Human Capital, Children and Divorce[1]

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Abstract

Concern about the high poverty rates experienced by children in female-headed households has led to policies aimed at increasing these households' income. This paper presents a model that analyzes decisions made before and during marriage to invest in the human capital of parents and children. These decisions result from a variety of anticipated post-divorce monetary transfers between spouses. The study yields two main findings: A child's welfare is not necessarily an increasing function of transfers from males to their former spouses, and females acquire more schooling than do males even though they spend less time in the marketplace.

JFL Classification: J12, J13, J18, J24

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1 Introduction

Concern about high poverty rates among children in female-headed households has led to policies aimed at inducing non-custodial parents to provide more support. Economists have focused largely on the consequences of marital breakdown for adult and child welfare as well as on the design and effect of policies governing monetary transfers following divorce and custody arrangements. The primary objective of these activities is to enhance the well-being of children and divorced parents. Below we present a theoretical analysis of these policies. We analyze the investments in adult human capital, both before and during marriage, emerging from different policies and the outcomes for children's human capital given different levels of investment. We are not aware of any study that provides either a general equilibrium analysis of investments in parents' and children's human capital in a divorce-intensive environment or a similar analysis of the impact of different policies on parents' investments in their own human capital.

The paper establishes an environment in which an individual's schooling decisions and investment in children decisions may be analyzed together. Agents (males and females) have two ways of transferring resources between marital states: investing in their own human capital (by schooling or on-the-job training) or investing in children. The return on both types of investment depends on the probability of divorce and the policy governing divorce (both in transfers between previous spouses and the amount of contact between each spouse and his or her children following divorce). Contrary to many studies in this field, we assume that the amount of human capital that individuals acquire is endogenous. Hence, any change in the policy governing transfers following divorce will alter both spouses' investment in human capital and wages.

Family economists often assume that decisions taken within a family are Pareto-efficient (Becker, 1991). However, even though there are large potential benefits if a couple can coordinate their affairs after marriage, two additional questions remain: Can they coordinate their affairs before marriage, and how are these decisions taken within a setup that includes divorce? The answers to both questions may affect the couple's possibility of reaching a Pareto-efficient result.

We show that the amount of schooling acquired by males and females substitute for one another. A higher amount of schooling acquired by one spouse allows the other to free ride on his spouse's schooling. We show that one set of parameters yields two equilibria. In the first equilibrium, males acquire more schooling than females, who free ride on their spouses' schooling. In the second equilibrium, females acquire more schooling than males, while the latter free ride on their spouses' schooling. A different set of parameters yields only one equilibrium, in which either males or females acquire the higher amount of schooling.

One of the key stylized facts observed in the marriage market is the high degree of assortative mating on education (Browning, Chiappori and Weiss, 2010; Lewis and Oppenheimer, 2000). In the current paper, we assume that all males and all females are identical, and we obtain that due to the gains from marriage, everyone marries. These assumptions imply that all males acquire the same schooling level, and that every female knows that her future husband will have this common schooling level irrespective of her own schooling level. In such an economy, there is no difference between potential spouses and there is no competition over them. We expect that relaxing this assumption will weaken this result, but it will still hold. We intend to investigate this question in our future work.

Note that the number of females who attend college has increased in recent decades, while the number of males has remained roughly unchanged (Becker et al., 2010; Browning et al., 2008; Goldin, Katz, and Kuziemko, 2006). This empirical observation can be explained by the two equilibria result. Becker, Hubbard and Murphy (2010) provide another explanation for the larger number of females than males who attend college. They find that the cost of attending college was lower for females than for males.

Our paper relates to that of Chiappory, Iyigun and Weiss (2009) who analyze an economy in which, as in the present paper, every member of the same gender is ex-ante identical. They also assume that females have a higher labor-market return on schooling, that the traditional norms that once required females to spend time at home, irrespective of their educational achievements, have weakened, and that with the passage of time, the technology of housekeeping has improved, requiring females to spend less time at home. They analyze the outcomes of the above changes and show that they have affected the market for marriage, modifying both marriage patterns and the division of surplus between spouses.

Another contribution of the paper is in analyzing parents' investment in their children during the marriage as a function of the divorce probability and the policy that governs monetary transfers following a divorce. The question of whether the lower economic outcomes of children of divorced parents is the result of low incomes or the change in the behavior of parents following the divorce, differences among individuals who get divorced or do not get a divorce, or the results of the divorce per se, is an empirical question.

Empirical evidence supporting the third option, that the lower economic outcomes of children of divorced parents are the result of parents' behavior during the marriage rather than following it, can be found in Piketty (2003), Johnson and Skinner (1986), Tartari (2007), Bjorklund and Sundstrom (2006) and McLanahan and Sandefur (1994).

Piketty (2003) uses the school performance of children a few years before their parents separated and finds that they performed as poorly as children living with only one parent did. He therefore deduces that it is parental behavior during the marriage that harms children. Bjorklund and Sundstrom (2006) find that individuals who experienced parental separation in childhood obtained the same education as their siblings who grew up with both biological parents. Hence, those studies document children's outcomes and their parents' probability of divorcing. Tartari (2007) shows that test scores of children of divorced parents would have been higher had the parents not divorced. Johnson and Skinner (1986) find a significant effect of the probability of divorce on the labor supply of married females. McLanahan and Sandefur (1994) find that the child's age at the time of the family's rupture is unrelated to the risk of dropping out of school or early childbearing. They also show that differences in income between divorced and intact families account for as much as half the difference in the school achievement and early childbearing of children in single-parent and two-parent families.

The aforementioned studies suggest that in order to understand the full impact of a policy that governs monetary transfers following a divorce, we must analyze the parents‘ behavior both during the marriage and following the divorce.

We show that by making monetary transfers following a divorce be a decreasing function of females wage and an increasing function of males', both parents spend more time with their children during the marriege.

In the present paper we show that if males' transfers to former spouses are a decreasing function of females' income, females have fewer incentives to acquire human capital; hence, they spend more time with their children and less in the market. Bernal (2008), Bernal and Keane (2011) as well as other studies show that maternal employment and child care have a sizable negative effect on children's outcomes. Hence, our main policy recommandation is to make males' transfers to their former spouse an increasing function of their own wage and a decreasing function of their former spouse wage. We also show that shared custody, in which one spouse (either the father or the mother) has a slightly higher amount of contact with children following divorce, results in the highest investment in children.

Our study also relates to those of Brown and Flinn (2006), Aiygari, Greenwood and Guner (2000) and Rasul (2006) who model the role of institutions in determining the welfare of divorced parents by governing their actions after a divorce. Following the framework developed by them, we analyze the role of institutions during the marriage and prior to it.

In the present paper, we do not offer a welfare criterion. However, we do analyze the change in the number of individuals who attend college, the labor supply and the time spent with children that result from a variety of policies. Obviously, the government can choose the policy that increases any variable it chooses.

The paper develops as follows: Section 2 introduces the model and presents a simplified benchmark. Section 3 simulates and discusses policy devices that affect investment in children's and parents' human capital as well as the probability of divorce. Section 4 concludes and suggests directions for further research.

2 The Model

In the current paper we analyze the behavior of married individuals within a three-period model. Each individual is forward-looking and has full information.

The focus of the present paper is investments in children that are made during the marriage for a variety of transfers following a divorce. To simplify the analysis, we assume that all of the investments in children are made during the marriage. Hence, under the assumption that every couple has the same divorce probability, every couple makes the same investment in their children, regardless of whether they stay married or not. As a result of this observation all adults are identical regardless of whether their parents got divorced or not.

This assumption has two empirical implications. The first one, which has been established by a large body of research that is summarized in the introduction, is that the economic outcomes of children are a function of parents' behaviour during the marriege (Piketty (2003), Bjorklund and Sundstrom (2006) and Tartari (2007)). The other implication, which is similar to the first one, is that the economic outcomes of children of divorced parents are the result of their parents' probability of getting a divorce, rather than the divorce itself. We are not aware of a paper that has tested this point and intend to test it in our future work.

Each individual is allotted one unit of time in each period. In the first period, each individual decides the level of his investment in his own human capital (schooling), denoted by s. At the beginning of the second period, individuals observe the amount of schooling acquired in the previous period by all potential spouses. Following this observation, each individual decides whether and who to marry in a frictionless marriage market. A married individual divides his time between the market and raising his children. The time each individual spends in the labor market increases his human capital via experience. Divorce may occur in the third period.

Our focus is on the analysis of parents' investment in their own and their children's human capital for a variety of policy regimes governing transfers following a divorce. We analyze the investments made by parents during and prior to marriage under a variety of policies governing transfers following a divorce.

The behavior of individuals who do not marry but do cohabit can be analyzed in the same way; however, the transfer policy following a divorce can differ between individuals who marry and those who cohabitate.

We use a three-period model for the following reasons: A two-period model is needed to analyze choices that individuals make before and after marriage. The third and last period is necessary to allow for two periods after marriage: one in which the couple is married with certainty and one in which the probability of divorce is evident.

We denote the probability of divorce by π and discuss it later. A divorce has two outcomes: less contact between each parent and his or her children and the distribution of family income between the former spouses.

The utility function of an individual in the first and second period is given by

$$u = Ln\left(c\right)$$

where c denotes consumption.

The utility that each parent derives from the quality of his child is modified by the amount of contact that he has with the child in each marital state. The amount of contact with the child, given the parent's marital state, is determined by the court and denoted by β. We assume that parents have complete access to their children while they are married; hence, β of each married spouse equals 1. Though their intrinsic valuation of the child remains the same after a divorce, both parents have less contact with their children. We denote females' (males') amount of contact with their children by β_f (β_m).

The utility in the third period is given by

$$u^3 = Ln\left(c_3\right) + \beta_i Q \tag{1}$$

$$Q = Ln\left(zq_f\right) + Ln\left(zq_m\right) \tag{2}$$

where c_3 denotes consumption in the third period, which depends on the marital state, Q denotes the children's human capital, q_f (q_m) denotes the investment in children made by females (males), and z is a technological parameter measuring the quality of the time that parents invest in their children. We assume that children's human capital is a function of the time their parents spend with them only (i.e., not of monetary expenditures spent on them). We also assume that children's consumption is subsumed in parental consumption. This assumption simplifies the analysis. We show later in the paperthat the qualitative results of the paper are robust to this assumption.

To conclude, the utility function of each individual is given by $Ln\left(c\right)$ in the first two periods and by $Ln\left(c\right) + \beta Q$, in the third one.

In the remainder of this paper, we denote by β the amount of contact that a divorced mother has with her children $\left(\beta = \beta_f\right)$; hence, $1 - \beta$ is the amount of contact that a divorced father has with his children. Recall that both spouses are presumed to have amount of contact (which equals 1) while married.

We analyze an economy without a capital market; thus, individuals cannot borrow or save. Each individual consequently consumes only his own income in the first period and only his and spouse's incomes in the second period (the period after marriage). This assumption allows us to concentrate on the human-capital investment incentives resulting from the probability of divorce and transfers after a divorce.

Consumption in the first period is given by

$$c_1 = 1 - s_i, i \in (male, female), s \in (s_l, s_h)$$

where s_i denotes schooling (which is acquired only in the first period). We assume that schooling is a binary choice; each individual may choose a high (s_h) or a low (s_l) amount of schooling $s_h > s_l$.

The consumption in the second period differs among the benchmark which is analyzed in Subsection (2.1) and the model which is analyzed in Section (3) and we discuss it below.

We now describe consumption in the third period.

Wages in the third period are given by

$$W_{3i} = 1 + Gs_i + (1 - q_i)\gamma \tag{3}$$

where G denotes the return for schooling and γ the return for experience.

We assume that all consumption by a married individual is a public good. Consumption by a married individual in the third period, denoted by $c_{3married}$, equals the sum of both spouses' income and is given by

$$c_{3married} = W_{3m} + W_{3f} \tag{4}$$

The consumption of a single individual equals his income in all periods and he does not have children.

We now describe different policies governing transfers after a divorce.

In the setup that we analyze, divorced males (females) consume α_m (α_f) of their income and transfer $1 - \alpha_m$ $(1 - \alpha_f)$ of their income to their previous spouses. In this setup, males' consumption in the case of divorce is given by (c_{md}). Hence,

$$c_{md} = \alpha_m W_{3m} + (1 - \alpha_f) W_{3f} \tag{5}$$

while females' consumption in the case of divorce (c_{fd}) is given by

$$c_{fd} = (1 - \alpha_m) W_{3m} + \alpha_f W_{3f} \tag{6}$$

Note that we allow transfers following a divorce to be a function of females' wages. An economy with $\alpha_f = 1$, in which transfers following a divorce are not a function of females' wages, is analyzed below.

We do not formalize children's utility. We assume that children's consumption is subsumed in parental consumption (recall that all consumption is a public good) both during marriage and after a divorce. This assumption simplifies the analysis. We later show that the results of the paper are robust to this assumption. However, we do assume that the welfare of children is an increasing function of Q (their own human capital).

In modeling the behavior of married and divorced parents, an important specification is the manner in which spouses interact. One may assume that spouses interact either cooperatively or non-cooperatively. In the non-cooperative case, spouses make decisions representing Nash equilibrium; in addition, the family will not, in general, achieve the Pareto frontier. Under the cooperative specification, spouses make decisions that place family members on the Pareto frontier. A testable implication of the hypothesis that married spouses behave cooperatively is that only divorces efficient for the family are finalized. Since laws governing the consent to divorce do not modify total family resources but only shift property rights between the spouses, a change from bilateral to unilateral divorce laws (unilateral laws allow marriage dissolution at the request of only one spouse) should have no effect on the decision to divorce when married partners behave cooperatively. Both Friedberg (1998) and Gruber (2004) find evidence of the significant effects of unilateral divorce laws on marital dissolution rates in the U.S., indicating non-cooperative interaction in married households. Below we assume that spouses behave non-cooperatively irrespective of their marital state. As a result of this assumption individuals choose their amount of schooling (which is acquired prior to the marriage, in the first period), without internalizing the benefits their future spouse is going to derive from it in the second period (his higher consumption). However, due to the assumption that all goods are public; the decision whether to get divorce is always efficient.

2.1 A Benchmark

Our benchmark entails two strong assumptions: The probability of divorce (denoted by π) is determined exogenously and wages in the second period equal 1 regardless of the amount of schooling acquired in the first period. Wages in the third period will depend on schooling. Both assumptions will be relaxed in Section (3) while all the results hold.

This simplified benchmark allows us to discuss the income and substitution effects of the variance policy devices while ignoring the "strategic motive" which results from the change in the divorce probability (which is discussed at the next section). Hence, it allows us to better understand our results. It also allows us to obtain a closed form solution.

In the current section, all agents (males and females) have four choices: whether or not to marry and who, the amount of schooling they acquire and their investment in their children - that determine their labor supply.

The income of a Type i individual (a male or a female) in the second period is given by

$$1 - q_i$$

where q_i denotes the investment in children's human capital made by Type i agents. Due to the assumption that family consumption is a public good, we obtain that consumption in the second period of a married individual, c_2, is given by

$$c_2 = 2 - q_f - q_m$$

Thus, each female maximizes

$$Ln\left(1 - s_f\right) + \delta Ln\left(c_2\right) + \delta^2\left(1 - \pi\right)\left(Ln\left(c_{3married}\right) + Q\right) + \delta^2\pi\left(Ln\left(c_{df}\right) + \beta Q\right) \quad (7)$$

over s_f and q_f for a given s_m and q_m, where δ denotes the discount rate.

The first term of the above equation represents a female's utility in the first period, the second term represents her utility in the second period, the third represents her utility in the third period if she remains married, and the fourth represents her utility if she divorces.

Recall that $c_{3married}$ (c_{df}) denotes consumption during marriage in the third period (females' consumption following a divorce) and is given by equations (4) and (6), whereas Q denotes children's human capital, given by equation (2). Note that $c_{3married}, c_{df}$ and Q are a function of s_f,q_f,s_m and q_m.

Note that each male maximizes

$$Log\left(1-s_m\right)+Log\left(c_2\right)+\left(1-\pi\right)\left(Log\left(c_{3married}\right)+Q\right)+\pi\left(Log\left(c_{dm}\right)+\left(1-\beta\right)Q\right) \quad (8)$$

over s_m and q_m for a given s_f and q_f.

Recall that c_{dm} denotes male's consumption following a divorce.

The probability of divorce affects the level of married individuals' investment in their human capital as well as that of their children. It also affects the investment in human capital of an unmarried individual who internalizes this probability.

A single individual does not have children and consumes only his own income. Hence, the utility of a single individual in all periods is given by

$$Ln\left(c_s\right)$$

where c_s, the consumption of a single individual, equals his own wage.

We obtain that the gains from marriage are the result of both the increased consumption in the second and third periods and the benefits from raising children. However, there is also a cost associated with being married, namely, the division of income between previous spouses following a divorce.

We denote the expected lifetime utility of an individual who intends to get married by UM and the expected lifetime utility of an individual who does not intend to get married by US.

All individuals intend to get married if $UM > US$. Even though we do not have a closed-form solution to the above condition, we assume that it holds. As a result of this assumption, all individuals get married. To motivate this assumption, note that a single individual does not derive utility from children and consumes only his own wage.

In this setup, we may draw several conclusions:

Corollary 1 *Females (males) invest more in their children than males (females) when* $\beta > .5$ $(\beta < .5)$.

Proof. Using the first-order conditions of Equations (7) and (8). ∎

Corollary 2 *An increase in either α_f or α_m, with α_m (α_f) and the amount of schooling held constant, decreases both males' and females' investment in their children.*

Proof. *Using the second-order conditions and the implicit-function derivative.* ∎

In other words, an increase in α_f (recall that females transfer $1 - \alpha_f$ of their income to their former spouses) increases females' consumption following a divorce. However, it also increases females' incentives to acquire human capital and deccreases their incentives to spend time with their children. Under the assumption that children's utility is an increasing function of the time their parents spend with them, we obtain that as a result from an increase in α_f, the welfare of children is deccreased, regardless of whether their parents got a divorce or not.

Note that the government can compensate females for the above transfers by decreasing α_m. A decrease in α_m increases females' consumption following a divorce (by increasing males' transfers to their previous spouses). It also decreases males' incentives to acquire human capital and increases males' investment in children, (due to Corollary (2)).

The result of this corollary represents the paper's main policy recommendation. By allowing post-divorce transfers to be a decreasing function of females' wage and an increasing function of males' wage, the investment in children will increase. As a result of such transfers, females have fewer incentives to acquire human capital, they work less and spend more time with their children. Another result of such transfer is that males have fewer incentives to acquire human capital, they work less and spend more time with their children as well. Hence, a government wishing to increase investment in children should increase both α_f and α_m. If females do not enjoy all the benefits of their wages later in life, they will have fewer incentives to invest in their own human capital and greater incentives to invest in their children's human capital. Note that we do not offer to reduce females' consumption following a divorce. We show that if males' transfers to their previous spouse following a divorce is a decreasing function of females' wage, females spend more time with their children. However, we also suggest that such transfers will be an increasing function of males' wage.

We ignore decisions and investments that are made following the divorce. Those decisions are analyzed in Aiyagari, Greenwood and Guner (2000) as well as other papers. However, as discussed in the introduction, a large line of research (Piketty (2003), Johnson and Skinner (1986), Tartari (2007) and Bjorklund and Sundstrom (2006)) find that the lower economic outcomes of children of divorced parents are the results of whether their parents got divorced or not (or the result of parents' behavior prior to the divorce) and not the results of parents' lower income following the divorce.

We now turn to an analysis of the investments in schooling made by both types of individuals (males and females). The level of investment is given by a Nash equilibrium in which each individual chooses his or her amount of schooling, while taking as given the amount of schooling chosen by individuals of the other.

We obtain two main results. The first one is that the individual with the lower amount of schooling free ride on his spouse's superior education (and second period wage) and the existense of two equilibria. The second finding is the relations between the monetary transfers following a divorce and the amount of schooling acquired prior to the marriage..

One of the key stylized facts observed in the marriage market is the high degree of assortative mating on education (Lewis and Oppenheimer, 2000; Browning, Chiappori and Weiss, 2010). In the current paper, we assume that all males and all females are identical (an assumption which was also made by Chiappory, Iugym and Weiss (2009)), and due to gains from marriege, we obtain that everyone marries. This implies that all males make the same choice of education, and that any females knows that her future husband will have this common male educational level irrespective of her own educational choice. In such an economy, there is no difference between potential spouses and there is no competition over them. We expect that relaxing this assumption will weaken this result but it will still hold. We intend to investigate this question in our future work.

Browning, Chiappori and Weiss (2008) find that the amount of schooling acquired by males remains constant over time, regardless of the change in the return on schooling, an observation that can be explained by the model presented in the current paper.

Formally, we can show that:

Corollary 3 *Several parameters of the model yield two equilibria. In the first equilibrium* *males acquire the higher amount of schooling* (s_h) *while females acquire the lower amount of schooling* (s_l) *. In the second equilibrium females acquire the higher amount of schooling* (s_h) *while males acquire the lower amount of schooling* (s_l)*.*

Proof. Using the FOC of equations (7) and (8)with respect to s we obtain that for $G = 0$ all individuals acquire the lower amount of schooling and that there exists G such that all individuals acquire the higher amount.

Consider the equilibrium that we obtain in an economy where the court divides divorced spouses' income equally $(\alpha_f = \alpha_m = 0.5)$ and $\beta = 0.5$. We denote by G^*, the schooling premium that makes individuals of one type (either males or females) indifferent between s_l and s_h, while individuals of the other type choose s_l.

Using the FOC of equations (7) and (8)with respect to s, one can show that, if males choose s_l they enjoy a strictly higher utility if females choose s_h. Hence, if $G = G^*$ and females choose s_h males choose s_l. However, note that if $G = G^*$ and males choose s_h than females choose s_l. Hence, if the courts divide divorced spouses' income equally $(\alpha_f = \alpha_m = 0.5)$, there exists G^* such that individuals of one type acquire the high amount of schooling, while individuals of the other type acquire the low amount of schooling. ■

We explain the above outcome – by using the return for schooling, G. The argument remains when we analyze increases in the probability of divorce rather than the return to schooling.

Note that the number of equilibria in the model – either one or two – is a function of the parameters. If the return to schooling is sufficiently high, both males and females acquire the high amount of schooling; if it is sufficiently low, they acquire the low amount. For a medium return to schooling, we obtain that only one type of individual acquires the higher amount of schooling.

We are justified in ignoring mixed-strategy equilibria because they cannot be a part of the equilibrium. This observation flows from the assumption that individuals choose their spouses after observing their schooling. Hence, an individual who acquired a higher amount of schooling will marry an individual with a higher amount of schooling as well. However, if individuals prefer to choose the lower amount of schooling given that their spouse chooses the higher amount of schooling, then either all males choose the higher amount while females choose the lower amount, or vice versa.

Next we analyze the case in which males' income surpasses females' and $\alpha_f = 1$; hence, transfers following a divorce are not a function of females' wages. In this case, we find that if there is only one equilibrium, then females acquire more schooling than males. We prove this by using the first-order conditions of equations (7) and (8). The intuition behind this result is the following: Females acquire more schooling due to the income effect (they are poorer) as well as the substitution effect (they enjoy a larger share of their own wage).

In the next section of the paper we show that monetary expenditures on children during the third period, performed by the wife in the event of divorce, do not change the paper's qualitative results. The intuition behind this result states that the prospect of facing additional monetary expenditures after a divorce induce females to acquire larger amounts of schooling before marriage and to spend less time with their children after marriage.

To conclude, the model presented at the benchmark yields two interesting results. First, males' schooling substitutes for females' schooling; the same is true vice versa. Second, an increase in males' transfers to their ex-wives may decrease children's welfare. Due to the first result, we find that there is a set of parameters that yields two equilibria, one with males acquiring more schooling and the other with females' doing so.

3 Endogenous Divorce Probability

Here we relax some of the assumptions made in the previous section. Two differences separate the economy in this section from that in the previous one. First, the probability of divorce is determined endogenously; second, wages in the second period are a function of schooling. Later we will discuss the robustness of the results for each difference.

We assume that the quality of the match, θ, is not observable at the date of the marriage but fully revealed by the end of the second period. At the end of that period, θ, is drawn from a uniform distribution over the set $[-t, t]$. The utility of a married individual, (male or female) in the third period is given by

$$u^{married} = \sigma Log\left(c_{3married}\right) + \mu Q + \theta$$

where μ is the weight of preference given to children's human capital and σ is the preference weight on consumption. Based on this preference in addition to divorce laws, spouses decide to stay married or divorce. We assume a unilateral divorce regime; therefore, the couple enters the state of divorce if one spouse requests it.

We denote by $divf$ $(divm)$ the probability that females' (males') outside alternative surpasses that of males' (females').

$$\begin{aligned} divf &= Probability\ \left(u_{fd} > u^{married}\right) = \frac{1}{2} - \frac{u^{married} - u_{fd}}{2} \\ divm &= Probability\ \left(u_{md} > u^{married}\right) = \frac{1}{2} - \frac{u^{married} - u_{md}}{2} \end{aligned} \quad (9)$$

where u_{fd} (u_{md}) denotes females' (males') utility after a divorce.

The probability of divorce, π, is given by

$$\pi = \max\left(0, divf, divm\right) \quad (10)$$

The couple's income (which equals their consumption) in the second period is given by

$$c_2 = \left(1 + Gs_m\right)\left(1 - q_m\right) + \left(1 + Gs_f\right)\left(1 - q_f\right)$$

while wages in the third period are given by (3), as in the previous section.

Thus, each female maximizes

$$\sigma Log\left(1 - s_f\right) + \delta\sigma Log\left(c_2\right) + \delta^2\left(\left(1 - \pi\right)u^{married} + \pi u_{fd}\right) \quad (11)$$

over s_f and q_f for a given s_m and q_m.

While each male maximizes

$$\sigma Log\left(1 - s_m\right) + \delta\sigma Log\left(c_2\right) + \delta^2\left(\left(1 - \pi\right)u^{married} + \pi u_{md}\right) \quad (12)$$

over s_m and q_m for a given s_f and q_f.

In this section of the paper, each agent have five choices: whether or not to marry and who, the amount of schooling they acquire, their investment in their children (which determines his or her labor supply during the second period) and whether to divorce. Since the first-order conditions of this maximization problem do not have a closed-form solution, simulations must be used.

Before presenting our results we indicate the parameters used. Recall that σ denotes preference weight on consumption, G the return for schooling, γ the return for experience, β females' amount of contact with their children, t the boundaries of the quality of the match distribution, z is a technological parameter measuring the quality of the time that parents invest in their children, μ the weight of the preference given to children's human capital and δ the discount rate.

We use $\sigma = 2$, $\beta = .8$, $G = 3$, $\gamma = .5$, $t = 5$, $z = 3$, $\mu = 1$, $s_l = .3$, $s_h = .4$, $\delta = 1$.

The foregoing parameters yield two equilibria. In the first equilibrium, females choose the higher amount of schooling (.4) while males free ride on their potential spouse's schooling and choose the lower amount of schooling (.3). As a result, males enjoy higher consumption in the first period. In this equilibrium, $q_m = .15, q_f = .28$ and $\pi = .36$. In the second equilibrium, males choose the higher amount of schooling (.4) while females free ride on their potential spouse's schooling and choose the lower amount of schooling (.3). In this equilibrium, $q_m = .039, q_f = .411$ and $\pi = .344$. In Subsection (3.1) we perform a robustness check and show that the qualitative results are robust to the chosen parameters.

In an economy in which individuals do not derive utility from θ, the quality of the match, the divorce probability is zero and we obtain that individuals of one type choose the higher amount of schooling (.4) and invest .44 in their children, while individuals of the second type choose the lower amount of schooling (.3) and invest (.5) in their children. Note that in an economy without divorce probability, there are no differences between males and females; hence there are two equilibria.

In the following figures, we show the investments in schooling and in the children's human capital for the chosen parameters; we also show the divorce probabilities resulting from those investments.

In Figures (1) $-$ (3) we use $\alpha_m = \alpha_f = .75$ while changing the divorce probability by assigning t values between 2 and 12. In Figures (4) and (5) we use $\alpha_f = .75$ while changing α_m. In Figures (6) and (7) we use $\alpha_m = .75$ while changing α_f. In Figures (8) and (9) we use $\alpha_m = \alpha_f = .75$ while assigning β values between .4 and 1. Note that the figures entitled qf and qm represent $Ln(z\ q_f)$ and $Ln(z\ q_m)$. Males' wages in the third period surpass females' in all the above parameters.

After completion of the study proper, we performed three robustness checks. We show that the results are robust to changes in the parameters (G, γ and δ). We also show that the results are robust to changes in both the assumptions, which differ from the previous section of the paper (i.e., endogenous divorce probability and wages in the second period that are a function of schooling acquired in the first period). The last robustness check shows that the results of the model are robust to introducing a monetary expenditure on children.

Here we analyze the intuition behind our results, specifically, that investments in parents' – like children's – human capital depends on the probability of divorce. Note that any change in α_f or α_m modifies consumption after a divorce. Therefore, it has a direct effect (which has subsequent income and substitution effects) and an indirect effect through the endogenous divorce probability.

Part of the intuition behind the following results stems from the following observation: When the couple's total income is divided equally between them, we obtain $divf > divm$ (the probability that females' outside alternative surpasses that of males') because we assume that females have more contact with their children than do males in the event of divorce. We show below that the observation that $divf$ is greater than $divm$ remains valid for a large set of parameters.

We begin analyzing the model by discussing an exogenous increase in t, the lower and upper boundaries of the quality of the match distribution, which results in an exogenous increase in the divorce probability (Recall that the quality of the match, θ, is drawn from a uniform distribution over the set $[-t, t]$). Recall, too, that some parameters yield two equilibria. The first equilibrium is characterized by females choosing s_h and males choosing s_l; we refer to this equilibrium as FH (Female High). The second equilibrium is characterized by females choosing s_l and males choosing s_h, which we refer to as FL (Female Low).

We divide the discussion into two parts, by equilibrium. We discuss the FH equilibrium first.

Figure I shows the outcomes of an exogenous increase in t. We assume that upon a divorce, each spouse transfers 0.25 of his income to his former spouse, $(a_f = a_m = .75)$. Females, however, have a higher amount of contact with their children than do males, so $(\beta = .7)$. The increase in the probability of divorce has both income and substitution effects on both spouses. The substitution effect traces to the change in the probability of divorce and, hence, to the need to divide income. Note that the income effect results from lower consumption and lower amounts of contact between parents and children after a divorce.

An increase in the probability of divorce reduces males' and females' investments in their children, but also increases their investment in their own human capital (via experience). These changes are the result of the substitution effect. By comparing Figure I.a (with $\beta = .7 < a_f = .75$) with Figure I.b (with $\beta = .8 > a_f = .75$), we find that as a result of an exogenous increase in the probability of divorce, females may decrease or increase their investments in children for different relations between β and a_f.

Using Figure I, we also see that the decrease in males' investments in their children is greater than the decrease in females' investments. This is due to the larger substitution effect: Males' contact with their children after a divorce is .3 whereas females' is .7.

Another result of an exogenous increase in the probability of divorce is an increase in investments in schooling. The increase in schooling among Type i individuals raises the cost of their investing in children.

The main outcomes of the FL equilibrium (characterized by females choosing s_l and males choosing s_h) are presented in Figure I.c.

We now analyze an increase in a_m (Recall that males transfer $1 - a_m$ of their income to their previous spouses). The main outcomes are presented in Figure II. As before, we divide the discussion into two parts: If the model yields two equilibria, we begin the analysis by discussing the FH equilibrium. One can see that an increase in α_m decreases the probability of divorce when females' outside alternative surpasses that of males (hence, $divf > divm$ prior to $a_m < .86$) and increases it when males' outside alternative surpasses that of females. An increase in α_m increases males' investments in children for a fixed amount of schooling when females' outside alternative surpasses those of males. It decreases it when females' outside alternative surpasses that of males.

The increase in α_m changes males' incentives to acquire schooling. As Figure II.a. shows, for $a_m > 0.51$, males choose s_h. For $a_m > .69$, however, females increase their investment in schooling and males free ride on their potential spouses' schooling while decreasing their own.

We now analyze the FL equilibrium. The main outcomes are presented in Figure II.b. This equilibrium yields higher investments in children by females, lower investments by males, and larger total investments by both spouses.

The main outcomes of an increase in α_f are presented in Figure III. The probability of divorce is a decreasing function of α_f when males' outside alternative surpasses that of females (for $\alpha_f < .67$) and is an increasing function otherwise.

An increase in α_f decreases females' investments in children for a fixed amount of schooling. Males' investment in their children is an increasing function of α_f when their outside alternative surpasses that of females and a decreasing otherwise.

The FL equilibrium is characterized by females investing less in their children together with males investing more than in the FH equilibrium. However, the sum of both parents' investments is lower in the FH equilibrium.

Note that in all of the above figures, males' investments in children is more sensitive than are females' investments for a fixed amount of schooling. Also note that the equilibrium in which females acquire more schooling is characterizes by lower investments in children.

Recent legislative amendments in the U.S. and Western Europe advocate shared custody or more moderate increases in fathers' access to their children upon a divorce. Dominus (2005) and Cook and Brown (2005) documented those changes for the U.S. The proposed model allows us to analyze those changes by altering β. Figure IV shows the results for $\beta \in (.4, 1)$ while retaining $\alpha_f = \alpha_m = .75$. An increase in β results in an increase in divorce probability when females' outside alternative surpasses that of males. Males' investments in their children are a decreasing function of β while females' are an increasing function of the same variable. The total investment by both spouses is a decreasing function of β for $\beta < 0.55$ in both equilibria. Furthermore, for $\beta > 0.5$ ($\beta < .5$), the sum of both spouses' investments in children is higher (lower) in the $FL(FH)$ equilibrium. The highest investment in children is obtained by giving the spouse with the higher amount of schooling an amount of contact that is slightly above .5.

3.1 Robustness check

We performed three robustness checks. In the first one, we show that the results are robust to the chosen parameters. In the second, we test the robustness of the results to the assumptions that differ from the previous section (exogenous divorce probability and fixed wage in the second period) and discuss the impact of each relaxed assumption on the results obtained in this section. In the last check, we show that the results are robust to introducing a monetary cost of raising children. We treat the construct analyzed at the beginning of this study (i.e., the model analyzed on section (3)) as the original construct.

We show that the results of the paper are robust to all of the robustness checks we perform. In this subsection we provide the exact results obtained in each robustness check.

We begin by testing the robustness of our results to the chosen parameters. Recall that we simulated and presented the results for a change in β and t in the previous section. Here we discuss the results of changes in the other parameters.

Our results showed that a change in G (the return for schooling), δ (the discount rate) or γ (the return for experience) modified the incentives to acquire schooling and to invest in children. As a result, the two-equilibria result does not persist for any G and γ.

We ran the simulation with various parameter values and obtained the following: When we increase α_f while keeping the parameters of the original construct (in a way similar to the analysis of Figures 6 and 7), all individuals choose the low amount of schooling when $\gamma > 1.4$, and the higher amount of schooling for $G > 3.96$.

If we assign G values between 3.95 and 3.62, females choose the lower amount of schooling for all parameters while males choose the higher amount of schooling for several values of the parameters. For values of G that are lower than 2.5, all individuals choose the lower amount of schooling. If we assign G values between 2.5 and 2.84 to , females choose the lower amount of schooling while males choose the higher amount for several values of the parameters. For values between 2.84 and 3.62, we obtain that males and females acquire the lower or higher amount of schooling for a different values of α_f (some parameter values result in two equilibria).

For values of γ lower than 1.4, only males choose s_H while females continue to acquire the lower amount of schooling; females choose the higher amount of schooling if $\gamma < 0.74$. This value of γ results in two equilibria for several values of α_f.

Next, we ran the simulation with an increase in α_m (instead of an increase in α_f). Recall that in the previous robustness test we ran the simulation with an increase in α_f while keeping α_m constant. In the current simulation we increase α_m while keeping α_f constant. We obtain that all individuals choose the higher amount of schooling if $G > 3.9$ for values $3.57 < G < 3.9$ only males choose the higher amount of schooling for the entire range. For $G < 3.57$, we obtain two equilibria, with males choosing the higher or lower and females choosing the higher or lower amount of schooling for different values of α_m.

When we assign δ, the discount rate, values between 0.4 and 1, we obtain a decrease in both the investment in children made by both spouses and the amount of acquired schooling. The intuition is straightforward: schooling is acquired in the first period while it increases wages in the second and third periods, while investment in children are performed in the second period and individuals derive utility from them in the third one.

For values of γ higher than 1.48, all individuals choose the lower amount of schooling; for values between 1.48 and 0.7, only females choose the higher amount of schooling for some range of the parameters. Lower values of result in two equilibria.

We also ran the simulation while assigning z a variety of parameter values (between 2 and 4). This manipulation only altered the magnitude of the changes in the investment in children without changing any of the qualitative results.

The next test run was a simulation with an exogenous (fixed) divorce probability ($\pi = .35$). As in the original construct, this elicited one set of parameters that result in individuals of one type choosing the higher amount of schooling and individuals of the other type choosing the lower amount; the other set produced two equilibria. However, when males' outside alternative surpasses that of females (as in the original construct), males invested less in their children and both males and females acquire the lower amount of schooling for a larger set of parameters.

The third test entailed a simulation with a fixed wage (equal to 1) in the second period (similar to the benchmark construct). In this construct, we find that both types of individuals acquire the lower amount of schooling and invest more in their children.

In a final test, we ran the simulation with a fixed expenditure on children. Such expenditures characterize couples who stay together or wives after a divorce. When males' outside alternative surpasses that of females, the probability of divorce increases, both parents invest less in their children, and females acquire the higher amount of schooling for a larger set of parameters. Yet, when females' outside alternative surpasses that of males, the probability of divorce decreases, with all other results remaining. The intuition behind these results is the following: If a monetary expenditure on children is to be financed by females after a divorce, females need to increase their future wage by acquiring more human capital via schooling or experience.

4 Conclusions

The economic literature analyzes a variety of policies designed to reduce poverty and increase the economic outcomes of divorced families and their children. In the presented model we analyze those policies having endogenous investments in human capital. We show that a change in monetary transfers following a divorce or the allocation of the custody rights of each spouse alters the amount of human capital acquired and the investment in children.

The model describes the behavior of a household during three periods of its lifetime. In the first period, each agent acquires human capital and consumes his or her own income. In the second period, the individual gets married, consumes, and invests in his or her children and in augmenting his or her own human capital. In the last period each individual observes a shock that may cause him to divorce.

We show that males and females face different incentives for choosing how much to invest in human capital. Women who invest more in their children than males acquire less experience and consume less than males after a divorce. By implication, females may acquire more schooling than males and, by so doing, increase their income after a divorce. Another finding is that individuals free ride on their spouses' schooling. If an individual of one type acquires more schooling, individuals of the other type acquire less schooling and consume more due to their spouses' higher wages.

Another contribution of our model lies in its analysis of a variety of policies. We show that the investments that both parents make in their children while they are married result from the different policies that govern transfers after a divorce and the amount of contact that each parent has with his or her children after a divorce. An interesting and unintuitive result is that an increase in the monetary transfers that males make to former spouses reduces their children's welfare for a large set of parameters.

Even thou, we do not offer a welfare criterion, we do analyze the change in the number of individuals who attend college, the labor supply and the time spent with children that result from a variety of policies. Obviously, the government can choose the policy that increases any variable it chooses.

The framework developed in this paper may also be used to analyze the question of commitment to alimony payments when the court cannot enforce its decisions perfectly. Another direction of future research is to endogenize the number of children. Finally, the collection and analysis of data on wages and the acquisition of human capital as a function of the divorce rate may lend further support – or indicate possible adjustments – to the model constructed in this paper.

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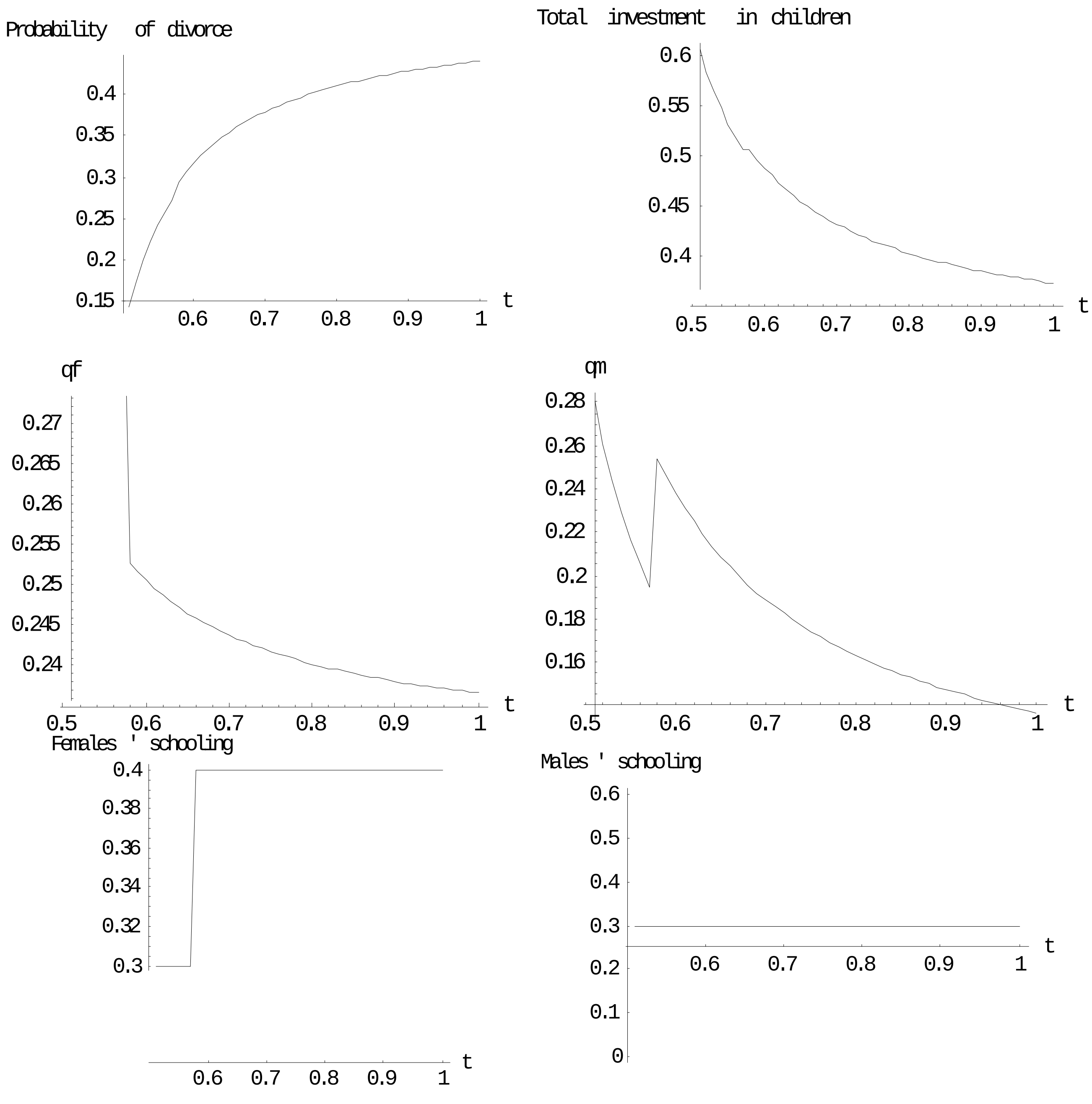

Figure 1: FH (This equilibrium is characterized by females choosing s_h and males choosing s_l), an increase in t (the lower and upper boundaries the of the quality of the match distribution), β=0.7 (females' amount of contact with their children).

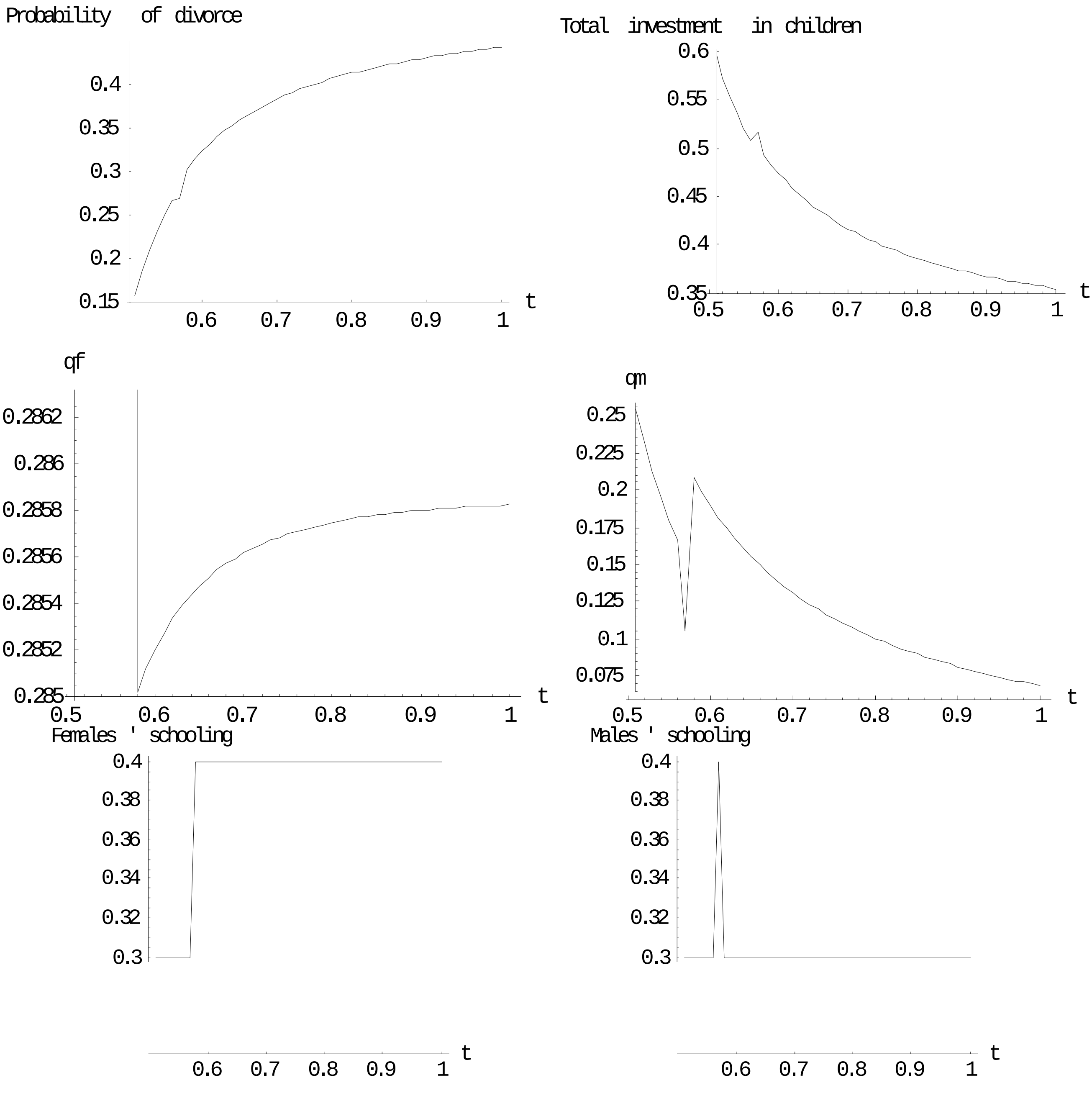

Figure 2: FH, An increase in t (β=0.8)

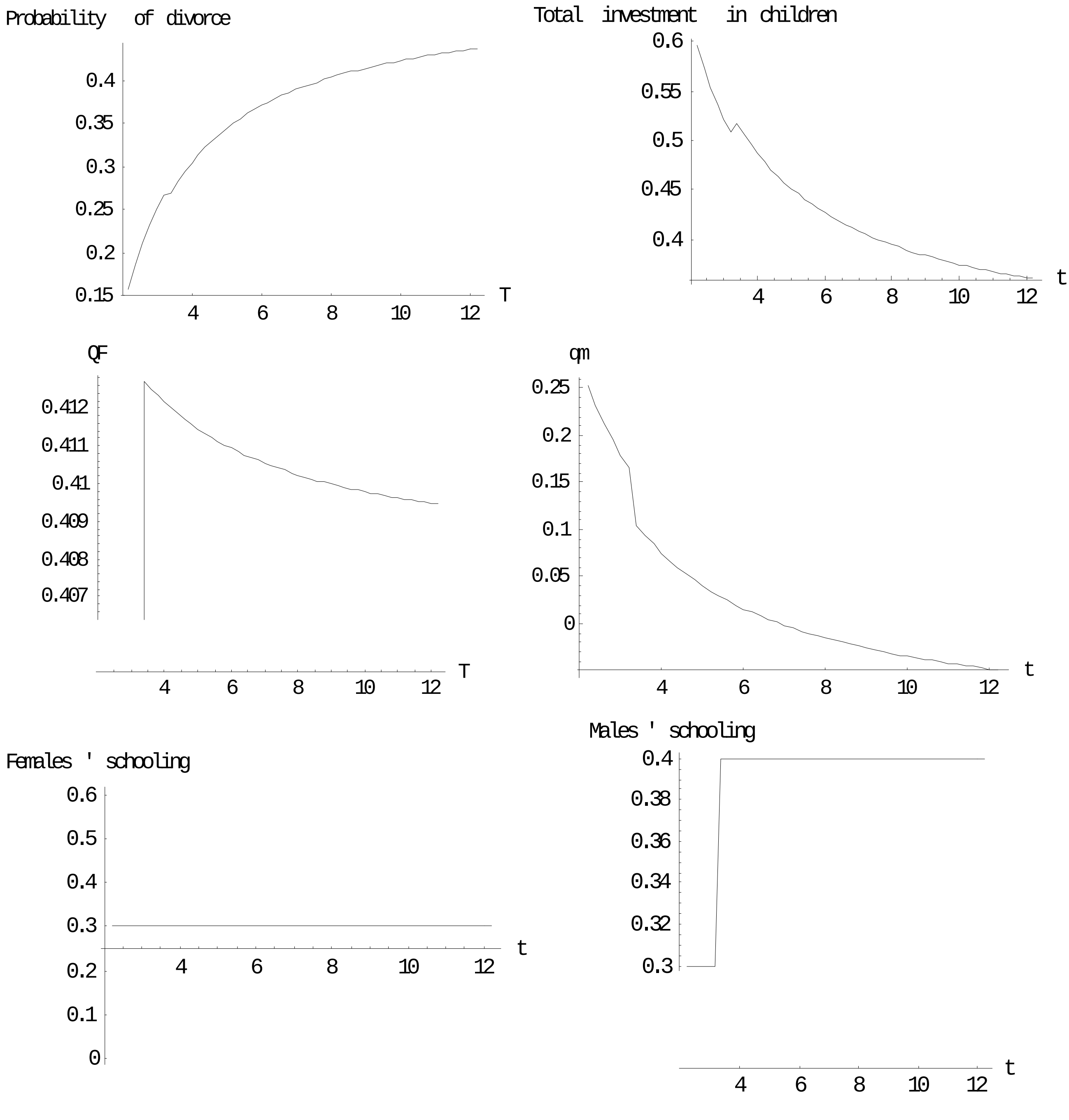

Figure 3: FL (This equilibrium is characterized by females choosing s_l and males choosing s_h), an increase in t.

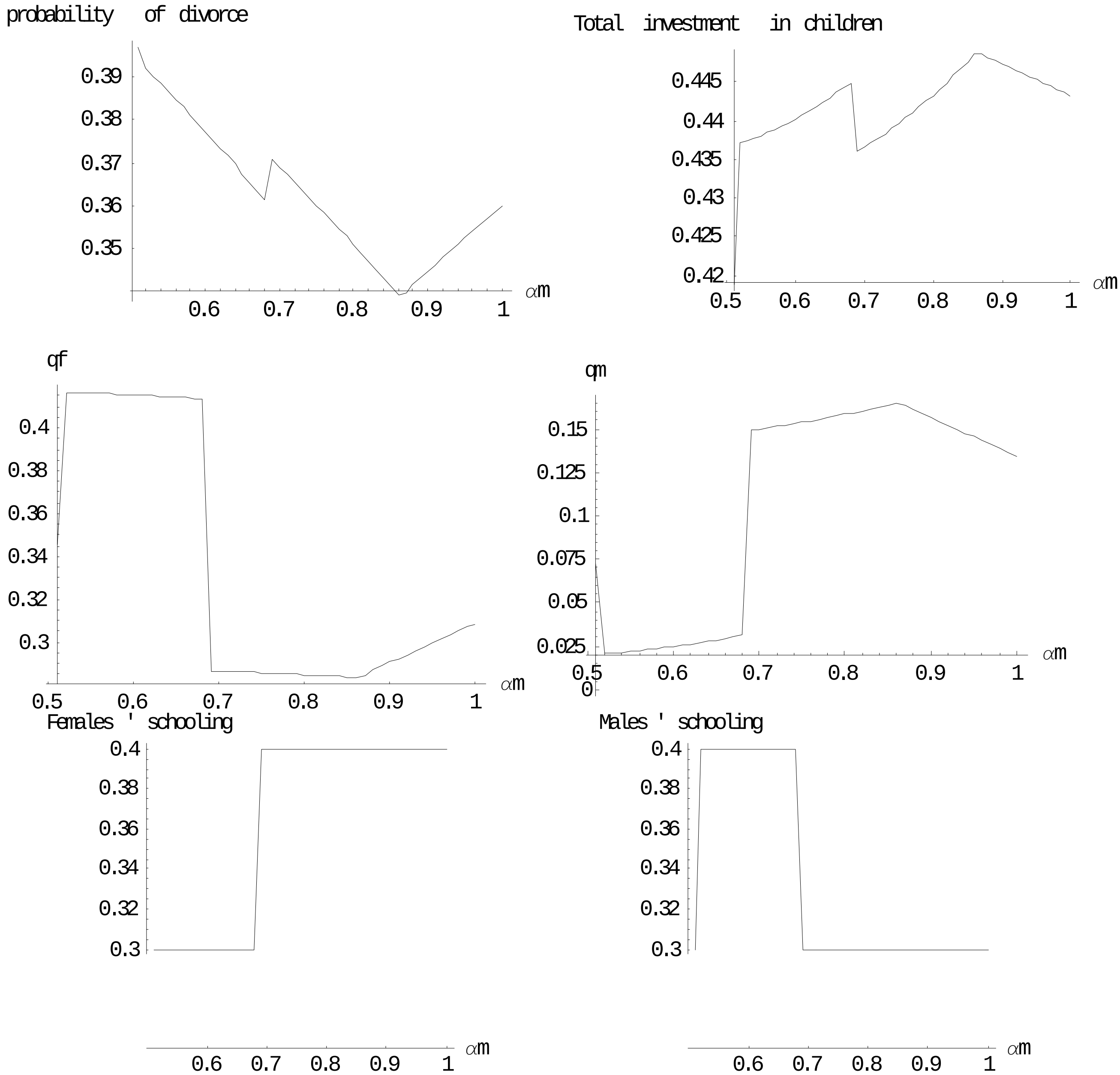

Figure 4: FH, An increase in α_m, i.e. a decrease in males' transfer to their previous spouse.

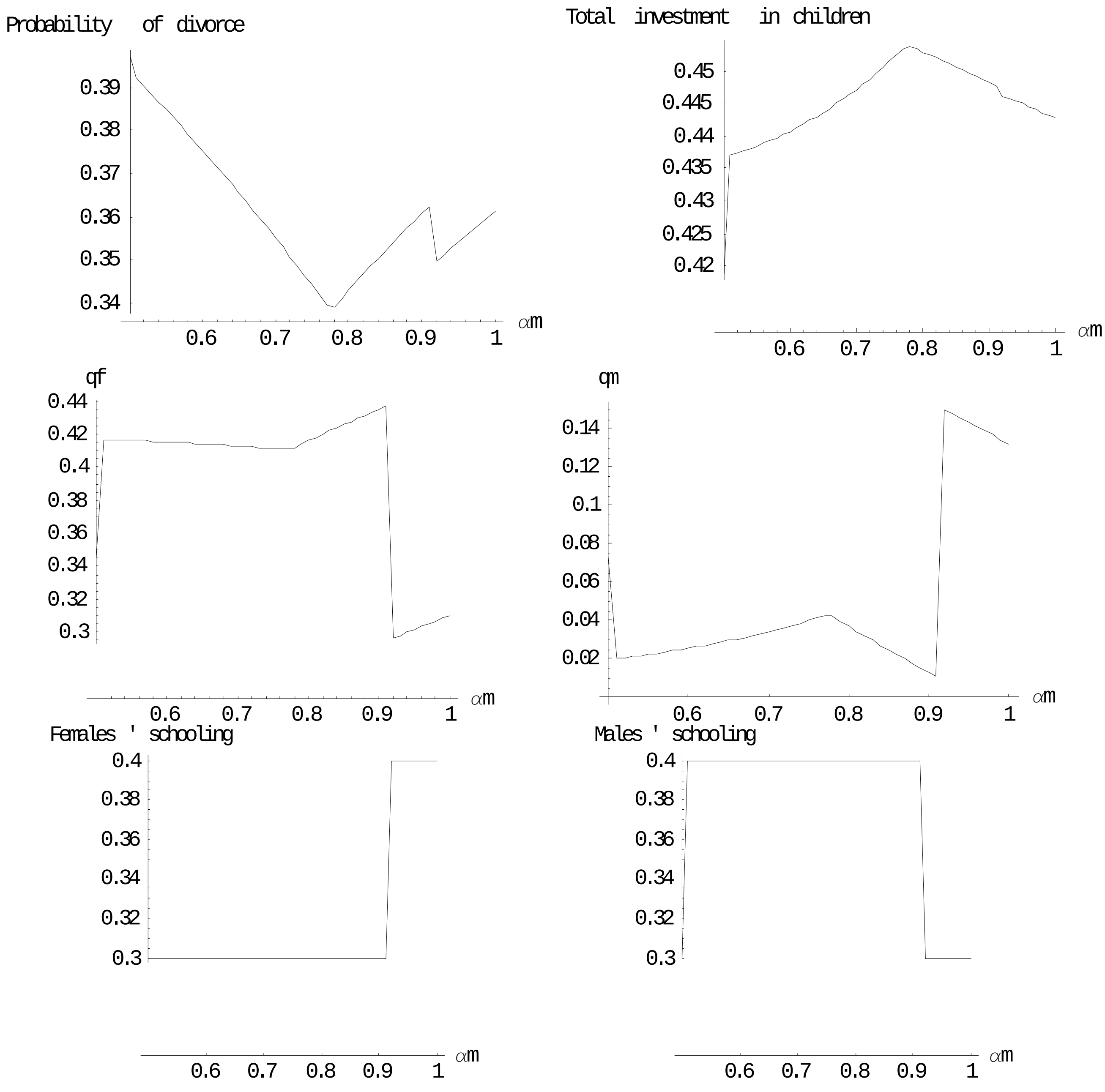

Figure 5: FL, an increase in α_m

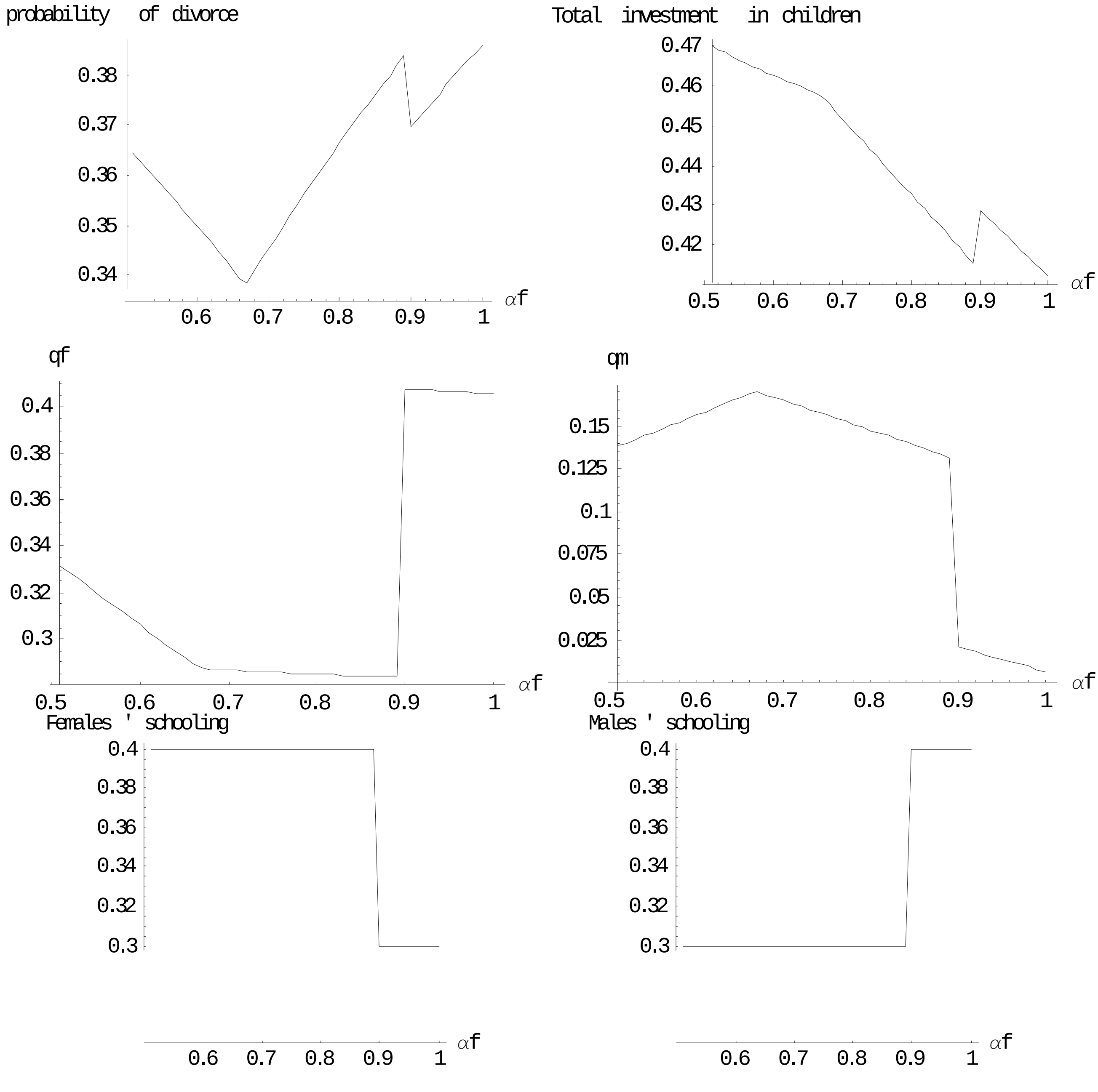

Figure 6: FH, an increase in α_f, i.e. a decrease in males' transfer to their previous spouse.

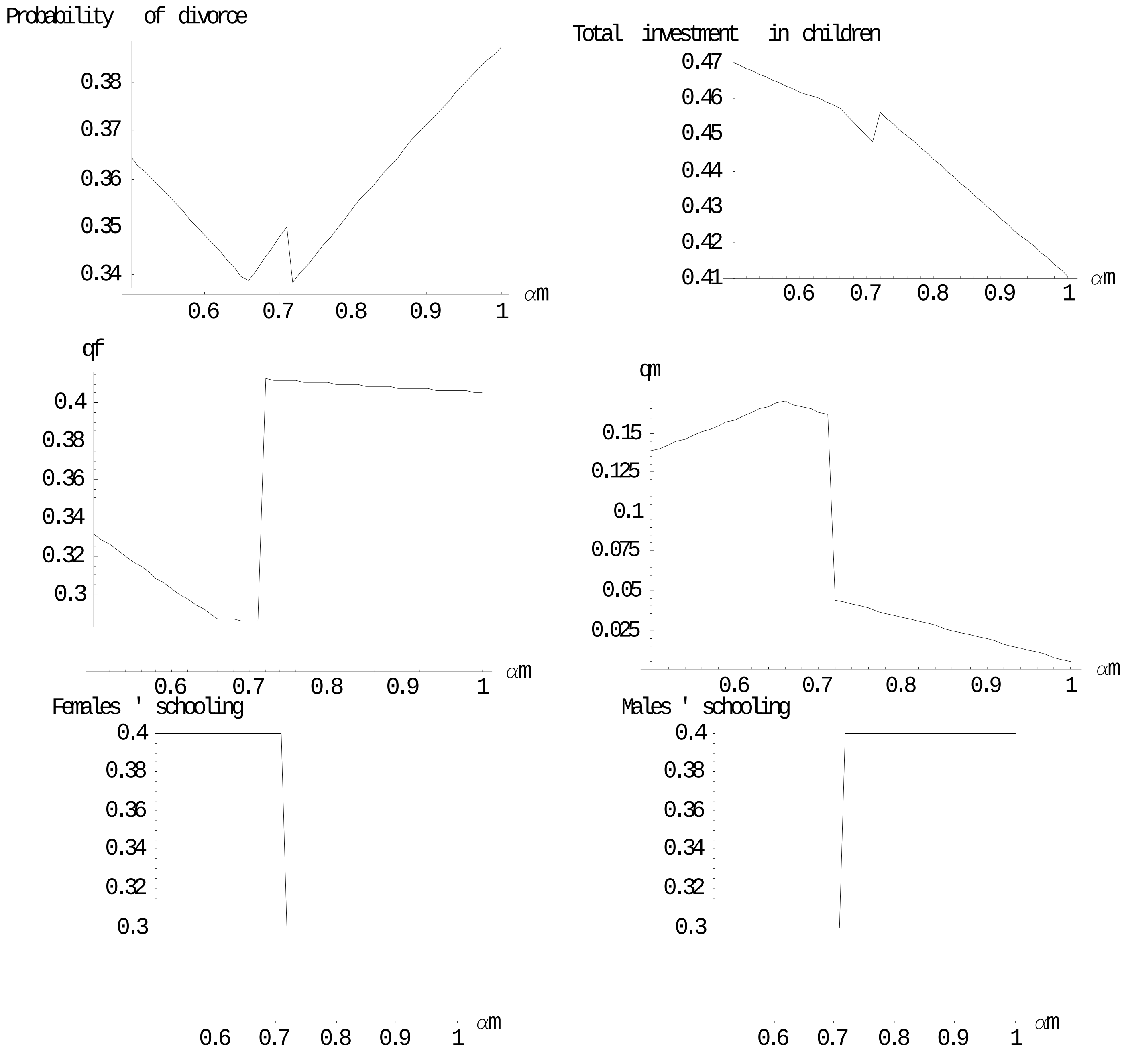

Figure 7: FL, an increase in α_f

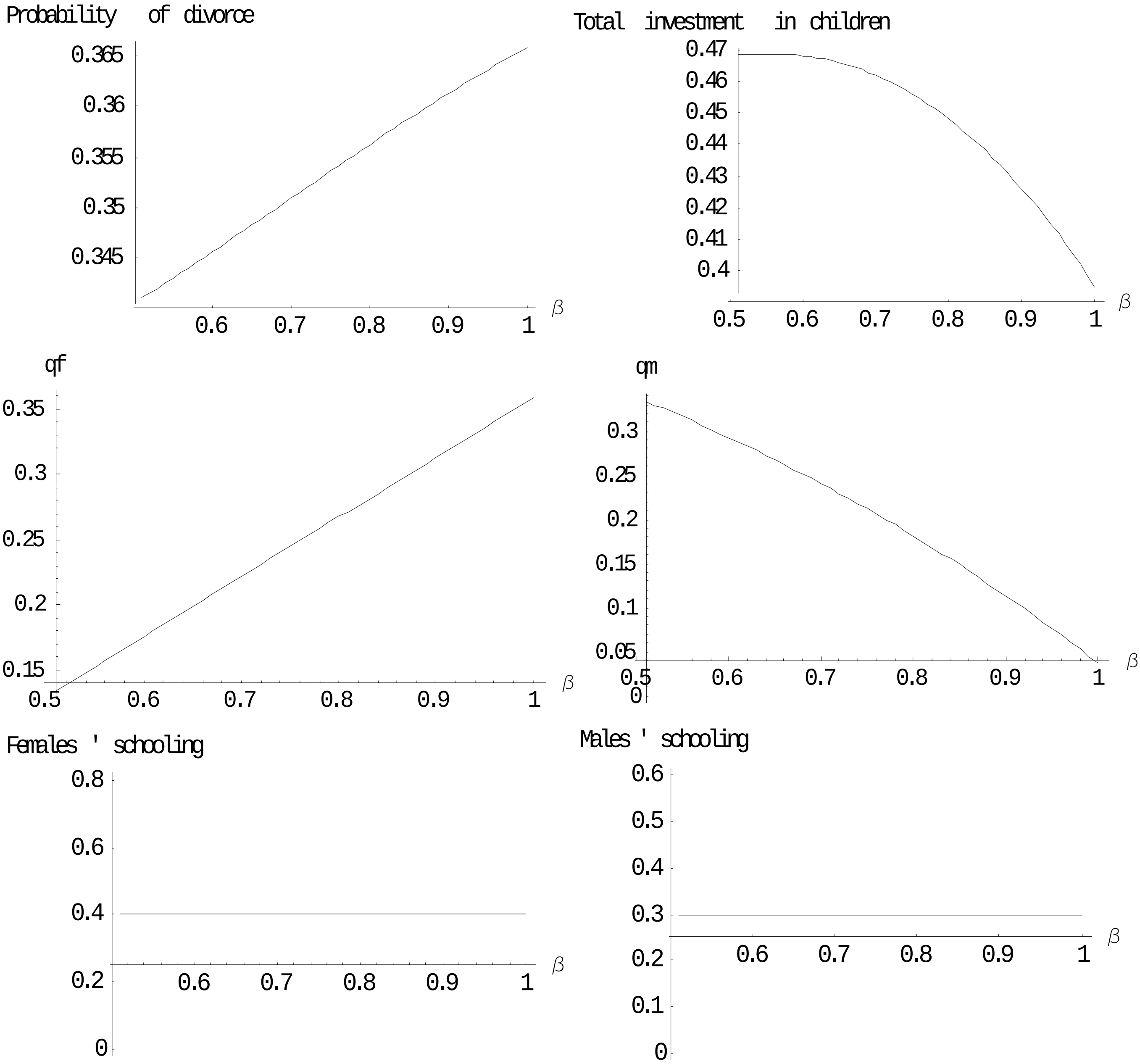

Figure 8: FH, an increase in β, females' amount of contact with their children.

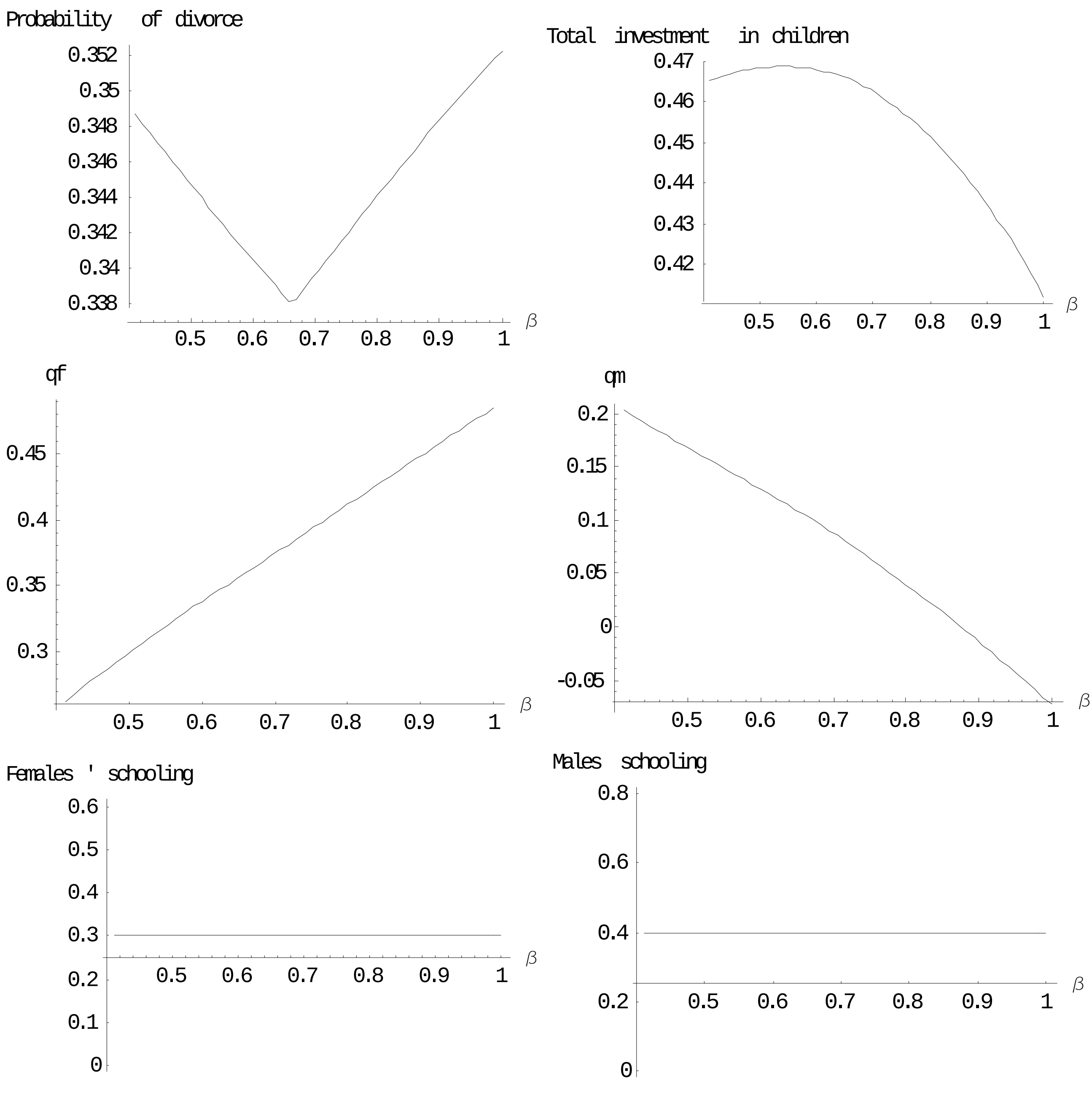

Figure 9: FL, an increase in β