | | (0.039) | |
| JM bridge intensity X post '87 | | | | 1.760*** | | | | 0.090 |
| | | | | (0.498) | | | | (0.068) |
| Born Dhaka X post | 0.179 | 0.175 | | | 0.019 | 0.018 | | |
| | (0.503) | (0.502) | | | (0.074) | (0.074) | | |
| Born Dhaka X post '87 | | | -0.324 | -0.333 | | | -0.094 | -0.095 |
| | | | (0.482) | (0.484) | | | (0.067) | (0.067) |
| Observations | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 |
| Dep Variable Mean (Jamuna pre '83) | 2.064 | 2.064 | 2.064 | 2.064 | 0.142 | 0.142 | 0.142 | 0.142 |
| q-value | 0.160 | 0.096 | 0.006 | 0.005 | 0.479 | 0.379 | 0.278 | 0.221 |
| *Panel B: Above land threshold* | | | | | | | | |
| JM bridge X post | 0.744** | | | | 0.060 | | | |
| | (0.311) | | | | (0.039) | | | |
| JM bridge intensity X post | | 1.257** | | | | 0.104 | | |
| | | (0.550) | | | | (0.068) | | |
| JM bridge X post '87 | | | 1.013*** | | | | 0.133*** | |
| | | | (0.274) | | | | (0.036) | |
| JM bridge intensity X post '87 | | | | 1.795*** | | | | 0.235*** |
| | | | | (0.478) | | | | (0.063) |
| Born Dhaka X post | -0.218 | -0.252 | | | -0.039 | -0.043 | | |
| | (0.545) | (0.543) | | | (0.071) | (0.071) | | |
| Born Dhaka X post '87 | | | -0.401 | -0.411 | | | -0.086 | -0.087 |
| | | | (0.495) | (0.497) | | | (0.064) | (0.065) |
| Observations | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 |
| Dep Variable Mean (Jamuna pre '83) | 4.022 | 4.022 | 4.022 | 4.022 | 0.337 | 0.337 | 0.337 | 0.337 |
| q-value | 0.045 | 0.045 | 0.004 | 0.004 | 0.160 | 0.160 | 0.004 | 0.004 |

Note: This table presents the results of OLS regressions of education-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table, except that it includes two additional treatment variables: a binary indicator for being born in the Jamuna region post 1987, and a corresponding continuous treatment intensity measure, along with a binary indicator for being born in the Dhaka manufacturing belt post 1987. Robust standard errors clustered by subdistrict are in parentheses, and sharpened q-values are reported in the final row of each panel. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix to “Social Barriers to Female Migration: Theory and Evidence from Bangladesh”

## Appendix 0: Theoretical Definitions and Technical Results

In this section, we provide some definitions and tehnical results necessary for the proofs of the theoretical propositions in Section 2. The formal proofs of these technical results and the propositions in the body of the paper are provided in Appendix A.

We define $D^g\left(h_m, h_f, k \middle| \{\tau_k(.)\}\right)$ as the measure of families of gender $g$ that chooses the characteristic pair $(h_m, h_f)$ and market $k$ given the marriage price schedules $\{\tau_k(.)\}$. A marriage market equilibrium requires that

$$D^f\left(h_m, h_f, k \middle| \{\tau_k(.)\}\right) = D^m\left(h_m, h_f, k \middle| \{\tau_k(.)\}\right) \tag{8}$$

for each $(h_m, h_f) \in \mathcal{H}^2$, and $k \in \{RR, RU, UR, UU\}$.

We define an equilibrium in the theoretical model as follows:

**Definition 1.** *Given wealth distributions $\Gamma_{mR}(.), \Gamma_{mU}(.), \Gamma_{fR}(.), \Gamma_{fU}(.)$, physical capital stock $K$ and agricultural land $T$, the economy is in equilibrium if the following conditions hold:*

*- each family is making education, marriage and migration decisions $(h, P_M, P_L)$ so as to maximise expected payoffs;*

*- the rural and urban marriage markets clear for each level of human capital as per equation (8);;*

*- the relative prices of the manufacturing and agricultural goods are given by equation (3) and, in each sector, human capital is paid its marginal product value.*

To obtain precise, empirically testable predictions, we introduce an equilibrium refinement as follows.

**Definition 2.** *A positive mixed strategy equilibrium is an equilibrium as per Definition 1 in which, if a family is indifferent between a set of alternative pure strategies, involving the choice of different market segments or different levels of expenditures on the offspring, and one of these pure strategies is assigned a positive probability, all other pure strategies in the set are also assigned positive probabilities.*

The equilibrium refinement in 2 is equivalent to the assumption that whenever a particular family type is indifferent between two or more alternative choices, and one of them is pursued in the equilibrium, there is a positive mass of families pursuing each of these alternatives.

**Marriage Price Schedule:** Following arguments provided by Anderson and Bidner (2015), we can show that, in each market, the marriage price schedule is linear in the human capital of the marriage partners:

**Proposition 6.** *In equilibrium, the marriage price schedule in market $k$ is given by*

$$\tau\left(h_f, h_m, k\right) = \begin{cases} \varphi_{0k} + \varphi_m h_m w_U + \varphi_f h_f w_U \text{ for } k \in \{UR, UU\} \\ \varphi_{0k} + \hat{\varphi}_m h_m w_R + \varphi_f h_f \phi_1 \text{ for } k \in \{RR, RU\} \end{cases} \tag{9}$$

where $\varphi_{0k}$ is a constant, $\varphi_f = -\frac{a_m}{b_m}$, $\varphi_m = \left(\frac{1}{\theta_f w_U} - \frac{a_m}{b_m}\right)\left(\frac{a_f}{b_f} - \frac{1}{\theta_f w_U}\right)^{-1}$ and $\hat{\varphi}_m = \left(\frac{1}{\theta_f \phi_1} - \frac{a_m}{b_m}\right)\left(\frac{a_f}{b_f} - \frac{1}{\theta_f \phi_1}\right)^{-1}$.

The intuition behind Proposition 6 is as follows. The returns to human capital on the marriage market adjust to equate the cost to families of increasing post-marriage consumption of their offspring through different channels. For example, female families can increase the post-marriage consumption of a daughter by investing more in her human capital or by spending more on the human capital of the groom. If these costs are not equated, female families will opt for a corner solution in making human capital investment decisions and the marriage markets will not clear. Thus, a higher $w_U$ makes it more attractive for the parents of a bride (who opts for the urban labour market) to raise her consumption by investing in her human capital, rather than by paying for a more educated husband. This is because a higher $w_U$ leads to a higher return to female human capital on the urban labour market. As it becomes more attractive for the parents to invest in their daughter's human capital, the cost of male human capital on the marriage market has to adjust downward to ensure that the marriage market clears. Consequently, $\varphi_m$ is decreasing in $w_U$.

The constant term in the marriage price schedules in (9), $\varphi_{0k}$, can be regarded as the 'entry cost' for the respective marriage markets. In equilibrium, they adjust to ensure that each marriage market clears. Given that the cost of increasing an offspring's consumption through different channels are equated in equilibrium, we can show that the post-marriage consumption depend, not on the specific levels of human capital of the bride and groom, but on the total expenditures on each individual by his or her family:

**Lemma 1.** *In equilibrium, the consumption of male and female offspring who have opted for market*

*$k$ are given by*

$$C_m = \begin{cases} \delta_{mU} E_m + b_m \varphi_{0k} \text{ for } k \in \{UR, UU\} \\ \delta_{mR} E_m + b_m \varphi_{0k} + a_m \phi_0 \text{ for } k \in \{RR, RU\} \end{cases} \tag{10}$$

$$C_f = \begin{cases} \delta_{fU} \left(E_f - \varphi_{0k}\right) + b_f \varphi_{0k} \text{ for } k \in \{UR, UU\} \\ \delta_{fR} \left(E_f - \varphi_{0k}\right) + b_f \varphi_{0k} + a_f \phi_0 \text{ for } k \in \{RR, RU\} \end{cases} \tag{11}$$

*where $E_m$ and $E_f$ are the expenditures on the male and female offspring, $\delta_{mU} = w_U \theta_m b_m \left(1 + \varphi_m\right)$, $\delta_{fU} = \left(a_f + b_f \varphi_f\right) \left(\frac{1}{\theta_f w_U} + \varphi_f\right)^{-1}$, $\delta_{mR} = w_R b_m \theta_m \left(1 + \hat{\varphi}_m\right)$, $\delta_{fR} = \left(a_f + b_f \varphi_f\right) \left(\frac{1}{\theta_f \phi_1} + \varphi_f\right)^{-1}$.*

The parameters $\delta_{fR}, \delta_{fU}, \delta_{mR}$ and $\delta_{mU}$ defined in the statement of Lemma 1, determine the 'returns to expenditures' by families in the form of post-marriage consumption by their sons and daughters in rural and urban areas. It is straightforward to see that for daughters in rural areas the returns $\delta_{fR}$ are increasing in $\phi_1$, the productivity of human capital in home production, while for daughters in urban areas, the returns $\delta_{fU}$ are increasing in the urban wage rate $w_U$. Similarly, for sons in rural areas $\delta_{mR}$, the returns are increasing in the rural wage rate $w_R$. But for sons in urban areas, the returns may be increasing or decreasing in the urban wage rate; the latter can happen because a higher urban wage rate lowers $\varphi_m$, the equilibrium price of male human capital in the urban marriage market. The following result provides the conditions under which the returns to expenditures on sons in urban areas are increasing in the urban wage rate.

**Condition 1.** $w_U > \frac{2b_f}{2a_f \theta_f - 1}$

**Lemma 2.** *The returns to expenditures on sons in urban areas, $\delta_{mU}$, is increasing in the urban wage rate $w_U$ if and only if Condition 1 holds.*

# Appendix A: Theoretical Proofs

*Proof.* of Proposition 6: Recall that, in male families, parental consumption and offspring consumption are given by

$$C_p = W - \frac{h_m}{\theta_m}$$
$$C_o = a_m z_f + b_m z_m$$

Note that parental consumption in male families is independent of the choice of human capital of the bride, $h_f$. Therefore, $h_f$ is chosen to maximise the son's consumption. By assumption, female families make positive investments in the human capital of their daughters. Therefore, to ensure that marriage markets clear, the choice of $h_f$ by male families in equilibrium must be an interior solution.

In markets $RR$ and $RU$, we have $h_f < \bar{h}(w_k)$ by assumption. Therefore, women engage in home production. Therefore, $z_f = \phi_0 + \phi_1 h_f$ and $z_m = h_m w_k + \tau(h_f, h_m, w_k)$. Therefore

$$C_o = a_m(\phi_0 + \phi_1 h_f) + b_m\{h_m w_k + \tau(h_f, h_m, w_k)\}$$

Then the following first-order condition must hold:

$$a_m\phi_1 + b_m\frac{\partial\tau(h_f, h_m, w_k)}{\partial h_f} = 0$$

$$\Longrightarrow \frac{\partial\tau(h_f, h_m, w_k)}{\partial h_f} = -\frac{a_m}{b_m}\phi_1$$

Therefore, for $k = RR$ and $RU$, we obtain $\tau(h_f, h_m, w_k) = \tau_m(h_m, w_k) + \varphi_f h_f \phi_1$ where $\varphi_f = -\frac{a_m}{b_m}$. Similarly, In markets $UR$ and $UU$, we have $h_f \geq \bar{h}(w_k)$ by assumption. Therefore, women participate in the labour market. Therefore, $z_f = h_f w_k$ and $z_m = h_m w_k + \tau(h_f, h_m, w_k)$. Then, using the first-order condition for male families, we obtain $\tau(h_f, h_m, w_k) = \tau_m(h_m, w_k) + \varphi_f h_f w_k$ for $UR$ and $UU$.

Recall that, in female families, parental consumption and offspring consumption are given by

$$\begin{aligned} C_p &= W - \frac{h_f}{\theta_f} - \tau(h_f, h_m, w_k) \\ C_o &= a_f z_f + b_f z_m \end{aligned}$$

In markets $RR$ and $RU$, since $h_f < \bar{h}(w_k)$, these become

$$\begin{aligned} C_p &= W - \frac{h_f}{\theta_f} - \tau_m(h_m, w_k) - \varphi_f h_f \phi_1 \\ C_o &= a_f(\phi_0 + \phi_1 h_f) + b_f\{h_m w_k + \tau_m(h_m, w_k) + \varphi_f h_f \phi_1\} \end{aligned}$$

Thus, raising the human capital of a female offspring, $h_f$ lowers, for female families, parental consumption at a rate $\frac{\partial C_p}{\partial h_f} = \frac{1}{\theta_f} + \varphi_f\phi_1$ and raises the offspring's consumption at a rate $\frac{\partial C_o}{\partial h_f} = a_f\phi_1 + b_f\varphi_f\phi_1$. So, $C_p$ is converted to $C_o$ at a rate $\frac{a_f\phi_1 + b_f\varphi_f\phi_1}{\frac{1}{\theta_f} + \varphi_f\phi_1}$. On the other hand, raising the human capital of the groom $h_m$ lowers, for female families, parental consumption at a rate $\frac{\partial C_p}{\partial h_m} = \frac{\partial \tau_m}{\partial h_m}$ and raises the offpspring's consumption at a rate $\frac{\partial C_o}{\partial h_m} = b_f w_k + b_f\frac{\partial \tau_m}{\partial h_m}$. So $C_p$ is converted to $C_o$ at a rate $\frac{b_f\left(w_k + \frac{\partial \tau_m}{\partial h_m}\right)}{\frac{\partial \tau_m}{\partial h_m}}$. In equilibrium, these two rates must equal each other.

Therefore, we have

$$\frac{a_f\phi_1 + b_f\varphi_f\phi_1}{\frac{1}{\theta_f} + \varphi_f\phi_1} = \frac{b_f\left(w_k + \frac{\partial\tau_m}{\partial h_m}\right)}{\frac{\partial\tau_m}{\partial h_m}}$$

Rearranging terms in the equation above, we obtain

$$\frac{\partial\tau_m}{\partial h_m}\left(a_f\phi_1 + b_f\varphi_f\phi_1\right) = b_f\left(\frac{1}{\theta_f} + \varphi_f\phi_1\right)\left(w_k + \frac{\partial\tau_m}{\partial h_m}\right)$$

$$\begin{aligned}
\implies\ & \frac{\partial\tau_m}{\partial h_m}\left\{\left(a_f\phi_1 + b_f\varphi_f\phi_1\right) - b_f\left(\frac{1}{\theta_f} + \varphi_f\phi_1\right)\right\} = b_f w_k\left(\frac{1}{\theta_f} + \varphi_f\phi_1\right) \\
\implies\ & \frac{\partial\tau_m}{\partial h_m}\left(a_f\phi_1 - \frac{b_f}{\theta_f}\right) = b_f w_k\left(\frac{1}{\theta_f} + \varphi_f\phi_1\right) \\
\implies\ & \frac{\partial\tau_m}{\partial h_m} = b_f w_k\frac{\left(\frac{1}{\theta_f} + \varphi_f\phi_1\right)}{\left(a_f\phi_1 - \frac{b_f}{\theta_f}\right)} = w_k\frac{\left(\frac{1}{\theta_f\phi_1} - \frac{a_m}{b_m}\right)}{\left(\frac{a_f}{b_f} - \frac{1}{\theta_f\phi_1}\right)}
\end{aligned}$$

Therefore, for $k = RR, RU$, we obtain $\tau\left(h_f, h_m, w_k\right) = \varphi_{0k} + \hat{\varphi}_m h_m w_k + \varphi_f h_f \phi_1$ where $\hat{\varphi}_m = \left(\frac{1}{\theta_f\phi_1} - \frac{a_m}{b_m}\right)\left(\frac{a_f}{b_f} - \frac{1}{\theta_f\phi_1}\right)^{-1}$ and $\varphi_{0k}$ is a constant. Similarly, in markets $UR$ and $UU$, using $z_f = h_f w_k$ and following the same steps, we obtain $\tau\left(h_f, h_m, w_k\right) = \phi_{0k} + \varphi_{mk} h_m w_k + \varphi_f h_f w_k$ for $k = UR$ and $UU$, where $\varphi_m = \left(\frac{1}{\theta_f w_U} - \frac{a_m}{b_m}\right)\left(\frac{a_f}{b_f} - \frac{1}{\theta_f w_U}\right)^{-1}$. □

*Proof.* of Lemma 1: By assumption, in markets $RR$ and $RU$, we have $h_f < \bar{h}\left(w_k\right)$. Therefore, women engage in home production. Therefore, $z_f = \phi_0 + \phi_1 h_f$ and $z_m = h_m w_k + \tau\left(h_f, h_m, k\right)$. Substituting for $z_m$ and $z_f$ in (2), we obtain

$$C_m = a_m\left(\phi_0 + \phi_1 h_f\right) + b_m\left\{h_m w_k + \tau\left(h_f, h_m, k\right)\right\}$$

Substituting for $\tau\left(h_f, h_m, k\right)$ in the equation above using (9), we obtain

$$C_m = a_m\left(\phi_0 + \phi_1 h_f\right) + b_m\left(h_m w_k + \varphi_{0k} + \hat{\varphi}_m h_m w_k + \varphi_f h_f \phi_1\right)$$

$$\implies C_m = a_m\left(\phi_0 + \phi_1 h_f\right) + b_m\varphi_f h_f\phi_1 + b_m\left(1 + \hat{\varphi}_m\right) h_m w_k + b_m\varphi_{0k}$$

By assumption, a level of human capital $h_m$ requires expenditures $E_m = h_m/\theta_m$. Using $\varphi_f = -\frac{a_m}{b_m}$, $a_m = \frac{1}{2}\alpha$, $b_m = \left(1 + \frac{1}{2}\alpha\right)$ and $h_m = \theta_m E_m$ in the equation above, we obtain

$$C_m = a_m\left(\phi_0 + \phi_1 h_f\right) - a_m h_f\phi_1 + \left(1 + \frac{1}{2}\alpha\right)\left(1 + \hat{\varphi}_m\right)\theta_m E_m w_k + \left(1 + \frac{1}{2}\alpha\right)\varphi_{0k}$$

$$\implies C_m = \delta_{mR} E_m + \frac{1}{2}\alpha\phi_0 + \left(1 + \frac{1}{2}\alpha\right)\varphi_{0k}$$

where $\delta_{mR} = w_k \left(1 + \frac{1}{2}\alpha\right)(1 + \hat{\varphi}_m)\,\theta_m$.

Substituting for $z_m$ and $z_f$ in (1), we obtain

$$C_f = a_f (\phi_0 + \phi_1 h_f) + b_f \left\{h_m w_k + \tau(h_f, h_m, k)\right\}$$

$$\implies C_f = a_f (\phi_0 + \phi_1 h_f) + b_f (h_m w_k + \varphi_{0k} + \hat{\varphi}_m h_m w_k + \varphi_f h_f \phi_1)$$

$$\implies C_f = a_f \phi_0 + (a_f + b_f \varphi_f) h_f \phi_1 + b_f (1 + \hat{\varphi}_m) h_m w_k + b_f \varphi_{0k} \tag{12}$$

By construction,

$$E_f = h_f/\theta_f + \tau(h_f, h_m, k)$$

Substituting for $\tau(h_f, h_m, k)$ using (9), we obtain

$$E_f = \left(\frac{1}{\theta_f \phi_1} + \varphi_f\right) h_f \phi_1 + \varphi_{0k} + \hat{\varphi}_m h_m w_k$$

$$\implies h_m w_k = \frac{1}{\hat{\varphi}_m}(E_f - \varphi_{0k}) - \frac{1}{\hat{\varphi}_m}\left(\frac{1}{\theta_f \phi_1} + \varphi_f\right) h_f \phi_1 \tag{13}$$

Substituting for $h_m w_k$ in (12) using (13), we obtain

$$C_f = a_f\phi_0 + (a_f + b_f\varphi_f) h_f \phi_1 + b_f (1 + \hat{\varphi}_m) \left\{\frac{1}{\hat{\varphi}_m}(E_f - \varphi_{0k}) - \frac{1}{\hat{\varphi}_m}\left(\frac{1}{\theta_f\phi_1} + \varphi_f\right) h_f \phi_1\right\} + b_f \varphi_{0k}$$

$$\implies C_f = a_f\phi_0 + \left\{\frac{(a_f + b_f\varphi_f)}{\left(\frac{1}{\theta_f\phi_1} + \varphi_f\right)} - \frac{b_f(1 + \hat{\varphi}_{mk})}{\hat{\varphi}_{mk}}\right\}\left(\frac{1}{\theta_f\phi_1} + \varphi_f\right) h_f\phi_1 + b_f\left(\frac{1 + \hat{\varphi}_m}{\hat{\varphi}_m}\right)(E_f - \varphi_{0k}) + b_f\varphi_{0k}$$

By construction, $(a_f + b_f\varphi_f)\left(\frac{1}{\theta_f\phi_1} + \varphi_f\right)^{-1} = \frac{b_f(1+\hat{\varphi}_{mk})}{\hat{\varphi}_{mk}}$. Therefore, the expression within the curly brackets in the expression above is equal to zero, and we obtain

$$C_f = a_f\phi_0 + \delta_{fR}(E_f - \varphi_{0k}) + b_f\varphi_{0k}$$

where $\delta_{fR} = b_f\left(\frac{1+\hat{\varphi}_m}{\hat{\varphi}_m}\right) = (a_f + b_f\varphi_f)\left(\frac{1}{\theta_f\phi_1} + \varphi_f\right)^{-1}$.

By assumption, in markets $UR$ and $UU$, we have $h_f \geq \bar{h}(w_k)$. Therefore, women participate in the labour market. Therefore, $z_f = h_f w_k$ and $z_m = h_m w_k + \tau(h_f, h_m, k)$. Then, following the steps above, we obtain the equivalent expressions for $C_m$ and $C_f$ in (11) and (10). □

*Proof.* of Proposition 2: Since $\zeta_m = \zeta_g = 0$, Lemma 3 implies that we obtain all economic outcomes that can be attained in equilibrium by considering only the market choices $RR$ and $UU$. Let us denote by $\hat{E}(u,o,g;w)$ the minimum expenditures required to attain utility $u$ when the wage is equal to $w$. Without loss of generality, let $o=R$ and $w_U>w_R$. Let $\underline{u}=V(W,w_R,g)$. Then, by construction, we have

$$\begin{aligned}\hat{E}(\underline{u},o,g;w_R) &= W\\ \hat{E}(\underline{u},o,g;w_U) &= W-\mu(W,o,g;w_U,w_R)\end{aligned}$$

$$\Longrightarrow \mu(W,o,g;w_U,w_R)=\hat{E}(\underline{u},o,g;w_R)-\hat{E}(\underline{u},o,g;w_U)$$

$$\Longrightarrow \frac{\partial\mu(W,o,g;w_U,w_R)}{\partial W}=\frac{\partial V}{\partial W}\left\{\frac{\partial\hat{E}(\underline{u},o,g;w_R)}{\partial V}-\frac{\partial\hat{E}(\underline{u},o,g;w_R)}{\partial V}\right\}$$

Also, we can show that $\frac{\partial\hat{E}(\underline{u},o,g;w)}{\partial V}=\left(\frac{\partial U}{\partial C_p}\right)^{-1}$ for $C_p=C_p^h(\underline{u},o,g;w)$, the Hicksian demand function.[44] Note that the Hicksian demand varies negatively with the price (See Mas-Colell, Whinston and Green, 1995, Proposition 2.F.2). Note that the price of offspring consumption relative to parental consumption is given by $\frac{1}{\delta_{gk}}$ which is decreasing in the wage rate $w_k$ for $g=f$ and, if Condition 1 holds, for $g=m$. Therefore, we have $C_p^h(\underline{u},o,g;w_U)<C_p^h(\underline{u},o,g;w_R)$. Therefore, given that marginal utility is decreasing in consumption,

$$\frac{\partial U}{\partial C_p}|_{C_p=C_p^h(\underline{u},o,g;w_U)}>\frac{\partial U}{\partial C_p}|_{C_p=C_p^h(\underline{u},o,g;w_R)}$$

$$\Longrightarrow \frac{\partial\hat{E}(\underline{u},o,g;w_U)}{\partial V}>\frac{\partial\hat{E}(\underline{u},o,g;w_R)}{\partial V}$$

[44] To see this, we write out the Expenditures Function:

$$\hat{E}(\underline{u},o,g;w)=\min C_p+pC_o \text{ subject to } U(C_p,C_o)\geq\underline{u}$$

where $p=(1/\delta_{gk})$ is the 'price' of offspring consumption.

From the first-order condition w.r.t. $C_p$, we have

$$1-\lambda\frac{\partial U}{\partial C_p}=0$$

where $\lambda$ is the Lagrange multiplier. Also, using the Envelope Theorem, we have (see Mas-Colell, Whinston and Green 1995, Theorem M.K.5)

$$\frac{\partial\hat{E}}{\partial\underline{u}}=\lambda$$

Combining the two equations, we obtain

$$\frac{\partial\hat{E}(\underline{u},o,g;w)}{\partial V}=\left(\frac{\partial U}{\partial C_p}\right)^{-1}$$

Also, by construction, $\frac{\partial V}{\partial W} > 0$. Therefore, $\frac{\partial \mu(W,o,g;w_U,w_R)}{\partial W} > 0$.

Let us denote by $\overline{W}$ be the level of family wealth at which, given migration cost $\mu$, a rural family is indifferent between migrating and not migrating. Therefore, $\mu\left(\overline{W}, o, g; w_U, w_R\right) = \mu$. Since $\frac{\partial \mu(W,o,g;w_U,w_R)}{\partial W} > 0$, families with wealth more than $\overline{W}$ will have a threshold migration cost above $\mu$ and, so, offspring from these families will migrate when the migration cost equals $\mu$. And families with wealth less than $\overline{W}$ will have a threshold migration cost below $\mu$ and, so, offspring from these families will not migrate when the migration cost equals $\mu$. □

*Proof.* of Proposition 3: If $\zeta_f > 0$, then the market $UU$ entails an additional cost $\zeta_f\sigma$ for rural female families compared to market $UR$. If $\zeta_m = 0$ then market $UU$ entails no additional cost for rural male families. Both choices $UR$ and $UU$ lead to the urban labour market and urban wages. Therefore, rural female families would prefer market $UU$ to market $UR$ if and only if $\varphi_{0UU} + \zeta_f\sigma < \varphi_{0UR}$ and rural male families would prefer market $UU$ to market $UR$ if and only if $\varphi_{0UU} > \varphi_{0UR}$. Therefore, there are no feasible values of $\varphi_{0UU}$ and $\varphi_{0UR}$ such that both rural male and rural female families prefer market $UU$ to $UR$. On the other hand, if only rural male or only rural female families choose $UU$ then the marriage market in $UU$ will not clear. Therefore, it must be that, in equilibrium, none of the rural families choose $UU$.

Then, if there is rural-urban migration, it must be that both male and female rural migrants choose market $UR$ and prefer $UR$ to $UU$. Therefore, $\varphi_{0UR} > \varphi_{0UU}$ and $\varphi_{0UR} < \varphi_{0UU} + \zeta_f\sigma$. Then, equation (9) implies that, for given levels of human capital of the bride and groom, the dowry is higher in market $UR$ compared to market $UU$.

Consider a female family with wealth $W$ that, in equilibrium, chooses a level of human capital $h_f$ for the daughter and marries her to a groom with human capital $h_m$ in market $UU$. The total child-related expenditures for this family is given by $E_f = h_f//\theta_f + \tau\left(h_f, h_m, UU\right)$. Using (11), the daughter's consumption is given by $C_f = w_U\delta_f\left(E_f - \varphi_{0UU}\right) + \alpha\beta\varphi_{0UU}$. Optimisation implies that

$$\frac{\partial V\left(W - E_f, C_f\right)}{\partial W} = \frac{\partial V\left(W - E_f, C_f\right)}{\partial C_f}$$

As shown above, the same combination of human capital $(h_f, h_m)$ in market $RU$ will require expenditures

$$\begin{aligned} E'_f &= h_f//\theta_f + \tau\left(h_f, h_m, UR\right) \\ &= \varphi_{0UR} + \left(\varphi_{mU}h_m + \varphi_{fU}h_f\right)w_U \end{aligned}$$

As shown above, $\varphi_{0RU} > \varphi_{0UU}$. Therefore, $E'_f > E$. The daughter's consumption is given by

$$C'_f = w_U\delta_f\left(E'_f - \varphi_{0UR}\right) + \alpha\beta\varphi_{0UR}$$

Note that $E'_f - \varphi_{0UR} = \varphi_{mU} h_m + \varphi_{fU} h_f = E_f - \varphi_{0UU}$. Therefore, $C'_f > C_f$. Then, since $V(.)$ is concave in both arguments, we have

$$\frac{\partial V\left(W - E'_f, C'_f\right)}{\partial W} > \frac{\partial V\left(W - E'_f, C'_f\right)}{\partial C_f}$$

Therefore, the combination $(h_f, h_m)$ cannot be optimal for a female family with wealth $W$ in market $UR$. The inequality above implies that a female family in market $UR$ will choose a level of expenditures less than $E'_f$. Therefore, if the chosen groom has human capital $h_m$, the daughter must have human capital less than $h_f$. □

*Proof.* of Corollary to Proposition 3: As per Proposition 3, in any equilibrium with rural-urban migration, $\varphi_{0UR} \geq \varphi_{0UU}$. We prove by contradiction that, in a positive mixed strategy equilibrium with rural-urban migration, $\varphi_{0UR} > \varphi_{0UU}$, as follows: Suppose $\varphi_{0UR} = \varphi_{0UU}$. Then rural-born men are indifferent between markets $UR$ and $UU$. Then, they opt for market $UU$ with some positive probability. On the other hand, rural-born women have a strict preference for market $UR$ (as market $UU$ entails a marriage search cost $\zeta_f \sigma$ for them); and urban-born men and women have a strict preference for market $UU$ (as market $UR$ entails marriage search costs $\sigma$ for them). Therefore, the markets $UR$ and $UU$ will not clear. Therefore, there is no positive mixed strategy equilibrium with rural-urban migration in which $\varphi_{0UR} = \varphi_{0UU}$. Therefore, we must have $\varphi_{0UR} > \varphi_{0UU}$. □

*Proof.* of Corollary to Proposition 2: Without loss of generality, let $o = R$ and $w_U > w_R$. By Proposition 3, rural families that participate in the urban labour market will opt for $RU$. Therefore, migration involves the migration cost $\mu$, a marriage search cost of $\zeta_g \sigma$ and an additional marriage payment of $\{1 - 2\mathbf{I}(g = m)\}(\varphi_{0RU} - \varphi_{0RR})$ (where.$\mathbf{I}(g = m)$ is an indicator function which takes a value of 1 if $g = m$ and 0 otherwise). Let us denote by $\hat{E}(u, o, g; w)$ the minimum expenditures required to attain utility $u$ when the wage is equal to $w$. Let $\underline{u} = V(W, w_R, g)$. Then, by construction, we have

$$\begin{aligned}\hat{E}(\underline{u}, o, g; w_R) &= W \\ \hat{E}(\underline{u}, o, g; w_U) &= W - \tilde{\mu}(W, o, g; w_U, w_R, \varphi_0) - \zeta_g \sigma - \{1 - 2\mathbf{I}(g = m)\}(\varphi_{0RU} - \varphi_{0RR})\end{aligned}$$

$$\Longrightarrow (W, o, g; w_U, w_R, \varphi_0) + \zeta_g \sigma + \{1 - 2\mathbf{I}(g = m)\}(\varphi_{0RU} - \varphi_{0RR}) = \hat{E}(\underline{u}, o, g; w_R) - \hat{E}(\underline{u}, o, g; w_U)$$

Note that the terms $\zeta_g \sigma$ and $\{1 - 2\mathbf{I}(g = m)\}(\varphi_{0RU} - \varphi_{0RR})$ do not vary with wealth $W$. Therefore, the subsequent steps in the proof of Proposition 2 apply. Therefore, $\tilde{\mu}(W, o, g; w_U, w_R, \varphi_0)$ is monotonically increasing in $W$. □

*Proof.* of Proposition 4: Suppose that the cost of migration is, initially, equal to $\mu_0$. Let us denote by $w_{U0}$ and $w_{R0}$ the rural and urban wage rates in the initial equilibrium. We assume that $w_{U0} > w_{R0}$. There exist wealth levels $\overline{W}_{m0}$ and $\overline{W}_{f0}$ satisfying the equation $\mu\left(\overline{W}_{g0}, R, g; w_{U0}, w_{R0}\right) = \mu_0$ for $g = m, f$ such that, as per Proposition 2 (if $\zeta_m = \zeta_f = 0$ and, as per its corollary if $\zeta_f > \zeta_m = 0$), all rural families with wealth $W > \overline{W}_{g0}$ will choose to migrate while those with wealth $W < \overline{W}_{g0}$ will choose the rural market.

(i) A decline in the cost of migration to, say, $\mu_1 < \mu_0$ will, by Proposition 2 (if $\zeta_m = \zeta_f = 0$ and, by its corollary if $\zeta_f > \zeta_m = 0$), lower the threshold wealth levels $\overline{W}_{m1}$ and $\overline{W}_{f1}$ that trigger migration. Therefore, more families with a rural origin will choose $UR$ or $UU$ in the new equilibrium compared to the initial equilibrium. Thus, there is an increase in rural-urban migration.

(ii) An increase in the proportion of rural families choosing $UR$ or $UU$ increases labour in manufacturing and lowers labour in agriculture. These effects will be partially – but not entirely – offset by an increase in educational investments in families that participate in the rural market and a decrease in educational invests in families that participate in urban markets. Thus, there is a decrease in human capital in the rural market and an increase in human capital in the urban market. Therefore, the the marginal product of human capital in agriculture and the rural wage rate are higher in the new equilibrium. The marginal product of human capital in manufacturing.and the urban wage rate are lower in the new equilibrium.

(iii) As per equation (10) and Lemma 2, under Condition 1, the increase in the rural wage will lower the 'price' of offspring consumption in male families. Since offspring consumption is, by assumption, an ordinary good, the increase in rural wage will increase expenditures on male offspring that opt for the rural market, which translates into higher male education. As the urban wage rate exceeds the rural wage rate, the same holds true for rural male families that opted for the rural market in the original equilibrium but opt for the urban market in the new equilibrium.[45]

(iv) As per equation (11), there is no change in the 'price' of offspring consumption for female families that opt for the rural location (they are not affected by the rural wage rate because, by assumption, women in rural areas do not participate in the labour market). As women in urban areas participate in the labour market, the increase in migration following the decline in migration cost will translate into an increase in female labour force participation. Using equation 11), we can see that the price of consumption is lower for female offspring who opt for the urban location compared to those who opt for the rural location. Therefore, the increase in migration from rural to urban areas will lead to increased expenditures on rural-born female offspring.

[45] For rural male families that were already opting for the urban market in the original equilibrium, the effect would go in the opposite direction to the extent that the decrease in migration costs leads to a reduction in urban wages.

Lemma 2 implies that these families are indifferent between different combinations of dowry and education spending that sum up to the total expenditures. In positive mixed strategy equilibria, they pursue a mixed strategy assigning a positive probability to all these combinations. This will lead to an increase in average spending on dowries and on education within rural female families.

(v) As per equation (10) and Lemma 2, under Condition 1, the decline in the urban wage will increase the 'price' of offspring consumption in male families. This 'price' increase will decrease expenditures on urban-born male offspring and, thus, lead to lower male education.

(vi) As per equation (11), the decline in the urban wage will increase the 'price' of offspring consumption in female families. This 'price' increase will decrease expenditures on urban-born female offspring. Following the reasoning in part (iv), this will lead to a decrease in average spending on dowries and on education with urban female families.

(vii) By assumption, the urban wage rate is sufficiently high that all women in urban areas participate in the labour market. As the urban wage rate is higher than the rural wage rate, all urban-born female offspring participate in the urban labour market both in the original equilibrium and the new equilibrium. Therefore, there is no change in female labour force participation in urban families. □

*Proof.* of Proposition 5: (i) If $\zeta_f > \zeta_m = 0$, then Proposition 3 implies that all rural families whose offspring migrate to urban areas choose market $UR$ and none choose $UU$. Suppose that the cost of migration is, initially, equal to $\mu_0$. Let us denote by $w_{U0}$ and $w_{R0}$ the rural and urban wage rates in the initial equilibrium. We assume that $w_{U0} > w_{R0}$. By the Corollary to Proposition 2, there exist wealth levels $\overline{W}_{m0}$ and $\overline{W}_{f0}$ satisfying the equation $\tilde{\mu}\left(W, o, g; w_{U0}, w_{R0}, \varphi_0\right) = \mu_0$ for $g = m, f$ such that all rural families with wealth $W > \overline{W}_{g0}$ will choose to migrate via market $UR$ while those with wealth $W < \overline{W}_{g0}$ will choose $UU$. A decline in the cost of migration to, say, $\mu_1 < \mu_0$ will, by the Corollary to Proposition 2, lower the threshold wealth levels $\overline{W}_{m1}$ and $\overline{W}_{f1}$ that trigger migration. Therefore, more families with a rural origin will choose to migrate in the new equilibrium compared to the initial equilibrium. Proposition 3 implies that the increased migration will take place via market $UR$ and not via market $UU$.

(ii) If $\zeta_f = \zeta_m = 0$ then, as per the reasoning in part (i), there will be increased migration in the new equilibrium compared to the initial equilibrium. Proposition 1 implies that those who migrate are indifferent between the market choices $UR$ and $UU$ (the two choices involve the same marriage price schedule and the same urban wages). In positive mixed strategy equilibria, the migrating families pursue a mixed strategy with positive probabilities assigned to the two alternatives. Then, there is increased participation in both markets $UR$ and $UU$. □

# Appendix B: Additional Technical Results

*Proof.* of Lemma 2: Using $\varphi_{mk} = \left(\frac{1}{\theta_f w_k} - \frac{a_m}{b_m}\right)\left(\frac{a_f}{b_f} - \frac{1}{\theta_f w_k}\right)^{-1}$ in the expression for $\delta_{mk}$, we obtain

$$\begin{aligned}
& w_k\theta_m b_m\left(1+\frac{\frac{1}{\theta_f w_k}-\frac{a_m}{b_m}}{\frac{a_f}{b_f}-\frac{1}{\theta_f w_k}}\right)\\
= \;& w_k\theta_m b_m\left(\frac{\frac{a_f}{b_f}-\frac{1}{\theta_f w_k}+\frac{1}{\theta_f w_k}-\frac{a_m}{b_m}}{\frac{a_f}{b_f}-\frac{1}{\theta_f w_k}}\right)\\
= \;& w_k\theta_m b_m\left(\frac{\frac{a_f}{b_f}-\frac{a_m}{b_m}}{\frac{a_f}{b_f}-\frac{1}{\theta_f w_k}}\right)\\
= \;& w_k\theta_m b_m\left(\frac{\frac{a_f}{b_f}-\frac{a_m}{b_m}}{\frac{a_f\theta_f w_k-b_f}{b_f\theta_f w_k}}\right)\\
= \;& (w_k\theta_m b_m)\,(b_f\theta_f w_k)\left(\frac{\frac{a_f}{b_f}-\frac{a_m}{b_m}}{a_f\theta_f w_k-b_f}\right)\\
= \;& (w_k\theta_m b_m)\,(b_f\theta_f w_k)\left(\frac{a_f b_m-a_m b_f}{a_f\theta_f w_k-b_f}\right)\frac{1}{b_f b_m}
\end{aligned}$$

$$= (w_k)^2\,(\theta_m\theta_f)\left(\frac{a_f b_m-a_m b_f}{a_f\theta_f w_k-b_f}\right)$$

Differentiating w.r.t. $w_k$ we obtain

$$\frac{2Kw_k}{a_f\theta_f w_k-b_f} - K\,(w_k)^2\,(a_f\theta_f)\,(a_f\theta_f w_k-b_f)^{-2}$$

where $K = (\theta_m\theta_f)\,(a_f b_m - a_m b_f)$.

$$\begin{aligned}
= \;& \frac{2Kw_k}{a_f\theta_f w_k-b_f} - K\left(\frac{w_k}{a_f\theta_f w_k-b_f}\right)^2(a_f\theta_f)\\
= \;& \left(\frac{Kw_k}{a_f\theta_f w_k-b_f}\right)\left\{2-\left(\frac{w_k}{a_f\theta_f w_k-b_f}\right)\right\}(a_f\theta_f)
\end{aligned}$$

By construction, $K > 0$. Therefore, the derivative is positive if and only if

$$2-\left(\frac{w_k}{a_f\theta_f w_k-b_f}\right) > 0$$

$$\implies 2\,(a_f\theta_f w_k - b_f) > w_k$$

$$\implies \left(2a_f\theta_f - 1\right) w_k > 2b_f$$
$$\implies w_k > \frac{2b_f}{2a_f\theta_f - 1}$$

□

We use the following lemma in the proof of Proposition 2.

**Lemma 3.** *Suppose $\zeta_m = \zeta_g = 0$. Then, any equilibrium involving the four market choices $\{RR, RU, UR, UU\}$ is identical to an equilibrium involving only the two market choices $\{RR, UU\}$ in terms of the equilibrium wage rates, marriage and migration outcomes and human capital investments.*

*Proof.* of Lemma 3: Consider an equilibrium where some individual $i$ of type $g$ opts for the market $RU$. Note that the choice $UU$ involves an identical labour market and, therefore, entails the same returns to human capital on the labour market as $RU$ (both for oneself and any prospective marriage partner). Using Proposition 6, we obtain $\tau\left(h_f, h_m, UU\right) - \tau\left(h_f, h_m, RU\right) = \varphi_{0UU} - \varphi_{0R}$ – i.e. the marriage price schedules in markets $UU$ and $RU$ are identical up to the constant $\varphi_{0UU} - \varphi_{0R}$. If $\varphi_{0RU}$ is more favourable to $g$ than $\varphi_{0UU}$ then market $UU$ will be more advantageous for the opposite gender and the marriage market corresponding to choice $RR$ will not clear. If $\varphi_{0RU}$ is less favourable to $g$ than $\varphi_{0UU}$, then $i$ is better off choosing $UU$ than $RU$. Therefore, we must have $\varphi_{0RU} = \varphi_{0UU}$ in equilibrium. Thus the marriage price schedule and wage rates are identical for choices $RU$ and $UU$. By construction, choice $UU$ does not entail any additional migration or search costs relative to $RU$ (we can verify this by examining Table 1 and setting $\zeta_m = \zeta_g = 0$: the costs are identical if the individual has a 'rural' origin and lower if the individual has an 'urban' origin). If it involves a *lower* cost relative to $RU$, then choice $RU$ cannot be optimal in the first place. Therefore the migration+search costs must be identical. By similar reasoning, we can show that the marriage price schedules, wage rates and migration+search costs are identical for choices $UR$ and $RR$. Therefore, individuals are indifferent between $RU$ and $UU$ and indifferent between $UR$ and $RR$.

Then, we can propose an alternative equilibrium as follows. All individuals, of both genders, who chose market $RU$ in the original equilibrium will choose market $UU$; all individuals who chose market $UR$ in the original equilibrium will choose market $RR$. As the choices of both genders are being changed, the marriage markets will continue to clear. As the labour market outcomes will continue to be the same, the rural and urban wage rates will also remain the same. As individuals were indifferent between $RU$ and $UU$, and between $UR$ and $RR$ in the original equilibrium, the proposed new market choices will continue to be optimal. As they face the same marriage price schedules and wage rates in these new markets, their levels of human capital investment in the original equilibrium will continue to be optimal. Thus, we obtain an alternative equilibrium with identical wage rates, marriage and labour outcomes and human capital investments. □

# Appendix C: Testing for Selection in the Analysis of RMG Outcomes

In Table 6 of Section 7.2 we analyze the effect of the Jamuna Bridge on the work outcomes of WiLCAS respondents. Our outcome of interest is a binary measure for whether respondents have ever worked in the readymade garment (RMG) industry. However, this information is only available for a subset of WiLCAS respondents - in particular, the 60% of respondents who answered our phone survey on RMG work outcomes. To address the fact that selection into the phone sample might bias the results in Table 6, we employ two complementary strategies: 1) we re-run the analysis with a related outcome variable (currently employed in the RMG sector) for which selection is not a concern, and 2) we try to explicitly account for any selection patterns by running a Heckman selection model (i.e. a Type II Tobit model).

First, we re-run the results with the dependent variable “RMG worker”, which is an indicator for whether the respondent is currently employed in the RMG sector. Importantly, we have this outcome for all respondents, and not just those in the phone survey, so the previous concern with selection is avoided. One problem with this outcome is that it only captures current employment, and will therefore not capture the effect of the bridge on those who worked previously in the RMG sector but no longer do so. With that caveat in mind, the results of the test are reported in Tables 10 and 11 (for respondents from wealthier and less wealthy families, respectively). The results are in line with those from Table 6: the bridge has a discernable positive effect on RMG employment for respondents from wealther families, but not for those frome less wealthy families.

Our second approach involves running a Heckman Selection model to explicitly test and account for potential selection patterns. The main challenge in implementing the test is that it is difficult to find exogenous determinants with strong predictive power in the selection equation that are not a linear combination of the exogenous covariates in the main regression equation. One reason for this is that our preferred specification includes a fair number of covariates in the main regression equation out of a desire to improve the precision of our estimates and account for any potential trends that may differ based on differences in such characteristics across regions. However, including these characteristics may not be strictly necessary for identifying the effect of the bridge. Indeed, this is confirmed in Table 12 below, which replicates the results of Table 6 with controls - in columns 1 and 3 - and then again without controls - in columns 2 and 4. [46] It can

[46] The controls that are included in all specifications include the treatment measures, a post 1983 year of birth

be seen from comparing the even columns with the odd columns in this table that the omission of most controls (including division fixed effects and parental characteristics) has no appreciable effect on the estimated coefficients for the main treatment indicators ("JM bridge x post" and "JM bridge intensity x post").

We therefore attempted to run the selection model after removing these "inessential" controls from the main equation so that we could use them in the selection equation instead.[47] In addition to all of the covariates from our primary specification (e.g. division fixed effects and parental characteristics), the phone survey selection equation also includes the following regressors: an indicator for having a birth certificate, a measure of the respondent's attitude (friendly, cooperate, hostile, etc) when taking the main WiLCAS survey, and the duration of the interview for the main WiLCAS survey. This procedure was successful for the subsample of wealthier families and the results are reported in Table 13.[48] The odd columns depict results from the main equation while the even columns depict results from the selection equation. From the table one can see that the estimate for rho (which measures the correlation between errors in the main and selection equations) is not significantly different from 0, suggesting that selection is not in fact a problem. Indeed, we see that the coefficient on the inverse Mills ratio is not significant either, and the coefficients on the main treatment indicators are almost the same as in the standard specification without accounting for selection.

dummy, the treatment measures interacted with the post 1983 dummy, an indicator for being born in Dhaka, the Dhaka indicator interacted with the post 1983 dummy, and distance from the respondent's place of birth to Dhaka. In addition, columns 1 and 3 include division fixed effects, age, age-squared, a non-muslim indicator and parental characteristics.

[47] The model is not well identified when all controls are included in both equations. We have also had to include one covariate, "Dhaka across river", which is correlated with having worked in the RMG sector, in the selection equation because the likelihood function for the selection model does not converge without the inclusion of this variable.

[48] We do not show results for the subsample of less wealthy families as the likelihood function for the corresponding selection equation does not converge for any plausible set of IVs.

Table 10: Work Outcomes Among Respondents with Parental Landholdings of Half an Acre or More (Current RMG Worker)

| | (1)<br>RMG Worker | (2)<br>RMG Worker |
|---|---|---|
| JM bridge X post | 0.032** | |
| | (0.015) | |
| JM bridge intensity X post | | 0.058** |
| | | (0.026) |
| JM bridge intensity | | 0.725*** |
| | | (0.193) |
| Born post '82 | -0.014 | -0.014 |
| | (0.009) | (0.009) |
| Born Dhaka manf. belt | -0.013 | -0.001 |
| | (0.018) | (0.017) |
| Born Dhaka X post | 0.028 | 0.030 |
| | (0.029) | (0.029) |
| Dhaka dist. (10km) | -0.001* | 0.001 |
| | (0.001) | (0.001) |
| Dhaka across river | -0.010 | -0.006 |
| | (0.017) | (0.017) |
| Age | -0.022*** | -0.023*** |
| | (0.007) | (0.007) |
| Age sq. | 0.000*** | 0.000*** |
| | (0.000) | (0.000) |
| Constant | 0.514*** | 0.498*** |
| | (0.116) | (0.115) |
| Observations | 3340 | 3340 |
| Dep Variable Mean (Jamuna pre '83) | 0.015 | 0.015 |

Source: 2014 WiLCAS and authors' calculations.

Note: Additional controls (not shown) include parental characteristics and division dummies.

Robust standard errors clustered by subdistrict in parentheses.

Statistical significance denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table presents the results of OLS regressions of an alternative work-related outcome variable (currently employed in the RMG sector) against treatment variables of interest and covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 11: Work Outcomes Among Respondents with Parental Landholdings of Less than Half an Acre (Current RMG Worker)

| | (1)<br>RMG Worker | (2)<br>RMG Worker |
|---|---|---|
| JM bridge X post | 0.012 | |
| | (0.021) | |
| JM bridge intensity X post | | 0.024 |
| | | (0.035) |
| JM bridge intensity | | 0.353 |
| | | (0.234) |
| Born post ’82 | -0.013 | -0.013 |
| | (0.015) | (0.016) |
| Born Dhaka manf. belt | -0.042 | -0.037 |
| | (0.042) | (0.042) |
| Born Dhaka X post | 0.078* | 0.079* |
| | (0.047) | (0.047) |
| Dhaka dist. (10km) | 0.000 | 0.001 |
| | (0.001) | (0.002) |
| Dhaka across river | -0.033 | -0.031 |
| | (0.033) | (0.033) |
| Age | -0.050*** | -0.050*** |
| | (0.010) | (0.010) |
| Age sq. | 0.001*** | 0.001*** |
| | (0.000) | (0.000) |
| Constant | 0.960*** | 0.949*** |
| | (0.164) | (0.164) |
| Observations | 2897 | 2897 |
| Dep Variable Mean (Jamuna pre ’83) | 0.041 | 0.041 |

Source: 2014 WiLCAS and authors’ calculations.

Note: Additional controls (not shown) include parental characteristics and division dummies.

Robust standard errors clustered by subdistrict in parentheses.

Statistical significance denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table presents the results of OLS regressions of an alternative work-related outcome variable (currently employed in the RMG sector) against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors’ calculations.

Table 12: Work Outcomes Among Respondents with Parental Landholdings of Half an Acre or more (without covariates)

| | (1)<br>Worked in RMG | (2)<br>Worked in RMG | (3)<br>Worked in RMG | (4)<br>Worked in RMG |
|---|---|---|---|---|
| JM bridge X post | 0.047** | 0.050** | | |
| | (0.023) | (0.024) | | |
| JM bridge intensity X post | | | 0.081** | 0.088** |
| | | | (0.041) | (0.042) |
| JM bridge intensity | | | 0.113 | -0.263 |
| | | | (0.293) | (0.218) |
| Born post '82 | -0.004 | 0.021 | -0.004 | 0.021 |
| | (0.022) | (0.013) | (0.021) | (0.013) |
| Born Dhaka manf. belt | -0.025 | 0.011 | -0.022 | 0.005 |
| | (0.050) | (0.047) | (0.050) | (0.046) |
| Born Dhaka X post | 0.006 | 0.007 | 0.006 | 0.007 |
| | (0.066) | (0.066) | (0.066) | (0.066) |
| Dhaka dist. (10km) | -0.000 | -0.003** | 0.000 | -0.004*** |
| | (0.002) | (0.001) | (0.002) | (0.001) |
| Dhaka across river | -0.062** | | -0.061** | |
| | (0.028) | | (0.028) | |
| Age | -0.002 | | -0.002 | |
| | (0.012) | | (0.012) | |
| Age sq. | -0.000 | | -0.000 | |
| | (0.000) | | (0.000) | |
| Constant | 0.304 | 0.082*** | 0.299 | 0.091*** |
| | (0.186) | (0.015) | (0.185) | (0.015) |
| Observations | 2108 | 2108 | 2108 | 2108 |
| Dep Variable Mean (Jamuna pre '83) | 0.039 | 0.039 | 0.039 | 0.039 |

Note: This table presents the results of OLS regressions of work-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown), and are only included in columns 1 and 3. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 13: Work Outcomes Among Respondents with Parental Landholdings of Half an Acre or more (Correcting for Selection)

| | (1) | | (2) | |
|---|---|---|---|---|
| | | Worked in RMG | | Worked in RMG |
| | Worked in RMG | in phone survey | Worked in RMG | in phone survey |
| JM bridge X post | 0.039 | -0.253** | | |
| | (0.028) | (0.110) | | |
| JM bridge intensity X post | | | 0.061 | -0.394** |
| | | | (0.049) | (0.191) |
| JM bridge intensity | | | -0.349 | -3.551*** |
| | | | (0.227) | (1.163) |
| Born post '82 | 0.019 | 0.032 | 0.017 | 0.026 |
| | (0.014) | (0.101) | (0.014) | (0.101) |
| Born Dhaka manf. belt | 0.021 | 0.400** | 0.020 | 0.343* |
| | (0.041) | (0.192) | (0.042) | (0.193) |
| Born Dhaka X post | -0.002 | -0.550** | -0.013 | -0.552** |
| | (0.055) | (0.225) | (0.055) | (0.225) |
| Dhaka dist. (10km) | -0.003*** | 0.005 | -0.004*** | -0.008 |
| | (0.001) | (0.006) | (0.001) | (0.007) |
| Dhaka across river | | | | |
| Age | | 0.074 | | 0.077 |
| | | (0.048) | | (0.048) |
| Age sq. | | -0.001 | | -0.001 |
| | | (0.001) | | (0.001) |
| Constant | 0.059 | -1.289* | 0.049 | -1.218* |
| | (0.043) | (0.678) | (0.039) | (0.679) |
| Observations | 3266 | | 3266 | |
| Dep Var Mean (JM pre83) | 0.039 | | 0.039 | |
| Inverse Mills Ratio | 0.038 | | 0.079 | |
| Inverse Mills Ratio (se) | 0.072 | | 0.067 | |
| Rho | 0.149 | | 0.303 | |
| Rho (se) | 0.071 | | 0.166 | |

Note: This table presents the results of a Heckman selection model estimated via MLE. The odd columns depict the coefficients of the main equation, which estimates the effect of the Jamuna Bridge on work outcomes for respondents with parental landholdings of more than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates in the main equation include geographic distance from the individual's place of birth to the manufacturing belt around Dhaka and binary indicators for being born post 1982, being born in the Jamuna region, and being born in the Dhaka region. The even columns depict a subset of coefficients from the selection equation, which predict participation in the phone survey. These coefficients include age, age squared, having to cross a river to access Dhaka, an indicator for having a birth certificate, a measure of the respondent's attitude (friendly, cooperate, hostile, etc) when taking the main WiLCAS survey, and the duration of the interview for the main WiLCAS survey, as well as division fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. The table also reports the coefficient on the Inverse Mills Ratio and the estimate of rho, a measure of the correlation between errors in the main and selection equations (along with their standard errors). Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix D: Testing and Correcting for Selection in the Analysis of Dowry Outcomes

In Table 8 of Section 7.2 we estimate the effect of the Jamuna Bridge on dowry outcomes, including the natural log of the dowry paid by respondents (in columns 3 and 4 of the table). We find a positive effect of the bridge on the dowry amount conditional on dowry marriages occurring, which we interpret as confirming the prediction from our model that a reduction in migration costs should increase dowry amounts. However, the dowry amount is only observed for those who paid a dowry as a part of their marriage arrangement, and so this interpretation may be incorrect if the bridge changed the nature of selection into dowry marriages (e.g., if the bridge reduced the likelihood of paying a dowry among those who would have paid a particularly low dowry, we might observe the positive coefficient even if the bridge did not increase paid dowry amounts). In this Section of the Appendix, we therefore attempt to test and account for such selection patterns using a Heckman selection model.

Our analysis mirrors the analysis of the main results, with the exception that our selection equation (i.e. the equation which predicts selection into dowry marriages) includes the following covariates *in addition* to the ones used in the main analysis: indicators for whether the respondent's mother worked and whether the respondent is Hindu. Our results are reported in Tables 14 and 15. The odd columns depict results from the main equation while the even columns depict results from the selection equation. Our results when correcting for selection are qualitatively the same as the results reported in Table 8 (in fact, for poor families the effect is stronger). This confirms that selection into dowry marriage is not driving these effects.

As an additional robustness check, we estimate the effects of the Jamuna bridge on the inverse hyberbolic sine transformation of the dowry amount and the natural logarithm of (1 + dowry amount). The results are reported in Tables 16 and 17. As shown in the tables, we obtain a significant effect on these outcome variables for poor families. We no longer see a significant effect for wealthier families (the point estimates are negative and not significantly different from zero). This is expected given that only 38% of respondents reported positive dowry payments and our main estimates show only an effect on the intensive margin for wealthier families (with a negative but insignificant effect on the extensive margin).

Table 14: Dowry Outcomes Among Respondents with Parental Landholdings of Half an Acre or more (Correcting for Selection)

| | (1) Ln(Joutuk) | | (2) Ln(Joutuk) | |
|---|---|---|---|---|
| | Ln(Joutuk) | Joutuk Paid | Ln(Joutuk) | Joutuk Paid |
| JM bridge X post | 0.301** | -0.156 | | |
| | (0.118) | (0.115) | | |
| JM bridge intensity X post | | | 0.528*** | -0.311 |
| | | | (0.197) | (0.202) |
| JM bridge intensity | | | -1.700 | 2.626** |
| | | | (1.357) | (1.193) |
| Born post '82 | -0.215* | 0.055 | -0.217* | 0.060 |
| | (0.125) | (0.102) | (0.125) | (0.102) |
| Born Dhaka manf. belt | 0.333* | 0.190 | 0.302 | 0.237 |
| | (0.188) | (0.164) | (0.190) | (0.165) |
| Born Dhaka X post | 0.027 | -0.260* | 0.024 | -0.263* |
| | (0.220) | (0.144) | (0.220) | (0.143) |
| Dhaka dist. (10km) | 0.011 | -0.015** | 0.003 | -0.006 |
| | (0.008) | (0.007) | (0.013) | (0.009) |
| Dhaka across river | 0.097 | -0.002 | 0.086 | 0.011 |
| | (0.151) | (0.113) | (0.150) | (0.113) |
| Age | 0.001 | 0.116** | 0.004 | 0.115** |
| | (0.059) | (0.052) | (0.059) | (0.052) |
| Age sq. | -0.001 | -0.002** | -0.001 | -0.002** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Constant | 10.574*** | -1.754** | 10.592*** | -1.832** |
| | (0.896) | (0.748) | (0.899) | (0.754) |
| Observations | 3161 | | 3161 | |
| Dep Var Mean (JM pre83) | 10.598 | | 10.598 | |
| Inverse Mills Ratio | -0.142 | | -0.123 | |
| Inverse Mills Ratio (se) | 0.071 | | 0.066 | |

Note: This table presents the results of a Heckman selection model estimated via MLE. The odd columns depict the coefficients of the main equation, which estimates the effect of the Jamuna Bridge on ln of dowry paid for respondents with parental landholdings of more than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). The selection equation (reported in even columns) includes the following additional covariates (not shown): indicators for whether the respondent's mother worked and whether the respondent is Hindu. Robust standard errors clustered by subdistrict are in parentheses. The table also reports the coefficient on the Inverse Mills Ratio and its standard error. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 15: Dowry Outcomes Among Respondents with Parental Landholdings of Less Than Half an Acre (Correcting for Selection)

| | (1) | | (2) | |
|---|---|---|---|---|
| | Ln(Joutuk) | | Ln(Joutuk) | |
| | Ln(Joutuk) | Joutuk Paid | Ln(Joutuk) | Joutuk Paid |
| JM bridge X post | 0.200 | 0.275** | | |
| | (0.123) | (0.134) | | |
| JM bridge intensity X post | | | 0.320 | 0.401* |
| | | | (0.215) | (0.227) |
| JM bridge intensity | | | -2.498** | 3.245** |
| | | | (1.240) | (1.456) |
| Born post '82 | 0.094 | -0.103 | 0.090 | -0.086 |
| | (0.135) | (0.117) | (0.135) | (0.117) |
| Born Dhaka manf. belt | 0.252 | 0.296 | 0.214 | 0.357* |
| | (0.213) | (0.209) | (0.214) | (0.209) |
| Born Dhaka X post | 0.144 | -0.610*** | 0.137 | -0.614*** |
| | (0.221) | (0.166) | (0.221) | (0.165) |
| Dhaka dist. (10km) | -0.002 | 0.000 | -0.012 | 0.012 |
| | (0.008) | (0.009) | (0.010) | (0.010) |
| Dhaka across river | -0.032 | -0.253* | -0.045 | -0.237* |
| | (0.163) | (0.135) | (0.161) | (0.134) |
| Age | -0.050 | 0.186*** | -0.052 | 0.187*** |
| | (0.066) | (0.057) | (0.066) | (0.057) |
| Age sq. | 0.001 | -0.003*** | 0.001 | -0.003*** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Constant | 11.312*** | -2.469*** | 11.430*** | -2.598*** |
| | (0.842) | (0.777) | (0.855) | (0.782) |
| Observations | 2692 | | 2692 | |
| Dep Var Mean (JM pre83) | 10.211 | | 10.211 | |
| Inverse Mills Ratio | -0.031 | | -0.034 | |
| Inverse Mills Ratio (se) | 0.070 | | 0.071 | |

Note: This table presents the results of a Heckman selection model estimated via MLE. The odd columns depict the coefficients of the main equation, which estimates the effect of the Jamuna Bridge on ln of dowry paid for respondents with parental landholdings of more than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in columns 1 and 2), an alternative continuous treatment intensity measure (in columns 3 and 4), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). The selection equation (reported in even columns) includes the following additional covariates (not shown): indicators for whether the respondent's mother workedand whether the respondent is Hindu. Robust standard errors clustered by subdistrict are in parentheses. The table also reports the coefficient on the Inverse Mills Ratio and its standard error. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 16: Dowry Outcomes Among Respondents with Parental Landholdings of Half an Acre or more (IHS and ln(1+dowry))

| | (1)<br>ihs(Joutuk) | (2)<br>ihs(Joutuk) | (3)<br>Ln(1 + Joutuk) | (4)<br>Ln(1 + Joutuk) |
|---|---|---|---|---|
| JM bridge X post | -0.324 | | -0.289 | |
| | (0.459) | | (0.432) | |
| JM bridge intensity X post | | -0.707 | | -0.637 |
| | | (0.804) | | (0.757) |
| JM bridge intensity | | 8.731* | | 8.118* |
| | | (4.741) | | (4.462) |
| Born post '82 | 0.117 | 0.138 | 0.104 | 0.124 |
| | (0.377) | (0.375) | (0.354) | (0.352) |
| Born Dhaka manf. belt | 1.074 | 1.216* | 1.016 | 1.148* |
| | (0.711) | (0.713) | (0.668) | (0.669) |
| Born Dhaka X post | -1.220* | -1.225* | -1.146* | -1.150* |
| | (0.650) | (0.650) | (0.612) | (0.612) |
| Dhaka dist. (10km) | -0.066** | -0.036 | -0.062** | -0.034 |
| | (0.028) | (0.034) | (0.027) | (0.032) |
| Dhaka across river | 0.024 | 0.063 | 0.025 | 0.062 |
| | (0.492) | (0.495) | (0.462) | (0.464) |
| Age | 0.439** | 0.434** | 0.413** | 0.408** |
| | (0.195) | (0.195) | (0.183) | (0.183) |
| Age sq. | -0.008** | -0.008** | -0.007** | -0.007** |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| Constant | -1.018 | -1.220 | -0.968 | -1.156 |
| | (2.857) | (2.868) | (2.687) | (2.697) |
| Observations | 3166 | 3166 | 3166 | 3166 |
| Dep Variable Mean (Jamuna pre '83) | 7.236 | 7.236 | 6.792 | 6.792 |

Note: This table presents the results of OLS regressions of (alternative) dowry-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of more than half an acre. The specification is identical to that from the main tables. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 17: Dowry Outcomes Among Respondents with Parental Landholdings of Less Than Half an Acre (IHS and ln(1+dowry))

| | (1)<br>ihs(Joutuk) | (2)<br>ihs(Joutuk) | (3)<br>Ln(1 + Joutuk) | (4)<br>Ln(1 + Joutuk) |
|---|---|---|---|---|
| JM bridge X post | 1.520*** | | 1.435*** | |
| | (0.552) | | (0.518) | |
| JM bridge intensity X post | | 2.293** | | 2.169** |
| | | (0.930) | | (0.873) |
| JM bridge intensity | | 12.179** | | 11.358** |
| | | (6.008) | | (5.650) |
| Born post '82 | -0.490 | -0.414 | -0.460 | -0.388 |
| | (0.445) | (0.443) | (0.417) | (0.416) |
| Born Dhaka manf. belt | 1.334 | 1.564* | 1.259 | 1.474* |
| | (0.904) | (0.906) | (0.849) | (0.851) |
| Born Dhaka X post | -2.448*** | -2.469*** | -2.293*** | -2.313*** |
| | (0.717) | (0.715) | (0.675) | (0.673) |
| Dhaka dist. (10km) | 0.003 | 0.047 | 0.003 | 0.044 |
| | (0.035) | (0.037) | (0.033) | (0.035) |
| Dhaka across river | -1.167** | -1.105* | -1.096** | -1.038* |
| | (0.583) | (0.583) | (0.547) | (0.547) |
| Age | 0.714*** | 0.712*** | 0.669*** | 0.667*** |
| | (0.210) | (0.211) | (0.198) | (0.198) |
| Age sq. | -0.013*** | -0.013*** | -0.012*** | -0.012*** |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Constant | -3.634 | -4.029 | -3.391 | -3.761 |
| | (2.887) | (2.895) | (2.712) | (2.720) |
| Observations | 2696 | 2696 | 2696 | 2696 |
| Dep Variable Mean (Jamuna pre '83) | 5.752 | 5.752 | 5.387 | 5.387 |

Note: This table presents the results of OLS regressions of (alternative) dowry-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre. The specification is identical to that from the main tables. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix E: Analysing Dowry Outcomes With An Alternative Control Group

In Table 8 of Section 7.2 we estimate the effect of the Jamuna Bridge on dowry outcomes. However, dowry practices have differed (both historically and today) between the northwestern region of Bangladesh and other parts of the country, which is reflected in the fact that the incidence of dowry marriage is substantially higher in the Jamuna region (63%) than in other parts of the country (30%). In this Section of the Appendix, we replicate our analysis of dowry outcomes using an alternative control group with dowry rates closer to that of the Jamuna region. Specifically, we remove from the analysis southern and eastern Bangladesh, keeping only individuals born in Dhaka division or in one of the nine districts just south of the Jamuna region and proximate to

Dhaka city (Meherpur, Kushtia, Chuadanga, Jhenaidah, Magura, Faridpur, Gopalganj, Madaripur and Shariatpur) in the control group.

The rationale for the choice of the alternative control group is as follows. There is a consensus in the literature that dowry practice is a recent phenomenon in Bangladesh. In the 1970s, it first emerged among the urban middle class and then spread to rural areas with urban-ward migration (Lindenbaum (1981)). The dowry rates in the WiLCAS data reflects this pattern: dowry rates are relatively high in districts proximate to Dhaka (that have historically had high rates of male economic migration towards the capital city) and lower in southern and eastern Bangladesh.

The results, shown in Tables 18 and 19 below, document that our main findings are robust to using this alternative control group: the alternative estimates also imply that the bridge led to higher rates of dowry practice in respondents from lower-wealth families and higher dowry payments in respondents from higher-wealth families (i.e. those whose families owned more than half an acre of land). In some cases the results become only marginally significant (i.e. at the 10% level), which is likely due to a loss of statistical power from the substantially smaller sample size.

Table 18: Dowry Outcomes Among Respondents with Parental Landholdings of Less Than Half an Acre (With Alternative Control Group)

| | (1)<br>Joutuk Paid | (2)<br>Joutuk Paid | (3)<br>Ln(Joutuk) | (4)<br>Ln(Joutuk) |
|---|---|---|---|---|
| JM bridge X post | 0.101$^{*}$<br>(0.058) | | 0.053<br>(0.156) | |
| JM bridge intensity X post | | 0.146<br>(0.099) | | 0.013<br>(0.272) |
| JM bridge intensity | | 1.090$^{*}$<br>(0.616) | | -4.872$^{***}$<br>(1.587) |
| Born post ’82 | -0.059<br>(0.061) | -0.048<br>(0.061) | 0.052<br>(0.176) | 0.069<br>(0.175) |
| Born Dhaka manf. belt | 0.090<br>(0.085) | 0.130<br>(0.088) | 0.309<br>(0.227) | 0.194<br>(0.226) |
| Born Dhaka X post | -0.243$^{***}$<br>(0.069) | -0.248$^{***}$<br>(0.069) | -0.001<br>(0.243) | -0.038<br>(0.242) |
| Dhaka dist. (10km) | -0.004<br>(0.004) | 0.003<br>(0.006) | -0.011<br>(0.010) | -0.042$^{***}$<br>(0.015) |
| Dhaka across river | -0.113$^{**}$<br>(0.052) | -0.103$^{**}$<br>(0.051) | -0.043<br>(0.165) | -0.085<br>(0.158) |
| Age | 0.091$^{***}$<br>(0.028) | 0.092$^{***}$<br>(0.027) | 0.013<br>(0.071) | 0.006<br>(0.073) |
| Age sq. | -0.002$^{***}$<br>(0.000) | -0.002$^{***}$<br>(0.000) | -0.001<br>(0.001) | -0.001<br>(0.001) |
| Constant | -0.595<br>(0.379) | -0.682$^{*}$<br>(0.382) | 10.763$^{***}$<br>(0.879) | 11.129$^{***}$<br>(0.914) |
| Observations | 1518 | 1518 | 785 | 785 |
| Dep Variable Mean (Jamuna pre ’83) | 0.528 | 0.528 | 10.211 | 10.211 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of less than half an acre. The control group in these regressions consists of only those respondents born in Dhaka division or the 9 districts mentioned above. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors’ calculations.

Table 19: Dowry Outcomes Among Respondents with Parental Landholdings of Half an Acre or More (With Alternative Control Group)

| | (1) Joutuk Paid | (2) Joutuk Paid | (3) Ln(Joutuk) | (4) Ln(Joutuk) |
|---|---|---|---|---|
| JM bridge X post | -0.061 | | 0.241* | |
| | (0.050) | | (0.127) | |
| JM bridge intensity X post | | -0.121 | | 0.443** |
| | | (0.087) | | (0.209) |
| JM bridge intensity | | 1.180** | | -4.402*** |
| | | (0.570) | | (1.631) |
| Born post '82 | 0.042 | 0.045 | -0.242* | -0.247* |
| | (0.049) | (0.049) | (0.136) | (0.134) |
| Born Dhaka manf. belt | 0.084 | 0.118* | 0.334* | 0.198 |
| | (0.067) | (0.069) | (0.191) | (0.191) |
| Born Dhaka X post | -0.095 | -0.096 | -0.020 | -0.014 |
| | (0.062) | (0.062) | (0.232) | (0.232) |
| Dhaka dist. (10km) | -0.007** | 0.000 | -0.000 | -0.030* |
| | (0.003) | (0.006) | (0.010) | (0.016) |
| Dhaka across river | -0.003 | 0.006 | 0.087 | 0.043 |
| | (0.044) | (0.045) | (0.145) | (0.142) |
| Age | 0.041* | 0.040 | -0.056 | -0.046 |
| | (0.024) | (0.024) | (0.065) | (0.065) |
| Age sq. | -0.001 | -0.001 | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.001) | (0.001) |
| Constant | -0.148 | -0.199 | 11.413*** | 11.559*** |
| | (0.350) | (0.352) | (0.993) | (0.990) |
| Observations | 1949 | 1949 | 978 | 978 |
| Dep Variable Mean (Jamuna pre '83) | 0.644 | 0.644 | 10.598 | 10.598 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and covariates for respondents with parental landholdings of half an acre or more. The control group in these regressions consists of only those respondents born in Dhaka division or the 9 districts mentioned above. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include division fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

We also reestimate the hedonic dowry equations using this alternative control group. That is, the sample used for the estimations excludes all respondents who were not born in Rajshahi, Rangpur, Dhaka or the 9 districts listed above. The results are presented in Tables 20 and 21 below. The second step estimate for the all urban sample is no longer significant at conventional levels (p-value of 0.115) but, otherwise, the estimated coefficients for the marriage migration variables are close to those obtained in Section 5.

Table 20: Hedonic Equations for Dowries - All Urban Clusters (With Alternative Control Group)

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | Joutuk Paid | Ln(Joutuk) | Ln(Joutuk) | |
| | _ | _ | Ln(Joutuk) | Joutuk Paid |
| Marriage Migration to Urban Area | $0.125^{***}$ | $0.207^{**}$ | 0.149 | |
| | (0.0375) | (0.0916) | (0.115) | |
| Own Initiated Marriage | $-0.246^{***}$ | 0.224 | $0.863^{***}$ | $-0.727^{***}$ |
| | (0.0477) | (0.165) | (0.300) | (0.151) |
| Consang. Marriage | $-0.107^{*}$ | -0.0243 | 0.233 | $-0.315^{*}$ |
| | (0.0602) | (0.168) | (0.235) | (0.173) |
| Marriage Age Gap | $-0.0147^{***}$ | 0.00427 | $0.0358^{*}$ | $-0.0477^{***}$ |
| | (0.00402) | (0.0100) | (0.0190) | (0.0126) |
| Bride Schooling | -0.00551 | $0.101^{***}$ | $0.110^{***}$ | -0.0147 |
| | (0.00620) | (0.0162) | (0.0200) | (0.0168) |
| Groom Schooling | -0.00840 | $0.0493^{***}$ | $0.0658^{***}$ | $-0.0266^{*}$ |
| | (0.00530) | (0.0127) | (0.0184) | (0.0146) |
| Bride's Mother Worked | | | | $0.231^{**}$ |
| | | | | (0.114) |
| Hindu | | | | $0.717^{***}$ |
| | | | | (0.184) |
| Constant | $0.694^{***}$ | $9.805^{***}$ | $9.804^{***}$ | -0.228 |
| | (0.0478) | (0.126) | (0.689) | (0.398) |
| Observations | 882 | 428 | 882 | |
| Inverse Mills Ratio | | | -1.294 | |
| Inverse Mills Ratio (se) | | | 0.420 | |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in all urban clusters. In column 1, a binary indicator for whether 'joutuk' was paid (the part of dowry given directly to the groom) is regressed against marriage migration status and a set of covariates. Other covariates (not shown) include subdistrict fixed effects and parental characteristics. In column 2, ln(joutuk payment) is regressed against the same variables. Column 3 reports the results from a Heckman two-step estimator to account for selection bias (the second step is reported in the first sub-column of column 3). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 21: Hedonic Equations for Dowries - Dhaka Manufacturing Belt (With Alternative Control Group)

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | Joutuk Paid | Ln(Joutuk) | Ln(Joutuk) | |
| | _ | _ | Ln(Joutuk) | Joutuk Paid |
| Marriage Migration to Dhaka | 0.0762 | 0.104 | 0.105 | |
| | (0.0561) | (0.166) | (0.136) | |
| Own Initiated Marriage | -0.309*** | 0.621*** | 0.679** | -1.043*** |
| | (0.0497) | (0.176) | (0.330) | (0.213) |
| Consang. Marriage | -0.0713 | 0.126 | 0.143 | -0.203 |
| | (0.0701) | (0.212) | (0.202) | (0.213) |
| Marriage Age Gap | -0.0105** | 0.00888 | 0.0107 | -0.0336** |
| | (0.00491) | (0.0126) | (0.0142) | (0.0137) |
| Bride Schooling | -0.0106 | 0.0940*** | 0.0954*** | -0.0335* |
| | (0.00773) | (0.0172) | (0.0162) | (0.0193) |
| Groom Schooling | -0.00978 | 0.0361** | 0.0377** | -0.0270 |
| | (0.00628) | (0.0166) | (0.0150) | (0.0169) |
| Bride's Mother Worked | | | | 0.205 |
| | | | | (0.144) |
| Hindu | | | | 1.000*** |
| | | | | (0.328) |
| Constant | 0.650*** | 10.07*** | 10.74*** | 0.351 |
| | (0.0853) | (0.150) | (0.340) | (0.308) |
| Observations | 592 | 269 | 592 | |
| Inverse Mills Ratio | | | -0.0893 | |
| Inverse Mills Ratio (se) | | | 0.359 | |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in the Dhaka manufacturing belt only. In column 1, a binary indicator for whether 'joutuk' was paid (the part of dowry given directly to the groom) is regressed against marriage migration status and a set of covariates. Other covariates (not shown) include subdistrict fixed effects and parental characteristics. In column 2, ln(joutuk payment) is regressed against the same variables. Column 3 reports the results from a Heckman two-step estimator to account for selection bias (the second step is reported in the first sub-column of column 3). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix F: Robustness Test: Repeating DID Analysis Without Covariates

In Tables 5 to 9 of Section 7.2 we estimate the effect of the Jamuna Bridge on various outcomes, including controls to improve the precision of our estimates and to account for possible sources of bias that are not absorbed by the Division fixed effects and post 1983 year of birth dummy. In this section of the Appendix we repeat our DID analysis without any extra covariates - using only the simplest DID specification. In particular, these regressions include only i) the treatment indicator (either a binary indicator for being born in the Jamuna region or a continuous measure based on the size of the detour needed to access the bridge), ii) a post 1983 year of birth dummy, iii) the treatment indicator interacted with the post 1983 dummy, and iv) Division fixed effects. The results, reported in Tables 22 to 31 below, show that our main results are qualitatively unchanged from the specifications with controls.

## Results for Respondents with Parental Handholdings of less than Half an Acre

Table 22: Migration Outcomes

| | (1)<br>Reside Dhaka | (2)<br>Reside Dhaka | (3)<br>Migr Dhaka | (4)<br>Migr Dhaka | (5)<br>Family Migr | (6)<br>Family Migr | (7)<br>Economic Migr | (8)<br>Economic Migr |
|---|---|---|---|---|---|---|---|---|
| JM bridge X post | -0.007<br>(0.027) | | -0.001<br>(0.024) | | -0.017<br>(0.018) | | 0.001<br>(0.017) | |
| JM bridge intensity X post | | -0.009<br>(0.045) | | 0.005<br>(0.042) | | -0.023<br>(0.030) | | 0.002<br>(0.029) |
| JM bridge intensity | | 0.522**<br>(0.263) | | 0.370<br>(0.237) | | 0.157<br>(0.127) | | 0.106<br>(0.167) |
| Born post '82 | 0.115***<br>(0.015) | 0.114***<br>(0.014) | 0.085***<br>(0.014) | 0.083***<br>(0.014) | 0.022**<br>(0.010) | 0.021**<br>(0.010) | 0.059***<br>(0.010) | 0.059***<br>(0.010) |
| Born Dhaka manf. belt | 0.587***<br>(0.051) | 0.586***<br>(0.051) | 0.415***<br>(0.060) | 0.413***<br>(0.060) | 0.433***<br>(0.056) | 0.432***<br>(0.056) | -0.002<br>(0.036) | -0.003<br>(0.036) |
| Born Dhaka X post | 0.021<br>(0.050) | 0.022<br>(0.050) | -0.088<br>(0.074) | -0.086<br>(0.074) | -0.101<br>(0.075) | -0.100<br>(0.075) | -0.001<br>(0.046) | -0.001<br>(0.046) |
| Constant | 0.159***<br>(0.021) | 0.160***<br>(0.021) | 0.141***<br>(0.019) | 0.142***<br>(0.019) | 0.075***<br>(0.013) | 0.076***<br>(0.013) | 0.050***<br>(0.015) | 0.050***<br>(0.015) |
| Observations | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 |
| Dep Variable Mean (Jamuna pre '83) | 0.060 | 0.060 | 0.055 | 0.055 | 0.037 | 0.037 | 0.018 | 0.018 |

Note: This table presents the results of OLS regressions of migration-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 23: Work Outcomes

| | (1)<br>Worked in RMG | (2)<br>Worked in RMG |
|---|---|---|
| JM bridge X post | -0.021<br>(0.035) | |
| JM bridge intensity X post | | -0.038<br>(0.060) |
| JM bridge intensity | | 0.384<br>(0.306) |
| Born post '82 | 0.094***<br>(0.018) | 0.094***<br>(0.018) |
| Born Dhaka manf. belt | 0.005<br>(0.081) | 0.005<br>(0.081) |
| Born Dhaka X post | 0.018<br>(0.088) | 0.019<br>(0.088) |
| Constant | 0.137***<br>(0.023) | 0.138***<br>(0.023) |
| Observations | 1639 | 1639 |
| Dep Variable Mean (Jamuna pre '83) | 0.065 | 0.065 |

Source: 2014 WiLCAS and authors' calculations.

Note: Additional controls (not shown) include parental characteristics and division dummies.

Robust standard errors clustered by subdistrict in parentheses.

Statistical significance denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table presents the results of OLS regressions of work-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 24: Marriage Outcomes

| | (1)<br>Husb Dhaka | (2)<br>Husb Dhaka | (3)<br>Husb Migr Dhaka | (4)<br>Husb Migr Dhaka |
|---|---|---|---|---|
| JM bridge X post | -0.005 | | -0.003 | |
| | (0.008) | | (0.015) | |
| JM bridge intensity X post | | -0.008 | | -0.007 |
| | | (0.014) | | (0.026) |
| JM bridge intensity | | 0.097 | | $0.281^{*}$ |
| | | (0.067) | | (0.145) |
| Born post '82 | 0.007 | 0.007 | $0.051^{***}$ | $0.051^{***}$ |
| | (0.006) | (0.006) | (0.009) | (0.009) |
| Born Dhaka manf. belt | $0.678^{***}$ | $0.678^{***}$ | -0.007 | -0.007 |
| | (0.049) | (0.049) | (0.033) | (0.033) |
| Born Dhaka X post | -0.001 | -0.001 | 0.027 | 0.028 |
| | (0.058) | (0.058) | (0.027) | (0.027) |
| Constant | $0.036^{***}$ | $0.037^{***}$ | $0.055^{***}$ | $0.055^{***}$ |
| | (0.009) | (0.009) | (0.013) | (0.013) |
| Observations | 2696 | 2696 | 2696 | 2696 |
| Dep Variable Mean (Jamuna pre '83) | 0.005 | 0.005 | 0.014 | 0.014 |

Note: This table presents the results of OLS regressions of marriage-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 25: Dowry Outcomes

| | (1) Joutuk Paid | (2) Joutuk Paid | (3) Ln(Joutuk) | (4) Ln(Joutuk) |
|---|---|---|---|---|
| JM bridge X post | 0.122** | | 0.161 | |
| | (0.050) | | (0.131) | |
| JM bridge intensity X post | | 0.183** | | 0.246 |
| | | (0.085) | | (0.228) |
| JM bridge intensity | | 0.776 | | -1.477 |
| | | (0.478) | | (1.042) |
| Born post '82 | 0.022 | 0.024 | 0.188** | 0.199** |
| | (0.022) | (0.022) | (0.087) | (0.086) |
| Born Dhaka manf. belt | 0.119 | 0.120 | 0.291 | 0.299 |
| | (0.081) | (0.081) | (0.218) | (0.218) |
| Born Dhaka X post | -0.214*** | -0.216*** | 0.210 | 0.200 |
| | (0.063) | (0.063) | (0.233) | (0.233) |
| Constant | 0.437*** | 0.435*** | 10.425*** | 10.418*** |
| | (0.028) | (0.028) | (0.110) | (0.110) |
| Observations | 2696 | 2696 | 1043 | 1043 |
| Dep Variable Mean (Jamuna pre '83) | 0.528 | 0.528 | 10.211 | 10.211 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 26: Education Outcomes

| | (1) Educ (yrs) | (2) Educ (yrs) | (3) Educ (yrs) | (4) Educ (yrs) | (5) Sec School | (6) Sec School | (7) Sec School | (8) Sec School |
|---|---|---|---|---|---|---|---|---|
| JM bridge X post | 0.367 | | | | 0.009 | | | |
| | (0.333) | | | | (0.039) | | | |
| JM bridge intensity X post | | 0.722 | | | | 0.025 | | |
| | | (0.609) | | | | (0.069) | | |
| JM bridge X post '87 | | | 0.877*** | | | | 0.041 | |
| | | | (0.313) | | | | (0.042) | |
| JM bridge intensity X post '87 | | | | 1.531*** | | | | 0.072 |
| | | | | (0.548) | | | | (0.073) |
| JM bridge intensity | | -4.562 | | -4.047 | | -0.567 | | -0.528 |
| | | (2.835) | | (2.748) | | (0.360) | | (0.349) |
| Born post '82 | 2.360*** | 2.359*** | | | 0.248*** | 0.248*** | | |
| | (0.187) | (0.186) | | | (0.023) | (0.023) | | |
| Born post '87 | | | 2.112*** | 2.118*** | | | 0.253*** | 0.254*** |
| | | | (0.195) | (0.194) | | | (0.025) | (0.025) |
| Born Dhaka manf. belt | 0.604 | 0.603 | 0.851** | 0.853** | 0.111 | 0.111 | 0.158*** | 0.158*** |
| | (0.538) | (0.538) | (0.382) | (0.381) | (0.072) | (0.072) | (0.050) | (0.050) |
| Born Dhaka X post | -0.247 | -0.247 | | | -0.029 | -0.029 | | |
| | (0.557) | (0.557) | | | (0.084) | (0.084) | | |
| Born Dhaka X post '87 | | | -0.651 | -0.656 | | | -0.125* | -0.126* |
| | | | (0.471) | (0.471) | | | (0.066) | (0.066) |
| Constant | 3.365*** | 3.365*** | 4.036*** | 4.033*** | 0.255*** | 0.254*** | 0.312*** | 0.311*** |
| | (0.244) | (0.244) | (0.237) | (0.237) | (0.031) | (0.031) | (0.030) | (0.030) |
| Observations | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 | 2897 |
| Dep Variable Mean (Jamuna pre '83) | 2.064 | 2.064 | 2.064 | 2.064 | 0.142 | 0.142 | 0.142 | 0.142 |

Note: This table presents the results of OLS regressions of education-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of less than half an acre. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Results for Respondents with Parental Landholdings of Half an Acre or more

Table 27: Migration Outcomes

| | (1) Reside Dhaka | (2) Reside Dhaka | (3) Migr Dhaka | (4) Migr Dhaka | (5) Family Migr | (6) Family Migr | (7) Economic Migr | (8) Economic Migr |
|---|---|---|---|---|---|---|---|---|
| JM bridge X post | 0.053** | | 0.052** | | 0.038*** | | 0.001 | |
| | (0.021) | | (0.021) | | (0.014) | | (0.012) | |
| JM bridge intensity X post | | 0.087** | | 0.090** | | 0.066*** | | 0.001 |
| | | (0.036) | | (0.036) | | (0.025) | | (0.020) |
| JM bridge intensity | | 0.910*** | | 0.656*** | | 0.234 | | 0.179 |
| | | (0.219) | | (0.200) | | (0.144) | | (0.111) |
| Born post '82 | 0.048*** | 0.047*** | 0.045*** | 0.044*** | 0.022*** | 0.021*** | 0.015*** | 0.014*** |
| | (0.010) | (0.010) | (0.010) | (0.010) | (0.007) | (0.007) | (0.004) | (0.004) |
| Born Dhaka manf. belt | 0.810*** | 0.810*** | 0.547*** | 0.546*** | 0.541*** | 0.540*** | -0.012** | -0.012** |
| | (0.044) | (0.044) | (0.064) | (0.064) | (0.065) | (0.065) | (0.006) | (0.006) |
| Born Dhaka X post | -0.123** | -0.121** | -0.034 | -0.032 | -0.033 | -0.033 | 0.031 | 0.031 |
| | (0.053) | (0.053) | (0.073) | (0.073) | (0.075) | (0.075) | (0.022) | (0.022) |
| Constant | 0.063*** | 0.063*** | 0.056*** | 0.057*** | 0.031*** | 0.031*** | 0.012** | 0.012** |
| | (0.013) | (0.013) | (0.013) | (0.013) | (0.008) | (0.008) | (0.006) | (0.006) |
| Observations | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 |
| Dep Variable Mean (Jamuna pre '83) | 0.040 | 0.040 | 0.034 | 0.034 | 0.012 | 0.012 | 0.012 | 0.012 |

Note: This table presents the results of OLS regressions of migration-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 28: Work Outcomes

| | (1)<br>Worked in RMG | (2)<br>Worked in RMG |
|---|---|---|
| JM bridge X post | 0.048** | |
| | (0.024) | |
| JM bridge intensity X post | | 0.081* |
| | | (0.041) |
| JM bridge intensity | | 0.164 |
| | | (0.272) |
| Born post '82 | 0.024* | 0.024* |
| | (0.013) | (0.013) |
| Born Dhaka manf. belt | -0.011 | -0.010 |
| | (0.049) | (0.049) |
| Born Dhaka X post | 0.005 | 0.005 |
| | (0.067) | (0.067) |
| Constant | 0.092*** | 0.092*** |
| | (0.016) | (0.016) |
| Observations | 2108 | 2108 |
| Dep Variable Mean (Jamuna pre '83) | 0.039 | 0.039 |

Note: This table presents the results of OLS regressions of work-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 29: Marriage Outcomes

| | (1)<br>Husb Dhaka | (2)<br>Husb Dhaka | (3)<br>Husb Migr Dhaka | (4)<br>Husb Migr Dhaka |
|---|---|---|---|---|
| JM bridge X post | -0.002 | | 0.034** | |
| | (0.009) | | (0.014) | |
| JM bridge intensity X post | | -0.009 | | 0.057** |
| | | (0.017) | | (0.024) |
| JM bridge intensity | | 0.176** | | 0.195 |
| | | (0.088) | | (0.136) |
| Born post '82 | 0.004 | 0.004 | 0.023*** | 0.023*** |
| | (0.005) | (0.005) | (0.007) | (0.007) |
| Born Dhaka manf. belt | 0.804*** | 0.804*** | 0.024 | 0.024 |
| | (0.044) | (0.044) | (0.026) | (0.026) |
| Born Dhaka X post | -0.069 | -0.070 | -0.051* | -0.051* |
| | (0.059) | (0.059) | (0.031) | (0.031) |
| Constant | 0.022*** | 0.021*** | 0.024*** | 0.024*** |
| | (0.007) | (0.007) | (0.008) | (0.008) |
| Observations | 3166 | 3166 | 3166 | 3166 |
| Dep Variable Mean (Jamuna pre '83) | 0.012 | 0.012 | 0.009 | 0.009 |

Note: This table presents the results of OLS regressions of marriage-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 30: Dowry Outcomes

| | (1) Joutuk Paid | (2) Joutuk Paid | (3) Ln(Joutuk) | (4) Ln(Joutuk) |
|---|---|---|---|---|
| JM bridge X post | -0.049 | | 0.345*** | |
| | (0.040) | | (0.129) | |
| JM bridge intensity X post | | -0.103 | | 0.614*** |
| | | (0.070) | | (0.215) |
| JM bridge intensity | | 1.050*** | | -2.686*** |
| | | (0.341) | | (0.966) |
| Born post '82 | 0.032 | 0.033 | 0.085 | 0.089 |
| | (0.021) | (0.021) | (0.094) | (0.094) |
| Born Dhaka manf. belt | 0.108* | 0.109* | 0.228 | 0.230 |
| | (0.062) | (0.062) | (0.202) | (0.202) |
| Born Dhaka X post | -0.090 | -0.091 | 0.014 | 0.010 |
| | (0.057) | (0.057) | (0.256) | (0.256) |
| Constant | 0.400*** | 0.399*** | 10.480*** | 10.477*** |
| | (0.027) | (0.027) | (0.095) | (0.094) |
| Observations | 3166 | 3166 | 1209 | 1209 |
| Dep Variable Mean (Jamuna pre '83) | 0.644 | 0.644 | 10.598 | 10.598 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 31: Education Outcomes

| | (1)<br>Educ (yrs) | (2)<br>Educ (yrs) | (3)<br>Educ (yrs) | (4)<br>Educ (yrs) | (5)<br>Sec School | (6)<br>Sec School | (7)<br>Sec School | (8)<br>Sec School |
|---|---|---|---|---|---|---|---|---|
| JM bridge X post | 0.823** | | | | 0.069 | | | |
| | (0.359) | | | | (0.044) | | | |
| JM bridge intensity X post | | 1.360** | | | | 0.118 | | |
| | | (0.623) | | | | (0.075) | | |
| JM bridge X post '87 | | | 1.141*** | | | | 0.148*** | |
| | | | (0.309) | | | | (0.039) | |
| JM bridge intensity X post '87 | | | | 2.007*** | | | | 0.260*** |
| | | | | (0.525) | | | | (0.067) |
| JM bridge intensity | | -9.793*** | | -8.175*** | | -1.264*** | | -1.114*** |
| | | (2.696) | | (2.977) | | (0.366) | | (0.392) |
| Born post '82 | 2.216*** | 2.247*** | | | 0.282*** | 0.285*** | | |
| | (0.174) | (0.174) | | | (0.022) | (0.022) | | |
| Born post '87 | | | 1.993*** | 1.998*** | | | 0.225*** | 0.226*** |
| | | | (0.157) | (0.157) | | | (0.022) | (0.022) |
| Born Dhaka manf. belt | 0.000 | 0.020 | 0.193 | 0.195 | -0.010 | -0.008 | 0.016 | 0.016 |
| | (0.594) | (0.595) | (0.497) | (0.497) | (0.071) | (0.071) | (0.061) | (0.061) |
| Born Dhaka X post | 0.006 | -0.025 | | | -0.015 | -0.018 | | |
| | (0.487) | (0.487) | | | (0.067) | (0.067) | | |
| Born Dhaka X post '87 | | | -0.443 | -0.448 | | | -0.091 | -0.092 |
| | | | (0.547) | (0.547) | | | (0.072) | (0.072) |
| Constant | 3.952*** | 3.932*** | 4.618*** | 4.616*** | 0.312*** | 0.310*** | 0.407*** | 0.407*** |
| | (0.201) | (0.200) | (0.166) | (0.166) | (0.023) | (0.023) | (0.020) | (0.020) |
| Observations | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 | 3340 |
| Dep Variable Mean (Jamuna pre '83) | 4.022 | 4.022 | 4.022 | 4.022 | 0.337 | 0.337 | 0.337 | 0.337 |

Note: This table presents the results of OLS regressions of education-related outcome variables against treatment variables of interest and a pared-down set of covariates for respondents with parental landholdings of half an acre or more. Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982. Other covariates include only division fixed effects and a post 1983 year of birth dummy (as described above). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix G: Robustness Test: Repeating DID Analysis Among Respondents 24 Years and Older

In Tables 5 to 9 of Section 7.2 we estimate the effect of the Jamuna Bridge on various outcomes using the full sample of respondents aged 20 to 39. Among this sample, only 6% have never been married. Nevertheless, it is possible that there is some censoring in the data, as some younger individuals may not have completed their marriage and migration decisions by the time they are surveyed. In order to mitigate this concern, we repeat our DID analysis using only those aged 24 and older - among whom only 2% have never been married. Aside from this change to the sample, the specifications are identical to those reported in Section 7.2 . The results, reported in Tables 32 to 36 below, show that most of our main results are qualitatively unchanged from the primary specifications, albeit with some loss of power. In two cases (worked in RMG and husband migrated to Dhaka), the estimated effect sizes are half of those in the original specifications and no longer statistically significant. The implications of these results are discussed in Section 7.5 .

Table 32: Migration Outcomes

| | (1)<br>Reside Dhaka | (2)<br>Reside Dhaka | (3)<br>Migr Dhaka | (4)<br>Migr Dhaka | (5)<br>Family Migr | (6)<br>Family Migr | (7)<br>Economic Migr | (8)<br>Economic Migr |
|---|---|---|---|---|---|---|---|---|
| *Panel A:*<br>*Below land threshold* | | | | | | | | |
| JM bridge X post | 0.016<br>(0.027) | | 0.012<br>(0.025) | | -0.008<br>(0.019) | | 0.006<br>(0.017) | |
| JM bridge intensity<br>X post | | 0.037<br>(0.045) | | 0.032<br>(0.044) | | -0.006<br>(0.032) | | 0.014<br>(0.029) |
| Born Dhaka X post | 0.065<br>(0.052) | 0.068<br>(0.052) | -0.072<br>(0.073) | -0.070<br>(0.073) | -0.078<br>(0.078) | -0.076<br>(0.078) | 0.022<br>(0.048) | 0.023<br>(0.048) |
| Observations | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 |
| Dep Variable Mean<br>(Jamuna pre '83) | 0.060 | 0.060 | 0.055 | 0.055 | 0.037 | 0.037 | 0.018 | 0.018 |
| *Panel B:*<br>*Above land threshold* | | | | | | | | |
| JM bridge X post | 0.044**<br>(0.020) | | 0.049**<br>(0.021) | | 0.031**<br>(0.015) | | 0.008<br>(0.012) | |
| JM bridge intensity<br>X post | | 0.084**<br>(0.036) | | 0.096**<br>(0.038) | | 0.059**<br>(0.026) | | 0.015<br>(0.022) |
| Born Dhaka X post | -0.134**<br>(0.055) | -0.131**<br>(0.054) | -0.022<br>(0.066) | -0.019<br>(0.066) | -0.015<br>(0.066) | -0.014<br>(0.066) | 0.006<br>(0.013) | 0.007<br>(0.013) |
| Observations | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 |
| Dep Variable Mean<br>(Jamuna pre '83) | 0.040 | 0.040 | 0.034 | 0.034 | 0.012 | 0.012 | 0.012 | 0.012 |

Note: This table presents the results of OLS regressions of migration-related outcome variables against treatment variables of interest and covariates for respondents older than 23 with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). Treatment variables include a binary indicator for being born in the Jamuna region post 1982 (in odd columns), an alternative continuous treatment intensity measure (in even columns), and a binary indicator for being born in the Dhaka manufacturing belt post 1982 (not shown). Other covariates (not shown) include division fixed effects, respondent characteristics (age, age squared, religion, distance from place of birth to Dhaka, and a dummy indicating whether a river separates place of birth from Dhaka) and parental characteristics (mother's education, father's education, parental landholdings, status of father's occupation). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 33: Work Outcomes

| | (1) Worked in RMG | (2) Worked in RMG |
|---|---|---|
| *Panel A: Below land threshold* | | |
| JM bridge X post | -0.008 | |
| | (0.038) | |
| JM bridge intensity X post | | -0.017 |
| | | (0.064) |
| Born Dhaka X post | 0.029 | 0.031 |
| | (0.082) | (0.082) |
| Observations | 1295 | 1295 |
| Dep Variable Mean (Jamuna pre '83) | 0.065 | 0.065 |
| *Panel B: Above land threshold* | | |
| JM bridge X post | 0.024 | |
| | (0.025) | |
| JM bridge intensity X post | | 0.044 |
| | | (0.044) |
| Born Dhaka X post | -0.034 | -0.033 |
| | (0.064) | (0.064) |
| Observations | 1775 | 1775 |
| Dep Variable Mean (Jamuna pre '83) | 0.039 | 0.039 |

Note: This table presents the results of OLS regressions of work-related outcome variables against treatment variables of interest and covariates for respondents older than 23 with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification (including treatment variables and covariates) is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 34: Marriage Outcomes

| | (1) Husb Dhaka | (2) Husb Dhaka | (3) Husb Migr Dhaka | (4) Husb Migr Dhaka |
|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | |
| JM bridge X post | -0.005 | | 0.006 | |
| | (0.009) | | (0.016) | |
| JM bridge intensity X post | | -0.007 | | 0.009 |
| | | (0.016) | | (0.027) |
| Born Dhaka X post | -0.009 | -0.008 | 0.043* | 0.044* |
| | (0.058) | (0.058) | (0.025) | (0.026) |
| Observations | 2161 | 2161 | 2161 | 2161 |
| Dep Variable Mean (Jamuna pre '83) | 0.005 | 0.005 | 0.014 | 0.014 |
| *Panel B: Above land threshold* | | | | |
| JM bridge X post | -0.001 | | 0.019 | |
| | (0.009) | | (0.014) | |
| JM bridge intensity X post | | -0.009 | | 0.038 |
| | | (0.017) | | (0.024) |
| Born Dhaka X post | -0.096* | -0.096* | -0.038 | -0.037 |
| | (0.057) | (0.057) | (0.033) | (0.033) |
| Observations | 2708 | 2708 | 2708 | 2708 |
| Dep Variable Mean (Jamuna pre '83) | 0.012 | 0.012 | 0.009 | 0.009 |

Note: This table presents the results of OLS regressions of marriage-related outcome variables against treatment variables of interest and covariates for respondents older than 23 with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 35: Dowry Outcomes

| | (1) Joutuk Paid | (2) Joutuk Paid | (3) Ln(Joutuk) | (4) Ln(Joutuk) |
|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | |
| JM bridge X post | 0.123** | | 0.089 | |
| | (0.049) | | (0.128) | |
| JM bridge intensity X post | | 0.186** | | 0.140 |
| | | (0.084) | | (0.223) |
| Born Dhaka X post | -0.235*** | -0.236*** | 0.233 | 0.227 |
| | (0.066) | (0.066) | (0.243) | (0.243) |
| Observations | 2161 | 2161 | 836 | 836 |
| Dep Variable Mean (Jamuna pre '83) | 0.528 | 0.528 | 10.211 | 10.211 |
| *Panel B: Above land threshold* | | | | |
| JM bridge X post | -0.055 | | 0.257** | |
| | (0.043) | | (0.123) | |
| JM bridge intensity X post | | -0.109 | | 0.446** |
| | | (0.075) | | (0.209) |
| Born Dhaka X post | -0.099 | -0.099 | -0.046 | -0.047 |
| | (0.061) | (0.060) | (0.240) | (0.241) |
| Observations | 2708 | 2708 | 1043 | 1043 |
| Dep Variable Mean (Jamuna pre '83) | 0.644 | 0.644 | 10.598 | 10.598 |

Note: This table presents the results of OLS regressions of dowry-related outcome variables against treatment variables of interest and covariates for respondents older than 23 with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

## Table 36: Education Outcomes

| | (1) Educ (yrs) | (2) Educ (yrs) | (3) Educ (yrs) | (4) Educ (yrs) | (5) Sec School | (6) Sec School | (7) Sec School | (8) Sec School |
|---|---|---|---|---|---|---|---|---|
| *Panel A: Below land threshold* | | | | | | | | |
| JM bridge X post | 0.058 | | | | -0.013 | | | |
| | (0.328) | | | | (0.038) | | | |
| JM bridge intensity X post | | 0.240 | | | | -0.004 | | |
| | | (0.573) | | | | (0.067) | | |
| JM bridge X post '87 | | | 0.463 | | | | -0.005 | |
| | | | (0.361) | | | | (0.052) | |
| JM bridge intensity X post '87 | | | | 0.787 | | | | -0.016 |
| | | | | (0.644) | | | | (0.090) |
| Born Dhaka X post | 0.402 | 0.393 | | | 0.053 | 0.051 | | |
| | (0.590) | (0.589) | | | (0.086) | (0.085) | | |
| Observations | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 | 2220 |
| Dep Variable Mean (Jamuna pre '83) | 2.064 | 2.064 | 2.064 | 2.064 | 0.142 | 0.142 | 0.142 | 0.142 |
| *Panel B: Above land threshold* | | | | | | | | |
| JM bridge X post | 0.696** | | | | 0.052 | | | |
| | (0.322) | | | | (0.041) | | | |
| JM bridge intensity X post | | 1.156** | | | | 0.086 | | |
| | | (0.568) | | | | (0.071) | | |
| JM bridge X post '87 | | | 1.261*** | | | | 0.173*** | |
| | | | (0.328) | | | | (0.047) | |
| JM bridge intensity X post '87 | | | | 2.240*** | | | | 0.303*** |
| | | | | (0.572) | | | | (0.081) |
| Born Dhaka X post | -0.032 | -0.068 | | | -0.043 | -0.046 | | |
| | (0.601) | (0.600) | | | (0.081) | (0.080) | | |
| Observations | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 | 2759 |
| Dep Variable Mean (Jamuna pre '83) | 4.022 | 4.022 | 4.022 | 4.022 | 0.337 | 0.337 | 0.337 | 0.337 |

Note: This table presents the results of OLS regressions of education-related outcome variables against treatment variables of interest and covariates for respondents older than 23 with parental landholdings of less than half an acre (Panel A) and more than half an acre (Panel B). The specification is identical to that from the previous table, except that it includes two additional treatment variables: a binary indicator for being born in the Jamuna region post 1987, and a corresponding continuous treatment intensity measure. Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

# Appendix H: Technical details for the identification strategy of Section 6

Our empirical strategy in Section 6 is to use a difference-in-differences methodology by comparing outcomes (i) between individuals born in the treated regions versus untreated regions, and (ii) between younger cohorts and older cohorts – on the assumption that some younger cohorts were born late enough to have been affected by the bridge when making their decisions regarding marriage/migration while older cohorts had already made these decisions before the bridge was constructed. In particular, we assume that the bridge only affected individuals if they were 15 years of age or younger in 1998 – the year in which the bridge opened to the public. The rationale for this age cut-off is spelled out in Section 6.

We provide here a formal description of our empirical strategy and our identification assumptions, for which the goal is to estimate the effect of a treatment (lower migration costs) on a range of outcomes related to marriage, work and migration. Let us denote by $Y^0_{irt}$ and $Y^1_{irt}$ the potential outcome for individual $i$ born in region $r$ and year $t$ in the absence and presence of the treatment, respectively. We denote by $Y_{irt}$ the observed outcome of interest given by $Y_{irt} = Y^0_{irt}(1 - D_{irt}) + Y^1_{irt} \times D_{irt}$ , where $D_{irt}$ is a binary indicator which takes a value of $1$ if individual $i$ has been treated and $0$ otherwise. We let $D_{irt} = D_i(r, t)$ where

$$\begin{aligned} D_i(r,t) &= 1 \text{ if } t \geq 1983 \text{ and } r = \text{Jamuna} \\ D_i(r,t) &= 0 \text{ otherwise} \end{aligned}$$

We assume that the conditional expectation functions of the potential outcomes can be modeled with the following (linear, additive) structure:

$$\begin{aligned} E[Y_{0irt}|r,t,\mathbf{X}_{irt}] &= \gamma_r + \lambda_t + \mathbf{X}_{irt}\beta \\ E[Y_{1irt}|r,t,\mathbf{X}_{irt}] &= E[Y_{0irt}|r,t,\mathbf{X}_{irt}] + \rho \end{aligned} \tag{14}$$

where $\mathbf{X}_{irt}$ is a vector of individual $i$'s observable, predetermined characteristics (i.e. they are not affected by the treatment, and may include characteristics such as parental education, parental landholdings, religion, etc.); $\gamma_r$ and $\lambda_t$ represent region and birth-year fixed effects (respectively), and the treatment effect, $\rho$, is assumed to be constant and additive.[49] The observed outcome, $Y_{irt}$, can then be written:

$$Y_{irt} = \gamma_r + \lambda_t + \mathbf{X}_{irt}\beta + \rho D_{irt} + \varepsilon_{irt} \tag{15}$$

where $\varepsilon_{irt} = Y_{irt} - E[Y_{irt}|r,t,\mathbf{X}_{irt}]$ and $E[\varepsilon_{irt}|r,t,\mathbf{X}_{irt}] = 0$. The usual assumption to justify the

[49] Thus we rule out treatment heterogeneity.

DID approach is that the treated and control groups would have had common parallel trends in the absence of treatment, conditional on covariates:

$$\begin{aligned} E[Y^0_{irPost}|r,t,\mathbf{X}_{irt},D_{irt}=1]-E[Y^0_{irPre}|r,t,\mathbf{X}_{irt},D_{irt}=1]=\\ E[Y^0_{irPost}|r,t,\mathbf{X}_{irt},D_{irt}=0]-E[Y^0_{irPre}|r,t,\mathbf{X}_{irt},D_{irt}=0] \end{aligned} \tag{16}$$

where $t = Post$ for cohorts born in or after 1983 and $t = Pre$ for cohorts born before 1983. Under the formulation above (i.e. equation 14), this assumption is guaranteed to be satisfied. In terms of the regression equation (15), this assumption amounts to the following:

$$\begin{aligned} E[\varepsilon_{irPost}|r,t,\mathbf{X}_{irt},D_{irt}=1]-E[\varepsilon_{irPre}|r,t,\mathbf{X}_{irt},D_{irt}=1]=\\ E[\varepsilon_{irPost}|r,t,\mathbf{X}_{irt},D_{irt}=0]-E[\varepsilon_{irPre}|r,t,\mathbf{X}_{irt},D_{irt}=0] \end{aligned} \tag{17}$$

In other words, the change in the mean of the error term across cohorts should be independent of treatment status, conditional on region of birth, year of birth and covariates $\mathbf{X}_{irt}$. We have thus chosen the elements of $\mathbf{X}_{irt}$ such that they include measurable factors that are 1) likely to influence potential outcomes (regarding marriage, work or migration) and 2) may be changing over time at different rates between the treated and untreated regions. In particular, $\mathbf{X}_{irt}$ is a vector of predetermined individual characteristics including age, age-squared, religion, parental characteristics (mother and father's education, landholdings and occupation type), geographic distance from the individual's place of birth to the manufacturing belt around Dhaka, and a dummy indicating whether reaching the manufacturing belt involves crossing a river.[50]

Our regression equation follows directly from Equation 15 and takes the following form:

$$Y_{irt} = \delta_1 JM_r + \delta_2 MB_r + \gamma Post_t + \theta_1(Post_t \times JM_r) + \theta_2(Post_t \times MB_r) + \gamma_r + \mathbf{X_{irt}}\beta + \varepsilon_{irt} \tag{18}$$

where $JM_r$ indicates whether an individual was born in the region that the Jamuna Bridge connects to Dhaka, $MB_r$ indicates whether the individual was born in the Dhaka manufacturing belt, $Post_t$ is a binary variable indicating whether an individual born in year $t$ (i.e. in cohort $t$) was aged 15 or less in 1998.[51] We denote by $\gamma_r$ a full set of Division fixed effects, with Dhaka Division being the excluded category.[52] Again, the rationale for including controls for birth in

[50]We do not control for the individual's education or occupation as these factors were potentially affected by access to the bridge.

[51]In some specifications – namely those involving educational attainment – this variable may indicate whether cohort $t$ was aged 10 or less in 1998, because decisions to drop out or remain in school may have been taken prior to age 15 but unlikely before age 10. In the WiLCAS data, among women who enrolled in school, just 6% drop out before age 10 while 76% drop out by age 15.

[52]Although some parts of Rangpur Division lie east of the Jamuna river, all the WiLCAS respondents born in north-western Bangladesh (Rangpur and Rajshahi Divisions) were born west of the river. Therefore the binary version of the $JM_r$ variable corresponds exactly with the Rangpur and Rajshahi Divisions and so, in estimating the equation

the Dhaka manufacturing belt and its interaction with the variable $Post_t$ is based on Proposition 4 which predicts that a decline in the cost of rural-urban migration will affect urban families in addition to rural families.[53] Finally, $\varepsilon_{irt}$ is the error term. In our primary specifications standard errors are clustered at the sub-district ('upazila') level, using the sub-district where the individual was born.

Table 37: Comparison of Covariate Means, Jamuna versus other Regions

| Variable | (1) Non-Jamuna Mean/SE | (2) Dhaka Manf. Belt Mean/SE | (3) Jamuna Region Mean/SE | Normalized difference (1)-(2) | (1)-(3) | (2)-(3) |
|---|---|---|---|---|---|---|
| Schooling | 5.333 | 5.432 | 5.050 | -0.027 | 0.074 | 0.097 |
| | (0.057) | (0.185) | (0.099) | | | |
| Non-Muslim | 0.121 | 0.073 | 0.113 | 0.148 | 0.022 | -0.131 |
| | (0.005) | (0.013) | (0.008) | | | |
| Father's Education | 3.026 | 3.106 | 2.719 | -0.021 | 0.080 | 0.100 |
| | (0.059) | (0.200) | (0.096) | | | |
| Mother's Education | 1.686 | 2.030 | 1.378 | -0.121 | 0.111 | 0.241 |
| | (0.043) | (0.152) | (0.065) | | | |
| Father's Landholdings | 1.356 | 0.995 | 1.575 | 0.139 | -0.078 | -0.199 |
| | (0.041) | (0.076) | (0.079) | | | |
| Father landless | 0.055 | 0.048 | 0.049 | 0.032 | 0.029 | -0.004 |
| | (0.004) | (0.011) | (0.005) | | | |
| Father in low pay occ. | 0.212 | 0.154 | 0.239 | 0.142 | -0.067 | -0.205 |
| | (0.006) | (0.018) | (0.011) | | | |
| Mother employed | 0.243 | 0.318 | 0.308 | -0.173 | -0.146 | 0.023 |
| | (0.007) | (0.023) | (0.012) | | | |
| N | 4245 | 396 | 1596 | | | |

Note: This table presents mean values of pre-determined individual characteristics (respondents' schooling, religion and parental characteristics) for all cohorts by region (Jamuna Region, Dhaka manufacturing belt and other regions), along with normalised differences between group pairs. Standard errors are in parentheses. Source: 2014 WiLCAS Survey.

with division fixed effects, we drop the $JM_r$ variable.

[53]Note that the "Dhaka manufacturing belt" consists of a smaller area than Dhaka Division. In our sample, the former consists of towns located in the districts of Dhaka, Gazipur, Narayanganj and Tangail, while the later includes both urban and rural locations in all 17 districts located within the Division.

# Appendix I: Supplementary Tables

In this section of the appendix we present tables that are referenced in the main text of the paper:

Table 38: Characteristics of Female Economic Migrants

| | Non-Migrant | Economic Migrant | difference | p-value |
|---|---|---|---|---|
| Respondent's Age | 29.231 | 25.745 | 3.486 | (0.000) |
| Years of Schooling | 5.276 | 5.137 | 0.139 | (0.476) |
| Attended Sec. School | 0.476 | 0.444 | 0.033 | (0.200) |
| Currently Married | 0.917 | 0.517 | 0.399 | (0.000) |
| Divorced | 0.017 | 0.245 | -0.228 | (0.000) |
| Widowed | 0.013 | 0.022 | -0.009 | (0.129) |
| Father's Schooling | 2.979 | 2.569 | 0.411 | (0.038) |
| Mother's Schooling | 1.630 | 1.615 | 0.014 | (0.920) |
| Father in Low Paid Occ. | 0.210 | 0.287 | -0.077 | (0.000) |
| Mother Worked | 0.264 | 0.270 | -0.005 | (0.811) |
| Parental Landholding | 1.440 | 0.667 | 0.773 | (0.000) |

Note: The table shows the mean value for each characteristic, with female respondents grouped according to whether they have experienced at least one episode of economic migration or not. An 'economic migration' episode means moving out of the village/ward for a period of 6 months or more for economic reasons. N=408 for economic migrants and 5,852 for non-migrants. Source: 2014 WiLCAS Survey.

Table 39: Hedonic Equations for Dowries - Dhaka Manufacturing Belt

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | Joutuk Paid | Ln(Joutuk) | Ln(Joutuk) | |
| | _ | _ | Ln(Joutuk) | Joutuk Paid |
| Marriage Migration to Dhaka | 0.0573 | 0.0858 | 0.0901 | |
| | (0.0571) | (0.165) | (0.134) | |
| Own Initiated Marriage | -0.278*** | 0.596*** | 0.690*** | -0.974*** |
| | (0.0452) | (0.172) | (0.266) | (0.192) |
| Consang. Marriage | -0.105* | 0.124 | 0.166 | -0.292 |
| | (0.0601) | (0.190) | (0.196) | (0.193) |
| Marriage Age Gap | -0.0111** | 0.0120 | 0.0153 | -0.0372*** |
| | (0.00471) | (0.0125) | (0.0132) | (0.0132) |
| Bride Schooling | -0.0100 | 0.0905*** | 0.0927*** | -0.0325* |
| | (0.00707) | (0.0159) | (0.0151) | (0.0180) |
| Groom Schooling | -0.0115** | 0.0408*** | 0.0441*** | -0.0319** |
| | (0.00572) | (0.0154) | (0.0139) | (0.0155) |
| Bride's Mother Worked | | | | 0.318** |
| | | | | (0.134) |
| Hindu | | | | 1.207*** |
| | | | | (0.311) |
| Constant | 0.651*** | 10.07*** | 10.77*** | 0.403 |
| | (0.0866) | (0.148) | (0.302) | (0.306) |
| Observations | 697 | 295 | 697 | |
| Inverse Mills Ratio | | | -0.155 | |
| Inverse Mills Ratio (se) | | | 0.263 | |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in the Dhaka manufacturing belt only. In column 1, a binary indicator for whether 'joutuk' was paid (the part of dowry given directly to the groom) is regressed against marriage migration status and a set of covariates. Other covariates (not shown) include subdistrict fixed effects and parental characteristics. In column 2, ln(joutuk payment) is regressed against the same variables. Column 3 reports the results from a Heckman two-step estimator to account for selection bias (the second step is reported in the first sub-column of column 3). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 40: Hedonic Equations for IHS of Dowry Amounts - All Urban Clusters

| | (1)<br>Ln(1 + Joutuk) | (2)<br>ihs(Joutuk) |
|---|---|---|
| Marriage<br>Migration to Urban Area | 1.368*** | 1.447*** |
| | (0.338) | (0.359) |
| Own Initiated<br>Marriage | -2.122*** | -2.258*** |
| | (0.454) | (0.482) |
| Consang.<br>Marriage | -1.088** | -1.161** |
| | (0.519) | (0.552) |
| Marriage Age Gap | -0.102** | -0.109** |
| | (0.0396) | (0.0420) |
| Bride Schooling | -0.0162 | -0.0201 |
| | (0.0533) | (0.0567) |
| Groom Schooling | -0.0604 | -0.0654 |
| | (0.0451) | (0.0480) |
| Constant | 5.876*** | 6.284*** |
| | (0.498) | (0.530) |
| Observations | 1326 | 1326 |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in all urban clusters. In columns 1 and 2, the outcome variables are ln(1 + joutuk) and ihs(joutuk), respectively, where ihs is the inverse hyperbolic sine function and 'joutuk' refers to the part of the dowry given directly to the groom. Both outcomes are regressed against marriage migration status and a set of covariates, which include subdistrict fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.

Table 41: Hedonic Equations for IHS of Dowry Amounts - Dhaka Manufacturing Belt

| | (1)<br>Ln(1 + Joutuk) | (2)<br>ihs(Joutuk) |
|---|---|---|
| Marriage<br>Migration to Urban Area | 0.544<br>(1.265) | 0.586<br>(1.345) |
| Own Initiated<br>Marriage | -2.950***<br>(0.519) | -3.144***<br>(0.550) |
| Consang.<br>Marriage | -1.109<br>(0.679) | -1.183<br>(0.720) |
| Marriage Age Gap | -0.112**<br>(0.0531) | -0.120**<br>(0.0564) |
| Bride Schooling | -0.0698<br>(0.0772) | -0.0770<br>(0.0820) |
| Groom Schooling | -0.108*<br>(0.0624) | -0.115*<br>(0.0663) |
| Constant | 6.864***<br>(1.196) | 7.321***<br>(1.271) |
| Observations | 697 | 697 |

Note: This table presents the results from estimating hedonic equations for dowries among individuals living in the Dhaka manufacturing belt only. In columns 1 and 2, the outcome variables are ln(1 + joutuk) and ihs(joutuk), respectively, where ihs is the inverse hyperbolic sine function and 'joutuk' refers to the part of the dowry given directly to the groom. Both outcomes are regressed against marriage migration status and a set of covariates, which include subdistrict fixed effects and parental characteristics (not shown). Robust standard errors clustered by subdistrict are in parentheses. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Source: 2014 WiLCAS and authors' calculations.