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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 non-agricultural industries. However, women may be able to circumvent such restrictions by using marriage to engage in long-distance migration - if they are able to match with migrating grooms. Guided by a theoretical model in which women make marriage and migration decisions jointly, we hypothesize that marriage and labour markets will be inextricably linked by the possibility of marital migration. To test our hypotheses, we use the event of the construction of a major bridge in Bangladesh – which dramatically reduced travel time between the economically deprived north-western region and the manufacturing belt located around the capital city Dhaka – as a source of plausibly exogenous variation in migration costs. Our empirical findings support our model's main predictions and provide strong evidence for the existence of social barriers to female migration.

JEL Classification: J12, J16, J61, O15, O18, R23

Keywords: migration, marriage markets, female labour force participation, gender norms

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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. However, 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. In traditional societies, prevailing gender norms can restrict female work participation and independent (i.e. without a family) migration (Thadani and Todaro, 1984), which suggests that women may be more limited than men in their ability to take advantage of economic opportunities in urban non-agricultural industries. On the other hand, it is well-documented that marriage is an important vehicle for female long-distance migration in patrilocal societies (e.g. Rosenzweig and Stark, 1989). It is thus possible that marriage may serve as a means by which women can circumvent restrictions on their mobility in order to access economic opportunities in urban areas.

In this paper, we explore these issues theoretically, by developing a model of rural-urban migration with marriage and labour markets; and empirically, using the construction of a major bridge in Bangladesh as a natural experiment that generated exogenous variation in migration costs over time and across regions. The theoretical model combines elements of Harris and Todaro (1970)'s model of rural-urban migration with a model of marriage markets with endogenous property rights over dowries, based on Anderson and Bidner (2015). In the model we formalise the notion of social barriers to female independent migration to urban areas as a social cost associated with pre-marriage female migration (on top of the standard economic costs) and premarriage search on the urban marriage market.

We show that in the presence of such social barriers, 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 rural-born migrating grooms and urban-born grooms (with the same level of human capital).

To test some of the predictions of the model, we take advantage of a natural experiment. In 1998, a major bridge 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.¹ 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 these alternative hypotheses, 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) male and 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 later cohorts in our sample could make mar-

¹For 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.

riage and other decisions in response to the bridge opening but earlier cohorts could not. These 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 percentage points), work in the urban manufacturing sector, and pay a higher dowry. There is a statistically significant effect on marriage-related migration (3.6 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 and men 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 broadly 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 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 taking direct advantage of 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.

The paper contributes to a number of different strands in the literature. First, we contribute

to the large theoretical literature on marriage markets and marriage-related transfers (see, for example, Becker, 1981; Rao, 1993; Zhang and Chan, 1999; Botticini and Siow, 2003; Anderson, 2003, 2007; Iyigun and Walsh, 2007; Anderson and Bidner, 2015) by extending existing models to a setting in which marriage and labour markets are segmented, and individuals can choose between them through a (potentially costly) migration decision. Second, 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. 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.²

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 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, specifi-

²A 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.

cally 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 marriagemigration decisions formed part of a risk-sharing strategy between bride-sending and bridereceiving 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 for evidence of social norms that constrain female independent migration 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. Γ_{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.³ For ease of analysis, we abstract away from the option of choosing singlehood.⁴

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

$$P_M = P_L = o: c = 0$$

$$P_M = o \neq P_L: c = \mu$$

$$P_M \neq o = P_L: c = \sigma$$

$$P_M = P_L \neq o: c = \mu + \zeta_q \sigma$$

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 μ and if the marriage market does not match the origin location, there is a 'search cost' σ . If the marriage market does not match the origin location but does correspond to the location of the labour market, the search cost equals $\zeta_g \sigma$ where ζ_g is a gender-specific parameter.

³Thus, we don't allow a husband and a wife to participate in different labour markets.

⁴If 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.

The parameter μ 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, for example, because of poor infrastructure, then this has a multiplicative effect on the cost of permanent migration.

If $\zeta_g < 1$, this means that the marriage market search costs are lower if an individual opts for the labour market in the same location. We interpret ζ_g as follows. When a family opts to marry the offspring in a marriage market away from the origin but in the same location as its labour market of choice, this can potentially lower marriage search costs, because the offspring can migrate first, begin employment, and form social ties that facilitates a subsequent marriage market search. However, such a strategy may not be viable if migration before marriage is not socially approved, in which case the marriage market search has to be initiated – and the match made – before migration takes place. 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

$$C_{p} = \begin{cases} W - h_{m}/\theta_{m} \text{ in male families} \\ W - h_{f}/\theta_{f} - \tau \text{ in female families} \end{cases}$$

$$C_{o} = C_{g}(z_{f}, z_{m}) \text{ for } g = m, f$$

where τ 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

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

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

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 manufacturing 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:

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

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 partici-

pation 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 (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'.

We define $D^{g}(h_{m}, h_{f}, k | \{\tau_{k}(.)\})$ 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

$$D^{f}(h_{m}, h_{f}, k | \{\tau_{k}(.)\}) = D^{m}(h_{m}, h_{f}, k | \{\tau_{k}(.)\})$$
(5)

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

Equilibrium Definition: We define an equilibrium in this 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 <u>equilibrium</u> if the following conditions hold:

- each family is making education, marriage and migration decisions (h, P_M, P_L) so as to max-

imise expected payoffs;

- the rural and urban marriage markets clear for each level of human capital as per equation (5);;

- 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.

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

$$\bar{h}\left(w_{k}\right) = \frac{\phi_{0}}{w_{k} - \phi_{1}}$$

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 $(h \ge \bar{h}(w_k))$. For the subsequent analysis we make a number of simplifying assumptions. First, the cost of male human capital, as captured by the parameter θ_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 θ_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.

Marriage Price Schedule: Then, 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 1. In equilibrium, the marriage price schedule in market k is given by

$$\tau (h_f, h_m, k) = \begin{cases} \varphi_{0k} + \varphi_m h_m w_U + \varphi_f h_f w_U \text{ for } k \in \{UR, UU\} \\ \varphi_{0k} + \hat{\varphi}_m h_m w_R + \varphi_f h_f \phi_1 \text{ for } k \in \{RR, RU\} \end{cases}$$
(6)

where φ_{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 1 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. The constant term in the marriage price schedules in (6), φ_{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

$$C_{m} = \begin{cases} \delta_{mU}E_{m} + b_{m}\varphi_{0k} \text{ for } k \in \{UR, UU\} \\ \delta_{mR}E_{m} + b_{m}\varphi_{0k} + a_{m}\phi_{0} \text{ for } k \in \{RR, RU\} \end{cases}$$

$$C_{f} = \begin{cases} \delta_{fU}(E_{f} - \varphi_{0k}) + b_{f}\varphi_{0k} \text{ for } k \in \{UR, UU\} \\ \delta_{fR}(E_{f} - \varphi_{0k}) + b_{f}\hat{\varphi}_{0k} + a_{f}\phi_{0} \text{ for } k \in \{RR, RU\} \end{cases}$$

$$(7)$$

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

The parameters δ_{fR} , δ_{fU} , δ_{mR} and δ_{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 δ_{fR} are increasing in ϕ_1 , the productivity of human capital in home production, while for daughters in urban areas, the returns δ_{fU} are increasing in the urban wage rate w_U . Similarly, for sons in rural areas δ_{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 φ_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 or decreasing 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, δ_{mU} , is increasing in the urban wage rate w_U if and only if Condition 1 holds.

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 search 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 search costs for male migrants but there are positive search costs for female migrants: $\zeta_f > \zeta_m = 0$. As per Table 1, we assume throughout that there are no marriage search costs for non-migrants.

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. As Proposition 1 shows, 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 the constant terms φ_{0UR} and φ_{0UU} . If there are no marriage search costs, we must also have $\varphi_{0UR} = \varphi_{0UU}$ 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. For similar reasons, we have $\varphi_{0RU} = \varphi_{0RR}$ and, therefore, 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 2. 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 RU 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 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 3. 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.

Case 2: Positive Marriage Search Costs for Female Migrants: Next, we consider the case where there are positive marriage search costs for female migrants and no marriage search 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; or (ii) the strategy involves migration before marriage, a type of behaviour that meets with social disapproval and thus incurs disutility.

Because, for female migrants, marriage search 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 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 4. 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 4, an equilibrium with rural-urban migration *can* support marriage price schedules in which $\varphi_{0UR} = \varphi_{0UU}$. 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 the equilibrium refinement introduced in the preceding subsection:

Corollary 1. to Proposition 4: 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.

Alternatively, we can show that if rural families have some bias between markets UR and UU, and are heterogeneous in this respect, this pins down the equilibrium difference in dowry payments between the two markets, and the difference is strictly positive (See Appendix C). 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 3. To state the corollary, we define $\tilde{\mu}$ (W, o, g; w_U , w_R , φ_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; $\varphi_0 = (\varphi_{0RR}, \varphi_{0RU}, \varphi_{0UR}, \varphi_{0UU})$ describes the fixed marriage payment in each market.

Corollary 2. to Proposition 3: 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

The equilibrium characterisation in the preceding section provides a number of predictions – notably for the marriage price schedule and human capital investments in different market segments. In this section, we provide theoretical predictions for how prices, marriage and labour decisions respond to an exogenous decline in migration costs, that may be more suitable for empirical testing than the equilibrium results.

Suppose that the cost of migration is, initially, equal to μ_0 . Let us denote by w_{U0} and w_{R0} the rural and urban wage rates in the initial equilibrium. We assume that there is a rural-urban wage differential and $w_{U0} > w_{R0}$. If $\zeta_f = \zeta_m = 0$, then by Proposition 3, 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 the offspring of all rural families of type g and wealth $W > \overline{W}_{g0}$ migrate while those below the threshold remain at the rural location. Using Definition 1 we have, in equilibrium,

$$w_{U0} = w_{R0} + \mu_0 \tag{9}$$

$$\Gamma_{mR}\left(\overline{W}_{m0}\right) = \Gamma_{fR}\left(\overline{W}_{f0}\right) \tag{10}$$

A decline in the cost of migration to, say, $\mu_1 < \mu_0$ will, as per Proposition 3, lower the threshold wealth levels that trigger migration to, say, $\overline{W}_{m1} < \overline{W}_{m0}$ and $\overline{W}_{f1} < \overline{W}_{f0}$. 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. In the new equilibrium, we have

$$\mu\left(\overline{W}_{g1}, R, g; w_{U1}, w_{R1}\right) = \mu_1 \text{ for } g = m, f$$
(11)

$$w_{U1} = w_{R1} + \mu_1 \tag{12}$$

$$\Gamma_{mR}\left(\overline{W}_{m1}\right) = \Gamma_{fR}\left(\overline{W}_{f1}\right) \tag{13}$$

If $\zeta_f > \zeta_m = 0$, we can show similar effects of a decline in the cost of migration using the corollary of Proposition 3. Using Lemma 1, we can 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.⁵ By contrast, the decline in the urban wage rate leads to a decrease in expenditures on urban women. Formally, we have the following results.

⁵Lemma 1 implies that female families are indifferent between these different combinations for a given level of total expenditures on 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.

Proposition 5. 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 UU or UR in the new equilibrium, there is (iii) an increase in male education; (iv) an increase in expenditures 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 5 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.⁶ 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 6. 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 in both markets UR and UU by rural families.

⁶This 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.

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)⁷ – commonly attributed to family planning programmes launched in the 1970s (see, for example, Joshi and Schultz, 2007). And, since the 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 workers⁸ 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

⁷These figures refer to the total fertility rate.

⁸Figures obtained from the Bangladesh Garment Manufacturers and Exporters Association at http://www.bgmea.com.bd/

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 prevailing social norms regarding female mobility (Asadullah and Wahhaj, 2017).

3.2 Jamuna Multi-Purpose Bridge

We provide some background information about the Jamuna Multi-Purpose Bridge⁹ 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 began in October 1994 and 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

⁹While 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.

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.

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).

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;¹⁰ (ii) a stratified sample of urban households based on a full household census in 87 non-metropolitan urban primary sampling units, followed by a random selection of 20 households from each unit.¹¹ The 87

¹⁰About 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.

¹¹The 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

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).¹²

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 have a husband who comes from this region (5.5% of the full sample), because they have a husband who has migrated to this region (4% of the full sample), or due to independent migration 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%).

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 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

Bangladesh are typically much more mobile than rural households.

¹²The survey also 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.

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 4, 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 landholdings (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%). 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 An Empirical Test of Social Barriers to Female Independent Migration

The theoretical model in Section 2 suggests a test to investigate whether there are social barriers to female independent migration. In the presence of such barriers, grooms originating in rural areas who migrated to an urban location following marriage would have received a higher dowry payment¹³ than grooms originating in the urban location whose marriages involved no migration, holding constant the human capital of the bride and the groom (Proposition 4 and its corollary). In the absence of social barriers to female independent migration, there will be no such 'dowry premium' for migrant grooms (Proposition 2).¹⁴

Implementing this test empirically is complicated by the presence of possible differences in 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,

¹³More 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.

¹⁴Note 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 social barriers to female independent migration. Therefore, empirical evidence of such a difference would neither support nor disprove the social barriers hypothesis.

but also the husband's occupation at the time of marriage, parental occupations and landholdings, education of the bride's parents, the type of marriage (whether arranged by the family, initiated by the couple, consanguineous). Using these characteristics, we estimate hedonic dowry equations following Rao (1993). To test the theoretical predictions, we use only the subsample of couples residing 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 5. 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 11% points). 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 percentage 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 the age difference between the bride and the groom, the number of years that the couple has been married and the square of this variable; and binary variables indicating whether the bride's mother was employed outside of the household, whether the groom was in a low-paid occupation (both indicators are referring to the time of the marriage), and whether the couple is Hindu. The selection equation estimates, shown in column 3, indicate that most of these variables have a strong correlation with the probability that the marriage involved dowry payments to the groom (separately, we verify that they have little effect on the conditional mean of the log of the dowry amount in the selected sample). The second step estimates, also shown in column 3, indicate that dowry payments to the groom are higher by 15.2% when marriage-migration is involved (statistically significant at the 10% level).¹⁵

In Table 6, 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 5, requires an explanation. As shown in Section 2, in the absence of social barriers to migration, dowry payments between these two sets of couples should be identical (Proposition 2); but migrant grooms receive higher dowry payments when there are social barriers to female independent migration (Proposition 4).

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 5, 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 6 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 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

¹⁵The estimated coefficient on the Inverse Mills Ratio is negative and statistically significant, implying a negative selection effect.

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

In this section we aim to test the model's predictions (outlined above) regarding the effects of a reduction in the cost of migration on the marriage and migration behaviour of individuals. To implement this test, we take advantage of the construction of the Jamuna Bridge in 1998 (described in Subsection 3.2) 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 5 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 (where migration costs did not change).¹⁶

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

¹⁶In 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 5 and 6 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 5 and 6; 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.

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 16 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 that the majority of the women in the older group would have been married by this age (the Bangladesh Demographic and Health Survey of 1999-2000 shows a median age of marriage of 16.1 years for women aged 20-24 years (NIPORT et al., 2000)) and, as such, their marriage-migration decisions would not have been affected by the opening of the bridge.

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 and extend it to men only when looking at their schooling outcomes, as most men in the sample would have completed education by the age of 16 (as shown in Table 2, the median years of schooling for both men and women is 5 years).

We provide below 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_{irt}^0 and Y_{irt}^1 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 $Y_{irt} = Y_{irt}^0(1 - D_{irt}) + Y_{irt}^1 \times D_{irt}$, 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

> $D_i(r,t) = 1$ if $t \ge 1983$ and r = Jamuna $D_i(r,t) = 0$ otherwise

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

$$E[Y_{0irt}|r, t, \mathbf{X}_{irt}] = \gamma_r + \lambda_t + \mathbf{X}_{irt}\beta$$

$$E[Y_{1irt}|r, t, \mathbf{X}_{irt}] = E[Y_{0irt}|r, t, \mathbf{X}_{irt}] + \rho$$
(14)

where 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.); γ_r and λ_t represent region and birth-year fixed effects (respectively), and the treatment effect, ρ , is assumed to be constant and additive.¹⁷ The observed outcome, Y_{irt} , can then be written:

$$Y_{irt} = \gamma_r + \lambda_t + \mathbf{X}_{irt}\beta + \rho D_{irt} + \varepsilon_{irt}$$
(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 DID approach is that the treated and control groups would have had common parallel trends in the absence of treatment, conditional on covariates:

$$E[Y_{irPost}^{0}|r, t, \mathbf{X}_{irt}, D_{irt} = 1] - E[Y_{irPre}^{0}|r, t, \mathbf{X}_{irt}, D_{irt} = 1] = E[Y_{irPost}^{0}|r, t, \mathbf{X}_{irt}, D_{irt} = 0] - E[Y_{irPre}^{0}|r, t, \mathbf{X}_{irt}, D_{irt} = 0]$$
(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:

$$E[\varepsilon_{irPost}|r, t, \mathbf{X}_{irt}, D_{irt} = 1] - E[\varepsilon_{irPre}|r, t, \mathbf{X}_{irt}, D_{irt} = 1] = E[\varepsilon_{irPost}|r, t, \mathbf{X}_{irt}, D_{irt} = 0] - E[\varepsilon_{irPre}|r, t, \mathbf{X}_{irt}, D_{irt} = 0]$$
(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 X_{irt} . We have thus chosen the elements of 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, 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.¹⁸

¹⁷Thus we rule out treatment heterogeneity.

¹⁸We do not control for the individual's education or occupation as these factors were potentially affected by access to the bridge.

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

$$Y_{irt} = \delta_1 J M_r + \delta_2 M B_r + \gamma Post_t + \theta_1 (Post_t \times J M_r) + \theta_2 (Post_t \times M B_r) + \gamma_r + \mathbf{X_{irt}}\beta + \varepsilon_{irt}$$
(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 1998.¹⁹ We denote by γ_r a full set of Division fixed effects, with Dhaka Division being the excluded category.²⁰ Again, the rationale for including controls for birth in the Dhaka manufacturing belt and its interaction with the variable $Post_t$ is based on Proposition 5 which predicts that a decline in the cost of rural-urban migration will affect urban families in addition to rural families.²¹Finally, ε_{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.²²

In addition to the basic difference-in-difference regression model, we also conduct an eventstudy 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:

$$Y_{irt} = \delta_1 J M_r + \delta_2 M B_r + \sum_{t=1}^T \alpha_t \eta_t + \sum_{t=1}^T \theta_{1t} \left(\eta_t \times J M_r \right) + \theta_2 (Post_t \times M B_r) + \gamma_r + \mathbf{X_{irt}} \beta + \varepsilon_{irt}$$
(19)

where JM_r , MB_r , $Post_t$, γ_r and X_{irt} are defined as above, while η_t is a dummy variable for cohort *t* (in practice, we combine birth years into 3 year bins to improve the precision of our

¹⁹In 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.

 $^{^{20}}$ Although some parts of Rangpur Division lie east of the Jamuna river, all the WiLCAS respondents born in northwestern 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 with division fixed effects, we drop the JM_r variable.

²¹Note 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.

²²Most of our results are robust to clustering at the broader district-level.

estimates). The set of coefficients of the form θ_{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. We graph the coefficients to observe how this difference in outcomes varies over time in a fully flexibly way.

6.2 **Measure of Treatment Intensity**

In our base specification, JM_r is a dummy variable that takes a value of 1 if the individual was born in north-western Bangladesh and a value of 0 otherwise. 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:

$$JM_{intensity} = max \left\{ 0, 1 - \frac{(a+b)}{(c+300)} \right\}$$
(20)

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 300 kilometers.²³ 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.

 $^{^{23}}$ 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.

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.

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.

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 3). One of the implications of this result is that if rural-urban migration is low in the initial equilibrium, an exogenous decline in the economic costs of migration will have a stronger effect on women from better-off families . To capture these differential effects, we split the sample of women into two according to their parental landholdings. 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.²⁴ Then, we estimate equation 18 separately in both samples.

7.1 Preexisting Levels and Trends

Our main identification assumption is formally stated in Equation 16 and amounts to assuming that, conditional on the selected covariates, outcomes in the Rajshahi and Rangpur Divisions would have continued on a common trend with outcomes in other areas, and thus any deviations from the trend after 1998 are due to the construction of the bridge that directly reduced the cost of migration from the Rajshahi and Rangpur Divisions to Dhaka. Although this assumption is

²⁴Half an acre of land is a criterion widely used for poverty-targeted programmes, including a number of wellknown 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)).

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 approximation²⁵) 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 ready-made 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 above this threshold. A dashed vertical line in each graph separates the older cohorts (born before 1983 and at least 16 years of age when the bridge opened) 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. While these patterns do not prove our identifying assumption, it is satisfying to see that most outcomes were not very different in levels or on divergent trends prior to the construction of the bridge.

For younger cohorts (i.e. those making marriage and migration decisions after the bridge

²⁵Specifically, 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.

was built), the figures do suggest some divergence in trends, especially for respondents from better-off families (see Figure 4), and 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 Table 7, we present mean values of pre-determined individual characteristics (respondents' schooling, religion and parental 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.²⁶ 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.

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 Tables 8 through 12. 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", which corresponds to the term $Post_t \times JM_r$) in the regression specification from equation 18 while even columns present estimates using the continuous version of the treatment ("JM bridge intensity X post").

²⁶The 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.

Additionally, we control for birth in the Dhaka manufacturing belt and the corresponding interaction term in each specification ("Born Dhaka manf. belt" and "Born Dhaka post '82"). We focus our discussion below on the estimated coefficients of the treatment effects using both measures, but the tables also report coefficients on the distance to the Dhaka manufacturing belt (in tens of kilometres), whether individuals need to cross any river (including the Jamuna) to reach the manufacturing belt, whether they were young enough to be affected by the bridge construction (i.e. the *Post_t* term in the regression specification), their age, and their age squared. The regression specifications also include all of the variables discussed in the previous section – including Division fixed effects – but these are not shown for convenience. Note that coefficients for the JM bridge variable are absent from the odd columns as these effects are subsumed in the division fixed-effects (see footnote 20 for further details).

The results show no effect on the migration or work outcomes for women from poorer families in the north-western Divisions (Tables 8 and 9). The bridge does, however, appear to have had an impact on these women's marriage outcomes: they are now 12.4% points more likely to pay a dowry than before and, conditional on paying a dowry, the amount of dowry paid is about 21% points higher (albeit statistically significant only in the case of the binary treatment indicator) (Table 11). The bridge also appears to have affected incentives to invest in human capital: Table 12 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 school.

The results for women from better-off families (Tables 13 through 17) tell a different story. These women are more likely to migrate and reside in the Dhaka manufacturing belt – by about 5% points – after the construction of the bridge (Table 13). 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 (Table 13, columns 5-8). The estimates in Table 15 provide further insights about the nature of this family-related migration: there is no 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.²⁷ We

²⁷Note that here and in the following discussion we use "Dhaka" as a shorthand for the Dhaka manufacturing belt rather than the Dhaka Division.

also find a strong effect on the intensive margin for marriage-related payments (Table 16), 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.²⁸ 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 ever worked in the readymade garments sector (Table 14). 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 (Table 14). 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 13.4% points) to enroll in secondary school (Table 17).

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 0.098 in Table 13, column 3 implies that effect of the bridge on the probability to migrate to Dhaka varied between 4.22 (=0.095 x 0.445) and 7% 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 3.6 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 8 to 17 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 post '82"). Two notable exceptions are that (i) women born in poorer families in the manufacturing belt were less likely to have dowry marriages (11), and that women born in richer families were less likely to reside in Dhaka Division, following the bridge construction.

²⁸All of these estimated effects are sizable in magnitude relative to the mean values reported in Table 2.
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 19 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 "1983"). The omitted cohort is the 1980 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. In both cases, we focus on the main outcome variables of interest: 1) propensity to reside in Dhaka; 2) propensity to have engaged in marriage migration; 3) propensity to have engaged in economic migration; and 4) propensity to have worked in the readymade garments sector. 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 also 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 is 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 dis-

cernible 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 6, 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 6, 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 5. 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.

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. As summarised in Proposition 5, 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 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 effects are in line with the predicted effects described in Proposition 5, 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.

8 Conclusion

In this paper, we have investigated, both theoretically and empirically, the implications of social barriers to female independent migration in a developing country. We developed a theoretical model of rural-urban migration with segmented marriage and labour markets; and formalised the notion of social barriers to female independent migration to urban areas as a social cost associated with pre-marriage female migration (on top of the standard economic costs) and pre-marriage search on the urban marriage market.

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 a decline in the economic costs of long-distance migration would lead to an increase in female independent migration if the aforementioned social barriers are absent. But in the presence of such social barriers, the increase in female migration would occur primarily through marriage with 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 these predictions. 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 reduction in the economic costs of migration due to the bridge construction had no effect on female independent migration towards Dhaka but led to an increase in marriage-related urban migration for women from better-off families. We also 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 broadly in line with the difference-in-difference estimates.

Thus, the empirical analysis provides support to the hypothesis that there are social barriers ers to female independent migration. The immediate implication of these social barriers 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 cannot migrate except by marrying a male migrant – and that even this opportunity is not available to the least well-off – is evidence of significant and uneven labour market frictions.

Thus, the theoretical model and the empirical analysis highlight how a policy geared towards lowering the economic costs of rural-urban migration – for example, major infrastructure projects – will not, in itself, eradicate the disadvantages that rural-born women face from social barriers to independent migration. Therefore, addressing gender-related norms that underlie these social barriers must remain part of a broader development policy.

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Figures



Figure 1: Measure of Treatment Intensity

<u>Town</u>	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 graphs ... 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 6: All Outcomes (by Jamuna status for respondents with > half acre)

Note: This figure graphs ... 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.

Tables

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

Table 1: Migration and Marriage Search Costs

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

Table 2: Summary Statistics

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.

Married Women			Unmarrie	Unmarried Women		
# of	Economic	Family-	Economic	Family-		
Episodes	Migration	related	Migration	related		
	(%)	Migration	(%)	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		

Table 3: Incidence of Female Long-Distance Migration

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.

	Non-Migrant	Economic Migrant	difference	p-value
Respondent's Age	29.274	25.745	3.528	(0.000)
Years of Schooling	5.261	5.137	0.124	(0.523)
Attended Sec. School	0.475	0.444	0.031	(0.222)
Currently Married	0.917	0.517	0.400	(0.000)
Divorced	0.017	0.245	-0.228	(0.000)
Widowed	0.013	0.022	-0.009	(0.135)
Father's Schooling	2.976	2.569	0.407	(0.040)
Mother's Schooling	1.627	1.615	0.012	(0.935)
Father in Low Paid Occ.	0.210	0.287	-0.077	(0.000)
Mother Worked	0.264	0.270	-0.005	(0.816)
Parental Landholding	1.439	0.667	0.772	(0.000)

Table 4: Characteristics of Female Economic Migrants

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.

	(1) Jourtule Daid	(2) L m(Loutule)	(L m/L	(3)
		LII(JOULUK)	Ln(Joutuk)	Joutuk Paic
Marriage Migration to Urban Area	0.110*** (0.0304)	0.205** (0.0818)	0.152* (0.0877)	
Marriage Age	0.00806^{*} (0.00471)	0.0186 (0.0157)	0.00997 (0.0160)	0.00459 (0.0178)
Own Initiated Marriage	-0.191*** (0.0400)	0.0893 (0.156)	0.420** (0.175)	-0.565*** (0.128)
Consang. Marriage	-0.0969** (0.0462)	0.0414 (0.137)	0.174 (0.162)	-0.287** (0.142)
Bride Schooling	-0.00555 (0.00513)	0.0937*** (0.0142)	0.100^{***} (0.0144)	-0.0219 (0.0147)
Groom Schooling	-0.00830** (0.00415)	0.0485*** (0.0109)	0.0583*** (0.0127)	-0.0213* (0.0122)
Bride's Mother Worked				0.135 (0.0975)
Hindu				0.980*** (0.147)
Marriage Age Gap				-0.0384*** (0.0114)
Years Married				0.0840*** (0.0265)
Years Married Squared				-0.00366*** (0.00105)
Groom in Low Paid Occ.				0.211* (0.123)
Constant	0.388*** (0.0787)	9.629*** (0.259)	11.02*** (0.591)	-0.712 (0.540)
Observations Inverse Mills Ratio	1344	535	1326 -0.779	

Table 5: Hedonic Equations for Dowries - All Urban Clusters

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.

	(1)	(2)	(3)
	Joutuk Paid	Ln(Joutuk)	Ln(Jo Ln(Joutuk)	outuk) Ioutuk Paid
Marriage	0.0563	0.0851	0.0870	journerau
Migration to Dhaka	(0.0595)	(0.162)	(0.134)	
Marriage Age	0.00243 (0.00715)	-0.0117 (0.0174)	-0.00931 (0.0172)	-0.00631 (0.0236)
Own Initiated Marriage	-0.279*** (0.0437)	0.596*** (0.171)	0.635** (0.253)	-0.978*** (0.194)
Consang. Marriage	-0.0912 (0.0595)	0.113 (0.193)	0.121 (0.189)	-0.296 (0.193)
Bride Schooling	-0.00996 (0.00703)	0.0966^{***} (0.0156)	0.0921*** (0.0151)	-0.0351* (0.0194)
Groom Schooling	-0.0113* (0.00571)	0.0411^{***} (0.0150)	0.0426^{***} (0.0135)	-0.0283* (0.0158)
Bride's Mother Worked				0.314** (0.135)
Hindu				1.192*** (0.314)
Marriage Age Gap				-0.0344** (0.0138)
Years Married				0.0337 (0.0347)
Years Married Squared				-0.00173 (0.00137)
Groom in Low Paid Occ.				0.261 (0.171)
Constant	0.535*** (0.134)	10.32*** (0.325)	10.95*** (0.425)	0.406 (0.619)
Observations Inverse Mills Ratio	702	299	697 -0.0486	

Table 6: Hedonic Equations for Dowries - Dhaka Manufacturing Belt

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.

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

Table 7: Comparison of Covariate Means, Jamuna versus other Regions

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.

Main Results from Linear Probability Model

Results for Respondents with Parental Landholdings of less than Half an Acre

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Reside Dhaka	Reside Dhaka	Migr Dhaka	Migr Dhaka	Family Migr	Family Migr	Economic Migr	Economic Migr
JM bridge X post	0.003 (0.026)		0.009 (0.024)		-0.015 (0.018)		0.007 (0.016)	
JM bridge intensity X post		0.011 (0.044)		0.022 (0.040)		-0.019 (0.030)		0.014 (0.028)
JM bridge intensity		0.421 (0.302)		0.318 (0.275)		0.154 (0.159)		0.102 (0.186)
Born post '82	0.013	0.013	-0.019	-0.020	0.003	0.002	-0.005	-0.005
	(0.019)	(0.019)	(0.021)	(0.021)	(0.018)	(0.018)	(0.011)	(0.011)
Born Dhaka manf.	0.579***	0.584***	0.409***	0.413***	0.433***	0.434***	-0.007	-0.005
belt	(0.055)	(0.054)	(0.062)	(0.062)	(0.057)	(0.057)	(0.038)	(0.038)
Born Dhaka post '82	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)	(0.045)
Dhaka dist. (10km)	-0.001	0.000	-0.000	0.001	0.000	0.000	0.000	0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Dhaka across river	-0.012	-0.010	0.002	0.003	0.013	0.014	-0.023	-0.022
	(0.045)	(0.045)	(0.045)	(0.045)	(0.034)	(0.034)	(0.033)	(0.033)
Age	-0.076***	-0.076***	-0.058***	-0.058***	-0.010	-0.010	-0.040***	-0.040***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.009)	(0.009)	(0.009)	(0.009)
Age sq.	0.001***	0.001***	0.001***	0.001***	0.000	0.000	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	1.468***	1.454***	1.197***	1.187***	0.264**	0.260**	0.750***	0.746***
	(0.184)	(0.184)	(0.178)	(0.179)	(0.128)	(0.130)	(0.141)	(0.141)
Observations Dep Variable Mean (Jamuna pre1998)	2903 0.059	2903 0.059	2903 0.055	2903 0.055	2903 0.037	2903 0.037	2903 0.018	2903 0.018

Table 8: Migration Outcomes

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. 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.

	(1) Worked in RMG	(2) Worked in RMG
JM bridge X post	-0.019 (0.036)	
JM bridge intensity X post		-0.034 (0.061)
JM bridge intensity		0.521 (0.366)
Born post '82	-0.006 (0.030)	-0.007 (0.030)
Born Dhaka manf. belt	0.010 (0.083)	0.015 (0.083)
Born Dhaka post '82	0.037 (0.087)	0.039 (0.087)
Dhaka dist. (10km)	0.000 (0.002)	0.002 (0.002)
Dhaka across river	0.024 (0.052)	0.025 (0.052)
Age	-0.022 (0.016)	-0.022 (0.016)
Age sq.	0.000 (0.000)	0.000 (0.000)
Constant	0.657*** (0.246)	0.639** (0.248)
Observations	1645	1645
Dep Variable Mean (Jamuna pre1998)	0.064	0.064

Table 9: Work Outcomes

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 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 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.

	(1)	(2)	(3)	(4)
	Husb Dhaka	Husb Dhaka	Husb Migr Dhaka	Husb Migr Dhaka
JM bridge X post	-0.005 (0.008)		0.001 (0.015)	
JM bridge intensity X post		-0.008 (0.014)		0.000 (0.026)
JM bridge intensity		0.119 (0.097)		0.276 (0.173)
Born post '82	0.011	0.011	0.004	0.004
	(0.011)	(0.011)	(0.012)	(0.012)
Born Dhaka manf.	0.671^{***}	0.672***	-0.012	-0.008
belt	(0.049)	(0.050)	(0.035)	(0.035)
Born Dhaka post '82	-0.001	-0.001	0.036	0.036
	(0.058)	(0.058)	(0.027)	(0.027)
Dhaka dist. (10km)	-0.000	0.000	-0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Dhaka across river	-0.027	-0.027	0.003	0.004
	(0.018)	(0.018)	(0.030)	(0.030)
Age	0.003	0.004	-0.039***	-0.039***
	(0.006)	(0.006)	(0.010)	(0.010)
Age sq.	-0.000	-0.000	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.020	-0.023	0.725***	0.716***
	(0.087)	(0.088)	(0.158)	(0.158)
Observations Dep Variable Mean (Jamuna pre1998)	2702 0.005	2702 0.005	2702 0.014	2702 0.014

Table 10: Marriage Outcomes

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. 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.

	(1)	(2)	(3)	(4)
	Joutuk Paid	Joutuk Paid	Ln(Joutuk)	Ln(Joutuk)
JM bridge X post	0.124** (0.049)		0.207* (0.124)	
JM bridge intensity X post		0.183** (0.083)		0.331 (0.217)
JM bridge intensity		1.222** (0.513)		-2.446* (1.256)
Born post '82	-0.044	-0.038	0.083	0.080
	(0.040)	(0.039)	(0.134)	(0.134)
Born Dhaka manf.	0.105	0.127	0.257	0.221
belt	(0.080)	(0.080)	(0.214)	(0.216)
Born Dhaka post '82	-0.223***	-0.225***	0.133	0.123
	(0.061)	(0.061)	(0.224)	(0.224)
Dhaka dist. (10km)	0.000	0.004	-0.002	-0.012
	(0.003)	(0.003)	(0.008)	(0.010)
Dhaka across river	-0.105**	-0.099*	-0.038	-0.051
	(0.052)	(0.051)	(0.163)	(0.161)
Age	0.065***	0.065***	-0.041	-0.042
	(0.018)	(0.018)	(0.064)	(0.064)
Age sq.	-0.001***	-0.001***	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)
Constant	-0.337 (0.250)	-0.380 (0.251)	11.173*** (0.811)	$11.282^{***} \\ (0.824)$
Observations	2702	2702	1044	1044
Dep Variable Mean (Jamuna pre1998)	0.530	0.530	10.206	10.206

Table 11: Dowry Outcomes

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. 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.

	(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	0.423 (0.295)				0.013 (0.036)			
JM bridge intensity X post		0.915* (0.523)				0.045 (0.063)		
JM bridge X post (10 yrs)			0.949*** (0.285)				0.043 (0.039)	
JM bridge intensity X post (10 yrs)				1.731*** (0.503)				0.085 (0.068)
JM bridge intensity		-11.931*** (3.072)		-12.203*** (3.018)		-1.541*** (0.405)		-1.549*** (0.396)
Born post '82	0.166 (0.286)	0.131 (0.285)			-0.018 (0.038)	-0.022 (0.038)		
Born post '87			-0.182 (0.263)	-0.217 (0.263)			0.028 (0.040)	0.023 (0.040)
Born Dhaka manf. belt	0.229 (0.483)	0.051 (0.480)	0.478 (0.339)	0.296 (0.339)	0.069 (0.064)	0.045 (0.063)	0.121*** (0.046)	0.097** (0.046)
Born Dhaka post '82	0.174 (0.503)	0.172 (0.503)			0.018 (0.074)	0.017 (0.074)		
Born Dhaka post '87			-0.326 (0.482)	-0.334 (0.484)			-0.094 (0.067)	-0.096 (0.067)
Dhaka dist. (10km)	-0.027 (0.020)	-0.063*** (0.023)	-0.027 (0.020)	-0.064*** (0.023)	-0.004 (0.003)	-0.009*** (0.003)	-0.004 (0.003)	-0.009*** (0.003)
Dhaka across river	1.027*** (0.381)	0.976*** (0.375)	1.007*** (0.379)	0.953** (0.373)	0.132*** (0.045)	0.125*** (0.044)	0.132*** (0.045)	0.125*** (0.044)
Age	-0.256** (0.127)	-0.262** (0.126)	-0.200 (0.144)	-0.214 (0.144)	-0.030* (0.017)	-0.031* (0.017)	-0.022 (0.020)	-0.024 (0.020)
Age sq.	0.001 (0.002)	0.001 (0.002)	-0.000 (0.002)	-0.000 (0.002)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	10.704*** (1.716)	11.117*** (1.712)	10.389*** (2.264)	10.923*** (2.265)	1.135*** (0.237)	1.190*** (0.236)	0.954*** (0.331)	1.027*** (0.330)
Observations	2903	2903	2903	2903	2903	2903	2903	2903
Dep Variable Mean (Jamuna pre1998)	2.087	2.087	2.087	2.087	0.146	0.146	0.146	0.146

Table 12: Education Outcomes

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. 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.

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Reside Dhaka	Reside Dhaka	Migr Dhaka	Migr Dhaka	Family Migr	Family Migr	Economic Migr	Economic Migr
JM bridge X post	0.053**		0.052**		0.038***		0.002	
	(0.021)		(0.021)		(0.014)		(0.011)	
JM bridge intensity		0.094***		0.095***		0.069***		0.002
X post		(0.036)		(0.036)		(0.025)		(0.020)
JM bridge intensity		0.761***		0.469*		0.104		0.236*
		(0.257)		(0.244)		(0.171)		(0.123)
Born post '82	-0.040***	-0.041***	-0.035**	-0.036**	-0.012	-0.013	-0.007	-0.007
-	(0.014)	(0.015)	(0.014)	(0.014)	(0.012)	(0.012)	(0.007)	(0.007)
Born Dhaka manf.	0.781***	0.793***	0.524***	0.531***	0.532***	0.534***	-0.014**	-0.010*
belt	(0.046)	(0.045)	(0.066)	(0.066)	(0.065)	(0.065)	(0.007)	(0.006)
Born Dhaka post '82	-0.118**	-0.116**	-0.029	-0.027	-0.032	-0.032	0.034	0.035
	(0.052)	(0.052)	(0.073)	(0.073)	(0.075)	(0.075)	(0.022)	(0.022)
Dhaka dist. (10km)	-0.004**	-0.001	-0.003**	-0.001	-0.002*	-0.001	0.000	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dhaka across river	-0.047*	-0.043*	-0.030	-0.027	-0.008	-0.008	-0.004	-0.003
	(0.025)	(0.026)	(0.026)	(0.026)	(0.016)	(0.016)	(0.014)	(0.014)
Age	-0.047***	-0.048***	-0.035***	-0.035***	-0.019***	-0.019***	-0.010**	-0.010**
-	(0.010)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.004)	(0.004)
Age sq.	0.001***	0.001***	0.000***	0.000***	0.000**	0.000**	0.000*	0.000*
- · ·	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	1.100***	1.080***	0.850***	0.837***	0.412***	0.409***	0.256***	0.249***
	(0.154)	(0.153)	(0.147)	(0.147)	(0.116)	(0.116)	(0.076)	(0.076)
Observations	3355	3355	3355	3355	3355	3355	3355	3355
Dep Variable Mean	0.040	0.040	0.034	0.034	0.012	0.012	0.012	0.012
(Jamuna pre1998)	0.010	0.010	0.034	0.034	0.012	0.012	0.012	0.012

Table 13: Migration Outcomes

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 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 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.

	(1) Worked in RMG	(2) Worked in RMG
JM bridge X post	0.047** (0.023)	
JM bridge intensity X post		0.081** (0.041)
JM bridge intensity		0.107 (0.290)
Born post '82	-0.005 (0.021)	-0.005 (0.021)
Born Dhaka manf. belt	-0.025 (0.050)	-0.022 (0.050)
Born Dhaka post '82	0.006 (0.066)	0.006 (0.066)
Dhaka dist. (10km)	-0.000 (0.002)	0.000 (0.002)
Dhaka across river	-0.063** (0.027)	-0.062** (0.027)
Age	-0.001 (0.012)	-0.001 (0.012)
Age sq.	-0.000 (0.000)	-0.000 (0.000)
Constant	0.289 (0.180)	0.283 (0.180)
Observations	2119	2119
Dep Variable Mean (Jamuna pre1998)	0.039	0.039

Table 14: Work Outcomes

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 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.

	(1)	(2)	(3)	(4)
	Hush Dhaka	Hush Dhaka	Hush Migr Dhaba	Hush Migr Dhaka
JM bridge X post	-0.002 (0.009)	Thusb Dhaka	0.035** (0.014)	
JM bridge intensity X post		-0.008 (0.017)		0.061** (0.024)
JM bridge intensity		0.163 (0.108)		0.021 (0.162)
Born post '82	-0.018*	-0.017*	-0.015	-0.015
	(0.009)	(0.009)	(0.010)	(0.010)
Born Dhaka manf.	0.800^{***}	0.803^{***}	0.007	0.008
belt	(0.045)	(0.045)	(0.027)	(0.027)
Born Dhaka post '82	-0.068	-0.068	-0.050	-0.050
	(0.059)	(0.059)	(0.031)	(0.031)
Dhaka dist. (10km)	-0.001	-0.000	-0.002*	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Dhaka across river	-0.001	-0.001	-0.035***	-0.035***
	(0.015)	(0.015)	(0.013)	(0.013)
Age	-0.000	-0.000	-0.032***	-0.032***
	(0.005)	(0.005)	(0.008)	(0.008)
Age sq.	-0.000	-0.000	0.000***	0.000^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.084	0.080	0.652***	0.651***
	(0.080)	(0.081)	(0.130)	(0.130)
Observations Dep Variable Mean (Jamuna pre1998)	3181 0.012	3181 0.012	3181 0.009	3181 0.009

Table 15: Marriage Outcomes

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 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 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.

	(1)	(2)	(3)	(4)	
	Joutuk Paid	Joutuk Paid	Ln(Joutuk)	Ln(Joutuk)	
JM bridge X post	-0.043 (0.040)		0.273** (0.120)		
JM bridge intensity X post		-0.088 (0.070)		0.483** (0.200)	
JM bridge intensity		0.860** (0.407)		-1.646 (1.375)	
Born post '82	0.010	0.012	-0.225*	-0.228*	
	(0.034)	(0.034)	(0.124)	(0.124)	
Born Dhaka manf.	0.084	0.097	0.360^{*}	0.325*	
belt	(0.063)	(0.063)	(0.187)	(0.189)	
Born Dhaka post '82	-0.086	-0.086	-0.013	-0.011	
	(0.054)	(0.054)	(0.222)	(0.222)	
Dhaka dist. (10km)	-0.006**	-0.003	0.009	0.002	
	(0.002)	(0.003)	(0.009)	(0.013)	
Dhaka across river	0.001	0.005	0.083	0.072	
	(0.046)	(0.046)	(0.150)	(0.149)	
Age	0.039**	0.039**	0.032	0.033	
	(0.016)	(0.017)	(0.061)	(0.061)	
Age sq.	-0.001**	-0.001**	-0.001	-0.001	
	(0.000)	(0.000)	(0.001)	(0.001)	
Constant	-0.077	-0.100	10.054***	10.111***	
	(0.241)	(0.243)	(0.919)	(0.922)	
Observations Dep Variable Mean	3181	3181	1212	1212	
(Jamuna pre1998)	0.636	0.636	10.598	10.598	

Table 16: Dowry Outcomes

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. 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.

	(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	0.756** (0.312)				0.062 (0.039)			
JM bridge intensity X post		1.275** (0.551)				0.105 (0.067)		
JM bridge X post (10 yrs)			1.021*** (0.274)				0.134*** (0.036)	
JM bridge intensity X post (10 yrs)				1.806*** (0.478)				0.236*** (0.062)
JM bridge intensity		-12.230*** (2.936)		-11.844*** (3.052)		-1.407*** (0.400)		-1.416*** (0.419)
Born post '82	0.050 (0.269)	0.064 (0.267)			0.053 (0.036)	0.054 (0.036)		
Born post '87			-0.559** (0.256)	-0.569** (0.256)			-0.068* (0.038)	-0.069* (0.038)
Born Dhaka manf. belt	0.331 (0.599)	0.159 (0.597)	0.326 (0.431)	0.140 (0.431)	0.034 (0.074)	0.013 (0.074)	0.039 (0.058)	0.017 (0.059)
Born Dhaka post '82	-0.230 (0.545)	-0.263 (0.543)			-0.040 (0.071)	-0.044 (0.071)		
Born Dhaka post '87			-0.410 (0.495)	-0.419 (0.496)			-0.087 (0.064)	-0.088 (0.065)
Dhaka dist. (10km)	-0.007 (0.018)	-0.049** (0.020)	-0.007 (0.018)	-0.048** (0.021)	0.001 (0.002)	-0.004* (0.003)	0.000 (0.002)	-0.004* (0.003)
Dhaka across river	0.740*** (0.227)	0.687*** (0.226)	0.731*** (0.230)	0.679*** (0.230)	0.091** (0.037)	0.085** (0.037)	0.091** (0.037)	0.085** (0.038)
Age	-0.274** (0.112)	-0.271** (0.112)	-0.359*** (0.132)	-0.357*** (0.132)	-0.020 (0.015)	-0.019 (0.015)	-0.024 (0.019)	-0.024 (0.019)
Age sq.	0.001 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Constant	10.350*** (1.609)	$\frac{10.654^{***}}{(1.603)}$	12.385*** (2.128)	12.722*** (2.119)	0.847*** (0.219)	0.883*** (0.219)	1.086*** (0.317)	1.126*** (0.316)
Observations	3355	3355	3355	3355	3355	3355	3355	3355
Dep Variable Mean (Jamuna pre1998)	3.982	3.982	3.982	3.982	0.333	0.333	0.333	0.333

Table 17: Education Outcomes

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 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 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.

Appendix A: Theoretical Proofs

Proof. of Proposition 1: 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

$$C_{o} = a_{m} \left(\phi_{0} + \phi_{1} h_{f} \right) + b_{m} \left\{ h_{m} w_{k} + \tau \left(h_{f}, h_{m}, w_{k} \right) \right\}$$

Then the following first-order condition must hold:

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

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 $h_f \ge \bar{h}(w_k)$ 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

$$C_p = W - \frac{h_f}{\theta_f} - \tau (h_f, h_m, w_k)$$

$$C_o = a_f z_f + b_f z_m$$

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

$$C_{p} = W - \frac{h_{f}}{\theta_{f}} - \tau_{m} (h_{m}, w_{k}) - \varphi_{f} h_{f} \phi_{1}$$

$$C_{o} = a_{f} (\phi_{0} + \phi_{1} h_{f}) + b_{f} \{h_{m} w_{k} + \tau_{m} (h_{m}, w_{k}) + \varphi_{f} h_{f} \phi_{1}\}$$

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 $\frac{\partial C_o}{\partial h_m} = \frac{\partial \tau_m}{\partial h_m}$ and raises the offspring'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 $\frac{b_f (w_k + \frac{\partial \tau_m}{\partial h_m})}{\frac{\partial \tau_m}{\partial h_m}}$. 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

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

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

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

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

Therefore, for k = RR, RU, we obtain $\tau (h_f, h_m, w_k) = \varphi_{0k} + \hat{\varphi}_m h_m w_k + \varphi_f h_f \phi_1$ 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 φ_{0k} is a constant. Similarly, in markets UR and UU, using $z_f = h_f w_k$ and following the same steps, we obtain $\tau (h_f, h_m, w_k) = \phi_{0k} + \varphi_{mk} h_m w_k + \varphi_f h_f w_k$ 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 $h_f < \bar{h}(w_k)$. Therefore, women engage in home production. Therefore, $z_f = \phi_0 + \phi_1 h_f$ and $z_m = h_m w_k + \tau (h_f, h_m, k)$.

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 τ (h_f , h_m , k) in the equation above using (6), 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 $\delta_{mR} = w_k \left(1 + \frac{1}{2}\alpha\right) \left(1 + \hat{\varphi}_m\right) \theta_m$.

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

$$C_{f} = a_{f} (\phi_{0} + \phi_{1}h_{f}) + b_{f} \{h_{m}w_{k} + \tau (h_{f}, h_{m}, k)\}$$

$$\implies C_{f} = a_{f} (\phi_{0} + \phi_{1}h_{f}) + b_{f} (h_{m}w_{k} + \varphi_{0k} + \hat{\varphi}_{m}h_{m}w_{k} + \varphi_{f}h_{f}\phi_{1})$$

$$\implies C_{f} = a_{f}\phi_{0} + (a_{f} + b_{f}\varphi_{f}) h_{f}\phi_{1} + b_{f} (1 + \hat{\varphi}_{m}) h_{m}w_{k} + b_{f}\varphi_{0k}$$
(21)

By construction,

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

Substituting for τ (h_f, h_m, k) using (6), we obtain

$$E_{f} = \left(\frac{1}{\theta_{f}\phi_{1}} + \varphi_{f}\right)h_{f}\phi_{1} + \varphi_{0k} + \hat{\varphi}_{m}h_{m}w_{k}$$
$$\implies h_{m}w_{k} = \frac{1}{\hat{\varphi}_{m}}\left(E_{f} - \varphi_{0k}\right) - \frac{1}{\hat{\varphi}_{m}}\left(\frac{1}{\theta_{f}\phi_{1}} + \varphi_{f}\right)h_{f}\phi_{1}$$
(22)

Substituting for $h_m w_k$ in (21) using (22), we obtain

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

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

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

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

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 $h_f \ge \bar{h}(w_k)$. 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 (8) and (7).

Proof. of Proposition 3: 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

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

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

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

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

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.²⁹ 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

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

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 λ is the Lagrange multiplier. Also, using the Envelope Theorem, we have (see Mas-Colell, Whinston and

²⁹To see this, we write out the Expenditures Function:

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,

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

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 $\cot \mu$, a rural family is indifferent between migrating and not migrating. Therefore, $\mu(\overline{W}, o, g; w_U, w_R) = \mu$. 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 $\cot \theta$ above μ and, so, offspring from these families will migrate when the migration $\cot \theta$ and \overline{W} . And families with wealth less than \overline{W} will have a threshold migration $\cot \theta$ and, so, offspring from these families will migrate ψ .

Proof. of Proposition 4: 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 $\varphi_{0UU} + \zeta_f \sigma < \varphi_{0UR}$. Therefore, there are no feasible values of φ_{0UU} and φ_{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 (6) 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

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

Combining the two equations, we obtain

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

Green 1995, Theorem M.K.5)

child-related expenditures for this family is given by $E_f = h_f / \theta_f + \tau (h_f, h_m, UU)$. Using (8), the daughter's consumption is given by $C_f = w_U \delta_f (E_f - \varphi_{0UU}) + \alpha \beta \varphi_{0UU}$. 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

$$E'_{f} = h_{f} / /\theta_{f} + \tau (h_{f}, h_{m}, UR)$$
$$= \varphi_{0UR} + (\varphi_{mU}h_{m} + \varphi_{fU}h_{f}) w_{U}$$

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 4: As per Proposition 4, 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 σ 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 3: Without loss of generality, let o = R and $w_U > w_R$. By Proposition 4, rural families that participate in the urban labour market will opt for RU. There-

fore, migration involves the migration cost μ , 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

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

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

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 3 apply. Therefore, $\tilde{\mu}(W, o, g; w_U, w_R, \varphi_0)$ is monotonically increasing in W.

Proof. of Proposition 5: Suppose that the cost of migration is, initially, equal to μ_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 3 (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 3 (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 rural market and an increase in human capital in the rural market and an increase 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 (7) 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.³⁰

(iv) As per equation (8), 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 8), 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. 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 (7) 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 (8), 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 6: (i) If $\zeta_f > \zeta_m = 0$, then Proposition 4 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 μ_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 3, there exist wealth levels \overline{W}_{m0} and \overline{W}_{f0} satisfying the equation $\tilde{\mu}(W, o, g; w_{U0}, w_{R0}, \varphi_0) = \mu_0$ for g = m, f such that all rural families with wealth $W > \overline{W}_{g0}$ will choose to migrate via market

³⁰For 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.

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 3, 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 4 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 2 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 δ_{mk} , we obtain

$$w_k \theta_m b_m \left(1 + \frac{\frac{1}{\theta_f w_k} - \frac{a_m}{b_m}}{\frac{a_f}{b_f} - \frac{1}{\theta_f w_k}} \right)$$

$$= w_k \theta_m b_m \left(\frac{\frac{a_f}{b_f} - \frac{1}{\theta_f w_k} + \frac{1}{\theta_f w_k} - \frac{a_m}{b_m}}{\frac{a_f}{b_f} - \frac{1}{\theta_f w_k}} \right)$$

$$= w_k \theta_m b_m \left(\frac{\frac{a_f}{b_f} - \frac{a_m}{b_m}}{\frac{a_f}{b_f} - \frac{1}{\theta_f w_k}} \right)$$

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

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

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

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

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

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

$$2 - \left(\frac{w_k}{a_f \theta_f w_k - b_f}\right) > 0$$
$$\implies 2 \left(a_f \theta_f w_k - b_f\right) > w_k$$
$$\implies (2a_f \theta_f - 1) w_k > 2b_f$$
$$\implies w_k > \frac{2b_f}{2a_f \theta_f - 1}$$

We use the following lemma in the proof of Proposition 3.

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 1, we obtain $\tau (h_f, h_m, UU) - \tau (h_f, h_m, RU) = \varphi_{0UU} - \varphi_{0R}$ – i.e. the marriage price schedules in markets *UU* and *RU* are identical up to the constant $\varphi_{0UU} - \varphi_{0R}$. If φ_{0RU} is more favourable to *g* than φ_{0UU} then market *UU* will be more advantageous for the opposite gender and the marriage market corresponding to choice *RR* will not clear. If φ_{0RU} is less favourable to *g* than φ_{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: Preference Heterogeneity

In this appendix we show that how, if families have some bias between markets UR and UU, and are heterogeneous in this respect, this pins down the equilibrium difference in dowry payments between the two markets. Suppose that a family obtains additional utility ψ from finding a spouse for their offspring at the origin even if the couple subsequently migrates. There is heterogeneity in ψ in the population, and we denote by $\Psi(.)$ the corresponding cumulative distribution function. We assume that $\Psi(0) > 0$, which implies that a positive proportion of families incurs *disutility* from finding a spouse at the origin.

Recall that markets UR and UU entail participation in the same labour market. Therefore, the only difference between these two choices is in the marriage market 'entry cost' (φ_{0UR} versus φ_{0UU}), the marriage search cost at the location away from the origin ($\zeta_g \sigma$).and the preference heterogeneity captured in the term ψ . Therefore, for rural-born women, participation in market UR yields higher utility than participation in market UU if and only if

$$\psi - \varphi_{0UR} > -\varphi_{0UU} - \zeta_f \sigma$$
$$\iff \psi > (\varphi_{0UR} - \varphi_{0UU}) - \zeta_f \sigma$$

Therefore, given these parameter values, if there is rural-urban migration in equilibrium, a fraction $1 - \Psi(\varphi_{0UR} - \varphi_{0UU} - \zeta_f \sigma)$ of rural-born women opt for market UR. Similarly, a fraction

 $1-\Psi(\varphi_{0UU}-\varphi_{0UR}-\zeta_m\sigma)$ of rural-born men opt for market UR.

Note that market clearing requires that equal numbers of men and women opt for market UR. Therefore we must have

$$\Psi(\varphi_{0UR} - \varphi_{0UU} - \zeta_f \sigma) = \Psi(\varphi_{0UU} - \varphi_{0UR} - \zeta_m \sigma)$$

$$\implies \varphi_{0UR} - \varphi_{0UU} - \zeta_f \sigma = \varphi_{0UU} - \varphi_{0UR} - \zeta_m \sigma$$
$$\implies \varphi_{0UR} - \varphi_{0UU} = \frac{1}{2} \left(\zeta_f - \zeta_m \right) \sigma > 0$$

This equation pins down the difference between the marriage entry costs between markets φ_{0UR} and φ_{0UU} in an equilibrium with rural-urban migration.