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Dynamic intrahousehold bargaining, matrimonial property law and suicide in Canada

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DYNAMIC INTRAHOUSEHOLD BARGAINING, MATRIMONIAL PROPERTY LAW AND SUICIDE IN CANADA

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Abstract. This paper develops a dynamic model of household bargaining and uses it to motivate an empirical analysis of the impact changes in Canadian laws regarding the allocation of family assets upon divorce on female suicide. Using time series data, we show that in Ontario, the passage of Canadian legislation that improved women's rights to assets upon divorce was associated with reductions in the rate of female suicide amongst older (married) women while not affecting younger (unmarried) women. As suggested by our model, its impact was asymmetric in that male suicide rates were unaffected by this change. We also exploited a quasi-natural experiment in these data, namely that no comparable legislative change occurred in Quebec. Here, we do not observe a structural break in the data.

JEL Codes: D10, J12

Keywords: intrahousehold, bargaining, divorce, suicide, Canada

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1. Introduction

Since the early 1970s, economists have paid increasing attention to the economics of the family. This work is characterized by the application of economic theory to outcomes sometimes considered beyond the traditional remit of economics, such as the determinants of marriage and divorce, fertility and child bearing, the division of labor within the household, and human capital (including health and education) formation. Much of this work has been associated with examining the impact within the household of changes, such as public policy interventions, that originate outside the household.[1]

An important feature of this literature is the assumption that the household acts as a single unit; as reflected, for example, by the contention that there exists a single decision maker whose preferences form the basis of a household welfare function and that all household resources are effectively pooled. This is termed the 'unitary model' (Alderman et al., 1995). An alternative, (the 'collective model') takes as its starting point the possibility that different household members have different preference orderings and that the resolution of these differences is a non-trivial problem. In one strand of this literature (McElroy, 1990, 1997; McElroy and Horney, 1981; Manser and Brown, 1980), individuals use a cooperative Nash bargaining solution as the mechanism by which differences in preference rankings are resolved. A second approach is taken by Pierre-Andre Chiappori and his collaborators (e.g., Browning et al., 1994); here the key insight is that much of the empirical content of both the unitary model and the Nash Bargaining solution stems from the fact that both approaches predict (or assume) that allocations will be Pareto efficient, so that it's possible to simply start with nothing but some assumptions regarding utility functions and the presumption that outcomes will be efficient, and use these as the basis for empirical work. In contrast, to some authors the presumption of Pareto efficiency seems to strong, leading Ulph (1988), Lundberg and Pollak (1994), and Carter and Katz (1997) to use noncooperative game theory. In these models, instead of resolving differences in preferences, individual household members maximize their own utility functions, taking as given the actions of other household members; the outcome need not be Pareto efficient. Related, Lundberg and Pollak (1993) have suggested a 'separate spheres model' in which household members base their

[1]Much of this work has been inspired by Becker (1974, 1981). A recent set of detailed surveys of this literature can be found in the volumes edited by Rosenzweig and Stark (1996).

joint decisions on a cooperative bargaining solution, with a noncooperative outcome being the fallback position of each party.

This paper develops a dynamic model of household bargaining and uses it to motivate an empirical analysis of the impact changes in Canadian laws regarding the allocation of family assets upon divorce on female suicide. As such, its focus and methods are very much in the tradition of the literature on the economics of the family. However, it differs from existing work in several ways. First, models using a Nash cooperative set-up treat divorce as the "outside option" which determines the efficient division of resources in the household. Our model explicitly allows suicide, the ultimate outside option.[2] The ability (or inability) of women to escape unhappy marriages was noted by Durkheim (1897) in his seminal study on the sociology of suicide, which gave prominence to the relationship between the ease to which women and men could divorce and suicide rates amongst married adults in late 19th century western Europe.[3] Yet there are no studies within economics that consider this relationship.

A further weakness of the Nash cooperative model is that outside options are never actually resorted to; here divorce and suicide are sometimes predicted by the model. Lundberg and Pollak (1993) offer a further criticism; that in many households the "outside option" may not be relevant for determining allocations, as a threat to divorce may not be credible. Rather, some inefficient allocation within marriage may be the relevant threat point. Related, Lundberg and Pollak (1994) criticize the presumption of many models that outcomes within a marriage are always efficient. By contrast, our model encompasses both cases in which the outside options of divorce or suicide are relevant, as well as the case in which some inefficient outcome within marriage is of greater importance. Finally, the model is dynamic, and permits uncertainty.

Lastly, reviews by Behrman (1996), Hoddinott et al. (1997), Lundberg and Pollak (1996), Strauss and Thomas (1995) and Strauss and Beegle (1995) emphasize that empirical attempts to differentiate unitary from collective models suffer from several failings, the most grievous being that of "observational equivalence." The outside options that appear in some collective models also appear as explanatory variables in unitary models, leading Rosenzweig

[2]Anyone familiar with Tolstoy's *Anna Karenina*, Fassbinder's film *Effi Briest* or more recently Coppola's film *The Virgin Brides* would recognize at once the links between interactions amongst family members and suicide.

[3]Specifically, Durkheim notes that in countries or provinces where divorce was readily available and where the act of divorce imposed few costs on women, that suicide rates amongst married women were lower than in other localities.

and Schultz to remark that "If the joint family utility framework is to be replaced by a less parsimonious model of intra-family allocation, the increase in complexity should be explicitly demonstrated to have empirically distinguishable predictions" (Rosenzweig and Schultz, 1984, p. 522). As such, a further important feature of this model is that it provides such a prediction, namely that a legal change awarding women a larger share of assets in the event of divorce will lead to a decline in female suicide rates.

We structure the paper in the following fashion. Section 2 outlines our formal model of these bargaining processes. Section 3 provides context, demonstrating why Canadian divorce laws and suicides amongst Canadians provide an appropriate empirical setting for this paper, and Section 4 presents our empirical test of the central implication of the model. We conclude by re-iterating the central claim of the paper: Canadian legislation that improved women's rights to assets upon divorce was associated with reductions in the rate of adult female suicide. Such a result is consistent with dynamic bargaining processes amongst family members, but not with models that assume that households are unitary entities. It strengthens the oft-made but poorly substantiated claim that public policy can have powerful impacts within the household.

2. The Model

2.1. **Overview.** There are at least three distinct ways to think about the problem of modeling the dependence of household bargaining outcomes on the value of the outside options of suicide and divorce. First, we could think of the problem as a dynamic noncooperative game. In this case, the characterization below would describe the strongly renegotiation-proof equilibria of the game (Kletzer and Wright, 2000). Second, we could think of the solution given below as satisfying a set of axioms meant to characterize any 'reasonable' solution to a cooperative dynamic bargaining problem (Ligon, 2002). Third, we could think of the problem as one of contract design, as in Kocherlakota (1996) or Ligon et al. (2002). In this case, we'd want to regard the characterization below as a description of the properties of an efficient contract. We take the final approach because it seems slightly simpler than the other options; we could think of the problem of designing an efficient contract as the problem facing a couple who are attempting to design a marriage contract.

2.2. **The environment.** There are two agents, 1 (female) and 2 (male), and an infinite number of periods. In each period, one of a finite number of states of nature is realized, $s \in \Omega = \{1, \ldots, \ell\}$. In addition to s, a complete description of the state includes the status

of each agent, either "Single," "Married," or "Dead" (S, M, D). We denote the status of the pair of agents at the beginning of the period by a pair so that, for example, the problem faced by married couple in state s is indexed by $(s, (M, M))$. Of course, agents' status in subsequent periods depends on actions taken in the current period. We permit an action corresponding to each state, so that single agents can act to remain single (S), propose matrimony (M), or commit suicide (D). Similarly, married agents may seek divorce (S), remain married (M), or commit suicide (D); while by assumption dead agents cannot change their marital status, but must remain dead (D).[4]

More formally, denote an action pair by $a = (a^1, a^2)$. In general, the set of possible actions may depend on the realized state s as well as actions taken in the previous period; thus, if actions a are taken subsequent to the realization of some state s, then subsequent actions must be elements of the space $A_s(a)$.[5] For example, one imagines that if a couple takes the action pair of jointly committing suicide, then action spaces in subsequent periods ought to consist of the singleton $\{(D, D)\}$. Of course, the value each agent derives from playing this subgame may depend not only on his or her own actions; for example, the death of one's spouse might be expected to influence one's own happiness.

We next go about associating different payoffs with different states. Denote the set of (momentary) utility possibilities for agents 1 and 2 in state s given actions a by $W_s(a) \in \mathbb{R}^2$, and let $\mathbf{W}(a) = \{W_s(a)\}_{s\in\Omega}$. We assume that each $W_s(a)$ is convex and compact. Let $\varphi_s(w_2, a) = \max\{w_1 | (w_1, w_2) \in W_s(a)\}$ trace out the Pareto frontier of the set $W_s(a)$; we assume that each function φ_s is non-increasing and weakly concave.

The value any married agent places on remaining married depends not only on current utility derived from the marriage, but also on discounted, expected future utilities. Denote by $(U_s^1(a), U_s^2(a))$ the values associated with being married given that the current state is s and the current action pair a.

A couple contemplating marriage is presumed to solve the problem of maximizing the value of marriage to one spouse (1) subject to delivering some fixed value U^2 to the other

[4]It would be straightforward to expand the set of actions. One might include, for example, the option of delaying bargaining (as in Binmore (1985)), or of behaving unpleasantly toward one's spouse (as in Lundberg and Pollak (1993), or what Bergstrom (1996) calls an outcome of "harsh words and burnt toast."

[5]Additional notation for action spaces: Actions for agent i in state s given previous actions a are a subspace $A_s^i(a)$ of $A_s(a)$. It will sometimes be convenient to write out action pairs explicitly, referring, for example, to the action space $A_s(a^1, a^2)$.

(2). A general, recursive formulation of this problem is given by

$$U_s^1(U^2, a) = \max_{\substack{w \in W_s^2(a), \\ \{a_r \in A_r(a)\}_{r\in\Omega}, \\ \{(U_r^2(\hat{a}))_{\hat{a}\in A_r(a)}\}_{r\in\Omega}}} \varphi_s(w, a) + \beta \sum_{r\in\Omega} \pi(r|s) U_r^1(U_r^2(a_r), a_r) \tag{1}$$

subject to

$$w + \beta \sum_{r\in\Omega} \pi(r|s) U_r^2(a_r) = U^2 \tag{2}$$

and subject to the actions a^1 being a best response to the action a^2 for any subsequent state,

$$a_r^1 \in \underset{\hat{a}^1 \in A_r^1(a)}{\operatorname{argmax}} U_r^1(U_{s'}^2(\hat{a}^1, a_r^2), (\hat{a}^1, a_r^2)) \tag{3}$$

and

$$a_r^2 \in \underset{\hat{a}^2 \in A_r^2(a)}{\operatorname{argmax}} U_{s'}^2(a_r^1, \hat{a}^2) \tag{4}$$

for all $r \in \Omega$.

Now, recall that for our problem each agent is either single, married, or dead at the beginning of each period, so that $a^i \in \{S, M, D\}$ for $i = 1, 2$. The action space for dead agents is very limited; dead agents simply remain dead, so that if, for example, agent 1 is dead, then his action space is $A_r^1(D, a^2) = \{D\}$ for all r and all a^2. The action spaces for single or married people are richer; they can either take the action of remaining single/divorcing, marrying/remaining married, or committing suicide. Different action pairs give rise to different payoffs. These payoffs will also depend on the state, and on the bargaining position of each party. Consider the following table of momentary payoffs. Here, b_s^i is the momentary utility agent i receives in state s if both agents are single by choice. Similarly, j_s^i is momentary utility in state s if (s)he has been jilted, while an agent who jilts receives momentary utility k_s^i. Suicides receive momentary utility of d regardless of the state, while if i is a surviving partner, (s)he suffers a level of grief denoted by g_s^i in state s.

	S	M	D
S	(b_s^1, b_s^2)	(k_s^1, j_s^2)	(b_s^1, d)
M	(j_s^1, k_s^2)	$(\phi_s(w, (M, M)), w)$	(g_s^1, d)
D	(d, b_s^2)	(d, g_s^2)	(d, d)

This matrix of payoffs defines the function $\varphi_s(w, (a^1, a^2))$. Note that only the momentary payoffs associated with (M, M) have to do with bargaining, as only these payoffs depend

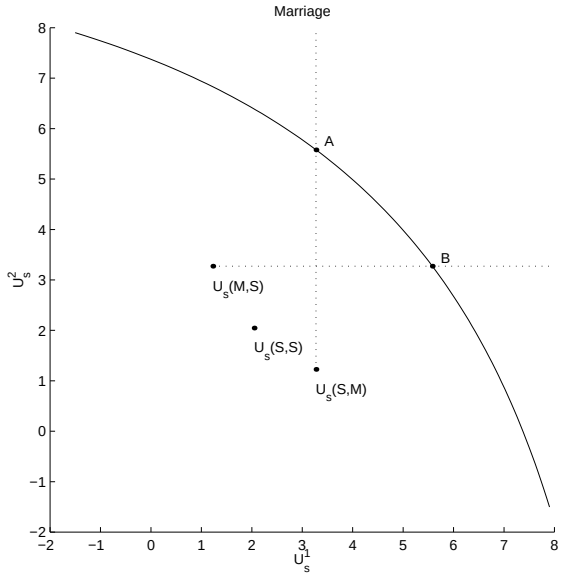

FIGURE 1. Arrangement of Values leading to Marriage

on the utility assignment w, via the exogenously specified functions $\{\phi_s\}$. Despite this, the *value*, or discounted expected utilities, associated with any of these action pairs *will* depend on bargaining position so long as there's a positive probability of being married at some date in the future.

Each of the variables in the payoff matrix above is just a number (an "EEP," in the jargon of McElroy (1990)) *except* for the payoffs associated with the action pair (M, M). The payoffs to remaining married depend on the outcome of bargaining within the household. The relationship between the payoffs associated with different action pairs can be seen in Figure 1. This figure illustrates the different possible values associated with every action pair. As noted above, every action pair except (M, M) delivers a single state-dependent value pair, and in the figure these are denoted by $U_s(a^1, a^2)$ in the obvious notation. In contrast, payoffs associated with marriage deliver a range of value pairs, depending on the bargain struck within the marriage. Thus, the concave frontier in the figure can be regarded as the possibility frontier given that both partners choose to (remain) married.

Suppose that the two agents are able to specify a proposed division of surplus in the event that they (remain) married. This pins down a particular payoff pair in the subgame represented by Figure 1. This point is necessarily in the locus of payoffs associated with the action pair (M, M); let us say some point on the frontier but below point B in the figure. With a value-pair associated with each action pair, we have a well-defined subgame. For

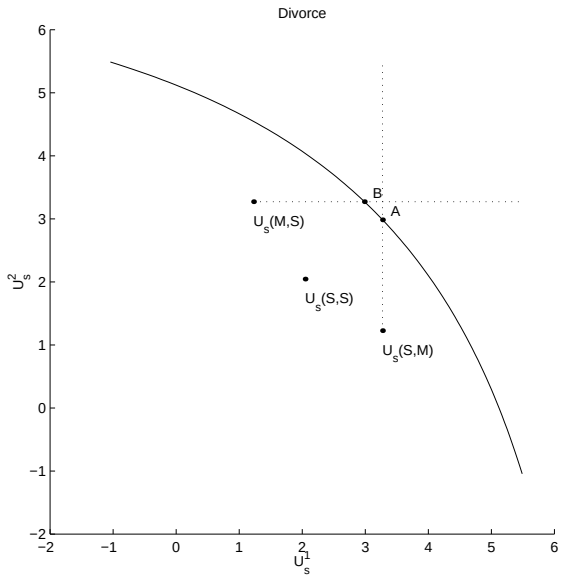

FIGURE 2. Arrangement of Values leading to Divorce

any point outside the segment of the frontier between A and B, marriage doesn't provide a great enough value to one or another of the agents, and the best response of this agent to M is S, so that the unique equilibrium is (S, S), or a no-fault divorce. However, consider an alternative division of surplus, so that the value of marriage corresponds to a point on the AB interval. Given such a division of surplus, it's easy to see that the only equilibrium action pair is (M, M), which also happens to be the only efficient action-pair.

Outcomes are not necessarily efficient, of course. Consider Figure 2. Here the arrangement of payoffs is identical to that of Figure 1, except that the value associated with marriage is now somewhat less. We can imagine many possible causes for this reduction; perhaps the couple is simply less fond of each other; perhaps their income processes are more highly correlated (and hence the insurance implicit in the arrangement is smaller); perhaps a change in tax law reduces the tax advantages of marriage. Regardless, even a small reduction in the benefits of marriage can have a dramatic influence on equilibrium actions. In Figure 2, for example, there is now *no* division of surplus which delivers marriage as an equilibrium. To see this, note that any proposal of (continued) marriage with a division of surplus which offers agent 1 less than what she would receive at point B will be declined. Similarly, any proposal of marriage which offers agent 2 less than what he would receive at point B will also be declined. As a consequence, the only equilibrium is a no-fault divorce, *despite* the fact that there's a wide range of possible arrangements such that both agents would prefer

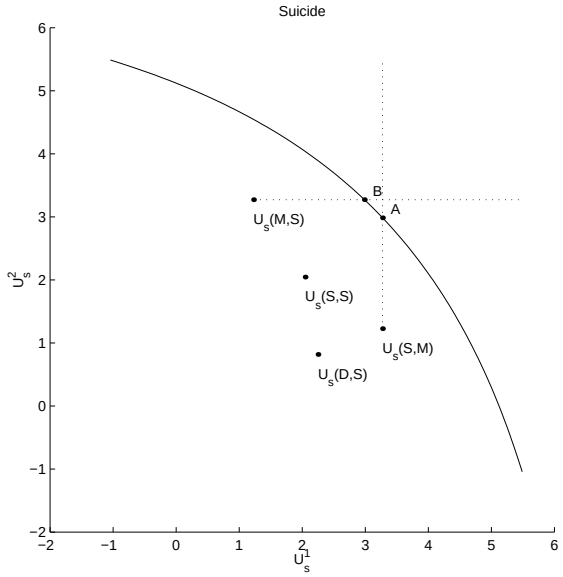

FIGURE 3. Arrangement of Values leading to Suicide

marriage (any division on the frontier to the northeast of the value-pair associated with (S, S)).

The tragedy of this outcome can be greatly exacerbated by even small changes in divorce law. Suppose, for example, that the division of assets in the event of divorce is changed so that $U_s^1(S, S)$ is slightly less than $U_s^1(D, S)$; the captures the case in which one partner (1) is sufficiently impoverished (or saddened) by the event of a no-fault divorce so as to prefer suicide. This situation is pictured in Figure 3. As in Figure 2, marriage is no longer an equilibrium; however, divorce is no longer an equilibrium either. Instead, the unique equilibrium action pair is (D, S); the second spouse proposes divorce, while the first commits suicide. Note that this outcome may be extremely inefficient; every outcome may be preferred by at least one agent, and all but one outcome may be preferred by both spouses.

It's important to remember that because the marriage frontier shown in these figures is just a set of discounted, expected utilities, the value associated with marriage in the current period may be dramatically reduced if the partners anticipate that in some not-too-distant state inefficient outcome (e.g., death or suicide) will result. For example, consider Figure 4. In this figure, we imagine that divorce laws initially favor males (agent 2). Two marriage frontiers are pictured; one for a couple for whom marriage is an equilibrium (solid line), and another for a couple with a slightly less blissful relationship, for whom female suicide is the equilibrium, as in Figure 3. Now imagine a change in the laws governing the division

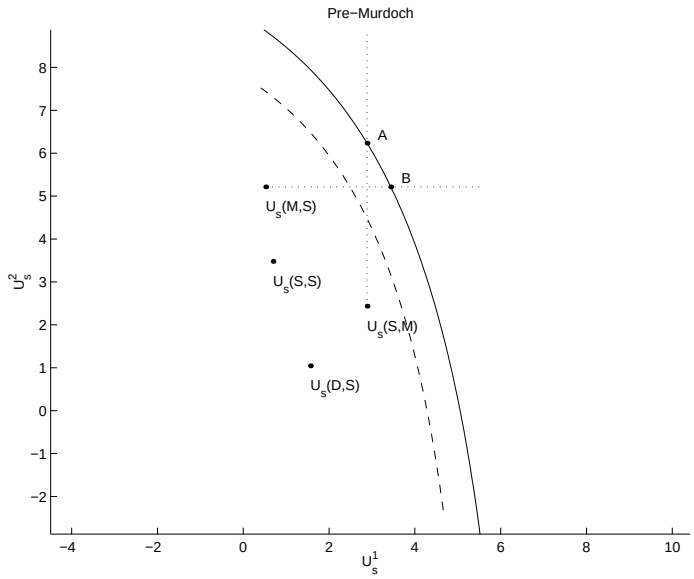

FIGURE 4. Possible Values prior to Murdoch. Note that for a household with a marriage frontier corresponding to the solid lines, marriage is the expected outcome, while for a household with a marriage frontier corresponding to the dashed line, female suicide will result.

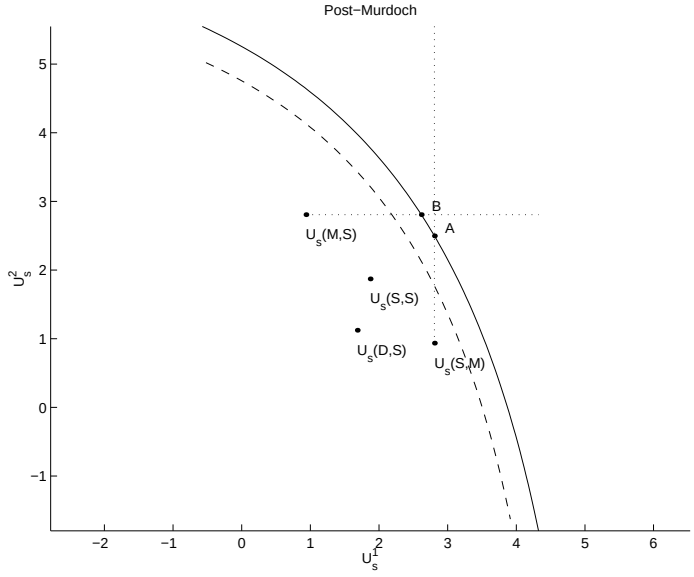

FIGURE 5. Possible Values after Murdoch. Here the value of divorce has increased for women. However, this changes the slope of the marriage frontier for men, whenever a future divorce is anticipated. These two effects combine to give rise to more frequent divorce, but less frequent female suicide.

of assets in the event of divorce, as pictured in Figure 5. This change in the law improves the female return to divorce sufficiently that in the event of marital dissolution, she will not opt for suicide. However, the share of marital surplus which can be claimed by the male (without provoking divorce) also declines; in this case by enough so that a no-fault divorce is the outcome. Thus, a small change awarding women a larger share of assets in the event of divorce can lead to both a decline in female suicide and an increase in divorce rates.

3. Divorce, Matrimonial Property Law and Suicide in Canada

3.1. **Divorce and Matrimonial Property Law in Canada.** Before 1968 Canadian divorce law varied from province to province. Although adultery was the sole ground for divorce everywhere except Nova Scotia (where 'cruelty in marriage' also provided grounds for divorce)—and consequently, by current standards, the incidence of divorce was low—differences in cultural or social tolerance for divorce meant that divorce rates varied widely across the provinces. In Quebec in particular, divorce was extremely rare until the late 1960s. The Divorce Act 1968 brought divorce legislation under federal jurisdiction, introduced nationwide no-fault grounds for divorce, and established equality in support of rights and obligations between men and women. The 1968 Act was amended in 1986 to simplify the grounds for divorce (the Act now states that the sole basis for divorce is the "breakdown of marriage") and reduced the period of separation required before a divorce was granted to one year. Crucially, however, regulation of the division of matrimonial property upon divorce falls outside the Divorce Act and is treated under provincial jurisdiction. Reflecting their history, the provincial legal code in Ontario and most other provinces is based on principles of Common Law while that of Quebec is based on the Civil Law embodied in the Custom of Paris.

Under Common Law, by marriage, 'the husband and wife became one person' to which was added the rider 'and the husband became that person'. The husband acquired control over all property owned by his wife at the time of marriage or acquired by her during marriage except for minor, personal items such as jewellery and clothing. In the late 19th century, the enactment of the 'Married Woman's Property Act' in the United Kingdom, and its subsequent replication in all Canadian provinces except Quebec, gave women the right to hold property in their own name, including property acquired both before and during marriage. However, the acquisition and ownership of property was tied to direct financial

contribution. If a husband was the household breadwinner while his spouse remained at home, the wife had no legal claim to assets acquired in her husband's name.

A case before the Supreme Court of Canada in 1973, Murdoch v. Murdoch, was the catalyst for change in this aspect of family law. The case involved a contested divorce between a Mr. and Mrs. Murdoch. For the first four years of their marriage, the Murdochs worked on ranches as a hired couple, with their pay being given to Mr. Murdoch. These funds were used, in part, to purchase a ranch and homestead. Over the next twenty years, Mrs. Murdoch made a substantial contribution to the operation and management of the ranch. When the marriage broke down, she sought a judicial separation and claimed she was entitled to a one-half share, not only in the homestead, but also in the ranch. However, in the absence of a direct, financial contribution or an extraordinary financial contribution, the court held that Mrs. Murdoch's actions were "just about what the ordinary rancher's wife does". As there was no explicit agreement linking Mrs. Murdoch's labour to an entitlement to a share of the ranch, she was deemed to have no interest in the ranch. She thus lost her case and faced financial destitution.[6]

Almost immediately remedial legislative action was put into place. The Government of Ontario passed the Family Law Reform Act, 1975. It provided that "no spouse should be dis-entitled to an interest in property simply because his or her efforts were no more than might be expected from a reasonable spouse of the kind" (McLeod and Mamo, 1995, p. O-4). Non-monetary contributions to the household, such as child care, gave the contributory spouse an interest in assets acquired during marriage. It is important to note that the law applied to all marriages in existence at that time. The act was subsequently amended by the Family Law Act, 1978 which went on to "provide that upon marriage breakdown each spouse was entitled to an equal interest in the 'family assets' regardless of who owned the assets."

Other provinces followed suit, with the exception of Quebec. A French colony until 1763, Quebec was subject to civil law as embodied in the Custom of Paris. This body of laws was retained when Quebec became a British colony and was eventually codified in 1866 and protected in the bill that provided Canada with its independence from Britain in 1867. "The Custom of Paris treated matrimonial property as community property but permitted the parties to enter into a marriage contract and, thereby, choose to be in separation of

[6]This discussion draws heavily on McLeod and Mamo (1995).

property" (McLeod and Mamo, 1995, p. Q-1). Although this has been subject to some change over time, the basic nature of this arrangement—the fact that both parties had entitlement to property acquired over the course of the marriage—has remained unchanged.

The separation of responsibility between federal and provincial jurisdictions in the matter of divorce and settlement in Canada provides us with the ingredients for a quasi-natural experiment for one of the implication of our model. Given that Murdoch v Murdoch led to legislative reform everywhere except in Quebec allows us to directly test our claim that this province-specific change should lead to a decline in female suicide in Ontario but not in Quebec.

3.2. **Suicide in Ontario and Quebec.** Although the legal reforms were enacted in all Anglophone provinces between 1975 and 1979, we focus our attention on the impact of this legal change in Ontario. There are two reasons for this. First, the accuracy of suicide data is often contested; some authors claim that up to a third of Canadian coroners are reluctant to certify a death as suicide (Syer-Solursh and Wyndowe, 1981). In Ontario, all coroners must be medically trained and all must attend provincial programs in instruction on death certification. As a result, there is greater consistency in the reporting of suicides in Ontario than in other provinces (Health and Welfare Canada, 1989). Second, as suicide is a comparatively rare event, measured in cases per 100,000 individuals, even small variations in reporting from year to year will have a marked effect on the reported rate in much less populated provinces.[7]

Data on suicides are reported by age and sex, not by marital status. This is somewhat problematic for us as the strongest test of our model involves comparing the impact of this legislative change on married and unmarried women. Our solution is to divide our data into four age cohorts: 15–19; 20–24; 25–44; and 45–64. The proportion of women who are married in the younger two cohorts around the time of this legislative change was about 8% and 50% respectively. By contrast, approximately 90% of women in the two older cohorts were married. There is a second reason for doing so, one that follows from three interrelated factors: a relatively high incidence of suicide throughout Canada during the Great Depression, a relatively low rate in the post-war period and the established fact that individuals, and especially children, who are bereaved by a suicide are themselves much more

[7]For example, the reported rates for suicides amongst women aged 40–44 in the province of Saskatchewan for the six years 1970–1975 were 12.0, 0, 8.4, 0, 4.4 and 18.0. These data were for a period in which there were three, zero, two, zero, one and six suicides respectively for this age group.

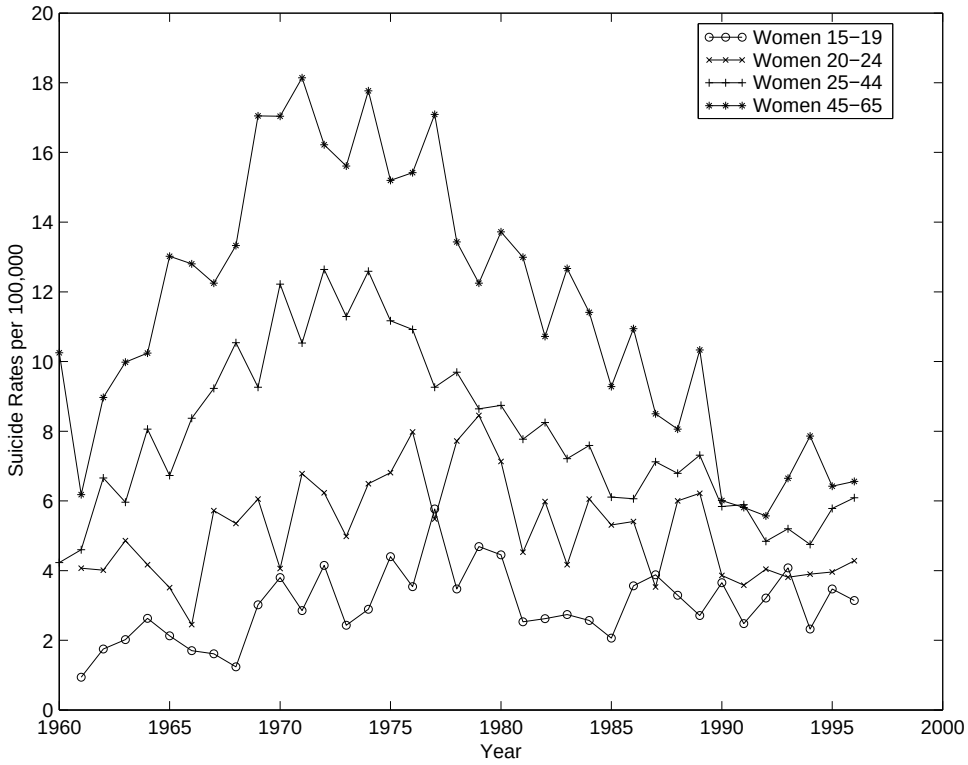

FIGURE 6. Ontario Female Suicide Rates per 100,000 Women

likely to commit suicide (Cain, 1966; Giffin and Felsenthal, 1983). Suppose we ignored these factors and presented results based on data for the age group 20–65. This combined age cohort would contain individuals who enter into our sample with significantly less exposure to suicide at precisely the point at which we hypothesize that there should exist a structural break in the trend for a completely different reason. To elaborate, a 25 year old born in Ontario in 1950, and whom has relatively little exposure to suicide in her parents' generation enters the sample in 1975. By separating the sample into four cohorts, we can test whether this factor is affecting our results.[8]

Figure 6 shows the rates of suicide for these four age cohorts of Ontario women from 1960 to 1996. These peak for women aged 25 to 44 and 45 to 64 in the early-mid 1970s with pronounced declines after 1975. By contrast, suicide rates for young women (the 15–19 and 20–24 age cohorts) are largely trendless. While such a simple visual inspection is suggestive

[8]We deliberately exclude children from our sample. For young people, other factors such as difficulties with schooling, broken homes and/or parental divorce, child abuse and sexual assault are generally regarded as being of greater importance (Garfinkel and Golombek, 1977).

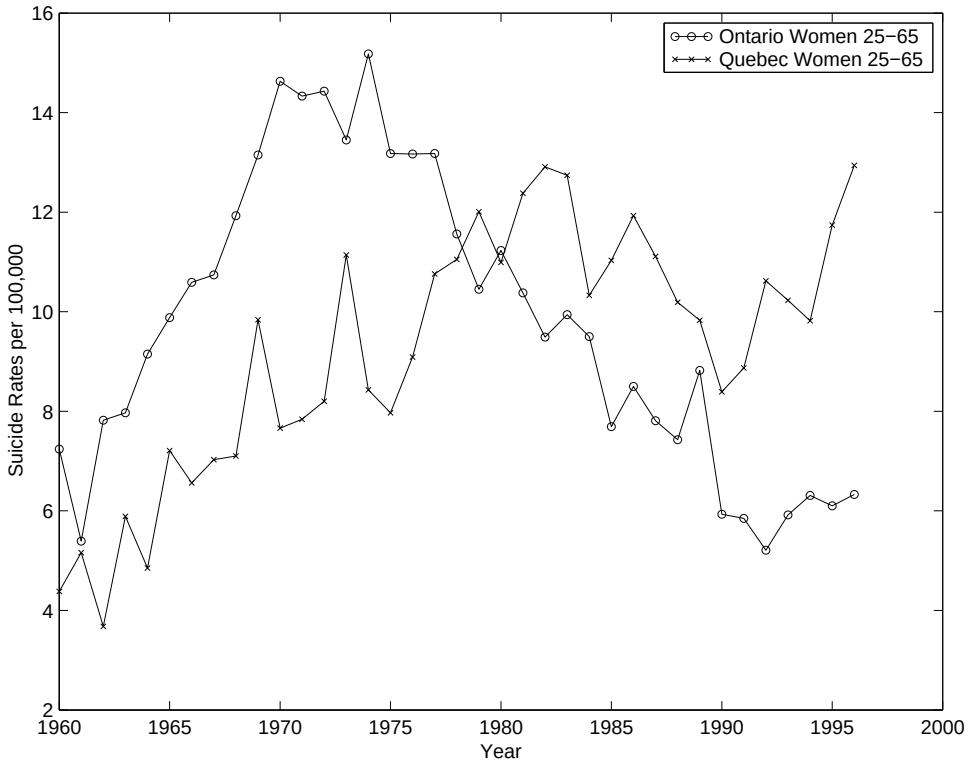

FIGURE 7. Female Suicide Rates in Ontario and Quebec

of an association between changes in matrimonial property law and female suicide rates, such evidence on its own is far from conclusive.

One simple explanation for the decline in women's suicide rates would be changes in reporting practices. However, this is unlikely to account for the change observed here for three reasons. First, changes in reporting practices would be expected to affect suicide rates of all women, not just those 25 or older. Second, the only significant change in reporting practices that we have been able to uncover relates to the fact that suicide attempts were decriminalized in 1972. Before that date, it was illegal to attempt to kill oneself in Canada. As a result, it has been suggested that coroners were more willing to certify deaths as suicides (Leenaars and Lester, 1992). But such a change makes it more difficult, not less, to observe a decline in female suicide rates in the wake of the Murdoch v Murdoch decision.

An alternative explanation would be that some change occurred that resulted in either overall suicide rates or, indeed, overall female suicide rate to decline elsewhere in Canada. Figure 7, which plots the aggregate suicide rate (for the 25–65 female cohort) for Ontario and Quebec, shows that the sharp decline in the female suicide rate occurs in Ontario (where Common Law was reformed) but not in Quebec.

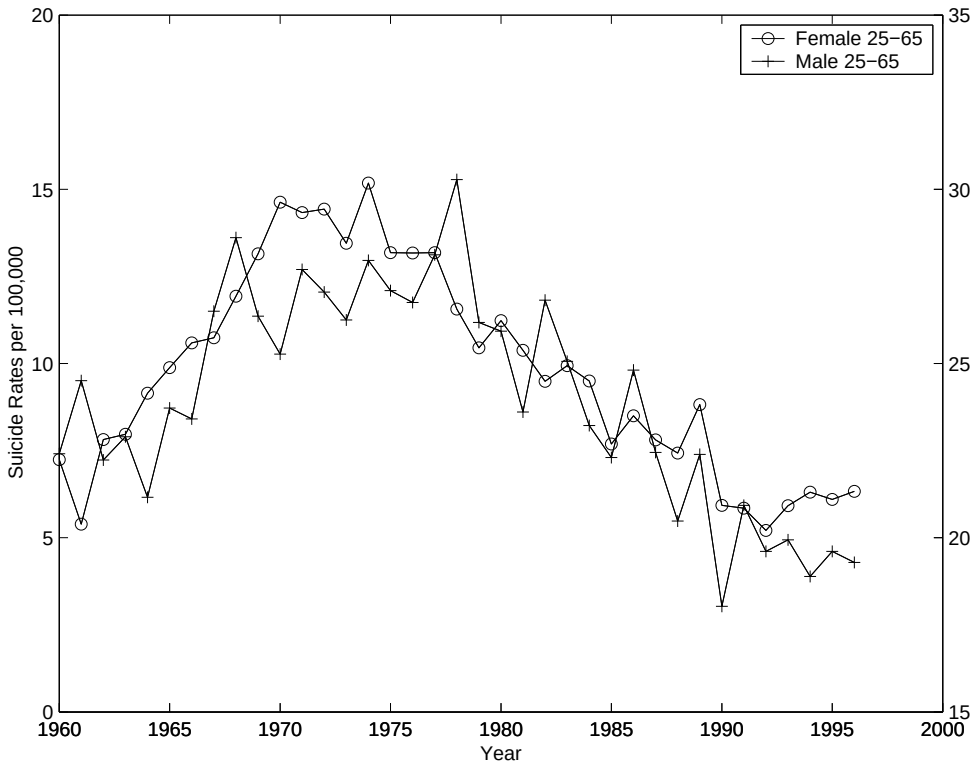

FIGURE 8. Male and Female Suicide Rates in Ontario

Figure 8 provides comparable data for the suicide rate amongst Ontario men aged 25–64. These suggest that, if anything, male suicide rates rise in the immediate post-1975 period, although they also indicate a fall by the early 1980.

Our descriptive data suggest that female suicide rates for women aged 25 and older in Ontario fell after the passing of the Family Law Reform Act in 1975. This decline does not appear to result from changes in the measurement of suicide, is not accounted for by factors affecting suicide identified in other disciplines, and does not occur amongst three different control groups: younger women in Ontario, identically aged Ontarian males and identically aged Quebecois females (whom recall, did not benefit from a similar legislative change).

Yet a sceptic might dispute this evidence. First, suicide is studied extensively in other disciplines, including epidemiology, sociology and psychiatry and one might expect that work in these fields would provide alternative explanations for this decline. This does not appear to be the case. Sakinofsky's (1999) extensive literature review covers more than 100 studies on suicide in Canada. These studies place considerable importance on changes in economic circumstances (such as unemployment) as well as age, cohort and ethnicity effects (for example, suicide rates are considerably higher in Aboriginal communities) and individual

mental disorder. Neither his own review, nor our examination of these studies, provides an explanation of the fall in female suicides in Ontario since the mid 1970s. Second, it could be argued that the decline in suicide rates occurs at some point other than 1975 or that some factors other than those listed here play a role. We now turn to such concerns.

4. Statistical Evidence

We hypothesize that the Ontario law of settlement in the light of Murdoch v. Murdoch should lead to a change in the level and trend of the suicide rate amongst women older than 25 (our proxy for married women). Further, this change should have no effect on the suicide rates of comparably aged Ontarian males and that no change should be observed in suicide rates for Quebec women of the same age. Our empirical model takes the form:

$$S_{ijt} = \alpha^0_{ij} + \beta^0_{ij} t + \alpha^1_{ij} DB_t + \beta^1_{ij} DT_t + \gamma_{ij} X_{ijt} + \epsilon_{ijt} \tag{5}$$

where i indexes age-sex cohorts, j provinces, and t time periods. S_{ijt} is the suicide rate defined as suicides per 100,000 people of the ith cohort in province j during year t, while X_{ijt} is a vector of other explanatory variables. The underlying linear trend component of the model $(\alpha^0_{ij} + \beta^0_{ij} t)$ is augmented by two dummy variables, defined relative to a hypothesized "break-point" T_b, thus:[9]

$$DB_t = \begin{cases} 1 & \text{if } t > T_b \\ 0 & \text{otherwise,} \end{cases}$$

while $DT_t = DB_t(t - T_b)$. These two break variables allow for a shift in the mean suicide rate ($\alpha^1_{ij} \neq 0$), a change in the trend growth of the suicide rate ($\beta^1_{ij} \neq 0$), or both. In the analysis that follows we test for potential breaks in the underlying trend suicide rate at any point between 1971 and 1985. Finally, the vector X_{ijt} allows us to take into account other factors that may have affected cohort-specific suicide rates and which might otherwise confound our results. For example, the period spanned by these data is one which also witnessed major changes in real incomes and in labor market conditions, and in particular a significant increase in the long-run or natural rate of unemployment (Bean et al., 1986).

[9]We use a simple linear trend; defining the model in terms of an exponential (i.e., a log-linear trend) does not alter the results. Also notice that we treat this (possibly broken) trend as though it were deterministic. An alternative would be to treat the trend as stochastic; arguably this would be more appropriate if we had access to a longer time series (since it would be consistent with the notion that any trend in suicide rates reflects persistence in economic, social, and cultural shocks).

Female unemployment in Ontario rose from 4.7% in the period from 1966 to 1974 to 8.0% in the period from 1975 - 1994, while over the same period the rate for men rose from 3.6% to 7.1%. This shift away from near full-employment occurred around the same time as the hypothesized break in the trend rate, raising the possibility that results for a univariate time-series analysis of suicide rates might be confounded by changes in labor market conditions. We therefore examine the evolution of suicide rates in a multivariate setting where we control for real income levels and changes in participation and unemployment rates. In what follows, the vector X_{ijt} consists of provincial-level unemployment, per capita real income, and labour force participation.[10]

A final word of caution is in order. In addition to the issues noted above, we are also faced with the problem of drawing inference from a relatively short time series. With only 35 observations in a series that has a relatively high unconditional variance, the precision of parameter estimates will be relatively low while tests of the significance and exact timing of structural breaks will exhibit low power.

We start with a simple statistical test of our basic hypothesis that there was a significant change in the trend rate of suicide amongst married women in Ontario, but not amongst women in Quebec or men in Ontario, following Murdoch v Murdoch. In terms of (5) this is represented by a test of the restriction

$$H_0 : \alpha^1_{ij} = \beta^1_{ij} = 0 \tag{6}$$

for $T_b = 1975$. The first set of statistics in Table 1 report the F-statistics for this restriction. The hypothesis of no structural break in the series after 1975 is decisively rejected for Ontario women aged 25-44 and 45-64 but not for younger age-cohorts of Ontario women nor for older men in Ontario. However, the statistics also seem to suggest that we reject the hypothesis of no structural break in the female suicide rate in Quebec and amongst younger men in Ontario, albeit less decisively. Thus, though these results are consistent with (part of) our argument they are far from decisive. It is well-known, however, that this class of 'Chow Test' has extremely low power, especially when the location of the breakpoint is assumed ex ante. To address this problem and to pinpoint more accurately the break points we turn to a test

[10]We use the aggregate provincial unemployment and participation rates instead of gender-specific rates. This allows us to utilize a longer time series on unemployment. However for the sub-sample where we do have data on male and female unemployment rates separately, there is no evidence of any substantial deviations between the two series other than in their mean levels.

	Chow tests against H_0 : No shift nor trend break at $T_b = 1975$.			Andrews' (1993) Recursive Break Point test	
Cohort	**Break**	***F*-Stat**	**Prob**	**'Most likely' break**	**LR Test Prob Level**
Ontario Females					
15-19 yrs	1975	3.46	[0.0451]	1977	[0.1865]
20-24 yrs	1975	4.94	[0.0146]*	1981	[0.1655]
25-44 yrs	1975	67.65	[0.0000]**	1975	[0.0136]*
45-65 yrs	1975	73.01	[0.0000]**	1976	[0.0004]**
Ontario Males					
25-44 yrs	1975	21.43	[0.0000]**	1979	[0.0016]*
45-65 yrs	1975	2.63	[0.0889]	1985	[0.5645]
Quebec Females					
25-44 yrs	1975	10.55	[0.0041]**	1984	[0.0093]*
45-65 yrs	1975	4.95	[0.0141]*	1985	[0.0215]*

TABLE 1. Testing for Breaks in Trend Suicide Rates. The critical values for the statistics reported in the final column are from the appendix of Andrews (1993).

devised by Andrews (1993) designed to test for structural breaks when the break-point is unknown.

Andrews' (1993) test is specified in terms of the null, defined by equation (6), against the alternative that a break occurs at some point t where t lies in the interval $\Pi = [\pi, 1 - \pi]$. The test computes a sequence of LR statistics for each point in the interval Π, selecting as the break point the observation immediately following maximum value of the sequence, and testing the restriction equation (6) at this point. Given the recursive nature of the test, the LR statistic does not follow a standard chi-square distribution but critical values for this supremum LR test are computed by Andrews (1993, Appendix 1). The results of implementing this test are reported in the right-hand panel of Table 1. This time the

results are much more decisive. Conditional on the vector of explanatory variables X_{ijt}, the likelihood ratio test identifies the most likely break points to be in 1975 and 1976 respectively for the 25–44 and 45–64 female age cohorts in Ontario. By contrast, the implied breakpoint for women in Quebec is between 1984 and 1985 and for younger men in Ontario the most likely break point is around 1980. A reasonable interpretation of these results is that the break in the series for Ontario women occurs at a point consistent with our hypotheses whereas there would appear to be a break for these other groups sometime later.[11]

It might be argued that, although it appears to have occurred somewhat later, the break in the suicide rate for (younger) Ontario males may also reflect the changes in divorce laws, with a rather long adjustment lag. If correct, this would seriously weaken the argument being advanced in this paper. It is, however, difficult to sustain the argument that the same phenomenon—changing the rules of divorce in favour of women—should induce an immediate positive response for female suicide rates but should take almost 6 years to induce a change in male suicide rates. It seems reasonable therefore, to suggest that the break in male suicide rates at the end of the 1970s is due to factors other than changes in divorce law following Murdoch v. Murdoch. In fact, such a factor exists. A well documented empirical regularity, in Canada and other developed countries, is that men are far more likely to use firearms for suicide than are women (Health and Welfare Canada, 1989). In 1978, the Canadian federal government introduced legislation that imposed strict controls on access to firearms. It is entirely plausible that this law, which took force in 1979, had the effect of reducing male suicide rates. As this was federal legislation, applicable to the entire country, a test of this claim is to examine trends in suicide rates for men outside of Ontario. We therefore conduct Andrew's (1993) likelihood ratio test for males aged 25–44 and 45–64 in Quebec and British Columbia. These indicate that the most likely breakpoint—in terms of the one that minimizes the residual sum of squares—occurs somewhere between 1978 and 1982. This supports our claim that the observed break in Ontario male suicide rates is due to factors other than the change in settlement law.[12]

[11]Entirely consistent results are found using Cox's (1961) non-nested encompassing test, which compares a model with a trend break at one point in time with a rival model having an alternative break-point. Encompassing tests demonstrate that the 1975 break point model dominates models with later breaks for the 20–24 and 25–44 Ontario female cohorts; that the reverse is the case for Quebec females; and that for all other cohorts neither model is dominant. These results available from the authors on request.

[12]Results available from the authors upon request.

Taken together, despite the limited statistical power available to us, the statistical evidence is broadly supportive of our hypothesis that changes in laws of settlement improved the well being of married women in Ontario, as measured here by the fall in suicide rates of women aged 25–64. This legislative change does not seem to have had a strong effect on two groups whom we had hypothesized would be unaffected by this change: younger women (who were less likely to be married) and men. Moreover, the quasi-natural experiment offered by a reform to matrimonial property law that did not apply to Quebec, allowed us to directly test the hypothesis that there should be no corresponding change in the equivalent female suicide rate there in response to the reform. The data support this hypothesis rather decisively.[13]

Our next step is to complement our determination of the breakpoint with the estimation of equation (5) for each age/sex/province cohort. Including controls for income, unemployment and participation rate, we again find significant breakpoints in 1975 or 1976 for Ontario women aged 25 to 65. We also estimated the models under alternative assumptions concerning the specification of the variables in the control vector X_{ijt}, for example by including either the unemployment rate or the participation rate but not both, or including all the elements of the vector X_{ijt} in levels rather than differences. Although the results change marginally, they do not fundamentally change the parameter estimates for the (broken) trend and certainly do not alter the fundamental argument developed in the paper. As a further check, we estimated a cohort-fixed effects regression for Ontario women, interacting the trend break variables with dummies denoting the four age cohorts. These regressions, which control for all provincial fixed effects, changes in incomes, unemployment and participation rates, as well as time-varying factors embodied by the inclusion of a trend variable, again show significant breakpoints in the trend suicide rates for women 25 to 65 but not for younger women.[14]

The model presented in Section 2 implies that reforms which favour women upon the dissolution of marriage will lead to both a decrease in the female suicide rate amongst

[13]There was a relevant change, but it occurs much later, well after the events that are the focus of this paper. Under legislation passed in 1992, Quebec women in low income households could obtain access to their husbands' pensions even after divorce (our thanks to Guy Fortin for bringing this to our attention).

[14]Following Gray (1998), who uses US data to explore the impact of changes in US laws on married women's labor force participation, it could be argued that the participation rate is endogenous. However, our results are not sensitive to teh inclusion or exclusion of the participation rate. Further, when we run a cohort-fixed effects regression with participation rates as the dependent variable we do not find evidence that participation rates for Ontario women 25–65 changed after 1975.

Province	**Ontario**						**Quebec**	
	Female				**Male**		**Female**	
Cohort	15–19	20–24	25–44	45–65	25–44	45–65	25–44	45–65
Constant	0.377	2.166	4.780	10.478	14.446	33.202	7.268	7.607
	[0.36]	[1.34]	[2.56]	[3.20]	[7.23]	[10.66]	[4.38]	[2.93]
Trend	0.150	0.074	0.728	1.352	0.875	−0.049	0.757	0.621
	[1.51]	[0.46]	[4.04]	[4.10]	[3.48]	[0.19]	[6.17]	[2.49]
DB	0.427	0.976	−2.764	−2.087	−4.664	−5.084	−3.568	−3.936
	[0.63]	[1.10]	[2.24]	[1.26]	[4.30]	[4.41]	[4.04]	[3.17]
DT	−0.258	−0.323	−0.947	−1.542	−0.992	−0.336	−0.577	−0.415
	[1.47]	[1.46]	[7.83]	[9.05]	[7.12]	[1.88]	[4.46]	[1.93]
Change in	−0.129	−0.150	0.084	0.228	0.043	0.726	−0.179	−0.404
Unemp. rate	[0.96]	[1.23]	[0.74]	[1.19]	[0.19]	[3.88]	[0.91]	[1.69]
Income/capita	0.012	0.030	−0.023	−0.122	−0.032	−0.027	−0.158	−0.122
	[0.47]	[0.75]	[0.52]	[1.45]	[0.58]	[0.39]	[2.64]	[1.17]
Participation	−0.160	0.027	−0.001	−0.000	0.870	0.972	−0.118	−0.006
rate	[1.25]	[0.11]	[0.01]	[0.61]	[1.02]	[1.56]	[0.70]	[1.92]
Year of break	1977	1981	1975	1976	1979	1985	1984	1985
R^2	0.452	0.540	0.848	0.891	0.790	0.883	0.837	0.695
Mean Suicide Rate								
1960-1996	3.0	5.2	8.0	11.6	21.3	26.7	8.9	9.6
Pre-break	2.4	4.9	9.0	13.4	21.0	29.5	8.2	9.2
Post break	3.4	5.4	7.3	10.3	21.6	20.1	10.5	10.5

TABLE 2. Cohort specific regressions. Numbers in brackets are absolute t statistics. The variables DB and DT are as defined near equation (5), with T_b as set in the row labelled "Year of Break." Participation rates are cohort-specific.

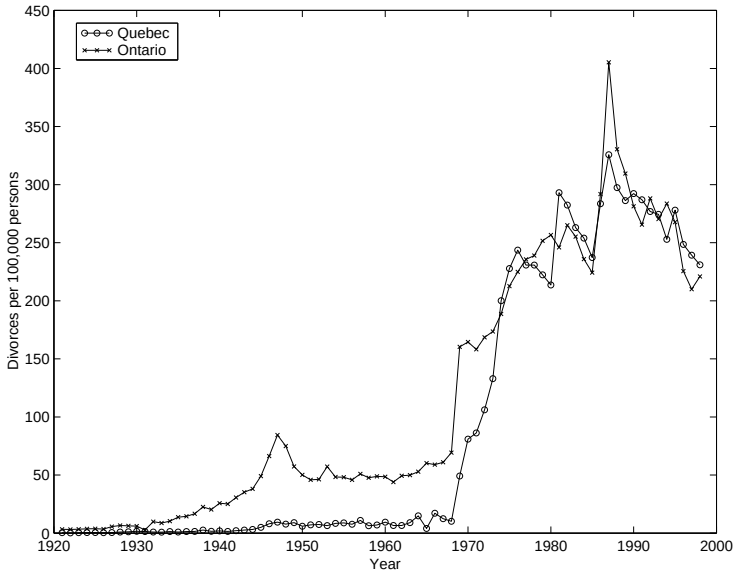

FIGURE 9. Provincial Divorce Rates 1921–1998

married women and an increase in their divorce rate. Our evidence so far has exploited inter-provincial differences in matrimonial property law to examine the first of these implications. We now turn to the second.

Data on provincial divorce rates go back to the early part of the 20th century, although until after the Divorce Act came into force in 1968 only crude divorce rate data were collected (i.e. numbers of divorces per 100,000 population). These are plotted for Ontario and Quebec in Figure 9 which illustrates the profound impact of the Divorce Act and, to a lesser extent, its amendment in 1986. Crude divorce rates for both provinces jumped very sharply following the introduction of the Act in 1968; in Ontario the response was almost instantaneous, in Quebec the response was lagged, but by the mid 1970s the difference in the crude divorce rate which had persisted throughout the century had been effectively eliminated.

The reforms of 1986, which were widely anticipated, induced a predictable, temporary response; in the year before the reform the divorce rate dipped slightly as people waited to see how the reform would finally emerge, and subsequently spiked as people rushed to take advantage of the shorter waiting period for divorce.

Of more interest in the context of this paper is whether the evolution of the divorce rate following Murdoch v Murdoch and the enactment of the Family Law Reform Act in 1975 is consistent with our model's claims. Visual inspection of the data for Ontario in Figure 9 certainly supports the interpretation that following the steep increase in the divorce rate in

1969 there was a further surge from 1974 until the early 1980s. This is entirely consistent with our model but, ideally, we should be able to subject this inference to more robust testing. In practice this is not possible, for a number of reasons.

The first is the data. Figure 9 reports only crude divorce rates expressed in terms of provincial population; these take no account of the changing demographics over this period. A robust test of our hypotheses requires age-specific divorce rates scaled in terms of the number of married women. Consistent data on these only exist from 1977 onwards, after our hypothesised break point. The second reason is that even if we attempted to test the hypothesis on the crude divorce rates plotted here any statistical test would have extremely low power against the null hypothesis of no break in the mid 1970s. If we exploited the long run of data it would be so dominated by the 1968 break as to make it impossible to simultaneously identify any break in the early 1970s; and if we restricted our time series to the post-1968 sample we would have insufficient observations prior to hypothesised break point. Third, since divorce reforms themselves (i.e. the 1968 Act and its amendment in 1986) are federal we are unable to exploit the inter-provincial comparisons as we did with the suicide data.

We are left with the slightly unsatisfactory but the only defensible conclusion that the crude evidence on divorce rates is not inconsistent with our model. There is no evidence that divorce rates fell following reforms, and weak evidence that they may have accelerated.

5. Conclusions

This paper develops a dynamic model of household bargaining and uses it to motivate an empirical analysis of the impact changes in Canadian laws regarding the allocation of family assets upon divorce on female suicide. We show that this change only reduce suicides amongst older (married) women while not affecting younger (unmarried) women. As suggested by our model, its impact was asymmetric in that male suicide rates were unaffected by this change.[15] We also exploited a quasi-natural experiment in these data, namely that no comparable legislative change occurred in Quebec. Here, we do not observe a structural break in the data.

Our paper contributes to the modeling of intrahousehold behaviour by encompassing cases in which outside options are relevant as well as the case where inefficient outcomes within

[15]Recall that although male suicide rates do fall in Ontario, this occurs well after this legislative change and can plausibly be attributed to federal changes in legislation governing access to firearms.

marriage are of importance. The model is dynamic and permits uncertainty. In light of concerns raised regarding the "observational equivalence" of unitary and collective household models, it is worth noting that our model has an empirically distinguishable prediction, namely that a legal change awarding women a larger share of assets in the event of divorce will lead to a decline in female suicide rates. Perhaps most importantly, it strengthens the oft-made, though poorly substantiated claim, that public policy can have powerful impacts within the household.

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