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The Mating Game: (Potential) Intergenerational Conflict on Marital Arrangements

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Abstract

Recent research has shown that across several countries there is an ongoing decline in marriages arranged by the parents of the spouses (AM). This transition has been associated with industrialization, higher human capital investment, incorporation of younger cohorts into paid jobs, urbanization and the dissolution of extended households - prominent features of the modernization process. This paper proposes a partial equilibrium model to explain these patterns, highlighting one mechanism within a household through which modernization might lead to self-choice marriages. The model is a non-cooperative two-period game between parents and one child, where AM are used as the means to enter into an informal risk-sharing contract with another household (i.e. allows parents to create alliances among them, or reinforce their standing within their social network): if the child accepts the AM, she (and her parents) will share risk with another household. However, the opportunity costs of the arranged marriage are limited geographic and social mobility - in order to enforce the informal contract, the new couple follows strict post-marital residence rules. In contrast, children having a self-choice marriage are not geographically nor socially constrained; they might look for a partner with higher labor market return, have access to better-remunerated occupations, and find a spouse of higher quality. The model suggests that arranged marriages might disappear when the net benefits of the insurance arrangement (within their social network) decrease relative to (unconstrained) returns (to human capital) outside of their social group. In this framework, love marriages, increasing investment in human capital and the dissolution of extended households are endogenously determined. Nonetheless, the transition period might be characterized by an inefficient investment in the human capital of children, as parents might try to lower their child's outside option.

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1 Introduction

Throughout the last century, anthropological and ethnographic studies (Murdock, 1967; Goode, 1970; Goody, 1983; among others) have shown that the decision of marriage traditionally belonged to the kinship group; however, during the past centuries, several marital institutions have emerged in response to economics, political and social changes.[1] The anthropological evidence shows that in the West (Europe and America) the marriage decision was slowly transferred to the couple between the 4th and the 12th centuries.[2] In the East (Asia and Africa), in contrast, marriage evolved into a fundamental institution that allowed the kinship to form alliances with other groups, and slowly became a social, political and economic arrangement between two or more families, becoming one of the two key mechanism sustaining social networks.[3,4] In this context, Rubio (2017a) (and references therein) has documented a relatively recent, continuous and steady decline of the dominant marital institution in these regions: the arranged marriage – where marital choices are taken by the parents of the spouses. This transition towards self-choice marriage is correlated with increases in education, formal employment and urbanization, and with the gradual dissolution of the extended family, otherwise also identified as prominent features of the modernization process (Rubio, 2017a).[5,6]

Motivated by these patterns, this paper proposes a model of one potential mechanism behind the driving forces through which modernization might affect the formation of arranged marriages. I focus on intrahousehold decision-making and construct a partial equilibrium model that delivers the transition as the outcome of a declining economic benefit of the arranged marriage relative to an increasing opportunity cost of such arrangement. The intuition behind this model is that arranged marriages provide insurance to parents and to their children by allowing them to enter into an informal risk-sharing agreement with another household; in these societies, parents have an information advantage by having access to a network of acquaintances, and by observing their reputation and their economic outcomes.[7] However, arranged marriages come with a cost: they constrain the geographic and social mobility of the child, thereby potentially reducing her expected income and the expected quality of her mate.[8]

The benchmark model is a non-cooperative static two-period game between parents (who act as one agent) and one child. In the first period, parents use an exogenous endowment for investing in education of

[1] See for instance Fafchamps and Quisumbing (2008), Giuliano (2017) and Anukriti and Dasgupta (2017).

[2] Although, in spite of the huge transformation during that period, arranged marriages remained common among the wealthy or landed class. Slater (1976), among other historians (Stone, 1979; MacFarlane, 1986; Perkin, 1989; Goñi, 2016), claims that for the wealthy class arranged marriages offered the beginning of "family life with expanded familial connections; these families served also as credit institutions, levers of power, arbiters of education and professional advancement, an institution for transmission and distribution of property, enhancement of political and social influence, etc."

[3] Most societies also saw the birth and raise of marriage payments between the family of the groom and the family of the bride. The direction and magnitude of the payments, as well as the property rights of such transfers varies across areas and has evolved through time. See Anderson (2007) and references therein for a historical description of these payments and their evolution. The analysis of bride-price and dowry payments are beyond the scope of this paper. See Anderson and Bidner (2015) and Corno, Hildebrandt and Voena (2017) for some of the mot recent research studying these patterns.

[4] Strict post-marital residence and limited geographic mobility of households or groups is often considered the second mechanism ensuring the sustainability of social networks (see for instance Fox, 1983; Munshi and Rosenzweig, 2009; and Munshi and Rosenzweig, 2016; and references therein).

[5] Rubio (2017a) documents and analyzes in detail the trends of the transition for 18 countries. She shows that at the beginning of the 20th century, at least 72.1% of marriages were arranged, and they have declined by 40% on average, practically disappearing in several countries (Latest draft if available upon request).

[6] Furthermore, Rubio (2017b) provides causal empirical evidence on modernization as the main driver behind the transition by exploiting the introduction of a large technological innovation in agriculture during the 1970s in Indonesia, showing that cohorts living in areas more intensely treated by the "modernization process" transitioned faster away from arranged marriages (Latest draft if available upon request).

[7] By observing the entire shock histories of other households and by having repeated interaction with them, they might be able to observe who within their network faces idiosyncratic income shocks that are negatively correlated with their own household's shocks.

[8] Strict post-marital residence rules are followed by newlyweds and the exact nature of such rules depends on the type of society studied: matrilocal, patrilocal, or ambilocal (Keesing, 1975; Fox, 1983; Goody, 1983).

their child, and for finding her an arranged marriage partner by exerting a costly effort. In this period, the child consumes her exogenous endowment and receives education; in the second period, she has agency over the marriage decision: chooses to accept the arranged marriage partner, or decides to marry a love marriage partner; receives the returns to schooling, and faces an additive shock to her income. In addition, in this period the child also transfers a fixed share of her family income back to her parents (after the realization of the shock).

The two key assumptions of the model are: 1) arranged marriages are used by two families (or groups) to enter into risk-sharing contracts – benefiting parents and children;[9,10] and 2) there is a wedge between parents and children in the valuation of the marriage: children receive additional utility through a match quality component, which is not internalized by the parents.

The trade-off between the economic benefit of the arranged marriage and its opportunity cost is introduced in the second period through three assumptions based on previous literature: 1) a child choosing the arranged marriage face a negative covariance between her income shock and her spouses' income shock; the child rejecting the arrange marriage is effectively giving up informal insurance, they face a zero or potentially a positive covariance with the income shock of her spouse;[11] 2) accepting the arranged marriage (potentially) constrains her returns to schooling.[12,13] Rejecting the arrangement is equivalent to (potentially) having access to unconstrained returns to schooling;[14]and 3) alternative insurance mechanisms and/or permanent income shocks lead to lower participation in social networks (Morten, 2013), or even to the decision of leaving the network through permanent migration of households, and by allowing the children's marriage to take place outside the social group (Munshi and Rosenzweig, 2016).[15]

In this framework, the analytical comparative statics show that arranged marriages might disappear when the net benefits of the insurance arrangement decrease relative to (unconstrained) returns to education outside of the social network. In this case, parents internalize the expected higher benefits of their child's freedom to reallocate across geographic areas (i.e. potentially having access to higher returns to education by expanding their occupation choice set) and endogenously invest in more human capital for the child,

[9]This assumption is based on ethnographic evidence (Ter Harr, 1948; Vreede-de Stuers, 1960; Geertz, 1961; Goode, 1970; Chang, 1997; Zaman, 2008; Buunk et al., 2008; Jones, 2010; Apostolou, 2010; among others), previous empirical results from South Asia (Rosenzweig and Stark, 1989; Munshi and Rosenzweig 2016), and additional suggestive results on consumption smoothing calculated using Indonesian Family Life Survey are available upon request.

[10]Section 7 briefly discusses other explanations given for the existence of arranged marriages and how they might be incorporated into this simple model.

[11]This assumption can be easily relaxed and different cases might be analyzed. For references see footnote 9. Similar intuition can be derived if I allow the parents' and children's exogenous endowment to be a function of the child's labor in the second period – and label it farm or agricultural income – and allow the shock to affect this component of the family income. This shock in turn could be smoothed out if the child accepts the arranged marriage. Note, however, that this model focuses on idiosyncratic shocks that can be smoothed out across households, but allowing for aggregate shocks might deliver additional intuition on the conditions and on the thresholds that would induce the transition away from arranged marriages.

[12]The child and her spouse remain living near her parents (or parents-in-law) as a mechanism that allows the enforcement of the informal contract and the management of flows of information across household (mitigating potential moral hazard issues). Table 7 shows that children having an arranged marriage are more likely to remain living near their parents (or parents-in-law).

[13]Economists have long recognized that informal insurance networks do not have access to written and binding contracts; instead they rely on informal mechanisms to sustain cooperation such as reputation built through repeated interactions or shame and exclusion from the network as punishment for reneging on a contract (Coate and Ravallion, 1993).

[14]See Rubio (2017a) for some suggestive evidence on migration patterns.

[15]It has been documented that in India the jati or subcaste is the relevant social network (i.e. Rosenzweig and Stark, 1989), and therefore marriage is arranged by parents belonging to the same jati. Bidner and Eswaran (2015) propose a gender-based theory of the origin of the caste system based on other features not related to risk-sharing but widely documented in the Anthropology literature: endogamy, hereditary and hierarchical structure (largely based on occupation), and production complementaries between spouses. Their model explains the origin of child marriages (arranged by parents) as a mechanism adopted by parents to avoid punishments from endogamy violations of their children (marry outside the group once they reach adulthood). Data calculated by Rubio (2017a) using the Indian Human Development Index supports this assumption: children self-reporting a self-choice marriage are more likely have a partner not belonging to their jati (these results are available upon request).

effectively further increasing her outside option (and thus the probability that she rejects the arranged marriage).[16,17] The comparative statics, however, also show that for a range of parameters, i.e. while the industrialization process is at the onset (education and returns to human capital are sufficiently small), parents might have incentives to reduce the investment in education, effectively reducing the outside option of the child and thus increasing her probability of accepting the arranged marriage - leading to an inefficient (or lower) investment on the child's human capital.[18]

My theoretical framework abstracts from incorporating many dimensions of the (arranged) marriage decision problem and I leave this discussion for section 7.[19] However, I do extend the benchmark model in two directions. First, I study the case of a household with two children, this allows me to (1) partially capture the notion of different sizes of social networks; and (2) analyze the impact of gender composition of children.[20] And the second extension introduces the possibility of divorce in a third period. This extension is motivated by high rates of divorce prevalent in Southeast Asia (Jones, 1981; Jones, 1995; section 2).[21]

This paper contributes to several strands of the literature. First, it directly contributes to an extensive literature studying marriage decisions. Since the seminal papers by Gary Becker (1973, 1974, 1991), a unified framework to study the family has arisen, tying within-family decisions to aggregate patterns of marriage, fertility and divorce – Browning, Chiappori and Weiss (2014) summarizes the most up to date findings and techniques, Fafchamps and Quisumbing (2008) summarize the literature focusing on determinants of marriage in developing countries devoting a section to briefly mention the importance of parents as part of the decision-making process in some societies. Anukriti and Dasgupta (2017) provide an up-to-date summary of the literature studying marriage markets in developing countries. Similar to the analysis of Rubio (2017a), they study trends, assortative patterns and explore several potential economics explanations for the existence of diverse marriage arrangements and some of the consequences of such choices.[22] Relative to this literature, this paper (explicitly and) theoretically incorporates parents as decision makers in the marriage decision, focuses on a specific gain from the arranged marriage that benefits the extended households. and establishes the conditions that might give rise to a trade-off between the agents - by presenting an economic model that explicitly incorporates a mechanism capturing the way economic growth has eroded the value of these informal insurance arrangements.

This study also relates to a smaller but growing set of papers modeling the intergenerational conflict between parents and children. On the theoretical side, many of the current models can be traced back to Becker's (1974) "Rotten Kid Theorem."[23]On the empirical side, there is a growing number of studies

[16]In addition to the key trade-off highlighted, the model also captures other economic changes experienced during the last century. Section 6briefly discusses these features of the model.

[17]The literature has shown that parents in developing countries do invest in more schooling in response to potentially higher economic returns to human capital for children of both genders, even in societies where there is a strong preference for boys (Jensen, 2012; Heath and Mobarak, 2015).

[18]A handful of empirical and theoretical studies have found supporting evidence in favor of this theoretical result (Jensen and Nolan, 2017; Kochar, 2004; Chakrabarti, Lord and Rangazas, 1993).

[19]Modeling the transition away from arranged marriages is a challenging task, nonetheless. The industrialization and development processes experienced by these countries have changed many margins. Intrahousehold decisions interact with marriage markets and social norms shaping the patterns and dynamics of the transition process leading to similar responses in some instances, or unique patterns in other cases.

[20]The intuition delivered from this exercise shows that small social networks might incentivize parents to arrange the marriage of only one child. And, when this is the case, they chose to marry the child with the lowest expected return in the labor market.

[21]This extension of the model might not apply to patrilocal societies where divorce has very high social cost.

[22]The literature in anthropology and ethnography has long studied this topic. These scholars assert that families use the marriage of their children as a way to create alliances with other groups and to strengthen their social ties within their communities, giving rise to the theory of alliance (Murdock, 1967; Levi-Strauss, 1969; Goode, 1970; Keesing, 1975; Fox, 1983; Goody, 1983; among others).

[23]The theorem states that, absent informational asymmetries, an altruistic parent can control her (selfish) child's actions indirectly through transfers if the child's actions affect the level of household income. But it only applies under certain conditions.

demonstrating the importance of children as decision makers within the household.[24] A handful of recent papers have also explicitly incorporated the children's preferences into the household decisions' problem. Burton et al. (2002) study the interaction between parenting style and child behavior. Hao et al. (2008) present a model endogenizing the parental response to risky behavior of older children aiming to deter the same behavior of younger children. Baland and Robinson (2000) propose a model of child labor showing that even if parents are altruistic and child labor is socially inefficient, it may arise in equilibrium because parents fail to fully internalize its negative effects. Jensen and Nolan (2017) present a model focused on labor markets, risk neutral agents, boys and a patrilocal society that delivers similar theoretical results to those found in this paper and provide empirical evidence in favor of their model. I differ the discussion of their paper to section 6.2. Relative to these studies, this paper also recognizes children as active agents within the household and introduces a simple model showing how parents might endogenously react to the expected marital choices of their children.[25] I endogenize the education decision, showing that if parents fail to internalize all the gains from the marriage of their child, they might respond by reducing the value of the outside option of their child by reducing her schooling.

Closely related to the goal of this paper and in the intersection of the (arranged) marriage and the intergenerational conflict literatures, Mathur (2007) and Huang, Jin and Xu (2015) aim to understand (1) the factors determining the selection into each type of marriage, and (2) how matching outcomes differ between the two types of marriage (by using data from urban India and urban China, respectively). They recognize important features incorporated in this paper: human capital of agents, post-marital living arrangements and search costs in marriage markets. However, they assume exogenous education of children and study urban areas – where they argue that the key benefit of the marital arrangement is the selection of new member of a household that would minimize conflict across generations and help providing old-age care for parents. In contrast, this model focuses on: 1) arranged marriages in rural areas; 2) the early transition period towards modernization; 3) a risk-sharing component embedded in the arrangements of marriages across households; and 4) endogenizes education. A more detailed discussion of the key similarities and differences is found in section 6.1.

The rest of the paper is organized as follows. Section 2 shows the trends and patterns of the marriage transition. Section 3 presents the base model of marriage choice as a game between parents and one child. Section 4 extends the model to allow for divorce. Section 5 presents the second extension of a households with two children. Section 6 discusses the differences with the current literature. And section 7concludes and highlights the limitations of this paper.

2 Stylized Facts

Arranged marriages have existed in most societies throughout history. In Europe, arranged marriages disappeared as the Catholic Church consolidated as the main religion in the Roman Empire. Anthropologist Jack Goody (1983) documents that arranged marriages were common among the ancient Greeks, Romans and Anglo-Saxon tribes until the rise of the Catholic Church, which favored self-choice marriage and monogamy. The disappearance of arranged marriages in Europe was not monotonic nor uniform; however, by the late

See for instance Bernheim, Shleifer, and Summers (1985), Bergstrom (1989), Weinberg (2001), Gatti (2005).

[24]For instance, Dauphin et al. (2011) use the UK Family Expenditure Surveys finding results consistent with children aged 16 to 21 being decision-makers.

[25]It is important to emphasize that this model takes a marriage partner as a bundle of three characteristics: a partner of certain quality, a (fixed or flexible) post-marital residence, and a set of occupations available for the child.

medieval period, the nuclear monogamous and self-chosen marriage was dominant in Europe (Greif, 2006), except among the wealthiest class, which continued to arrange the marriages of their children until the dawn of the Industrial Revolution (Goode, 1970).

In Asia and Africa, arranged marriages persisted as the dominant marriage institution until recent decades. The literature from sociology, anthropology and psychology (Goode, 1970; Buunk et al., 2008; Jones, 2010; among others) has long studied several of these countries, suggesting that arranged marriages originated as a strategy of families to form alliances with other families, groups or clans. Some examples of such studies are the following:[26,27]

> "Leaving aside divorce-dissolved families, couples who marry after free courtship are less likely permanently to be obliged to provide material and emotional care for their relatives and in-laws, in particular the husband's parents." (Korea: Chang, 1997).
>
> "At the micro level, especially in developing countries like Pakistan, the family remains centrally responsible for providing food and sustenance, offering also protection and safety to individuals, particularly in childhood and old age. The family as a supreme institution, however, then also dominates individual agency and asserts its will over choices in marital selection, thus potentially undermining individual emotions and causing hardship. Families promote such marriages where they perceive the possibility of gaining certain types of benefits or various forms of security." (Pakistan: Zaman, 2008).
>
> "The fact that lineages and clans are widespread does not differentiate Africa, except in degree, from many other culture areas. They are common, however, and thus the choice of spouse, gift exchanges at marriage, and the subsequent attention paid to marital behavior by the clan has a corporate character." (Sub-Saharan Africa: Goode, 1970).
>
> "The maintenance of the caste system [...] depended completely upon the arranged marriage. Maintenance of the caste was too important a matter to be left to the young. [...] in India it developed not only among the wealthy, who could afford early marriages and whose union might mark an alliance between two families, but also among the poor, who had nothing to share but their debts." (India: Goode, 1970).
>
> "Marriage, in adat (customary) law, is in varying degrees a matter of kinship group, community and personal concern. It is also a matter of social status. Marriage is the means by which the organized relationship groups which form autonomous communities maintain their existence. Social classes maintain themselves through well-regulated marriages, and hence the tie-up between marriage and social status.[...] Fellow members aid each other reciprocally. And groups, particularly kin groups, and exogamous sub-clans, are in a regular exchange of goods, which is linked to the exchange of women." (Ter Harr, 1948).[28]

[26] These scholars suggest that exogamy and descent rules combined with geographic restrictions and gender division of labor gave rise to a continuum of kinship and marital organizations, where parents or the kinship group have traditionally had a larger weight on choosing the partner of their children (Fox, 1983; Levi-Strauss, 1969).

[27] An example found in the evolutionary psychology literature also supports the hypothesis posed by sociologists and anthropologists: "Parents may have a relatively stronger preference for children's mates with characteristics suggesting high parental investment and cooperation with the in-group, whereas children may have a relatively stronger preference for mates with characteristics signaling heritable fitness." (Buunk et al., 2008)

[28] Similar examples can be found among other scholars studying Indonesia:

> "Parental marriage arrangement in Java must be seen not in terms of kinship organization as such, but as an aspect of the economic and prestige systems of the larger society, and as a function of the internal authority structure of the elementary family. For the choice of spouse, serves the interests of the parents primarily, by expanding the range of their social ties, or consolidating those already existing, and by validating their social rank in their community." (Geertz, 1961).
>
> "Adat never protects individual interests but guarantees in first place interests appertaining to the group. The settlement of a marriage should be regarded as an agreement between two families. Marriage and issue do not exist to further the happiness of the individual; they have a very different meaning: they are institutions which help to maintain the existence of the clan." (Vreede-de Stuers, 1960).

In a companion paper (Rubio, 2017a), I provide extensive and detailed analysis of the transition for eighteen countries: Turkey, Saudi Arabia, Israel, Japan, Korea, China, Taiwan, Indonesia, Malaysia, Cambodia, Vietnam, Sri Lanka, Nepal, Togo, Ghana, India, Pakistan and Bangladesh. Figure 1 shows these trends by region (Middle East and Africa, East Asia, South East Asia and South Asia). For the first three regions, we observe a clear trend toward the disappearance of arranged marriages, although at differing rates. The exception is South Asia (India, Bangladesh and Pakistan), where arranged marriages are still the most common form of marriage. However, a closer examination of India suggests that urban areas have started the transition towards love marriages, increasing from 5% to 10%.

The next figures show some of the main correlates of the decline of arranged marriages. Figure 2 shows that the decline in the share of arranged marriages across cohorts is correlated with the increase in educational attainment.[29] Figure 3 shows that the decline in arranged marriages is correlated with the increase in the share of women working in more formal labor markets, and figure 4 further indicates that the decline in agriculture is also associated with lower shares of arranged marriages. Although not shown here, most of these patterns also hold and are statistically significant when using a regression analysis that includes all the variables (Rubio, 2017a). And finally, table 7 provides evidence on the correlation of post-marital living arrangements and arranged marriages: for countries where data is available, it is shown that individuals having an arranged marriage tend to live near their parents or parents-in-law after marriage.[30] Overall, the correlations suggest that economic growth has been associated with a dramatic change in the formation of households. Finally, figures 5 and 6 present an additional piece of evidence, they show divorce trends by type of marriage and cohort of birth for Indonesia and Turkey, respectively. They show that divorce among couple having a love marriage has decreased in both countries, while it has increased among couples having an arranged marriage.

3 The Model

In this section I present the model which emphasizes a potential trade-off between insurance gains from arranged marriages and returns outside the social network (the outside option).[31,32] The outside option is represented by unconstrained returns to education; if individuals give up the arranged marriage, they are free to reallocate geographically (and thus accessing a broader set of occupations) and socially (potentially finding a partner with higher education/income).[33] I start by analyzing a two-period model for a household with only one child.[34] I then extend the model to allow for divorce in a third period. An a second extension

[29]Furthermore, education and arranged marriages are negatively correlated even within cohorts and countries, ruling out the possibility that the time series correlation is exclusively driven by a common unobserved time trend, these results are available upon request.

[30]The data from IFLS still has to be included, but a similar pattern appears.

[31]The recent literature in development economics has modeled this problem in the context of a limited commitment model (Coate and Ravallion, 1993; Lingon, Thomas and Worral, 2002), where households participate in the agreement as long as they receive at least a reservation value (equivalent to the outside option being lower than the net gain from the risk-sharing agreement). The model proposed in this section omits the potential limited commitment problem; however, a similar intuition should follow if we relax this assumption.

[32]This assumption is based on ethnographic evidence (Ter Harr, 1948; Vreede-de Stuers, 1960; Geertz, 1961; Goode, 1970; Chang, 1997; Zaman, 2008; Buunk et al., 2008; Jones, 2010; Apostolou, 2010; among others), previous empirical results from South Asia (Rosenzweig and Stark, 1989; Munshi and Rosenzweig 2016), and additional suggestive results on consumption smoothing are available upon request, these were calculated using the panel component of the Indonesian Family Life Survey by type of marriage.

[33]To solve the model, I assume assortative matching in terms of education level which might be interpreted as children finding a partner with higher education/income.

[34]This model also attempts to capture other economic changes that characterize the process of modernization. See section 6

examines a household with two children and differing gender composition.

3.1 One-child Model: Setup

There are two periods and each household has two agents: parents (who act as one agent) and one child, denoted by the subscript f and k, respectively. Each agent maximizes a quadratic utility function, $u(c_{t,i}) = c_{t,i} - \frac{d_i}{2}c_{t,i}^2$, $i = f,\ k,\ t = 1, 2$, where $c_{i,t}$ is consumption of agent i at time t, d_i is the parameter that captures her degree of risk aversion and it is bounded such that $u(c_{i,t}) > 0$, $u'(c_{i,t}) > 0$ and $u''(c_{i,t}) < 0$ in the relevant region in which $c_{i,t}$ takes values. Parents and child have an income endowment normalized to 1 in each period.

In period 1, parents choose investment in education λ_k for the child and the level of effort, $e \in \{0, 1\}$ that they exert to find her a partner. The first period budget constraint for parents is given by $c_{1,f} = 1 - p\lambda_k - e_{high}I(e = 1)$, where p is the price of education, $I(e = 1)$ is an indicator variable taking the value of one if parents choose high effort and e_{high} is its cost. In this period, the child consumes her exogenous endowment. In period 2, the child receives $x_k\lambda_k + \delta_k$, where x_k are the (ex-ante) known returns to her education λ_k and faces a shock $\delta_k \sim N(0, \sigma_\delta^2)$. The shock faced is the same regardless of the level of education or type of marriage. For simplicity, I allow that the average returns to schooling differ by type of marriage, $x_{k,h}$, $h = L, A$.[35] Parents receive a share $0 < \varphi < 1$ from the returns to schooling of the child.

All children marry at the beginning of the second period, and within marriage the child shares resources with her spouse equally. Under these assumptions, the consumption in the second period for each agent is given by (eliminating the time index for simplicity):

$$c_{k,h} = 1 + (1 - \varphi)(\frac{x_{k,h}\lambda_{k,h} + x_{s,h}\lambda_{s,h}}{2} + \frac{\delta_k + \delta_s}{2}) \tag{1}$$

$$c_{f,h} = 1 + \varphi(\frac{x_{k,h}\lambda_{k,h} + x_{s,h}\lambda_{s,h}}{2} + \frac{\delta_k + \delta_s}{2}) \tag{2}$$

where $x_{s,h}\lambda_{s,h} + \delta_s$ is the income of the child's spouse. Finally, I assume a positive assortative matching function between spouses in terms of education.[36,37] The child receives additional utility from an additive love term, $u(c_{k,h}) + \alpha_h$, $h = A, L$, which comes from a known distribution: the cdf in the arranged marriage market is denoted by $\alpha_A \sim F_A(\alpha)$, and the cdf in the love marriage market is represented by $\alpha_L \sim F_L(\alpha)$.

The effort of parents in the first period determines the insurance quality of the partner in the second period. I define insurance quality as the correlation between the child's shock and her spouse's shock, $\varrho_{ks}\left(I(e = 1),\ I(L = 1)\right)$, where $I(L = 1)$ is an indicator variable taking the value of one if the child chose the love marriage: (i) If parents exert high effort, $e = 1$, and the child accepts the arranged marriage, $L = 0$, she and her spouse have a perfectly negatively correlated income; (ii) If parents exert low effort, $e = 0$, and

for a brief discussion on these features.

[35] Alternatively, we might interpret this assumption as $x_{k,L}\lambda_{k,L} = w(\lambda_{k,L})$, which would correspond to the income received in an urban area or in geographic area where she finds the maximum return to her human capital. Similarly, $x_{k,A}\lambda_{k,A} = f(\lambda_{k,A})$, which in turn corresponds to the income received in the rural area where the child remains living in the second period. Note that education, $\lambda_{k,h}$, is also indexed by $h = L,\ A$ and will vary depending on the type of marriage chosen in period 2 – It will be the outcome of the maximization process discussed in the next section.

[36] This assumption allows me to find the optimal education level for the child in terms of the parameters of the model; otherwise, the optimal education for the child will depend on the expected education (and return) of her spouse. This assumption might be relaxed to analyze other cases.

[37] The exogenous positive assortative matching function also attempts to capture the fact that higher skills in labor markets might attract better mates – the literature has shown that investment in human capital, for instance, might also be considered a pre-marital investment prior to entering the marriage market.

the child accepts the arranged marriage, $L = 0$, the negative correlation between spouses' shocks is less than perfect — for simplicity I assume that it is $\varrho_{ks}\left(I(e=0),\, I(L=0)\right) = 0$; (iii) If the child decides to find her own mate in the love marriage market, $L = 1$, the correlation with her spouse's income might be positive, negative or zero, regardless of the effort of the parents — for solving of the model I set it equal to zero. It is important to emphasize that all results still hold if I eliminate the effort component. It was added to capture the fact that potential mates in the arranged marriage market might become scarce through time as people move across geographic areas.

3.2 Solution of the model and Analysis

The model is solved backwards. Starting in period 2, parents and children calculate their expected utility for a given level of education, a given effort and an expected love term. Anticipating the decision of the child in period 2, parents choose effort and education in period 1 by solving the following maximization problem:

$$\underset{\lambda_{k,h},e\in\{0,1\}}{Max}\; u(c_f) + \beta E[u(c_f)] \tag{3}$$

where: $$s.t. \quad c_f = 1 - p\lambda_{k,h} - e_{high} I(e=1)$$

$$\begin{aligned} E[u(c_{f,h})] \;=\; & \left[1+\varphi\left(\frac{x_{k,h}\lambda^*_{k,h} + x_{s,h}\lambda_{s,h}}{2}\right)\right] - \frac{d}{2}\left[1+\varphi\left(\frac{x_{k,h}\lambda^*_{k,h} + x_{s,h}\lambda_{s,h}}{2}\right)\right]^2 \\ & -\frac{d}{2}\varphi^2\sigma^2_\delta\left(\frac{1+\varrho_{ks}\left(I(e=1),\, I(L=1)\right)}{2}\right) \end{aligned} \tag{4}$$

The first order condition delivers:[38]

$$\lambda(e)^*_{k,h} = \frac{(\beta\varphi x_{k,h} - 2p)(1-d) - 2pde_{high}I(e=1)}{d(2p^2 + \beta\varphi^2 x^2_{k,h})} \tag{5}$$

Parents invest in the child's education if the discounted share of returns they receive ($\beta\varphi x_{k,h}$) is higher than the foregone consumption in the first period ($2p$).[39] Parents also face a trade-off ($2pde_{high}I(e=1)$) between investing in education and looking for a high quality insurance partner for their child.[40] It is important to emphasize that the main results still hold if we set the effort cost equal to zero.

The optimal effort is chosen based on the comparison of the expected utility under each scenario; high effort, $e = 1$, is optimal if its present discounted value of consumption is higher than choosing the alternative (suppressing the subscripts k and h):

$$\begin{aligned} & [1-p\lambda^*(e=1) - e_{high}] - \frac{d}{2}\left[1-p\lambda^*(e=1)-e_{high}\right]^2 + \beta\left\{[1+\varphi x\lambda^*(e=1)] - \frac{d}{2}\left[1+\varphi x\lambda^*(e=1)\right]^2\right\} \;> \\ & [1-p\lambda^*(e=0)] - \frac{d}{2}\left[1-p\lambda^*(e=0)\right]^2 + \beta\left\{[1+\varphi x\lambda^*(e=0)] - \frac{d}{2}\left[1+\varphi x\lambda^*(e=0)\right]^2 - \frac{d}{2}\varphi^2\sigma^2_{i\delta}\right\} \end{aligned} \tag{6}$$

High effort decreases consumption in the first period and decreases education ($\frac{\partial\lambda}{\partial e_{high}}\;|_{I(e=1)} < 0$) (and

[38] In equilibrium $x_{k,h} = x_{s,h}$, by the assumption of assortative matching. Therefore the FOC can be simplified and expressed only in terms of $x_{k,h}$.

[39] The optimal education level is increasing in the returns to education and on the share that parents receive as long as $\frac{2p}{\beta}\frac{\left[1+d(e_{high}-1)\right]}{(1-d)} < \varphi x_{k,h} < \frac{4p}{\beta}\frac{\left[1+d(e_{high}-1)\right]}{(1-d)}$. For the rest of the analysis, I assume that the returns to education fall within this range in order to derive comparative statics.

[40] The introduction of the effort cost mechanically introduces a trade-off between investing in education and finding an insurance partner for the child. This trade-off might be assumed away by setting $e_{high} = 0$, the main results still follow.

therefore consumption in the second period), but it is optimal as long as the child accepts the arranged marriage and the gains in utility from offsetting the income shock ($\frac{d}{2}\varphi^2\sigma_\delta^2$) are large enough to compensate for the loss in consumption in both periods.

In this model all children marry; they decide at the beginning of period 2 either to accept the arranged marriage or not based on the comparison of the expected utility under each type of marriage (suppressing the subscript k):

$$E[u(c_{k,L})+\alpha_L]-E[u(c_{k,A})+\alpha_A]=(1-\varphi)\left(x_L\lambda_L^*-x_A\lambda_A^*\right)\Bigg[(1-d_k)-\frac{d_k}{2}(1-\varphi) \tag{7}$$

$$(x_L\lambda_L^*+x_A\lambda_A^*)]-d_k\frac{(1-\varphi)^2}{4}\sigma_\delta^2\left[\varrho_{ks}\left(e,\, I(L=1)\right)-\varrho_{ks}\left(e,\, I(L=0)\right]+E\left(\alpha_L\right)-E\left(\alpha_A\right)>0$$

Using these results and the assumptions outlined, we can summarize the main implications of the model in the following proposition.

Proposition 1. *Parents and children receive benefits from insurance (and thus from arranged marriages) and from the returns to education. The child, however, receives additional utility from the expected value of match quality term; she might be willing to give up insurance in order to find a mate in the love marriage market. In contrast, parents do not receive utility from this match quality component, generating a wedge between the child and the parents. Ceteris paribus, love marriage is preferred when (among others):*

(i) $(x_L - x_A) > 0$*, the returns to education are higher or increasing for love marriages. For a given level of education, higher* ***unconstrained*** *returns increase the probability that the child chooses the love marriage. In turn, parents internalize it, decrease effort, which produces two additional effects. It further increases education, which increases the value of the outside option. It also decreases the insurance quality of the arranged marriage mate, decreasing the insurance benefits of the arrangements.*

(ii) And, σ_δ^2*, the size of the shock decreases. For a given level of education, a decrease in the size of the shock decreases the probability that the parents will exert high effort; in turn, this lowers the insurance quality of the arranged marriage partner. It also increases the investment in education,* λ_k*, effectively increasing the outside option of the child. For the child, the insurance advantage of the arranged marriage also disappears.*

Proof. *The appendix shows the analytical proofs for changes in* $(x_L - x_A)$ *and* σ_δ^2*. In addition it shows analytical results for changes in* $\varrho_{ks}\left(e,\, I(L=1)\right)-\varrho_{ks}\left(e,\, I(L=0)\right.$*,* d_k*,* d*,* e_{high}*, and* $E\left(\alpha_L\right)-E\left(\alpha_A\right)$*.*[41]

4 Extending the Model to Include Divorce

The goal of this section is to understand how divorce behavior might differ by type of marriage as the insurance advantage of arranged marriages vanishes. This extension is motivated by large divorce rate in

[41] Previous versions of the paper present simulations showing graphically the results of Proposition 1 and the results found in appendix 9.1. These results are available upon request.

some Southeast Asian countries. In order to derive the intuition, I allow for a third period when the divorce decision takes place.

The sequence of decisions remains unchanged for the first two periods. At the beginning of period 3, the child observes the realization of the love term, α, and decides whether to remain married or not. If she divorces, she will face alone the realization of her shock in this period and pay a utility cost $\phi > 0$ in period 3; and in the next period (a fourth period in concrete terms), she will find a new partner in the love market regardless of the previous type of marriage. Therefore, the child will divorce if:

$$\alpha_h + u\left(c_k\right)^{M,h} + \beta\left\{E\left[u\left(c_k\right)\right]^{M,h} + \alpha_h\right\} < u\left(c_k\right)^{D} - \phi + \beta\left\{E\left[u\left(c_k\right)\right]^{M,L} + E\left(\alpha_L\right)\right\},\ h = L, A \quad (8)$$

M represents the utility of married individuals, D represents the utility of divorced individuals, h, as before, refers to the type of marriage, L referring to love marriage and A to arranged marriage; α_h is the realized love term for the married individual in type of marriage $h = L$, A, and α_L is the love term drawn from $F_L(\alpha)$. This expression is simplified in the appendix and used to derive the thresholds for divorce by type of marriage.

Since the distribution of α_h differs by marriage, the probability of divorce depends directly on the distribution of the love term in each marriage market. Let us define the expressions (see appendix 9.2 for details on these thresholds):

(i) $$\hat{\alpha}_L = (1+\beta)^{-1}\left[-\phi + \tfrac{d_k}{2}(1-\varphi)^2\sigma_\delta^2\left[\tfrac{\varrho_{ks}(e,\,I(L=1))}{2} - \tfrac{1}{2}\right] + \beta E\left(\alpha_L\right)\right]$$

(ii) $$\hat{\alpha}_A = (1+\beta)^{-1}\left[-\phi - \tfrac{d_k\beta}{2}\tfrac{(1-\varphi)^2}{4}\sigma_\delta^2\left[\varrho_{ks}\left(e,\,I(L=1)\right) - \varrho_{ks}\left(e,\,I(L=0)\right)\right]\right] + \tfrac{d_k}{2}(1-\varphi)^2\sigma_\delta^2\left[\tfrac{\varrho_{ks}(e,\,I(L=0))}{2} - \tfrac{1}{2}\right] + \beta E\left(\alpha_A\right)$$

Recall that $\alpha_L \sim F_L(\alpha)$ and $\alpha_A \sim F_A(\alpha)$, delivering the following probabilities of divorce (divorce occurs for any draw, α_h, that falls below the thresholds defined above):

$$P^{D,L} = \int_{-\infty}^{\hat{\alpha}_L} dF_L(\alpha)d\alpha \ \ and \ \ P^{D,A} = \int_{-\infty}^{\hat{\alpha}_A} dF_A(\alpha)d\alpha \quad (9)$$

The solution to the model is found in a similar way as before. Once the probabilities of divorce are calculated for each type of marriage, the child uses them to calculate the expected utility for each type of marriage in period 2, and the parents incorporate them into the optimal choices (education and effort) of period 1. The appendix 9.2 shows the expressions determining these choices.

Proposition 2. *For arranged marriages, ceteris paribus, divorce increases as the gains from insurance disappear:* $\downarrow \left[\varrho_{ks}\left(e,\,I(L=1)\right) - \varrho_{ks}\left(e,\,I(L=0)\right)\right]$.

Proof. *The threshold,* $\hat{\alpha}_A$*, increases as* $\downarrow \left[\varrho_{ks}\left(e,\,I(L=1)\right) - \varrho_{ks}\left(e,\,I(L=0)\right)\right]$*. This leads to an increase in* $P^{D,A}$ *from equation 9.*

If arranged marriages provide more insurance, $\varrho_{ks}\left(e,\,I(L=1)\right) > \varrho_{ks}\left(e,\,I(L=0)\right.$, their divorce threshold will be smaller $\hat{\alpha}_A < \hat{\alpha}_L$. In countries where the cost of divorce (ϕ) is the same by type of marriage, we should expect $P^{D,A} > P^{D,L}$ only if $F_L(\alpha)$ first order stochastically dominates (FSD) $F_A(\alpha)$ and the difference

between thresholds, $\hat{\alpha}_A - \hat{\alpha}_L$, is small. If the threshold difference is large, or if $F_A(\alpha)$ FSD $F_L(\alpha)$, then we should expect the opposite result. Notice, however, that the risk aversion of the child, d_k, will determine how important the variances and covariance of the shock are. Less risk-averse children will place a higher weight on the love term. β plays a similar role; impatient children will put a higher weight on the dis-utility generated by being single during period 3.

5 Extending the Model to Two Children

I extend the model to consider the case in which parents have two children. This extension enables me to examine two important dimensions that are assumed away in the base model: the role of the size of the network and the effect of the gender composition of the children (within the household, abstracting from general equilibrium effects on the marriage markets). As the number of children increases, the size and quality of the social network play a crucial role; parents must take into account that the households where their children may be married to might have correlated shocks. If the social network is small (in this context, equivalent to having insurance partners with positively correlated shocks), parents might have incentives to arrange marriages for only some children.[42,43]

For the rest of the section I assume that all households have two children, differing only in the gender composition: (i) 2 boys; (ii) 1 girl and 1 boy; (iii) or 2 girls. In period 1, parents invest in the education of both children and decide the amount of effort exerted looking for a partner for each of them. The first period budget constraint is now given by:

$$c_f = 1 - gp_g\left(\frac{1}{j}\sum_j \lambda_{g,j}\right) - bp_b\left(\frac{1}{n}\sum_n \lambda_{b,n}\right) - g(\frac{1}{j}\sum_j e_j^g I(e_{j,g}=1)) - b(\frac{1}{n}\sum_n e_n^b I(e_{n,b}=1)) \tag{10}$$

where $j = 0, 1, 2$ and $n = 0, 1, 2$ are the number of girls and boys, respectively; $N_k = j + n$ is the total number of children; $g = \frac{j}{N_k}$ is the share of girls and $b = \frac{n}{N_k}$ is the share of boys; $e_{g,,j} \in \{0, 1\}$ is the effort for girl j with cost e_j^g, and $e_{b,n} \in \{0, 1\}$ is the effort for boy n with cost e_n^b; $I(e_{j,g} = 1)$ is an indicator variable that takes the value of 1 if parents choose to exert high effort for girl j; and $I(e_{n,b} = 1)$ has a similar interpretation for boy n. Children are homogeneous within gender but heterogeneous between gender in the price of education ($p_g \neq p_b$) and the returns to schooling ($x_g \neq x_b$).[44] Again, the returns to schooling differ by type of marriage, $h = A, L$; for notational simplicity, I am omitting the subscript h.[45]

[42] Under the assumption that the only benefit from arranging the marriage of children is access to the risk-sharing agreement. If other benefits are present (as suggested by Mathur (2007) and Huang, Jin and Xu (2015)), then this result might not hold anymore.

[43] This result also assume that there are no birth-order effects in the education or marital decisions, which might not be true in some of these countries (Volg, 2013).

[44] We might interpret the differences in prices as boys and girls having different opportunity cost of studying; for example, girls might have a lower opportunity cost of being taking away from home or from agricultural production (in the societies where female labor is less used for agricultural production). The differences in returns to schooling might be considered in a similar way; in agricultural societies, boys might have an advantage due to larger returns to physical strength, so as countries move away from agriculture the differences in returns to education might be reduced. The main goal of this section is to explore gender differences that in the absence of differences in cost and/or returns are not present, leading to a less interesting case for analysis. In the absence of gender differences, the analysis from the previous section can be directly applied provided that the budget constraint is properly adjusted to account for more costly children (as there are more children within a household).

[45] Recall that this assumption is equivalent to setting $x_{k,L}\lambda_{k,L} = w(\lambda_{k,L})$, which would correspond to the income received in an urban area or in geographic area where the child finds the maximum return to her human capital. And, $x_{k,A}\lambda_{k,A} = f(\lambda_{k,A})$, in turn corresponds to the income received in the rural area where the child remains living. And λ will now differ by gender, number of children and the solution of the model in the second period, i.e. the type of marriage.

Under these assumptions, the choice of education for the children depends on the gender composition of the family. I focus here on the case of one boy and one girl; the other two cases can be analyzed in a similar manner. The problem faced by the parents in the first period can be re-written as:

$$\begin{aligned} &\underset{\lambda_{g,j},\lambda_{b,n},e_j\in\{0,1\},e_n\in\{0,1\}}{Max} u(c_f)+\beta E[u(c_f)] \\ s.t. \quad &c_f = 1-\tfrac{1}{2}p_g\lambda_{g,1}-\tfrac{1}{2}p_b\lambda_{b,1}-\tfrac{1}{2}e_1^g I(e_{g,1}=1)-\tfrac{1}{2}e_1^b I(e_{b,1}=1) \end{aligned} \tag{11}$$

For given effort levels $e_{g,1}$ and $e_{b,1}$, the first order conditions for $\lambda_{g,1}$ and $\lambda_{b,1}$ determine the parents' optimal investment in education for boys and girls:

$$if\ \frac{x_g}{p_g}>\frac{x_b}{p_b}\Rightarrow \lambda_{g,1}^*=\frac{(1-d)\left(\beta\varphi x_g-2p_g\right)-2dp_g e}{dg\left(2p_g^2+\beta\varphi^2x_g^2\right)},\ \lambda_{b,1}^*=0 \tag{12}$$

$$if\ \frac{x_g}{p_g}<\frac{x_b}{p_b}\Rightarrow \lambda_{b,1}^*=\frac{(1-d)\left(\beta\varphi x_b-2p_b\right)-2dp_b e}{db\left(2p_b^2+\beta\varphi^2x_b^2\right)},\ \lambda_{g,1}^*=0 \tag{13}$$

where $e=\frac{1}{2}e_1^g I(e_{g,1}=1)+\frac{1}{2}e_1^b I(e_{b,1}=1)$.

In the case of households with two boys or two girls, we might expect a priori that parents provide the same level of education to both children (they are homogeneous within gender); however, the final choice of education might be asymmetric and it will depend on the marriage choice of each child (see discussion in appendix 9.3).

The model is solved backwards starting in the second period. Parents and children calculate their expected utility for a given level of education and effort. The expected utility of parents is given by (let $e_{g,1}$ and $e_{b,1}$ denote the chosen effort):

$$\begin{aligned} E[u(c_f)] \quad = \quad & \left\{\left[1+\varphi\left(gx_g\lambda_g^*+bx_b\lambda_b^*\right)\right]-\tfrac{d}{2}\left[1+\varphi\left(gx_g\lambda_g^*+bx_b\lambda_b^*\right)\right]^2\right. \\ & -\frac{d}{2}\sigma_\delta^2\left\{\varphi^2\left(\frac{1+\varrho_{g_1s}\left(I(e_{g,1}=1),\,I(L=1)\right)}{2}\right)+\varphi^2\left(\frac{1+\varrho_{b_1s}\left(I(e_{b,1}=1),\,I(L=1)\right)}{2}\right)\right. \\ & \left.\left.+\varphi^2\varrho_{g_1,b_1}(e_{g,j},e_{b,i})\right\}\right. \end{aligned} \tag{14}$$

where $\varrho_{g_1,b_1}(e_{g,j},e_{b,i})=\varrho_{g_1b_1}+\varrho_{g_1s_2}+\varrho_{b_1s_1}+\varrho_{s_1s_2}$.[46] This term captures the correlation between the households where the children are married, and it depends on: (i) the effort level exerted by parents for finding a mate for each child (recall that effort determines the insurance quality of the partner proposed by the parents); and (ii) the type of marriage chosen by each child. In contrast to parents, each child still decides based on 7, which does not depend on $\varrho_{g_1,b_1}(e_{g,j},e_{b,i})$.

In the extreme case in which the parents belong to a very small network, i.e., they have access to only one potential insurance partner (only one available household), arranging the marriage of both children into this household will increase the dis-utility term (the last term of 14, $\varrho_{g_1,b_1}(e_{g,j},e_{b,i})$) instead of providing more insurance;[47] furthermore, as the number of children increases, the concern of a small social network increases as well (see appendix 9.3 for proof).

[46] $\varrho_{g_1b_1}$ is the income correlation between the two children; $\varrho_{g_1s_2}$ is the income correlation between the first child and the spouse of the second child; $\varrho_{b_1s_1}$ is the income correlation between the second child and the spouse of the first child; and $\varrho_{s_1s_2}$ is the income correlation between the spouses of the two children.

[47] The goal of considering the extreme case of a unique insurance partner is to provide a clear intuition on how parents decide how to allocate education and effort. Studying other cases of small networks should deliver a similar intuition, but a more complex analysis are required.

Proposition 3. *If* $\varrho_{g_j,b_n}(e_{g,j}=1,e_{b,n}=1) \Rightarrow \varrho_{k,s}=1\ k=g_j,b_n,\ s=s_j,s_n$ *(the most constrained case, only one potential insurance partner, each component of* $\varrho_{g_1,b_1}(e_{g,j},e_{b,i})$ *has a positive correlation equal to 1) and* $\varrho_{g_j,b_i}(e_{g,j}=0,e_{b,i}=1)=\varrho_{g_j,b_i}(e_{g,j}=0,e_{b,i}=0)=0$*, then, ceteris paribus, parents exert high effort for (offer the arranged marriage) and give no education to the child with the lowest net return in the labor market. Parents invest in positive education for the child with the highest net return in the labor market and exert low effort for her (the appendix 9.3 show a more detailed analysis for different gender composition).*

Proof. *Appendix.*

In summary, the results suggest that parents use education investment and effort to induce children to accept the arranged marriage. By reducing education (for the child with the lowest net returns), parents are effectively reducing her outside option. When the child with a low outside option is offered the possibility of entering into the insurance arrangement by marrying a high insurance quality partner (through parents exerting high effort for finding her a partner), she will likely accept it. These results depend crucially on the assumption of limited or small social network, which imply that the households where the children would be married (under arranged marriages) have high income correlation. An additional analysis might be required to understand the dynamics when parents have access to multiple insurance partners through marrying their children into different households.

Corollary 3.1. *As* $\varrho_{g_j,b_i}(e_{g,j}=1,e_{b,i}=1)$ *increases, the probability of both children having an arranged marriage decreases.*

Proof. *This statement follows directly from 14. When* $\varrho_{g_j,b_i}(e_{g,j}=1,e_{b,i}=1)<0$*, parents gain from arranging the marriage of both children, as long as the outside option is sufficiently low. As* $\varrho_{g_j,b_i}(e_{g,j}=1,e_{b,i}=1)$ *increases and becomes positive, the dis-utility term of equation 14 dominates and parents prefer to arrange the marriage for only one of their children.*

However, preliminary empirical results suggest that within household there might an endogenous relationship between the gender composition and the probability of having an arranged marriage. In order to explore this prediction for the whole population, it is necessary to incorporate a general equilibrium framework.[48]

6 Discussion

There is a growing literature showing that economic changes that are characteristic of the modernization process and that economic policies being implemented in developing countries interact with social norms shaping the responses of individuals to such changes and programs. In some cases, the outcomes of this process lead to inefficient responses (i.e. Atkin, 2016, Corno and Voena, 2016; Corno, Hildebrandt and Voena, 2017), or favor only certain groups (i.e. Mushi and Rosenzweig, 2006; Luke and Munshi, 2011; Ashraf et. al., 2016). There is also a growing recognition that these changes and policies might contribute to the transformation or evolution of customary laws and social norms (i.e. Luke and Munshi, 2006; Ambrus et al., 2010).

The goal of this paper has been twofold. First, I aim to highlight a one of potential inefficient response in human capital investment occurring during the the early stages of the modernization process in (mostly)

[48] Preliminary empirical results suggest that within household there might an endogenous relationship between the gender composition and the probability of having an arranged marriage (in order to explore this prediction for the whole population, it is necessary to incorporate a general equilibrium framework): the larger the share of female siblings, the lower the probability that an individual has an arranged marriage (for Vietnam, Turkey and Indonesia). These results are available upon request.

agricultural countries that rely on children and social networks to overcome issues related to missing markets. And second, I have focused on marriage markets, and in particular on an institution still prevalent in several countries of Asia and Africa, arranged marriages, that has been often associated with welfare decreasing practices (marriage payments, child marriage, domestic violence, lower educational attainment, declining mental health among women, among others; see Anukriti and Dasgupta, 2017 for a summary of the trends on marriage markets in developing countries), although recent literature has also shown that it might benefit some groups of the population at some stages (Luke and Munshi, 2011; Ashraf et. al., 2016).

The key assumptions of this paper are based on results found by previous literature in different fields (anthropology, ethnography, sociology and economics) and on patterns document in a companion paper (Rubio, 2017a). As a result, I have assumed that arranged marriages are a bundle encompassing a spouse, a geographic location and a (potentially constrained) set of occupations. I have also emphasized one often cited gain from this marital institution in rural areas: access to a risk-sharing contract between two families.

The force behind the changes studied in this model is the process of modernization that leads to increasing returns to education; and I have focused on the transition period of an economy based on agriculture to an economy where manufacture and services start growing leading to permanent structural changes in these societies. During these initial stages of the transition, educational attainment and returns to education in rural areas tend to be low (Psacharopoulos and Patrinos, 2002). As a country starts to industrialize, these returns and human capital investment respond by increasing, even in rural areas (i.e., Foster and Rosenzweig, 1996; Psacharopoulos and Patrinos, 2002; Jensen, 2012). In these areas and during the initial transition, nonetheless, parents are the agents deciding how much schooling (and health) invest in their children. At the same time, decision-making agents start learning that one of the main features of human capital relative to other types of capital (social and physical) is its portability: individuals might have incentives to reallocate towards areas with higher returns for their skills.[49]

The benchmark model also attemps to capture other economic changes experienced throughout this period and the comparative statics found in appendix 9.1partially show their relative importance: (i) Changes in the risk profile (as countries move away from agriculture to manufacture and services, and as welfare programs are introduced by governments) can be studied by analyzing changes in the variance and covariance (across agents) of the shock that children face in the second period; (ii) the increasing cost of informal insurance (as migration and urbanization reduce and change the pool of potential insurance partners, increase the barriers to information flows, and limit the enforcement of the agreements) is introduced through an effort cost that parents exert for finding a partner for their child; and (iii) other changes in the marriage markets can be studied by analyzing how the distribution of the match quality component of spouses (by type of marriage) might change.[50]

[49] Although, there is also evidence of misallocation of resources, especially in developing countries, due to frictions that are initially costly to overcome.

[50] The variance and covariance of the shocks have shifted as countries industrialize (by changing the set of available occupations). At the same time, governments increase their revenue as the formal and taxable employment increases, allowing the establishment and spread of welfare programs - crowding out the need of informal insurance. The modernization process also changes the cost of belonging to informal social networks as migration and urbanization reduces the pool (and possibly the quality) of potential insurance partners, increases the barriers to information flows and worsens the limited commitment that characterize these informal insurance arrangements. And finally, we should expect changing quality of mates in each marriage market as we move away from one type of marriage to the other.

6.1 Relationship with the current literature: focusing on arranged marriages

Within the literature that has focused on arranged marriages, Mathur (2007) uses the model developed by Lundberg and Pollak (2003) to study the intergenerational game between parents and one son in the choice of marriage. She shows that (1) parents might prefer a partner that minimizes potential conflict (even if these characteristics reduce the total household income, i.e. lower schooling of the spouse); (2) there might be an additional utility gain from keeping the household intact (the extended household might break down if conflict between the two generations arises due to the spouse selected by the child). Mathur takes the education level of children as exogenous; her model, instead, hinges on the assumption that disagreement on the matchmaking mechanism might result on the dissolution of the household.[51,52]

Huang, Jin and Xu (2015) propose a model in which sons choose the search method in marriage markets, they might: (1) search themselves and incur the search cost; or (2) delegate the search to their parent (the parents borne the cost). They show that the agency of the decision yields differences in schooling and match quality and that the choice of marriage is determined by the search costs of each agent. The agency of the decision yields differences in schooling and match quality because (1) parents do not fully internalizing the gains of marriage of their sons, and (2) there are differences in the search cost function between parents and children. The choice of marriage is thus determined by the search costs of each agent. Similar to Mathur (2007), they take the education of the sons as exogenous; however, they do not incorporate the potential dissolution of the extended household as a driving force in their model, instead they assume that parents receive a share from the household production of their children (in addition to being altruistic towards their children) and the sharable part of the marriage outcome could be lower or higher under parental matchmaking depending on exogenous characteristics of the agents: lower son's human capital leads to parental matchmaking, and higher schooling of parents is associated with arranged marriages and with more children.[53]

This paper incorporates important features exploited in these two papers, but emphasizes some important differences. They highlight the role of: human capital of agents, post-marital living arrangements and search costs in marriage markets. However, they assume exogenous education of children and study urban areas,

[51] Mathur (2007) acknowledges that there are several reasons why parents and children may have different preferences for a spouse. For instance, if a wife produces two types of marital output, a private component consumed only by her husband and a public component consumed by the entire household and parents and sons value these two components differently, spouse preferences will differ across the two agents. Another reason why preferences may diverge relates to how the chosen spouse affects parents' relative share of household output. Parents may value characteristics in a spouse that enable them to maintain control within the household and maximize their share of household resources.

[52] She also finds differences in schooling and labor force participation of spouses by type of marriage. She concludes that these effects are driven, at least in part, by parental preferences and cannot be entirely attributed to correlation between arranged marriages and unobserved characteristics or preferences. Her findings lend support to the patterns shown in this paper and in Rubio (2017a, 2017b), suggesting that the identity of the decision maker matters when choosing the spouse of the child. She also finds that stronger financial and kinship ties between parents and sons increase the likelihood of an arranged marriage, supporting the mechanism proposed in this paper: labor market outcomes and marital arrangements are plausibly endogenously determined within a household.

[53] Their key predictions are that love in a marriage should be lower for parents-involved matches than for self-matches, the sharable part of the marriage outcome could be lower or higher under parental matchmaking, lower son's human capital leads to parental matchmaking, higher schooling of parents is associated with arranged marriages and with more children. They use data from China in 1991 finding that in rural and urban areas, parent matchmaking is associated with less marital harmony between the couple, more submissive wives, and a stronger belief in old age support for the son. And parent-matched marriages yield higher couple income in urban areas, but lower income in rural areas, and parent-matched marriages are associated with more children (in rural areas). They use an instrumental variable approach: the share of individuals in an arranged marriage at the smallest geographic by age group (to instrument for having an arranged marriage, under the assumption that it only affects the search cost in marriage markets after controlling for average income and average schooling at the town/village level). However, their instrumental variable might proxy other cultural characteristics (as they acknowledge), but it might also be the resulting equilibrium caused by changes: in occupational outcomes, risk-profiles and schooling availability/choices. In these cases, the exclusion restriction might be violated.

where they argue that the key benefit of the marital arrangement is the selection of new member of a household that would minimize conflict across generations (emphasizing the old-age care benefit in these extended households); in contrast, this model focuses mainly on characteristics of arranged marriages in rural areas, the early transition period towards modernization, and assumes endogenous education, recognizing that the level of education is likely the decision of the parents in these areas, especially in rural regions where agent have low schooling.[54] In addition, the model presented here: (1) allows me to study under which conditions intergenerational conflict is likely to arise and how parents might endogenously respond to changes in labor markets, by initially investing inefficiently on the human capital of their children; (2) I focus on a different benefit of arranged marriages also frequently cited in the literature: the formation of social networks as a response to missing markets in agricultural areas.[55]

6.2 Relationship with the current literature: focusing on interaction of modernization and social norms.

The most related paper to mine is Jensen and Nolan (2017). They develop a simple theoretical framework of strategic responses from parents who want to keep their children at home (in rural areas), and they empirically test their model by using a field experiment in India that provided recruiting services for the business process outsourcing industry in randomly selected rural Indian villages; thus, giving information on the higher returns to education available in urban areas.

Jensen and Nolan (2017) focus on labor markets, potential migration of sons and assume risk-neutrality of both parents and children. The driving force in their theoretical framework is the inability of parents to appropriate the income of their sons if they migrate. Instead, they receive a remittance from their son, which corresponds to a fraction of the labor income of the child minus the cost of migration that is paid by the child. In their model, they introduce this component (the share of the son's income that they do not receive) as an additional cost of education. Their theoretical results and main predictions are similar to the conclusions of the model presented in this paper: migrating children receive more education, and non-migrating children receive less education. However, the intuition behind their result is derived from a different margin: in order to incentivize the children to stay, parents must transfer a larger share of household resources to the child. The total household resources in turn depend on human capital; therefore, parents reduce the investment in education, as long as the remittance that parents receive is smaller than the income that the child would contribute by staying in the farm.[56]

In contrast, the model presented in this paper tries to capture changing human capital returns in labor and marriage markets as these societies start their process of modernization.[57] I assume risk averse agents and use the previous literature as motivation to introduce risk-sharing between households as the main gain of the arranged marriage: this arrangement allows the child (and her parents) to eliminate this shock

[54] Rubio (2017a) documents the average schooling for some of these countries: 3 years in Cambodia (2000 and 2005), 5 years in Indonesia (1993), 10.6 years in Taiwan (2006), 5 years in Turkey (1998), 2 years in Togo (1988), 4.6 years in India (2005), 8 years in China (2006), 12 years in Korea (2006). These levels of schooling levels suggest that most of the population has finished elementary or junior high school, at most.

[55] Rosenzweig and Stark, 1989; Munshi and Rosenzweig, 2016; Luke and Munshi, 2006; Luke, Munshi and Rosenzweig, 2004; among others.

[56] Jensen and Nolan (2017) acknowledge that there are other models that might deliver a similar intuition and mention some of the variants that might be used.

[57] Recall that I assume positive assortative matching between spouses, which would capture the returns to education in marriage markets.

at a cost.[58] I introduce a wedge between parents and their children by assuming that children obtain an additional utility from marriage (α_k), which is not internalized by her parents, and I focus on a case where a potential conflict between parents and children might arise: as returns to schooling start to increase, the child might prefer more education (giving up the insurance component) if in expectation of the match quality component from a love marriage is larger – even under the assumption that $u_p(.)$ and $u_k(.)$ are identical, the difference is generated by $u_k(.) + \alpha_k$; generating a conflict between parents and their child, and leading to an inefficient investment in the education of the child, i.e. parents lower the outside option of their child by lowering her level of education.[59,60] As returns to education continue to increase or if the expected match quality component is high enough – such that children, even after having their schooling lowered, continue to choose the love marriage – then parents internalize this choice increasing further the education of the child, as they receive a share γ of the household income of their child.

A second paper closely related is Ashraf et. al (2016), which exploits a decline in the cost of schooling in Indonesia and Zambia and shows that ethnic groups that traditionally engage in bride-price practice respond by sending their daughters to school and obtain a higher bride-price at time of marriage. They develop a theoretical model that allows them to explain these results and derive additional testable implications lending support to their hypothesis and initial results. Their model assumes risk neutral and altruistic parents. Parents invest in education of their daughters in a first period and receive a bride-price compensation in the second period when all the daughters marry. In contrast, this paper abstracts from including and modeling marriage payments across families and focuses on arranged marriages. Although marriage payments at time of marriage and arranged marriages have a high correlation, especially in areas where dowry is prevalent (i.e. see Anderson (2007), Giuliano (2017) and Anukriti and Dasgupta (2017) for a brief summary on marriage markets in developing countries and the changing role of gender through history), they do not have a one-to-one relationship. In turn, my paper focuses on a different aspect of arranged marriages: strict post-marital residence (more closely followed in patrilocal and patrilineal societies, but also present and still prevalent in matrilineal and matrilocal rural societies). Children having an arranged marriage are more likely to live with or close to their parents (sons brings wives into the extended household in patrilocal societies; daughters bring their husbands into their household in matrilocal societies). One of the main rationales behind these patterns, as discussed in previous sections, is to ensure the enforceability of risk-sharing contracts and mitigate problems of moral hazard in case of needing assistance.[61] These characteristics of arranged marriages are introduced through the assumption of risk-averse agents and the introduction of a random shock to child's income in the second period; and by the assumption that arranged marriages are a bundle (partner, geographic location and set of occupations). If parents were to receive an additional inflow of money from a marriage payment, $MP(x_k)$, which in turn is an increasing function of the education of the child, their second period budget constraint would be given by:

[58] Similar intuition can be derived if I allow the parents and children exogenous endowment to be a function of the child's labor. See 11 for an explanation on how this assumption might be relaxed.

[59] Similar results would follow if the parents are altruistic: $u(c_f) + \beta E[u(c_f)] + \beta\pi \left[E\left(u(c_{k,}) + \alpha_k\right)\right]$ as long as $\pi < 1$.

[60] The exogenous matching function assumed in the benchmark model implicitly recognizes that investing in schooling might result in a partner with higher education (incorporating the results shown by the literature studying marriage markets that has shown the importance of pre-marital investments).

[61] Other often cited benefit also present in rural areas is old-age care of parents. Jensen and Nolan (2017) briefly mention this characteristic as an additional mechanism in their model. Mathur (2007) and Huang, Jin and Xu (2015) explicitly focus on this gain, and the references in Rubio (2017a) often mention it as one highly valued benefit, especially as countries start witnessing movement of people across areas.

$$c_{f,h} = 1 + \underbrace{\varphi(\frac{x_{k,h}\lambda_{k,h} + x_{s,h}\lambda_{s,h}}{2} + \frac{\delta_k + \delta_s}{2})}_{insurance\,component} + \underbrace{MP(x_{k,h})}_{marriage\,payment} \tag{15}$$

In case of conflict between parents and their child, the final investment in schooling (increase or decrease) would depend on the relative marginal effects of the two components in equation 15. If:

$$\frac{\partial \left(\varphi(\frac{x_{k,h}\lambda_{k,h}+x_{s,h}\lambda_{s,h}}{2} + \frac{\delta_k+\delta_s}{2})\right)}{\partial x_{k,h}} > \frac{\partial MP(x_{k,h})}{\partial x_{k,h}} \tag{16}$$

the results from the theoretical model proposed in this paper still hold. Parents would still have an incentive to reduce the education of their child in order to induce them to accept the arranged marriage (the insurance component would be relatively more valuable than the marginal increase in the payment received). This additional gain from the marriage payment, however, would mitigate the inefficient investment in human capital. If the inequality sign in equation 16 favors the marginal return to marriage payments, then parents would give up the insurance component in exchange for a one time transfer of higher value, at least, in this simple model of two periods.[62]The results found by Ashraf et. al (2016), nonetheless, are consistent with the theoretical results of this paper given the time period and the quasi-experiment that they exploit in Indonesia. The oil-boom experienced in the early 1970s allowed the government to finance a series a programs aimed to:1) increase the productivity of agriculture (the program was known as BIMAS/INMAS, or Green Revolution); 2) increase access to schooling (INPRES program); and 3) stimulate the growth of the scarce national industry (the five-year national plans from the mid-1960s to the late-1970s detail how the government expected the industrialization of the country to occurs as a by-product of the increase of the agricultural productivity).[63]

7 Conclusions: Limitations and Work in Progress

This paper proposes a model explaining the disappearance of arranged marriages as the outcome of a decreasing economic benefit (from the arranged marriage) and an increasing outside option. The model explicitly incorporates the preferences of parents and one child through a game played in two periods. The main intuition derived from the model suggests that arranged marriages should disappear when the net benefits of the insurance arrangement decrease relative to the (unconstrained) returns outside of the social network. In this framework, love marriages, increases in education and the dissolution of extended households

[62]A model with more than two periods might strengthen the result of this paper as parents benefit from the risk-sharing component for more than one period. But the result from Ashraf et al. (2016) would still mitigate the inefficiency of the first period (lower investment in schooling).

[63]Rubio (2017b) exploits the BIMAS/INMAS program to study the impact on marital arrangements. The official documents from those decades state that the Green Revolution was the main program implemented by the government. Wet (or sawah) rice was the main staple in Indonesia and by the the late 1960s, Indonesia was a net importer of rice. The introduction of higher yield seeds from the early 1970s onwards (after two decades of political and civil instability following their independence) was extremely successful. Indonesia became net exporter of wet rice by the mid-1980s. This program was also the seed for the industrialization process that took off during the late 1970s and continued throughout the 1980s and 1990s. Rubio (2017b) documents large increases in agricultural income even during the first decade of the implementation of the program. Therefore, during the implementation of the INPRES program, returns to education were plausible very low, and ethnic groups practicing bride-price also plausible invested in the schooling of their daughters mostly considering the gains in the bride-price payment, and not the labor market returns. This is consistent with the result of Rubio (2017b), which finds that the cohorts responding to the increasing returns and structural transformation of Indonesia were those marrying by the late 1970s-early 1980s, once the BIMAS/INMAS program started delivering successful outcomes.

are endogenously determined. The goal of this paper has been to analyze how static considerations within the household might determine the initial choice between the two types of marriages by highlighting a trade-off between one economic benefit and its opportunity cost. This paper offers a novel explanation for the transition of marital institutions at early stages of modernization by highlighting the incentives of parents and children. This paper, however, has several limitations and I leave open many interesting (theoretical and empirical) questions, which are beyond the scope of this project and are briefly outlined in the following paragraphs.

The benchmark model presented in this paper lends further support to the empirical results found by Jensen and Nolan (2017). However, it presents several limitations. First, it might explain the investment in schooling in rural areas when a country is in the early stages of industrialization, returns to education are still low, and agriculture is main source of income and employment, relative to stages where industrialization has permeated most areas and increased its weight in labor markets, and returns to schooling are rapidly increasing. Importantly, I also disregard other pecuniary and non-pecuniary gains from arranged marriages that Jensen and Nolan (2017) briefly outline as additional benefits of having children living with or near their parents.[64]

A second limitation is the assumption that children easily find a mate in love marriage markets. This framework might be suitable for explaining inefficiencies in rural areas with high population density, or areas that are on the onset of being connected with other rural and urban areas during periods of expansion of transportation and communication infrastructures – which are also features of early stages of modernization.

In this model, the driving force is the ability to freely reallocate across geographic areas by giving up the risk-sharing contract — and thus, do not follow strict post-marital residence rules. Nonetheless, an alternative mechanism delivering a similar theoretical results might come through the interaction with members of the opposite gender at school or at a new occupation. The low educational attainment of the areas studied, even after initial increases in schooling, suggest that children are too young to meet potential partners at school. But even if school acts as an additional marriage market, it is likely that parents are aware that by sending their children to school and that by potentially allowing them to work in new occupations, they are allowing them to have access to different set of potential mates. Access to thicker marriage markets might be an additional contributing factor.

There is also substantial evidence that urban areas are still following traditional marriage practices, where parents arrange the marriage of their children through traditional matchmakers, or by making use of new technologies available, i.e. from newspapers adds to online dating. The model presented in this paper is not suitable for explaining these persistent patterns. Although as shown by Rubio (2017a), urban areas are also transitioning away from arranged marriages faster. This seemingly puzzlingly fact might be the outcome of: a) persistent social norms (see Giuliano, 2017 and references therein); b) preferences for mates belonging to the same social or ethnic group (Banerjee et al., 2013); c) other pecuniary and non-pecuniary benefits for parents and children not capture in this model (i.e., Luke and Munshi, 2006, or see Fafchamps and Quisumbing (2008) and Anukriti and Dasgupta (2017) for a discussion on this topic); or d) parents strategically limiting the group of peers their children interact with in such a way that marriages are arranged among members of these pre-selected groups (Bisin and Verdier, 2000).

Another important aspect is that the model implicitly assumes commitment between parents and children

[64]Other benefits often cited in the literature of anthropology, sociology and psychology are old age care (parents prefer to choose their caretaker through choosing the spouses of their children), investment in productive activities (the formation of networks allows individuals to have access credit or other inputs needed for production), consolidation of wealth or land, and conservation of social status, among others. The relative importance of these benefits might depend on the social class of the families involved, on the missing markets that each society face, and other idiosyncrasies of the country studied.

in the second period, regardless of the marriage (migration) status of the child.[65] The study of this question if beyond of the scope of this paper; however, in a new project I attempt to mitigate this concern by incorporating the bargaining process between parents and their children by allowing φ to be the outcome of a bargaining process between the child and her parents and therefore allowing for endogenous bargaining power of children.[66] For the model presented in this paper, an alternative way to deal with this problem is to assume altruistic children, which might mitigate the concerns about this assumption. However, making a distinction of the gender of the child (in the benchmark model), the type of society (matrilocal or patrilocal), the setting studied (rural or urban) and the driving force analyzed (industrialization, reduction in migration cost, reduction on the cost of schooling, among others) might be needed to understand potentially differential responses from parents and children.

Another drawback is to study the problem using a static model. A dynamic model (even if we keep the intro-household approach) might allow us to understand the dynamics resulting from: a) a changing the composition in the pool of available partners (or the quality of partners); b) learning in the marriage markets, i.e. children might start searching for a partner in the love marriage market that provides them insurance, especially as new occupations with negative correlation between them appear as countries continue to industrialize; and c) capture the evolution of social norms as they interact with modernization.

And finally, I also disregard the general equilibrium problem. If children are heterogeneous (in price and returns to schooling) and parents belong to a small social network, I show that they might have incentives to arrange the marriage only of the child with the lowest expected return in the labor market (and satisfy their insurance needs). If women are considered to have lower returns than men (Strauss and Thomas, 1996; Behrman, 1997), then parents might prefer to arrange the marriage of their daughters.[67] However, in equilibrium, households should supply the same number of sons. Moreover, a general equilibrium framework with two marriage markets present might help to understand the dynamics of the transition, selection into each type of marriage at different stages, and changes in market clearing conditions (when dowry and bride price are used as market clearing prices, i.e. Anderson, 2007; Anderson and Bidner, 2015; Corno, Hildebrandt and Voena, 2017). Current work in progress is focusing on this question of two marriage markets and the transition from the arranged marriage market to the love marriage market.[68]

[65] Preliminary data from IFLS supports this assumption, it shows that transfers from and to parents and parents-in-law for both types of marriages do not differ in the extensive margin. Evidence for other countries and for the intensive margin within Indonesia are currently under construction.

[66] Rubio and Sheth (2018)

[67] Preliminary results using data from Indonesia, Turkey and Vietnam, show that gender sibling composition is indeed associated with the probability of having an arranged marriage (even after instrumenting this measure).

[68] Search cost in marriage markets, matching functions between partners, and the changing the composition in the pool of available partners (or quality of partners) are likely the outcome of this general equilibrium framework (Rubio and Zhang, 2018).

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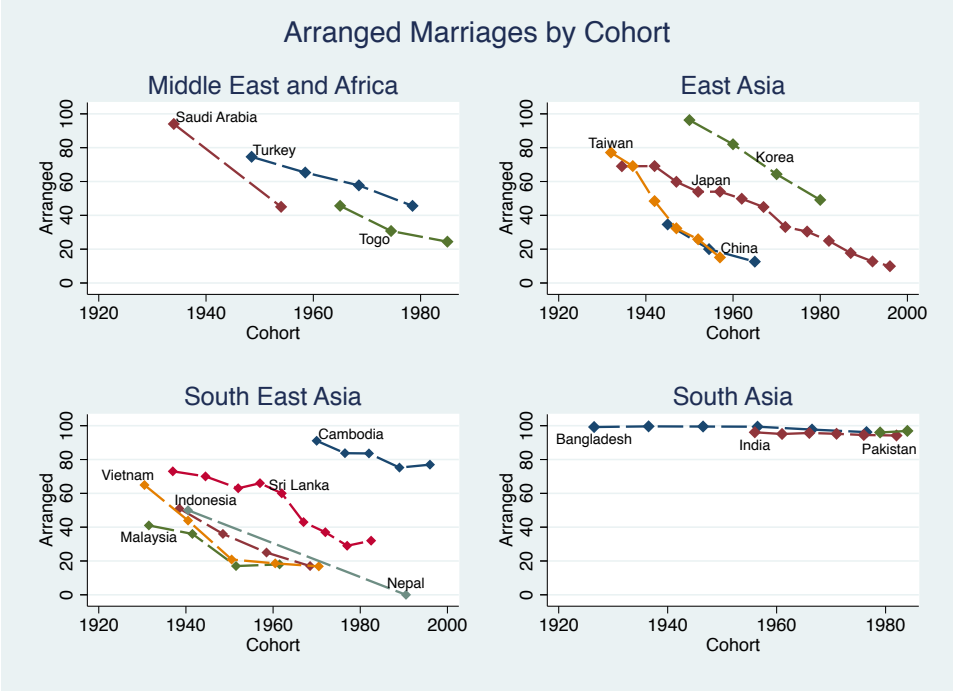
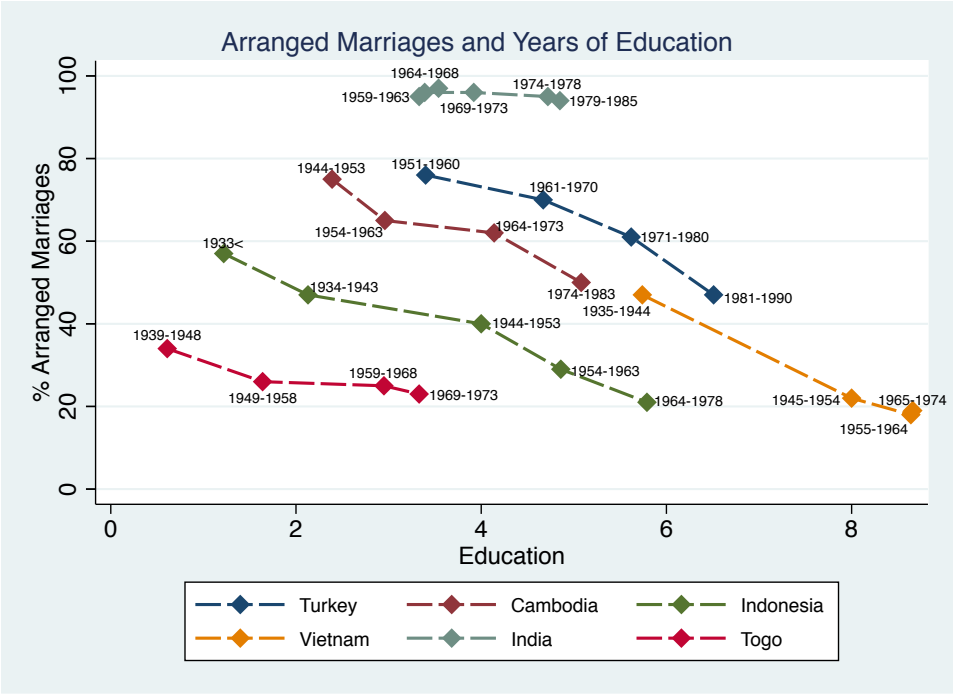
8 Graphs and Tables

Figure 1: Arranged Marriages by Cohort and Region



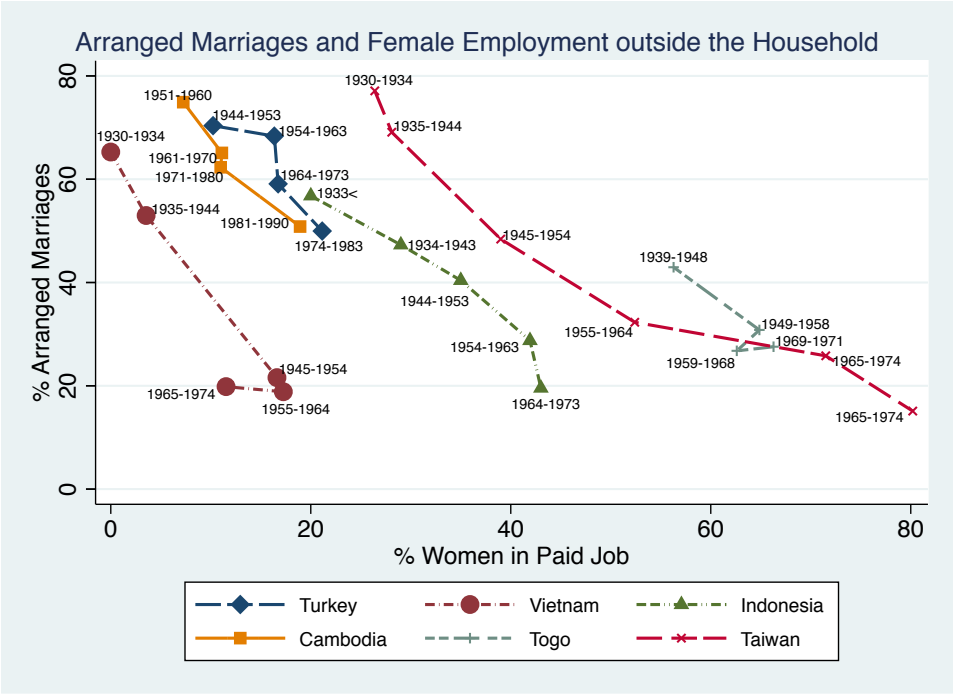
The data sources used to generate figures 1 to 4 are described in detail in Rubio (2015a). For the following countries, I have used aggregate information collected from survey reports and other research papers: Japanese National Fertility Survey (Japan), Korean National Fertility Survey (Korea), Chitwan Valley Family Study (Nepal), Chengtu City and Urumchi city Surveys (China), Shefar 'Am Arab community (Israel), Coastal Sri Lanka Survey (Sri Lanka), Southern Ghana Survey (Ghana), Asian Marriage Survey (Thailand), City of Damman Survey (Saudi Arabia), Taiwan Provincial Institute of Family Planning (Taiwan), Malaysian Marriage Survey (Malaysia). For the rest of the countries I have used micro-data from: Cambodian (2000 and 2005), Togolese (1988) and Turkish (1998, 2003 and 2008) Demographic and Health Survey, Vietnam Longitudinal Survey (1995-1998), Indonesia Family Life Survey (1993, 1997, 2000, 2007), India Human Development Survey (2005), and Matlab (Bangladesh) Health and Socio-Economic Survey (1996).

Figure 2: Arranged Marriages and Education by Cohort



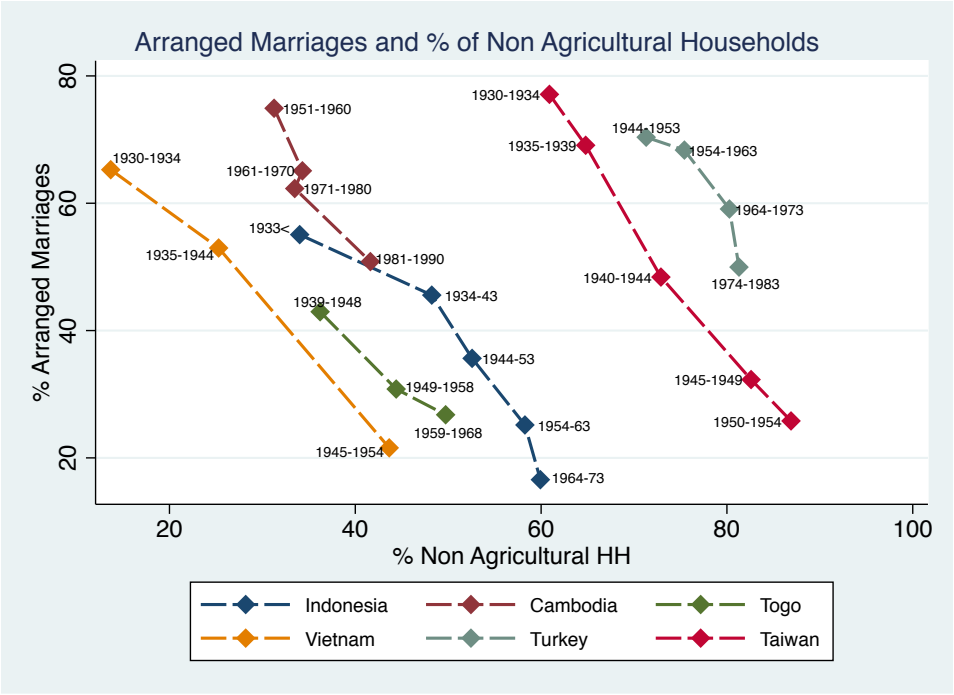
Each line of the graph refers to a different country and each point represents a different cohort for women. It correlates the average years of schooling of the cohort with the average percentage of women who ever had an arranged marriage within the same cohort.

Figure 3: Arranged Marriages and Female Employment



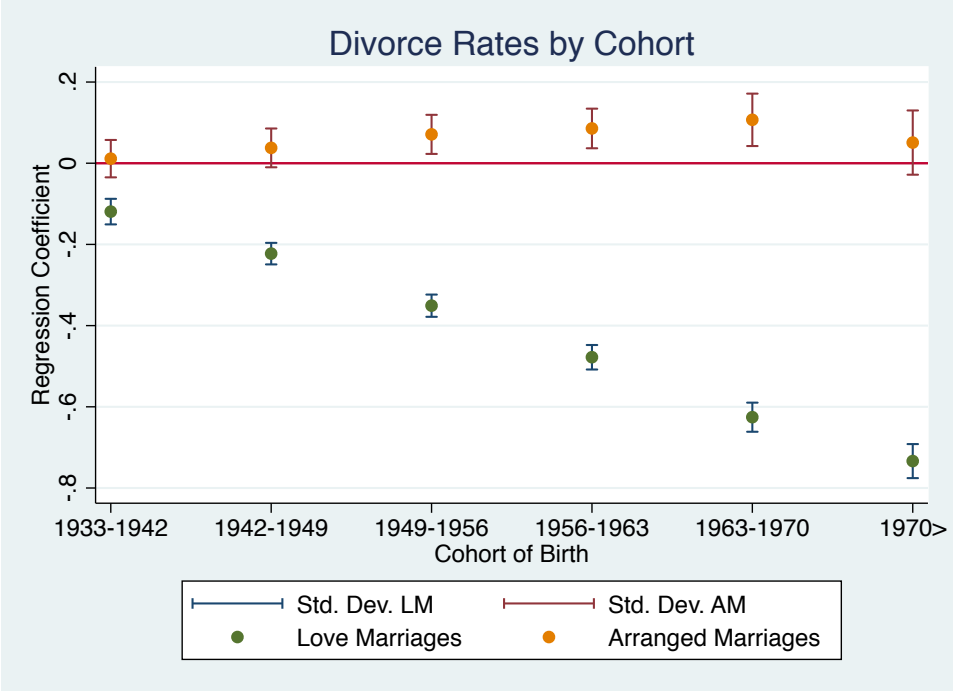
The definition of employment outside the household varies for each country depending on the information available. For Cambodia, Indonesia, and Turkey, women report three types of work status: employee, self-employed and family worker. This figure plots the percentage of employees by cohort. For Togo, there is no information on the work status of women; the variable used instead is the percentage of women "owning" their wages conditional on being in the labor force (women who can freely spend their wages). For Vietnam, the variable used corresponds to women working outside the household for non-relatives conditional on being in the labor force. For Taiwan, I use aggregate information on work status reported by cohort.

Figure 4: Arranged Marriages and Percentage of Non-Agricultural Households



Non-agricultural refers to households whose main income source is not agriculture.

Figure 5: Divorce Trends in Indonesia

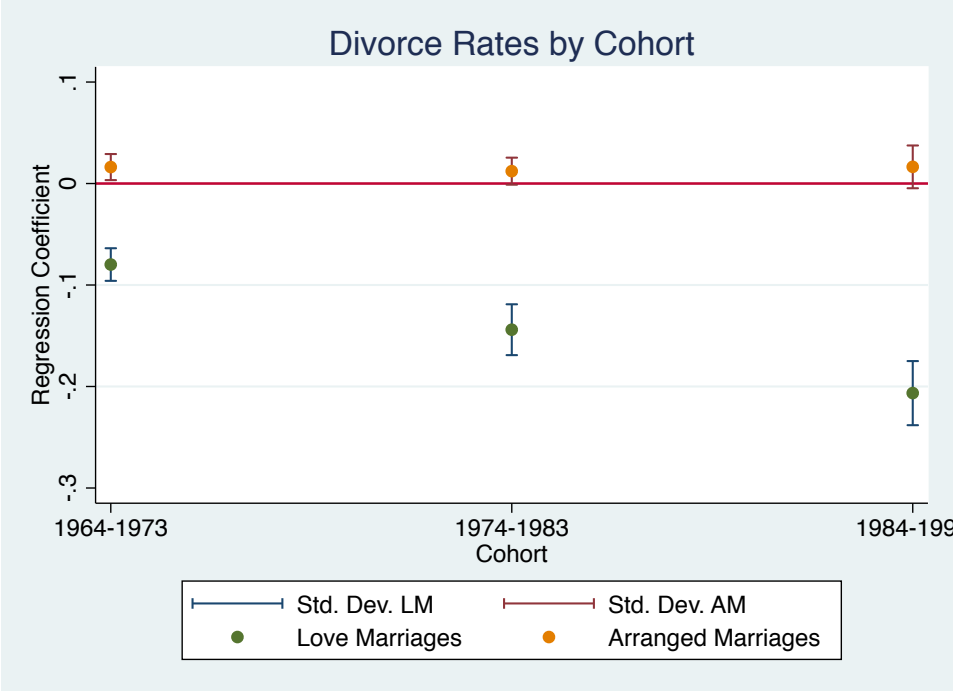


The coefficients plotted come from the following regression:

$$D_{ipc} = = \beta_0 + \gamma_c + \eta_p + \beta_1 AM_{ipc} + \sum_c (\gamma_c * AM_{ipc})\beta_{2,c} + \sum_p (\eta_p * AM_{ipc})\beta_{3,p} + \beta_4 female_{ipc} + \beta_5 duration_{ipc} + \varepsilon_{ipc}$$

The graph shows $\beta_{2,c}$ by type of marriage. The omitted cohort is individuals born before 1933.

Figure 6: Divorce Trends in Turkey



The coefficients plotted come from the following regression:

$$D_{ipc} = = \beta_0 + \gamma_c + \eta_p + \beta_1 AM_{ipc} + \sum_c (\gamma_c * AM_{ipc})\beta_{2,c} + \sum_p (\eta_p * AM_{ipc})\beta_{3,p} + \beta_4 female_{ipc} + \beta_5 duration_{ipc} + \varepsilon_{ipc}$$

The graph shows $\beta_{2,c}$ by type of marriage. The omitted cohort is women born between 1954 and 1963.

Figure 7: Post-marital living arrangements

	Turkey	**Cambodia**	**Vietnam**	**India**
Living with parents or nearby		0.0250*		
		(0.0145)		
Living with parents-in-law or nearby	0.0653***			
	(0.00986)			
Living on their own house			-0.0721***	-0.0897***
			(0.0144)	(0.00647)
Observations	13,524	5,345	3,607	32,018
R-squared	0.011	0.038	0.136	0.034

Data sources and additional controls: For Turkey (Demographic and Health Surveys) are age, urban dummy, education, LFP dummy, employment status (self-employed, paid or employee), region, and year of survey fixed effects; for Cambodia (Demographic and Health Surveys) are age, urban dummy, education, LFP dummy, employment status, occupation, province fixed effects and year of survey fixed effects; for Vietnam (Vietnamese Longitudinal Study) are age, urban dummy, education, LFP dummy, employment status, occupation, and district fixed effects; and for India (India Human Development Survey) are age, urban dummy, education, occupation, employment status, caste and province fixed effects.

Norms on post-marital living arrangements vary by country depending on whether the country is patrilocal (living with or near the parents of the husband), matrilocal (living with or near the parents of the wife) or ambilocal (live with or near either the husband's parents or the wife's parents).

9 Appendix 1: Proofs of propositions

9.1 Proof of Proposition 1

Proposition 1 establishes two testable results regarding the choice between love and arranged marriages. Children calculate their expected utility and compare it for each type of marriage.

$$\begin{aligned} E[u(c_k)] &= \left[1+(1-\varphi)\left(\frac{x_{k,h}\lambda^*_{k,h}+x_{s,h}\lambda_{s,h}}{2}\right)\right]-\frac{d_k}{2}\left[1+(1-\varphi)\left(\frac{x_{k,h}\lambda^*_{k,h}+x_{s,h}\lambda_{s,h}}{2}\right)\right]^2 \\ &-\frac{d_k}{2}\left\{(1-\varphi)^2\sigma^2_\delta\left(\frac{1+\varrho_{ks}\left(I(e=1),\,I(L=1)\right)}{2}\right)\right\}+E\left(\alpha\right) \end{aligned} \tag{17}$$

(i) The assumption on assortative mating allows me to simplify equation 7, in equilibrium $x_{k,h}=x_{s,h}$, which implies that $\lambda_{k,h}=\lambda_{s,h}$. The first term of this equation is positive as long as $x_L-x_A>0$ and $\frac{2p}{\beta}\frac{[1+d(e_{high}-1)]}{(1-d)}<\varphi x_{k,h}<\frac{4p}{\beta}\frac{[1+d(e_{high}-1)]}{(1-d)}$, $h=A,L$:

$$(1-\varphi)\left(x_L\lambda^*_L-x_A\lambda^*_A\right)\left[(1-d_k)-\frac{d_k}{2}\left(1-\varphi\right)\left(x_L\lambda^*_L+x_A\lambda^*_A\right)\right]>0 \tag{18}$$

This follows from $\frac{\partial\lambda}{\partial x}=\frac{\beta\varphi(1-d)\left[2dp^2+d\beta\varphi^2x^2\right]-[(1-d)(\beta\varphi x-2p)-2pde]\left[2d\beta\varphi^2x\right]}{d^2(2p^2+\beta\varphi^2x^2)^2}>0$ and $\lambda>0$ as long as the returns to school belong to the range defined above. For simplicity, I am assuming that $e=0$ and $d=d_k$. Therefore, $(x_L\lambda^*_L-x_A\lambda^*_A)>0$ since $x_L>x_A\rightarrow\lambda^*_L>\lambda^*_A$.

As long as the returns to schooling are larger than the lower bound, the increase on x_L-x_A leads to an increase in the probability of love marriage. The remaining question is whether equation 18 holds when x_L reaches the upper limit. Notice that as x_L or x_A increase, the negative term of equation 18 increase as well, $-\frac{d_k}{2}\left(1-\varphi\right)\left(x_L\lambda^*_L+x_A\lambda^*_A\right)$. We should consider the possibility that this term becomes larger than $(1-d_k)$, leading children to prefer arranged marriages. I will consider the upper bound of the term $(x_L\lambda^*_L+x_A\lambda^*_A)$, which will be reached when $x_L=x_A=\frac{4p}{\varphi\beta}$.

If both $x_L=x_A=\frac{4p}{\varphi\beta}$, the first part $(x_L\lambda^*_L-x_A\lambda^*_A)$ becomes zero. I am disregarding this effect since I am interested in showing only that:

$$|-\frac{d_k}{2}\left(1-\varphi\right)\left(x_L\lambda^*_L+x_A\lambda^*_A\right)|\leq|\left(1-d_k\right)| \tag{19}$$

when the term on the left hand side reaches the maximum. Therefore, by assuming $x_L=x_A=\frac{4p}{\varphi\beta}$, I can show that 19 holds as long as $1>\frac{(1-\varphi)}{\varphi}\left[\frac{4}{\beta+16}\right]$. Then as long as parents receive a sufficiently large share φ that satisfies this condition, even when the returns to education are close to their upper boundary, the second term will remain be positive. Then, for a given x_A, as $\uparrow x_L$, the gain represented by the term 18 will increase relative to the dis-utility generated by the loss of insurance (arranged marriage).

(ii) Follows from equations 6 and 7. As the potential shock is reduced ($\downarrow\sigma^2_{i\delta}$), the insurance benefits decrease and the utility loss from incurring the effort cost increases, leading parents to switch to low effort (increasing education for the child and, therefore, increasing her outside option). Holding constant education, it also increases $E[u(c_{k,L})+\alpha_L]-E[u(c_{k,A})+\alpha_A]$.

The other parameters of the model also matter for the final decision since they will determine the value of insurance, the investment in education and the decision on effort:

(i) $As \varrho_{ks}(e,\, I(L=1)) - \varrho_{ks}(e,\, I(L=0)$ *converges to zero. Arranged marriage partners lose their insurance advantage relative to love marriage partners when there is no difference in the dispersion of income between both types of marriages.*

(ii) $d_k > 0$ *or* $d > 0$ *decreases. More risk-averse agents will prefer arranged marriages over love marriages.*

(iii) $e_{high} > 0$ *increases. Parents face a trade-off between exerting high effort and investing in education/consuming; the rising cost of effort will increase the foregone consumption in both periods.*

(iv) $E(\alpha_L) - E(\alpha_A) > 0$ *when the average in partner "compatibility" is larger in love marriages than in arranged marriages.*

These additional results follow from:

(i) Follows directly from equation 7, as $\varrho_{ks}(e,\, I(L=1)) - \varrho_{ks}(e,\, I(L=0) \to 0$, then $E[u(c_{k,L}) + \alpha_L] - E[u(c_{k,A}) + \alpha_A]$ increases.

(ii) More risk-averse children will give higher weight to the insurance gain:

$$\frac{\partial(E[u(c_k)]_L - E[u(c_k)]_A)}{\partial d_k} = -\frac{1}{2}\left[1 + (1-\varphi)\, x_L \lambda_L^*\right] + \frac{1}{2}\left[1 + (1-\varphi)\, x_A \lambda_A^*\right] - \frac{(1-\varphi)^2}{4}\left[\varrho_{ks}(e,\, I(L=1)) - \varrho_{ks}(e,\, I(L=0)\right]$$

where $x_L > x_A \to \lambda_L^* > \lambda_A^* \to -\frac{1}{2}\left[1 + (1-\varphi)\, x_L \lambda_L^*\right] + \frac{1}{2}\left[1 + (1-\varphi)\, x_A \lambda_A^*\right] < 0$, and $\varrho_{ks}(e,\, I(L=0) < 0$ by assumption, therefore $-\frac{(1-\varphi)^2}{4}\left[\varrho_{ks}(e,\, I(L=1)) - \varrho_{ks}(e,\, I(L=0)\right] < 0$, leading to $\frac{\partial(E[u(c_k)]_L - E[u(c_k)]_A)}{\partial d_k} < 0$. More risk-averse children prefer the insurance provided by the arranged marriage.

In the case of parents, a similar result follows:

$$\frac{\partial(E[u(c_k)]_L - E[u(c_k)]_A)}{\partial d} = \left[(1-\varphi)\, x_L\,(1+\lambda_L) - d_k\right]\frac{\partial \lambda_L}{\partial d} - \left[(1-\varphi)\, x_A\,(1+\lambda_A) - d_k\right]\frac{\partial \lambda_A}{\partial d}$$

where $\frac{\partial \lambda_i}{\partial d} = -\frac{(\beta\varphi x - 2p)}{d^2[2p^2+\beta\varphi^2 x^2]^2} - \frac{2pe}{d^2[2p^2+\beta\varphi^2 x^2]^2} - \frac{[(\beta\varphi x - 2p)(1-d) - 2pde]\left[2p^2+\beta\varphi^2 x^2\right]}{d^2[2p^2+\beta\varphi^2 x^2]^2} < 0$, in addition $x_L > x_A \to \lambda_L^* > \lambda_A^* \to \left[(1-\varphi)\, x_L\,(1+\lambda_L) - d_k\right] > \left[(1-\varphi)\, x_A\,(1+\lambda_A) - d_k\right]$ and $\frac{\partial^2 \lambda}{\partial d \partial x} = \frac{-\beta\varphi\left(2p^2 - \beta\varphi^2 x^2 + 4\varphi x p\right)}{d^2(2p^2+\beta\varphi^2)} < 0$, therefore $\frac{\partial(E[u(c_k)]_L - E[u(c_k)]_A)}{\partial d} < 0$. More risk-averse parents also prefer insurance. They invest in lower education for their child, reducing her outside option and effectively increasing the probability that the child will accept the arranged marriage.

(iii) The derivative of equation 6 with respect to e_H:

$$\left[p\frac{\partial \lambda}{\partial e_H} + 1\right]\left[d\,(1 - p\lambda^* - e_H) - 1\right] + \beta\varphi x \frac{\partial \lambda}{\partial e_H}\left[1 - d\,(1 + \varphi x \lambda^*)\right] < 0$$

where $\left[p\frac{\partial \lambda}{\partial e_H} + 1\right] = 1 - \frac{2p^2}{2p^2+\beta\varphi^2 x^2} > 0$; $\left[d\,(1 - p\lambda^* - e_H) - 1\right] < 0$ since $(1 - p\lambda^* - e_H) \leq 1$; $\frac{\partial \lambda}{\partial e_H} < 0$ and $\left[1 - d\,(1 + \varphi x \lambda^*)\right] = \left(2p^2 + 2p\varphi x\right)(1-d) + 2pde\varphi x > 0$. The utility from choosing high effort decreases as the cost of effort increases to the point where parents will switch to low effort, increasing the education of children and their outside option.

Therefore, as e_{high} increases, education decreases $\frac{\partial \lambda(e_{high})}{\partial e_{high}} < 0$ and $\frac{\partial E[u(c_p)]}{\partial e_{high}} < 0$ leading parents to switch to low effort instead.

(iv) Also follows from equation 7; a sufficient condition for *(iv)* is that $F_L(\alpha)$ first order stochastically dominates $F_A(\alpha)$ (by definition of FSD).

9.2 Extending the Model to Include Divorce

Expression 8 might be reduced to[69]:

$$\alpha_h - \beta\left[E\left(\alpha_L\right) - \alpha_h\right] < -\phi - \frac{d_k\beta}{2}\frac{\left(1-\varphi\right)^2}{4}\sigma_\delta^2\left[\varrho_{ks}\left(e,\, L=1\right) - \varrho_{ks}\left(e,\, h\right)\right] + \frac{d_k}{2}\left(1-\varphi\right)^2\sigma_\delta^2\left[\frac{\varrho_{ks}\left(e,\, h\right)}{2} - \frac{1}{2}\right] \quad (20)$$

where $\varrho_{ks}\left(e,h\right)$ is the correlation between the child and her spouse and depends on the type of marriage and the effort of parents in the first period; $\varrho_{ks}\left(e,\, L=1\right)$ is the correlation between spouses' income in a love marriage (independent of effort) and σ_δ^2 is the variance of the shock.

The final expression of 20 depends on the type of marriage chosen in period 2 and determines the thresholds for divorce:

(i) If the child chooses love marriage in period 2, then $\varrho_{ks}\left(e,\, L=1\right) = \varrho_{ks}\left(e,h\right)$ and the divorce threshold is given by:

$$\alpha_L < \left(1+\beta\right)^{-1}\left[-\phi + \frac{d_k}{2}\left(1-\varphi\right)^2\sigma_\delta^2\left[\frac{\varrho_{ks}\left(e,\, I(L=1)\right)}{2} - \frac{1}{2}\right] + \beta E\left(\alpha_L\right)\right] \quad (21)$$

(ii) If the child chooses arranged marriage in period 2, then $\varrho_{ks}\left(e,\, L=1\right) > \varrho_{ks}\left(e,h\right)$ and the threshold is given by:

$$\begin{array}{c}\alpha_A < \left(1+\beta\right)^{-1}\left[-\phi - \frac{d_k\beta}{2}\frac{\left(1-\varphi\right)^2}{4}\sigma_\delta^2\left[\varrho_{ks}\left(e,\, I(L=1)\right) - \varrho_{ks}\left(e,\, I(L=0)\right)\right.\right.\\ \left.\left. + \frac{d_k}{2}\left(1-\varphi\right)^2\sigma_\delta^2\left[\frac{\varrho_{ks}(e,\, I(L=0))}{2} - \frac{1}{2}\right] + \beta E\left(\alpha_A\right)\right]\end{array} \quad (22)$$

These thresholds are used to derive the divorce probabilities in 9. The solution of the model, therefore, is found by calculating the expected utility from period 2, taking into account these (endogenous) probabilities of divorce for period 3. For a given level of education λ_k, the child will prefer love marriage if:

$$\begin{array}{c}E\left[u\left(c_k\right)\right]^{M,L} + \beta(1-P^{D,L})E\left[u\left(c_k\right)\right]^{M,L} + \beta P^{D,L}E\left[u\left(c_k\right)\right]^{D,L}\\ > E\left[u\left(c_k\right)\right]^{M,A} + \beta(1-P^{D,A})E\left[u\left(c_k\right)\right]^{M,A} + \beta P^{D,A}E\left[u\left(c_k\right)\right]^{D,A}\end{array} \quad (23)$$

In period 1, parents will choose the education and effort levels also taking into account the probability of divorce:

$$\lambda(e) = \frac{\left(1-d\right)\left\{\left(1-\varphi\right)\left[\left(\beta+\beta^2\left(1-P^D\right)\right)\left(1+\beta\right) + 2\beta^2P^D\right]x + \left(1-\varphi\right)\beta^3P^Dx - 2p\right\} - 2dep}{d\left\{2p^2 + \left(1-\varphi\right)^2\left[\left(\beta+\beta^2\left(1-P^D\right)\right)\left(1+\beta\right) + 2\beta^2P^D\right]x + \left(1-\varphi\right)^2\beta^3P^Dx\right\}} \quad (24)$$

These results show that individuals will divorce depending on the realization of the love term relative to the economic characteristics of the spouse (her insurance quality)

[69] I am assuming that individuals in arranged marriages will find a partner with returns x_A in the love marriage market. If this assumption is relaxed, the threshold for divorce for individuals in arranged marriages will depend directly on the difference of returns $x_L - x_A$ and on the education level λ:

$$\begin{array}{rcl}\alpha_A & < & \left(1+\beta\right)^{-1}\left\{-\phi - \frac{d_k\beta}{2}\frac{\left(1-\varphi\right)^2}{4}\sigma_\delta^2\left[\varrho_{ks}\left(e,\, L=1\right) - \varrho_{ks}\left(e,\, L=0\right)\right] + \beta(1-\varphi)\lambda\left(x_L - x_A\right)\right.\\ & & \left.\left[1 - d_k - \frac{d_k}{2}(1-\varphi)\left(x_L + x_A\right)\lambda\right] + \frac{d_k}{2}\left(1-\varphi\right)^2\sigma_\delta^2\left[\frac{\varrho_{ks}\left(e,\, L=0\right)}{2} - \frac{1}{2}\right] + \beta E\left(\alpha_L\right)\right\}\end{array}$$

If this is the case, the optimal solution for λ^* in period 1 depends on the partial derivative of the probability of divorce with respect to λ ($\frac{\partial P^d}{\partial\lambda}$) delivering a cubic term on λ. There is no closed form solution for this case and we need to rely on numerical solutions. For simplicity, I am assuming that this is not the case. However, if the assumption is relaxed, it will deliver a higher divorce rate for arranged marriages as x_L increases relative to x_A. This in turn is internalized by parents in period 1 when choosing education and effort.

Proposition 4. *For both type of marriages, the probability of divorce will:*

(i) *Increase if the discounted expected match quality from a new draw from the love distribution is larger than that of the current partner:* $\uparrow \left[\beta E\left(\alpha_L\right)\left(1+\beta\right)^{-1}-\alpha_h,\right]$ $h=L,A$.

(ii) *Increase if the income covariance between spouses increases for a given size (variance,*σ_δ^2*) of the shock.*

(iii) *Decrease if the size of the shock (*σ_δ^2*) increases for a given income covariance between spouses.*

(iv) *Decrease as the cost of divorce increases,* $\uparrow \phi$.

Proof of proposition 4. They follow directly from expressions 21 and 22 combined with equation 9.

9.3 Proposition 3 and Numerical Comparative Statics with Different Gender Composition:

Proposition 3. *If* $\varrho_{g_j,b_n}(e_{g,j}=1,e_{b,n}=1)\Rightarrow\varrho_{k,s}=1$ $k=g_j,b_n$, $s=s_j,s_n$ *(the most constrained case, only one potential insurance partner, each component of* $\varrho_{g_1,b_1}(e_{g,j},e_{b,i})$ *has a positive correlation equal to 1) and* $\varrho_{g_j,b_i}(e_{g,j}=0,e_{b,i}=1)=\varrho_{g_j,b_i}(e_{g,j}=0,e_{b,i}=0)=0$*, then ceteris paribus:*

a) If $g=1/2$*, families are composed of one boy and one girl, and if* $x_b^h/p_b^h>x_g^h/p_g^h$, $h=A$, L *(Strauss and Thomas, 1996; Behrman, 1997), the optimal education level is: (i)* $\lambda_b>0$ *for the boy; and (ii)* $\lambda_g=0$ *for the girl. Given the choice of education, parents endogenously decide to exert high effort for the girl* $e_{g,1}=1$ *and low effort for the boy* $e_{b,1}=0$ *(given a low enough love term for the girl, such that she does not reject the arranged marriage). The education of the boy endogenously responds to his marriage decision in the second period: (i)* $\lambda_b(x_L)$ *if he chooses love marriage with returns* x_L*; or (ii)* $\lambda_b(x_A)$ *if he chooses the proposed arranged marriage (corresponding to the low insurance quality mate) with returns* x_A*. And if* $x_L>x_A$*, then* $\lambda_b(x_L)>\lambda_b(x_A)$.

b) If $g=1$ *or* $g=0$*, families are composed of two girls or two boys, and if they are identical in* $p_g(p_b)$ *and* $x_g(x_b)$*, then parents toss a coin and offer with 50% probability the high insurance quality mate to girl (boy) 1 (*$e_{g,1}=1$*) and the low insurance quality mate to girl (boy) 2 (*$e_{g,2}=0$*), conditional on the high insurance quality arranged marriage being accepted. The education level of both girls (boys) responds endogenously to the marriage decision of the second girl (boy). If she (he) decides to reject the low quality partner and* $x_L>x_A$*, then* $\lambda_{2g}(x_{gL})>0$, $\lambda_{1g}(x_{gA})=0$*. If the girl (boy) decides to accept the low quality arranged marriage, then* $\lambda_{2g}(x_{gA})=\lambda_{1g}(x_{gA})>0$.

Previous versions of the paper showed numerical results using the analytical solution of the model for several comparative statics for two families with different gender composition: 1) one son and one daughter;[70]

[70]It is important to emphasize that although the decision of each child depends on equation 7, the second period utility for each of them depends on the set of strategies of the three agents (parents, son and daughter). The agents affect each other through the budget constraint (education and effort are costly) and through $x_b^h/p_b^h \gtrless x_g^h/p_g^h$. It also showed that as the net returns for boys increase relative to the net returns for girls ($\left(\frac{x_b^L}{p_b}-\frac{x_b^A}{p_b}\right)-\left(\frac{x_g^L}{p_g}-\frac{x_g^A}{p_g}\right)$), the probability that the son has an arranged marriage decreases and the probability that the daughter accepts the arranged marriage increases. In addition, it showed that parents exert high effort for the child with the lowest net returns to schooling (the effort decreases for boys and increases for girls as the returns shift in favor of boys). And finally, that the results are achieved through differential investments in education for boys and girls.

and 2) two daugherts.[71,72]

9.3.1 Proof of Proposition 3:

Proposition 3 compares two-children households with different gender composition under the assumption that boys and girls might have different prices/returns to education:

a) The proof of the education levels follows directly from the results of equation 13. Since the returns (per dollar spent) for the boy are larger than the returns (per dollar spent) for the girl, parents choose to educate only the boy. Parents still have incentives to acquire insurance since:

$$E\left[u(c_f\left(\lambda_{b,1}>0,\lambda_{g,1}=0,e_{g,1}=1,e_{b,1}=0\right)\right]=\left[1+\varphi\left(\frac{1}{2}x_b\lambda_b^*\right)\right]-\frac{d}{2}\left[1+\varphi\left(\frac{1}{2}x_b\lambda_b^*\right)\right]^2-\frac{d}{4}\sigma_\delta^2\varphi^2>$$

$$E\left[u(c_f\left(\lambda_{b,1}>0,\lambda_{g,1}=0,e_{g,1}=0,e_{b,1}=0\right)\right]=\left[1+\varphi\left(\frac{1}{2}x_b\lambda_b^*\right)\right]-\frac{d}{2}\left[1+\varphi\left(\frac{1}{2}x_b\lambda_b^*\right)\right]^2-\frac{d}{2}\sigma_\delta^2\varphi^2$$

Therefore parents will prefer to offer the arranged marriage to the girl since her outside option is low enough ($\lambda_g=0$) such that she will accept the arranged marriage as long as $E\left(\alpha_L\right)-E\left(\alpha_A\right)$ is sufficiently small (recall that each child still decides the type of marriage based on equation 7).

(b) If the two children are identical, parents are indifferent choosing between them for the arranged marriage. Parents will calculate the expected utility under each scenario and choose education and effort that gives them the highest expected utility (payoff):

$$\begin{aligned}E[u(c_f(\lambda_{g1}(e_{g1}),\lambda_{g2}(e_{g2}),e_{g1} &= 1,e_{g2}=0)]=E[u(c_f(\lambda_{g1}(e_{g1}),\lambda_{g2}(e_{g2}),e_{g1}=0,e_{g2}=1)]=\\ \left[1+\frac{\varphi}{2}\left(x_{g1}\lambda_{g1}(e_{g1})+x_{g2}\lambda_{g2}(e_{g2})\right)\right]- &\quad \frac{d}{2}\left[1+\frac{\varphi}{2}\left(x_{g1}\lambda_{g1}(e_{g1})+x_{g2}\lambda_{g2}(e_{g2})\right)\right]^2-\frac{d}{4}\sigma_\delta^2\varphi^2\end{aligned} \tag{25}$$

$$\begin{aligned}E[u(c_f(\lambda_{g1}(e_{g1}),\lambda_{g2}(e_{g2}),e_{g1} &= 0,e_{g2}=0)]=\\ \left[1+\frac{\varphi}{2}\left(x_{g1}\lambda_{g1}(e_{g1})+x_{g2}\lambda_{g2}(e_{g2})\right)\right]- &\quad \frac{d}{2}\left[1+\frac{\varphi}{2}\left(x_{g1}\lambda_{g1}(e_{g1})+x_{g2}\lambda_{g2}(e_{g2})\right)\right]^2-\frac{d}{2}\sigma_\delta^2\varphi^2\end{aligned} \tag{26}$$

Then equation 25 is larger than equation 26 for sufficiently low (unconstrained) returns (since both children are identical, and the unconstrained returns are high enough, they will prefer to educate both children and give up the insurance). Parents will choose to offer the arranged marriage to girl 1 (girl 2) if

[71] The numberical results plotting of the probability of arranged marriage (high effort) of girl 1 against the probability of arranged marriage (high effort) of girl 2 showed that they are inversely correlated; since by construction parents have incentives to marry only one of them ($\varrho_{g_j,b_n}(e_{g,j}=1,e_{b,n}=1)\Rightarrow\varrho_{k,s}=1\ k=g_j,b_n,\ s=s_j,s_n$ and $\varrho_{g_1,g_2}(e_{g_1}=0,e_{g_2}=1)=0$). They also showed the response of the arranged marriage probability as $(x_{gL}-x_{gA})\uparrow$; since both girls are identical, both of them face the same trade-off between insurance and returns outside the network, leading to a decreasing probability of arranged marriage for each of them. And they showed the probability of both girls receiving positive education; and the fact that when both girls choose the same type of marriage, the model delivers identical education for them, illustrated by a positive relation between each pair of variables in those simulations.

[72] These numerial simulations are available upon request, they were removed as suggested by a referee in a previous submission.

$E(\alpha_{g1,L}) - E(\alpha_{g1,A})$ is sufficiently small (equivalent to girl 1 (girl 2), accepting the arranged marriage with the high insurance quality groom).

The education levels depend on the choices of the girl offered the low insurance quality arranged marriage ($e_{g,j} = 0$). From the maximization problem 11, if she accepts the low quality arranged marriage, then $x_{g1,A} = x_{g2,A}$, and since both girls face p_g cost of education, then $\lambda_{2g}(x_{gA}) = \lambda_{1g}(x_{gA}) > 0$. If she rejects the low insurance quality arranged marriage, and if $x_{g,L} > x_{g,A}$, then from equations 12 and 13 we have a corner solution where the girl with the higher returns receives all the education, $\lambda_{g,2}(x_{g,L}) > 0$, $\lambda_{g,1}(x_{g,A}) = 0$.

9.3.2 Size of the network and the number of children

This section shows how the number of children affects the role of the size and insurance quality of the network. For the rest of this section, I assume that insurance quality of the network refers to income covariance across the households where the children are married (conditional on having an arranged marriage). For simplicity, I abstract from the children's decision. I only consider the side of the parents who face a shock; they have incentives to smooth it out by marrying off their N_k children with their insurance partners. If we consider the children as decision makers, the analysis becomes increasingly complicated as the number of players in the game increases to $N_k + 1$.

Let ε be the shock faced by parents in period 2 with mean 0 and variance σ_ε^2. If the parents marry off all their children, they pool their resources with the N_k households and consume the average. Their consumption in the second period is given by:

$$c_f = 1 + \frac{\varepsilon + \sum_i^{N_k} \varepsilon_i}{N_k + 1}$$

The size of the network (including the household) is $N_k + 1$, corresponding to the total number of children plus the parents. The parents calculate their expected utility in period 2:

$$E[u(c_f)]_A = E\left\{ \left(1 + \frac{\varepsilon + \sum_i^{N_k} \varepsilon_i}{N_k + 1}\right) - \frac{d}{2}\left(1 + \frac{\varepsilon + \sum_i^{N_k} \varepsilon_i}{N_k + 1}\right)^2 \right\}$$

$$E[u(c_f)]_A = 1 - \frac{d}{2}\left\{1 + \frac{\sigma_\varepsilon^2}{(N_k+1)^2} + \frac{1}{(N_k+1)^2}\left[\sum^{N_k}\sigma_i^2 + \sum^{m}\sigma_{ij} + \sum^{N_k}\sigma_{\varepsilon i}\right]\right\},\ m = \begin{pmatrix} N_k \\ 2 \end{pmatrix} = \frac{N_k!}{2!(N_k-2)!} \quad (27)$$

where σ_ε^2 is the variance of the shock of the parents' household, σ_i^2 is the variance of the N_k households where children are married, σ_{ij} is the covariance across the households where children are married, and $\sigma_{\varepsilon i}$ is the covariance between the parents' household and the other households.

From expression 27, the need of a large and high quality insurance network becomes evident. As the number of children increases, so does the number of income covariances between them. The total number of covariances that parents should be consider is: $m = \begin{pmatrix} N_k \\ 2 \end{pmatrix} = \frac{N_k!}{2!(N_k-2)!}$. Households belonging to a small social network face a potentially large dis-utility if they arranged the marriage of all their children.