Non-contractibilities in the Household: Theory and Evidence

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Contents

List of Tables

List of Figures

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ABSTRACT

I develop and test models of household behavior where household members behave non-cooperatively. I view marriage as a contract between husband and wife. This approach stresses the importance of household members to make enforceable contracts or agreements with each other. The reason why actions taken by individuals within the household are non-contractible is because they are non-verifiable to third parties outside of the household.

This approach has two major appeals. First, whenever non-contractible choices are subject to renegotiation, dynamic inefficiencies arise. This helps provide a theoretical underpinning to a growing body of empirical evidence that suggests households do not always make efficient decisions. Second, thinking of marriage as a contract leaves scope for individual household members to have different preferences and face different constraints. As households renegotiate over the division of the surplus from marriage, individual threat points and outside options still play a role in determining the allocation of resources within the household.

I apply this framework to three settings - investing into fertility, investing into child quality, and decisions to marry and divorce.

1 Introduction

Understanding the household decision making process is an important field of study in economics. The decisions households make have both welfare implications for household members themselves, and also macroeconomic consequences for society as a whole.

Furthermore, the process by which household make decisions is of fundamental importance in not only predicting household choice, but also the response of households to government policies and a changing economic environment.

Since Gary Becker's seminal works, summarized in Becker (1991), economists have developed a number of approaches to modelling household decision making. The first, as suggested by Becker himself, is the *unitary* model of the household.[1] This approach assumes the existence of a household welfare function that aggregates the preferences of all members. Households then seek to maximize this welfare function subject to a series of resource constraints.

This generates a demand function for each good, with testable implications for the effects of prices and incomes on household demand. The beauty of the unitary model approach is its simplicity, its applicability to a diverse range of household choices, and the wealth of testable empirical predictions it generates.

Modelling the household as a unitary entity gives two powerful implications. First, because the household behaves *as if* it is a single individual, household decisions are necessarily Pareto efficient. Namely no one individual can be made better off without another member becoming worse off. Second, it is the aggregate resources available to the household that determines outcomes.

The main limitation of the unitary model is that it sheds little light on how households resolve internal conflict. Individuals within a household rarely agree on everything. Often understanding how households resolve internal conflicts is the key to predicting how behavior will change in response to altering circumstances and policies.

A second approach in economics to modelling household behavior, the *collective* approach, explicitly takes account of the fact that household members have individual preferences and constraint. In the existing literature, there are two classes of collective

[1] This approach is also referred to as the "common preferences" model, the "neoclassical" model, or the "dictatorial" model.

model - cooperative and non-cooperative.

Cooperative models take it as given that household decisions are Pareto efficient, but assume nothing about process by which these decisions are made (Chiappori (1988, 1992)). These models generate a set of empirical predictions from which the household "sharing rule" can be inferred.

There also exist cooperative models that explicitly model the household decision making process as some bargaining game amongst its members (Manser and Brown, McElroy and Horney (1981)). The key insight from these models is that the *outside option*, or *threat point*, that each household member has in the bargaining process, determines how the surplus that marriage creates, is shared amongst household members.[2]

The collective approach, like the unitary model, takes it as given that household reach efficient outcomes. However a growing body of evidence casts doubt on this assumption in a variety of settings. These are as diverse as responses to income risks (Townsend (1994), Duflo and Udry (2001)), health shocks (Dercon and Krishnan (1998)), and agricultural production (Alderman *et al* (1996), Udry (1996), Goldstein (1999)).

Marriage as a Contract

In this thesis I develop an alternative way of thinking about household behavior. I view marriage as a contract between husband and wife, in which spouses behave non-cooperatively to maximize their own utility.[3] This approach stresses the relationship between household actions and the ability of household members to make enforceable contracts or agreements with each other. The reason why actions taken by individuals within the household are non-contractible is because they are non-verifiable to third parties outside of the household. This is true even if these actions are observable to household members.[4]

[2]It is taken as given that marriage creates a surplus over remaining single, or divorcing. The source of this can be economies of scale in consumption, investment or production; the provision of household public goods; specialization within the household.

[3]Other non-cooperative models of household decision making include Ulph (1988), Konrad and Lommerud (1995), and Chen and Woolley (2001). Some models combine the cooperative and non-cooperative approaches. For example in Lundberg and Pollak (1993) the household is assumed to act cooperatively, but the threat point in household bargaining is what would be the outcome if household members behaved non-cooperatively.

[4]Independently, other recent contributions in economics have stressed the importance of non-contractible actions within the household (Lundberg and Pollak (2001), Murphy (2002), Rainer (2002)). Brinig and Crafton (1994) provide a overview of marriage as contract from a legal perspec-

The non-verifiability of actions means that agreements between household members cannot be made contingent upon these actions. This is because at any time, any individual within the household could claim that the others had not undertaken the agreed-to actions and decide to renege on the agreement. As no third party outside of the household could verify this claim, household members face a "hold-up" problem with each other. This occurs when an individual reneges on a previous agreement and appropriates some of the benefits of others actions.

Thinking about marriage as a contract between individuals has appeal for the following reasons. First, this stresses the role that *renegotiation* plays in household decision making. Namely when individuals take non-verifiable actions within the household, they know they will later face a hold-up problem and this leads to renegotiation over the division of the surplus that marriage creates. The fact that individuals are aware that there will be renegotiation *ex post*, alters their choice of actions *ex ante*. In contrast to the unitary and collective approaches to household decision making, this model provides a theoretical foundation for why households make inefficient choices.

This result borrows from the growing literature in incomplete contract theory (Grossman and Hart (1986), Hart and Moore (1990)). Whenever non-contractible choices are subject to renegotiation, dynamic inefficiencies arise. Choices made today affect future bargaining positions. Marriage is thus not simply a repeated game in which efficient equilibria can be enforced. Rather marriage is an inherently non-stationary game, where bargains are commonly subject to renegotiation. Whenever marital contracts are unenforceable, equilibria in these games need not be efficient.

The inefficiency stems from the inability of spouses to make agreements contingent on all actions within marriage, as part of the marital contract. It does not stem from asymmetric information, or the existence of transactions costs.

The second appeal of this framework is that it leaves scope for individual household members to have different preferences and face different constraints. Moreover, as households renegotiate over the division of the surplus from marriage, individual threat points and outside options still play a role in determining the allocation of resources within the household.

The Thesis Chapters

In this thesis I develop and apply this framework to three different settings.

tive. Pollak (1985) was the first economist to refer to marriage as a contracting problem.

The next chapter models investments into fertility as being non-contractible. Given that world population is set to rise by two billion in the next 25 years, understanding how households make fertility choices remains a salient issue for economists and policy makers alike.

Modelling the household acting as a unitary entity may be inappropriate to analyze the determinants of fertility if preferences conflict. In a unitary framework preferences of household members are aggregated in a family welfare function, so that there is no role for conflicting preferences. Yet much demographic evidence suggests fertility is one action that husbands and wives are most likely to disagree on.

Preferences over fertility are likely to diverge between husband and wife - men bear relatively little of the costs of producing children, and the returns to children may differ across spouses.

This chapter develops and tests a model of bargaining over fertility which makes precise how conflicts are resolved when transfers between spouses are possible. The analysis emphasizes that when bargains are subject to renegotiation, the bargaining power of wives affects both transfers and fertility.

Understanding the role of female bargaining power helps shed light on the efficacy of policies of female empowerment. This is the main channel through which policy makers today are attempting to reduce fertility.

The analysis also shows that male preferences and other factors, such as child custody rules, are important determinants of fertility outcomes.

The predictions of the model are tested using Malaysian household panel data containing information on household fertility outcomes and spouses' fertility preferences.

I find evidence that - (i) male and female preferences are of equal importance in determining fertility outcomes; (ii) spouses renegotiate over fertility over the course of the fertility cycle; (iii) the social and institutional context strongly influences fertility outcomes and the effectiveness of empowerment policies.

The third chapter models investments into child quality as being non-contractible. Again the underlying framework is one in which spousal investments to be into child quality *during* marriage, cannot be written down as part of the marital contract at the *start* of marriage.

I use this framework to understanding the relation between divorce costs and

children's outcomes. In particular, I study the effects of making divorce easier on two child related outcomes - parental investments into child quality, and the allocation of child custody in divorce.

In a unitary or collective bargaining model of household decision making, making divorce less costly increases the probability of marital dissolution. This is generally regarded as being bad for children.

The chapter studies how reduced costs over divorce may have affected children when household bargains are subject to renegotiation. In doing so the model sheds new light on the relation between divorce costs and child outcomes. In particular, the model captures the intuition that when divorce costs are low, couples own investments into marriage specific goods such as child quality, have relatively more influence on keeping the marriage intact. They therefore have more incentives to invest into child quality.

Hence making divorce easier can be good for children that *remain* in intact marriages. By thinking of marriage in this framework, I show that there are actually two effects of reducing divorce costs and making divorce easier - (i) marginal marriages break up with lower costs of exiting marriage, and this may have detrimental effects on children's welfare; (ii) investments into child quality made *during* marriage rise. This latter effect, which applies to the stock of all marriages, may dominate the former effect which applies to the flow of marriages into divorce.

I also identify the conditions under which joint custody is optimal. The model predicts that incidence of joint custody increases as divorce becomes easier or female labor force participation rises.

In common with the first chapter, the model studies household outcomes when spouses have conflicting preferences. In this context, conflict arises because parents value child quality differently.

The final chapter studies the marriage market as a whole. I endogenize decisions to marry and divorce. Understanding these decisions appears particularly relevant at a time in which family structure has changed so dramatically. Economists and lawyers have placed most attention on the rise in divorce. In particular, studying whether there exists a causal relation between divorce laws and this rise in divorce rates. Ironically much of this debate has taken place when divorce rates have been falling. Indeed the last 15 years have witnessed the longest period of sustained decline in divorce in America since records began in 1860.

A cursory look at the data suggests that of more concern now is the sustained decline in marriage. Today in America, fewer people are marrying than at any time in the past 40 years, the children of the unmarried account for nearly as many as those living in single parent households, and the majority of births occur out of wedlock.

The decline in marriage is of concern if we believe marriage to be a good thing, in that there are positive private and social returns to marriage. A large body of literature, summarized in Waite and Gallagher (2000), shows a strong correlation between being married and having better health, higher wages, and accumulating more wealth. They argue these effects exist for married individuals relative to cohabitees as well as divorced individuals.

This chapter studies the effects of divorce law changes on incentives to marry. In particular I examine the effect of the move from mutual consent to unilateral divorce that swept through America in the 1970s.

A unitary or collective bargaining framework, which both assume household outcomes to be Pareto efficient, would predict that such a law change ought to have no affect on the incidence of marriage and divorce. If spouses can bargain efficiently, the Coase theorem implies that moving from mutual consent to unilateral divorce only affects the distribution of welfare within marriage, not decisions to marry or divorce.

This chapter puts forward a model of search in marriage markets in which individuals learn the true value of marriage prior to, and during marriage. I then use US state level panel data to test the predictions of this model.

I provide evidence that after the adoption of unilateral divorce, marriage rates declined significantly and permanently in adopting states. This decline accounts for half of the initial gap in marriage rates between adopting and non-adopting states. The effect of unilateral divorce law is greatest for marriage rates amongst younger age cohorts, those marrying for the first time, and whites.

I also find the duration of marriages that take place under unilateral divorce to be significantly greater than those that occur under mutual consent. Taken together the results suggest unilateral divorce law reduces incentives to marry, but those couples that do marry are better matched than under mutual consent.

The result that unilateral divorce significantly and permanently reduces marriage rates, sheds light on the nature of household bargaining. This chapter suggests the underlying nature of household decision making is inconsistent with the unitary or collective approaches. Households do not bargain efficiently.

Again, the reason for this may be that marital contracts are unenforceable. This stems from the non-verifiability to third parties of actions taken within the household. This leads spouses to renegotiate *ex post* over the division of the marriage surplus. Unilateral divorce reduces the expected value of this surplus and thus reduces the *ex ante* incentives of spouses to take first best actions within marriage. If so, we would expect to observe spouses making fewer marital specific investments, such as having children, after the introduction of unilateral divorce. This is precisely what the model in the second chapter predicts.

Conclusion

This thesis stresses the importance of non-contractible actions within the household. The actions of household members are often non-contractible because they are non-verifiable to third parties outside of the household. Whenever actions are non-contractible, household outcomes will be subject to dynamic inefficiencies that arise because household members renegotiate over the division of the marital surplus.

The range of such actions is enormous. They include not just investments into fertility and child quality, but any decision that cannot be committed to *ex ante*. Thinking about household decision making this way not only helps provide a theoretical underpinning to a growing body of empirical evidence on the inefficiency of household outcomes, but also calls for a re-assessment of the design and effectiveness of family policy more broadly. Some of these wider implications are discussed in each of the following chapters. There remains much to be done.

2 Household Bargaining Over Fertility: Theory and Evidence From Malaysia

In the last fifty years population in developing countries has been growing at unprecedented rates, more than doubling to reach nearly five billion. The social, economic, political and environmental consequences of this are expected to be tremendous. Hence understanding the determinants of fertility has remained a salient issue for policy makers, governments, and academics alike. The recent consensus in the public policy debate has been that policies designed to empower women will reduce fertility rates.[5] The 1994 United Nations International Conference on Population and Development in Cairo stated this position clearly in its 20-year program of action,

> "*Improving the status of women enhances their decision making capacity especially in the area of sexuality and reproduction. This is essential for the long term success of population programs. Experience shows that population programs are most effective when steps have simultaneously been taken to improve women's status*".

Such policies are by definition exclusively targeted towards women.[6] However if men have a significant say in fertility outcomes, it is necessary to understand the process through which *couples* determine fertility, as a basis for examining the impact of female empowerment. Understanding the household decision making process is particularly relevant in this context as spousal preferences over fertility are likely to diverge - men bear relatively little of the costs of producing children, and the returns to children may differ across spouses.

Modelling the household acting as a unitary entity may be inappropriate to analyze the determinants of fertility if preferences conflict. In a unitary framework preferences of household members are aggregated in a family welfare function. The Coase theorem predicts that households will always make efficient decisions, even if preferences diverge. However, as this chapter shows, when households bargain subject to renegotiation, inefficient outcomes can occur.

[5] See Jejeebhoy (1995) and Abadian (1996) for surveys of the literature in support of this view. The UNDP has a website devoted to such policies at http://www.undp.org/gender.

[6] Examples include increasing female education, income earning opportunities, access to credit, income transfers, and the availability of contraception and family planning services. They may also include changing institutional or legal rules with respect to inheritance, rights to divorce, child custody and alimony.

This chapter develops and tests a model of bargaining over fertility which makes precise how conflicts are resolved when transfers between spouses are possible. The analysis emphasizes that when bargains are subject to renegotiation, the bargaining power of wives affects both transfers and fertility. The analysis also shows that male preferences and other factors, such as child custody rules, are important determinants of fertility outcomes.

Modelling fertility as the outcome of a bargaining process has three main advantages over a unitary framework. First, it gives a natural way in which to introduce spousal conflicts over desired fertility. Second, female empowerment policies can be parsimoniously modelled as changes in female bargaining power. Third, it can generate overinvestment into fertility in equilibrium, which is of interest given the current population growth rate.

The theory makes precise the relationship between fertility preferences and - (i) fertility outcomes; (ii) the transfers between spouses required in order to enforce that level of fertility. The predictions of the model are tested using Malaysian household panel data containing information on household fertility outcomes and spouses' fertility preferences.

The main empirical findings of this chapter are as follows. First, in Malay households, preferences of husbands and wives are equally important in determining fertility. This suggests that policies also targeted towards men can reduce fertility rates.

Second, I find evidence that households renegotiate throughout the course of the fertility cycle. As explained below, such renegotiation implies policies to empower females can actually lead to increased fertility levels. In addition, policies that affect payoffs in divorce, such as child custody or alimony, also affect fertility decisions.

Third, the evidence for Chinese households in Malaysia suggests that only the preferences of the wife determine fertility outcomes. Therefore the social context in which empowerment policies are introduced also determines whether they will be successful or not.

In the model of bargaining over fertility, children are assumed to be a public good in marriage, utility is transferable so that transfers are possible, and spouses have heterogeneous fertility preferences. I make the simplifying assumption that only wives make investments into fertility. These types of investment include the frequency with which spouses have sex with each other, forms of contraceptive use, and the care the wife takes of herself over the fertility cycle. Fertility outcomes depend critically

on whether spouses are able to make agreements contingent on such investments.

When agreements contingent on investments into fertility are possible, wives choose fertility investments to maximize the total marriage surplus. Fertility outcomes are therefore efficient and depend equally upon the preferences of husband and wife. Increases in female bargaining power allow women to appropriate a greater share of the marriage surplus, but have no effect on equilibrium fertility levels.

When fertility investments are non-verifiable to third parties however, agreements cannot be made contingent on them. After investments into fertility have been made, spouses can renegotiate over the division of the surplus created by marriage over divorce. In this case the wife chooses investments to maximize her payoff taking into account the transfers she receives in the renegotiation phase. The equilibrium level of fertility is in general inefficient, and can be above or below the first best level. The Coase theorem breaks down because of the inability of spouses to write agreements contingent on fertility investments. I show that in general, female preferences will be at least as important as male preferences in determining outcomes. Since female bargaining power determines the transfers the wife receives in the renegotiation phase, policies to empower women will have direct effects on fertility outcomes, albeit not necessarily in the expected direction.

Furthermore, if households renegotiate there is an additional channel through which policy affects fertility. Policies that change the divorce payoffs to spouses when children are present, such as child custody or alimony, will affect the fertility outcomes of married couples. This is because the relevant threat point of each spouse in the renegotiation phase is to divorce when children are present, as renegotiation takes place after fertility investments are made. This opens up a range of policy channels that can be expected to have both distributional and efficiency consequences.

The chapter is organized as follows. Section 2 discusses the related literature, section 3 sets out the theory. Section 4 discusses the institutional background and data, section 5 sets out the empirical method, section 6 gives the basic empirical results, section 7 considers some extensions and econometric concerns, and section 8 concludes.

2.1 Related Literature

This chapter is at the intersection of two areas of literature - microeconomic models of fertility, and household decision making.

Microeconomic models of fertility include household demand models (Becker (1960), Becker and Lewis (1973)) which apply the framework of consumer demand to fertility, and synthesis models (Easterlin (1978), Easterlin *et al* (1980)) which introduce supply side variables, like tastes, contraceptive use, and social group behavior, into the analysis.

These models generate a rich set of testable empirical predictions for price and income effects on fertility, the trade-off between child quality and quantity, and the simultaneous determination of fertility and labor supply, child labor, and contraceptive use (see Birdsall (1988) and Schultz (1997) for surveys).

The main limitation of these approaches is that they do not allow for conflicting spousal preferences over fertility. Yet there is much evidence, mainly from demographers, to suggest that males and females do differ in their desires both across developing countries generally (Mason and Taj (1987), Pritchett (1994)), and within Malaysia in particular (Leung (1987)). Empirical work that has controlled for spousal preferences in fertility regressions (Freedman *et al* (1980), Thomson *et al* (1990), Bankole (1995), Thomson (1997), Dodoo (1998)) has found that both male and female preferences determine fertility. This chapter bridges the gap between economic research on how households resolve conflicts, with the demography literature showing that such conflicts exist in fertility decisions.

In line with existing evidence I find that male and female preferences are equally important in determining fertility for Malays in Malaysia. In contrast with the existing theories, this chapter provides a framework to analyze fertility decisions when parental preferences conflict.

In addition, the model precisely identifies potential sources of bias in existing estimates of household fertility, when preferences are typically not controlled for. In particular, the model shows that when spouses are able to make agreements contingent on investments, fertility outcomes are determined by the sum of preferences. In this case, household fixed effects capture any relevant unobservable heterogeneity implying that omitting preferences will not bias estimation. However, if such binding agreements cannot be made (as the evidence in this chapter suggests), the model shows that fertility outcomes are determined by individual preferences. Hence pa-

rameter estimates in fertility equations are biased even if household fixed effects are included.

The chapter relates to the literature on household decision making. Unitary models (Becker (1981)), assume preferences are homogeneous within the household. Hence aggregate resources, pooled across household members, determine outcomes. Bargaining models (Manser and Brown (1980), McElroy and Horney (1981)) and collective models (Chiappori (1988)), allow individual characteristics and preferences to differ, and therefore predict that outcomes depend upon the distribution of resources and preferences across household members.

Much of the empirical work in this field has tested the resource pooling implication of the unitary framework (Haddad and Hoddinott (1993), Strauss and Beegle (1996), Behrman (1997)). Failure to accept the resource pooling hypothesis is used to infer that there exists some bargaining process in the household, and by implication, underlying preferences may be the source of conflict. These tests are inferential in that preferences are typically not observed.

Such inferential approaches are not without econometric problems. For instance, proxies for bargaining shares such as income, education, transfers, and assets are typically endogenous to household outcomes. Even if exogenous, these proxies may be correlated with unobservable household characteristics that also determine intra-household allocations. Finally, if household members have differential productivities in home or market work, or face different resource constraints, the unitary framework gives observationally equivalent predictions to bargaining models without the need to assume conflicting preferences.

This chapter avoids many of the pitfalls of the inferential approach precisely because I am able to control directly for preferences. This has not been done before in empirical work on household bargaining. Moreover, the theory imposes restrictions onto the estimated equations that allow the inference of bargaining shares from coefficient estimates. Thus I do not use any observable variable as a proxy for bargaining power.

Both the unitary and cooperative bargaining models assume household decisions to be Pareto efficient. As households are engaged in repeated interactions, there is symmetric information across household members, and low transactions costs, it may be reasonable to assume households are efficient. The empirical evidence, however, suggests that decisions are inefficient in a variety of settings such as responses to

income risks (Townsend (1994), Duflo and Udry (2001)), health shocks (Dercon and Krishnan (1998)), and agricultural production (Alderman *et al* (1996), Udry (1996)).

This chapter reconciles these two literatures by being amongst the first to provide a theoretical justification for inefficient household decision making (see Lundberg and Pollak (2001) for a similar argument). In particular, I show that if agreements cannot be made contingent on investments or efforts, the Coase theorem breaks down and outcomes will be Pareto inefficient. In addition to the fertility investments analyzed in this chapter, investments into child quality and agricultural production may be non-contractible and lead to inefficient household outcomes in those areas too.

2.2 Theory

2.2.1 General Payoffs

The household comprises a married couple - a husband (h) and a wife (w). Only the wife makes a sunk investment, q, to produce children, and this leads to exactly q children being born *ex post*.[7] This simplification reduces the level of notation, and the results hold as long as there exists a one-to-one mapping between investments and outcomes.[8] Only wives bear the investment costs, $c(q)$, where $c(.)$ is convex and $c'(0) = 0$. These include the time and resource costs of pregnancy, childbirth, and lactation over the fertility cycle. Finally, children are assumed to be a public good in marriage.

Denote spouse i's preferred number of children as π_i^*, $i \in \{h, w\}$. The payoff to i from having q children in marriage, when i's preferred number of children is π_i^* is $V(q, \pi_i^*)$. The payoff to spouse i in divorce is $\overline{V}(q, \pi_i^*)$. Spouses prefer to be married rather than divorced so that $V(q, \pi_i^*) \geq \overline{V}(q, \pi_i^*)$. This can be because of non child related benefits of marriage over being single such as economies of scale in household consumption, increasing returns to scale in household production, or the production of household public goods.

Contractible Investments

[7] Wives can always undertake some hidden action, such as contraceptive use, that allows them to control their fertility levels without the consent of their husband.

[8] Suppose fertility outcomes are stochastic such that an *ex ante* investment of q produces $q + \xi$ children *ex post*, where ξ is a random shock. If ξ is mean independent of q, the stochastic component of fertility does not affect *ex ante* investment incentives.

Suppose agreements between spouses can be made contingent on fertility investments. With transferable utility, the wife chooses the level of investment to maximize the total surplus in marriage;

$$q^* = \max_q V(q, \pi_h^*) + V(q, \pi_w^*) - c(q)$$

The equilibrium investment q^* solves;

$$V_q(q, \pi_h^*) + V_q(q, \pi_w^*) = c'(q) \tag{1}$$

which is the Samuelson rule. The result that bargaining leads to an efficient outcome is an application of the Coase theorem. Here q^* is the first best level of investment. As the payoff in marriage, $V(.)$, is the same across spouses, it follows that;

Proposition 1: *With contractible investments, the level of investment will be Pareto efficient. Both spouses' preferences will be equally weighted in determining the equilibrium number of children.*

Transfers between spouses ensure that both spouses are left at least as well off in marriage as in divorce. If investments are contractible, spouses can write agreements at any stage of the marriage. Hence the relevant outside option of each spouse in bargaining is to leave the marriage *before* fertility investments are made. Hence $\overline{V}(q, \pi_i^*) = \overline{V}(0, \pi_i^*)$ which is independent of the number of children produced.

Denoting the bargaining power of husbands as θ and the transfer as t, where this is positive if it is from husband to wife, the equilibrium transfer solves;

$$t = \max_z \left[V(q, \pi_h^*) - z - \overline{V}(0, \pi_h^*)\right]^\theta \left[V(q, \pi_w^*) + z - \overline{V}(0, \pi_w^*)\right]^{1-\theta} \tag{2}$$

$$t = (1-\theta)\left[V(q, \pi_h^*) - \overline{V}(0, \pi_h^*)\right] - \theta\left[V(q, \pi_w^*) - \overline{V}(0, \pi_w^*)\right] \tag{3}$$

It follows that;

Proposition 2: *Increasing the bargaining shares of women increases the level of transfers husbands give to their wives. The equilibrium fertility level is unaffected.*

Policies designed to empower women, raise the bargaining power of women and leave them better off. This is because they are able to appropriate a greater share of the marriage surplus. However such policies have no affect on fertility levels, which

remain at the efficient level q^* given by (1).[9]

If utility were non transferable within the household, the equilibrium investment would equate the sum of marginal rates of substitution between children and all other goods, to the shadow cost of fertility investments. This defines a contract curve of efficient investment levels. The preferences of husband and wife still have equal effects on each of these Pareto efficient outcomes.

Non-Contractible Investments

The types of fertility investment the wife makes includes the frequency with which she has sex with her husband, and the care she takes of herself over the fertility cycle. These investments are non-verifiable to third parties outside of the household. Hence agreements between spouses cannot be made contingent upon the wife's fertility investment. If spouses were to make agreements contingent on investments, one spouse could claim the other had not made the agreed-to investment, and dissolve the marriage. Hence spouses face a standard hold-up problem. This leads to renegotiation over the marriage surplus even after the investment has been made.[10]

If the couple divorce, a pre-specified child custody rule is enforced. Both spouses are in general able to obtain some share of child custody. Hence the wife is unable to appropriate the full marginal benefit of her fertility investment. This alters the wife's incentives to invest *ex ante* and leads to an inefficient level of fertility.

The timing of actions is as follows;

1. At the start of her fertility cycle, the wife makes an observable but non-verifiable sunk investment, q, into producing children.

2. During the fertility cycle, husband and wife Nash bargain over the allocation of the surplus created by marriage over divorce.

3. At the end of the fertility cycle the spouses decide to remain married or divorce. If they divorce, a specified child custody rule is enforced.

The framework in which spouses renegotiate *ex post* is appropriate if the wife's investment also has the following characteristics. First the investment must be costly

[9]This result is an application of Bergstrom and Cornes (1983). They show the Pareto optimal provision of a public good is independent of the distribution of resources for a class of utility functions, in which $V(.)$ is a special case.

[10]I assume spouses cannot credibly commit not to renegotiate *ex post*. However, one interpretation of marriage vows or pre-nuptial agreements may be precisely to "tie the hands" of spouses, and thus prevent *ex post* bargaining taking place.

to reverse. Otherwise the wife could make take-it-or-leave-it offers to her husband *ex post*, and there would be no scope for renegotiation during the fertility cycle. In this context, the wife can reverse her investment by having an abortion, which is costly.

Second, the wife's investment must not be expropriable by her husband. Otherwise husbands could make take-it-or-leave-it offers to their wives and there would again be no scope for renegotiation. Here the wife's investment is literally embodied in her.

Third, there must be a period of time between when the investment is made and when the equilibrium number of children is actually realized, in order for there to be time for renegotiation. Here the fertility cycle of the wife is the relevant period over which renegotiation takes place.

Fourth, *ex post* custodial rights must be well defined and costly to transfer. I assume *ex post* custodial rights are exogenously given, either by social norms or by law.[11]

With non-contractible investments, the relevant threat point in renegotiation is to divorce with children, as investments are already committed to. Hence the equilibrium level of transfers is given by;

$$t = (1-\theta)\left[V(q,\pi_h^*) - \overline{V}(q,\pi_h^*)\right] - \theta\left[V(q,\pi_w^*) - \overline{V}(q,\pi_w^*)\right] \tag{3a}$$

Changes in relative bargaining shares across spouses will alter the distribution of the marriage surplus. Given spouses anticipate renegotiation, the wife's *ex ante* payoff is;

$$V(q,\pi_w^*) + t - c(q) \tag{4}$$

The wife chooses the investment level to maximize her *ex ante* payoff. The crucial point to note is that with renegotiation, spousal payoffs in divorce depend upon the number of children produced. This in turn depends on the allocation of custodial rights.

Substituting (3a) into (4) and maximizing with respect to q, the first order condition for fertility is;

$$(1-\theta)\left[V_q(q,\pi_h^*) + V_q(q,\pi_w^*)\right] + \theta\overline{V}_q(q,\pi_w^*) - (1-\theta)\,\overline{V}_q(q,\pi_h^*) = c'(q) \tag{5}$$

[11]The next chapter endogenises *ex post* custodial rights in a model where parental investments into child quality are non-contractible.

In general each spouses preferences will not have equal weight in determining fertility levels. The weight of each spouse's preference depends on their bargaining power and the marginal benefits of investing in divorce to each spouse.

The wife has two sources of investment incentive - (i) maximizing the total surplus created in marriage as captured in the first term; (ii) investments change the relative payoffs in divorce to both spouses. Given that transfers ensure both spouses are at least as well off in marriage as in divorce, the wife can appropriate a greater share of the marriage surplus as her divorce payoff increases relative to that of her husband.

If the wife's marginal divorce payoff is sufficiently greater than her husbands, at the first best level of investment q^*, then her incentives to invest are higher than in the case with contractible investments. This is because by overinvesting in fertility the wife is able to appropriate a greater share of the surplus in marriage. Hence there can be over investment into fertility. More precisely;

Proposition 3: *With non-contractible investments, spousal preferences have different weights in determining fertility levels. Wives will over invest in fertility, relative to the first best, if at the first best level of investment, q^*;*

$$\theta \overline{V}_q(q^*, \pi_w^*) - (1-\theta)\overline{V}_q(q^*, \pi_h^*) > \theta c'(q^*)$$

and under invest otherwise.

From the first order condition (5) it is clear that female bargaining power has a direct effect on equilibrium fertility. This is because when the wife chooses her investment she takes account of the transfers she receives in the renegotiate phase, and these transfers are directly influenced by her relative bargaining power.

However increasing female bargaining power will not necessarily reduce fertility. To see this rewrite the first order condition (5) as;

$$\overline{V}_q(q, \pi_w^*) + (1-\theta)\left[V_q(q, \pi_h^*) - \overline{V}_q(q, \pi_h^*) + V_q(q, \pi_w^*) - \overline{V}_q(q, \pi_w^*)\right] = c'(q) \qquad (6)$$

The effects of bargaining shares on fertility depend on whether the total marginal benefits in marriage exceed the total marginal benefits in divorce. As female bargaining power increases, the wife is able to appropriate a greater share of the marginal benefits that marriage creates over divorce. If these benefits are positive then increasing female bargaining power increases the investment incentives of the wife. If

policies of female empowerment are to actually reduce fertility we require the total marginal benefits of investment to husbands in marriage over divorce, to be less than the marginal loss to wives of investment in marriage over divorce.

Proposition 4: *For a given equilibrium investment q, a necessary condition for fertility to be decreasing in female bargaining power is;*

$$\left[V_q(q,\pi_h^*) - \overline{V}_q(q,\pi_h^*)\right] < -\left[V_q(q,\pi_w^*) - \overline{V}_q(q,\pi_w^*)\right] \tag{7}$$

If (7) does not hold for any q, then it is always the case that the marginal benefits of investment in marriage are greater than in divorce. Empowering women allows them to capture a greater share of this surplus and only increases their investment incentives, contrary to the conventional wisdom on empowerment policies.

When is (7) likely to hold? If spouses have conflicting fertility preferences, the marginal benefits of investment to husbands can be less than the marginal loss to their wife. This is true if husbands prefer more children than their wives, and spouses suffer a loss as the number of children produced diverges form their preference.

Why should spouses suffer a loss when the number of children diverges from their preference? This can be thought of in terms of a model in which parents care about child quantity and quality (Becker (1991)). The desired number of children is that which equates the marginal rate of substitution between child quality and quantity, to their ratio of shadow prices. Diverging from this optimal number reduces the payoff from marriage.

Proposition 4 gives insights into the relation between fertility preferences and policies of female empowerment. Consider married couples who have fewer children than either spouse desires. The marginal benefits in marriage of investing in fertility are still positive. Empowering women in such households allows them to appropriate a greater share of this surplus, and thus *increases* fertility level.

Households in which the number of children lies between the preferences of spouses, where there is the most conflict over fertility, are those in which the marginal benefits of investing are likely to be negative for the spouse that prefers fewer children, most likely to be the wife. If the wife is made sufficiently worse off by producing another child, then empowering these women leads them to produce *fewer* children.

The aggregate effect of female empowerment on fertility rates depends upon the level of heterogeneity of fertility preferences within married couples, and the age

distribution of fertile women. If household bargains are subject to renegotiation, suggests targeting policies of empowerment towards women early in their fertility cycle with few children, could be particularly counterproductive.

2.2.2 Specific Payoffs

In order to move towards an empirical test of the model, I put more structure on the payoffs in marriage and divorce.

Assumption 1: The payoff to spouse i in marriage is;

$$V(q, \pi_i^*) = \upsilon_i + \phi(q) - \frac{1}{2}(q - \pi_i^*)^2 \tag{8}$$

where υ_i are the private benefits to marriage, $\phi(q)$ captures the consumption and investment benefits of having children, with $\phi(q)$ concave, $\phi(0) = 0$, $\phi''(.) \leq 1$. We can think of the last two terms in (8) as capturing the separable benefits from child quantity and child quality

Assumption 2: The payoff to spouse i in divorce is;

$$\overline{V}(q, \pi_i^*) = \delta_i \phi(q) - \frac{\eta}{2}(q - \pi_i^*)^2 \tag{9}$$

The parameters $(\delta_h, \delta_w, \eta)$ are exogenous and such that $\delta_h + \delta_w \leq 1$.

In divorce spouses lose the private benefits of marriage.[12] Moreover, each spouse has partial custody of children so the benefits from children are lower. In other words, children are a public good in marriage, but a private good in divorce. The (δ_h, δ_w) parameters capture the allocation of child custody to each parent. The fact that δ_h and δ_w may sum to less than one captures the fact that children are a relationship specific good - they generate greater benefits in marriage than in divorce.[13]

The extent to which preferences over the desired number of children still matter *ex post* is captured by the η parameter. This is because in divorce spouses may be less able to monitor child quality investments (Weiss and Willis (1985, 1993)). In the extreme, if a divorced spouse no longer invests in child quality their utility will not

[12]The model does not endogenise the decision to marry. I take it as given that this loss is sufficiently large so that individuals always prefer to be married rather than divorced.

[13]There is a wealth of literature detailing the negative impact on children's welfare when one parent is absent from the household (Kiernan (1997)). If divorced parents internalize this reduction in children's welfare, then even if one parent has sole custody of the children, it will be the case that the benefits of children are reduced vis-à-vis the benefits from children in marriage.

be affected by the fact that the actual number of children diverges from the preferred number of children.

If $\eta = 0$ spouses no longer suffer a loss from not having achieved their desired number of children in the last marriage. If $\eta = 1$ spouses continue to suffer disutility from not having achieved their desired number of children.[14]

If the loss to each spouse associated with diverging from their preferred number of children is different in marriage and divorce, the marginal surplus that marriage creates over divorce can be decreasing in the number of children. Thus (7) may hold, which is a necessary condition for policies of female empowerment to be effective.

Transfers

If investments are non-contractible, the surplus in marriage over divorce is;

$$V(q,\pi_h^*) + V(q,\pi_w^*) - \overline{V}(q,\pi_h^*) - \overline{V}(q,\pi_w^*)$$

$$= \upsilon_h + \upsilon_w + (2 - \delta_h - \delta_w)\,\phi(q) - \frac{1}{2}(1-\eta)\,(q-\pi_h^*)^2 - \frac{1}{2}(1-\eta)\,(q-\pi_w^*)^2$$

If spouses suffer the same loss in marriage and divorce from not having achieved their desired fertility level ($\eta = 1$), the *surplus* that marriage creates over divorce does not depend on these divergence terms, and so they do not enter the transfer function.[15]

If in divorce spouses no longer suffer this source of disutility ($\eta = 0$), these divergence terms form part of the marriage surplus, and enter the transfer function. Each spouse receives a higher transfer, all else equal, as the number of children diverges from their desired number.

The marriage surplus also depends on the benefits spouses obtain from children. These include the consumption and investment benefits of children, captured in $\phi(q)$. How these benefits are divided across spouses, depends upon two effects that are expected to go in opposite directions. First, there is the effect of *ex ante* bargaining shares. Holding all other factors constant, as q increases then so does the surplus

[14] Of course spouses may not suffer the same loss in divorce from not having achieved their desired fertility level. In this case there would be a combination of the effects discussed for the two cases I focus on, $\eta = 0, 1$.

[15] The equilibirum transfer level is found by substituting (8) and (9) into (3a);

$$\begin{aligned} t &= [(1-\theta)\upsilon_h - \theta\upsilon_w] + [(1-\theta)\,(1-\delta_h) - \theta\,(1-\delta_w)]\,\phi(q) \\ &\quad -\frac{1}{2}(1-\theta)\,(1-\eta)\,(q-\pi_h^*)^2 + \frac{1}{2}\theta\,(1-\eta)\,(q-\pi_w^*)^2 \end{aligned}$$

created by marriage as $\phi(q)$ is concave. If husbands have the greater bargaining power they are able to appropriate the majority share of this marriage surplus. They therefore need greater transfers to remain married.

Second, there is the effect of custodial shares. These shares act as *ex post* bargaining powers. The parent with the majority custodial share has a higher payoff in divorce and therefore needs greater transfers to remain married. These have opposite effects on the direction of transfers if husbands have the greater *ex ante* bargaining power and wives are assigned the greater share of child custody.

Transfers from the husband will be increasing in the number of children if;

$$\frac{1-\delta_h}{1-\delta_w} > \frac{\theta}{1-\theta} \tag{10}$$

so the relative division of *ex post* custodial rights, is more in favour of the wife than *ex ante* bargaining shares.

Fertility Preferences and Outcomes

When fertility investments are contractible the wife chooses investment to maximize the total surplus in marriage. As stated in proposition 1, fertility investments are efficient, and place equal weight on the preferences of both spouses. Hence it is the sum of preferences that matters. Policies targeted towards reducing male preferences will be as effective in reducing fertility as those targeted towards women. As stated in proposition 2, bargaining shares alter the division of the marriage surplus, but have no effect on fertility investments.

If fertility investments are non-contractible, the weights given to spousal preferences depend on if fertility preferences enter divorce payoffs.

If fertility preferences no longer matter in divorce ($\eta = 0$), spousal preferences have equal weight in determining fertility levels. To see this recall that the wife has two sources of investment incentive - (i) to maximize the total payoff in marriage, (ii) the relative divorce payoffs of spouses. Preferences determine investments only through the first source of incentives. The marriage surplus is increasing equally in both spouses' payoffs, and so each spouses preferences matter equally.

If fertility preferences still matter in divorce ($\eta = 1$), then only the wife's preference determines fertility outcomes. The intuition is that the wife maximizes the value of her outside option plus her share of the marriage surplus. In this case, both spouses suffer disutility in marriage and divorce as the number of children produced diverges

from their desired number. Therefore the *surplus* that marriage creates over divorce does not depend on this disutility. The only way in which preferences influence the wife's investment incentives is through her incentive to maximize her divorce payoff, which depends on her own preferences. Therefore only her preference determines the equilibrium fertility level.

As stated in proposition 3, there will be overinvestment into fertility when the marginal benefits to investing in divorce are sufficiently greater for the wife than for the husband. This is more likely to occur if women have the majority custodial rights over children in divorce. As women are relatively better off than men in divorce because they have child custody, husbands have to give their wives greater transfers in marriage for them to remain married. By investing into fertility wives are able to extract a greater share of the surplus that marriage creates over divorce. This can leave them better off overall, even though by over investing in fertility the wife moves further from her own preferred number of children.

Female Empowerment

The model makes precise when policies of female empowerment will be effective. From proposition 4, a necessary condition for this is the marginal benefits of investment to the husband are less than the marginal loss to the wife. In other words, if there is sufficient preference heterogeneity in the household, the total marginal surplus that marriage creates over divorce is somewhere *decreasing* in the number of children produced.

When parents suffer disutility in divorce from not having achieved their desired number of children the *surplus* that marriage creates over divorce depends only the benefits of children. Given children are a marriage specific good, the returns to investing in fertility are higher in marriage than divorce. From proposition 4 this implies that policies of female empowerment lead to increased fertility levels.

If spouses no longer care about their desired preferences in divorce, the marginal benefits of investing can be lower in marriage than divorce. This is more likely to occur if, first, there is sufficient heterogeneity in spouses preferences so that marginal increases in investment lead to one parent being better off and the other worse off. Hence the total surplus created by marriage over divorce falls. Second, if children are not a marriage specific good, the total marginal benefits in divorce of investing are almost as great as in marriage, but in marriage parents suffer disutility from diverging from their preferences. Overall this can lead to the marginal benefits of investment in

marriage to be lower than in divorce. Empowering women would then reduce fertility rates.

2.2.3 Summary

The link between female empowerment and fertility rates is not as straightforward as suggested in the public policy debate. The theory provides the following insights.

First the nature of household bargaining, and the role of preferences is key to understanding the links between female empowerment and fertility. If spouses are able to make agreements contingent on investments, bargaining leads to the result that both spousal preferences equally determine fertility outcomes. Hence fertility policies ought to be targeted to men and women alike.

Second, if spouses are able to make agreements contingent on investments, the role of female bargaining power is purely distributional - empowering women does improve their welfare but has no effects on fertility outcomes.

Third, if investments are non-contractible, the relation between preferences and fertility depends on how preferences enter divorce payoffs. If they still matter then only wives preferences drive fertility, and policies directed at changing preferences will only be effective when targeted at women.

Fourth, female bargaining power now affects both fertility and the distribution of welfare in marriage. Empowering women allows them to appropriate a greater share of the marital surplus. This affects investment incentives. These incentives are determined by how the *surplus* that marriage creates over divorce changes with children, as well as the marginal changes in the wife's divorce payoff. These factors depend upon how fertility preferences enter divorce payoffs, the degree of preference heterogeneity, and the allocation of child custody rights.

Fifth, over and under investment into fertility can occur relative to the case with contractible investment. Empowering women can exacerbate these inefficiencies. In particular the fact that women have the majority custodial rights over children can lead women to produce too many children. This is because by producing more children within marriage, they are able to extract a greater share of the surplus that marriage creates over divorce.

Finally, empowering females only leads to unambiguous falls in fertility rates if the total marginal benefits of children in marriage are less than in divorce. A necessary condition for this to be the case is if there is sufficient heterogeneity in fertility

preferences across spouses.

In conclusion, the effects of policies to empower women will depend on the social context in which they are introduced. The effects depend on how preferences matter in divorce, and the rules on child custody. Hence the same empowerment policies within a country can have different effects if social norms differ across groups within society. An ethnically diverse country such as Malaysia provides an excellent testing ground for this framework.

2.3 Institutional Background and Data

Fertility rates have been of concern to policy makers in Malaysia. Due to growing awareness of the pressures being placed on the economy by its growing population, two major policies have been implemented over the past forty years. First, in 1966 the National Family Planning (NFP) board was established to coordinate a family planning program. This met with considerable success as the fertility rate dropped from over 6 in 1966 to 3.6 by 1988. However, because the program was concentrated in urban regions, its effect was least on the predominantly rural Malay population. Second, the New Population Policy (NPP) announced in 1982 also called for a decline in the total fertility rate, but it nevertheless gave tax incentives and maternity benefits to encourage parents to "go for five".

The decline in fertility has been different across ethnic groups. Between 1958 and 1983 the fertility rate for Malays dropped from 5.9% to 4.5%, a smaller drop than for the other ethnic groups.[16] Much of this decline can be attributed to the rising age at marriage for females - this rose from 17 in 1950 to 22 in 1985. Marriage is a near universal practice for Malay women, with nearly all marrying by age 30. Births out-of-wedlock are almost non existent.

Since the 1950s, Malays in Malaysia have had one of the highest divorce rates in the world (Jones (1981, 1997)).[17] Table 1i gives the divorce rates from 1965 to 1990 for Malays in Peninsular Malaysia, for Malays in Indonesia, as well as for England

[16] Chinese accounted for 30% of the population in 1970 and Indians 10%. For the Chinese the fall in fertility between 1958 and 1983 was 6.5% to 2.7%, and for Indians it was 7.2% to 3% (Pong (1994)).

[17] This has been confirmed using a variety of other data sources such as vital statistics and survey data (such as the World Fertility Survey (1974) or the Malaysian Population and Family Survey (1984)).

and Wales and the United States.[18] Over the periods 1950-57 and 1972 - 76, in some states half of all marriages were ending in divorce (see map 1ii). In some Malaysian states the divorce rate in the late 1970s was four times as high as that in the United States today. Divorce is clearly a credible threat in Malaysia.[19]

Islamic Family Law

The Federal Constitution of Malaysia prescribes that Muslim family law is the jurisdiction of state legislatures. Whilst procedures regarding marriage and divorce differ by state, these follow the orthodox tenets of the *Shafi'i* School of Law (Ibrahim (1973)).[20] Four types of divorce exist – (i) *talak*, where husbands file for divorce; (ii) *cerai taalik*, where wives file for divorce; (iii) *khula*, where the wife files for divorce and the husband has to "buy" the divorce by transferring money or assets; (iv) *fasah*, where the divorce is granted to the wife by an Islamic court on grounds of desertion or failure of the husband to provide maintenance.

While *talak* constitutes the majority of all divorces performed, ethnographic evidence suggests that Islamic law is liberally interpreted and that in practice, the numbers of women instigating divorce is higher than officially recorded (Rudie (1983), Jones (1981, 1997)). Malay women have historically been given considerable autonomy with regards to marriage partner, household decisions within marriage, and the decision to divorce (Swift (1965), Firth (1966), Kuchiba *et al* (1979), Resid (1988)). These studies also suggest there is little social stigma associated with being a divorcee of either gender.

Shafi'i law states that divorced women should retain custody of their children. Boys are then passed into the care of their fathers at age seven, whilst girls remain

[18]The general divorce rate is defined as the number of divorcees per thousand population aged 15 and over. This measure understates the true divorce rate in Western countries as individuals marry at an older age compared to in Malaysia. The measure understates the true divorce rate in Peninsular Malaysia in later periods relative to early periods because the median age at marriage for Malays has been rising over this period. However, the general trends remain unchanged if we use those currently married as the denominator. Also, the incidence of marital reconciliation has remained constant over the period (Jones (1981)) suggesting that the trends in table 1i are truly reflective of changes in divorce rates themselves.

[19]Data on the timing of divorce is harder to obtain. Guest (1991) shows that of the 27 countries included in the World Fertility Survey, the ratio of the probability of marital dissolution in the first five years, to the probability of dissolution in the next five, was higher in Indonesia and Malaysia than any other country. Hirschman and Teerawichitchainan (2001) use 1970 census data to show that timing of first births is a significant determinant of marital dissolution, suggesting that in divorce, the allocation of custodial rights over children is a salient issue.

[20]The Islamic Family Law Act (1984) was enforced by most states by the late 1980s, and was designed to formalize common divorce procedures across states.

with their mothers until they marry. Jones (1981, 1994) suggests this practice is not followed and children actually always tend to reside with their mothers, regardless of age or gender. The Malaysian Marriage Survey (1984) reports that 55% of children involved in divorce reside with their mothers, 19% stayed with their fathers, and 13% resided with both parents in some form of joint custody (Tan and Jones (1990)).[21]

Data and Key Variables

I use the Malaysian Family Life Surveys (MFLS) for the empirical analysis. This is a short household panel, collected in two waves in 1976/7 (MFLS-1) and 1988/9 (MFLS-2). The MFLS-1 sample consists of 1,262 households with an ever-married woman aged 50 or less, located in 52 districts, and representative of Peninsular Malaysia in 1976. Both the wife and her current husband were interviewed. MFLS-2 re-interviewed 926 households. Each survey collected detailed current and retrospective information on family structure, fertility, preferences, economic status, and transfers. The key variables used are the following;

Preferences

In the first wave both spouses were asked, *"suppose you could start your married life all over again and you could decide what children to have. How many children would you want?"* I use the response as the measure of each spouses desired number of children (π_h^*, π_w^*). This question was also asked regarding the desired number of boys and girls. Respondents were specifically asked about wants rather than expectations, and the questionnaire was administered in one of ten languages further reducing the possibility of respondents misinterpreting the question.[22]

Equilibrium Fertility Outcomes

The number of children alive in the second wave measures the equilibrium level of fertility.[23] This is measured twelve years after fertility preferences were expressed. The average age of women in the second wave is 47 years. Census data confirms that over 98% of women of this age have completed their fertility cycle.

Monetary Transfers

I use data on monetary transfers from husband to wife measured in wave 1, twelve

[21] Fathers are required by Islamic law to pay maintenance to their former wives in divorce to cover child costs. In practice, the incidence of fathers paying is less than universal. Tan and Jones (1990) report 59% of husbands never paying any maintenance.

[22] Less than 10% of the sample did not respond to this question.

[23] The number of children ever born has a correlation coefficient of .95 with the number of pregnancies the wife has ever had. Malaysia experienced a sharp reduction in mortality rates during the 1960s before the population boom of the 1970s (Jones (1994)).

years prior to when the equilibrium fertility outcomes are measured. Spouses were asked, *"in the past 12 months did you receive money from your husband/wife?"* If yes, they were asked the amounts and frequency of payments. I use this data to construct weekly monetary transfers from husbands to wives.[24]

Monetary payments are the most direct means by which spouses can make transfers between each other in marriage. The effects ought to be stronger than for other forms of transfer.

Other Covariates

Information on the age at which the wife began menstruating is used to construct an indicator of the stage of the fertility cycle the women is at. To measure wealth, I use information on the value of household assets, property, and whether the household has its own supply of running water and electricity. Finally, each household is located in one of 70 census districts. I match the MFLS data with census information regarding the socioeconomic characteristics of the local district. This is used to control for local marriage market characteristics.

In order to match with the theory, it is important to identify the required timing of the variables of interest. If investments are contractible, spouses are able to specify investments and the transfers between spouses required to enforce these investments. These transfers can take place at any stage of the fertility cycle.

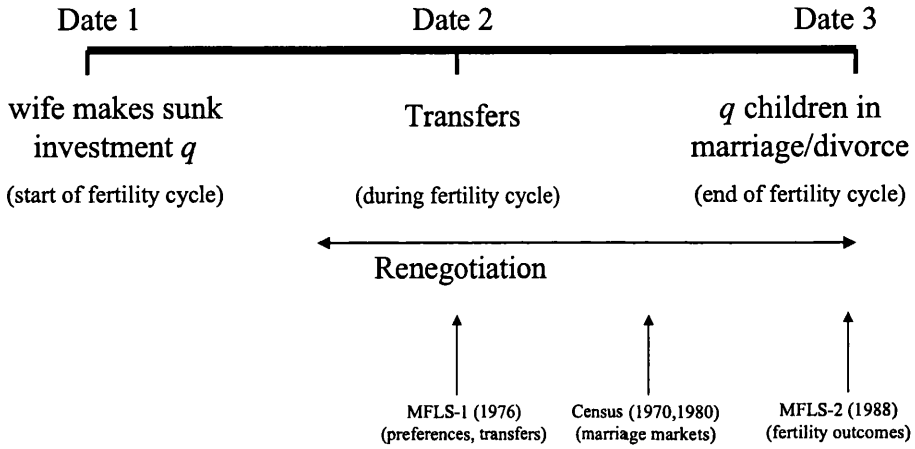
If investments are non-contractible, transfers take place during the fertility cycle, the period of renegotiation. Transfers need to be measured before the equilibrium number of children are produced. Once the fertility cycle is completed, there is no reason why observed transfers ought to be related to fertility investments as there is nothing left to bargain over.

The measure of monetary transfers from MFLS-1 is measured during the fertility cycle, when spouses can renegotiate over the distribution of the marriage surplus. Spousal preferences (π_h^*, π_w^*) are also measured in wave 1, while the equilibrium number of children, q, is measured in wave 2 when wives have completed their fertility cycle.

If spouses renegotiate over the course of the fertility cycle, variables that reflect changing relative divorce payoffs have to be measured during this renegotiation phase. I will use marriage market characteristics from census data to capture changing di-

[24] Around 60% of these women said they received these transfers weekly, suggesting this variable is not just picking up lump sum transfers which occur at the time of the survey.

vorce payoffs over the fertility cycle. The following figure details the timing of when the key variables are measured;



The working sample used for the fertility regressions is Malay husband and wife pairs for whom, (i) both spousal preferences, expressed in MFLS-1, were available; (ii) were continuously married between MFLS-1 and MFLS-2; (iii) were both fertile over the two waves.[25] There are 472 pairs of Malay husband and wife pairs, and 220 Chinese pairs that satisfy these criteria. Whilst this sample is not representative of Peninsular Malays, it is exactly those households that the theory applies to. Namely households that bargain to allocate the marriage surplus so the couple remain married in equilibrium.

Table 2i presents summary statistics of the main variables used. The average age at marriage of women in the sample is 17, precluding the possibility of children being born prior to marriage.

Table 2ii reports the desired number of children by spouse, also broken down by gender of child. There exist significant differences in the spousal desires, largely driven by husbands wanting more sons than their wives. Note that 34% of spouses agree on the number of children desired, 22% differ by one child, and 44% differ by at least two children - 10% differ by more than four.

These levels of preference heterogeneity underestimate the true levels of conflict in the population as the sample is restricted to households which are continuously

[25] To determine whether spouses are fertile, each was asked, *"are you and your spouse physically able to have more children now?"* Whilst spouses may be unaware of their own fecundity, the sample of Malay women have had on average 3.46 children in wave 1 and 6.38 in wave 2, a significant difference.

married over both waves.[26]

As a consistency check, I report the additional number of children wanted, and attitudes regarding what constitutes a large and small family.[27] On average both spouses wanted to almost double their family size. The figures for large and small family sizes are reasonable given average family sizes in the sample.

The fact that spouses report significantly different preferences to each other, is consistent with them reporting their innate preferences and not some outcome of a bargaining model. In addition I found no evidence that the degree of preference heterogeneity between spouses differs with the number of years they have been married.

Table 2iii gives the summary statistics for the number of children ever born in wave 2. This is significantly greater than the number of children in wave 1, suggesting the fertility cycle is incomplete at MFLS-1. The number of children born are greater than either spouses' desired number. This suggests households are over investing in fertility, an issue I return to later.

2.4 Empirical Method

2.4.1 Fertility

The equilibrium fertility level is given by the first order condition (5), which after substituting in for payoffs (8) and (9) reduces to an equation of the form;

$$g(\theta, \delta_h, \delta_w, \eta, q) = \beta_h(\theta, \delta_h, \delta_w, \eta)\pi_h^* + \beta_w(\theta, \delta_h, \delta_w, \eta)\pi_w^* - c'(q) \qquad (11)$$

I estimate a linear approximation to this first order condition for each household;

$$q = \alpha + \beta_h \pi_h^* + \beta_w \pi_w^* + \mu \mathbf{X} + u \qquad (12)$$

[26]The model suggests that there ought to be sorting by preferences in the marriage market. For any given level of fertility investments, if spousal preferences are more homogeneous then the absolute level of transfers required in equilibrium is lower, and investments are closer to the first best level. However, fertility preferences are not the only source of marital conflict. The sample correlation between spousal preferences is .33, for age .79 , and for years of schooling .60. Hence spouses appear to sort more on other dimensions.

[27]Respondents were asked, "*would you personally like to have any more children than the number you have now*?", and if yes, "*how many more children do you want*?". This second question was broken down by the gender of the child. The other question asked, "*how many children would there be in a small/large family?*"

where q is the equilibrium number of children, π_h^* and π_w^* are the spouse's preferences, $\mathbf{X}$ is a vector of covariates that proxies for the marginal cost of investments and other exogenous factors that determine fertility outcomes, and u is a household level disturbance term.

If fertility investments are contractible then both spousal preferences will have the same effects on equilibrium fertility levels so $\beta_h = \beta_w > 0$. If investments are non-contractible, the effect of female preferences on fertility will be at least as great as male preferences so $\beta_w \geq \beta_h$.

2.4.2 Transfers

The theory makes precise how transfers depend on preferences. Substituting payoffs (8) and (9) into (3a), the level of transfers can be written in the general form;

$$t = \gamma(\theta, \delta_h, \delta_w)\,\phi(q) + \lambda_h(\theta, \eta_h)\,(q - \pi_h^*)^2 + \lambda_h(\theta, \eta_w)\,(q - \pi_w^*)^2 \tag{13}$$

I estimate the following form for the transfer equation;

$$t = \alpha + \gamma q + \lambda_h\,(q - \pi_h^*)^2 + \lambda_w\,(q - \pi_w^*)^2 + \tau\mathbf{Z} + \nu \tag{14}$$

where q is the equilibrium number of children produced, $(q - \pi_i^*)^2$ is the preference divergence term for each spouse, $\mathbf{Z}$ is a vector of exogenous determinants of intra-household transfers, and v is a household specific disturbance term.

The coefficients (λ_h, λ_w) map into the underlying structural parameters of the model as follows;

$$\begin{aligned} \lambda_h &= -\frac{1}{2}(1-\theta)(1-\eta) \\ \lambda_w &= \frac{1}{2}\theta(1-\eta) \end{aligned} \tag{15}$$

Hence the implied bargaining share of the husband can be inferred from[28];

$$\widehat{\theta} = \frac{\widehat{\lambda}_w}{\widehat{\lambda}_w - \widehat{\lambda}_h} \tag{16}$$

2.5 Basic Results

2.5.1 Fertility

I estimate a household fertility equation of the form;

$$q = \alpha + \beta_h \pi_h^* + \beta_w \pi_w^* + \mu \mathbf{X} + u \tag{12}$$

The dependent variable is the number of children born to the spouses by wave 2. Preferences are measured twelve years earlier in wave 1. In $\mathbf{X}$ I also control for wife's age in MFLS-1, her age at marriage, and the age at which she first started menstruating.[29]

In addition, I control for the wife's years of schooling, and her monthly non-earned income. These capture the opportunity cost of having children. More educated women have to forgo higher earnings if they become pregnant and so ought to have lower fertility. Women with higher non-earned incomes have a lower opportunity cost

[28] A confidence interval for $\widehat{\theta}$ is constructed using the delta method. Define $f(\widehat{\lambda}_h, \widehat{\lambda}_w) = \frac{\widehat{\lambda}_w}{\widehat{\lambda}_w - \widehat{\lambda}_h}$ so that;

$$\frac{\partial f}{\partial \widehat{\lambda}_h} = \frac{\widehat{\lambda}_w}{\left(\widehat{\lambda}_w - \widehat{\lambda}_h\right)^2} \; ; \; \frac{\partial f}{\partial \widehat{\lambda}_w} = -\frac{\widehat{\lambda}_h}{\left(\widehat{\lambda}_w - \widehat{\lambda}_h\right)^2}$$

Using the delta method, the asymptotic distribution of $f(\widehat{\lambda}_h, \widehat{\lambda}_w)$ for sample size n is given by;

$$\sqrt{n}\left[f(\widehat{\lambda}_h, \widehat{\lambda}_w) - f(\lambda_h, \lambda_w)\right] \xrightarrow{d} N\left(0, \Phi \Sigma \Phi'\right)$$

where;

$$\Phi = \begin{pmatrix} \frac{\widehat{\lambda}_w}{(\widehat{\lambda}_w - \widehat{\lambda}_h)^2} & -\frac{\widehat{\lambda}_h}{(\widehat{\lambda}_w - \widehat{\lambda}_h)^2} \end{pmatrix} \text{ and } \Sigma = \begin{pmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{pmatrix}$$

$\sigma_{11} = var(\lambda_h)$, $\sigma_{22} = var(\lambda_w)$, and $\sigma_{12} = \sigma_{21} = cov(\lambda_h, \lambda_w)$. Hence;

$$Var\left[f(\widehat{\lambda}_h, \widehat{\lambda}_w) - f(\lambda_h, \lambda_w)\right] \underset{a}{\rightarrow} \frac{1}{n} \frac{1}{(\lambda_w - \lambda_h)^4} \left[\sigma_{11}\lambda_w^2 - 2\sigma_{12}\lambda_h\lambda_w + \sigma_{22}\lambda_h^2\right]$$

[29] Age at marriage is unlikely to be endogenous because teen marriage is the social norm, and first marriages are typically arranged, although women do have some say in the choice of marriage partner (Jones (1994)).

of having children, and should have higher fertility levels, all else equal.

I also control for wealth using data on whether the household has its own supply of running water and electricity. Wealth has ambiguous effects on fertility levels as income and substitution effects move in opposite directions if children are a normal good.

I control for husband's years of schooling, non-earned income, and employment status. These capture the husband's opportunity costs of raising children.

Finally, I control for district fixed effects because of regional variations in marriage markets (table 1), how Islamic law is interpreted. Robust standard errors are calculated throughout. All regressions are estimated using least squares. I report p-values in parentheses, and do not control for potentially endogenous regressors such as income.

In table 3 I estimate the specification in (12). The key test of the theory is whether spousal preferences determine equilibrium fertility outcomes. Column 1 of table 3 controls only for the preferences of husband and wife. At the foot of table 3 I give the p-value for the hypothesis that $\beta_h = \beta_w$.

Both preferences have positive and significant effects on the equilibrium level of fertility, measured twelve years after fertility preferences were measured. I cannot reject the hypothesis that the marginal effects of spousal preferences on fertility are equal across spouses (p-value of .8428).

In column 2 I additionally control for each set of covariates described above. Introducing these variables, (i) the coefficients on spousal preferences remains positive and significant; (ii) the test for the equality of these coefficients still cannot reject the null that $\beta_h = \beta_w$; (iii) the point estimates $(\widehat{\beta}_h, \widehat{\beta}_w)$ remain stable suggesting preferences are not proxying for an earlier omitted variable.[30]

The preferences of husbands and wives are equally important in the determination of fertility. The policy implication is striking - policies designed to reduce fertility should not only be targeted towards females. Policies that target male preferences will be equally effective in reducing fertility as those that target women. This policy channel has been largely ignored in the public policy debate.

The coefficients on the other covariates are also informative. In column 2, women

[30] I used non-parametric regressions to check for the linearity of spousal preferences in the fertility equation. I did this by first estimating (12), and then estimating a kernel regression of $q_i - \widehat{q}_i$ on spousal preferences. Using 95% bootstrapped confidence intervals on the kernel regression, I could not reject linearity.

who are older, married earlier, and started menstruating later, have more children. Surprisingly female non-earned income and the measures of household wealth do not enter significantly. This last result may be because the income and substitution effects offset each other. This is not unreasonable in a developing country where there are large consumption and investment benefits of children.

Husband's characteristics all enter significantly - husbands that are more educated, have higher non-earned income, and are employed, have significantly higher levels of fertility. Husband's education is most likely proxying for household income.

One surprising result is that wife's education has no effect on fertility, once spousal preferences are controlled for. This contradicts a body of empirical evidence that suggests a robust negative correlation exists between female education and fertility (see Dréze and Murthi (2000) for a review). This result suggests that one of the most central policies of female empowerment, educating women, may have little *direct* effect on fertility.[31]

Raising female education is expected to reduce fertility, either because it increases the opportunity cost of having and raising children; it reduces infant mortality; it increases knowledge and use of contraception; or it reduces the desired number of children. One interpretation of the result in column 2 is as confirmation of female education affecting fertility outcomes through preferences. As a check, in column 3 I drop the preference data, and find the standard negative and significant effect of female education.

This raises two issues - (i) preferences may be endogenously determined; (ii) what is the role of public policy in affecting household fertility decisions. I return to both issues in more detail later.

The efficiency of the estimates can be improved if I explicitly take account of the discrete nature of the dependent variable. In column 4 I run an ordered probit regression. The signs and significance of the variables are in line with column 2. I continue to fail to reject the hypothesis that $\beta_h = \beta_w$.

The results in table 3 imply the *sum* of spousal preferences determine fertility outcomes.[32] This is consistent with households being able to bargain efficiently. Fe-

[31]The correlation between female education and preferences is -.1270 suggesting the result is not driven by multicolinearity. Similar results were obtained using households in which preferences differed across spouses.

[32]Throughout I have not included any potentially endogenous regressors such as income. Including income leaves both preferences significant, and I am still unable to reject the hypothesis that $\beta_h =$

male bargaining power should not determine fertility outcomes in this case. If female education and non-earned income are proxies for this, the fact that neither of these are significant is consistent with efficient bargaining within households. However, these characteristics are significant for husbands, although they may be picking up income effects.

To precisely identify the underlying nature of household bargaining, I turn to estimating the transfers equation. For now it is worth noting that all the observable male characteristics controlled are significant determinants of fertility in Malays households. Clearly men matter for fertility outcomes, and this has been largely overlooked in the current policy debate.

2.5.2 Transfers

I estimate the following specification for the transfers equation;

$$t = \alpha + \gamma q + \lambda_h \left(q - \pi_h^*\right)^2 + \lambda_w \left(q - \pi_w^*\right)^2 + \tau \mathbf{Z} + \nu \tag{17}$$

where monetary transfers between spouses are measured in wave 1. This is measured during the fertility cycle, when spouses can renegotiate over the distribution of the marriage surplus. Spousal preferences (π_h^*, π_w^*) are also measured in wave 1, while the equilibrium number of children, q, is measure twelve years later, when women have completed their fertility cycle.

Table 2iii shows that monetary transfers constitute a non-negligible proportion of Malay wives incomes, especially for wives who are not employed (40% of the sample).

The set of other covariates controlled for in $\mathbf{Z}$ are the wife's age, age at marriage, years of schooling, non-earned income, and whether the wife is employed. I also control for the value of household assets, husbands years of schooling, non-earned income, employment status and earnings from employment. In part these controls pick up other potential channels through which transfers are determined. For instance, women who do not work may receive transfers from their husbands to compensate them from not having any earned income.

The available sample is only 88 Malay households, so I am unable to control for district fixed effects. I allow for clustering of the errors by sampling district, and

β_w. Furthermore, as income and preferences are negatively correlated, the omitted variables bias suggests that the true effect of preferences on outcomes is underestimated in these regressions.

calculate robust standard errors.

Column 1 of table 4 regresses monetary transfers from husband to wife, on the equilibrium number of children, and the divergence of this number of children from each spouses desired number of children. As the divergence between the number of children produced and the desired number of the husband increases, then during the fertility cycle, the husband significantly reduces his monetary transfers to his wife. Similarly, as the divergence between the number of children produced and the desired number of the wife increases, the husband significantly increases his monetary transfers.

The fact that transfers depend on these preference divergence terms is consistent with households bargaining over the division of the surplus in marriage. Furthermore the results are consistent with spouses needing to be compensated for the loss of not achieving their desired fertility level. This compensation takes place during the fertility cycle.

The result also suggests that as the equilibrium number of children rises, transfers given to wives during the fertility cycle rise.

Column 2 shows that this result is robust to the inclusion of the full set of covariates $\mathbf{Z}$, discussed above. Women who marry earlier (and have thus been married longer) receive significantly lower transfers.[33] Husbands with more years of schooling give greater transfers, but husbands with higher levels of non-earned income significantly reduce transfers. Husbands income from employment has no effect on transfers. I cannot reject the hypothesis of equal bargaining shares across spouses. This is consistent with ethnographic evidence suggesting high levels of female autonomy in Malaysia relative to other Islamic societies.

I test whether it is valid to assume that the divergence terms are quadratic. Expanding (17) gives the unrestricted regression;

$$t = \alpha + \gamma q + \delta_0 q^2 + \delta_1 q q_h^* + \delta_2 \left(q_h^*\right)^2 + \delta_3 q q_w^* + \delta_4 \left(q_w^*\right)^2 + \tau \mathbf{Z} + \nu$$

which generates the linearly independent restrictions;

$$\delta_3 + \delta_4 = -\frac{1}{2}(\delta_1 + \delta_2) \; ; \; \delta_0 = -\frac{1}{2}(\delta_1 + \delta_2)$$

[33] One reason for such an age profile of transfers is that women make relatively more marriage specific investments early in marriage.

I use a Wald test for the null hypothesis that both restrictions hold. The p-value for this is reported at the foot of column 2. The restrictions are valid, although the power of such a test is inevitable low in such a small sample.

The result in column 2 may be spurious for a number of reasons. First, if women have greater control over household resources, expenditures on child goods increase (Schultz (1990), Thomas (1990), Haddad and Hoddinott (1994)). Monetary transfers may be given to wives specifically for this purpose. If so, transfers should be correlated with the *contemporaneous* number of children. The earlier results may be picking up the fact that the equilibrium number of children, measured in MFLS-2, is correlated with the contemporaneous number of children, measured in MFLS-1. In column 3 I drop the divergence terms and control only for the number of children in the household, measured contemporaneously with transfers from husbands in MFLS-1, and the set of covariates **Z**. Children in the household in MFLS-1 do not significantly affect the level of transfers the wive receives.

Column 4 runs the same regression as in column 2 but also controls for the number of children measured in wave 1. The contemporaneous number of children has no significant effect on the level of transfers to wives. In addition, the equilibrium number of children continues to have a positive and significant effect, and the preference divergence terms remain significant. The earlier results are not spuriously picking up transfers to wives given to look after the contemporaneous number of children.

An alternative hypothesis is that women receive more transfers because they care more about children, or have a comparative advantage in child care. To address this I control for the relative valuations of parents for children by including spouses desired number of children.

The result in column 5 shows fertility preferences have no significant direct effect on the level of transfers. Controlling for spousal preferences and the number of children in the household in wave 1, the result is the same as in earlier specifications. It is the *divergence* between spousal preferences and realized numbers of children that drives transfers across spouses.

Another concern is that if spouses determine the equilibrium level of fertility investments and transfers simultaneously, then in the transfers equation the equilibrium number of children is endogenous. If this endogeneity is due to any unobservable factor that drives both fertility outcomes and preferences, it will be washed out in the preference divergence terms, and only affects the level of equilibrium children in wave

2. In column 6 I deal with this by instrumenting for the number of children in wave 2. The instruments are the number of stillbirths and miscarriages the wife has had by wave 2. The identifying assumption is that these events are correlated with the equilibrium fertility level, and uncorrelated with unobservables that drive both fertility and transfers. This is true if stillbirths and miscarriages are random events. In column 6 once the number of children in wave 2 is instrumented for, the preference divergence effect continues to hold, although there is no longer any levels effect of children in wave 2 on transfers in wave 1.

To conclude, estimating the transfer equation suggests spouses do compensate each other during the fertility cycle, in monetary terms, as they move away from their own desired fertility level. Transfers do not appear to be given to women simply because they have more children to look after at the time, nor do they reflect fully different valuations that spouses may have for children.

Throughout I have also found the estimated bargaining shares to be around one half for each spouse. This is in line with sociological evidence, cited earlier, that shows high levels of female autonomy with respect to household decision making in Malaysia.

2.6 Extensions

2.6.1 Renegotiation

Taken together, the fertility and transfers imply - (i) husband and wife preferences both determine fertility outcomes; (ii) during the fertility cycle spouses compensate each other through monetary transfers, as the number of children produced diverges from their preferred number. This suggests an underlying model in which households are able to bargain efficiently over fertility investments, or one where spouses renegotiate over the fertility cycle and preferences no longer determine payoffs in divorce. Given that, as the model makes clear, the policy implications will be different in these cases, it is important to empirically distinguish between these two. I do this using four different approaches.

First, irrespective of the bargaining process, the marginal effects of spousal preferences on fertility outcomes are stronger for couples earlier in the fertility cycle. This is because younger couples have greater opportunities to adjust to shocks to fertility, and thus reach an outcome closer to their preferences, all else equal.

If households renegotiate during the fertility cycle however, the marginal effects of preferences differ across spouses over the fertility cycle. This is because spouses *relative* payoffs in divorce changing during the course of marriage as fertility investments are undertaken. If investments are contractible, this would not be true - investments do not change the relative payoffs in divorce as those are independent of the level of investment made.

Let L denote the stage of the fertility cycle at which the wife is at. I test for the presence of different marginal effects of preferences of husband and wife, over the life cycle, by interacting this life cycle variable with spousal preferences;

$$q = \alpha + \beta_h \pi_h^* + \beta_w \pi_w^* + \rho_h \left(\pi_h^* . L\right) + \rho_w \left(\pi_h^* . L\right) + \mu \mathbf{X} + u \tag{18}$$

If investments are contractible and households bargain efficiently the marginal effects of preferences are the same across spouses over the fertility cycle ($\rho_h = \rho_w$). If households renegotiate over the course of the fertility cycle, $\rho_h \neq \rho_w$.

The results in table 3 did not reject the null hypothesis that the sum of preferences is what determines fertility outcomes. I now assume this restriction to be valid. The regression specifications in table 5 continue to control for the set of baseline covariates in table 3. Column 1 runs the basic fertility specification (12) imposing the restriction that $\beta_h = \beta_w$ for comparison.

In column 2 I estimate specification (18). As the wife is at a later stage in her fertility cycle, the marginal effects of husbands' preferences on fertility outcomes, falls significantly. There are no significant changes over the female fertility cycle of the marginal effect of wives preferences, although the point estimate of the interaction effect is still negative.

There are at least two ways to interpret this result. First, later in the fertility cycle husbands are less able to exert their preferences than wives because, as we saw in table 2ii, husbands typically want more children than their wives. This would be true if shocks to fertility were negative so that spouses on average underachieved their desires. The results in table 2 suggest the opposite however - spouses tend to overachieve relative to their desires.

The second explanation is that with renegotiation, as more children have been produced later in the fertility cycle, relative divorce payoffs change. If females obtain the majority share of child custody, their relative payoffs in divorce are increasing

later in the fertility cycle as more children are born. Hence the marginal effect of male preferences is weaker, in line with the evidence in column 2.

The result can only be consistent with *some* model of bargaining with contractible investments, if spouses can make agreements contingent on all future outcomes.

The second approach uses the intuition that divorce payoffs are different when investments are contractible, to when they are not. In the former case fertility levels ought to depend upon divorce payoffs at the time of marriage before fertility is invested into. Factors correlated to parental wealth, such as the value of inheritance and parental education, pick up the value of this payoff.

The result in column 3 shows parental education variables to be insignificant determinants of fertility. Only the value of husband's inherited land has a significant effect, and this may just be picking up wealth effects. Taken together these variables are not strong determinants of fertility, suggesting payoffs at marriage are not determining fertility outcomes, consistent with *ex post* bargaining between spouses.

The third approach stems from the intuition that if households renegotiate during marriage, fertility depends on divorce payoffs after children have been produced. These payoffs are proxied by local marriage market characteristics. In particular, using census data I control for the proportion of single males in the same census district as the household.

The mean age at marriage of women in the sample is 17, and women tend to marry slightly older men. Therefore I control for the proportion of single males aged 15-24 in 1960, the average year of marriage of women in the sample. This is the relevant pool of available marriage partners. The average age of women in MFLS-1 is 35, and as women marry older men, I also control for the proportion of single males aged 35-44 in 1974.[34] This is the relevant pool of men available for re-marriage. These should only be a determinant of fertility outcomes if households renegotiate over the fertility cycle.

If these measures are picking up re-marriage possibilities, then given that there is no marriage across ethnic groups (Jones (1994)), we ought to find only Malay demographics have any effect on fertility in Malay marriages. Hence I also control for the same marriage market variables amongst the Chinese. All the measures are taken at the census district level, so I drop the district level fixed effects.[35]

[34]These variables are constructed from 1970 and 1980 Malaysian census data.

[35]If there were no variation in these district level variables over time, then they just proxy for

The result in column 4 shows that - (i) the more competition there is for females at the time of marriage, as measured by the proportion of single Malay 15-24 year olds, the greater the equilibrium fertility level; (ii) the greater possibilities for re-marriage to 35-44 Malay males significantly reduces equilibrium fertility levels; (iii) the proportions of Chinese males in each age group are not a significant determinant of fertility levels in Malay households. In short, local marriage markets influence equilibrium fertility outcomes, as would be the case if spouses renegotiate throughout the fertility cycle.

The coefficient signs are consistent with the theory - as there is more competition for females in the re-marriage market then females enjoy relatively greater bargaining power in marriage, and thus are able to move fertility outcomes closer to their own preferences, which on average, are less than those of males. The fact that the characteristics of the local Chinese marriage market are not significant for Malays is as expected given the low incidence of inter-ethnic marriage.

However, an alternative explanation for this result is that these local ethnic population shares are correlated to the local political power of demographic groups. If Malays are able to lobby more effectively for local public services that affect fertility, such as the provision of schools, hospitals or family planning clinics, this creates a spurious correlation between these demographic shares and fertility outcomes.

In column 5 I additionally control for the following district level variables - (i) the number of family planning clinics per 1000 currently married women; (ii) the proportion of women aged 15-34 with education greater than primary, and (iii) the proportion of women aged 15-34 in the non-agricultural sector. These are correlated to the levels of income and female autonomy in the region.

The signs and significance of the coefficients of interest are unchanged from column 4. Local family planning clinics appear to reduce fertility, rising local female education raises fertility, whilst a greater proportion of women engaged in the non-agricultural sector reduces fertility levels.

The final method to find evidence of households renegotiating is based on the transfers equation. Recall that if (10) holds, which is true if husbands have the

district level fixed effects. I calculated the average change in these variables over the period 1970 to 1980 and 1980 to 1990 using census information. I find that the average changes across districts of these marriage market variables are around 10% from 1970 to 1980 and 9% from 1980 to 1990. The fact that the proportions of single males in each category is rising over time is largely due to the median age at marriage also rising, and the high degree of geographical mobility in Malaysia.

majority *ex ante* bargaining power and wives obtain the majority *ex post* share of child custody, then the sign of γ, the coefficient on the equilibrium number of children in the transfers equation, is informative about the nature of household bargaining.[36] In particular, $\gamma < 0$ would be consistent with investments being contractible, and $\gamma > 0$ would be consistent with households renegotiating over the fertility cycle.

In table (3) the coefficient on the number of children in wave 2, the equilibrium number of children, was positive and significant. As the equilibrium number of children rises, transfers rise. This is consistent with households renegotiating over the fertility cycle.

2.6.2 Ethnic Effects

Given the theory stresses the role institutional norms play in determining fertility outcomes, it is of interest to see if the results for Malay households continue to hold for the Chinese, for whom marriage markets operate very differently.

I estimate the fertility equation (12) for the Chinese, controlling for the full set of covariates. The result is reported in column 5 of table 3. Only female preferences have positive and significant effects for fertility outcomes. This result remains true controlling for any subset of the other covariates in this regression.

Unlike for Malays, policies targeted towards altering male preferences will be ineffective in changing fertility outcomes in Chinese households. However, the small sample size does not allow the rejection of the hypothesis that the marginal effects of spousal preferences are equal.

The conclusion that males matter less for fertility outcomes in Chinese than Malay households is reinforced if we examine the other coefficients. Wife characteristics such as age, age at marriage, and non-earned income affect fertility in the expected direction. Unlike for Malays, female education has a significant effect (at the 10% level) on fertility even after preferences are controlled for. Once preferences are dropped as in column 6 of table 3, female education and non-earned income continue to have the expected signs and significance.

The striking result is that, unlike for Malays, husbands' education, non-earned income and employment status are *not* significant determinants of fertility. Chinese

[36]The implied bargaining share of the husband was one half, so (10) holds if women have the majority custodial share.

men have no influence in fertility outcomes through these observable characteristics.[37] The policy implication is that policies targeted towards Chinese males would have limited effects on fertility outcomes.

The result that only female preferences determine fertility is consistent with divorce payoffs being;

$$\overline{V}(q, \pi_i^*) = \delta_i \phi(q) - \frac{1}{2}(q - \pi_i^*)^2$$

Unlike for Malays, preferences still matter in divorce. Earlier this was interpreted as capturing the ability of parents to monitor child quality investments in divorce. For the Chinese, an alternative interpretation may be appropriate.

It is extremely rare for Chinese marriages to end in divorce (Tan (1988), Jones (1994)). Divorce may not be a credible outside option for Chinese spouses. If bargaining over fertility breaks down, the relevant threat point is therefore some non-cooperative outcome within marriage (Ulph (1988), Lundberg and Pollak (1993), Chen and Woolley (2001)). The divergence term still appears in the outside option payoff above as both parents continue to contribute to child quality investments in marriage, but because of marital conflict, spouses lose part of the returns from children, as picked up by the δ_i parameter above.

The results suggest the social context of marriage markets matters. Whatever the threat point in marriage is, not only determines fertility outcomes, but also the effectiveness of policies of empowerment.

2.6.3 Gender Preference

One striking feature to emerge out of the descriptive analysis in table 2 is that Malay households tend to over invest in fertility relative to what either spouse desires. If households bargain subject to renegotiation, they may overinvest in fertility. However such overinvestment may also be consistent with spouses having strong gender preferences. For example, they may continue producing children until at least one boy and girl are born. Such "stopping rules" lead to parents overinvesting relative to their preferences.[38]

[37] Chinese households on average desire fewer children than Malays. However, the level of preference heterogeneity is similar. Husbands want 4.30 children, wives want 4.03, which are significantly different (the p-value is .0225).

[38] Suppose both parents desire one boy and one girl, and they decide to continue producing children until this is achieved. Given equal probability of a boy or girl being born, the expected number of births is $2.\frac{1}{2} + 3.\frac{1}{4} + 4.\frac{1}{8} + ...$, greater than either spouse desired.

Table 2ii suggests husbands have a preference for boys over girls. To see if this drives the results, I define a measure of gender preferences - the ratio of boys desired to the total number of desired children for each spouse, denoted $\frac{\pi_i^B}{\pi_i^*}$ for $i \in \{h, w\}$. I then estimate the following specification;

$$q = \alpha + \beta_h \left(\frac{\pi_h^B}{\pi_h^*}\right) + \beta_w \left(\frac{\pi_w^B}{\pi_w^*}\right) + \mu \mathbf{X} + u$$

The result in column 1 of table 6, shows that gender preferences of neither husband nor wife determine fertility outcomes. This result is consistent with previous literature which also finds little evidence of son preference amongst Malays (Leung (1994).

2.6.4 Endogenous Preferences

At the time preferences are expressed, households have an average of 3.5 children and so were already some way into the fertility cycle. This could lead to preferences being endogenous if spouses learn the true costs and benefits of children, and update their preferences accordingly. In addition, the sample consists of households that have been continuously married for at least twelve years. There may be selection bias such that some unobservable characteristic drives preferences, fertility outcomes and marital stability - for instance, the level of communication between spouses.

If so preferences will be correlated to the error term in the fertility equation (12) and the coefficients will be inconsistently estimated. I address this issue using the following methods.[39]

Using information on the additional number of children desired (expressed in wave 1), a_i $i \in \{h, w\}$, provides an alternative way to estimate the effect of preferences on fertility;

$$\Delta q_{it} = \beta_h a_h + \beta_w a_w + \mu \mathbf{X}_{it} + u_{it} \tag{19}$$

where $\Delta q_{it} = q_t - q_{t-1}$ is the additional number of children born between waves 1 and 2. Given that the additional number of children desired is $a_i = \pi_i^* - q_{t-1}$

[39] As a preliminary check, I find that earnings significantly reduce both spouses preferences. In addition the number of children measured in the household at the same time significantly increases husbands reported preferences. Education, non-earned income, and age are not predictors of preferences. For 106 women fertility preferences are also available for the second wave. The majority of women revise their preferences downwards. These revisions are significantly related to the number of children in the household in MFLS-1, but are unrelated to either spouses education, age, non-earned income or years married.

where π_i^* is spouse i's innate preference, and q_{t-1} is the number of children in the household in wave 1, any fixed unobservable factor that drives both fertility outcomes and preferences is washed out in this specification. The result is given in table 6.

Column 2 gives the most preferred baseline specification for comparison. Column 3 controls for each spouses additional number of children wanted. The coefficients β_h and β_w remain positive and significant. The null hypothesis that they are equal has p-value .5899. Given that the additional number of children born between the two waves takes discrete values, I also estimate (19) using an ordered probit. The result is in column 4 where the coefficients of interest continue to follow the same pattern.

The second strategy is to instrument for preferences directly. I use the number of older brothers at age 10 for the husband, and the number of older sisters of the wife at age 10 as instruments for fertility preferences. The identifying assumption here is that spouses' birth order within the same gender may be correlated to their own preferences, but will not be correlated to any other household unobservable driving fertility outcomes. Additional instruments are the gender of the first two children - these are valid if gender of child, assumed to be a random outcome, is correlated to the total number of desired children say because parents learn the returns by gender of child, but has no additional influence on fertility controlling for all other factors. The final instrument used is the number of miscarriages caused by shock or accident (I do not count miscarriages caused by illness or not wanting the child). Again this is a valid instrument if it is a random event correlated to preferences, but has no additional influence on fertility outcomes once all other covariates are controlled for. Given that I already control for the stage of the fertility cycle the wife is at, this ought to have no direct effect on fertility outcomes.

The instrumental variables regression is in column 5. Each spouses preference continues to have positive and significant effects on fertility outcomes, and I cannot reject the null hypothesis that the marginal effects are equal. The instruments pass tests of overidentification, and are significant determinants of preferences in the first stage regression.

The final robustness check deals with the possibility that some household unobservable drives both marital stability, preferences and outcomes. This is of concern as the sample has been restricted to be spousal pairs continuously married between the two waves. I estimate a Heckman selection equation to predict the likelihood of the spouses remaining married, and then estimate the fertility equation.

The exclusion restrictions that identify the selection equation are that the hours spent by the wife on various household chores, as a proportion of the total hours devoted to those chores in the household, are predictors of marital stability but not of fertility outcomes. The chores I use are shopping, cleaning, and hours spent on "other" chores (not including shopping, cleaning, child care, food preparation or washing). The results are in column 6. Again I cannot reject the hypothesis that the sum of spousal preferences drives fertility outcomes. In the selection equation I find that marital dissolution becomes significantly more likely as the wife devotes a greater share of the total time devoted to these household chores.

To conclude, using a variety of robustness checks, the results together suggest the *sum* of spousal preferences determines fertility outcomes in Malay households. Table 6 also shows the coefficients on male and female education throughout. After accounting for the possible endogeneity of preferences using these methods, female education is always an insignificant determinant of fertility. Male education also becomes insignificant after accounting for the potential endogeneity of preferences. However after controlling for potential selection biases I do find significant effects of both spouses education. Clearly the relationship between education and fertility remains an important topic for future research.

2.6.5 Measurement Error in Reported Preferences

A second concern for the fertility equation (12) is that preferences may be reported with error. This may be for two reasons. First, spouses may alter their reported preferences if their partner is present at the time of the interview. Spouses may not wish to contradict their partner, or give an appearance of a household in conflict. Second, individuals may report some societal norm on the desired number of children, rather than their true preference. This report may be at some focal point, such as the number of children they actually have at the time of the survey, or some other socially accepted level. In both cases, such systematic deviations away from true preferences would bias the estimated coefficient of interest, β.

To deal with the first problem, I use information on whether spouses were present at the time of interview. The reported preferences, by others present in the interview, are given in table 2iv. There are no significant differences in reports, nor in the difference between reports, depending on the presence of others.[40]

[40] Around 80%, of spouses were interviewed alone.

To deal with the second form of measurement error, table 2iv also reports the preferences of each spouse relative to the actual number of children they had in MFLS-1, when the preference data was collected. We see that there is no tendency to report the desired number as being equal to the contemporaneous number in the household. If all households were reporting some fixed social norm there would be no variation in reported preferences. This is not the case. Furthermore, given that fertility cycles are incomplete in wave 1, it is reassuring to see that the majority of spouses report wanting more children than they actually have at that time.

2.6.6 Summary

The fertility regressions in table 3 lead to the robust conclusion that for Malay households both spouse's preferences are equally significant determinants of fertility outcome. Hence policies targeted towards altering male preferences will be as effective as those targeting women. Furthermore female education has no direct effect once preferences are controlled for. This may be because female education determines preferences. I used three strategies to deal with this endogeneity bias - the main results remain robust to each of these.

The transfer regression results in table 4 confirms that monetary transfers are used by spouses to compensate each other consistent with bargaining over fertility. In particular, as the number of children produced diverges from the wife's preferred number, husbands are observed to give larger money transfers to wives. Similarly transfers from husbands fall as equilibrium fertility outcomes diverge from their own desires.

Further analysis in table 5 suggests households renegotiate over the fertility cycle. I find that divorce payoffs at the time of marriage, measured by proxies of parental wealth, have no effect on fertility outcomes. However, factors relating to divorce payoffs over the course of marriage, proxied by marriage market characteristics, do have significant effects on fertility.

These results have been argued to be robust to the potential endogeneity of, and measurement error in, reported preferences, as well as potential selectivity bias.

2.7 Conclusions

Since Malthus wrote *An Essay on the Principle of Population* economists have been trying to understand the determinants of fertility. Empowering women is one of the main channels through which governments are currently seeking to reduce fertility rates. This chapter has developed a model of household bargaining to assess the validity of these types of policy.

The model of household bargaining presented here makes precise the relationship between spousal preferences and fertility outcomes when transfers are possible. The theory highlights that the ability for couples to renegotiate agreements is key to understanding how conflicts over fertility preferences are resolved within households.

The theory shows that the social context into which policies are introduced, as defined by whether bargains are subject to renegotiation, the level of conflict over fertility preferences within households, and whether divorce is socially acceptable, are all factors which impinge on the success of empowerment policies. The analysis highlights the importance of alternative policies to reduce fertility. These include male preferences, the legal framework governing divorce, the allocation of child custody and other factors that determine divorce payoffs.

The empirical analysis is unique in that, unlike the existing literature, I use preference data directly rather than having to infer the presence of conflicting spousal preferences from tests of resource pooling. I find that couples do have conflicting preferences over fertility, and I empirically identify how these conflicts translate into fertility outcomes.[41] The model and results both imply that how these conflicts are resolved depends on the social context. Identifying precisely which characteristics are relevant for fertility outcomes, helps improve the design and implementation of population policies.

Understanding household decision making in the way put forward by this chapter, sheds light on the precise circumstances when we can expect policies of female empowerment to have the desired effects of reducing fertility. The model and empirical results reverse much of the received wisdom amongst policy makers on the usefulness of such empowerment policies. The chapter gives alternative insights into policies that can be expected to reduce fertility, such as those targeted towards men, and

[41] Information on preferences has been used in economics before, but almost exclusively as a left hand side variable. For instance, research into the determinants of happiness and preferences for redistribution use this approach.

those that change the relative outside options of males and females to marriage.

The chapter also gives a theoretical underpinning to a growing body of empirical research showing that households make inefficient decisions. The reason suggested here for inefficient household outcomes is the inability of spouses to make agreements contingent on investments.[42] In the context of fertility investments, I have shown how such non-contractibilities can lead to over or under investment into fertility.

This chapter thus provides a new framework for thinking about several other household decisions. Whenever the actions of individuals in the household cannot be contracted upon, we can expect spouses to renegotiate over the allocation of the surplus that marriage creates over divorce. In decisions as diverse as effort into agricultural production, investments into child quality, insurance against shocks, and intergenerational transfers, the framework presented here suggests that the Coase theorem will break down, and households will be unable to reach efficient outcomes. The broad policy implication in all of these cases is that policies designed to change the outside options of spouses will not only affect the behavior of individuals in marriage, but can also lead to Pareto improvements. This leads to far greater welfare effects than would be predicted using a unitary or collective choice approach to household decision making.

Finally, this chapter also gives new insights into demographic transitions. The model suggests women over invest into fertility if, by improving their relative divorce payoff, this allows them to appropriate a larger share of the surplus that marriage creates. I have found evidence that monetary transfers are indeed used for this purpose. Changes in societal attitudes, allowing fathers a greater share of child custody and visitation rights, have all contributed to reduce the incentives of wives to over invest in fertility. Long run changes in the labour market reduce the importance of intrahousehold transfers, and thus also contribute to fertility declines. Assessing the relative importance of policies relating to the role of fathers in divorce, labour markets, and female empowerment in reducing fertility rates, is the subject of future research.

[42]Pollak (1985) first suggested marriage as a contracting problem. This paper formalizes many of those intuitions.

Table 1: Background to Malaysia

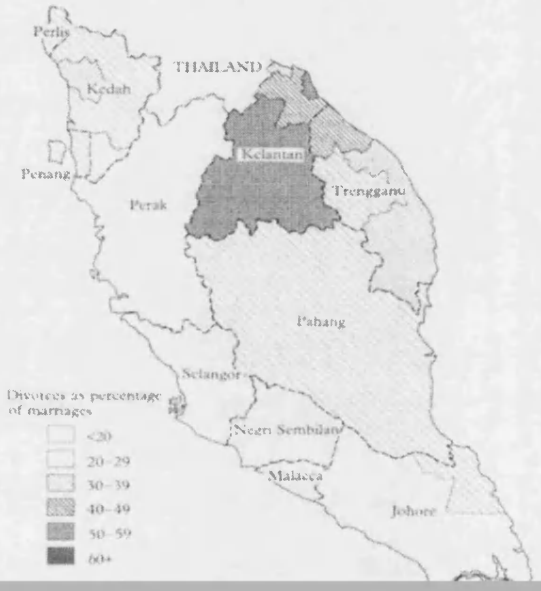
(I) General Divorce Rates: 1970 - 1990
(number of divorces per 1000 population aged 15 and over)

	Malays in Peninsular Malaysia	Indonesian Muslims	England and Wales	United States
1965	7.4	11	1	3.5
1970	6.1	5.2	1.5	4.8
1975	5.6	4.6	3.2	6.3
1980	3.9	2.6	3.8	6.7
1985	2.8	1.5	4	6.3
1990	n/a	1.1	3.7	6

Source: Jones (1994, table 5.8)

(ii) Peninsular Malaysia: Ratio of Malay Divorces (Net of revocations) to Marriages, by State
(divorces as percentage of marriages)

1950 - 57



1972 - 76

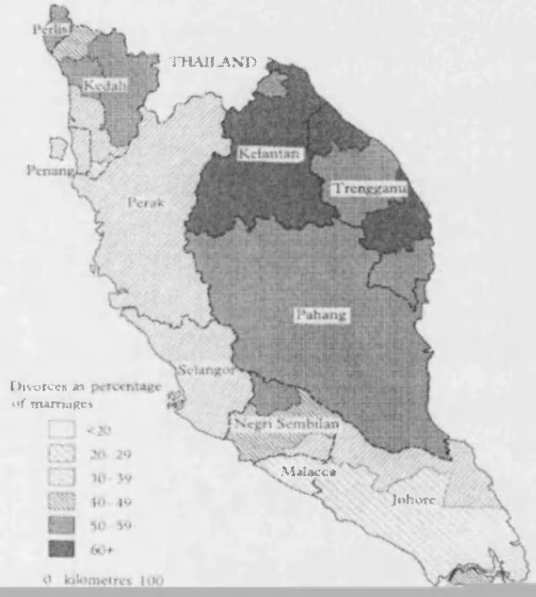


Table 2: Summary Statistics from Malaysia Family Life Survey

(i) Basic Characteristics (standard errors in parentheses)

	Husband	Wife	Difference	Test (p-value)
Age	41.32	35.25	6.07	.0000
	(.49)	(.40)	(.63)	
Age at marriage	25.67	16.51	9.16	.0000
	(.45)	(3.09)	(.47)	
Age menstruation started		13.44		
		(1.53)		
Years of schooling	4.49	3.00	1.49	.0000
	(.15)	(.15)	(.21)	
Non-earned income (monthly)	297.80	218.77	79.29	.3608
	(67.42)	(54.07)	(86.43)	
Employed (yes==1)	.96	.60	.36	.0000
	(.01)	(.02)	(.02)	
Water supply (yes=1)	.26			
	(.44)			
Electric supply (yes==1)	.33			
	(.47)			

(ii) Preferences for Children (95% confidence interval)

	Husband (q_h^*)	Wife (q_w^*)	Difference	Test (p-value)
Number of total children wanted	4.97	4.60	.37	.0161
	(4.72, 5.22)	(4.42, 4.77)	(.16)	
Number of boys wanted	2.48	2.25	.23	.0114
	(2.37, 2.63)	(2.24, 2.43)	(.09)	
Number of girls wanted	2.16	2.20	-.03	.7068
	(2.03, 2.28)	(2.10, 2.31)	(.09)	
Number of additional children wanted	3.31	3.05	.27	.1280
	(3.06, 3.57)	(2.81,3.28)	(.18)	
Number of children in a small family	2.74	2.98	-.243	.0053
	(2.62, 2.86)	(2.86, 3.10)	(.09)	
Number of children in a large family	8.29	8.29	-.002	.9905
	(8.03, 8.55)	(8.06, 8.53)	(.18)	

(iii) Dependent Variables (95% confidence interval)

	Wave 1	Wave 2	Difference	Test (p-value)
Number of children	3.46	6.38	2.92	.0000
	(3.25, 3.67)	(6.11, 6.64)	(2.58, 3.25)	

Monetary Variables Measured in wave 1, Malay Households (weekly - standard deviations in parentheses)

	Monetary transfer from husband to wife	Wife's non earned income	Wife's earned income
	28.27	218.8	148.7
	(23.79)	(1174.7)	(246.4)

(iv) Consistency Checks on Reported Preferences

(95% confidence intervals in parentheses)

	Husband (π_h^*)	Wife (π_w^*)	Difference
Alone	4.96	4.71	1.74
	[4.71,5.18]	[4.52,4.91]	[1.55,1.93]
Spouse Present	5.04	4.18	1.86
	[4.00,6.08]	[3.21,5.15]	[.84,2.87]

(95% confidence intervals in parentheses)

	Husband	Wife	Difference	Test (p-value)
Prefer less children than in wave 1	.22	.21	.01	.7526
	(.18, .26)	(.18, .25)	(-.06, .04)	
Prefer same number of children as in wave 1	.10	.14	-.04	.0679
	(.07, .12)	(.10, .17)	(-.002, .08)	
Prefer more children than in wave 1	.68	.65	.03	.3343
	(.64, .72)	(.61, .69)	(-.09, .03)	

Notes: Tests of differences of means and proportions all have two-sided alternative hypothesis. For tests of means I do not impose the restriction that the samples have the same variance or are paired. All monetary amounts are measured in 1986 Malaysian Ringgit. Samples are those used in the regression analysis.

Fertility Regressions

: Variable = Number of Children in Wave 2
eported in parentheses

	(1)	(2)	(3) - No Preferences	(4) - Ordered Probit	(5) - Chinese	(6) - No Preferences
preferred number of children (π_h^*)	.145	.123		.053	.047	
	(.009)	(.039)		(.023)	(.724)	
erred number of children (π_w^*)	.164	.143		.063	.325	
	(.014)	(.034)		(.018)	(.006)	
		.071	.058	.029	.134	.151
		(.000)	(.002)	(.000)	(.000)	(.000)
riage		-.170	-.0138	-.079	-.233	-.255
		(.000)	(.001)	(.000)	(.000)	(.000)
ruation started		.245	.163	.110	.076	.128
		(.005)	(.039)	(.002)	(.301)	(.080)
hooling		-.051	-.117	-.015	-.072	-.067
		(.390)	(.043)	(.516)	(.097)	(.090)
l income x 10^{-4}		-.645	.275	-.201	.414	.482
		(.421)	(.716)	(.515)	(.039)	(.028)
ly (yes=1)		-.373	-.594	-.148	-.636	-.909
		(.419)	(.194)	(.400)	(.068)	(.009)
pply (yes=1)		-.307	-.296	-.124	-.180	.095
		(.385)	(.370)	(.370)	(.631)	(.800)
years of schooling		.124	.118	.052	.003	-.030
		(.019)	(.016)	(.011)	(.950)	(.431)
non-earned income x 10^{-4}		2.97	2.10	1.10	-.498	-.700
		(.001)	(.020)	(.001)	(.681)	(.398)
nployed (yes=1)		2.52	2.19	1.00	1.06	2.03
		(.001)	(.001)	(.001)	(.336)	(.149)
d Effects	Yes	Yes	Yes	Yes	Yes	Yes
e): $\beta_h = \beta_w$	.8428	.8523		.8091	.1753	
squared	.1263	.2392	.1893	.0754	.5949	.5846
s	472	472	472	472	220	220

standard errors are calculated throughout. For OLS regressions, adjusted R-squareds are reported. The pseudo R-squared is reported for the ordered probit regression. Controlling for the value of assets, and property values led to similar
d's age, access to credit, availability of savings, and the gender composition of the children in wave 1 were insignificant in all specifications.

Table 4: Monetary Transfer Regressions

Dependent Variable = Monetary Transfers From Husband to Wife in Wave 1 (measured in 1986 Malaysian Ringgit)
P-values reported in parentheses

	(1)	(2) - All Covariates	(3) - Needs	(4) - Needs	(5) - Preferences	(6) - IV
(Male preference - number children wave 2) squared	-.766	-.769		-.791	-.592	-.926
	(.032)	(.033)		(.035)	(.094)	(.107)
(Female preference - number children wave 2) squared	.584	.769		.771	.685	.788
	(.004)	(.002)		(.002)	(.011)	(.031)
Number of children in wave 2	1.624	2.07		2.35	2.62	1.90
	(.115)	(.103)		(.097)	(.065)	(.781)
Number of children in wave 1			.199	-.649	-.005	
			(.871)	(.644)	(.997)	
Husband's preferred number of children (π_h^*)					-3.84	
					(.147)	
Wife's preferred number of children (π_w^*)					-.454	
					(.852)	
Age		.515	.545	.464	.506	.392
		(.182)	(.231)	(.256)	(.241)	(.544)
Age at marriage		-1.24	-1.81	-1.13	-1.34	-1.18
		(.044)	(.001)	(.060)	(.031)	(.539)
Years of schooling		-.578	-.431	-.612	-.833	-.357
		(.527)	(.639)	(.500)	(.388)	(.698)
Non-earned income x 10^{-4}		.530	5.54	.163	.899	-.099
		(.922)	(.284)	(.976)	(.862)	(.983)
Wife employed (yes=1)		-5.04	-3.27	-4.75	-4.49	-5.27
		(.286)	(.496)	(.304)	(.340)	(.309)
Value of household assets x 10^{-3}		.218	.266	.224	.273	.462
		(.564)	(.430)	(.559)	(.517)	(.418)
Husband's years of schooling		3.09	2.54	3.06	2.60	2.52
		(.009)	(.029)	(.010)	(.035)	(.054)
Husband's non-earned income x 10^{-4}		-12.99	-.14.84	-11.82	-14.52	-11.36
		(.092)	(.089)	(.140)	(.078)	(.267)
Husband employed (yes=1)		-4.16	-4.43	-3.62	-4.65	-5.28
		(.584)	(.716)	(.640)	(.527)	(.748)
Husband's employment income x 10^{-4}		14.4	19.9	13.4	13.7	14.6
		(.557)	(.411)	(.579)	(.582)	(.572)
Test (p-value): $\lambda_h + \lambda_w = 0$	.4600	.9981		.9294	.6923	.8467
Implied theta	.4325	.4998		.4937	.5366	.4595
	[.3790,.4861]	[.4553,.5444]		[.4490,.5384]	[.4816,.5917]	[.3042,.6149]
Wald test for functional form (p-value)		.5952				
R-squared	.0960	.2926	.2095	.2943	.3160	.2929
Observations	88	88	88	88	88	88

Notes: Robust standard errors calculated throughout, allowing for clustering across sampling districts. Additional variables controlled for include whether the household has electricity, and whether it has a direct water supply. Similar results are obtained if the number of children per adult in the household is controlled for instead of household size. Confidence intervals for the implied theta parameter are calculated using the delta method. The overidentification test is based on a Lagrange multiplier test formed by regressing the instrumental-variables residuals on the full instrument matrix. The joint null hypothesis is that the equation is properly specified and the instruments are valid instruments (i.e. uncorrelated with the error term). The test statistic, under the null, is distributed Chi-squared(m), where m is the number of overidentifying restrictions. See Davidson and MacKinnon (1993, p. 236). In column (6) the p-value for the overidentification test is .9343, and the p-value for the test of underidentification of the instruments in the first stage regression is .0145.

Table 5: Renegotiation

Dependent Variable = Number of Children in Wave 2
P-values reported in parentheses

	(1) - Restricted	(2) - Fertility Cycle	(3) - Divorce Payoff at Marriage	(4) - Marriage Market	(5) - Marriage Market
Total preferred number of children $(\pi_h^* + \pi_w^*)$	.131	.316	.112	.113	.107
	(.000)	(.002)	(.005)	(.001)	(.002)
Husband's preferred number of children (π_h^*)		-.009			
x (age - age menstruation started)		(.044)			
Wife's preferred number of children (π_w^*)		-.006			
x (age - age menstruation started)		(.176)			
Husband's father's education			.016		
			(.843)		
Mother's father's education			-.040		
			(.557)		
Husbands inherited value of land x 10^{-4}			.162		
			(.032)		
Husband's inherited value of gifts x 10^{-4}			.167		
			(.143)		
Malay males single aged 15-24				.254	.334
				(.004)	(.000)
Malay males single aged 35-44				-.333	-.285
				(.074)	(.108)
Chinese males single aged 15-24				.173	.196
				(.410)	(.341)
Chinese males single aged 35-44				-.070	.073
				(.309)	(.403)
Family planning clinics per 1000 currently married women					-.649
					(.015)
Proportion of women aged 15-34 with education greater than primary					.350
					(.074)
Proportion of women aged 15-34 in non-agricultural sector					-.656
					(.004)
District Fixed Effects	Yes	Yes	Yes	No	No
Adjusted R-squared	.2410	.2439	.2468	.1926	.2112
Observations	472	472	337	472	472

Notes: Alternative measures of life cycle effects, such as the number of years married led to similar results as in column 2. In column 3, inheritance can take the form of land, a house, farm equipment, business, or money from either parent. The district level variables are derived from the 1970 and 1980 Malaysia census. There are 70 such districts in Peninsular Malaysia, covering a population of 12 million individuals - 36 of these districts are in the sample above.

Table 6: Endogenous Preferences

Dependent Variable = Number of Children in Wave 2 (columns 1,2,4,5)
Dependent Variable = Number of Children Born Between Waves 1 and 2 (column 3)
P-values reported in parentheses

	(1) - Gender Preference	(2) - Baseline	(3) - Additional (OLS)	(4) - Additional (Oprobit)	(5) - IV	(6) - Selection
Husband's gender preference $\left(\frac{\pi_h}{\pi_w}\right)$	-.993					
	(.194)					
Wife's gender preference $\left(\frac{\pi_h}{\pi_w}\right)$	.589					
	(.467)					
Husband's preferred number of children (π_h)		.123			.501	.109
		(.039)			(.110)	(.040)
Wife's preferred number of children (π_w^*)		.143			.923	.136
		(.034)			(.096)	(.023)
Husband's additional children wanted			.122	.068		
			(.043)	(.069)		
Wife's additional children wanted			.184	.113		
			(.024)	(.023)		
Years of schooling		-.051	.007	.014	.032	-.096
		(.390)	(.896)	(.645)	(.742)	(.098)
Husband's years of schooling		.124	.001	.012	.090	.099
		(.019)	(.977)	(.664)	(.191)	(.062)
Test (p-value): $\beta_h = \beta_w$		.8523	.5899	.5227	.4868	.7698
Over-identification: (p-value)					.7803	
Augmented Hausman test: (p-value)					.1679	
Observations	453	472	177	177	415	574

	First Stage Regressions for IV Estimation in Column 5		First Stage Selection Equation in Column (6)
	Husband's preferred number of children	Wife's preferred number of children	Probability remain married
Husband's older brothers at age 10	.192	.019	
	(.067)	(.838)	
Wife's older sisters at age 10	.112	.177	
	(.342)	(.032)	
Gender of first child (boy = 1)	.106	.259	
	(.068)	(.209)	
Gender of second child (boy =1)	.265	.079	
	(.289)	(.692)	
Number of miscarriages caused by accident or shocks	-.832	.267	
	(.000)	(.146)	
Under-identification: (p-value)	.0027	.0969	
Adjusted R-squared	.1710	.1900	
Observations	415	415	574

on are significant
The

Notes: The augmented Hausman test for the validity of the instruments test whether the residuals from the first stage regressi
in the second stage regression. Under the null hypothesis, these residuals are not significant in the second stage regression.
underid

3 Making Divorce Easier: The Effect on Children

In 1970, 42% of families consisted of an employed father, a homemaker mother and children. The figure today is less than 20%. In addition, those marriages that do form have become less likely to endure, to the extent that half of all recent marriages can be expected to dissolve sometime in the future, and one million children are involved in divorce each year.[43]

The increased instability of marriage has been associated with a host of economic, legal and sociological factors that have contributed to reducing the cost of exiting marriage. These include increased participation of women in the labor force, greater financial independence of women, welfare payments to single parents, the reduction in social stigma towards divorcees, the rise in women's rights, and divorce law changes such as the introduction of no-fault divorce.

This chapter studies the relationship between the costs of divorce and parental behavior towards their children. I present a model in which married parents make three decisions - (i) how much to each invest into child quality, a household public good; (ii) whether to divorce or remain married; (iii) how to allocate physical child custody if the couple were to divorce.

The chapter makes precise the relationship between the costs of divorce and two child related outcomes - investments into child quality during marriage, and the allocation of physical custody in divorce. I show that making divorce easier is not necessarily bad for children. This is because when divorce costs are lower, parents own investments into marital specific capital have a stronger impact on keeping the marriage intact. Hence parents increase their investments into child quality. This effect, which applies to the stock of all intact marriages, may offset the detrimental effects of lower divorce costs causing an increase in the flow of marginal marriages into divorce.

The chapter also shows that when divorce is easier couples are more likely to share custody *ex post*. As children then maintain contact with both parents in divorce, children may be better off with lower divorce costs even conditional on divorce occurring.

Understanding the determinants of parental investments is important because

[43] In 1994 37% of children in single parent households were living with divorced parents, 36% were living with a never married parent, and the remainder lived with a separated parent (US Census Bureau (1996)). In the US, the divorce rate more than doubled between 1965 and 1980.

as recent research suggests, these not only affect the emotional well-being of children when young, but are correlated with schooling outcomes that at least partly determine early labor market opportunities and welfare across the life cycle. Understanding the determination of child custody is equally important. The living arrangements of children in divorce, and contact time with each parent, are determinants of the long run material and emotional well-being of children.[44]

The chapter also provides insights into why lower costs of divorce do not necessarily imply a higher probability of divorce; the interaction between divorce costs, gender roles and children's outcomes; the different incentives to invest into child quality that married couples have vis-à-vis cohabiting couples; and a rationale for why there has been a move away from the legal presumption of maternal custody, towards the allocation of custodial rights "in the child's best interests".[45]

The same framework is utilized to examine the effects of family policy on children in intact families. In particular I make precise how child support, welfare payments, and legal custodial rights, affect investments into child quality and the allocation of physical custody.[46]

The framework makes two key assumptions. First, spouses are unable to specify investments into child quality *ex ante*, as part of the marital contract. This is because such investments are non-verifiable and non-describable to third parties outside of the household. If spouses were to make agreements contingent on child quality investments, at any stage of marriage either spouse could hold-up the other, claiming they had not made the agreed-to investment. As no third party can verify whether each parent has undertaken the agreed-to investments, there remains scope for spouses to renegotiate over the division of the marital surplus even after investments are made.

[44] Danziger and Waldfogel (2000) summarize recent literature showing the beneficial benefits of parental investments, particularly in young children, over the life cycle. On the second point, note that throughout the last decade female headed households with children were five times as likely to be living in poverty than intact households (US Census Bureau (1998)). Del Boca and Ribero (1998) provide evidence that non-residential parents with joint custody are more likely to voluntarily transfer resources to children.

[45] The presumption that the interests of young children were best served when the mother had sole custody was abolished or demoted in nearly all states between 1960 and 1980.

[46] Joint custody is defined to include - (i) joint legal custody where both parents retain joint responsibility for the care and control of the child and joint authority to make decisions concerning the child even though the child's primary residence may be only with one parent; (ii) joint physical custody where both parents share physical and custodial care of the child; (iii) any combination of joint legal and joint physical custody which the court deems to be in the best interests of the child. I deal first with physical custody, and then in section 3 consider the effects of legal custody.

Second, the framework explicitly recognizes the instability of marriage so that divorce occurs with positive probability. The probability of divorce is partly exogenously determined by a random realization of marriage quality.[47] It is also partly endogenously determined by parental investments themselves. Since the benefits from child quality are marriage specific, the gains from marriage increase in investments. This reduces the probability of divorce.

The first main result is that reducing the cost of exiting marriage and thereby making divorce easier, can be better for children in that parents invest *more* into child quality during marriage. This follows from the fact that the probability of the marriage remaining intact is partly endogenously determined by spousal investments into child quality. Hence one reason why spouses want to invest into child quality is to increase the likelihood of the marriage remaining intact. This incentive is maximized when divorce costs are low so the likelihood of the marriage surviving is largely determined by parent's own investments into child quality.

The result that reducing the costs of exiting marriage is not necessarily bad for children is contrary to much popular opinion. The no-fault divorce revolution that swept across the US in the 1970s is largely credited with reducing the barriers to exiting marriage, increasing marital instability, and reducing investments into children. Indeed, there has been a gradual tendency for state legislatures to reverse the no-fault revolution and make divorce more costly. The analysis here shows that it is not necessarily the case that making divorce easier is bad for children. There are actually two effects present - (i) marginal marriages break up with lower costs of exiting marriage, and this may have detrimental effects on children's welfare; (ii) investments into child quality made *during* marriage rise. This latter effect, which applies to the stock of all marriages, may dominate the former effect which applies to the flow of marriages into divorce.

This result helps explain why establishing the empirical relation between divorce costs and the incidence of divorce has proved so difficult. Reduced costs of divorce, such as the introduction of no-fault divorce, will all else equal, increase the probability of divorce. However as this chapter makes clear, lower divorce costs increase investments into marital specific capital such as child quality, reducing the probability of divorce.

[47] Similar to Becker *et al*'s (1977) seminal work on marital instability, divorce is thus an optimal response to new information received during marriage.

The second main result is on the optimal allocation of rights over physical custody of children in divorce. There are opposing effects on investment incentives of having more own custodial rights. On the one hand, because child quality is a public good, spouses prefer the parent that values child quality the most to have *ex post* child custody. This gives the high valuation parent the greatest incentives to invest in marriage, leaving both parents better off. On the other hand, as divorce occurs with positive probability, both parents prefer to have more own custody to maximize their returns to investment should the couple divorce. These sources of investment incentive are traded-off to give the optimal allocation of physical child custody.

For couples with relatively homogeneous preferences, joint custody will be optimal with the high valuation spouse having the majority share. Couples with relatively heterogeneous preferences prefer the high valuation parent to have sole custody.

The *ex post* efficient allocation of custody, giving sole custody to the high valuation parent, only maximizes *ex ante* investment incentives if the degree of spousal preference heterogeneity is sufficiently strong.

Joint custody is more likely to be optimal when the costs of exiting marriage are low. Hence as divorce becomes easier, children in dissolved marriages are more likely to maintain contact with both parents. This is recognized to generally improve children's welfare in divorce (Beller and Graham (1993), Del Boca and Ribero (1998)).

I also show that if a spouse is more specialized in household production, the effects on investment and custody are similar to the spouse having a greater valuation of child quality relative to their partner. Hence as women have devoted more labor to the market rather than within the home, the traditional comparative advantage of women in household production has been eroded. This leads to a greater incidence of joint custody.

The model thus provides a rationale for why the incidence of joint custody has risen as divorce has become easier and female labor force participation has risen.

Related Literature

By applying contract theory to the household, this chapter shows how insights in the literature on asset ownership, interpreted here as child custody, sheds light on household behavior.

Economists have sought to understand the impact on individual welfare as households break-up (Smock (1993)), and the efficacy of divorce policies to maintain the welfare of divorcees and their children. These issues are of concern because children

from divorced families do worse than children in intact families in a diverse range of welfare outcomes (Amato and Keith (1991)). Similarly, empirical evidence suggests the welfare of adults is also higher in marriage than divorce. Married individuals are typically found to have better health, higher wages, be more attached to the labor market, and accumulate more wealth than divorcees or cohabitees (Waite and Gallagher (2000)).[48]

By considering household behavior in a framework of marital contracting, this chapter is amongst the first to provide a theoretical underpinning to how parents allocate custody, and the relation of *ex post* custodial rights to *ex ante* incentives to invest in child quality during marriage.[49]

Furthermore, the framework provides a natural way of thinking through the effects of family policy and a range of socioeconomic and legal factors that have contributed to making divorce easier over time. This chapter thus builds on related empirical work examining the effects on behavior within intact families of policies such as divorce laws (Gray (1998), Flinn (2000), Stevenson and Wolfers (2000), Chiappori *et al* (2001)), and welfare payments (Del Boca and Flinn (1994), Lundberg *et al* (1997), Rabaclava and Thomas (2000)).

This chapter also relates to the literature on asset ownership in firms (Grossman and Hart (1986), and Hart and Moore (1990) (henceforth GHM)). In the standard GHM environment ownership improves an investors bargaining power within the relationship, and it is generally optimal for one investor to have sole ownership based on some technological advantage over the other investor. Extensions to this framework show joint ownership can be optimal when some part of investment is embodied in physical assets rather than human capital (Hart (1995)), dynamic concerns such as reputation (Halonen (2002)), alternative bargaining rules such as outside options bargaining (de Meza and Lockwood (1998)), and if ownership induces greater specialization (Rajan and Zingales (1998)).

[48]It is not easy to identify the causal effect of divorce on children's welfare because the relevant counterfactual is that parents stay together in an unhappy marriage. Absent exogenous factors that cause divorce but not child quality, very little of this literature is able to disentangle the effect of divorce on child quality from the effect of marital conflicts that causes parents to divorce in the first place.

[49]Becker and Lewis (1973) and Willis (1973) first introduced the notion of child quality when studying the trade-off between the quantity and quality of children. Child quality has become of independent interest in economics, where it is typically interpreted as the psychological and emotional well-being of children. The return on investment into child quality is interpreted as the formation of a lasting emotional bond between parent and child.

Besley and Ghatak (2001) extend the GHM framework to when investments are made into a public good. They show the public good is optimally owned by whichever party values the public good the most. Hence allocating property rights *ex post* efficiently maximizes *ex ante* investment incentives, so joint ownership is generally suboptimal.

This chapter extends their model to allow investors to endogenously choose from a continuum of *ex post* ownership structures, and by allowing the relationship to break down endogenously.[50] I show joint custody is always optimal for some couples if the marriage breaks down with positive probability. Typically this leads to the spouse with the higher valuation of child quality having the majority custodial share in divorce.

In keeping with earlier literature, I find that when investments into child quality cannot be specified *ex ante* as part of the marital contract, investments are below the surplus maximizing level. This is in contrast to unitary (Becker (1991) and cooperative bargaining models (McElroy and Horney (1981)) of the household, which assume household decisions to be Pareto efficient.[51]

The chapter is organized as follows. In section two I present the model and solve for the Nash equilibrium investment levels, the optimal allocation of custodial rights, and show how these change with divorce costs. Section three considers the effects of various family policies on investment and custodial rights. Section four concludes. All proofs are in the appendix.

3.1 The Model

3.1.1 Set-up

The household comprises a married husband (h) and wife (w) with at least one child. Spouse i decides how much to invest into child quality, denoted $q_i \geq 0$. Spouses derive benefits from - (i) child quality; (ii) the private gains from marriage. Child quality is

[50]Rainer (2002) extends the Besley and Ghatak (2001) framework in a different direction. He considers the effects of rules on the division of property in divorce, on investments into marital specific assets. He assumes these investments are non-contractible, but does not allow for divorce to occur in equilibrium.

[51]Peters (1986), Lundberg and Pollak (2001), and Murphy (200) also present models of household behavior in which there are limits on marital contracting that result in inefficent household outcomes.

assumed to be a public good so the payoff to spouse i in marriage is;

$$U_i^M(q) = \nu_i + \theta_i u(q) \tag{1}$$

where ν_i is the private gain from marriage, $q = (q_h, q_w)$ is the vector of parental investments into child quality, $u(q)$ are the benefits in marriage of making these investments, and $\theta_i \geq 0$ is spouse i's observable valuation of the benefits from child quality.

The private benefits, or "happiness", of marriage, ν_i, are randomly drawn from a known distribution.[52] These are unknown to either spouse at the time of marriage, but are observed during marriage.

The divorce payoff to spouse i is;

$$U_i^D(q) = \theta_i \overline{u}(q) \tag{2}$$

In common with the earlier literature on the economic analysis of divorce (Weiss and Willis (1985)), child quality remains a public good in divorce so that each parent enjoys this level of benefit even if the children do not reside with them. The benefits from child quality in divorce are less than those in marriage if investments into child quality are partly embodied in the human capital of the other parent, and thus cannot be appropriated in divorce. Hence I take it as given that $u(q) \geq \overline{u}(q)$ so investments into child quality are marriage specific.[53] In keeping with the empirical literature cited in the previous section, other things equal, individuals are better off within marriage than divorce.

If spouses divorce, some allocation of physical custodial rights over the children is enacted. Each parent's share of physical custody can be thought of as the proportion of the child's time endowment spent with them in divorce. A fraction of custody, λ_h, goes to the husband, and λ_w to the wife such that $\lambda_h + \lambda_w = 1$. This covers arrangements of both sole physical custody to one parent, and joint physical custody where children spend some time with both parents.

The *marginal* benefit to each spouse's investment made during marriage depends

[52]The happiness of marriage can also be thought of as marriage quality. I use the term happiness to keep clear the distinction between the quality of marriage and the quality of children.

[53]Becker (1991, page 329) cites children as the prime example of marital specific capital. However, in contrast to other forms of marital specific capital, property rights over children still have to be allocated in divorce.

on their custodial rights. This return to investment is interpreted as the formation of a lasting emotional bond between parent and child.

I make the following assumptions on the returns to investment;

A1. $\frac{\partial u(q_i,q_j)}{\partial q_i} \geq \frac{\partial \overline{u}(q_i,q_j)}{\partial q_i} > 0$ for all q_j

A2. $\frac{\partial}{\partial \lambda_i}\left(\frac{\partial \overline{u}(q)}{\partial q_i}\right) > 0$

A1 says the returns to own investments are higher within marriage than divorce so, other things equal, spouses prefer the marriage to remain intact. A2 says the marginal returns to own investment are higher in divorce if the parent has greater custody of the child. This is because with a greater share of physical custody, each parent is better able to form a lasting emotional bond with their children. This is the channel through which the allocation of custody affects investments in marriage.

I assume the benefits from child quality in marriage, $u(q)$, are concave, continuous and twice differentiable in each investment, with $\frac{\partial u(q_i,q_j)}{\partial q_i}$ bounded from above for all q_j, $\frac{\partial u(q_i,0)}{\partial q_i} > 0$, $|u_{ii}(q)| > |u_{ji}(q)|$ for $i \neq j$. The same assumptions are made on the benefits from child quality in divorce, $\overline{u}(q)$.

While spousal investments in marriage are observable to both parents, I assume they cannot be specified *ex ante* as part of the marriage contract at the start of marriage. This is because they cannot be verified by third parties. If spouses were to make agreements contingent on child quality investments, then at any stage of marriage either spouse could hold-up the other, claiming they had not made the agreed-to investment. No third party can verify whether each parent has undertaken the agreed-to investments, even if total child quality is observable to third parties.[54]

Hence after investments are made, there remains scope for renegotiation over the division of the marital surplus. When renegotiation takes place there is symmetric information across spouses because at that stage of marriage, spouses know their

[54] Courts are reluctant to intervene with respect to parental conduct towards children during marriage (with the obvious exception of abusive behavior). This includes decisions that have direct consequences for child welfare, such as the allocation of financial resources within the household or where children go to school. This suggests parents are unable to write legally enforceable agreements contingent upon actions within marriage even if actions within marriage are verifiable. In cases where spouses have written explicit marital contracts, courts have still been reluctant to enforce them (Rasmusen-Stake (1998)). This raises the interesting issue of why an increasing number of couples are observed making such contracts, an issue I return to in the conclusion.

own, and their partners, private benefits from marriage, as well as the investments each has made into child quality.

I assume the allocation of child custody is contractible between spouses at the start of marriage. I do this for two reasons. First, suppose spouses were to *ex post* bargain over custody, so custodial allocations do not form part of the marital contract. Given child quality is a public good, the surplus maximizing outcome would be for the high valuation parent to have sole custody. As both parents know custody goes *ex post* to the high valuation parent, this affects investments during marriage. However this is just a special case of the framework set out below.[55]

Second, this assumption helps focus on the first order contracting problem in marriage, that actions taken within marriage cannot be specified *ex ante*. In contrast, custodial arrangements can be written as part of the marital contract. Indeed, courts of law and government agencies are observed devoting resources towards the enforcement of spousal agreements over custody.[56] In this framework, the role of the legal system is to determine the set of feasible custodial allocations, but parents themselves endogenously choose the allocation of custody implemented.

The timing of actions is as follows;

1. at the start of marriage, the married couple decide upon a verifiable allocation of custodial rights should they divorce.

2. each parent makes a non-verifiable investment into child quality.

3. the happiness of marriage to both parents is observed, and spouses decide whether to remain married or to divorce.

4. if they remain married, spouses bargain over the surplus created by marriage over divorce. If they divorce, each spouse pays their share of the divorce cost and the child custody arrangement is enacted.

[55] One way to empirically distinguish whether custodial arrangements form part of the marital contract, or whether they are bargained over *ex post*, is to see if custody depends on divorce costs. With *ex post* bargaining, custodial allocations ought not to depend on the sunk costs of exiting marriage.

[56] In an overview of divorce law practice, Mnookin-Kornhauser (1979) argue the role of courts has been to provide, "a framework within which divorcing couples can themselves determine their post-dissolution rights and responsibilities". If courts were *not* just to rubber stamp parental agreements over custody, there may be strategic incentives for parents to manipulate investments during marriage. Spouses could also engage in post marital behavior that influence court rulings over custody, for example if one spouse threatened to relocate. I focus on behaviour within marriage in this paper, and will not consider such actions outside of marriage.

All payoffs are received in stage 4. I assume investments are made before the happiness from marriage is realized. For the results to still hold in a setting in which investments were made over a number of periods, there needs to be at least one period in which investments are made before the private benefits of marriage are realized. This model better captures the investment incentives of those early in marriage, where divorce is more likely and investments still have to be undertaken. Arguably, it is investments into young children that have the most permanent effects on welfare.[57]

In this framework individuals once divorced do not remarry. Allowing for remarriage would further reduce investment incentives of married couples if child quality across marriages is partially substitutable.

3.1.2 Stages 3 and 4: Divorce and Marital Bargaining

Couples divorce if and only if it is efficient to do so. In other words the costs of divorce, c, are smaller than the gain from divorcing;

$$c < U_h^D(q) + U_w^D(q) - U_h^M(q) - U_w^M(q) \tag{3}$$

By the Coase theorem, when spouses can bargain at little or no cost, the allocation of property rights has no effect on divorce outcomes, only on the intrahousehold allocation of resources. Hence this divorce rule holds irrespective of whether there are mutual consent or unilateral divorce laws in place.

However divorce laws do affect the cost of divorce. For example, the introduction of no-fault divorce laws reduced divorce costs because they reduced the proof required to instigate a divorce, and courts cannot impose financial penalties on at-fault spouses. By reducing the costs of exiting marriage, no-fault divorce laws have been widely perceived as increasing marital instability. This framework makes precise the relationship between divorce costs and investment incentives within marriage, and the allocation of custody.

Rearranging (3), spouses remain married if the happiness of marriage is such that;

$$\phi = (\nu_h + \nu_w) \geq -c - (\theta_h + \theta_w)\,\Delta(q) \tag{4}$$

where $\Delta(q) = u(q) - \overline{u}(q)$ are the (positive) gains from marriage. Hence some couples

[57] Recent advances in neurology show the first three to five years of brain development are crucial for cognitive and socio-emotional development (Shore (1997)).

can remain in a "unhappy" marriage in that the only reason they stay together is either because the costs of exiting the marriage are prohibitively high, or because they have made large investments into marriage specific capital such as child quality.[58]

The total happiness in marriage, $\phi = \nu_h + \nu_w$, is distributed according to a probability distribution $g(\phi)$, with associated cumulative density function $G(\phi)$ and support $[\underline{\phi}, \overline{\phi}]$.

The probability of divorce is therefore;

$$G(\phi^*) = G(-c - (\theta_h + \theta_w)\,\Delta\,(q))$$

where ϕ^* is the value of happiness in the marginal marriage. The probability of divorce depends on parental preferences (θ_i), and divorce costs (c). Couples are more likely to remain married if they value child quality more, or divorce costs are high.

The probability of divorce is also partly endogenously determined through investments in child quality ($\Delta\,(q)$). As investment increases, because the benefits from child quality are marriage specific, the gains from being married increase and so the probability of divorce falls.

Consistent with the idea that marital specific investments reduce the likelihood of divorce, marital dissolution is less likely if children (especially young children) are present in the household, or marital duration increases (Becker *et al* (1977), Lillard and Waite (1991)), or the couple have more property (Weiss and Willis (1997)).

Suppose the marriage has remained intact after the happiness from marriage has been realized. As investments cannot be *ex ante* specified as part of the marital contract, the couple renegotiate over the division of the marital surplus. Husband and wife can foresee such renegotiation when they make their investments. I make the simplifying assumption that spouses split divorce costs and the gains from marriage equally, and the marginal cost of investing into child quality, p, is constant and finite.

Hence the *ex ante* payoff to spouse i before investments are undertaken is;

$$V_i(q) = (\theta_i \overline{u}(q) - \frac{c}{2}) + \frac{1}{2}\mathbf{E}(\text{gains from marriage}|\phi > \phi^*) - pq_i \qquad (5)$$

The first term is the divorce payoff, the second term is each spouse's share of the expected gains from marriage conditional on the marriage surviving, and the final

[58]The results are robust to ϕ being correlated with investments. The model as presented keeps clear the distinction between exogenous and endogenous sources of divorce.

term is the total cost of making the investment.[59]

Substituting the expected gains from marriage conditional on the marriage surviving into (5);

$$V_i(q) = (\theta_i \overline{u}(q) - \frac{c}{2}) + \frac{1}{2}\left[h(\phi^*) + (1 - G(\phi^*))\left((\theta_h + \theta_w)\Delta(q) + c\right)\right] - pq_i \quad (6)$$

where $h(\phi^*) = \frac{g(\phi^*)}{1-G(\phi^*)}$, is the expected value of happiness conditional on the marriage surviving or the hazard rate for the happiness in marriage, and;

$$S = (\theta_h + \theta_w)\Delta(q) + c$$

is what I refer to as the marriage surplus.[60] Writing *ex ante* payoffs as in (6) decomposes the expected gains from marriage conditional on the marriage surviving into two parts - (i) the expected happiness from marriage conditional on the marriage surviving; (ii) the expected surplus in marriage if the marriage survives.[61]

In order ensure there exists at least one pure strategy Nash equilibrium in spousal investments, more structure needs to be imposed on the distribution of happiness

[59] As payoffs are quasi-linear in the happiness from marriage, the expected marital surplus depends on the total happiness from marriage. If individual realizations of happiness (ν_h, ν_w) are correlated, this is taken account of in their joint distribution, ϕ.

[60] An underlying model of household bargaining consistent with this is where spouses *ex post* Nash bargain with transfers over the marriage surplus. Define the transfer t to be positive if it is from husband to wife;

$$\begin{aligned} t^* &= \arg\max_z \left[U_h^M(q) - z - U_h^D(q)\right]\left[U_w^M(q) + z - U_w^D(q)\right] \\ &= \frac{1}{2}\left[\nu_h - \nu_w + (\theta_h - \theta_w)\Delta(q)\right] \end{aligned}$$

The wife's *ex ante* payoff is;

$$V_w(q) = \int_{\phi^*}^{\overline{\phi}} \left[u_w(q) + t^*\right] g(\phi) d\phi + \left[\theta_w \overline{u}(q) - \frac{c}{2}\right] G(\phi^*) - pq_w$$

The first term is her expected payoff in marriage, conditional on the marriage surviving. The second term is her expected payoff in divorce. As the payoff in marriage is additive in the happiness of marriage, the wife's *ex ante* maximization problem simplifies to;

$$\max_{q_w} \frac{1}{2}\left[h(\phi^*) + (\theta_h + \theta_w)u(q) + (\theta_w - \theta_h)\overline{u}(q)\right]\left[1 - G(\phi^*)\right] + \left[\theta_w \overline{u}(q) - \frac{c}{2}\right] G(\phi^*) - pq_w$$

Rearranging gives (6).

[61] If divorce costs become arbitrarily large, the probability of divorce and the expected happiness in marriage conditional on the marriage surviving, tend towards zero. Hence the wife's *ex ante*

in marriage. In particular, if the expected gains from marriage conditional on the marriage surviving are concave in the marriage surplus, then each spouses *ex ante* payoff is concave in their own investment. The following assumptions are sufficient to guarantee this;

A3. ϕ is log-concavely distributed

A4. $g'(\phi^*) > 0$

A5. $1 - G(\phi^*) > h'(\phi^*)$

A6. $\phi^* \leq -\left[\frac{2g(\phi^*)+h''(\phi^*)}{g'(\phi^*)}\right]$

Assumptions A3 to A5 ensure the expected gains from marriage surplus increase in the actual marriage surplus. Log concavity implies the hazard rate is non-decreasing and the distribution of happiness in marriage is unimodal. A4 says that the marginal marriage is less likely to break up if spouses invest into child quality.

To understand the intuition behind A5, note from (4), marriages remain intact either because the happiness from marriage, or investments into child quality, are high. Hence the expected happiness in marriage conditional on the marriage remaining intact, *declines* in investments because happiness in marriage and the benefits from child quality are substitutable reasons why the marriage remains intact. Assumption A5 places an upper bound on how quickly the expected happiness from marriage declines in investment, so that these disincentive effects do not dominate.

A6 ensures that the expected gains from marriage increase are concave in the marriage surplus. As the happiness in the marginal marriage is minus the marriage surplus ($\phi^* = -S$) this condition requires this surplus to be sufficiently high.

Assumptions A4 to A6 relate to the happiness in the marginal marriage. This is because the payoff in any marriage is expressed as a function of the happiness in the marginal marriage, as seen in (5) above.

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payoff reduces to;

$$\begin{aligned} V_w(q) &= (\theta_w \overline{u}(q) - \frac{c}{2}) + \frac{1}{2}(1 - G(\phi^*))\left((\theta_h + \theta_w)\,\Delta(q) + c\right) - pq_w \\ &= \frac{1}{2}\left[(\theta_h + \theta_w)\,u(q) + (\theta_w - \theta_h)\,\overline{u}(q)\right] - pq_w \end{aligned}$$

The model is then identical to Besley and Ghatak (2001).

Proposition 1: *If A3-A6 hold, there exists at least one pure strategy Nash equilibrium in spousal investments. Spouses always underinvest relative to a first best world in which - (i) spouses can specify investments during marriage as part of the marital contract; (ii) there is no uncertainty over the stability of marriage.*

Assumptions A3 to A6 ensure the expected gains from marriage are concave in the marital surplus. This is sufficient to ensure that there exists some marginal investment cost, p, at which positive investments are made in equilibrium.

Spouses underinvest relative to a first best world because they cannot appropriate all of the return on their own investment. As spouses renegotiate *ex post* over the marriage surplus, each receives half of the return to their own investment. The returns on own investment are further reduced because divorce occurs with positive probability which reduces the expected surplus to be bargained over.

3.1.3 Stage 2: Child Quality

I focus on the wife's investment choice to keep the exposition clear. The first order condition for the wife's investment is;

$$\frac{\partial V_w}{\partial q_w} = \theta_w \frac{\partial \overline{u}(q)}{\partial q_w} + \frac{1}{2} \frac{\partial \mathbf{E}(\text{surplus} | \phi > \phi^*)}{\partial S} \frac{\partial S}{\partial q_w} = p \tag{7}$$

where $S = (\theta_h + \theta_w)\,\Delta(q) + c$, is the marriage surplus. This can be rewritten as;

$$\frac{\partial V_w}{\partial q_w} = \theta_w \frac{\partial \overline{u}(q)}{\partial q_w} + \frac{1}{2}\left[1 - G(\phi^*)\right] \frac{\partial S}{\partial q_w} - \frac{1}{2} h'(\phi^*) \frac{\partial S}{\partial q_w} + \frac{1}{2} g(\phi^*) \frac{\partial S}{\partial q_w} S = p \tag{7'}$$

There are thus four sources of incentives to invest. First there are the returns on this investment in divorce captured in the first term above. Second, by investing the wife increases the surplus available to be bargained over if spouses remain married. Third, as investments and happiness in marriage are alternative reasons why the marriage remains intact, investing lowers the expected happiness of marriage conditional on the marriage remaining intact. This acts as a disincentive to invest.

Finally, by investing the wife increases the probability that the marriage remains intact. This last effect is the "endogenous divorce" effect. By investing, the wife increases the likelihood the marriage remains intact.

An implication is that both the absolute gains and marginal benefits of investing, determine investment incentives. Policies that affect either the *marginal* returns

to investment, or the *level* of payoffs in marriage and divorce, affect equilibrium investments into child quality. Such policies are considered in section three.[62]

Investment and Divorce Costs

The costs of exiting marriage have been falling steadily over the past thirty years. The effect of lower costs of divorce is to increase investment incentives during marriage;

$$\frac{\partial}{\partial c}\left(\frac{\partial V_w(q)}{\partial q_w}\right) = \frac{1}{2}\frac{\partial^2 \mathbf{E}(\text{surplus}|\phi > \phi^*)}{\partial S^2}\frac{\partial S}{\partial c}\frac{\partial S}{\partial q_w} < 0$$

To see the intuition for this, note that there are two separate margins along which divorce costs and investments interact. On the one hand higher divorce costs make the marriage more stable and this increases investment incentives.

On the other hand as the probability of divorce is $G(-c-(\theta_h+\theta_w)\Delta(q))$, with high divorce costs, individual investment choices have less influence, relative to the divorce cost, on the probability the marriage remains intact. Through this endogenous divorce effect, spouse have *lower* incentives to invest when divorce costs are high.

This latter effect dominates under assumptions A3-A6. In short, divorce costs have the greater affect on investment incentives along the margin of keeping the marriage intact, rather than marital stability *per se*. As divorce costs fall incrementally, by marginally increasing investment, the marginal gain from remaining married rather than divorcing, dominates the marginal loss from investing within a more unstable marriage.

The model captures the intuition that when divorce costs are high, the couple is effectively locked into marriage irrespective of their own actions. Hence they have less incentives to make marriage specific investments into child quality.

Proposition 2: *Investments made during marriage into child quality increase as the costs of exiting marriage fall.*

Key to this result is that divorce occurs endogenously. If divorce occurred for exogenous reasons, then as divorce costs rise marriage becomes more stable irrespective of spouse's own actions. As investment returns are higher in marriage than divorce, equilibrium investment always rises. This captures the traditional notion that making

[62] The returns to each spouse's investment depends on both spouse's valuations. Hence one spouse does not completely free-ride on the others investment even if they themselves do not value child quality. This is in contrast to standard models of the private provision of public goods. Free riding does not occur here because of *ex post* bargaining that arises from the non-verifiability of investments.

divorce easier is bad for children.

With endogenous divorce this chain of reasoning breaks down. In such a world, the offsetting effect when divorce costs are high, is that individual investment choices have less effect on the likelihood that the couple remain married. In essence the couple are locked into marriage irrespective of their own actions. Hence they have *lower* incentives to invest into marriage specific capital, such as child quality.

The result that investment increases as divorce costs fall is contrary to popular opinion. For example, the no-fault divorce revolution of the 1970s is perceived as having considerably reduced the barriers to exiting marriage and increased marital instability. Policy makers concerned with the detrimental effects on adults and children have tried to reverse the decline in divorce costs, through increased periods of separation before divorce is legitimized, or the reintroduction of fault based divorce.[63]

This framework clarifies two separate effects that divorce costs have on children - (i) in all marriages parents make a greater commitment to marriage through investments in child quality; (ii) children in marginal marriages may be worse off as divorce becomes easier and their parents marriage no longer remains intact. The former effect could have a potentially greater and offsetting welfare impact than the effect of lower divorce costs on children from marginal marriages alone. Evaluating the relative importance of these two channels remains an important topic for future research.

Finally note the effect of divorce costs on the probability of divorce is ambiguous;

$$\frac{dG(\phi^*)}{dc} = -g(\phi^*)\left[1 + (\theta_h + \theta_w)\left(\frac{\partial \Delta}{\partial q_h}\frac{\partial q_h}{\partial c} + \frac{\partial \Delta}{\partial q_w}\frac{\partial q_w}{\partial c}\right)\right] \tag{8}$$

On the one hand it is easier to divorce, on the other hand spouses make more investments during marriage. Cross sectional evidence on the probability of divorce is indeed mixed as to the effects of divorce cost. For example Johnson and Skinner (1986) and Peters (1986) find no evidence that no-fault divorce increases the probability of marital dissolution, while Weiss and Willis (1993) find a positive and significant effect.

[63]Sixteen states had required periods of separation in 1980, the average length of which was 6.7 months. By 2000, 28 states had introduced such requirements, the average duration of which was 9.2 months. Furthermore, between January and April 1996 legislators in 18 states introduced bills to make divorce more difficult (Estin (1998)). Arizona and Louisiana have passed such laws and moved towards covenant marriages so that spouses can only seek divorce on grounds of adultery, felony conviction, abandonment, abuse, or two years separation.

3.1.4 Stage 1: Child Custody

In the first stage of marriage parents decide the allocation of physical custody over children if the couple were to divorce. The fraction of physical custody that goes to spouse i is λ_i, such that $\lambda_h + \lambda_w = 1$. The key assumption is;

A2. $\frac{\partial}{\partial \lambda_i}\left(\frac{\partial \overline{u}(q)}{\partial q_i}\right) > 0$

The marginal returns to child quality are higher in divorce if the parent has a greater share of custody. This is because the parent is better able to form a lasting emotional bond with their children.

I make the simplifying assumption that when a parent has zero custody the returns to investing are zero, when they have sole custody the returns are the same as in marriage, and when parents have equal custodial rights, the returns to each parent are the same.

To see how the allocation of custody relates to investment incentives, consider the case in which divorce occurs largely for exogenous reasons so the probability of divorce is approximately $G(-c)$. The effect of granting the wife greater custodial rights on her investment incentives is;

$$\frac{\partial}{\partial \lambda_w}\left(\frac{\partial V_w(q)}{\partial q_w}\right) = \frac{1}{2}(\theta_w - \theta_h)\frac{\partial}{\partial \lambda_w}\left(\frac{\partial \overline{u}(q)}{\partial q_w}\right)(1 - G(-c)) + \theta_w \frac{\partial}{\partial \lambda_w}\left(\frac{\partial \overline{u}(q)}{\partial q_w}\right) G(-c) \tag{9}$$

On the one hand, as child quality remains a public good in divorce, giving custody to the high valuation spouse increases that spouse's incentive to invest, leaving both partners better off. This effect is captured in the first term. On the other hand both spouses would like to have more own custody so that in the event of divorce, their own return on investment is maximized. Hence it is not necessarily the case that giving more *ex post* custody to the wife, increases her *ex ante* investment. Investment incentives and custodial rights move together for the wife if;

$$\frac{\theta_w}{\theta_h} > \frac{1 - G(-c)}{1 + G(-c)}$$

If the investment incentives of both spouses increase with their own share of custody, joint custody is optimal. Hence joint custody is optimal for the following non-empty

set of couples[64];

$$\left\{(\theta_h, \theta_w) : \frac{\theta_w}{\theta_h} \in \left[\frac{1-G(-c)}{1+G(-c)}, \frac{1+G(-c)}{1-G(-c)}\right]\right\} \tag{10}$$

Proposition 3: *When divorce occurs for largely exogenous reasons - (i) for couples with heterogeneous valuations, the high valuation spouse optimally has sole custody. For couples with homogeneous valuations, joint custody is always optimal; (ii) the set of couples for whom joint custody is optimal decreases in divorce costs.*

Figure 1 shows the optimal allocation of custody by the heterogeneity in spousal valuations of child quality. Intuitively, the high valuation spouse always has the majority custodial share.

The *ex post* efficient allocation of custody, giving sole custody to the high valuation parent, only maximizes *ex ante* investment incentives if the degree of spousal preference heterogeneity is sufficiently large.

To see the effect on divorce costs on the allocation of custody, note that as divorce costs rise, the probability the couple remain married increases. It is then more important for couples to give custody to the spouse who invests the most, namely the high valuation spouse. This reduces the likelihood of joint custody being optimal. The share of custody for the high valuation spouse is non-increasing in divorce costs.

For any *given* couple (holding $\frac{\theta_w}{\theta_h}$ constant), higher divorce costs shift the optimal custodial allocation towards the high valuation spouse. Across the population of all married couples, the incidence of joint custody decreases in divorce costs. These effects are shown on figure 1.[65]

This framework provides a rationale for why as the costs of exiting marriage have fallen, there has been an increased incidence of joint custody *per se*, and, controlling for couples characteristics, fathers have been given a greater custodial share.

[64] Consider a couple for whom $\frac{\theta_w}{\theta_h} < \frac{1-G(-c)}{1+G(-c)}$. Granting the husband incrementally more custody will increase his investment incentives, and decrease those of his wife. Given that for this couple the husband values child quality more than his wife, it is optimal for the husband to have sole custody. A similar argument applies for couples for whom $\frac{\theta_w}{\theta_h} > \frac{1+G(-c)}{1-G(-c)}$. Only for couples with relatively homogeneous preferences will it be optimal for custody to be allocated jointly. This equates each spouses investment incentives, maximizing aggregate investment and the marriage surplus.

[65] In the limiting case of infinite divorce costs, the high valuation parent has sole custody - this is the result in Besley and Ghatak (2001).

To isolate the effect endogenous divorce has on the allocation of custody, differentiate the wife's first order condition with respect to her own custodial share;

$$\begin{aligned}\frac{\partial}{\partial\lambda_w}\left(\frac{\partial V_w(q)}{\partial q_w}\right) &= \frac{1}{2}(\theta_w-\theta_h)\frac{\partial}{\partial\lambda_w}\left(\frac{\partial\overline{u}(q)}{\partial q_w}\right)(1-G(\phi^*)) \\ &+\theta_w\frac{\partial}{\partial\lambda_w}\left(\frac{\partial\overline{u}(q)}{\partial q_w}\right)G(\phi^*) \\ &+\frac{1}{2}\frac{\partial}{\partial\lambda_w}\left(\frac{\partial S}{\partial q_w}\right)S \\ &-\frac{1}{2}h'(\phi^*)\frac{\partial}{\partial\lambda_w}\left(\frac{\partial S}{\partial q_w}\right)\end{aligned} \tag{11}$$

Endogenous divorce introduces the last two effects. First, giving more *ex post* custody to the wife reduces the marginal effect her investment has on the marriage surplus. This follows from A1 - investment returns are higher in marriage than divorce.[66] Granting the wife more custody reduces the impact her investment has on keeping the marriage intact. This in turn reduces her incentive to invest in child quality during marriage. In short, endogenous divorce causes investment and custody to move in *opposite* directions.

Second, the expected happiness in marriage is less sensitive to the wife's investments as she has more custody. In other words having more own custody reduces the wife's disincentive to invest that arises from expecting a less happiness in marriage as she invests. This increases her investment as she has more own custody.

The first of these two new factors means investment and custody need not move together and this can have perverse effects on the allocation of custody. The strength of this effect depends on the size of the marriage surplus, $S=(\theta_h+\theta_w)\Delta(q)+c$. The surplus increases in divorce costs if;

$$(\theta_h+\theta_w)\left(\frac{\partial\Delta}{\partial q_h}\frac{\partial q_h}{\partial c}+\frac{\partial\Delta}{\partial q_h}\frac{\partial q_h}{\partial c}\right)+1>0 \tag{12}$$

This is the same condition that ensures the probability of divorce increases as the costs of exiting marriage fall. When the marriage surplus is small, the net effect of the new incentives arising from endogenous divorce is the same as when divorce

[66] In the extreme case when the wife has sole custody, the mariage surplus would not change on the margin with her investment, because her investment returns are the same inside and outside of marriage.

occurs for exogenous reasons.

The set of couples for whom joint custody is optimal is greater than with exogenous divorce, because of the increased investment incentives arising from having more own custody that come through the happiness effect.

Now suppose (12) holds and the cost of divorce rises. This increases the marriage surplus. The desire to have less own custody because of the endogenous divorce effect becomes stronger vis-à-vis the desire to have more own custody through the stronger happiness effect. Hence the set of couples for whom joint custody is optimal shrinks, but remains non-empty.

When the costs of divorce rise further, spouses prefer their partner to have more custody. This effect can become the dominant effect so that it is optimal to give the majority share of custody to the *low* valuation spouse. Joint custody remains optimal for some couples - those for whom both husband and wife's incentives to invest are *decreasing* in their own custodial share.

Similar to the case of exogenous divorce, the *ex post* efficient allocation of custody, only maximizes *ex ante* investment incentives if the degree of spousal preference heterogeneity is sufficiently strong.

Proposition 4: *If the probability of divorce decreases in the cost of divorce, then for low (high) divorce costs - (i) the high (low) valuation spouse has the majority custodial share; (ii) the low valuation spouse's custodial share is decreasing in the divorce cost.*

Figure 2 shows how the allocation of custody changes in the marriage surplus. The disincentives to invest arising from the weakened endogenous divorce gradually become stronger vis-à-vis the incentives to invest arising from the higher expected happiness in marriage.

An alternative way to think about this is if (12) holds so the marriage surplus rises in the divorce cost, and the probability of divorce decreases as divorce costs rise.

The relationship between divorce costs and custodial shares is non-monotonic. When divorce costs are low, if (12) holds, the marriage surplus is also small. Hence the incentives to invest arising from the higher expected happiness in marriage outweigh the disincentives arising from the weakened endogenous divorce effect. The net effect of having custody is similar to when divorce occurs for exogenous reasons. Namely the high valuation spouse has the majority custodial share, and this share increases with the divorce cost.

As divorce costs rise there exists some cost, $\overline{c}$, at which the dominant effect becomes both spouses preferring their partner to have more custody. For divorce costs above $\overline{c}$, the *low* valuation party has the majority custodial share.[67]

Figure 3 shows the non-monotonic relationship between the husband's optimal allocation of child custody and the divorce cost in the case where husbands have a lower valuation of child quality than wives.[68]

Joint custody can be optimal because child quality is a public good, and divorce occurs with positive probability. These two features are sufficient to generate conflicting incentives to invest across parents so that it is optimal to share custody.[69] Endogenous divorce introduces the possibility that investment and custody do not move together so the low valuation spouse may have the majority custodial share.

This contrasts with previous explanations of why joint custody is optimal in the literature on non-contractible investments into a private good. For instance, Rajan and Zingales (1998) argue that if investment leads to greater specialization within a relationship, the returns to outside options fall in own investment. Hence parties appropriate a lower share of the marginal benefits in the current relationship because their position is weakened in *ex post* renegotiation. Each party is therefore better off by not owning the asset so that they do not lock themselves into the current relationship. Hence joint ownership can be optimal. Alternatively, de Meza and Lockwood (1998) present a model in which parties use outside options bargaining so

[67] Children were considered as legal property solely of fathers in divorce up until the second half of the nineteenth century (Mason (1994)) - a period in which divorce was prohibitively expensive.

[68] Holding total valuation constant, a small increase in the divergence of valuations such that $d\theta_w = -d\theta_h$ when $d\theta_w > 0$, changes aggregate investment by;

$$dq = d\theta_w \left(\frac{\partial \overline{u}\left(q_h^*, q_w^*\right)}{\partial q_h} - \frac{\partial \overline{u}\left(q_h^*, q_w^*\right)}{\partial q_w} \right)$$

where (q_h^*, q_w^*) are investment levels with homogeneous preferences. With low divorce costs it is optimal for the high valuation spouse to have the majority share of custody and so aggregate investment falls as parental preferences diverge. Hence spouses want to positively sort by valuations in the marriage market. Therefore as divorce costs fall, this sorting effect in the marriage market *reinforces* the main effect discussed, that investments increase as divorce costs fall.

[69] Consistent with this result, Seltzer (1990) and Brown *et al* (1997) find that joint custody is more likely to occur for marriages of greater duration, where couples are likely to have made more marital specific investments such as those into child quality. Furthermore, if parental valuation of child custody is positively correlated with own income, this model helps understand the results in Brown *et al* (1997) that - (i) parents are more likely to have sole custody as their incomes rise relative to their spouses; (ii) joint custody is most common when parents have higher aggregate incomes, or more similar incomes.

that if one parties divorce payoff binds after the investment is made, then the other party appropriates all of the surplus. Hence investing in the relationship increases the likelihood that a parties own outside option binds in renegotiation, and they do not appropriate the returns on their own investment. Again joint ownership can be optimal in such a setting.

The result here builds on Besley and Ghatak (2001). They show that when investments are made into a public good and there is no uncertainty over the stability of the relationship, then allocating property rights *ex post* efficiently maximizes *ex ante* investment incentives. In this framework when marriage is unstable, joint custody is always optimal for some couples, with the high valuation spouse having the majority custodial share. With endogenous divorce, there remains a set of couples for whom joint custody is optimal, and it may be the case that the low valuation spouse has the majority share of custody depending upon the strength of the endogenous divorce effect.

3.1.5 Further Issues

Specialization in Household Production Traditionally women have been more specialized in household production. The effects of specialization are captured in the model by assuming;

$$\frac{\partial u}{\partial q_w} > \frac{\partial u}{\partial q_h} \text{ and } \frac{\partial \overline{u}}{\partial q_w} > \frac{\partial \overline{u}}{\partial q_h}$$

The effects of specialization on investment incentives can be seen from the first order condition (7′). If the degree of specialization is independent of the marital state, specialization affects investment through the returns to investment in divorce, the first term in (7′). Hence the more specialized spouse invests more into child quality during marriage. Both spouses are better off if the more specialized spouse has a greater custodial share in divorce.

One of the most important factors that has influenced household behavior in the last generation is the rise in the labor force participation of women. This framework predicts that as this women devote more labor to the market, the comparative advantage in household production women have relative to men, is eroded. This leads to - (i) investments of men rising relative to women; (ii) a greater incidence of joint custody. Furthermore the model predicts that for any given couple, the custodial rights

of each parent increases in the amount of labor supplied outside of the household by their spouse.

Cohabitation The framework provides a way of thinking through whether married and cohabiting couples invest differently in child quality. This is important given the dramatic rise in out-of-wedlock births, a significant part of which are attributable to cohabiting couples.[70]

In contrast to married couples, cohabiting couples face zero divorce costs, so the probability of their relationship breaking up is;

$$G(\phi^c) = G(-(\theta_h + \theta_w)\Delta(q)) > G(\phi^*)$$

where ϕ^c is the value of happiness in the marginal cohabiting relationship. Hence for *given* valuations of child quality and gains from marriage, cohabiting couples are more likely to break up than married couples. This is supported by evidence from the US (Bumpass and Sweet (1989)) and the UK (Ermisch and Francesconi (1999)). Hence on the one hand as cohabiting relationships are more unstable, cohabitees make lower investments than identically married couples.

On the other hand, as cohabitees face zero divorce cost, their own investments have a greater impact on the marginal probability that the relationship remains intact, than for married spouses. This gives cohabitees greater incentives to invest than identically married couples. By proposition 2 this second effect dominates so overall, cohabiting couples invest more in child quality than *identically* married couples.[71]

From proposition 4, cohabiting couples have a lower marriage surplus than identically married couples. For a cohabiting couple with relatively heterogeneous valuations, the high valuation spouse has sole custody. For cohabiting couples with relatively homogeneous valuations, joint custody is always optimal, with the high

[70]The prevalence of cohabitation has increased rapidly in America since the 1960s. Then there was one cohabiting couple for every 90 married couples. By 2000, there was one cohabiting couple for every 12 married couples. In America today, 5% of all children aged under 18 live with cohabiting parents. The percentage of births to unmarried women in America rose from 5% in 1940 to 65% in 2000. Between 1980-4, 29% of non-marital births were to cohabiting couples. By 1990-4 this figure had risen to 39%. (National Vital Statistics Report (2000)).

[71]This begs the question whether there is selection into cohabitation. Rindfuss and VandenHeuval (1990) provide evidence from the National Longitudinal Study showing cohabitees to be more similar to singles than married individuals, on a range of socioeconomic characteristics and attitudinal variables.

valuation spouse having the majority share.

Again the framework helps rationalize observed legal reforms over time. A series of Supreme Court rulings since 1971 have led to the equal recognition of the rights and obligations of unwed fathers, and the gradual erosion of custodial presumption in favour of mothers, unwed or otherwise. The analysis here suggests joint physical custody can maximize *ex ante* parental incentives to invest into child quality when parents are cohabiting. If courts place positive weight on the welfare of children, we would then expect the expansion of custodial rights to unwed parents.

3.2 Family Policy

The framework presented offers a number of insights into how behavior within families towards children changes as divorce becomes easier. The same framework can also be used to study the impact on children of family policy. The policies I look at work both through changing the level of payoffs in divorce, such as child support and welfare payments, and changing the marginal returns to child quality, such as legal custodial rights.

3.2.1 Child Support

Child support payments made at the time of divorce change the *level* of divorce payoffs to the following;

$$\begin{aligned} U_h^D(q) &= \theta_h \overline{u}(q) - \tau \\ U_w^D(q) &= \theta_w \overline{u}(q) + \tau \end{aligned} \tag{13}$$

where τ denotes the transfer from husband to wife.[72] If child support payments form part of the marriage contract, these transfers cannot be made contingent upon investments into child quality, because at the time they ought to be paid - if and when the couple divorce - either spouse could claim the other had not made the agreed to investment during marriage. No third party can verify this claim, and the level of

[72] Of the 14 million American custodial parents in 1998, 57% had some type of alimony award or child support agreement, averaging $4200 annually. If the tax system introduces a wedge between the amount paid and the amount received, the effect of such transfers is similar to that of welfare payments, considered in the next subsection.

transfer is then determined by bargaining *ex post*;

$$\begin{aligned} \tau^* &= \arg\max_z \left[U_h^D(q) - z\right]\left[U_w^D(q) + z\right] \\ &= \frac{1}{2}\left[(\theta_h - \theta_w)\,\overline{u}(q)\right] \end{aligned} \tag{14}$$

As spouses anticipate such *ex post* bargaining, spouse i's *ex ante* payoff is;

$$V_i(q) = \frac{1}{2}((\theta_h + \theta_w)\,\overline{u}(q) - c) + \frac{1}{2}\mathbf{E}(\text{gains from marriage}|\phi > \phi^*) - pq_i \tag{15}$$

In contrast to (6), *ex ante* payoffs are determined by the *sum* of parental valuations of child quality. Hence *ex post* bargaining over divorce transfers eliminates the source of conflict across spouses. Both spouses then face an identical investment choice problem.

Proposition 5: *If spouses bargain ex post over child support, spouses make the same investments into child quality during marriage. Joint custody is always optimal.*

Investments in marriage are higher in the presence of child support payments because the divorce payoff to both parents rises with *ex post* bargaining. The effect of *ex post* bargaining over child support is to undo the effect of preference heterogeneity that leads parents to have conflicting interests within marriage.

This result suggests that resources devoted towards the enforcement of alimony and child support awards amongst divorcees will have beneficial consequences for children within intact marriages.[73] This externality is typically not recognized as a potential benefit of enforcing support awards. If improved enforcement increases the expected value of child support, this - (i) raises investments into children during marriage; (ii) makes joint custody more likely for all couples.

[73]The Federal Office of Child Support Enforcement was established in 1975, and subsequent federal legislative acts have sought to further increase state enforcement powers. However payment rates are largely unchanged since the 1970s. Despite the fact that the majority of awards are considered legally enforceable by a court or government agency, only 59% of the total amount due in 1998 was actually received by custodial parents (Case *et al* (2000), US Census Bureau (2000)).

3.2.2 Welfare Payments

A number of welfare programs target transfers to single parents.[74] Welfare payments, ω, differ from transfers between spouses in that they *reduce* the marriage surplus so the probability of divorce rises to;

$$G(\phi^{\omega}) = G\left(-c - (\theta_h + \theta_w)\Delta(q) + \omega\right) > G(\phi^*) \tag{16}$$

where ϕ^{ω} is the value of happiness in the marginal marriage with welfare payments.[75] There are two opposing effects - one the one hand the relationship is more likely to break down because the gains from marriage are smaller. On the other hand, conditional on the marriage surviving, the marriage surplus is greater, because welfare payments effectively reduce divorce costs from c to $(c - \omega)$.

The net effect of welfare payments on parental investments is;

$$\frac{\partial V_i}{\partial q_i} = \theta_i \frac{\partial \overline{u}(q)}{\partial q_i} + \frac{1}{2}\frac{\partial \mathbf{E}(\text{surplus}|\phi > \phi^{\omega})}{\partial S}\frac{\partial S}{\partial q_i} = p$$

The surplus marriage creates over divorce, falls, so the marginal returns to investments rise. Hence *both* parents invest more even if only one of them is a welfare recipient in divorce. The identity of the recipient is irrelevant for investment incentives within marriage.

As welfare payments rise, the marriage surplus falls and hence from proposition 4, the incidence of joint custody increases.

Proposition 6: *If one parent is a welfare recipient in divorce, both parent's investments rise. For any given couple, the custodial share of the high valuation parent is increasing in the welfare payment. The incidence of joint custody increases with the level of welfare payments.*

[74] Examples include Temporary Assistance for Needy Families (TANF) which replaced the Aid to Families with Dependent Children (AFDC) program in 1996. States are permitted to use TANF grants to - (i) provide assistance to needy families so that children may be cared for; (ii) encourage the formation and maintenance of two-parent families. The main federal eligibility criterion is that funds are targeted towards families with children.

[75] Consistent with this, evidence from the income maintenance experiments suggests family breakdown is more likely to occur with generous welfare payments (Knudsen *et al* (1977)). More recently, Nixon (1997) finds a positive association between receipt of AFDC benefits and the likelihood of divorce.

3.2.3 Legal Custodial Rights

In marriage physical and legal custody coincide, but there is a distinction in law between the two in divorce. Physical custody refers to the fraction of time the child spends with each parent. This covers both where the child resides and parental visitations rights, and has been the focus of analysis so far. Legal custody refers to each parent's right to make decisions regarding their children's health, education, and welfare. It is seen as a way to maintain emotional ties between non-custodial parents and their children.

If the allocation of legal custody can be written into the marital contract, the effects of this policy can be captured by allowing the difference in returns to investment inside and outside of marriage to narrow. In other words when a parent has more legal custody, the benefits of child quality become less marriage specific.

To see the effect on investment, consider the extreme case in which legal custody implies $\frac{\partial u}{\partial q_i} = \frac{\partial \overline{u}}{\partial q_i}$ so that returns to investments into child quality are the same across marital states. Hence investment has no effect on the marriage surplus and so - (i) the surplus to be split between parents in *ex post* bargaining does not depend upon investments made during marriage; (ii) the likelihood that the marriage remains intact does not depend upon parental actions within marriage. Therefore the only incentive to invest arises from the fact that there is some positive return on investment in divorce.

Proposition 7: *Granting legal custodial rights in divorce decreases investments during marriage. The incidence of joint custody falls. In the limiting case where legal custody equates the returns to investments across marital states, the high valuation parent has sole custody.*

If legal custody equates the returns to investments into child quality across marital states, spouse i's first order condition for investment is;

$$\frac{\partial V_i}{\partial q_i} = \theta_i \frac{\partial \overline{u}(q)}{\partial q_i} = p$$

The optimal allocation of custodial rights is for the high valuation parent to have sole custody. This is because in this limiting case, child quality is less of a marital specific good, so spouses have fewer incentives to invest within marriage unless they know they will obtain custody *ex post.*

More generally, granting legal custodial rights to parents effectively weakens the investment incentives that arise from the endogenous divorce effect, and leads parents to place more emphasis on the return on their investment should divorce occur. Overall investments into child quality become less sensitive to the cost and probability of divorce.[76]

The effects of the three policy interventions on the allocation of custody are shown in figure 4. The policies have very different effects on equilibrium investment and custody. Child support, or more generally *ex post* transfers across spouses, offset the effects of preference heterogeneity across spouses, increase investments and make joint custody optimal for all couples.

Welfare payments, or more generally policies that reduce the *level* of gains from marriage, increase the likelihood of divorce, increase parents' investments during marriage, and increase the probability of joint custody being optimal.

Granting legal custodial rights, or more generally policies that reduce the *marginal* gains from marriage, decrease spousal investments because spouses no longer have an incentive to invest in order to keep the marriage together. Sole custody by the high valuation parent then becomes optimal.

3.3 Conclusion

This chapter contributes to the debate on whether making divorce easier is bad for children. The traditional view is that making divorce easier is bad for children. This is because marriages are more likely to break up with lower divorce costs. This chapter suggests that an additional effect has to be considered. As divorce becomes easier, parental investments into marital specific capital such as child quality, have a stronger impact on keeping the marriage intact. Hence when divorce costs are low, parents have additional incentives to invest.

This effect, which applies to the stock of marriages, could have a potentially greater and offsetting welfare impact than the effect of lower divorce costs on children from marginal marriages alone.[77]

[76]There has been an increased willingness of courts to grant both parents legal custody (Brown *et al* (1997)). Consistent with the model, Seltzer (1990) finds granting legal rights to both parents reduces the likelihood of physical custody being shared between parents.

[77]Johnson and Mazingo (2000) and Gruber (2000) both show individuals exposed to unilateral divorce as children are more likely to do worse on a range of welfare outcomes as children and into

The model stresses that this potentially offsetting effect is stronger the more likely it is that divorce occurs endogenously. In this scenario parents can be viewed as staying together "for the sake of the children". In contrast, if divorce occurs largely for exogenous reasons, say because of the arrival of new information about the true quality of the marriage, then the first order effect of lower divorce costs is to increase marital instability which is likely to leave children worse off. Evaluating the relative importance of these two channels remains an important topic for future research.

The chapter also provides useful insights into the allocation of child custody in divorce. In particular, I show joint custody is always optimal for couples with relatively homogeneous valuations of child quality, or with a similar degree of specialization in household production. This chapter helps provide a rationale for why we there has been a legal move towards the award of joint custody as divorce has become easier.

The model also helps explain why the incidence of joint custody has risen as female labor force participation has increased, and helps bring together a body of empirical evidence on the allocation of custody, the determinants of marital dissolution, and the effects of family policy on behavior within marriage.

The framework presents a stylized model of household behavior, and captures the main intuitions when actions within the household cannot be specified as part of the marital contract, and marriage is unstable. The model can be made richer in a number of ways to further address more specific questions. For example, endogenizing household formation, fertility and labor supply, or allowing spouses to invest in children across marital states, would all be useful extensions to consider.[78]

The chapter shows that the inability of spouses to write marital contracts contingent on investments during marriage, leads them to make less than the surplus maximizing level of investments. This suggests that one reason spouses increasingly use pre-nuptial agreements is to precisely "tie their hands", and reduce the possibility of *ex post* renegotiation.[79] Many lawyers have put forward the case for the

adulthood. Consistent with this, the model predicts that an exogenous increase in the probability of divorce increases marital instability and so gives spouses less incentives to invest in marital specific capital.

[78]Brown and Flinn (2001) present a structural dynamic model of parental investments in children across marital states and empirically test for predicted effects of different *given* custodial arrangements. Their model shares the characteristic that divorce occurs endogenously. However in their model parents only choose investments and not custodial arrangements, and investments can be *ex ante* specified in their framework.

[79]Rainer (2002) makes a similar argument with regards to spouses being able to write enforceable pre-nuptial agreements on the division of property.

enforcement of marital contracts ("private ordering") within marriage (Mnookin and Kornhauser (1979), Ramseyer (1998)) precisely arguing that greater marriage specific investments would be made as a result.

Finally, it has previously been argued that many policy interventions replicate the efficient outcomes that would be reached if children had a voice in household decision making (Becker and Murphy (1988)). This chapter shows how joint custody, child support, welfare payments, and legal custody help move household decisions closer to first best outcomes. It remains important to analyze if and how other aspects of family policy can overcome the inefficiencies caused by limits to marital contracting.

3.3.1 Appendix: Proofs

Proof of Proposition 1: Spouse i's investment choice problem is;

$$\max_{q_i} V_i(q) = \max_{q_i}(\theta_w \overline{u}(q) - \frac{1}{2}c) + \frac{1}{2}\left[h(\phi^*) + (1 - G(\phi^*))\left((\theta_h + \theta_w)\Delta(q) + c\right)\right] - pq_i$$

The first term is the payoff outside of marriage, which is concave in q_i. To ensure $V_i(q)$ is concave in q_i it is therefore sufficient to show that;

$$h(\phi^*) + (1 - G(\phi^*))\left((\theta_h + \theta_w)\Delta(q) + c\right)$$

is concave in q_i. Differentiating this term with respect to q_i;

$$[h'(\phi^*) - (1 - G(\phi^*)) + \phi^* g(\phi^*)]\frac{\partial \phi^*}{\partial q_i}$$

Differentiating again;

$$[h'(\phi^*) - (1 - G(\phi^*)) + \phi^* g(\phi^*)]\frac{\partial^2 \phi^*}{\partial q_i^2} + [h''(\phi^*) + 2g(\phi^*) + \phi^* g'(\phi^*)]\left(\frac{\partial \phi^*}{\partial q_i}\right)^2$$

As $\frac{\partial \phi^*}{\partial q_i} = -(\theta_h + \theta_w)\frac{\partial \Delta}{\partial q_i} < 0$, $\frac{\partial^2 \phi^*}{\partial q_i^2} = -(\theta_h + \theta_w)\frac{\partial^2 \Delta}{\partial q_i^2} > 0$, sufficient conditions to ensure the second order condition is negative are;

$$\begin{aligned} h'(\phi^*) &\leq (1 - G(\phi^*)) \\ h''(\phi^*) + 2g(\phi^*) + \phi^* g'(\phi^*) &\leq 0 \end{aligned}$$

The first of these is assumption A5. The second condition is true if;

$$\phi^* \leq -\left[\frac{2g(\phi^*) + h''(\phi^*)}{g'(\phi^*)}\right] \tag{A1}$$

and $g'(\phi^*) > 0$. These are assumptions A4 and A6 respectively. Note that by assumption A3, ϕ is log concavely distributed. This ensures the the right hand side in (A1) is negative for sure and so A6 can be satisfied at ϕ^* for some distribution of ϕ.

The *ex ante* payoffs, $V_i(q)$, are continuous in (q_h, q_w), and the strategy space for spouse i is a non-empty compact subset of $\Re^+$ if the cost of investing is positive and finite. Hence under assumptions A3 to A6, the payoff function is concave in q_i, so by the Glicksberg-Fan theorem, there exists at least one pure strategy Nash equilibrium.

Turning to the efficiency of investments, there are two potential sources of inefficiency - investments cannot be *ex ante* specified in the marital contract, and divorce occurs with positive probability. In a benchmark first best world in which investments can be specified, there is no scope for renegotiation during marriage. If in addition divorce does not occur then parents choose investments to maximize the total marriage surplus. The efficient level of investments solve the following pair of first order conditions;

$$(\theta_h + \theta_w)\frac{\partial u^M(q)}{\partial q_i} = p \quad i \in \{h, w\} \tag{A2}$$

In the first best world equilibrium investments are determined by (i) the sum of parental valuations; and (ii) the returns on investment within marriage. Comparing the first order conditions (A2) and (7), spouse i overinvests if;

$$(\theta_h + \theta_w)\frac{\partial u}{\partial q_i} - \theta_i\frac{\partial \overline{u}}{\partial q_i} - \frac{1}{2}(\theta_h + \theta_w)\frac{\partial \mathbf{E}(\text{surplus}|\phi > \phi^*)}{\partial S}\left(\frac{\partial u}{\partial q_i} - \frac{\partial \overline{u}}{\partial q_i}\right) > 0$$

$$\frac{\frac{\partial u}{\partial q_i}}{\frac{\partial \overline{u}}{\partial q_i}} \geq 1 > \frac{\theta_i - \frac{1}{2}(\theta_h + \theta_w)\frac{\partial \mathbf{E}(\text{surplus}|\phi > \phi^*)}{\partial S}}{(\theta_h + \theta_w) - \frac{1}{2}(\theta_h + \theta_w)\frac{\partial \mathbf{E}(\text{surplus}|\phi > \phi^*)}{\partial S}}$$

where the first inequality follows from A1. Rearranging this gives the result that spouse i overinvests if $\theta_i < 0$ which is never the case. Hence choosing the allocation of custodial rights to maximize the marriage surplus is equivalent to maximizing total investment into child quality because investments are always below the first best level.■

Proof of Propositions 3 and 4: Rewrite the wife's investment choice problem as;

$$\max_{q_w}\left[\theta_w\overline{u}-\frac{1}{2}c\right]G(\phi^*)+\frac{1}{2}h(\phi^*)+\frac{1}{2}\left[\left(\theta_h+\theta_w\right)u+\left(\theta_w-\theta_h\right)\overline{u}\right]\left[1-G(\phi^*)\right]-pq_w$$

The first order condition is;

$$\begin{array}{c}\frac{1}{2}h'(\phi^*)\frac{\partial\phi^*}{\partial q_w}+\frac{1}{2}\left[\left(\theta_h+\theta_w\right)\frac{\partial u}{\partial q_w}+\left(\theta_w-\theta_h\right)\frac{\partial\overline{u}}{\partial q_w}\right]\left[1-G(\phi^*)\right]\\ -\frac{1}{2}\left[\left(\theta_h+\theta_w\right)u+\left(\theta_w-\theta_h\right)\overline{u}\right]g(\phi^*)\frac{\partial\phi^*}{\partial q_w}+\theta_w\frac{\partial\overline{u}}{\partial q_w}G(\phi^*)+\left[\theta_w\overline{u}-\frac{1}{2}c\right]g(\phi^*)\frac{\partial\phi^*}{\partial q_w}\end{array}=p$$

There are four sources of investment incentive arising from having more own custody. Consider the simpler case where divorce occurs for largely exogenous reasons;

Case 1: Exogenous Divorce

The probability of divorce is approximately $G(-c)$ and as child quality is not such a marriage specific investment, spousal investments do not affect much the value of happiness in the marginal marriage so that $\frac{\partial\phi^*}{\partial q_w}$ is close to zero. The wife's first order condition reduces to;

$$\frac{1}{2}\left[\left(\theta_h+\theta_w\right)\frac{\partial u}{\partial q_w}+\left(\theta_w-\theta_h\right)\frac{\partial\overline{u}}{\partial q_w}\right]\left[1-G(-c)\right]+\theta_w\frac{\partial\overline{u}}{\partial q_w}G(-c)=p$$

The effect of giving the wife more custody on her investment incentives is;

$$\frac{1}{2}\left(\theta_w-\theta_h\right)\frac{\partial}{\partial\lambda_w}\left(\frac{\partial\overline{u}}{\partial q_w}\right)\left[1-G(-c)\right]+\theta_w\frac{\partial}{\partial\lambda_w}\left(\frac{\partial\overline{u}}{\partial q_w}\right)G(-c)\qquad\text{(A3)}$$

The first term implies spouses want the high valuation parent to have sole custody. The second term implies spouses want more own custody to maximize the returns on their investment should the couple divorce. To maximize the marriage surplus, custody is allocated to equate the marginal returns across spouses. If parents have homogeneous preferences then equating marginal incentives implies $\frac{\partial}{\partial\lambda_w}\left(\frac{\partial\overline{u}}{\partial q_w}\right)=\frac{\partial}{\partial\lambda_h}\left(\frac{\partial\overline{u}}{\partial q_h}\right)$ which is satisfied if $\lambda=\frac{1}{2}$ so custody is equally shared.

Suppose there exists some degree of preference heterogeneity at which the wife's investment incentive increases in her own custodial share. This is when (A3) is positive, namely when $\frac{\theta_w}{\theta_h}\geq\frac{1-G(-c)}{1+G(-c)}$. Similarly, if the husband's investment incentives are increasing in his custodial share it must be that $\frac{\theta_w}{\theta_h}\leq\frac{1+G(-c)}{1-G(-c)}$. Hence both spouses

investment incentives are increasing with more own custody for the set of couples that lie in (10) in the main text. These incentives are traded off by giving both spouses some custodial share. The high valuation spouse has the strictly greater share because the investment incentives on them having more own custody are greater than for the low valuation spouse. The set of couples for whom joint custody is optimal is decreasing in divorce costs as;

$$\frac{\partial}{\partial c}\left(\frac{1-G(-c)}{1+G(-c)}\right) = \frac{(1+G(-c))\,g(-c)+(1-G(-c))\,g(-c)}{(1+G(-c))^2} > 0$$

$$\text{and } \frac{\partial}{\partial c}\left(\frac{1+G(-c)}{1-G(-c)}\right) = \frac{-(1-G(-c))\,g(-c)-(1+G(-c))\,g(-c)}{(1-G(-c))^2} < 0$$

Case 2: Endogenous Divorce

In the general case with endogenous divorce the same method can be used to determine the set of couples for whom joint custody will be optimal. This is given by;

$$\left\{(\theta_h,\theta_w) : \frac{\theta_w}{\theta_h} \in \left[\frac{1-G(\phi^*)+S-h'(\phi^*)}{1+G(\phi^*)-S+h'(\phi^*)}, \frac{1+G(\phi^*)-S+h'(\phi^*)}{1-G(-c)+S-h'(\phi^*)}\right]\right\}$$

where $S = ((\theta_h+\theta_w)\,\Delta\,(q)+c)$, and from A5 we have that $1-G(\phi^*)+S-h'(\phi^*) \geq 0$. To summarize, joint custody is optimal for this set of couples because the wife's investment moves with her custody if $\frac{\theta_w}{\theta_h} \geq \frac{1-G(\phi^*)+S-h'(\phi^*)}{1+G(\phi^*)-S+h'(\phi^*)}$ and the husband's investment moves with his own custody if $\frac{\theta_w}{\theta_h} \leq \frac{1+G(\phi^*)-S+h'(\phi^*)}{1-G(-c)+S-h'(\phi^*)}$. In the above region both spouses optimally have some positive custodial share. To see this consider a couple with preference heterogeneity so that $\frac{\theta_w}{\theta_h} > \frac{1+G(\phi^*)-S+h'(\phi^*)}{1-G(-c)+S-h'(\phi^*)}$. The wife's investment increases with an increment to her custody, and the husband's decreases with an increment to his own custody. Hence both spouse are better off if the wife has sole custody. To understand which spouse has the majority share of custody, there are four cases to consider.

(i) $1+G(\phi^*) > S-h'(\phi^*) > -G(\phi^*)$

In this region $h'(\phi^*) > S$ so the incentives to invest arising from the higher expected happiness in marriage outweigh the disincentives arising from the weakened endogenous divorce effect. The net effect of these incentives is now similar to the case where divorce occurs for exogenous reasons, but the set of couples for whom

joint custody is optimal is greater than that given in (10).

(ii) $G(\phi^*) > S - h'(\phi^*) > 0$

In this region the incentives to invest arising from endogenous divorce slightly dominate those arising from the happiness effect. The net effect of these incentives is still similar to the case where divorce occurs for exogenous reasons, except that a smaller set of couples find it optimal to have joint custody compared to (10). Clearly at the border of regions (i) and (ii) when $S = h'(\phi^*)$ the two new effects arising from endogenous divorce exactly offset each other and the set of couples who optimally choose joint custody is the same as in the case where divorce occurs only for exogenous reasons.

(iii) $1 + G(\phi^*) > S - h'(\phi^*) > G(\phi^*)$

In this range the incentive to have less own custody arising from the weakened endogenous divorce begins to dominate those arising from exogenous divorce. The wife's investment increases in her own share of custody if;

$$\frac{\theta_w}{\theta_h} \geq \frac{1 - G(\phi^*) + S - h'(\phi^*)}{1 + G(\phi^*) - S + h'(\phi^*)} > 1$$

Hence the wife's investment only increases in her own custody if she values child quality sufficiently *more* than her husband. For couples such that $\frac{\theta_w}{\theta_h} > \frac{1-G(\phi^*)+S-h'(\phi^*)}{1+G(\phi^*)-S+h'(\phi^*)}$ the wife's incentives increase with more custody, the husbands fall with more custody to him. Hence the wife still has sole custody if she values child quality sufficiently more than her husband. Similarly for couples with $\frac{\theta_w}{\theta_h} < \frac{1+G(\phi^*)-S+h'(\phi^*)}{1-G(-c)+S-h'(\phi^*)}$ the husband optimally has sole custody. For couples with relatively homogeneous preferences such that;

$$\left\{(\theta_h, \theta_w) : \frac{\theta_w}{\theta_h} \in \left[\frac{1 + G(\phi^*) - S + h'(\phi^*)}{1 - G(-c) + S - h'(\phi^*)}, \frac{1 - G(\phi^*) + S - h'(\phi^*)}{1 + G(\phi^*) - S + h'(\phi^*)}\right]\right\}$$

the dominant effect is for both spouses to prefer their spouse to have more custody. This is optimally traded off so that both spouses have some custodial share, with the high valuation spouse having the smaller share. This is because the disincentives to invest when a spouse has more own custody is greater for the high valuation spouse, and so investments, and the marriage surplus, are maximized if the low valuation spouse has the majority custodial share.

(iv) $S - h'(\phi^*) > 1 + G(\phi^*)$

In this range the incentive to have less own custody arising from the weakened endogenous divorce effect dominates all other effects. The wife's investment increases in her own share of custody if;

$$\frac{\theta_w}{\theta_h} \leq \frac{1 - G(\phi^*) + S - h'(\phi^*)}{1 + G(\phi^*) - S + h'(\phi^*)} < 0$$

which is a contradiction as valuations of child quality cannot be negative. In other words it is *always* the case that investment of either spouse increases if they have *less* custody. Hence joint custody will be optimal for all couples, with the low valuation spouse having the majority custodial share.■

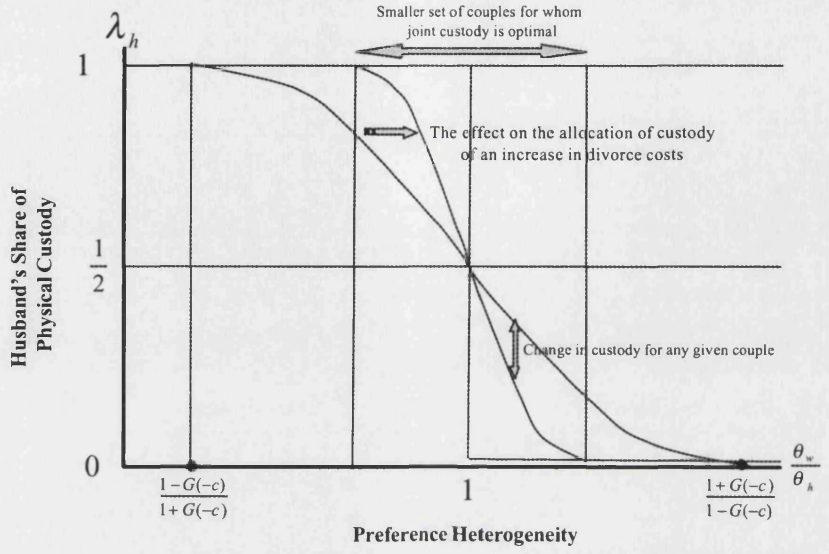

Figure 1: The Optimal Allocation of Physical Custody if Divorce Occurs for Exogenous Reasons

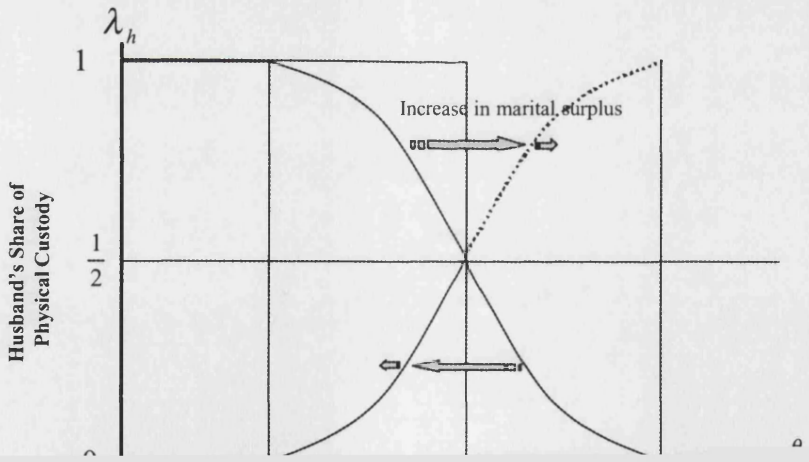

Figure 2: The Optimal Allocation of Physical Custody With Endogenous Divorce

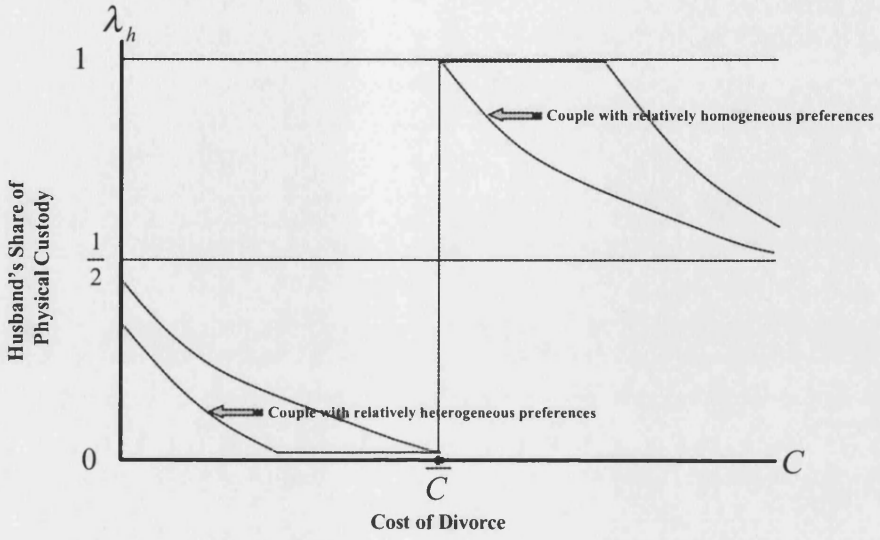

Figure 3: The Cost of Divorce and the Optimal Allocation of Physical Custody

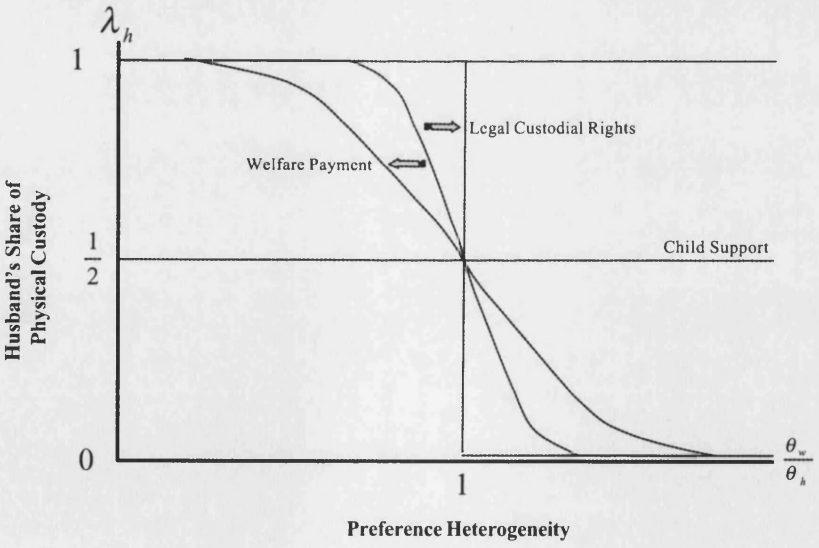

Figure 4: Family Policy and the Optimal Allocation of Physical Custody

4 The Impact of Divorce Laws on Marriage

The family is a building block of society that has changed dramatically over the past two generations. Most attention has been on the rise in divorce. In particular, whether there exists a causal relation between divorce laws and the rise in divorce rates. Ironically much of this debate has taken place when divorce rates have been falling. Indeed the last 15 years have witnessed the longest period of sustained decline in divorce in America since records began in 1860.[80]

Of more concern now is the sustained decline in marriage. Today, fewer people are marrying than at any time in the past 40 years, the children of the unmarried account for nearly as many as those living in single parent households, and the majority of births occur out of wedlock.[81]

The decline in marriage is of concern if we believe marriage to be a good thing, in that there are positive private and social returns to marriage. A large body of literature, summarized in Waite and Gallagher (2000), shows a strong correlation between being married and having better health, higher wages, and accumulating more wealth. They argue these effects exist for married individuals relative to cohabitees as well as divorced individuals.

Furthermore, changing marital patterns have implications for the life cycle behavior of individuals - their attachment to the labor market, savings, and fertility. Even ignoring the welfare consequences of those directly involved, the decline in marriage has macroeconomic consequences that affect us all.

This paper studies the effects of divorce law changes on incentives to marry. In particular I consider the effects on marriage rates of two changes in divorce law - (i) from mutual consent to unilateral divorce; (ii) from fault based to no-fault divorce. In much of the earlier literature these laws have been referred to almost interchangeably. However economic theory would suggest they ought to have very different effects on incentives to marry.

Unilateral divorce re-assigns the right to divorce. In contrast, no-fault divorce

[80] This paper focuses exclusively on the United States. Similar trends in marriage and divorce are observed in the UK and Canada, both of which have reformed divorce laws as in the United States.

[81] In 1994 37% of children in single parent households were living with divorced parents, 36% were living with a never married parent, and the remainder lived with a separated parent (Bureau of the Census (1996)). The percentage of births to unmarried women rose from 5% in 1940 to 65% in 2000 (National Vital Statistics Report (2000)).

reduces the costs of exiting marriage.[82]

If spouses can bargain efficiently, the Coase theorem implies that moving from mutual consent to unilateral divorce only affects the distribution of welfare within marriage, not the incidence of marriage and divorce. However spouses may be unable to bargain efficiently because they cannot commit *ex ante* to all possible divisions of the gains from marriage, or because the benefits from household public goods such as children are neither divisible nor transferable. In this case the incidence of marriage and divorce would be different under mutual consent and unilateral divorce regimes.

To make precise the effects of both laws, I proceed in two stages. I first set out a model of search in marriage markets, where individuals learn the true gains from marriage over divorce before and during marriage. I then test the predictions of the theory using US state level panel data on marriage rates over the period 1960-2000.

The search model makes precise that when spouses are unable to bargain efficiently, moving from mutual consent to unilateral divorce has two effects which work in opposite directions - (i) the probability of divorce for any given couple rises, reducing the value of marrying today; (ii) each spouse is guaranteed at least their payoff in divorce if the marriage continues, and so cannot be locked into a bad marriage. This increases the value of marrying today.

If the first order effect of unilateral divorce is to increase the probability of divorce, individuals are only willing to enter matches of potentially *higher* quality than under mutual consent divorce. This increases the average quality of matched couples.

In this case, unilateral divorce causes individuals to become *more* selective in the marriage market, the flow of singles into marriage decreases, but because the probability of divorce rises, the stock of singles increases. Hence the change in the steady state marriage rate is ambiguous. Similarly the effect on the divorce rate is ambiguous because although the flow of individuals from marriage into divorce increases, the stock of married individuals falls.

If the first order effect of unilateral divorce is to ensure spouses cannot be locked into a bad marriage, then individuals are willing to enter matches of potentially *lower* quality than under mutual consent divorce. This worsens the average quality of matched couples as individuals are less selective in the marriage market. The effects on the marriage market then work in the opposite direction.

Which of these two channels is more important cannot be determined *a priori*. It

[82] Jacob (1988) also argues that unilateral divorce has no relation to the cost of divorce.

is left to the empirical analysis to distinguish which affect dominates.

Moving from fault based to no-fault divorce lowers the costs of exiting marriage. Divorce costs are lower under no-fault because less proof is required to file for divorce, and courts cannot impose financial penalties on at-fault spouses. By reducing the costs of exiting marriage, no-fault divorce raises spouse's divorce payoffs, and increases the lifetime value of marrying today. This is because the lower expected gains from marriage are more than offset by the higher expected payoff in divorce.

Under no-fault divorce individuals are willing to enter a match of potentially *lower* quality than under fault based divorce, precisely because the cost of exiting marriage has fallen. This increases the marriage rate, worsens the average quality of matched couples, and subsequently leads to a higher steady state divorce rate.[83]

The model thus makes clear that each law has different effects on marital formation, marital dissolution, and selection into marriage. The empirical section of the paper tests these predictions using state level panel data.

The main results are the following. First, marriage rates declined significantly in states that adopted unilateral divorce. Prior to the introduction of unilateral divorce, marriage rates were 20% higher in states that eventually adopted, compared to non-adopting states. The decline in marriage caused by unilateral divorce is present a decade after the implementation of unilateral divorce and accounts for half of the initial gap in marriage rates between adopting and non-adopting states. The effects are greatest in marriages involving younger age cohorts, whites, and those marrying for the first time.

The result that unilateral divorce caused a decline in marriage, is consistent with the probability of any given couple divorcing having risen and more than offset the effect that individuals cannot be locked into a bad marriage.

Second, the composition of those marrying under unilateral divorce differed from earlier marriage cohorts. In particular, the difference-in-difference in the duration of marriages that take place under unilateral divorce rather than mutual consent, increases significantly. This suggests unilateral divorce causes better selection into

[83] Models of search in marriage markets borrow heavily from the labor literature. No-fault divorce is similar to reducing firing costs. The fact that this has an effect on match formation is well established in the labor literature. However, the move from mutual consent to unilateral divorce is not so easily translatable into the labor literature. This is particularly so because families, unlike workers and firms, may not be able to bargain efficiently. Furthermore, assortive matching in marriage markets is perhaps more prevalent than in the labor market (Burdett and Coles (1997)).

marriage.

Throughout I find little or no evidence that no-fault divorce affected marriage rates. Taken together, the results suggest the first order effect of changes in divorce laws on marriage has been through changes in the right to divorce, rather than the costs of exiting marriage.

This paper makes three contributions to the literature. First, the theoretical analysis makes clear the effects of divorce law on selection into marriage, marital formation, marital dissolution, and the relation between the two.

Second the paper clearly distinguishes theoretically and empirically, the effects of unilateral and no-fault divorce on marriage rates.[84] Unilateral divorce accounts for much of the decline in marriage especially amongst younger cohorts. This result is robust to the inclusion of other laws such as legalized abortion, and other observable determinants of marriage rates. The effect of unilateral divorce is qualitatively large. Its introduction has the equivalent disincentive effects on marriage as a 16% rise in the female-male earnings ratio.

Third, the paper helps explain earlier findings in the literature on the relation between divorce laws and divorce rates (Friedberg (1998), Gruber (2000), Wolfers (2000)). By not explicitly taking account of the (perhaps unintended) effects of divorce laws on incentives to marry and selection into marriage, least squares estimates of the impact of divorce laws on divorce rates are likely to be underestimated.

The paper is organized as follows. Section two provides an overview of changes in divorce law that swept through America in the 1970s. Section three presents a model of search and learning in marriage markets. Section four contains the empirical analysis. Section five concludes. Proofs and data definitions are in the appendices.

5 A Brief History of Divorce Law

The 1970s witnessed major changes in divorce laws. Foremost of these was the introduction of unilateral divorce. Between 1968 and 1977 the majority of states passed such laws, moving from a regime in which the dissolution of marriage required the

[84] Brinig and Crafton (1994) regress state level marriage rates (defined as the number of marriages per 1000 of the population) from 1965-87 on a time trend, state adult population and a dummy for unilateral divorce (which they refer to as no-fault) but do not include state fixed effects. They find a significantly negative effect of unilateral divorce on marriage rates.

mutual consent of both spouses, to one in which spouses could unilaterally file for divorce.

To understand the motivation behind such laws, it is instructive to consider the case of California, one of the earliest adopters.[85] Criticism of the mutual consent system stemmed from the view that it reduced the welfare of spouses, and led to perjured testimony in collusive divorce proceedings that fostered disrespect towards the law.[86] Californian legislators believed they would improve welfare within families and end the legal convention in which extreme cruelty was almost the only universal ground for divorce (Parkman (1992)). The Californian Family Law Act became effective in 1970 and established two grounds on which spouses could unilaterally file for divorce - (i) irreconcilable differences; (ii) incurable insanity.

The reform received widespread support from conservative sections of society who perceived it as strengthening families and *reducing* the opportunities for divorce. Lobbies for divorced men and feminist groups also supported the move. Male lobby groups perceived mutual consent divorce to work in favor of wives because men had to "bribe" their wives for them to agree to divorce. Feminist lobbies viewed the reform as eliminating an unjust element of the legal system because women were often unable to "bribe" their husbands to divorce. Little if any consideration was given to the effect on the incentives to marry.

In addition to changing the right to divorce, the Californian law also established that the assignment of fault did not have to be established in divorce cases, nor did fault play any role in divorce settlements. Figure 1 shows the rapid spread of both unilateral and no-fault divorce laws. Table 1 gives the years in which the laws were passed by state.

This second strand of California's law change, no-fault divorce, has often been confused with unilateral divorce. The *innovative* part of the Californian legislation was the introduction of unilateral divorce. As Gruber (2000) notes, in 1960 some 20%

[85]The Californian experience is important because the National Conference on Commissioners of Uniform State Laws later based the standard for marital dissolution in the Uniform Marriage and Divorce Act (1974) on California's requirements for divorce.

[86]Both problems stem from whether spouses bargain efficiently. If spouses were unable or unwilling to make such agreements, the marriage could not be dissolved under mutual consent even though it would be Pareto efficient to do so. If spouses could bargain efficiently, the perception was that men had to "bribe" their wives in order for them to consent to divorce leading to collusion between spouses in court proceedings. Ellman *et al* (1998) provide evidence on how perjured testimony and collusion between spouses, were commonplace in divorce cases under mutual consent.

of the population already resided in no-fault states. Distinguishing unilateral from no-fault divorce is important because each law has different effects on incentives to marry.

The search model set out in the next section makes clear that when spouses are unable to bargain efficiently, moving from mutual consent to unilateral divorce has two effects - (i) it increases the probability of future divorce for any given couple, reducing the expected lifetime value of marrying today; (ii) it guarantees each spouse at least their divorce payoff in marriage, so that they cannot be locked into a bad marriage, and this increases the expected lifetime value of marrying today.

If the first order effect of unilateral divorce is to increase the probability of divorce, individuals are only willing to enter matches of potentially *higher* quality than under mutual consent divorce. This can cause the marriage rate to fall. As the average quality of matched couples increases, in the long run this can cause the divorce rate to fall.

In contrast, moving from fault based to no-fault divorce lowers the costs of exiting marriage. Individuals are willing to enter a match of potentially *lower* quality than under fault based divorce, precisely because it is easier to leave any marriage. This increases the marriage rate, worsens the average quality of matched couples, and subsequently leads to a higher steady state divorce rate.

6 A Basic Framework

The marriage market is modelled in discrete time with finitely lived risk neutral participants.[87] Each period new individuals are born into the marriage market at rate $1 - \beta$, and the same fraction of individuals die each period. Birth and death rates are the same across men and women, so total population remains constant and is normalized to one, with an equal number of men and women. An individual can be in one of three marital states - married, divorced or single (i.e. never married). The timing of the marriage market is as follows;

1. each period every surviving individual matches with a person of the opposite sex with certainty. The matched couple receive an imperfect signal (σ) of the gain from their potential marriage.

[87] I extend the model in Bougheas and Georgellis (1999) to take account of remarriage, derive steady state marriage and divorce rates, and consider the effect of unilateral divorce.

2. each individual decides to marry or remain single. If at least one of the matched couple decides to remain single, both go back into the marriage market.

3. if they marry, the actual gain from marriage (ϕ) is realized in the next period. The couple can then either remain married forever or divorce and remain divorced forever.

This framework emphasizes the role of learning in marriage markets. There are two stages of learning - first, when individuals meet in the marriage market they learn something but not everything about each other, embodied in the signal, σ. The signal can be thought of as being related to the immediately observable traits of a potential marriage partner.[88] The signal determines whether an individual is better off marrying today or remaining single.

The second stage of learning takes place within marriage. Married individuals update their prior beliefs about the gains from marriage (ϕ) by accumulating knowledge during marriage. This determines whether the individual is better off remaining married or divorcing.[89] Divorce is thus an optimal response to new information received during marriage.

Individuals do not remarry and all participants are *ex ante* identical. I relax both of these assumptions later.

The signal of the gains from marriage takes a realization in the closed set $[\underline{\sigma}, ..., \overline{\sigma}] = \Sigma$. The probability density function of signals is $f(\sigma)$, assumed everywhere positive, with associated cumulative density $F(\sigma)$. Conditional on the signal, the actual gain from marriage is ϕ with probability $g(\phi|\sigma)$. The distribution $g(\phi|\sigma)$ is assumed unimodal and symmetric with support $[\underline{\phi}, \overline{\phi}]$ for all signals. The associated cumulative distribution is $G(\phi|\sigma)$.

I assume signals are ordered such that the distribution of the gains from marriage generated by higher signals stochastically dominate the distributions given by lower signals;

[88] These traits relate to market outcomes, such as earnings capacity, as well as non-market outcomes, such as personality.

[89] In the labor literature, search models emphasize both "on-the-job" search, where separation occurs as workers re-evaluate the value of the current match as information about alternative matches becomes available; and learning about job characteristics, where separation occurs as workers learn the true quality of the match. Previous models of search in marriage markets include Becker *et al* (1977) and Mortensen (1988)). This model builds on Bougheas and Georgellis (1999), and focuses on learning before and within marriage. Allowing for on-the-job search gives qualitatively similar results if the cost of searching on-the job is sufficiently higher than the cost of search for singles.

Assumption 1 (Stochastic Dominance): $G_\sigma(\phi|\sigma) < 0$ for all ϕ.

Higher signals therefore imply higher expected gains from marriage. Married individuals are better off remaining married if the payoff in marriage is higher than the divorce payoff each period. The per period payoff to remaining married is ϕ, the per period divorce payoff is exogenously given by ϕ^*.[90]

Hence the expected lifetime value of marrying today having received signal σ in the marriage market is;

$$V(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi g(\phi|\sigma) d\phi + \frac{\beta}{1-\beta} \left[\int_{\phi^*}^{\overline{\phi}} \phi g(\phi|\sigma) d\phi + G(\phi^*|\sigma)\phi^* \right] \quad (1)$$

where β is the probability the individual survives into the next period. The first term is the expected marriage payoff in the first period of marriage, conditional on having received signal σ. The first term in brackets is the expected payoff in marriage from the second period of marriage onwards, conditional on the marriage remaining intact, namely if $\phi \geq \phi^*$. The second term in brackets is the expected divorce payoff where $G(\phi^*|\sigma)$ is the conditional probability of the couple divorcing.

If the individual were to receive a higher signal in the marriage market, the expected payoff in marriage in the first period of marriage increases because of the stochastic dominance of signals. The expected marriage benefits from the first period onwards also rise due to the same reason, but the expected divorce payoff falls. To ensure this last effect does not dominate;

Assumption 2: $\frac{\partial}{\partial \sigma} \left(\frac{g(\phi|\sigma)}{1-G(\phi^*|\sigma)} \right) = h_\sigma(\phi|\sigma) > 0.$

Intuitively, as the signal improves individuals shift weight from their expected divorce payoff to the expected payoff in marriage conditional on the marriage remaining intact, $h(\phi|\sigma)$. The value of marrying today increases as long as this expected payoff is itself increasing in the signal. This is what assumption 2 says.

Lemma 1: *If assumption 2 holds, the lifetime value of marrying today increases in the signal:* $V_\sigma(M|\sigma) > 0$.

After observing the signal, individuals decide whether to marry or remain single.

[90] The results are robust to the divorce payoff being stochastic as long as its expected value is independent of the signal σ.

The value of remaining single is;

$$V(S) = -c + \beta \int_{\underline{\sigma}}^{\overline{\sigma}} \max\left[V(M|\sigma), V(S)\right] f(\sigma) d\sigma \tag{2}$$

where the per period payoff to singles is normalized to zero and c is the per period search cost. The second term is the expected value of the optimal decision in the next period.[91]

Assumption 3: There exists a reservation signal $\sigma_R \in \Sigma$, such that $V(M|\sigma_R) = V(S)$.

In other words there exists at least one signal for which individuals would prefer to marry than remain single. By lemma 1, for all $\sigma \in (\sigma_R, \overline{\sigma}]$, $V(M|\sigma) > V(S)$ and *vice versa* for all $\sigma \in [\underline{\sigma}, \sigma_R)$. The lifetime value of remaining single can then be rewritten as;

$$V(S) = -c + \beta \int_{\underline{\sigma}}^{\sigma_R} V(S) f(\sigma) d\sigma + \beta \int_{\sigma_R}^{\overline{\sigma}} V(M|\sigma) f(\sigma) d\sigma$$

Solving for $V(S)$;

$$V(S) = \frac{-c + \beta \int_{\sigma_R}^{\overline{\sigma}} V(M|\sigma) f(\sigma) d\sigma}{1 - \beta F(\sigma_R)} \tag{3}$$

The value of remaining single depends on the per period payoff to being single, and the expected value of marrying from the next period onwards. Both factors are discounted at a rate which increases in the probability of no suitable match being found.[92]

The reservation signal σ_R is set where individuals are indifferent between marrying today and remaining single;

$$V(M|\sigma_R) = V(S) \tag{4}$$

The value of marriage (1), remaining single (3) and equilibrium reservation signal (4), determine the marriage market equilibrium. The comparative statics properties of the equilibrium hinge on how the value of marriage and remaining single change with the reservation signal.

[91] The per period search cost c is assumed to be small so that $V(S) > 0$ and individuals always enter the marriage market.

[92] In other words as the reservation signal, σ_R, rises the individual is more likely to remain single and so the expected payoff next period is discounted less.

From lemma 1, if individuals set a higher reservation signal, the value of marrying today rises. This value increases more quickly in the reservation signal, the more informative signals are about the true gains from marriage;

Definition (Informativeness of Signals): *Consider two distributions of marriage market signals, σ^1 and σ^2 with support Σ. Signal σ^1 is more informative than σ^2 if for all $\sigma^1 = \sigma^2 \in \Sigma$;*

$$\frac{\partial}{\partial \phi}\left(\frac{g_\sigma(\phi|\sigma^1)}{g(\phi|\sigma^1)}\right) > \frac{\partial}{\partial \phi}\left(\frac{g_\sigma(\phi|\sigma^2)}{g(\phi|\sigma^2)}\right) > 0 \tag{5}$$

This definition has an intuitive interpretation. The term $\frac{g_\sigma(\phi|\sigma)}{g(\phi|\sigma)}$ is the likelihood that as the signal improves, the actual gain from marriage is ϕ. The requirement that this likelihood increases in the gains from marriage is the standard monotone likelihood ratio property (Milgrom (1981)). It implies that as the realization of the gains from marriage rises, the likelihood of obtaining a gain of ϕ is higher for higher signals. The signal σ^1 is more informative than σ^2 if the likelihood of getting ϕ increases more quickly conditional on signal σ^1 than σ^2.

The value of remaining single also increases as individuals set higher reservation signals. This is because the individual is more likely to remain single next period, so the future is discounted less heavily. In addition, the value of marriage next period rises, but the individual forgoes the value of the marginal marriage, $V(M|\sigma_R)$, today. This increases the value of remaining single if signals are informative.

However the value of marrying today is more responsive to changes in the reservation signal if signals are informative because the informativeness of signals has a direct effect on the value of marriage today, while the effect on the value of remaining single works through the (discounted) expected value of marrying next period.

The determination of the equilibrium signal is shown in figure A. Whenever signals are informative, the value of marrying today increases more quickly in the reservation signal than the value of remaining single. The model captures the intuition that if the lifetime value of marrying today rises, the equilibrium reservation signal falls. Individuals are willing to trade-off being in a lower quality match, with higher lifetime gains from marriage over divorce. This trade-off occurs when signals are informative.[93]

[93]If signals were uninformative, individuals would need to receive a higher signal in the marriage market to want to marry because the value of remaining single would increase more quickly in signals than the value of marrying today. With completely uninformative signals, the value of marrying

Allowing Remarriage

Consider a richer framework in which individuals can remarry. The expected lifetime value of marrying today, having received signal σ is;

$$V(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi g(\phi|\sigma) d\phi + \frac{\beta}{1-\beta} \int_{\phi^*}^{\overline{\phi}} \phi g(\phi|\sigma) d\phi + \beta G(\phi^*|\sigma) V(S) \tag{6}$$

where $V(S)$ is the value of remaining single. The lifetime value of marrying today is still increasing in the signal received today under assumption 1.[94] Allowing for remarriage increases the divorce payoff from ϕ^* to $V(S)$, effectively reducing the cost of exiting marriage. Hence the value of marrying today is *underestimated* in the previous framework because the cost of divorcing is overestimated. The degree to which it is underestimated increases as divorcees remarry more frequently.[95] In short, allowing for remarriage reduces the equilibrium reservation signal set in the marriage market, reducing the average quality of marriages.

Marriage Market Equilibrium

To close the model I derive steady state marriage and divorce rates assuming individuals can remarry. Individuals can thus either be single or married. In steady state, the proportion of the population in each marital state k, n_k, $k \in \{s, m\}$ is constant. Individuals flow into singlehood through birth and divorce, and leave through marriage or death. Similarly individuals become married when they find suitable matches, and leave through death or divorce. The following flow equations define the steady state;

$$\begin{aligned} (1-\beta) + \beta D n_m &= \beta \left(1 - F(\sigma_R)\right) n_s + (1-\beta) n_s \\ \beta(1 - F(\sigma_R)) n_s &= \beta D n_m + (1-\beta) n_m \\ n_s + n_m &= 1 \end{aligned} \tag{7}$$

today is the same for all signals. If signals are perfectly informative, married individuals never divorce. Given positive search costs and positive probability of death, the expected duration of search for singles is always finite.

[94] The value of remaining single is independent of the signal received today because - (i) individuals cannot recall past matches in the marriage market; (ii) individuals do not direct their search so signals are uncorrelated over time.

[95] The basic framework would understate the true value of marriage by less if the expected gain in marriage were declining in the number of times previously married.

where $1 - F(\sigma_R)$ is the flow of singles into marriage, $D = \int_{\sigma_R}^{\overline{\sigma}} G(\phi^*|\sigma) f(\sigma)\, d\sigma$ is the flow of married individuals into singlehood, and I make the simplifying assumption that married couples die together. Solving for n_k;[96]

$$n_s^* = \frac{(1-\beta) + \beta D}{1 - \beta\left(F(\sigma_R) - D\right)};\ n_m^* = \frac{\beta\left(1 - F(\sigma_R)\right)}{1 - \beta\left(F(\sigma_R) - D\right)}$$

To summarize, when individuals can remarry, signals are informative, and married couples die together;

Lemma 2: *The stock of singles increases in both the reservation signal, and the flow of married individuals into singlehood. The stock of married individuals decreases in both the reservation signal, and the flow of married individuals into singlehood.*

As total population is normalized to one, the marriage rate is the fraction of singles that marry each period;

$$MR = \left(1 - F(\sigma_R)\right) n_s^* \tag{8}$$

This is the flow of singles into marriage, multiplied by the stock of singles. Finally the divorce rate is;

$$DR = \left(\int_{\sigma_R}^{\overline{\sigma}} G(\phi^*|\sigma) f(\sigma)\, d\sigma\right) n_m^* \tag{9}$$

which is the flow of married individuals into singlehood, multiplied by the stock of married individuals. Straightforward differentiation leads to the following result;

Lemma 3: *The marriage rate decreases in the reservation signal, and increases in the flow of individuals from marriage into singlehood. The divorce rate decreases in the reservation signal and increases in the flow of individuals from marriage into singlehood.*

The marriage rate falls as individuals set higher reservation signals because the decreased flow of singles into marriage more than offsets the increased stock of singles. Setting higher reservation signals leads to selection into marriage - newly married couples are less likely to divorce for any given realization of gains from marriage. The divorce rate falls in steady state because there are fewer married individuals and there is a reduced flow from marriage back into singlehood.

[96] This implies a positive fraction of the population *never* marries, and this fraction increases in the reservation signal.

From (8) and (9), the relation between marriage and divorce rates is;

$$DR = \frac{\beta D}{1 - \beta\left(F(\sigma_R) - D\right)} MR \tag{10}$$

This implies that - (i) the divorce rate is less than the marriage rate; (ii) the divorce rate is less responsive than the marriage rate to the reservation signal; (iii) the divorce rate is more responsive than the marriage rate to the flow of individuals from marriage into singlehood.

Having described the process of marital formation, dissolution and the relationship between the two, I now use these results to consider two comparative statics exercises - the move from fault based divorce to no-fault divorce, and the move from mutual consent to unilateral divorce.

6.1 No-fault Divorce

Moving from fault based divorce to no-fault divorce reduces the cost of exiting marriage, or equivalently, raises the divorce payoff (ϕ^*) vis-à-vis the payoff in marriage. This has two effects - (i) the lifetime value of marrying today rises because of the increase in the expected divorce payoff[97]; (ii) the lifetime value of remaining single rises because the value of the marrying next period increases.

The first effect dominates at any *given* reservation signal because the expected value of marrying next period is discounted by the probability of the individual surviving one period and a suitable match being found.

With informative signals, as the cost of exiting marriage falls, individuals prefer to marry today rather than wait another period in the hope of receiving a better signal. Individuals optimally set lower reservation signals and so marry with *higher* probability in the current period.

Lemma 4: *If the cost of exiting marriage falls, the equilibrium reservation signal in the marriage market decreases if marriage market signals are informative. The average quality of matched couples falls.*

[97] To see this note that;

$$\frac{\partial V(M|\sigma)}{\partial \phi^*} = \frac{\beta}{1-\beta}\left[-\phi^* g(\phi^*|\sigma) + g(\phi^*|\sigma)V(S) + G(\phi^*|\sigma)\frac{\partial V(S)}{\partial \phi^*}\right] > 0$$

The result is shown in figure B. As the cost of exiting marriage falls individuals are less selective in whom they marry if signals are informative. Individuals are willing to trade-off being in a potentially lower quality marriage, against obtaining the increased lifetime value of marriage. Hence newly matched couples are of lower quality than existing marriages.[98]

To see the effect of no-fault divorce on marriage market equilibrium, recall the marriage rate is;

$$MR = (1 - F(\sigma_R))\, n_s^*$$

If the cost of exiting marriage falls, the marriage rate *rises* if signals are informative because individuals optimally set *lower* reservation signals. In steady state, the marriage rate rises because the increased *flow* from singlehood into marriage more than offsets the fall in the *stock* of singles.[99]

Turning to the divorce rate, this is the fraction of married couples that have lower realized period payoffs in marriage than divorce;

$$DR = \left(\int_{\sigma_R}^{\overline{\sigma}} G(\phi^* | \sigma) f(\sigma)\, d\sigma \right) n_m^*$$

The introduction of no-fault divorce has two effects on the divorce rate. First, for the *existing* stock of married couples the likelihood of divorce rises. Second, if signals are informative, the reservation signal falls, and the marriage rate increases. Newly married couples are less well matched than the *existing* stock of married couples causing the divorce rate to rise further in the new steady state.

To summarize;

Result 1: *The introduction of no-fault divorce - (i) decreases the reservation signal; (ii) increases the marriage rate; (ii) causes couples to become worse matched, and the divorce rate to rise in the new steady state.*

[98] The intuition holds more generally. If there is an exogenous decrease in the gains from marriage over divorce, the equilibrium reservation signal falls, and the average quality of matched couples falls. This implies individuals search for less time in the marriage market as the gains from the match fall.

[99] To see this;

$$\frac{\partial MR}{\partial \sigma_R} = (1 - F(\sigma_R)) \frac{\partial n_s^*}{\partial \sigma} - f(\sigma_R) n_s^* = \left(\frac{\beta - 1 - \beta D}{1 - \beta(D - F(\sigma_R))} \right) f(\sigma_R) n_s^* < 0$$

6.2 Unilateral Divorce

To analyze the effect of moving from mutual consent to unilateral divorce, I extend the framework to allow for heterogeneity across genders. As discussed in section two, the divorce regime affects marriage and divorce rates only when spouses cannot bargain efficiently. This may be because not all divisions of the gains from marriage cannot be *ex ante* committed to, or because benefits such as those arising from children, are neither transferable nor divisible. In this section I take the extreme case where utility is non-transferable between spouses.

A natural way to introduce heterogeneity is to allow divorce payoffs to differ by gender;

Assumption 4 (Heterogeneity) : Men (m) have higher divorce payoffs than women (w): $\phi^{*m} > \phi^{*w}$.

Denote the joint distribution of spousal benefits in marriage, conditional on the couple having received signal σ as $g(\phi^m, \phi^w|\sigma)$ with support $[\underline{\phi}, \overline{\phi}] \times [\underline{\phi}, \overline{\phi}]$ and joint cumulative distribution $G(\phi^m, \phi^w|\sigma)$.

Analogous to assumptions 1 and 3, I assume - (i) signals are ordered such that the distribution of marriage benefits generated by higher signals stochastically dominate the distributions given by lower signals; (ii) there exists a reservation signal σ_R^j such that $V^j(M|\sigma_R^j) = V^j(S)$ for $j \in \{m, w\}$.[100]

The lifetime value of marrying today depends on the divorce regime. Under mutual consent this is;

$$V_m^j(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi^j g(\phi^j|\sigma) d\phi^j + \frac{\beta}{1-\beta} \left[\begin{array}{c} (1 - G(\phi^{m*}, \phi^{w*}|\sigma)) \int_{\underline{\phi}}^{\overline{\phi}} \phi^j g(\phi^j|\sigma) d\phi^j \\ + (1-\beta) G(\phi^{m*}, \phi^{w*}|\sigma) V_m^j(S) \end{array} \right] \quad (11)$$

where $V_m^j(S)$ is the value of remaining single in a mutual consent regime. The first term is the expected payoff in the first period of marriage, where $g(\phi^j|\sigma)$ is j's marginal conditional distribution of payoffs. With probability $1 - G(\phi^{m*}, \phi^{w*}|\sigma)$ at least one spouse wishes to remain married, the expected payoff in marriage being calculated over all possible realizations to j, not just those greater than ϕ^{j*}. With probability $G(\phi^{m*}, \phi^{w*}|\sigma)$ divorce occurs and spouses return to the marriage market.

[100] Stochastic dominance in this multi-dimensional setting places further restrictions on the payoff in marriage (Atkinson and Bourguignon (1982)).

Under unilateral divorce the probability the marriage remains intact is;

$$S\left(\phi^{m*},\phi^{w*}|\sigma\right)=\int_{\phi^{m*}}^{\overline{\phi}}\int_{\phi^{w*}}^{\overline{\phi}}g(\phi^{m},\phi^{w}|\sigma)d\phi^{m}d\phi^{w}$$

the probability that neither spouse wishes to divorce. Therefore the probability any given couple divorces is $1-S(\phi^{m*},\phi^{w*}|\sigma)$. Under unilateral divorce the lifetime value of marrying today is;

$$V_u^j(M|\sigma)=\int_{\underline{\phi}}^{\overline{\phi}}\phi^j g(\phi^j|\sigma)d\phi^j+\frac{\beta}{1-\beta}\left[\begin{array}{c}S(\phi^{m*},\phi^{w*}|\sigma)\int_{\phi^{j*}}^{\overline{\phi}}\phi^j g(\phi^j|.)d\phi^j\\+(1-\beta)\left(1-S(\phi^{m*},\phi^{w*}|\sigma)\right)V_u^j(S)\end{array}\right] \quad (12)$$

where $-j$ denotes j's spouse and $g(\phi^j|.)=g(\phi^j|\phi^{-j}\geq\phi^{-j*},\sigma)$. Unlike under mutual consent, if the marriage remains intact each spouses obtains at least their own divorce payoff. Spouses cannot be locked into "bad" marriages that they would leave if they had the right to. Figure C makes clear how the likelihood of divorce under each regime relates to individual gains from marriage over divorce.

The next result establishes the ranking of reservation signals across genders;

Lemma 5: *If the gain from marriage over divorce rises for spouse j, the equilibrium reservation signal σ_R^j, increases if signals are informative under either a mutual consent, or unilateral divorce regime.*

Given men have higher divorce payoffs than women so gain less from marriage over divorce, an immediate implication is that men set lower reservation signals than women, $\sigma_R^w>\sigma_R^m$. Men are more likely to marry any woman they match with, than women are to marry any man they match with. As both have to consent to marriage, the marriage rate is determined by the reservation signal set by women.

The steady state marriage and divorce rates under unilateral divorce are given by;

$$MR=\left(1-F(\sigma_R^w)\right)n_s^*$$

$$DR=\left(\int_{\sigma_R^w}^{\overline{\sigma}}\left(1-S(\phi^{m*},\phi^{w*}|\sigma)\right)f(\sigma)\,d\sigma\right)n_m^*$$

The steady state proportions of the population in each marital state is determined by a set of equations analogous to before, where two things have changed - (i) the reservation signal is σ_R^w; (ii) the probability of the couple divorcing is $1-S(\phi^{m*},\phi^{w*}|\sigma)$.

To see the effect on the marriage market equilibrium of moving from mutual consent to unilateral divorce, note from (11) and (12) that there are two effects on the value of marrying today.

First, for any given realization of marriage benefits, divorce is more likely (see figure C). This lowers the value of marrying today. Second, conditional on the marriage remaining intact, the expected payoff to either spouse is *greater* than under mutual consent because spouses cannot be locked into bad marriages, and this raises the value of marrying today. This effect is larger the greater the degree of complementarity between spouse's gains from marriage.

Whichever of these effects dominates determines whether equilibrium reservation signals are higher or lower under unilateral divorce. Rearranging (11) and (12), the lifetime value of marrying today is lower for j under unilateral divorce if the lifetime expected gains from marrying over remaining single, conditional on the marriage remaining intact are lower;

$$(1-G)\int_{\underline{\phi}}^{\overline{\phi}} \phi^j g(\phi^j|\sigma)d\phi^j + (1-\beta)\,GV_m^j(S) > S\int_{\phi^{j*}}^{\overline{\phi}} \phi^j g(\phi^j|.)d\phi^j + (1-\beta)\,(1-S)V_u^j(S) \tag{13}$$

In other words, if the first order effect of unilateral divorce is to increase the probability of divorce, the lifetime value of marrying today is lower. Only couples that receive sufficiently high signals will still choose to marry under a unilateral divorce regime. This possibility is shown in figure D.[101]

Those that marry under unilateral divorce are then better matched than couples married under mutual consent. In other words, the expected duration of marriage increases under unilateral divorce.

Using lemma 3, unilateral divorce has ambiguous effects on the marriage rate - the flow of singles into marriage falls as individuals set higher reservation signals, but the stock of singles rises because of the increased flow of individuals from marriage back into singlehood.

Similarly, unilateral divorce has ambiguous effects on the divorce rate. On the one hand as newly married couples are better matched this causes the divorce rate to fall. On the other hand unilateral divorce increases the probability of divorce for

[101] Unilateral divorce laws may also reduce spousal incentives to make marital specific investments during marriage, further reducing the value of marrying today (Rasul (2003)).

any given couple from $G(.|\sigma)$ to $1 - S(.|\sigma)$ so that the stock of married individuals falls. To summarize;

Result 2: *If the first order effect of moving from mutual consent to unilateral divorce is to increase the probability of divorce - (i) individuals set higher reservation values and so newly married couples are better matched than couples married under mutual consent; (ii) the stock of singles increases but the flow from singlehood to marriage falls; (iii) the stock of married individuals falls but the flow of individuals from marriage to singlehood increases.*

6.3 Empirical Predictions

Setting out a framework of search in marriage markets involving learning over time, makes clear the importance of distinguishing two important divorce law changes - (i) moving from fault based divorce to no-fault divorce; (ii) moving from mutual consent to unilateral divorce. To reiterate the effect of each of these on the marriage market;

1. No-fault divorce reduces the cost of exiting marriage. Individuals set lower reservation signals in the marriage market, and so the marriage rate rises. Newly married couples are less well matched than the pre-existing stock of marriages, and the steady state divorce rate rises.

2. If the first order effect of unilateral divorce is to increase the probability of divorce for any given couple, individuals set higher reservation values. This causes marriage rates to fall, and newly married couples to be better matched than couples married under mutual consent.

3. If the first order effect of unilateral divorce is that individuals cannot be locked into bad marriages, individuals set lower reservation values. This causes marriage rates to rise, and newly married couples to be worse matched than couples married under mutual consent.

7 Empirical Analysis

Figure 2 shows marriage and divorce rates from 1956 to 2000, defined as the number of marriages (divorces) per 1000 of the population aged 15 to 65.[102] Trends in the divorce rate follow those in marriage rates after a lag of around 9 years, and consistent with search in marriage markets, marriage rates are more volatile than divorce rates.[103]

Figures 3a and 3b show marriage and divorce rates by adoption of unilateral divorce law. States that adopt unilateral divorce have higher marriage and divorce rates than non-adopters, but there is no discernible difference in either trend prior to the 1970s.[104] While both rates have declined across all states, by the end of the 1990s marriage and divorce rates in adopting states had converged to the levels in non-adopting states.

Figure 4 shows how marriage and divorce rates changed *within* each adopting state, relative to the year of adoption of unilateral divorce. Within states, marriage rates often begin to decline after the introduction of unilateral divorce, with divorce rates beginning to decline after some lag.

Given the volatility in marriage and divorce rates in non-adopting states, changes in divorce laws do not explain all of the variation in the *level* of either of these rates. Using panel data I focus on whether divorce laws explain the difference-in-difference in marriage rates of adopters and non-adopters.

The empirical analysis is organized as follows. The next section reports the basic results, where I find unilateral divorce causes marriage rates to significantly decline in adopting states. This result is robust to a number of alternative hypotheses and econometric concerns. Section 4.2 examines the effect on marriage rates within specific cohorts. The effect of unilateral divorce on marriage rates is greatest for the young, those marrying for the first time, and whites. Section 4.3 analyses how the composition of the marital stock changes. In particular, I show the direction of selection into marriage is consistent with the effect of unilateral divorce causing a decline in marriage. Finally, section 4.4 shows the effect of unilateral divorce law is robust

[102] These measures of marriage and divorce rates hide some of the underlying variation within age cohorts. In the next section I use marriage and divorce certificate data, available from 1970 to 1995, to construct age-gender specific marriage and divorce rates.

[103] The coefficient of variation is 1.57 for marriage rates and .62 for divorce rates.

[104] Given around 40% of the population live in non-adopting states, a difference of 3 marriages per 1000 of the adult population between adopting and non-adopting states translates into a quantitatively large difference in the number of marriages taking place.

to controlling for other determinants of marriage rates.

7.1 Basic Results

I estimate panel data regressions for the marriage rate (m_{st}) in state s in year t;

$$m_{st} = \alpha_s + \gamma_t + \delta l_{st} + \beta X_{st} + u_{st} \tag{14}$$

where α_s are state fixed effects, γ_t are year fixed effects, l_{st} is a dummy equal to one if unilateral divorce is in place, X_{st} is a set of observable covariates, and u_{st} is a disturbance term. The sample runs from 1960 to 2000 and robust standard errors are calculated throughout.[105]

Identification of δ is possible because of variation in the timing of when states adopted unilateral divorce, and because some states never legislated for this change (see table 1).

In this section I define the marriage rate as the number of marriages per 1000 of the adult population, rather than within more specific age cohorts. I do this for two reasons. First, age specific marriage rates can only be constructed from marriage certificates data. This is available from 1970 to 1995, making it impossible to distinguish the causal effects of divorce law from pre-existing trends in marriage rates.

Second, given higher marriage rates of adopting states (figure 3a), divorce laws may be endogenously determined by marriage rates, biasing estimates of δ. If legislators take account of the marital patterns of specific age cohorts, this endogeneity bias is reduced by using this broad definition of marriage rates. In particular suppose;

$$\begin{aligned} m_{st} &= \alpha_s^m + \gamma_t^m + \delta l_{st} + u_{st}^m = \delta l_{st} + u_{st} \\ l_{st} &= \alpha_s^l + \gamma_t^l + \mu m_{st} + \upsilon_{st}^l = \mu m_{st} + \upsilon_{st} \end{aligned}$$

Denote $\sigma_\upsilon^2 = var(\alpha_s^l + \gamma_t^l + \upsilon_{st}^l)$, $\sigma_u^2 = var(\alpha_s^m + \gamma_t^m + \upsilon_{st}^m)$, $\sigma_{\upsilon u} = cov(u_{st}, \upsilon_{st})$, and

[105] As the adoption of unilateral law is positively serially correlated over time, standard errors may be biased downwards (Bertrand *et al* (2001)). Given divorce laws were gradually adopted, and not all states adopt, this problem may not be too severe. Estimating the model by GLS allowing for an AR(1) error, does not significantly change the coefficient on unilateral divorce in the baseline specifications. I also tested for unit roots in the marriage and divorce rate series using the test proposed in Im *et al* (1997). The null hypothesis of non-stationarity was rejected at the 1% level.

normalize σ_u^2 to one. If the introduction of unilateral divorce reduces marriage rates ($\delta < 0$), states with higher marriage rates are more likely to adopt unilateral divorce ($\mu > 0$), and error terms are positively correlated across the equations ($\sigma_{vu} > 0$), then if only the marriage rate equation is estimated;

$$\text{plim } \widehat{\delta} = \frac{\delta + \mu\sigma_v^2 + (1 + \mu\delta)\,\sigma_{vu}}{1 + \mu^2\sigma_v^2 + 2\mu\sigma_{vu}} > \delta \tag{15}$$

so that the estimated effect of unilateral divorce is biased upwards (i.e. less negative), and this bias decreases in δ.[106] In other words among cohorts that are most affected by unilateral divorce (δ is even more negative), $\widehat{\delta}$ is likely to be close to zero or positive.

In this section I use this broad measure of marriage rates to deal with both problems discussed above. In the next section I do examine the effects of divorce laws within gender, age, race and marriage number cohorts.

Column 1 of table 2 runs the baseline regression of marriage rates on fixed effects, and a dummy for whether unilateral divorce is in place.[107] Controlling for state and time fixed effects, unilateral divorce significantly reduces marriage rates. The joint tests of significance for the fixed effects reported at the foot of table 2 are both significant at 1%.

An identifying assumption in (14) is that in the absence of unilateral divorce, all states would have had the same trends in marriage rates. As the sample runs from 1960, it is possible to identify pre-existing trends in marriage propensities from the effects of unilateral divorce. I do this by including two dummies controlling for whether unilateral laws are passed in 2 or 3 years time, and whether they are passed in 4 to 5 years time. Column 2 reports the regression - there appear to be no significant pre-trends in marriage rates, consistent with figure 3a.

An issue of concern is the assumption that unobservable state level determinants of the marriage propensity are invariant over time. This is unlikely to be true if state fixed effects are proxying for social norms, tastes for marriage, labor market changes

[106] If unilateral divorce laws are exogenous to marriage rates then $\mu = \sigma_{vu} = 0$ and plim $\widehat{\delta} = \delta$. As δ increases;

$$\frac{\partial \text{plim } (\widehat{\delta} - \delta)}{\partial \delta} = \frac{1 + \mu\sigma_{vu}}{1 + \mu^2\sigma_v^2 + 2\mu\sigma_{vu}} - 1 < 0$$

[107] In all specifications I also control for the state adult population and its square to capture increasing returns to scale in the marriage market.

and so forth. One way to control for unobservable state specific determinants that are changing is to allow state effects to trend linearly over time.[108]

Column 3 includes linear state time trends. The coefficient on unilateral falls in absolute magnitude, but remains negative and significant. The state-time interactions are jointly significant. In the previous specification some of the effects of these changes were being attributed to unilateral divorce. By not allowing marriage propensities to trend linearly over time, the absolute effect of unilateral divorce is overestimated. As figure 3a shows, the long run trend in marriage rates is downward even in the absence of unilateral divorce - some of this trend is attributed to unilateral divorce when only fixed effects are controlled for. It is not therefore surprising that the coefficient on unilateral divorce falls in absolute magnitude moving from columns 2 to 3.[109]

To better control for underlying changes in marriage propensities in column 4 I allow for state effects to trend quadratically.[110] The effect of unilateral divorce is now only identified from variations in marriage rates from an underlying quadratic trend within state over time. The coefficient on unilateral divorce in column 4 remains negative and significant. The quadratic state-time interactions are jointly significant and the overall fit of the regression improves.[111] In short even allowing for underlying marriage propensities to change quadratically over time, the evidence suggests unilateral divorce caused a significant decline in marriage.[112]

[108]The hypothesis that the decline in marriage is purely down to a shift in tastes does not easily fit the facts. The percentage of Americans that report a "happy marriage is a part of the good life" actually increased between 1991 and 1996 from 72% to 86% (Cherlin (1992)).

[109]Another way of explaining why the inclusion of state specific trends changes the estimate of δ, is to note that the variation exploited in (14) is (using standard notation) $(m_{st} - m_{s.}) - (m_{.t} - \overline{\overline{m}})$. If state level marriage propensities are changing this causes - (i) biased estimation of δ; (ii) if the change in marriage propensity is correlated with the adoption of unilateral divorce, omitted variables bias exists.

[110]Hence I estimate the following specification;

$$m_{st} = \alpha_s + \gamma_t + \delta l_{st} + \lambda (\alpha_s \times time_t) + \kappa (\alpha_s \times time_t^2) + u_{st}$$

where $time_t$ is a time trend. Adult population and its square are also controlled for. The residuals from this regression are also shown in figure 5.

[111]The results are not driven by outliers. Dropping Nevada or California from the sample leads to the coefficient on unilateral remaining negative and significant, and it is not significantly different from that in column 4. If the sample is restricted to only include observations until 1988, the coefficient on unilateral falls to -1.08 with a t-statistic of 2.01.

[112]An alternative method to capture time varying unobservable determinants would be to include the lagged marriage rate in (14). Doing this, the coefficient on unilateral continues to be negative and significant, but the inclusion of a lagged dependent variable introduces a bias of order $\frac{1}{T}$. As a check I estimated this specification using the Arellano Bond (1991) one-step GMM estimator. The

Following Friedberg (1998), the bias caused by omitting state trends can be seen by plotting the residuals from (14). Figure 5a gives a stylized view of the estimated effects of a discrete law change (at time t_0) if state effects are not allowed to trend, when in reality they follow an underlying quadratic trend. Suppose only fixed effects are included in the regression. The effect of a policy change at time t_0 corresponds to X in figure 5a. With linear trends the difference-in-difference effect is $Y - Z$.

Figure 5b shows the actual estimated residuals. This shows what remains of the marriage rate to be explained by unilateral divorce when estimating (14).[113] In the absence of state trends the effect of unilateral divorce is stronger (more negative) because of the confounding effect of time varying unobservables at the state level that drive the marriage propensity. This plot of residuals is consistent with the pattern of coefficients in columns 1,3, and 4 in table 2.

I now turn to separately identifying the effects of unilateral and no-fault divorce. As stressed in sections 2 and 3, these divorce laws affect incentives to marry in different ways. As no-fault was implemented before unilateral, states either have both unilateral and no-fault divorce law (42% of the observations), no-fault but not unilateral (38%) or neither (20%). In column 5 I replace the unilateral dummy with a dummy if no-fault was in place (as coded by Gruber (2000)). No-fault divorce has a negative and insignificant effect on the marriage rate.

Column 6 then controls for the possible combinations of unilateral and no-fault law in place, the reference category being neither law is in place. Again the results suggest that no-fault laws by themselves have no significant effect on marriage rates. Only when states have *both* unilateral and no-fault divorce is there a significant fall in marriage rates. The magnitude of the coefficient remains similar to previous specifications.

The first order effect of divorce laws on incentives to marry appears to be changing the right to divorce, as embodied in unilateral divorce. Changing the cost of exiting marriage through no-fault divorce has only second order effects on the lifetime value of marriage.[114]

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estimated coefficient on unilateral is -1.26 with a t-statistic of 1.62.

[113]To be clear, these are calculated by estimating (14) using years prior to the introduction of unilateral divorce, and then using these estimates to predict the residuals over the entire sample. This is done using fixed effects only, and by allowing state effects to trend linearly and quadratically over time.

[114]The framework set out in section three made clear that increased rates of remarriage, like no-fault divorce, reduce the gains from marriage over divorce and so make individuals less selective in

Figure 3a shows marriage rates in adopting states to be higher than in non-adopting states. If the marriage market was out of equilibrium in the 1960s, convergence in marriage propensities, or regression to the mean, may explain why marriage rates fell faster in adopting states. To address this issue, column 7 controls for the marriage rate in 1960 interacted with a time trend. There is no evidence that states with initially higher marriage rates would have experienced a greater decline in marriage in the absence of unilateral divorce laws.

All the specifications have exploited variation across adopters and non-adopting states, treating the latter as a control group that did not receive the treatment of unilateral divorce. If however there are unobservable differences in adopting and non-adopting states that are uncorrelated with state trends, the estimated coefficients will be inconsistent. The next specification uses only the subsample of 31 states that adopted unilateral divorce so identification arises from variation in the timing of adopting states. The result in column 8 is similar to that in column 6. Only when adopting states introduced unilateral divorce in addition to no-fault divorce do marriage rates decline significantly.

In this specification, the qualitative impact of unilateral divorce law, over and above no-fault divorce, is to reduce the marriage rate by 1.35 marriages per 1000 of the adult population. This accounts for around half of the gap in 1970 in marriage rates between adopting and non-adopting states.

Omitted Policy Variables

Unilateral divorce may just be proxying some other policy. I consider the following possibilities - legalized abortion, joint custody of children, and common law marriage.

Abortion was legalized in five US states in 1970, with the remaining states following suit in 1973. This is exactly in the middle of the period in which divorce laws were being reformed.[115] Legalizing abortion would reduce marriage rates if prior to legalization, couples faced social pressures to marry if they were to give birth out-of-wedlock.[116] Furthermore the legalization of abortion may reflect changing social

the marriage market. For remarriage to be driving the results it would have to be that rates of remarriage have declined over time. This is not the case. Using marriage certificates data, I find that around 20% of all marriages in 1970 involved an individual marrying for the second or more time, and by 1995 this figure had steadily risen to 33%.

[115] Abortion was legalized nationally following the Supreme Court's 1973 decision in *Roe v. Wade*. The coding of when states legalized abortion is from Donohue and Levitt (2000).

[116] See Akerlof *et al* (1996) for an analaysis of such "shotgun weddings".

norms towards women's rights, or changes in the distribution of bargaining power within families. If these factors are not controlled for by allowing state effects to trend over time, the estimated coefficient $\widehat{\delta}$ would be inconsistent.

Column 1 of table 3 therefore controls for legalized abortion. As expected, this law has a significantly negative effect on marriage rates, but does not remove the effect of unilateral divorce over and above no-fault divorce found earlier.

Redistributive policies also affect incentives to marry. For example the move towards the promotion of joint custody of children in divorce, rather than maternal custody, effectively reduces the divorce payoff of women and raises it of men. This causes women to raise the reservation signal they set in the marriage market, so the marriage rate falls.[117] If the same factors drive the adoption of unilateral divorce and implementing legislation in favor of joint custody, then omitting this law biases $\widehat{\delta}$.

Column 2 controls for the adoption of laws promoting joint custody. They have a negative, but insignificant effect on marriage rates. The effect of unilateral divorce over and above no-fault divorce remains negative and significant.

A number of states permit heterosexual couples to legally marry without a license or ceremony, known as common law marriage. As expected, states which permit common law marriage have significantly lower marriage rates than other states.[118] However common law marriages have only gradually been recorded in marriage data, so the dependent variable in (14) is measured with error. Furthermore if common law marriage states are more likely to adopt unilateral divorce, this measurement error leads $\widehat{\delta}$ to be inconsistent.

To deal with this I estimate (14) using only non common law marriage states. The result in column (3) shows that unilateral divorce continues to significantly reduce marriage rates. The fact that the estimated coefficient falls by around 40% suggests

[117] If joint custody laws increase the aggregate incentives of spouses to make marital specific investments, this would increase the value of marrying today and raise marriage rates. I take as given that this redistributive policy is not so strong as to change the ranking of divorce payoffs across genders. Laws favoring joint custody were adopted from the 1980s onwards in nearly all states. The definition and coding for joint custody is given in the data appendix.

[118] This is true both prior to any state introducing unilateral divorce, and over the sample period as a whole. To have a valid common law marriage a couple must do all of the following - (i) live together for a significant period of time - this is not precisely defined in any state; (ii) hold themselves out as a married couple – typically this means using the same last name, and filing a joint tax return; (iii) state that they intend to marry. Common law marriage is recognized in AL, CO, DC, IA, KS, MT, OK, PA, RI, SC, TX and UT. Of these, AL, CO, IA, KS, MT, OK, RI and TX passed unilateral divorce laws.

there is a bias caused by changes in the recording of common law marriages over time in marriage data.

Endogenous Timing of Adoption

A second set of concerns arise from the identifying assumption in (14) that the marginal effect of unilateral divorce is the same across all states. At any moment, δ is identified using only those states that have passed the law, so if early adopters are different from late adopters $\widehat{\delta}$ will again be biased. This can arise if the timing of adoption is endogenous.

Figure 6 shows the geographical pattern of adoption across states. Unilateral divorce appears to have been adopted in regional clusters, and to have spread eastwards over time. In the next column I therefore additionally control for regional fixed effects.[119] The result, in column 4, shows that the estimated effect of unilateral divorce over and above no-fault divorce is largely unchanged from before.

Another way to address this issue is to estimate the effect of divorce laws by restricting the sample to only include states which adopted up until 1972.[120] Column 5 gives the result. Unilateral divorce laws have significantly negative effects on the marriage rate for early adopters. The estimated effect is not significantly different from when the entire sample is used.

A complicating factor in identifying the causal effect of unilateral divorce is that marriage and divorce need not occur in the same state. If states neighboring s adopt, it can be "as if" individuals in s have access to unilateral divorce. If the behavior of neighbors to s is not captured by unobservable state trends in s, $\widehat{\delta}$ is biased due to omitting unilateral divorce laws in neighboring states. This bias is negative if adoption by a neighboring state to s implies state s no longer needs to adopt.

The effect of laws in neighboring states will vary by the relative size of state s vis-à-vis its neighbors. The effect is greater if neighboring states are geographically larger - the effect of California adopting on Nevada would not be the same as the effect of Nevada adopting on California.

I control for the number of neighboring states that have adopted unilateral divorce

[119]The regions are defined using a standard classification of Pacific, Mountain, West North Central, East North Central, Middle Atlantic, New England, West South Central, East South Central, and South Atlantic.

[120]This splits the sample of adopters almost equally with AL, AK, CA, CO, FL, ID, IO, KS, KY, MI, NE, NH, ND and OK classified as early adopters. The results do not significantly alter if I divide states into adoption pre and post 1971.

in each year. I weight the adoption of unilateral divorce in neighboring states by the area of these neighbors (in 1000 of square km), and then also control for an interaction between this "weighted" measure of the number of neighbors that have adopted, with the area of state s itself.

The result in column 6 finds no evidence of such spillover effects from neighboring states biasing the previous estimates of the effect of unilateral divorce.[121] Such spillover effects may be of greater concern when estimating the impact of divorce laws on divorce rates (Wolfers (2000)).

Endogenous Legislation

Another concern arises if the adoption of unilateral divorce is endogenous to marriage rates. If for example more liberal states are more likely both to pass unilateral divorce, and have higher turnover in the marriage market, the estimate of δ in (14) is subject to endogeneity bias. To address this I calculate the percentage of births that occurred out-of-wedlock in 1970 by state. I then classify states as being high or low out-of-wedlock states and estimate the effects of divorce laws by each type of state separately. If only high out-of-wedlock states are those in which unilateral divorce has an effect, this may suggest that such divorce laws are endogenously passed. The results in columns (7) and (8) suggests unilateral divorce reduces marriage rates in both, but the effect is stronger in states in which more births occur out-of-wedlock.

7.2 Cohort Level Analysis

In this section I analyze the effects of divorce laws on marriage rates within gender, age, race, and marriage number cohorts. This precisely identifies the groups through which unilateral divorce causes the most disincentives to marry. As the model makes clear, the effect of divorce laws on marriage incentives is greatest for those early in the life cycle. This is because the lifetime value of marriage is more responsive to divorce laws as the probability of surviving to the next period increases.

To address this empirically, I define the marriage rate in cohort c for state s in year t as;

$$m_{cst} = \frac{\text{number of individuals in cohort } c \text{ that marry in state } s \text{ in year } t}{\text{number of individuals in cohort } c \text{ in state } s \text{ in year } t}$$

[121] Alaska and Hawaii are dropped from the sample in this specification. Controlling just for the percentage of neighbors that have adopted yields the same result.

Marriage rates within cohorts are constructed from marriage certificate data and are available from 1970 to 1995. Similar cohort specific divorce rates can also be constructed from divorce certificates data over the same period.

Figure 7 shows age-gender specific marriage and divorce rates. The decline in marriage has been most pronounced amongst 15-24 year olds. Older age cohorts have rising marriage rates over time, as individuals increasingly search longer in the marriage market, cohabit prior to marriage, and have become more likely to remarry.[122] The rise and subsequent decline in divorce rates highlighted in figure 2 is most pronounced amongst 25-34 year olds for both men and women. Divorce rates amongst 35-44 year olds have steadily risen over time.[123]

Some of these patterns reflect changing demographics over time. For example, the post war baby boom would have caused a marriage squeeze for women in the 1960s and 70s, and for men in the 1980s.

In table 4 I estimate the effects of divorce laws on cohort specific marriage rates, split between male and female cohorts.[124] In columns 1 to 3 I regress divorce laws on marriage rates for gender-age cohorts. Consistent with figure 7, I find the strongest effects of unilateral divorce over and above no-fault divorce on the youngest age cohort. A smaller but still significant effect is also found for men aged 35-44. The same pattern is repeated for women.

Columns 4 and 5 examine cohorts defined by marriage number. Unilateral divorce reduces marriage rates amongst those marrying for the first time, and has no effect on

[122]The median age at marriage rose for women from 20 in 1968 to 23 in 1988, and from 22 to 25 for men.

[123]This evidence is consistent with empirical studies of cohabitation. Cohabitation is often viewed as a trial period before marriage, thus only better matched couples may select into marriage. Although cohabitation has become more prevalent (in 1960 there was one cohabiting couple for every 90 married couples, by 2000 there was one for every 12 married couples) it remains short lived, preceding rather than replacing marriage. Bumpass and Sweet (1989) find 40% of cohabiting couples either marry or stop living together within one year, a third of cohabiting couples are still cohabiting after two years, and 60% of those in cohabiting unions marry their cohabiting partner. Furthermore, cohabitation is unlikely to explain the plateauing out of divorce rates in the 1990s. Couples who marry after cohabiting are typically found to have *higher* rates of marital dissolution (Bumpass and Sweet (1989), Waters and Ressler (1999)).

[124]The estimated specifications include state trends that trend quadratically over time. In addition I control for $sex\ ratio_{st}$ - the sex ratio of women to men for the relevant age group in cohort c in state s in year t. Hence the estimated equation is;

$$m_{cst} = \alpha_s + \gamma_t + \lambda\left(\alpha_s \times time_t\right) + \kappa\left(\alpha_s \times time_t^2\right) + \delta l_{st} + \beta\left(sex\ ratio_{st}\right) + u_{st} \qquad (16)$$

where $time_t$ is a time trend.

second marriages. Interestingly men are more likely to remarry a second time when no-fault divorce is introduced.

The final split in columns 6 and 7 is by race. The effect of unilateral divorce laws operates purely through the incentives to marry of whites. Marriage rates for blacks, amongst whom marriage rates are consistently lower than whites, are not significantly changed by any divorce laws. As Wilson (1987) argues, this may be because marriageable black men are scarce due to high unemployment and incarceration rates. In the framework of the model in section 3, marriage market signals for blacks may be uninformative. Amongst whites, signals are informative and the effect of divorce law is more in line with the analysis set out. Further research is required to explore this point fully.

Overall the results by cohort are consistent with those in the previous section. The move from mutual consent to unilateral divorce has significantly reduced marriage rates. The introduction of no-fault divorce has had little or no impact on marriage rates. Across both men and women, the greatest impact of unilateral divorce has been found amongst those aged 15-24, those in first marriages, and whites.

Dynamics

The adoption of unilateral divorce moves changes the steady state marriage market equilibrium. Hence its effects ought to be long lasting. To estimate the long run impact of unilateral divorce I focus on the 15-24 year old age cohort. For this cohort I estimate the following dynamic specification;

$$m_{cst} = \alpha_s + \gamma_t + \sum_{T=-4}^{10} \mu_{t-T} L_{sT} + \beta sexratio_{cst} + u_{st} \tag{15}$$

where L_{sT} is a dummy equal to one if unilateral divorce was passed T years ago in state s, and $sex\ ratio_{cst}$ is the ratio of women to men aged 15 to 24, which controls for marriage market tightness. The estimated effects of unilateral divorce T years after its introduction on the marriage rate $(\widehat{\mu}_{t-T})$ are plotted in figure 4, along with a 95% confidence interval.[125]

The precision with which the marginal effects are estimated improves over time as more states adopt unilateral divorce. Consistent with earlier results, the marginal

[125] In order to preserve degrees of freedom, I drop the quadratic state trends. A negative T implies a year prior to the introduction of unilateral divorce. Only states that adopt late can be used to estimate μ_{t-T} for negative T. Given the sample runs from 1970 I restrict $T \geq -4$.

effect of unilateral divorce is not significantly different from zero prior to adoption, and significantly negative after adoption. The impact of unilateral divorce on marriage is long lasting. The coefficients are negative and significant a decade after adoption.[126]

Turnover

The model sheds light on turnover in the marriage market, namely the number of divorces per marriage. From (10);

$$\frac{DR}{MR} = \frac{\beta D}{1 - \beta \left(F(\sigma_R) - D \right)}$$

The evidence in tables 2 and 3 suggested the first order effect of unilateral divorce is to increase the likelihood of marital dissolution. Hence unilateral divorce increases marital turnover by the above measure. In contrast, no-fault divorce has ambiguous effects on turnover - it increases the flow of individuals form singlehood into marriage, *and* from marriage into divorce.

In table 5 I estimate the effect of divorce laws on turnover in marriage markets. Column 1 uses the ratio of divorces to marriages per 1000 of the adult population as a measure of turnover. As expected, only when unilateral divorce is in place in addition to no-fault divorce, does turnover significantly increase. Columns 2 to 4 show this effect to be strongest amongst youngest age cohorts of men. These results confirm that the effect of divorce laws on marriage rates is not fully matched by the same rise in divorce rates within cohorts. As the theory makes clear, the first order effects of divorce laws are on marriage rates, not divorce rates.

Columns 5 and 6 split the sample by race. Unilateral divorce increases marriage market turnover amongst blacks and whites. Putting this together with the earlier results on marriage rates, the results point to blacks being affected by unilateral divorce mainly through increases in divorce rates rather than marriage rates.

As expected, a very similar pattern of coefficients is found when I look at female specific cohorts, as shown in the bottom panel of table 5. Throughout I find little or no evidence of no-fault divorce by itself affecting marital turnover.

[126]The absolute magnitude of the effect is greater here than in table 2 because of the exclusion of state trends. Including state trends reduces the absolute magnitude of the estimated coefficients, but decreases the precision with which each is estimated because of the large drop in degrees of freedom.

7.3 Composition of the Marital Stock

If moving from mutual consent to unilateral divorce causes the value of marrying today to fall, individuals set higher reservation signals and this reduces the flow of individuals from singlehood into marriage. Individuals that marry under unilateral divorce are better matched than the existing stock of married couples. If unilateral divorce then causes marriage rates to fall, the reduced flow of singles into marriage must more than offset the increases stock of singles.

In this section I present further supportive evidence that after the introduction of unilateral divorce - (i) the stock of married individuals fell; (ii) couples married under unilateral divorce were better matched than those married under mutual consent.

Figure 9 shows how the stock over time of ever married individuals, as a percentage of total population. This is calculated annually as two times the number of marriages minus divorces, divided by population.

Ideally I would like to measure how the stock of married individuals has changed. Using ever married individuals overstates the true change in the marriage stock because people also leave marriage due to death. However this measure still serves as a good proxy given a stable annual death rate of 1%. As married individuals are older than the average individual, the marital stock ought to fall by over 1% due to death. Hence figure 9 suggests that from the mid 1970s, the stock of married individuals has actually been declining.

If the move from mutual consent to unilateral divorce causes individuals to become more selective in the marriage market, then the stock of married individuals would fall. In contrast, the move to no-fault divorce unambiguously reduces the reservation signal set in marriage markets and so would lead to an increase in the stock of married individuals. As in the previous section, the evidence is in favor of unilateral divorce, not no-fault divorce, having a far greater impact on the marriage market.

Figure 9 begs the question whether the *composition* of married couples changes after the introduction of unilateral divorce. Namely, is does unilateral divorce induce selection into marriage. To address this I use divorce certificates data to calculate the duration of first marriages before and after unilateral divorce is implemented. This is an all encompassing measure of the quality of matches in the marriage market.

The median year of adoption of unilateral divorce was 1971. I consider first marriages that took place in 1968 and 1974 in adopting and non-adopting states that had dissolved by 1995. The top panel in figure 10 shows how the distribution of the

duration of first marriages in 1968 varies across states that did and did not adopt unilateral divorce laws. Prior to the introduction of unilateral divorce the average duration of first marriages is two years lower in adopting states.[127]

The middle panel shows the frequency distribution of marriages that took place in 1974. The mean duration of first marriages is actually significantly *higher* in adopting states.[128] Despite the duration of marriages falling over time in all states, the fall is smallest between 1968 and 1974 amongst states that adopted unilateral divorce.

The bottom panel shows the difference-in-difference in frequency densities between the two periods.[129] It shows the clear rightward shift of the difference in frequency distributions across adopting and non-adopting states.

This is consistent with couples that marry under unilateral divorce laws being better matched than those married under mutual consent.[130] Furthermore, as individuals do not have to divorce in the state in which they are resident, if individuals endogenously choose to divorce in unilateral states then this figure *understates* the true change in composition of those married in adopting states.[131]

7.4 Other Determinants of Marriage Rates

Divorce laws are not the only aspect of marriage markets to have changed since the 1960s. The labor market, incidence of cohabitation, and social norms have all changed beyond recognition in the last generation. These changes have been controlled for by

[127] Marriages that occurred in states that adopted after 1974 are not included in either sample. The mean duration of marriages that occured in 1968 is 11 years in non-adopting states, significantly above the duration of 8.8 years in adopting states.

[128] Mean duration is 6.94 years in adopting states, significantly greater at the 1% level than the mean of 6.5 in non adopting states.

[129] This is given by;

$$(p_{post\_adopter} - p_{pre\_adopter}) - (p_{post\_nonadopter} - p_{pre\_nonadopter})$$

where $p_{post\_adopter}$ is the frequency density of marital duration in adopting states post adoption (i.e. in 1974) and so forth.

[130] This result is not caused by simultaneous law changes that may have enforced longer periods of separation before divorce was legitimized. Required separation periods exist only in a minority of states, they were largely introduced at least a decade after unilateral divorce, and have increased on average from 7 months in 1980 to only 9 months by 2000.

[131] From divorce certificates data, I find that 13% of divorces involve couples married in another state but in the same region, and 14% involve couples married in another region. The fact that there is a slight change in trend in marital duration in non adopting states could be explained by individuals living next to neighboring states that do adopt.

allowing state effects to trend over time.

Adopting and non-adopting states differed in a number of observable dimensions, listed in table 6. Adopting states have smaller populations, more blacks, lower female labor force participation and lower female-male earnings ratios than non-adopters. Some of these factors could explain the difference in marriage rates over time.

However a number of these could also be endogenous to the adoption of unilateral divorce. To address this I first regress marriage rates (defined as the number of marriages per 1000 of the adult population) on state and year fixed effects. I then regress the residuals from this regression. shown on figure 5b, on a dummy for unilateral divorce and other observable determinants of marriage rates. This allows an assessment of the qualitative importance of divorce laws vis-à-vis other observable determinants of marriage, and sheds light on what has previously been captured in the trended state effects.

The results are given in table 7. In column 1 I regress the residuals on unilateral divorce, adult population and its square. The estimated coefficient on unilateral divorce is negative and significant, suggesting that when this law is adopted in state s, the marriage rate in state s falls below its long run mean. The magnitude of the effect is large - the introduction of unilateral divorce causes four less marriages per 1000 of the adult population to occur in each state on average. This compares to an average marriage rate of 18 over this period.

Column 2 then controls for the proportions of the population that are black and other race, and the ratio of men aged 20-34 to women aged 18 to 32 as a measure of marriage market tightness. The more women per man in the pool of marriageable individuals, causes marriage rates to significantly fall. This is consistent with women setting higher reservation signals and being the more selective gender in the marriage market.

Part of the decline in marriage may be due to the rise in real incomes, or individuals staying longer in school and delaying entry into the marriage market. Column 3 adds in state per capita income and male and female years of schooling. Wealthier states have lower marriage rates, suggesting that all else equal, the gains from marriage are higher for high income individuals. This may be because individuals positively sort on income in marriage markets. Marriage rates fall as men stay in school longer, and rise as women receive more education. I cannot reject the hypothesis that these are equal and opposite effects. This is consistent with, all else equal,

the gains from marriage being higher if spouses have more similar levels of education.

Public spending affect marriage markets. For example, it is well established that welfare payments increase the likelihood of marital dissolution (Nixon (1997)). By reducing the gains from marriage over divorce, such payments reduce the reservation signal individuals set in the marriage market. To see if this prediction holds up empirically, column 4 controls for state transfers to families, measured in $1000s per capita. I find that these significantly increase marriage rates.[132]

Column 5 adds female labor force participation rates and female-male earnings ratios to the regression. Female participation significantly increases marriage rates. This suggests that being attached to the labor market raises the divorce payoff of women. Consistent with search in marriage markets, this implies women set lower reservation signals in the marriage market and so marriage rates rise.

The higher female earnings are relative to men, the lower is the marriage rate. This is consistent with the lifetime value of marriage being lower the greater the equality of earnings across genders. This may reflect the fact that when female earnings are closer to those of men, there are lower gains from specialization within the household and this reduces incentives to marry.[133]

The impact of unilateral divorce on marriage is quantitatively significant. The introduction of unilateral divorce has the equivalent disincentive effects for marriage as a 23% fall in female labor force participation, or a 16% rise in the female-male earnings ratio. To put this into context, national female labor force participation rates rose from 45% in 1970 to 70% by 1990. The change in the female-male earnings ratio over the same period was from 30% to 50%.[134]

[132]This may be picking up spending on public goods that are used mostly by married couples, such as schools. I also controlled for state expenditure on education and found this to have a positive and significant effect on marriage rates. The effect of state transfers was unchanged.

[133]Using city level census data, Gould and Paserman (2002) find that wage inequality amongst men has contributed to a decline in marriage rates. I use CPS data to construct state level measures of male wage inequality, defined as the standard deviation of the log of real wages for men in the labor force. The results in column (5) are robust to controlling for male wage inequality. This entered negatively but was not significant.

[134]The results are robust to two further checks. First, if only adopting states are used to construct the residuals and estimate the regression, the pattern of coefficients is very similar. The effect of unilateral divorce is found to be even greater in absolute value. Second, if the sample is restricted to include observations only up to 1985, the coefficient on unilateral divorce falls in absolute value but is still negative and significant.

8 Conclusion

Marriage as a social institution has been in decline for the last three decades. This is of concern if we believe marriage to be a good thing. The existing evidence indeed points to a positive association between marriage and welfare outcomes.

This paper has sought to understand why marriage has declined. In particular I provide a theoretical framework for thinking through how changes in divorce laws affect incentives to marry, and selection into marriage. This allows me to make precise the different effects of unilateral and no-fault divorce on marriage markets when individuals learn the true value of marriage before and during marriage.

Taken together the empirical results provide robust evidence that unilateral divorce caused - (i) a significant decline in marriage. This effect is permanent, and most affects the young; (ii) selection into marriage - those that choose to marry under a unilateral divorce regime are significantly better matched than those married under mutual consent. Throughout I find that no-fault divorce has had little or no impact on marriage.

The result that unilateral divorce significantly and permanently reduces marriage rates, sheds light on the nature of household bargaining. If spouses could bargain efficiently, the Coase theorem implies the assignment of the right to divorce ought to have no affect on the incidence of marriage and divorce. This paper suggests households do not act in accordance with unitary or Nash bargaining models of behavior (Becker (1991), McElroy and Horney (1981)) as they would predict households bargain efficiently and so the divorce regime ought to affect the distribution of welfare within marriage, but not the decision to marry. Understanding why households do not reach Coasean bargains is an active area of current research.

One reason may be marital contracts are unenforceable. This stems from the non-verifiability to third parties of actions taken within the household. This leads spouses to renegotiate *ex post* over the division of the marriage surplus. Unilateral divorce reduces the expected value of this surplus and thus reduces the *ex ante* incentives of spouses to take first best actions within marriage. If so, we would expect to observe spouses making fewer marital specific investments, such as having children, after the introduction of unilateral divorce.

This paper helps to shed light on the empirical literature on the impact of unilateral divorce on divorce rates. Friedberg (1998), Gruber (2000) and Wolfers (2000)

find a significantly positive impact of unilateral divorce on divorce rates. However this paper makes clear that by ignoring the effect of unilateral divorce on selection into marriage, the impact of unilateral divorce on divorce rates is likely to be inconsistently estimated.

As the paper makes clear, the divorce rate depends on - (i) the marriage rate; (ii) the quality of matched couples. The earlier literature has essentially estimated the reduced form effect of unilateral divorce on divorce rates. Given that unilateral divorce has been shown to decrease marriage rates, and increase selection into marriage, the previous estimates of unilateral divorce on divorce rates are biased *downwards.*

In other words, the impact of unilateral divorce is even greater than that found in Friedberg (1998) because in the absence of unilateral divorce, marriage rates would have been higher and the quality of matched couples would have been worse. Decomposing the effects of unilateral divorce on divorce rates through each of these channels remains part of future research.[135]

In addition, this paper shows the effect of unilateral divorce law on divorce rates should be long lasting, and not die out after around 9 years as found in the existing literature.

The decline in marriage has far reaching consequences both for those directly involved, and for society as a whole. Understanding the optimal response of governments to such rapidly changing marital patterns opens up another broad research agenda. Policy has moved to take account of the rise in divorce in the welfare and legal systems, most notably in areas of alimony, child support, and child custody. However there remain important issues as to whether and how policies ought to be designed in spheres such as pension rights, taxation, and savings, when also marriage is in decline.

[135] As the model makes clear, the magnitude of the effect of unilateral divorce on marriage rates, ought to be greater than on divorce rates. I find unilateral divorce reduces marriage rates by around 1.3 marriages per 1000 of the adult population. This is three times the effect of unilateral divorce on divorce rates found by Friedberg (1998).

9 Appendix: Proofs of Results

Proof of Lemma 1: Rewrite the value of marrying today (1) as;

$$\begin{aligned} V(M|\sigma) &= \int_{\underline{\phi}}^{\overline{\phi}} \phi g(\phi|\sigma)d\phi + \frac{\beta}{1-\beta}\left[[1-G(\phi^*|\sigma)]\int_{\phi^*}^{\overline{\phi}} \phi \frac{g(\phi|\sigma)}{[1-G(\phi^*|\sigma)]}d\phi + G(\phi^*|\sigma)\phi^*\right] \\ &= \int_{\underline{\phi}}^{\overline{\phi}} \phi g(\phi|\sigma)d\phi + \frac{\beta}{1-\beta}\left[[1-G(\phi^*|\sigma)]\int_{\phi^*}^{\overline{\phi}} \phi h(\phi|\sigma)d\phi + G(\phi^*|\sigma)\phi^*\right] \end{aligned}$$

where $h(\phi|\sigma) = \frac{g(\phi|\sigma)}{1-G(\phi^*|\sigma)}$ is the probability that the payoff in marriage is ϕ conditional on signal σ having been observed and the marriage remaining intact. As $\int_{\phi^*}^{\overline{\phi}} h(\phi|\sigma)d\phi = 1$, $\int_{\phi^*}^{\overline{\phi}} \phi h(\phi|\sigma)d\phi$ is the expected payoff in marriage conditional on signal σ and the marriage remaining intact. Differentiating with respect to σ;

$$V_\sigma(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi g_\sigma(\phi|\sigma)d\phi + \frac{\beta}{1-\beta}\left[\begin{array}{c} -G_\sigma(\phi^*|\sigma)\left(\int_{\phi^*}^{\overline{\phi}} \phi h(\phi|\sigma)d\phi - \phi^*\right) \\ +[1-G(\phi^*|\sigma)]\int_{\phi^*}^{\overline{\phi}} \phi h_\sigma(\phi|\sigma)d\phi \end{array}\right] \quad \text{(A1)}$$

The first term is positive because of the first order stochastic dominance of signals. The second term is positive because $-G_\sigma(\phi^*|\sigma) > 0$ and the expected benefit from marriage conditional on the marriage remaining intact must be at least the divorce payoff, ϕ^*. Hence to ensure the value of marrying today is increasing in the signal it is sufficient that $h_\sigma(\phi|\sigma) > 0$ so the last term is also positive.■

Proof of Lemma 4: Totally differentiating the equilibrium reservation value condition (4) with respect to the per period payoff in divorce;

$$\frac{d\sigma_R}{d\phi^*} = \left[\frac{\frac{\partial V(M|\sigma_R)}{\partial \phi^*} - \frac{\partial V(S)}{\partial \phi^*}}{\frac{\partial V(S)}{\partial \sigma_R} - \frac{\partial V(M|\sigma_R)}{\partial \sigma_R}}\right] \quad \text{(A2)}$$

Consider the numerator. The value of remaining single is given by (3) so that;

$$\frac{\partial V(S)}{\partial \phi^*} = \frac{\beta}{1-\beta F(\sigma_R)}\int_{\sigma_R}^{\overline{\sigma}} \frac{\partial V(M|\sigma)}{\partial \phi^*} f(\sigma)d\sigma$$

Differentiating the value of the marginal marriage with respect to ϕ^*;

$$\begin{aligned}\frac{\partial V(M|\sigma_R)}{\partial \phi^*} &= \frac{\int_{\sigma_R}^{\overline{\sigma}} \frac{\partial V(M|\sigma_R)}{\partial \phi^*} f(\sigma)d\sigma}{1-F(\sigma_R)} > \frac{\beta \int_{\sigma_R}^{\overline{\sigma}} \frac{\partial V(M|\sigma_R)}{\partial \phi^*} f(\sigma)d\sigma}{1-\beta F(\sigma_R)} \\ &> \frac{\beta \int_{\sigma_R}^{\overline{\sigma}} \frac{\partial V(M|\sigma)}{\partial \phi^*} f(\sigma)d\sigma}{1-\beta F(\sigma_R)} \\ &= \frac{\partial V(S)}{\partial \phi^*}\end{aligned}$$

The second inequality holds because $\frac{\partial V(M|\sigma)}{\partial \phi^*} = \frac{\beta}{1-\beta} G(\phi^*|\sigma)$ which is decreasing in σ by the first order stochastic dominance of signals. In other words the effect of changing the benefits from marriage are greatest on the value of the marginal marriage so that the numerator in (A2) is always positive.

The sign of the denominator in (A2) depends on the magnitude of $V_\sigma(M|\sigma_R)$. To see how this relates to the informativeness of signals, note that from lemma 1 $V_\sigma(M|\sigma) > 0$ if $h_\sigma(\phi|\sigma) = \frac{\partial}{\partial \sigma}\left(\frac{g(\phi|\sigma)}{1-G(\phi^*|\sigma)}\right) > 0$. This implies the value of marriage increases in signals if;

$$\frac{g_\sigma(\phi|\sigma)}{g(\phi|\sigma)} > \frac{\frac{\partial}{\partial \sigma}\left[1-G(\phi^*|\sigma)\right]}{1-G(\phi^*|\sigma)}$$

which given $G_\sigma(\phi^*|\sigma) < 0$, implies $g_\sigma(\phi|\sigma) > 0$. The value of marriage increases more quickly in signals if the left hand side above becomes larger at higher levels of marriage benefits;

$$\frac{\partial}{\partial \phi}\left(\frac{g_\sigma(\phi|\sigma)}{g(\phi|\sigma)}\right) > 0 \qquad \text{(MLRP)}$$

This is the standard monotone likelihood ratio property (Milgrom (1981)). It says that as the benefits from marriage rise, the likelihood of obtaining a particular benefit ϕ is increasing in the signal. As this likelihood ratio increases for any given signal, the signal is more informative in the sense that the value of marriage increases more quickly in signals. This is the definition of informativeness of signals given in the main text.

Hence the denominator, $\frac{\partial V(S)}{\partial \sigma_R} - \frac{\partial V(M|\sigma_R)}{\partial \sigma_R} \leq 0$ when signals are informative because the value of marrying into the marginal marriage, $V(M|\sigma_R)$, increases more quickly in the reservation signal than the value of remaining single (see figure A). Hence when signals are informative;

$$\frac{d\sigma_R}{d\phi^*} = \left[\frac{\frac{\partial V(M|\sigma_R)}{\partial \phi^*} - \frac{\partial V(S)}{\partial \phi^*}}{\frac{\partial V(S)}{\partial \sigma_R} - \frac{\partial V(M|\sigma_R)}{\partial \sigma_R}}\right] = \frac{+ve}{-ve} < 0$$

so that reservation signals rise as the costs of exiting marriage fall (so that ϕ^* rises). Individuals become less selective over whom they marry if signals are informative of the true gains from marriage.■

Proof of Lemma 5: I first show that $V^j_\sigma(M|\sigma) > 0$ for $j \in \{m, w\}$ under each divorce regime. Under mutual consent;

$$V^j_{m\sigma}(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi^j g_\sigma(\phi^j|\sigma) d\phi^j + \frac{\beta}{1-\beta}\left[\begin{array}{c} -G_\sigma(\phi^{m*}, \phi^{w*}|\sigma)\left\{\begin{array}{c}\int_{\underline{\phi}}^{\overline{\phi}} \phi^j g(\phi^j|\sigma) d\phi^j \\ -(1-\beta)\, V^j_m(S)\end{array}\right\} \\ +[1 - G(\phi^{m*}, \phi^{w*}|\sigma)] \int_{\underline{\phi}}^{\overline{\phi}} \phi^j g_\sigma(\phi^j|\sigma) d\phi^j \end{array}\right]$$

This is positive because of the first order stochastic dominance of signals and;

$$\int_{\underline{\phi}}^{\overline{\phi}} \phi^j g(\phi^j|\sigma) d\phi^j \geq V^j_m(S) \text{ for all } \sigma \in [\sigma^w_R, \overline{\sigma}]$$

Similarly under unilateral divorce;

$$V^j_{u\sigma}(M|\sigma) = \int_{\underline{\phi}}^{\overline{\phi}} \phi^j g_\sigma(\phi^j|\sigma) d\phi^j + \frac{\beta}{1-\beta}\left[\begin{array}{c} S_\sigma(\phi^{m*}, \phi^{w*}|\sigma)\left\{\begin{array}{c}\int_{\phi^{j*}}^{\overline{\phi}} \phi^j g(\phi^j|\phi^{-j} \geq \phi^{-j*}, \sigma) d\phi^j \\ -(1-\beta)\, V^j_u(S)\end{array}\right\} \\ +S(\phi^{m*}, \phi^{w*}|\sigma) \int_{\phi^{j*}}^{\overline{\phi}} \phi^j g_\sigma(\phi^j|\phi^{-j} \geq \phi^{-j*}, \sigma) d\phi^j \end{array}\right]$$

which is positive because stochastic dominance implies $S_\sigma(\phi^{m*}, \phi^{w*}|\sigma) > 0$ for all (ϕ^m, ϕ^w).

In order to show that if signals are sufficiently informative;

$$\frac{d\sigma^j_R}{d\phi^{j*}} = \left[\frac{\frac{\partial V^j(M|\sigma^j_R)}{\partial \phi^{j*}} - \frac{\partial V^j(S)}{\partial \phi^{j*}}}{\frac{\partial V^j(S)}{\partial \sigma^j_R} - \frac{\partial V^j(M|\sigma^j_R)}{\partial \sigma^j_R}}\right] < 0$$

the only part of the proof of lemma 3 that needs to be checked is that $\frac{\partial V^j(M|\sigma^j_R)}{\partial \phi^{j*}}$ still

decreases in σ in both regimes. Under a mutual consent divorce regime;

$$\frac{\partial}{\partial\sigma}\left(\frac{\partial V_m^j(M|\sigma)}{\partial\phi^{j*}}\right)=\frac{\beta}{1-\beta}\left[\begin{array}{c} g(\phi^{-j*}|\sigma)\left\{\int_{\underline{\phi}}^{\overline{\phi}}\phi^j g(\phi^j|\sigma)d\phi^j-(1-\beta)\,V_m^j(S)\right\} \\ +G_\sigma(\phi^{m*},\phi^{w*}|\sigma)V_m^j(S)\end{array}\right]<0$$

Under a unilateral regime;

$$\frac{\partial}{\partial\sigma}\left(\frac{\partial V_u^j(M|\sigma)}{\partial\phi^{j*}}\right)=\frac{\beta}{1-\beta}\left[\begin{array}{c}\frac{\partial}{\partial\sigma}\left(\frac{\partial S}{\partial\phi^{j*}}\right)\left(\int_{\phi^{j*}}^{\overline{\phi}}\phi^j g(\phi^j|.)d\phi^j-(1-\beta)\,V_u^j(S)\right) \\ +\frac{\partial S}{\partial\phi^{j*}}\int_{\phi^{j*}}^{\overline{\phi}}\phi^j g_\sigma(\phi^j|.)d\phi^j \\ -\frac{\partial S}{\partial\sigma}\left(1+V_u^j(S)g(\phi^j|.)\right)-SV_u^j(S)g_\sigma(\phi^j|.)\end{array}\right]$$

where $g(\phi^j|.)=g(\phi^j|\phi^{-j}\geq\phi^{-j*},\sigma)$. Noting that $\frac{\partial S}{\partial\phi^{j*}}=\frac{\partial}{\partial\phi^{j*}}\int_{\phi^{j*}}^{\overline{\phi}}g(\phi^j|.)d\phi^{j*}=-g(\phi^j|.)<0$ and $\frac{\partial}{\partial\sigma}\left(\frac{\partial S}{\partial\phi^{j*}}\right)=-g_\sigma(\phi^j|.)<0$;

$$\frac{\partial}{\partial\sigma}\left(\frac{\partial V_u^j(M|\sigma)}{\partial\phi^{j*}}\right)=\frac{\beta}{1-\beta}\left[\begin{array}{c}-g_\sigma(\phi^j|.)\left(\int_{\phi^{j*}}^{\overline{\phi}}\phi^j g(\phi^j|.)d\phi^j-(1-\beta)\,V_u^j(S)\right) \\ -g(\phi^j|.)\int_{\phi^{j*}}^{\overline{\phi}}\phi^j g_\sigma(\phi^j|.)d\phi^j \\ -\frac{\partial S}{\partial\sigma}\left(1+V_u^j(S)g(\phi^j|.)\right)-SV_u^j(S)g_\sigma(\phi^j|.)\end{array}\right]<0$$

This ensures that for each regime, $\frac{\partial V^j(M|\sigma_R^j)}{\partial\phi^*}>\frac{\partial V^j(S)}{\partial\phi^*}$ so that the numerator is positive. As in the proof of lemma 3, $\frac{\partial V^j(S)}{\partial\sigma_R^j}>0$ for small search costs c, and again for more informative signals, $\frac{\partial V^j(M|\sigma_R^j)}{\partial\sigma_R^j}$ increases so that so that $\frac{\partial V^j(S)}{\partial\sigma_R^j}-\frac{\partial V^j(M|\sigma_R^j)}{\partial\sigma_R^j}$ is negative.■

10 Data Appendix

The coding for **unilateral divorce** is taken from Friedberg (1998), table 1. The coding for **no-fault divorce** states is taken from Gruber (2000). **Joint custody** is defined to include - (i) joint legal custody where both parents retain joint responsibility for the care and control of the child and joint authority to make decisions concerning the child even though the child's primary residence may be only with one parent; (ii) joint physical custody where both parents share physical and custodial care of the child; (iii) any combination of joint legal and joint physical custody which the court deems to be in the best interests of the child. The coding of when states

enact joint custody legislation is taken from Brinig and Buckley (1998). The coding for when **abortion was legalized** in each state is taken from Donohue and Levitt (2000).

Marriage and divorce certificate data were obtained from the *National Vital Statistics System of the National Center for Health Statistics,* for years 1968 to 1995. The data includes all records for states with small numbers of events and a sample of records for states with larger numbers of events. Marriage microdata includes date of marriage, state residency, education, previous marital status, number of marriages, and ages of bride and groom. This covers around 44 states. Divorce microdata includes marital duration, number of children under 18, month and year of marriage, number of marriages, age, race, state residency of husband and wife, and the allocation of child custody is recorded after 1989. Divorce certificates data covers 26 states in 1968, 28 in 1969-70, 29 in 1971-77, 28 in 1978, 30 in 1979-80, 31 in 1981-85, and 31 and DC after 1986. Marriages or divorces of members of the Armed forces or other US nationals that occur outside of the United States are excluded.

Labor market variables are all derived from *Current Population Surveys* from 1964-2000. These are available for only a subset of around 23 states in the period 1968-76. An individual is defined to be participating in the labor force if they are aged 16 to 64 (60 for women), in full-time employment, not in school and have worked for at least one week.

Transfer payments through 1995 consists of emergency assistance and aid to families with dependent children. From 1998 forward it consists of benefits, generally known as temporary assistance for needy families, provided under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996.

Data on **out-of-wedlock** births was obtained from the *1960-1995 National and State Data Files on Adolescent Fertility, Assembled by Child Trends*, supplied by the Sociometrics Corporation, Los Altos: California.

All monetary variables are indexed at April 1st 2000 values.

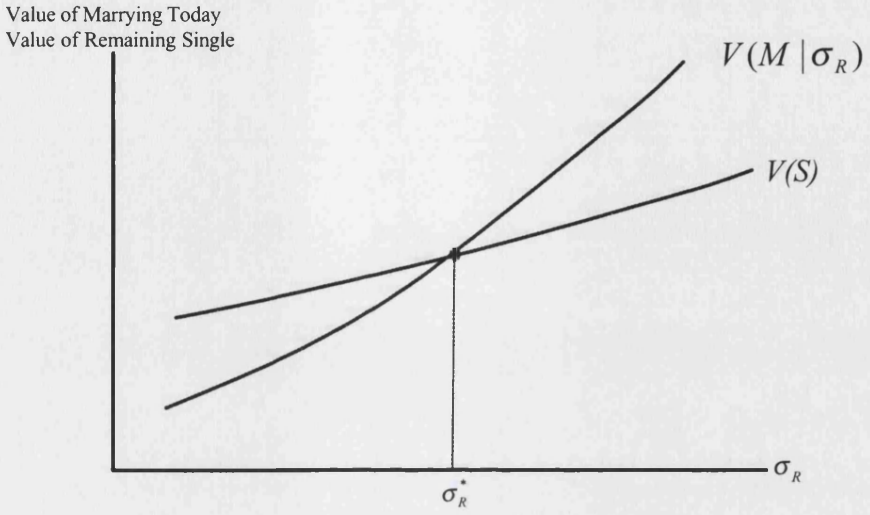


Figure A: Informative Signals

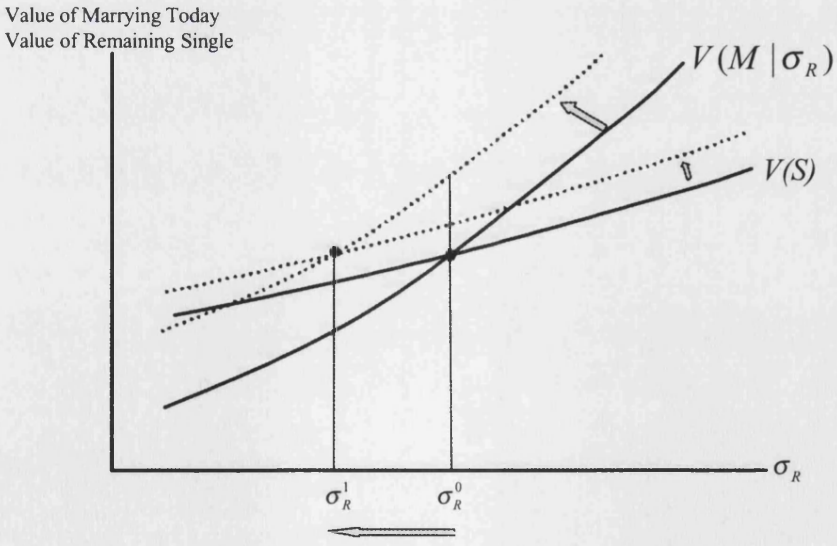


Figure B: No-fault Divorce
A Fall in the Cost of Exiting Marriage

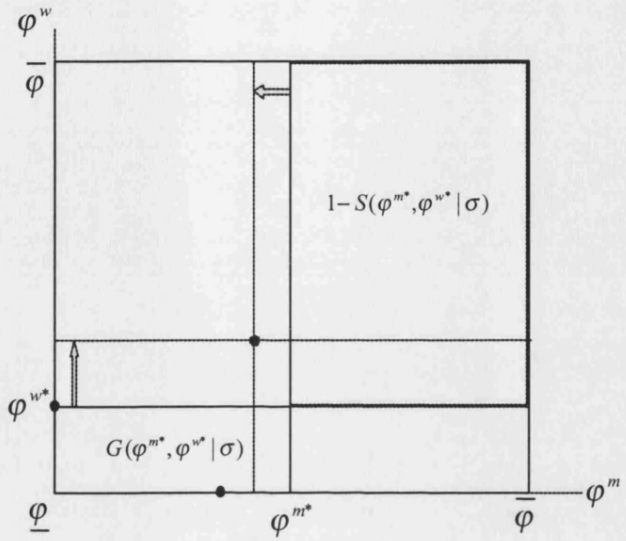


Figure C: The Probability of Divorce Under Different Divorce Regimes

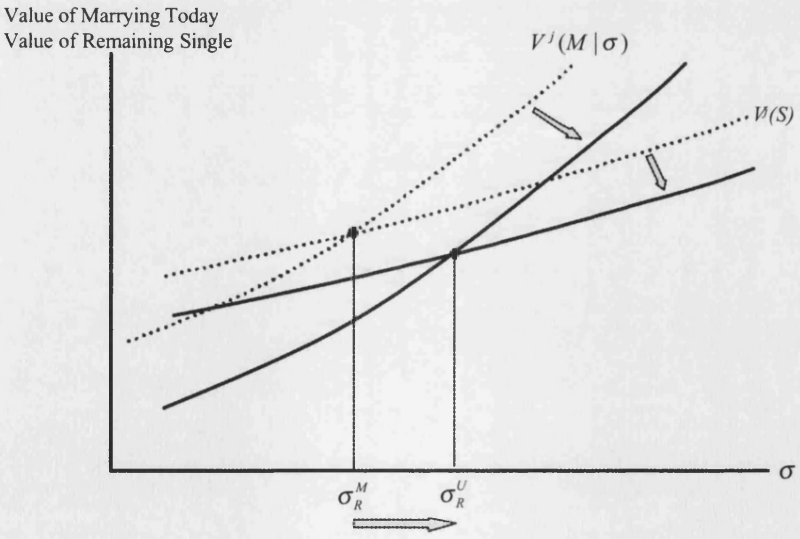


Figure D: The Introduction of Unilateral Divorce

Figure 1: The Passing of Divorce Laws

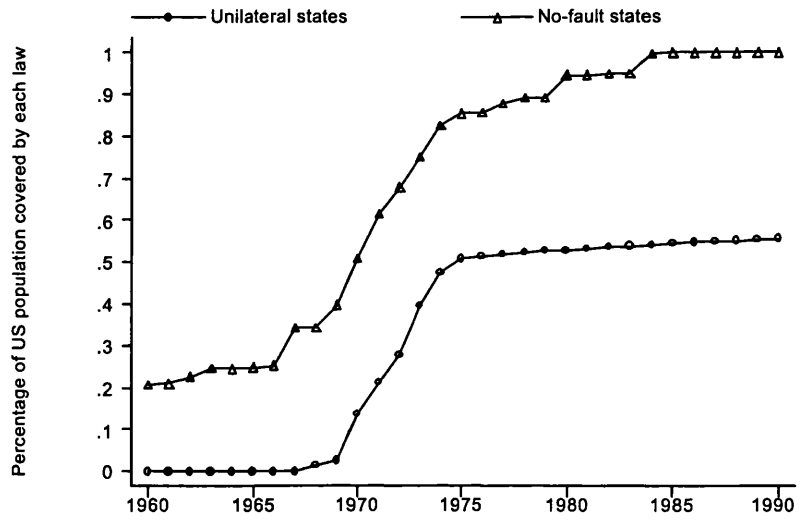
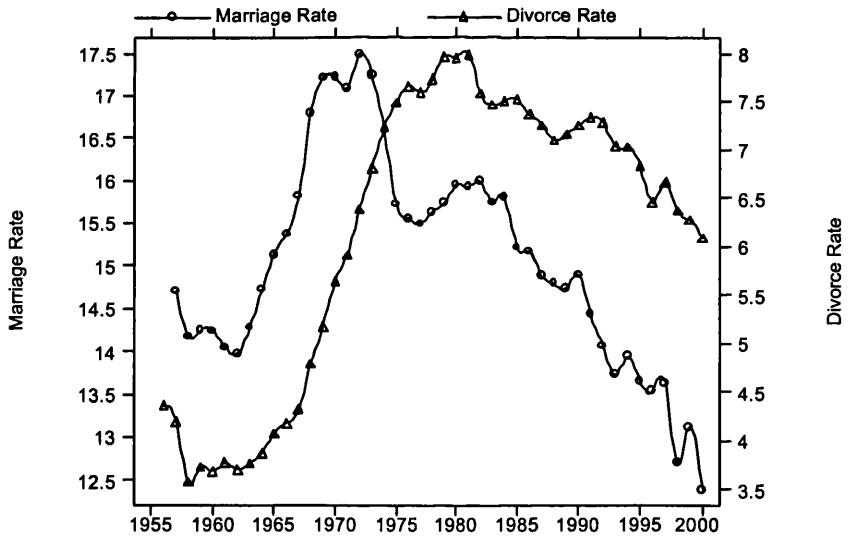


Figure 2: Marriage and Divorce Rates



Notes

1. Sources for the coding for divorce laws are given in the data appendix.
2. Marriage and divorce rates are defined as the number of marriages and divorces per 1000 of the population aged 15 to 65. These are weighted by mid year state populations to form aggregate rates. In 2002 al states, except NB and MS, required individuals to be 18 to marry without parental consent. NB sets the age of majority at 19, MS sets it at 21. DE, FL, GA, KY, MD, OK allow pregnant teens or teens who have already had a child to get married without parental permission. In FL, KY, and OK the couple must have court authorization.

Figure 3a: Marriage Rates by Adoption of Unilateral Divorce

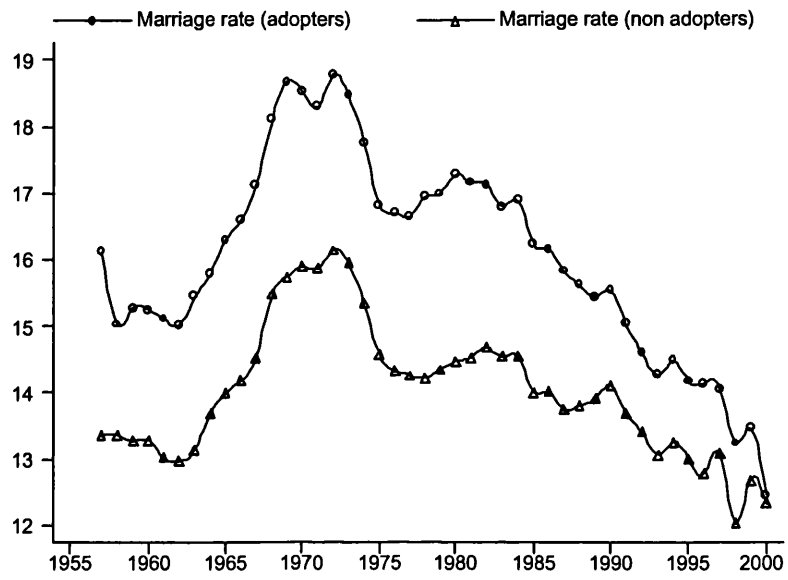
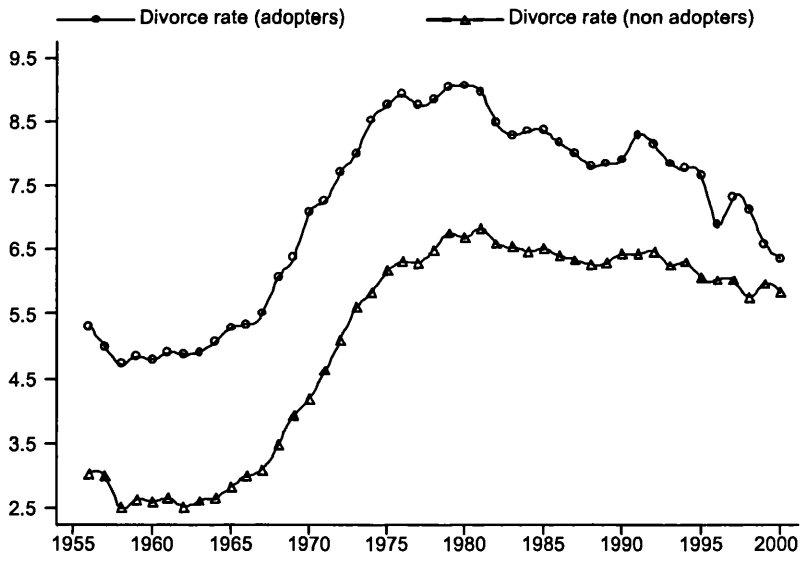


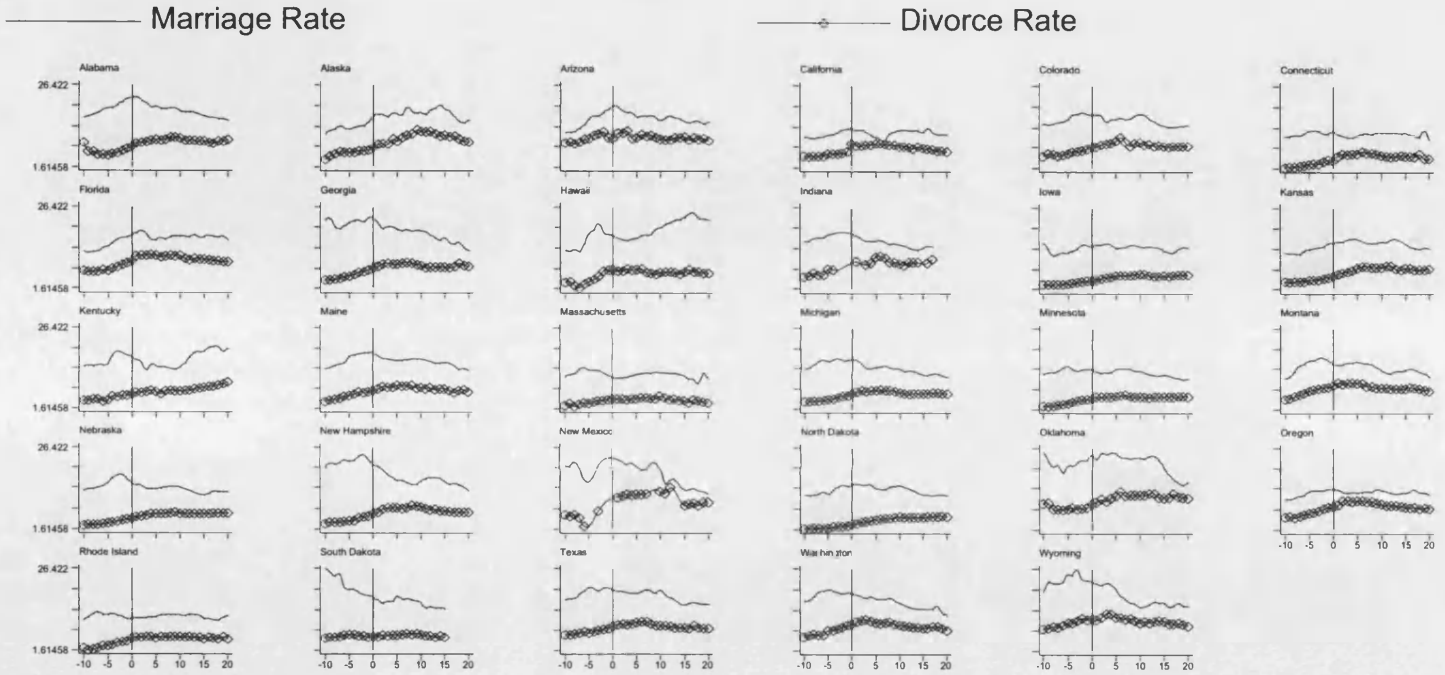
Figure 3b: Divorce Rates by Adoption of Unilateral Divorce



Notes

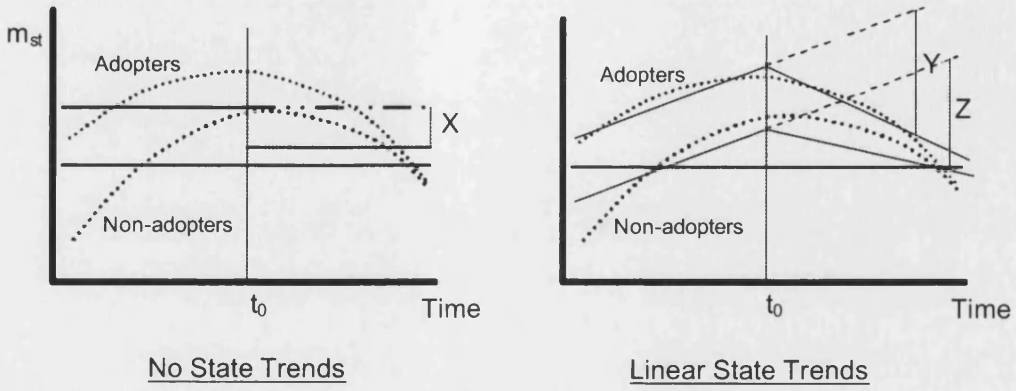
3. See also Table 1 for when each state adopted unilateral divorce laws. In total 31 states adopted unilateral divorce between 1968 and 1985. Each series in figures 3a and 3b is calculated as a population weighted average of state level marriage and divorce rates.

Figure 4: Marriage and Divorce Rates For Adopters by Years Since Adoption of Unilateral Divorce Law



Notes: The x-axis runs from 10 years prior to adoption of unilateral divorce, until 20 years after its adoption for each state. The vertical line in each chart signifies the year in which unilateral divorce was adopted. To allow the marriage rate axis to be comparable across states, the series for Nevada and Idaho are not shown.

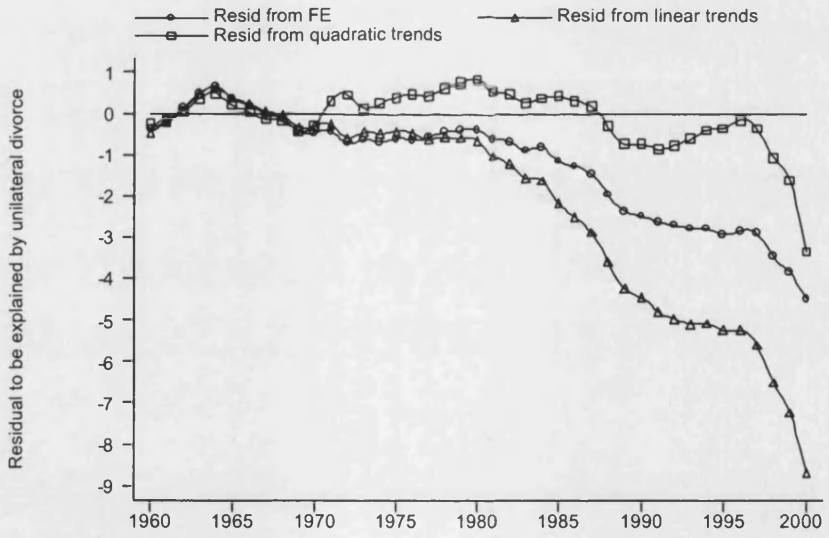
Figure 5a: The Stylized Effect of State Trends



No State Trends

Linear State Trends

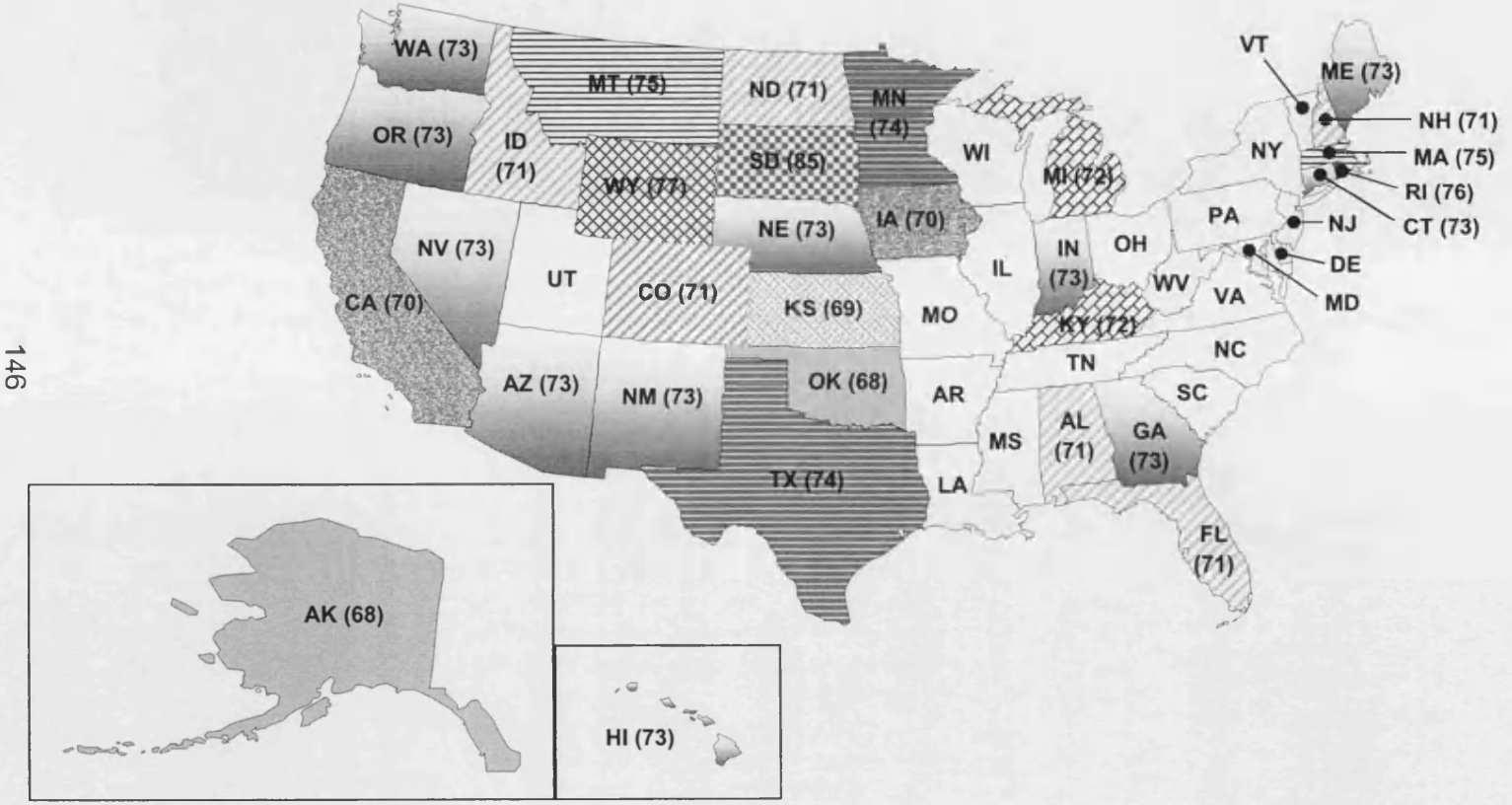
Figure 5b: The Estimated Effects of State Trends



Notes

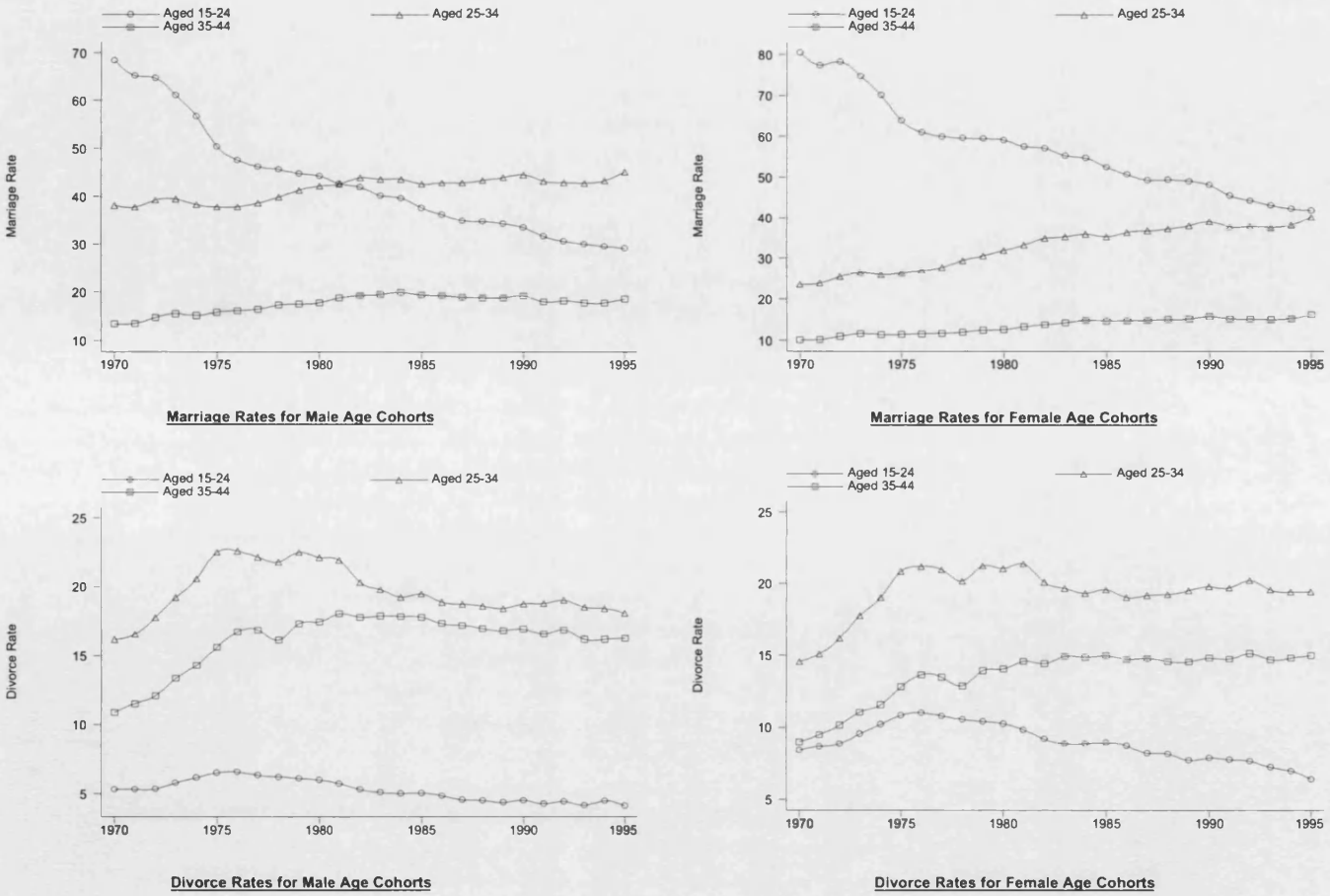
4. In figure 5b, the residuals shown are from estimating (14) using years in which unilateral divorce was not in place. The series show similar trends if Nevada is excluded from the sample.

Figure 6: The Adoption of Unilateral Divorce Laws Across the United States



Notes: Years in parentheses correspond to the year of adoption of unilateral divorce law. Coding for year of adoption taken from Friedberg (1998).

Figure 7: Marriage and Divorce Rates by Gender and Age Cohorts



Notes: Cohort specific marriage and divorce rates are derived from marriage and divorce certificates data. These are only available over the period 1970 to 1995. The marriage rate for cohort c in state s in year t is defined as (divorce rates within cohorts are similarly defined):

$$m_{cst} = \frac{\text{number of individuals in cohort } c \text{ that marry in state } s \text{ in year } t}{\text{number of individuals in cohort } c \text{ in state } s \text{ in year } t}$$

Figure 8: The Dynamic Effects of Unilateral Divorce on Marriage Rates

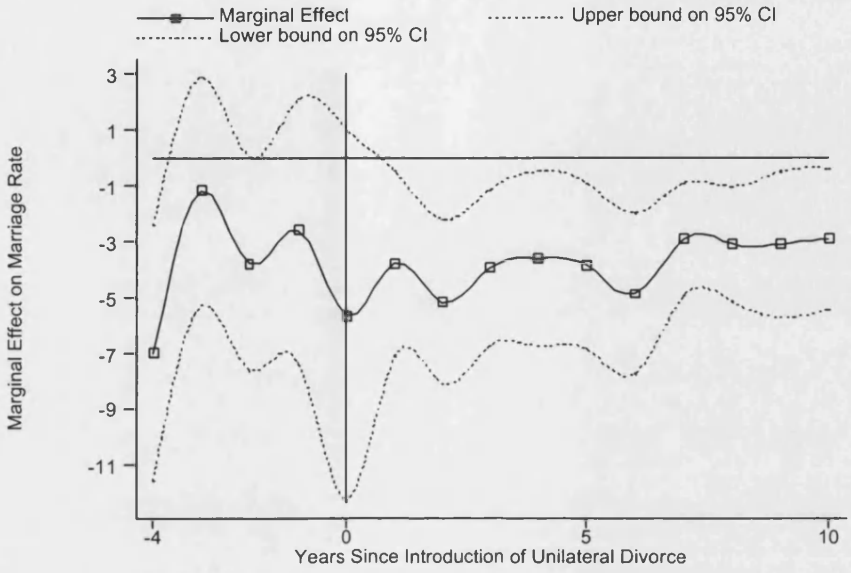
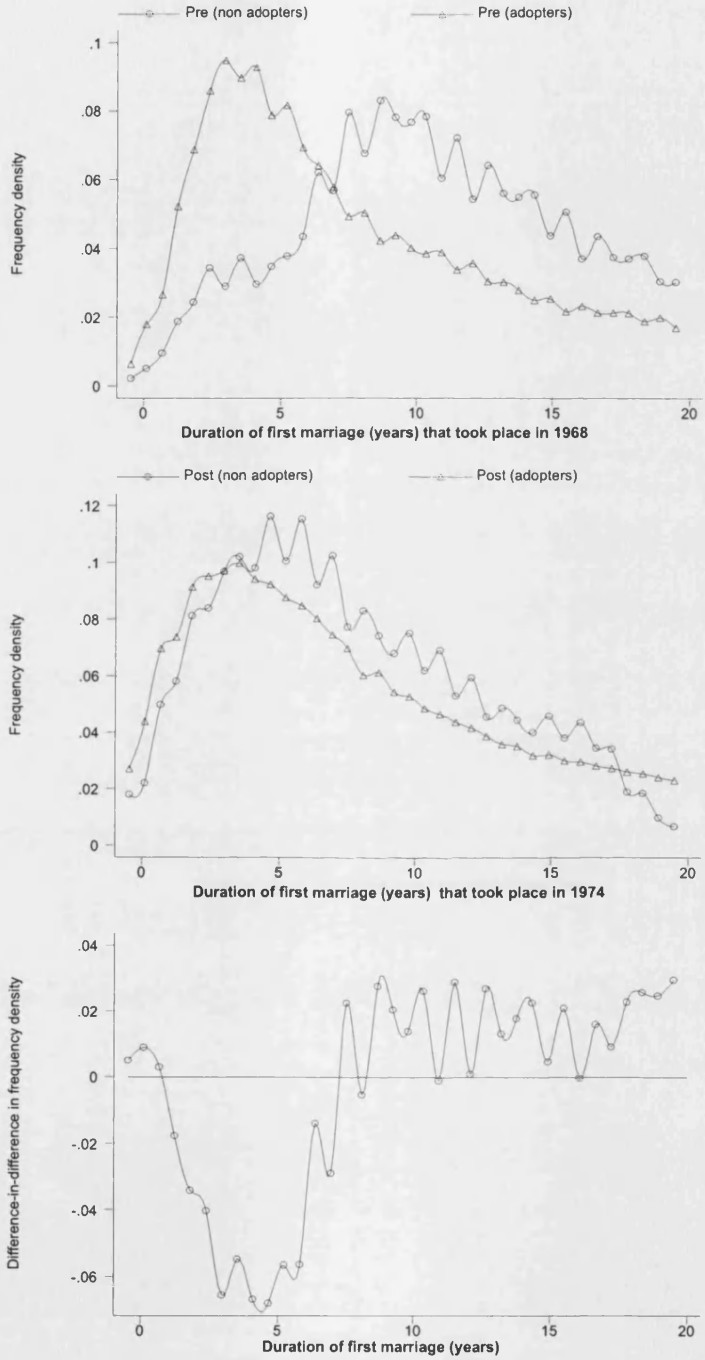


Figure 9: Change in the Stock of Ever Married Individuals

Notes

5. Figure 8 uses the marriage rate for 15-24 year old men. The corresponding figure for women in the same age cohort is very similar.
6. The variable measured in figure 9 is the change in the ever married population, as a percentage of total annual population. This is calculated annually as two times the number of marriages minus divorces, divided by population. The aggregate figure for the US is then derived by weighting the series from each state by state population.

Figure 10: Duration of First Marriages by Adoption of Unilateral Divorce



Notes: All estimates are based on the Epanechnikov kernel. The top figure shows the kernel density estimate for the duration of first marriage for marriages that occurred in 1968 in non-adopting states, and states that did adopt by 1974. The middle figure shows the kernel density estimate for the duration of first marriage for marriages that occurred in 1974 for non-adopting states, and states that had adopted by then. The bottom figure is the difference-in-difference of these frequency density functions;

$$(p_{post\_adopter} - p_{pre\_adopter}) - (p_{post\_nonadopter} - p_{pre\_nonadopter})$$

Marriage Rate			Divorce Rate				Percentage of US Population	
1970s	1980s	1990s	1960s	1970s	1980s	1990s		
20.9	17.8	15.7	6.4	9.3	9.7	9.3	1.73	Alabama
18.1	17.6	13.7	6.6	10.9	10.7	7.7	0.17	Alaska
18.5	16.5	14.5	9.2	11.6	10.6	9.5	1.09	Arizona
19.4	21.0	23.7	6.1	10.9	10.9	10.6	0.99	Arkansas
12.1	12.8	10.3	5.6	8.7	7.6		10.14	California
17.1	15.9	13.5	5.9	9.0	8.7	8.1	1.18	Colorado
12.1	12.4	10.7	2.2	5.1	5.7	4.7	1.37	Connecticut
11.3	12.5	11.0	2.7	6.7	7.0	6.9	0.26	Delaware
11.2	11.7	9.6	2.9	6.7	6.9	4.9	0.34	District of Columbia
17.5	17.5	16.5	7.3	11.2	10.6	9.4	3.89	Florida
21.2	18.0	13.2	4.6	8.3	8.5	7.8	2.41	Georgia
17.8	21.2	24.7	3.4	7.1	6.6	6.4	0.40	Hawaii
25.0	20.9	20.5	7.3	9.7	10.2	9.4	0.39	Idaho
15.8	13.0	11.8	4.0	6.5	6.4	5.5	5.15	Illinois
17.2	14.8	12.0	6.0	10.3	9.8		2.44	Indiana
15.0	14.0	13.0	3.4	5.4	5.9	5.9	1.33	Iowa
16.5	15.4	12.9	4.5	7.9	8.1	7.3	1.09	Kansas
15.7	17.2	18.2	4.2	6.3	7.5	8.7	1.61	Kentucky
16.1	14.2	13.8		4.9			1.78	Louisiana
17.6	16.2	13.2	4.4	7.6	7.8	6.5	0.51	Maine
17.7	15.2	12.6	3.1	5.2	5.4	4.9	1.84	Maryland
12.1	12.4	10.6	2.3	4.1	4.7	3.7	2.65	Massachusetts
15.3	13.1	11.1	4.1	6.8	6.6	6.2	4.08	Michigan
13.4	13.0	10.9	2.6	5.0	5.5	5.2	1.83	Minnesota
19.4	15.9	13.0	4.6	7.9	8.0	8.1	1.13	Mississippi
17.3	15.9	13.3	5.1	7.7	8.0	7.6	2.24	Missouri
16.2	14.3	12.4	5.3	8.8	8.6	7.2	0.35	Montana
14.8	13.0	12.1	3.1	5.5	6.3	6.1	0.72	Nebraska
262.5	171.4	133.3	37.7	26.1	21.1	12.8	0.33	Nevada
18.2	16.0	12.5	4.0	7.5	7.4	7.2	0.39	New Hampshire
11.6	11.8	10.6	1.5	4.1	5.4	4.6	3.28	New Jersey
21.4	16.6	13.1	5.3	11.1	11.6	9.0	0.55	New Mexico
12.7	13.3	12.5	0.8	4.2	5.4	4.8	8.31	New York
13.0	12.0	11.9	3.1	5.8	7.3	7.5	2.61	North Carolina
14.6	13.1	11.4	2.0	4.1	5.4	5.3	0.30	North Dakota
14.4	13.9	12.4	4.3	7.4	7.4	6.8	4.89	Ohio
23.9	18.9	13.8	8.3	11.6	11.6	10.3	1.30	Oklahoma
13.3	13.0	12.5	5.9	9.3	9.2	7.7	1.08	Oregon
12.4	11.5	10.0	2.3	4.2	5.0	5.1	5.53	Pennsylvania
12.0	12.3	11.8	1.9	4.4	5.6	5.2	0.44	Rhode Island
30.3	24.4	19.5	2.2	5.0	6.3	6.2	1.36	South Carolina
26.7	18.0	16.1	2.5	4.9	6.0	6.2	0.33	South Dakota
20.0	19.0	22.0	4.8	8.8	9.6	9.5	2.00	Tennessee
19.8	18.3	15.2	6.5	9.0	9.3	7.7	6.08	Texas
19.8	18.2	17.1	5.0	7.7	8.6	7.5	0.60	Utah
16.2	16.0	15.4	2.5	5.6	6.9	6.8	0.22	Vermont
17.2	16.5	15.1	3.2	5.4	6.4	6.6	2.35	Virginia
18.4	15.6	12.3	6.4	10.0	9.3	8.1	1.76	Washington
15.1	12.2	10.1	3.7	6.8	7.9	7.8	0.89	West Virginia
13.1	13.0	11.1	2.2	4.5	5.5	5.3	2.10	Wisconsin
23.3	17.8	15.6	7.5	10.6	11.4	9.9	0.18	Wyoming
16.4	**15.4**	**13.8**	**4.1**	**7.1**	**7.5**	**6.9**		**United States**

na reverted back to fault based covenant marriages in 1997. Marriage rate data is available for 1957-2000, except Mississippi which starts in 1958.
KT 56-58, LO 56-70, 84-00, MA 56, NY 56-57, NC 56-57 and WV 56-57. The marriage (divorce) rate is defined as the number of marriages (divorces)
culated if there at least five state observations. Decennial US average by weighting state averages by mid year population estimates. The column
he period 1960-2000 by state.

Table 2: The Effect of Divorce Laws on Marriage Rates

Panel data regression estimates

Dependent variable: Annual marriages per thousand of the adult population (aged 15 to 65)

	(1)	(2) Pre Trend	(3) Linear State Effects	(4) Quadratic State Effects	(5) No-fault Divorce Only	(6) Divorce Laws	(7) Reversion to the Mean	(8) Adopting States Only
Unilateral divorce	-4.36	-4.37	-.926	-1.43				
	(4.72)	(3.22)	(1.71)	(1.84)				
Unilateral adopted in 2-3 years time		-.822						
		(.40)						
Unilateral adopted in 4-5 years time		1.32						
		(.81)						
No-fault divorce					-.362			
					(1.54)			
No-fault divorce only						.275	.283	.768
						(.51)	(.55)	(.63)
Unilateral and no-fault divorce						-1.31	-1.29	-1.35
						(2.20)	(2.17)	(2.30)
Marriage rate in 1960 x time trend							-.001	
							(.675)	
F-tests								
Year Effects	3.97	5.06	9.44	11.37	14.12	11.04	8.62	9.03
State Effects	66.93	67.76	108.09	46.13	48.18	45.89	46.07	36.72
State Effects, Linear			53.72	14.14	15.21	13.81	13.03	8.11
State Effects, Quadratic				14.18	14.97	13.85	13.55	8.47
R-squared	.8893	.8894	.9877	.9883	.9883	.9883	.9883	.9886
Number of Observations	2091	2091	2091	2091	2091	2086	2086	1266

Notes: Absolute t-statistics reported in parentheses. Robust standard errors are calculated throughout. Sample period is 1964-2000, for all 51 states. All specifications control for adult population (in millions) and its square. The sample drops by 5 in column 6 because the following states have unilateral and fault based divorce - C0 72, AR 97-00. The specification in column 7 controls for the historic marriage rate, measured in 1960, interacted with a time trend. The sample in column 8 consists only of the 31 states that adopted unilateral divorce. F-tests for the joint significance of year and state effects were significant at the 1% level in all specifications above. Definitions of all variables are given in the data appendix.

Table 3: Robustness Checks

Panel data regression estimates

Dependent variable: Annual marriages per thousand of the adult population (aged 15 to 65)

	Omitted Policies			Endogenous Timing of Adoption			Endogenous Divorce Law	
	(1) Abortion	(2) Joint Custody	(3) Non Common Law Marriage States	(4) Regional Fixed Effects	(5) Early Adopters Only	(6) Neighboring Adopting States	(7) Low Out-of-wedlock Births	(8) High Out-of-wedlock Births
No-fault divorce only	.360	.407	.766	.283	.004	.486	.042	.114
	(.66)	(.74)	(1.07)	(.55)	(.02)	(.92)	(.22)	(.11)
Unilateral and no-fault divorce	-1.29	-1.28	-1.75	-1.29	-.844	-1.29	-.628	-4.17
	(2.17)	(2.15)	(2.34)	(2.17)	(3.02)	(2.03)	(2.05)	(1.86)
Legalized abortion	-1.10	-1.11	-1.90					
	(1.85)	(1.87)	(2.46)					
Joint Custody		-.484	-.475					
		(1.45)	(1.11)					
Neighboring states that adopt (weighted by the area of the adopting neighbouring states in 1000 sq km)						-.001		
						(1.02)		
Neighboring states that adopt x area of state *s* (in 1000 sq km)						.001		
						(1.26)		
Regional FE				Yes	Yes	Yes		
R-squared	.9884	.9884	.9887	.9883	.9372	.9884	.9254	.9889
Number of Observations	2086	2086	1595	2086	1393	2004	1229	857

Notes: Absolute t-statistics reported in parentheses. Robust standard errors are calculated throughout. All specifications control for adult population (in millions) and its square. Column 3 restricts the sample to only include states that do not allow common law marriage. In columns 4 to 6, regional fixed effects are also controlled for. The regions are defined using a standard classification of Pacific, Mountain, West North Central, East North Central, Middle Atlantic, New England, West South Central, East South Central, and South Atlantic. In column 5, early adopters are defined as those states that adopted unilateral divorce up to and including 1972. Alaska and Hawaii are dropped form the neighboring states specification in column 6. In columns 7 and 8 I split the sample by the percentage of total births that occur out-of-wedlock in 1970. Low out-of-wedlock states have less than the average percentage of births out-of-wedlock. F-tests for the joint significance of year and state effects were significant at the 1% level in all the specifications above. Definitions of all variables are given in the data appendix.

Table 4: The Effect of Divorce Laws on Marriage Rates Within Cohorts

Panel data regression estimates

Dependent variable: Annual marriages per thousand of the cohort population

Men

	Age			Marriage Number		Race	
	(1) 15-24 Year Olds	(2) 25-34 Year Olds	(3) 35-44 Year Olds	(4) First Marriage (15-34 year olds)	(5) Second Marriage (25-44 year olds)	(6) White (15-44 year olds)	(7) Black (15-44 year olds)
No-fault divorce only	.129	.578	.118	-.552	.400	.895	-3.23
	(.21)	(1.34)	(.33)	(1.19)	(1.80)	(1.07)	(1.52)
Unilateral and no-fault divorce	-1.37	-.170	-.988	-1.22	-.243	-3.06	-1.46
	(1.90)	(.33)	(1.86)	(2.52)	(.71)	(3.50)	(.49)
R-squared	.9823	.9587	.9488	.9614	.9625	.9486	.9014
Number of Observations	1109	1109	1109	1087	998	896	783

Women

	(1) 15-24 Year Olds	(2) 25-34 Year Olds	(3) 35-44 Year Olds	(4) First Marriage (15-34 year olds)	(5) Second Marriage (25-44 year olds)	(6) White (15-44 year olds)	(7) Black (15-44 year olds)
No-fault divorce only	.726	.181	.136	-.178	.048	1.32	-2.64
	(.97)	(.45)	(.47)	(.38)	(.23)	(1.41)	(1.20)
Unilateral and no-fault divorce	-1.66	.032	-.809	-1.32	-.293	-3.38	2.84
	(1.90)	(.06)	(1.84)	(2.65)	(.91)	(3.53)	(.72)
R-squared	.9788	.9724	.9588	.9605	.9622	.9509	.9393
Number of Observations	1109	1109	1109	1087	998	896	730

Notes: Absolute t-statistics reported in parentheses. Robust standard errors are calculated throughout. Cohort specific marriage and divorce rates are derived from marriage and divorce certificates data. These are only available over the period 1970 to 1995. All specifications control for the female to male sex ratio in the appropriate age group, and include quadratic state trends over time. Definitions of all variables are given in the data appendix.

Table 5: The Effect of Divorce Laws on Turnover in the Marriage Market

Panel data regression estimates

Dependent variable: Annual divorces per marriage by cohort

Men

		Age			Race	
	(1) Adult Population	(2) 15-24 Year Olds	(3) 25-34 Year Olds	(4) 35-44 Year Olds	(5) White (15-44 year olds)	(6) Black (15-44 year olds)
No-fault divorce only	.009	-.0003	-.023	.024	.002	.179
	(1.65)	(.09)	(1.73)	(.72)	(.21)	(2.05)
Unilateral and no-fault divorce	.019	.019	.026	.058	.061	.265
	(2.85)	(3.34)	(1.43)	(1.36)	(4.67)	(1.94)
R-squared	.9362	.9584	.9617	.9470	.9475	.8720
Number of Observations	2009	779	794	794	611	209

Women

	(2) 15-24 Year Olds	(3) 25-34 Year Olds	(4) 35-44 Year Olds	(5) White (15-44 year olds)	(6) Black (15-44 year olds)
No-fault divorce only	-.001	-.028	.032	.002	.079
	(.27)	(1.52)	(.60)	(.19)	(1.34)
Unilateral and no-fault divorce	.020	.018	.136	.063	.137
	(3.26)	(.77)	(1.46)	(4.80)	(1.92)
R-squared	.9617	.9660	.9305	.9479	.8601
Number of Observations	794	794	794	617	367

Notes: Absolute t-statistics reported in parentheses. Robust standard errors are calculated throughout. Cohort specific marriage and divorce rates are derived from marriage and divorce certificates data. These are only available over the period 1970 to 1995. All specifications control for the female to male sex ratio in the appropriate age group. Definitions of all variables are given in the data appendix.

Table 6 : Descriptive Statistics By Adoption of Unilateral Divorce (1964 - 2000)

Adopting States

	Mean	Standard Deviation	95% Confidence Interval	
Adult population (millions)	5.84	0.12	5.61	6.07
Proportion population black	15.07	0.30	14.49	15.66
Proportion population other race	1.69	0.07	1.56	1.82
Personal income per capita ($1000)	12.70	0.31	12.09	13.32
State Transfers to Families ($1000 per capita)	1.45	0.03	1.39	1.50
Male labor force participation rate	85.70	0.19	85.32	86.08
Female labor force participation rate	60.66	0.37	59.93	61.39
Female/male earnings ratio	39.53	0.40	38.74	40.32
Marriage rate (per 1000 of adult population)	22.10	1.05	20.05	6.04
Divorce rate (per 1000 of adult population)	7.64	0.12	7.40	7.88

Non-Adopting States

Adult population (millions)	6.82	0.17	6.49	7.16
Proportion population black	8.93	0.19	8.56	9.30
Proportion population other race	4.14	0.19	3.76	4.53
Personal income per capita ($1000)	13.41	0.24	12.93	13.89
State Transfers to Families ($1000 per capita)	1.37	0.02	1.33	1.42
Male labor force participation rate	85.97	0.16	85.65	86.29
Female labor force participation rate	62.65	0.29	62.08	63.22
Female/male earnings ratio	41.03	0.32	40.40	41.66
Marriage rate (per 1000 of adult population)	15.02	0.15	14.70	15.32
Divorce rate (per 1000 of adult population)	5.88	0.08	5.73	6.04

Notes: Labor market variables were derived from CPS utilities files for years 1964-2000. All monetary amounts are indexed at April 1st 2000 values. Personal income per capita data is converted to April 1st, 2000 values, and is also calculated using mid year population estimates. Transfer payments through 1995 consists of emergency assistance and aid to families with dependent children. From 1998 forward it consists of benefits, generally known as temporary assistance for needy families, provided under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996.

Table 7 : Other Determinants of Marriage Rates

Dependent variable: Residual from annual marriages per thousand of the adult population (aged 15 to 65) regressed on state and year effects only
This is calculated from years in which unilateral divorce was not in place

	(1)	(2)	(3)	(4)	(5)	Mean (sd) of variable
Unilateral divorce	-4.12	-4.36	-4.00	-4.58	-4.90	0.48
	(4.75)	(4.57)	(3.94)	(4.54)	(4.78)	(0.50)
Adult population (millions)	1.00	1.17	1.62	1.57	1.40	3.25
	(3.18)	(3.63)	(4.87)	(4.76)	(4.19)	(3.41)
Adult population squared	-.040	-.050	-.066	-.076	-.065	22.18
	(1.96)	(2.42)	(3.20)	(3.71)	(3.12)	(53.4)
Proportion population black		-.042	-.006	-.103	-.053	11.05
		(1.13)	(.16)	(2.54)	(1.21)	(12.4)
Proportion population other race		.131	.179	.099	.130	3.75
		(2.51)	(3.37)	(1.84)	(2.39)	(8.50)
Sex ratio (0-1)		-9.98	-8.06	-6.20	-5.76	0.94
		(2.36)	(1.89)	(1.46)	(1.36)	(.10)
Per capita income ($1000)			-3.92	-.415	-.242	13.92
			(4.74)	(5.07)	(1.98)	(8.20)
Male years of schooling			-4.87	-6.57	-7.66	13.62
			(3.29)	(4.42)	(5.02)	(.68)
Female years of schooling			8.29	8.73	8.74	13.31
			(4.33)	(4.61)	(4.56)	(.64)
State transfers to families ($1000 per capita)				4.40	4.80	1.35
				(6.27)	(6.76)	(.73)
Female labor force participation rate (0-100)					.209	63.03
					(2.61)	(10.7)
Female/male earnings ratio (0-100)					-.299	40.61
					(3.01)	(10.9)
Adjusted R-squared	.0260	.0319	.0464	.0686	.0735	
Number of Observations	1623	1623	1623	1623	1623	

Notes: Absolute t-statistics reported in parentheses. Sample period is 1964-2000. The dependent variable is calculated by estimating (14) using only years prior to the introduction of unilateral divorce, and then using these estimates to predict what the residuals over the entire sample. This is done using fixed effects only. All monetary variables are indexed at April 1st 2000 prices. The sample size is smaller than in table 2 because labor market variables can only be constructed for a subset of 22 states from the CPS data for years 1968-76. The sex ratio is the ratio of females to males aged 15-65. Transfer payments (family assistance) - through 1995, consists of emergency assistance and aid to families with dependent children. For 1998 forward, consists of benefits— generally known as temporary assistance for needy families— provided under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996. The average marriage rate over the sample in columns 1 to 6 was 17.8. Definitions of all variables are given in the data appendix.

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