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Women's rights and development

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Abstract Why has the expansion of women's economic and political rights coincided with economic development? This paper investigates this question by focusing on a key economic right for women: property rights. The basic hypothesis is that the process of development (i.e., capital accumulation and declining fertility) exacerbated the tension in men's conflicting interests as husbands versus fathers, ultimately resolving them in favor of the latter. As husbands, men stood to gain from their privileged position in a patriarchal world whereas, as fathers, they were hurt by a system that afforded few rights to their daughters. The model predicts that declining fertility would hasten reform of women's property rights whereas legal systems that were initially more favorable to women would delay them. The theoretical relationship between capital and the relative attractiveness of reform is non-monotonic but growth inevitably leads to reform. I explore the empirical validity of the theoretical predictions by using cross-state variation in the US in the timing of married women obtaining property and earning rights between 1850 and 1920.

Keywords Women's rights · Development · Property rights · Fertility · Patriarchy

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1 Introduction

The last 200 years witnessed a historically unprecedented expansion of women's rights, both economic and political. In almost all industrialized countries, women went from being the property of their husbands and/or their fathers, with very few legal rights, to possessing the same political rights and most of the same economic rights as men. Why did this process occur? And, in particular, why does the spread of women's rights across the globe appear to be positively correlated with economic development?[1]

The objective of this paper is to shed light on the relationship between women's rights and development by focusing on a fundamental economic right: property rights. Property rights include "the legal rights to acquire, own, sell and transfer property, collect and keep rents, keep one's wages, make contracts, bring lawsuits, and, if seeking divorce, maintain some of the marriage assets and keep control and guardianship of the children."[2] These are rights that married women did not exercise in full either in Europe or in the US until the legal system was reformed. Under most legal systems (e.g. those based on Roman civil law, which influenced most of continental Europe, or those based on English common law, like the majority of US colonies), married women lost, if not ownership then, at a minimum, control over their physical (inanimate) property. Upon divorce, they lost guardianship over their children as well.

Why did married women eventually obtain property rights in the US and in Europe?[3] Why did men lose some of the advantages of their privileged status? This paper examines the hypothesis that, over time, economic development—by which I mean primarily a process of capital accumulation and declining fertility—altered the balance of male interests regarding women's rights. That is, although men in general benefited from a patriarchal society in which women enjoyed few economic and political rights, they also suffered from the system's welfare consequences for their daughters. My hypothesis is that, at a sufficiently high level of wealth and/or at a sufficiently low level of fertility, a man's conflicting interests from being both a husband and a father (of girls as well as boys) were resolved in favor of the latter. This eventually led men to favor granting women greater economic rights. This argument is examined in a dynamic model and its implications are studied empirically using variation across US states in the timing of married women's property acts.

The theoretical argument is developed in the context of an economy with endogenous growth in which parents care about their own utility from consumption and the average welfare of their children. In this economy, individuals marry and have children. They then produce, consume, and bequeath capital to their children. Under a patriarchal system in which married women have no property rights (also denoted the "no rights" regime), the household allocation decisions are made entirely by the husband. In an economy where women have the same property rights as men (also known at the "equal property rights" regime), the household allocation weighs both spouses' welfares equally.

At each point in time, one can compare men's welfare under the two systems of property rights to determine whether reform will occur. The theory yields three main predictions. First, it predicts that growth will eventually lead men to prefer the equal rights regime over the patriarchal one. Male preferences over the system of property rights are shown, however, to

[1] This process is far from complete globally as is clear from various indices of gender equality (see e.g. the The Global Gender Gap Report (2007) or the World Development Report (2012) devoted to gender equality and development). See Duflo (2005) for a review of the literature on gender and development.

[2] See http://www.womeninworldhistory.com.

[3] Women today do not enjoy full property rights in several parts of the world, both de jure and de facto.

be non-monotonic with respect to their level of household wealth. Second, the theory predicts that lower fertility will lead to earlier regime change. This relationship is monotonic. Thus, ceteris paribus, states with lower fertility should reform their property regime sooner. Third, it predicts that states with legal regimes that are initially more favorable to married women should see property rights reform happen later.

The main intuition for why the development process eventually leads to reform relies on the asymmetric effect that higher wealth or lower fertility has on the welfare of sons versus daughters. Under the patriarchal regime, both factors improve the welfare of sons more than that of daughters. This is because the patriarchal system effectively imposes an implicit tax on a father's efforts to increase his daughter's welfare. Greater bequests do not increase a daughter's welfare by the same proportion as a son's since the benefits from the bequest are captured primarily by the daughter's husband (i.e., by the father's son-in-law). As household wealth increases, the disparity in sons' versus daughters' welfare levels does as well, exacerbating the welfare cost of the patriarchal regime relative to a system of equal property rights. At the same time, greater household wealth makes it less burdensome for a man to share more equally consumption with his wife. I show that there exists a critical level of wealth or fertility at which a father is better off sacrificing the extra consumption benefits he obtains from patriarchy in order to ensure that his sons-in-laws sacrifice their consumption benefits in favor of his daughters.

The empirical investigation uses variation across US states in the timing of property rights reform and other key variables. Beginning in the 1840s, US states and territories reformed the laws governing married women's ownership and control of (real and personal) property and earnings. This was a relatively lengthy process beginning with Massachusetts in 1846 and (for the purposes of this analysis) ending in 1920, with all but four out of 48 states having granted these rights by then.

In a series of specifications, I find that states with higher "survival-fertility" tended to reform later.[4] This positive correlation is robust to the inclusion of a variety of variables, including state fixed effects. Causality cannot be established as there is no instrument for fertility. Using child mortality as a proxy for fertility, however, allows me to rule out some alternative transmission channels. In addition, as implied by the theory, I find that states with legal systems that were relatively more favorable to women (those with a system of community law rather than common law) tended to reform their property laws later. There is no robust relationship, on the other hand, between state per-capita wealth and property rights reform.

The paper also examines the degree of empirical support for some alternative explanations for property rights reform. To study the role of women's bargaining strength, I use various measures of the latter such as women's relative scarcity or variation in the dates in which states granted suffrage to women. I show that these measures are unable to explain the variation across states in granting property rights. I also explore whether underinvestment in children's human capital played a role in the reform of women's property rights, as suggested in Doepke and Tertilt (2009), by using variation across states in the passage of compulsory schooling laws. I show that the data does not support this alternative hypothesis. Lastly, robustness to other measures and dating of key variables is also discussed.

The paper is organized as follows. The next section presents a literature review of the main work in this area followed by some historical background on married women's property rights in the US in the 1800s. Section 3 presents the model, derives the main theoretical results, and discusses the roles of the various assumptions and extensions of the model. Section 4

[4] I create a measure of the relevant fertility variable by considering only children above the age of ten as during this time period there was a high degree of child mortality.

examines the empirical evidence regarding the relationship between women's property laws between 1850 and 1920 in the US and state levels of per-capita wealth, survival-fertility, and different legal systems using a variety of estimation methods. Section 5 examines other hypotheses and checks robustness and Sect. 6 concludes. An Appendix collects the proofs and presents some moments of the data.

2 Literature and history

In this section I present a brief review of the literature in this area and a brief historical overview of married women's property rights.

2.1 Literature review

There is a growing literature that investigates why rights were extended to various segments of society. The general idea that an elite may give up some of its privileges to improve its own welfare rather than because of threats of revolution or violence can be found in several contexts such as suffrage extensions, slavery, and children's rights, although for reasons unrelated to the ones developed here.[5] With respect to women's rights, an interesting paper by Bertocchi (2011) develops the hypothesis that men granted women the vote once industrialization and the ensuing narrower gender wage-gap made male and female preferences over taxation more similar.[6] With respect to women's economic rights, the two papers that tackle this question—Geddes and Lueck (2002) and Doepke and Tertilt (2009)—also share the premise that men granted women rights because it was in the former's self interest. These papers are discussed in greater detail below.

Geddes and Lueck's theoretical reasoning is similar to the economic argument made for the abolition of slavery. They argue, without a formal model, that married women's inability to own and control property (including earnings) produced suboptimal effort on their part and that this inefficiency increased with higher levels of capital. This argument is made perhaps less persuasive by the fact that very few white married women in the US worked outside the home during the second half of the 1800s.[7] The main contribution of their paper (as well as Khan 1996 earlier study), however, lies in its use of variation in the timing of when US states granted married women the right to own and control separate estates and earnings.[8] In a variety of regressions, they showed that there existed a positive relationship between the level of per-capita wealth across states and the reform of married women's property rights.

The empirical portion of the present paper uses Geddes and Lueck's reform variable to date the timing of reform, but finds that the authors' results regarding the positive correlation of wealth and reform are not robust to controlling for fertility differences across states. In particular, once fertility is included in the regressions, the coefficient on per-capita wealth becomes insignificant whereas, as predicted by my model, fertility is always significantly negative.

[5] See, for example, Fogel and Engerman (1974), Galor and Moav (2006), Doepke and Zilibotti (2005), and (Lizzeri and Persico (2004). An alternative view is that rights are ceded in order to forestall revolts (e.g., Acemoglu and Robinson 2000)

[6] See, e.g., Edlund and Pande (2002) for evidence on the existence of a gender gap in voting behavior.

[7] In 1880, for example, the labor force participation of white married women in the US between the ages of 30 and 40 was below 3 % and rose very slowly over the following 4–5 decades (see Fernández 2011).

[8] Kahn investigated the effect of the reforms of women's property rights on women's patenting activity.

Doepke and Tertilt (2009) present an interesting, purely theoretical, analysis that relies on two key ingredients: inefficient investment in children and gender differences in preferences. They assume that the marriage market matches people at random and that children are public goods. As is well known, this necessarily leads to inefficiently low investment in the public good (in their case, inefficiently low levels of human capital in children), as there is no "price" mechanism (i.e. no competition) that allows the marriage market to internalize the utility gain to the child's future spouse from higher investment in the child. They also assume that women discount the welfare of their children less than men do. This implies that if the return to the time spent educating children is sufficiently high, men may be better off allowing women to have a greater say in deciding a child's level of education as this ameliorates the investment inefficiency. Although this does not speak directly to women's property rights, the authors make the plausible argument that granting women greater economic rights increases their household bargaining power and thus their ability to determine the level of human capital investment in children.

A possible objection to their hypothesis is that if the main reason to grant women greater economic rights is to ameliorate the problem of underinvestment in children's human capital, it would have been easier and more advantageous for men to simply mandate a higher level of education for all children. This is in fact what compulsory schooling achieved around the same time period. The authors are aware of this issue and develop an extension of their model in which parental time investment and time spent in school are complements in the production of children's human capital. In this extension, a higher return to human capital makes it more attractive to increase both inputs to human capital. My empirical analysis, however, weakens the case for this mechanism. If formal education and parental investment are complements, one would expect that states that adopted compulsory education earlier would also have reformed married women's property rights earlier. This is not the case. As I show in Sect. 5, the year in which a state adopted compulsory education is insignificant in explaining the timing of married women's property rights reform.

The mechanism highlighted by my paper is different from the ones discussed previously.[9] In particular it relies neither on inefficiencies in the marriage market or in production nor on gender differences in preferences. This is not to say that these factors did not play a role, and the mechanism I highlight can be viewed as complementary to the others. The main driver in the present paper is the burden of the implicit tax faced by fathers under a patriarchal system when they attempt to make their daughters better off. It thus relies on paternalistic concerns about daughters' welfare (not in and of itself a controversial assumption in economics or biology) affecting policy outcomes. It is reassuring therefore that two recent papers Washington (2008) and Oswald and Powdthavee (2010) provide evidence that daughters influence fathers' legal and political preferences and voting behavior.[10]

Washington (2008) uses voting records from the US Congress in 1997–1998 and finds that, conditional on the total number of children, a US Congressional Representative is more likely to vote liberally on women's issues the greater the proportion of female children she/he has. Oswald and Powdthavee (2010) use the British Household Panel Study data to examine preferences towards political parties in the UK. They find that, for a constant family size, parents with more girls have more "left" wing preferences (i.e., are more likely to identify with voting for either the Labor or Liberal Party). In the model presented here, it will also be

[9] Although Doepke and Tertilt (2009) frame their discussion as fathers' caring about their daughters, this factor doesn't play a critical role in their analysis. In particular, if men cared only about their sons the results would go through. What mattes in their model is inefficiently low investment in human capital and finding a way to commit to a higher level of this investment.

[10] See Lundberg (2005) for an excellent review of the literature on sons, daughters, and parental preferences.

the case that a father with more daughters would, ceteris paribus, show a greater preference for women's rights.

2.2 Married women's property laws in nineteenth century US

The British colonies based their laws on English common law which, as summarized in the Blackstone Commentaries, stated:

> By marriage, the husband and wife are one person in law: that is, the very being or legal existence of the woman is suspended during the marriage, or at least is incorporated and consolidated into that of the husband; under whose wing, protection, and cover, she performs every thing; and is therefore called in our law-a *feme-covert*.[11]

Under nineteenth century common law, a married woman was bound by the rules of coverture which, as seen above, vested her legal rights in her husband. Upon marriage, a woman's personal possessions became her husband's and he could dispose of them in any way he wished during his lifetime or in his will. He was, in general, also entitled to all the personal property his wife might acquire during the marriage. Although her real property remained under her ownership, the income from these went to the husband.[12] Furthermore, the husband had the right to manage her land. Thus, a husband controlled his wife's property and earnings (whether from labor or from land). Furthermore, married women were not permitted to enter into contracts without the consent of their husbands nor allowed to engage in trade on their own account as "sole traders". Even children were allocated to their father in the (rare) case of divorce. After 1830, US states began to pass legislation that revised these restrictions. Between then and 1920 there was a large increase in women's rights.[13]

Some of the initial revisions of the law of coverture were in response to the Panic of 1837 and the ensuing depression, particularly in the South.[14] These laws mainly attempted to shield a married woman's property (including slaves) from her husband's creditors. This factor does not explain why the laws evolved over time to allow women to own and control separate property, to write contracts, to own and control their earnings, or to maintain custody over their children. The excellent legal studies literature in this field (e.g., Basch 1982; Chused 1983, 1985; Salmon 1986; Shammas 2002; Warbasse 1987) discusses multiple causes that range from the desire for codification, the heightened awareness of the similarity in legal position of slaves and married women, the greater status of women arising from their growing responsibilities in the domestic sphere, the burgeoning feminist movement, and paternalism. While these may have all played a role, an important question is why did they become critical in the mid to late 1800s rather than earlier or later?

Paternalism is the reason given for reform in this paper in the sense that men's concerns about their daughters' welfare is the key factor that, in combination with economic development, gives rise to women being granted property rights.[15] In light of this, it is interesting to note that in the popular rhetoric of this period, paternalism appears repeatedly. Legislators, for example, would raise the "specter of drunken husbands" to gain passage of married

[11] From Blackstone (1765–1769), Book 1, Chap. 15., p. 431.

[12] Real property is defined as any property that is attached directly to land, as well as the land itself.

[13] See Doepke and Tertilt (2009) for a review of the expansion of some of these rights in the US and England.

[14] Mississippi was the first state to pass a married women's property act in 1839.

[15] Furthermore, as will be made clear in Sect. 3.5, the type of paternalism required by the theory is straightforward. In particular, fathers need not care about their grandchildren via their daughter's utility function as in Doepke and Tertilt (2009)—it is sufficient that they care about their daughter's utility from consumption.

women's property acts. In Warbasse (1987) discussion of New York's experience, she concludes: "Final passage became assured only when conservatives, convinced that a married women's property acts held definite benefits for their own wives and daughters, dropped their talk of separate interests and family disharmony."[16] The contribution of this paper is to provide an explanation for why paternal concern for a daughter's welfare, presumably always present, finally trumped the benefits associated with man's privileged status in a patriarchal system. As will be shown, a process of capital accumulation and declining fertility eventually realigned a man's interests to favor his daughter.

3 The model

Below I develop a simple dynamic OLG model to study how growth, fertility, and legal regimes that are relatively more favorable to married women affect male preferences towards a patriarchal system relative to one in which women have equal property rights. I do not model the intricate legal system that governed bequests, inheritance rights in case of death of a spouse (dower and curtesy), real versus personal property, or divorce. Instead I simplify matters by assuming that the issue is one of control over the allocation of property income over consumption and bequests. While this is a considerable abstraction, it serves to clarify some of the basic implications of the two property systems.

3.1 The basic framework

The economy consists of married households composed of a man (the husband h), a woman (the wife w), and their $2n$ children (consisting of n boys and n girls). Throughout the analysis I will keep fertility exogenous and examine how a change in its level affects the relative attractiveness of the two regimes.[17]

3.1.1 Preferences

Individuals have log preferences over the consumption good c and they also care about the average welfare of their children.[18] Note that a prime $'$ is used to denote variables for the next generation (thus if U_h, for example, is the husband's utility then U_h' is the utility of his son—himself a future husband). Maximization of a concave utility function implies that all sons will obtain the same utility, U_h'; similarly, all daughters will obtain the same utility, U_w'. The welfare of daughters relative to sons, however, will depend on the property-rights regime. The average welfare of children is thus $\frac{nU_h'+nU_w'}{2n} = \frac{U_h'+U_w'}{2}$ and an individual's utility, U_i, can be written as:

$$U_i\left(c_i, U_h', U_w'\right) = \log(c_i) + \beta\left(\frac{U_h' + U_w'}{2}\right), \quad 0 < \beta < 1 \tag{1}$$

for $i = h, w$.

[16] Warbasse (1987), p. 229.

[17] This assumption makes the model analytically tractable. In a model with endogenous fertility one could still examine the comparative static properties of variables that change desired fertility (e.g., by modifying an exogenous component of the cost associated with fertility, such as urbanization).

[18] This is a fairly standard assumption (see, e.g., Doepke and Tertilt (2009)).

3.1.2 Timing and household maximization problem

Households start out with some inherited capital or property k (these terms will be used interchangeably) which is used to produce output of a single good. The production is assumed to be Ak, $A > 1$. The output is then allocated between consumption of the husband, c_h, the wife, c_w, and inheritances k_i', $i = h, w$, for each son (h) or daughter (w). Once bequests are allocated, sons and daughters enter the marriage market and find a spouse.

The rules governing the household-allocation decision depend upon the property rights regime. Under a patriarchal regime in which women have no property rights (also denoted NR for "no rights"), all the decision power is assumed to rest with the husband. Under the equal property rights regime (also denoted ER for "equal rights"), on the other hand, women and men jointly own and control marital property and the final allocation is assumed to maximize the equally weighted sum of the two spouses' utilities. A discussion of this is postponed to the relevant section.

3.1.3 The marriage market

Before deriving the equilibrium allocations under each regime, we specify how spousal matches are formed and any restriction on the contracts individuals can write. As in most of the literature on marriage we make the realistic assumption that parents cannot make match-specific bequests, i.e., that parents are unable to write contracts specifying bequests contingent on the amount of capital that the future spouse inherits, nor can they contract on the consumption or welfare level of a spouse. If they could, the property-rights regime would not play a role.

To avoid the outcome of suboptimal investments in children (bequest levels in this case), we assume that the marriage market is perfectly competitive—i.e., there is costless search in a large market as in, for example, Peters and Siow (2002) or Iyigun and Walsh (2007a).[19] As shown by these authors, in a competitive market there always exists an efficient equilibrium.[20] The assumption of a perfectly competitive marriage market simplifies the algebra and clarifies the mechanism driving the results in the paper by not introducing another source of inefficiency. It is worth noting, however, that the exact matching environment is not critical; the results go through with random matching as well.

An equilibrium in the marriage market consists of an assignment of men to women including the null assignment (i.e. a woman is not assigned to a man or vice versa—they remain single) such that there does not exist a pair of individuals or a single individual that can, by breaking their current assignments, make themselves better off (with at least one of them strictly better off). We will assume that remaining single is very undesirable (this is easy to ensure by attaching a large negative number to that state) so that everyone marries.

[19] See Gall et al. (2009) for a more general discussion of when efficiency obtains in models with non-transferable utility.

[20] The externality from a bequest to a child comes from the fact that it also makes her/his spouse better off. This is not taken into account by a parent who is only maximizing parental and child's welfare. A competitive market internalizes the spouse's welfare by bidding up the "price" (in the model, the bequest level) one must pay in order to get married. In a random matching marriage market, by way of contrast, there is no price for marriage. Hence investments are inefficient.

3.2 Equilibrium under no property rights (*NR*)

A household begins its married life with an endowment of (inherited) capital for the husband k_h and an endowment for his wife, $\widetilde{k}_h$, where $\tilde{k}_i$ denotes the capital brought to the household by i's spouse, $i = h, w$ (equivalently, from the point of view of the wife, married life begins with the capital brought in her, k_w, and the capital endowment of her husband, $\tilde{k}_w$). In the patriarchal (i.e., *NR*) regime the husband controls the allocation of the income derived from the total capital endowment $k = k_h + \widetilde{k}_h$.

I assume that husbands must guarantee their wives a minimum consumption level $c_w = \underline{c} > 0$. Thus, the husband maximizes (1) subject to:

$$Ak \geq c_h + \underline{c} + nk'_h + nk'_w \tag{2}$$

As noted previously, we solve for the efficient level of bequests to children given the property-rights regime. To derive the efficient level of bequests, we write the maximization problem *as if* siblings married one another since, in that case, parental bequest decisions internalize both the welfare of the child and child's spouse.[21] Thus, the value functions V_i must satisfy the recursive relationships:

$$V_h\left(k_h, \widetilde{k}_h\right) = \underset{c_h, k'_h, k'_w}{Max} \left\{ \log c_h + \frac{\beta}{2}\left[V_h(k'_h, k'_w) + V_w(k'_w, k'_h)\right] \right\} \tag{3}$$

$$V_w\left(k_w, \tilde{k}_w\right) = \log \underline{c} + \frac{\beta}{2}\left[V_h(k'_h, k'_w) + V_w(k'_w, k'_h)\right] \tag{4}$$

where $V'_j,\ j \in \{h, w\}$ has been written as a function of both the bequest to a son, k'_h, and to a daughter, k'_w, rather than to a non-related spouse, $\widetilde{k}'_i$, as a way to solve for the efficient bequest level.

Lemma 1 *The husband's and wife's value functions under the NR regime are log-linear in* $k - \frac{\underline{c}}{A-n}$ *(where k is the household's total capital endowment) and take the forms:*[22]

$$V_h^{NR}(k) = a_h + \frac{1 - \frac{\beta}{2}}{1 - \beta} \log\left(k - \frac{\underline{c}}{A - n}\right) \tag{5}$$

$$V_w^{NR}(k) = a_w + \frac{\frac{\beta}{2}}{1 - \beta} \log\left(k - \frac{\underline{c}}{A - n}\right) \tag{6}$$

where

$$a_h = \frac{\left(1 - \frac{\beta}{2}\right) \log \frac{A(1-\beta)}{\left(1-\frac{\beta}{2}\right)} + \frac{\beta}{2} \log \underline{c} + \frac{\beta/2}{(1-\beta)} \log\left(\frac{A}{n} \frac{\beta/2}{\left(1-\frac{\beta}{2}\right)}\right)}{(1 - \beta)} \tag{7}$$

[21] N.B.: This is simply a method to solve for the efficient equilibrium level of bequests; it is *not* a description of the marriage market. Agents are *not* marrying their siblings.

[22] We will impose conditions such that the value function is well defined.

and

$$a_w = \frac{\frac{\beta}{2}\log\frac{A(1-\beta)}{\left(1-\frac{\beta}{2}\right)} + \left(1-\frac{\beta}{2}\right)\log\underline{c} + \frac{\beta/2}{(1-\beta)}\log\left(\frac{A}{n}\frac{\beta/2}{\left(1-\frac{\beta}{2}\right)}\right)}{(1-\beta)} \tag{8}$$

(the NR superscript denotes the NR regime).

Proof See the Appendix. □

Returning to the husband's maximization problem and using (5) and (6) yields the first-order condition:[23]

$$-\frac{n}{Ak-\underline{c}-nk'} + \frac{\frac{\beta}{2}}{(1-\beta)}\frac{1}{k'-\frac{\underline{c}}{A-n}} = 0 \tag{9}$$

where $k = k_h + k_w$ and $k' = k'_h + k'_w$. Solving for the husband's consumption and k' yields:

$$c_h^{NR} = \frac{(1-\beta)}{1-\frac{\beta}{2}}A\left(k - \frac{\underline{c}}{A-n}\right) \tag{10}$$

and

$$k'_{NR} = \frac{\frac{\beta}{2}(Ak-\underline{c}) + (1-\beta)\frac{n\underline{c}}{A-n}}{n\left(1-\frac{\beta}{2}\right)} \tag{11}$$

Note that we cannot solve for k'_h and k'_w separately because individual welfare under *NR* depends only the total sum of household capital.[24] This follows from the fact that the husband controls the income from household capital (Ak) regardless of the amount of capital the wife brought into the marriage. Note that $k' = k'_h + k'_w$ is uniquely determined, however, and under *NR* it is the only economically relevant variable since it alone determines welfare.

Any decomposition of k' into k'_h and k'_w can be sustained by the appropriate equilibrium strategies in the marriage market. These take the following form: an individual of gender i, $i \in \{w, h\}$, is willing to marry another individual (of the opposite gender j) *iff* that agent's bequest is at least k'_j. Thus if, for example, equilibrium bequests to sons and daughters are equal, a man's strategy is to marry a woman if and only if $k'_w \geq \frac{k'_{NR}}{2}$, where k'_{NR} satisfies (11). A similar strategy—to marry a man if and only if $k'_h \geq \frac{k'_{NR}}{2}$—is held by women. The fact that agents are atomistic implies that agent i is not concerned with the possibility of not finding another agent to marry if he/she rejects the agent j because k'_j is too low. No parent will therefore invest less in a child (nor more). Note that although a woman's consumption does not depend on either her own or her husband's wealth, her welfare is nonetheless an increasing function of the level of household capital as her children's welfare is an increasing function of the latter.

It is important to place some restrictions on the parameters of the model that will ensure, among other things, that the value functions are well defined. First, to ensure that the husband

[23] The same first-order condition is obtained for k'_h and k'_w.

[24] Note that all women bring the same capital endowment to the marriage market (as do all men). Thus, unlike in the case of a non-degenerate household capital distribution, solving for equilibrium does not require a condition guaranteeing that a father would not want to marginally increase/decrease a bequest so that his son/daughter gets a different match.

is better off than his wife under *NR* (otherwise what would be the point of a patriarchal system?) requires:

$$c_h^{NR} > \underline{c} \tag{12}$$

In order to satisfy Eq. (12, the economy must be sufficiently wealthy (or equivalently, $\underline{c}$ must be sufficiently small). To guarantee this holds in period zero, we assume $A1$:

$$A1: \qquad k_0 > \frac{\underline{c}}{A}\left(\frac{1-\frac{\beta}{2}}{1-\beta}+\frac{A}{A-n}\right) \tag{13}$$

which is a necessary and sufficient condition for Eq. 12 to hold for all $t \geq 0$.

For Eq. (12) to hold at all points in time requires $k_t > \frac{\underline{c}}{A}\left(\frac{1-\frac{\beta}{2}}{1-\beta}+\frac{A}{A-n}\right)$. A sufficient condition, given $A1$, is for the economy to grow over time (which was the case for the historical period of interest). This requires:

$$k'_{NR} > k_{NR} \tag{14}$$

Using (11), the necessary and sufficient condition for (14) to hold, given $A1$, is given by condition $A2$ below:

$$A2: \qquad A > \frac{\left(1-\frac{\beta}{2}\right)}{\frac{\beta}{2}}n \tag{15}$$

Thus, the economy must be sufficiently productive relative to the growth rate of the population. Note that $A2$ will always hold for A sufficiently high. We henceforth assume that the economy satisfies $A1$ and $A2$.

It is worth making a few remarks at this point. First, given $A1$ and $A2$, the value functions V_j^{NR}, $j = h, w$, given in (5) and (6) are well-defined since these conditions ensure $(A-n)k - \underline{c} > 0$.[25] Second, V_j^{NR} is concave. Third, this economy exhibits endogenous growth.

3.3 Equilibrium under equal property rights (*ER*)

Under the *ER* regime husbands and wives are assumed to jointly own and control marital property and the equilibrium allocation is assumed to maximize the equally weighted sum of both spouses' utilities. Thus, the solution must satisfy:

$$\begin{aligned} V_h(k_h,k_w)+V_w(k_w,k_h) = \underset{c_h,c_w,k'_h,k'_w}{Max} & \left\{\log c_h+\log c_w+\beta\left[V_h\left(k'_h,k'_w\right)+V_w\left(k'_w,k'_h\right)\right]\right\} \\ s.t. \qquad & A(k_h+k_w)-c_h-c_w-n(k'_h+k'_w)\geq 0 \end{aligned} \tag{16}$$

Note that the weight placed on future generations' welfare in (16) is twice that in the *NR* regime as the allocation under *ER* maximizes the sum of both spouses' utilities as opposed to only the husband's. On the other hand, the wife's consumption under *ER* is no longer a constant and instead the allocation must maximize the sum of the log consumptions in addition to the continuation value. As before, in order to solve for the efficient investment in children, the value functions are written as if siblings married one another.

[25] To see this right away, note that if a father with capital k were to bequeath each son-daughter pair k, this would yield him consumption $c_h = Ak - nk - \underline{c}$. This expression must be positive since, by $A2$, $k' > k$ and by $A1$, $c_h > \underline{c}$.

Lemma 2 *The husband's and wife's value functions under the ER regime are identical and log-linear in k (where k is the sum of each spouse's capital endowment) and take the form:*

$$V_h^{ER}(k) = V_w^{ER}(k) = \phi + \frac{1}{1-\beta}\log k \tag{17}$$

where

$$\phi = \frac{\log(1-\beta)\,\frac{A}{2} + \frac{\beta}{(1-\beta)}\log\beta\frac{A}{n}}{(1-\beta)} \tag{18}$$

Proof See the Appendix. □

Returning to the maximization problem in (16), and substituting (17) for V_h' and V_w', yields the first-order conditions:

$$-\frac{n}{Ak - c_w - nk'} + \frac{2\beta}{(1-\beta)}\frac{1}{k'} = 0 \tag{19}$$

and

$$-\frac{1}{c_h} + \frac{1}{c_w} = 0 \tag{20}$$

where $k = k_h + k_w$ and $k' = k_h' + k_w'$.

Solving for consumption and k' yields:.

$$c_h^{ER} = c_w^{ER} = \frac{1-\beta}{2}Ak \tag{21}$$

and

$$k'_{ER} = \beta\frac{Ak}{n} \tag{22}$$

Note that, as in the *NR* regime, only the aggregate bequest left to a household by the parents and parents-in-law is determined, rather than the separate amounts. In this case the multiplicity arises because, under *ER* allocation rules, only the total quantity of household capital affects outcomes, rather than how this is divided initially between spouses. As before, all variables of interest (consumption, investment or individual welfare) depend only on the aggregate level of household capital.

The equilibrium strategies in the marriage market that sustain a given division of k' into its component k_h' and k_w' are analogous to the ones in the *NR* regime. If, for example, bequests are given equally to sons and daughters, all men have the strategy to marry a woman if and only if $k_w' \geq \frac{k'_{ER}}{2}$, where k'_{ER} satisfies (22). A similar strategy—to marry a man if and only if $k_h' \geq \frac{k'_{ER}}{2}$—is held by women.

We can also require that this economy grow over time, as we did for the *NR* regime, i.e.,

$$k'_{ER} > k_{ER} \tag{23}$$

Using (22), the necessary and sufficient condition for (23) to hold is given by:

$$A > \frac{1}{\beta}n \tag{24}$$

but this condition is not binding given $A2$.

3.4 Regime change: growth, fertility, and the treatment of women

This section analyzes the circumstances under which men would prefer the *ER* over the *NR* regime. Rather than introduce a full-fledged dynamic political economy model, we follow Doepke and Tertilt (2009) and assume that each generation of men is faced with a once-and-for-all choice between the patriarchal regime or switching to the equal rights regime. This assumption significantly simplifies the political economy part of the model since it both eliminates strategic considerations and allows the model to be solved analytically.[26] It is equivalent to each generation of men comparing $V_h^{ER}(k)$ to $V_h^{NR}(k)$ and choosing whichever is greater. As k evolves over time (following the law of motion given by the property-rights regime the agents are in, i.e., as specified in either (11) or (22)), agents' relative valuation of the *NR* versus *ER* regime evolves.

It is useful to start by summarizing the allocation differences across regimes in a lemma.

Lemma 3 *(i)* $c_h^{NR}(k) > c_h^{ER}(k)$*; (ii)* $k'_{NR}(k) < k'_{ER}(k)$.

Proof These follow directly from comparing Eqs. (21) with (10), and (22) with (11) □

Not surprisingly, a husband's consumption is higher under *NR* relative to *ER*. While it is possible for a wife's consumption to be lower under *ER* for sufficiently low levels of capital (as the household under may prefer to engage in large bequests), this situation will not persist once the economy is sufficiently wealthy. In all cases, the wife of course prefers the *ER* regime to the *NR*. Less obviously, capital accumulation (growth) is higher under *ER*. There are two forces at work that yield this result. First, a father's valuation of an additional unit bequeathed (for any given level of k') is higher under *ER* than under *NR* since the marginal unit will benefit equally his daughter and his son. This is due to the implicit tax faced by a father trying to make his daughter better off under *NR*. Under *ER*, an additional unit of capital bequest increases a daughter's utility directly via her own consumption rather than only indirectly via her children's welfare as it does under *NR*. Second, for any utility function, the fact that under *ER* both spouses must consume equal amounts leads, on its own, to lower consumption. This does not necessarily lead to higher bequests under *ER*, however, since the amount bequeathed is $Ak - 2c_h$ rather than $Ak - (c_h + \underline{c})$ under *NR*. With log preferences, however, this second force also leads to higher bequest levels. Thus, $k'_{NR}(k) < k'_{ER}(k)$.

We next turn to the first of the three main propositions of the paper. In this proposition we establish that the reform of the property rights regime will happen in finite time and characterize how a man's utility differential across regimes changes over time.

A few preliminary definitions. Henceforth, we will use $\Delta V_h(k)$ to denote the difference in men's welfare in the *NR* versus *ER* regime at a capital stock of k, i.e.,

$$\Delta V_h(k) \equiv V_h^{NR}(k) - V_h^{ER}(k) \tag{25}$$

Since the patriarchal system is supposed to be in men's advantage, we will henceforth restrict our attention to initial values of the capital stock, k_0, such that $\Delta V_h(k_0) > 0$, i.e., men start out strictly preferring the *NR* regime.[27]

[26] If each generation faced instead the option of reforming the regime that period or postponing the choice to the following generation, I conjecture that the Markov Perfect equilibrium would have each generation mixing over whether to reform with a probability that is a function of k.

[27] Note that modifying the model to include an endowment of a household good z and preferences given by $U_i = u(z_i) + \log c + \beta\left(\frac{U'_h + U'_w}{2}\right)$, $z_w + z_h = z$, guarantees $V_h^{NR}(k) > V_h^{ER}(k)$ for $u'(z)$ sufficiently large. Under the NR regime, the husband would set $z_h = z$, whereas under ER, $z_h = z_w = z/2$.

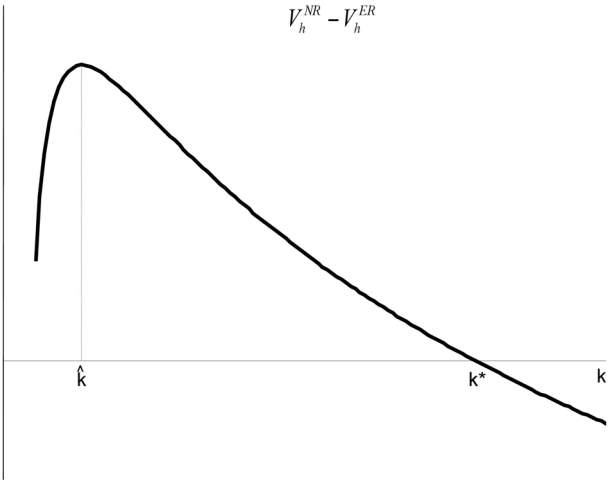

Fig. 1 Men's welfare differential as a function of household capital

It will also be useful to define two levels of k. In particular, let $\widehat{k}$ be defined as:

$$\widehat{k} = \frac{2}{\beta}\frac{\overline{c}}{A-n} \tag{26}$$

and define k^* as:

$$\Delta V_h(k^*) = 0 \tag{27}$$

This is the level of household capital at which men would be indifferent between the *NR* and *ER* regimes.

Proposition 1 (Wealth) *i*. $\forall k < \widehat{k},\ \Delta V_h(k)$ *is increasing in* k; $\forall k > \widehat{k},\ \Delta V_h(k)$ *is decreasing in* k. *ii*. *Reform happens in finite time and is not overturned.*

Proof i. Taking the derivative of $\Delta V_h(k)$ with respect to k yields the necessary and sufficient condition below to ensure that the derivative is positive:

$$k < \frac{2\underline{c}}{\beta(A-n)} = \widehat{k} \tag{28}$$

ii. To show that eventually there will be a reform of property rights, note that we can write $\Delta V_h(k)$ as $a_h - \phi + \frac{1-\frac{\beta}{2}}{1-\beta}\log\left(k - \frac{\underline{c}}{A-n}\right) - \frac{1}{1-\beta}\log k$. Taking the limit as k goes to infinity (which is valid as the capital stock does not converge in this model) yields $\lim_{k\to\infty}\Delta V_h = a_h - \phi + \left(\frac{1-\frac{\beta}{2}}{1-\beta} - \frac{1}{1-\beta}\right)\lim_{k\to\infty}\log k + \left(\frac{1-\frac{\beta}{2}}{1-\beta}\right)\lim_{k\to\infty}\log\left(1 - \frac{\underline{c}}{(A-n)k}\right) = -\infty$. Thus, reform occurs once $k \geq k^*$. Note that since $\widehat{k} < k^*$, (i) and the fact that k increases under both regimes, imply that once the reform is passed it will never be overturned. □

$\Delta V_h(k)$ is depicted in Fig. 1. The intuition for its shape is as follows. At low levels of income (i.e., low k), consumption is relatively low. Hence, increases in the capital stock have a large impact on a husband's welfare since the marginal utility of consumption is high. The fact that husbands must share the additional consumption with their wives under the *ER*

regime but not under the *NR* regime renders the *NR* regime relatively more attractive. Hence there is a range of k where the relative attractiveness of the *NR* regime is increasing. Once k is greater than $\widehat{k}$ however, this is no longer the case. Past that level of wealth, the fact that a man cannot directly improve the welfare of his daughters becomes relatively more important than additional gains in his own consumption. Indeed, a man would be willing to sacrifice some of his own consumption in favor of his wife's if his sons-in-law agreed to do the same vis a vis their spouses. This is a contract he cannot enforce, however. Thus, for $k > \widehat{k}$, the relative attractiveness of the *NR* regime is decreasing in k but overall the *NR* regime remains preferred to the *ER* regime as long as $k < k^*$. For k sufficiently large, i.e., for all $k > k^*$, a man would be better off under the *ER* regime, where k^* satisfies (27).

We next establish a relationship between fertility, the relative attractiveness of the two regimes, and the timing of reform.

Proposition 2 (Fertility) ***i.*** *Lower fertility (n) increases the attractiveness of reform for all levels of household wealth.* ***ii.*** *Reform happens sooner if n is lower.*

Proof i. It suffices to show that $\Delta V_h(k;n)$ is increasing in n, $\forall k$. Taking the derivative with respect to n yields $\frac{d\Delta V_h(k;n)}{dn} = \frac{\frac{\beta}{2}}{(1-\beta)^2}\frac{1}{n} - \frac{1-\frac{\beta}{2}}{1-\beta}\frac{\underline{c}}{(A-n)((A-n)k-\underline{c})}$. For this to be positive requires:

$$(A-n)\left((A-n)k-\underline{c}\right) > \frac{(1-\beta)\left(1-\frac{\beta}{2}\right)}{\beta/2}n\underline{c} \tag{29}$$

By $A1$ and $A2$, $(A-n)k-\underline{c} > Ak-nk'-\underline{c} = c_h > \underline{c}$. Thus, (29) holds if $(A-n)\underline{c} \geq \frac{(1-\beta)(1-\frac{\beta}{2})}{\beta/2}n\underline{c}$ or

$$\frac{\beta}{2}A \geq \left(1-\beta\left(1-\frac{\beta}{2}\right)\right)n$$

As the RHS of this expression is increasing in n, we can substitute for n with its highest value as implied by $A2$. This yields the condition $1-\frac{\beta}{2} \geq \frac{1}{2}$, which holds $\forall\beta \in [0,1]$.

ii. To show that reform happens sooner when fertility is lower, first note that, by (i), k^* is an increasing function of n. We next show that k'_{NR} is a decreasing function of n whereupon we are done. Differentiating k'_{NR} with respect to n yields, after some manipulation and using $A2$, $\frac{dk'}{dn} < 0$. □

The proposition above establishes that the reform of women's property rights will happen earlier if fertility is lower. This effect can be seen graphically in Fig. 2. The effect of a decrease in n is to decrease both $\widehat{k}$ (the point at which the welfare differential becomes decreasing in k) and k^* (the point at which men are indifferent between the two regimes), and to increase bequests, leading reform to occur sooner.

The conclusion above follows from the concavity of the utility function over own and children's consumptions. A lower fertility level implies that the "price" of increasing the average welfare of one's children is lower. Thus the amount bequeathed to each household is higher. Under *NR*, the higher bequest increases a son's welfare both by increasing his consumption and by increasing the welfare of his offspring. The welfare of a daughter, on the other hand, only increases because of the second channel. Thus, although the welfare of both sons and daughters increases, so does the disparity in their welfare levels. In particular, the difference between $\log c_h$ and $\log \underline{c}$ increases as n falls. Concavity implies that the gains

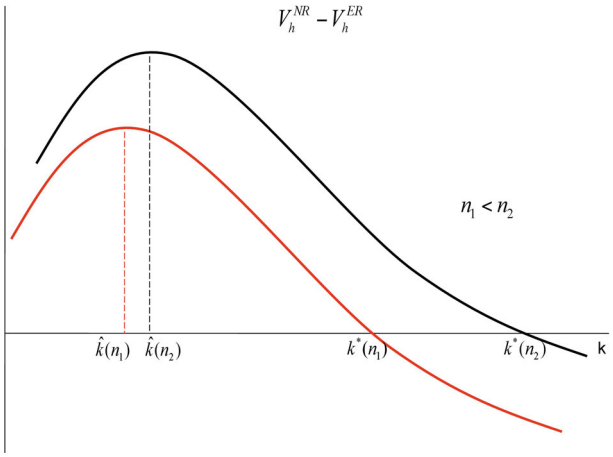

Fig. 2 Comparative statics with respect to fertility

to equalizing the consumption of the spouses is increasing in this gap, thereby increasing the attractiveness of the *ER* regime at every value of k.[28]

The next proposition compares *NR* regimes that are more versus less generous towards married women by providing them with different levels of consumption $\underline{c}$. These consumption differences are supposed to reflect differences in legal regimes across US states as discussed in greater detail in the empirical section. Here we ask whether a more generous system, which decreases husbands' consumption benefits from patriarchy, will lead men to reform the property rights system sooner? Perhaps surprisingly, the answer is no.

Proposition 3 (Wife's welfare) *A higher level of* $\underline{c}$ *increases the critical level of wealth for reform,* k^**, and delays reform.*

Proof The proof proceeds by showing that an increase in $\underline{c}$ increases k^* and decreases k'_{NR}. Differentiating $V_h^{NR}(k)$ with respect to $\underline{c}$ yields $\frac{\partial V_h^{NR}}{\partial \underline{c}} < 0$ if $k < \widehat{k}$, and $\frac{\partial V_h^{NR}}{\partial \underline{c}} > 0$ if $k > \widehat{k}$. Thus $\frac{dk^*}{d\underline{c}} > 0$. Next, differentiating k'_{NR} (in (11)) with respect to $\underline{c}$ yields, after some manipulation and using $A2$, $\frac{dk'_{NR}}{d\underline{c}} < 0$. □

The effect of an increase in $\underline{c}$ can be seen in Fig. 3. An increase in $\underline{c}$ decreases the attractiveness of the patriarchal regime at low levels of wealth ($k < \widehat{k}$) and increases it at higher levels of wealth $\left(k > \widehat{k}\right)$. Intuitively, when income is low, a husband is made worse off sacrificing more of his income to his wife although it improves his daughters' welfare (as they too enjoy the higher level of $\underline{c}$). The opposite is true once income is high enough and this renders the *NR* regime relatively more attractive since the disparity between sons' and daughters' welfare is smaller. Thus this increases k^*, the level of wealth at which men are indifferent between the two regimes. Furthermore, the pace of capital accumulation slows down at all levels of k as more income is diverted to the wife's consumption.

[28] Why does the effect on ΔV_h of an increase in k depend on the initial level of k whereas the effect of a decrease in n is always negative? Note that the first is an income effect whereas the second is a price effect—it becomes less expensive to increase the average welfare of a man's children.

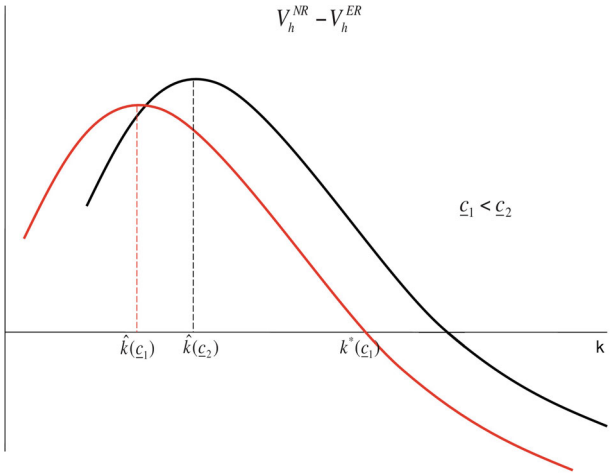

Fig. 3 Comparative statics with respect to $\underline{c}$

3.5 Discussion of assumptions and extensions

The model made several assumptions, some merely for simplicity and notational ease whereas others play a more fundamental role. This section discusses the role played by various assumptions (e.g., preferences, altruism, and efficient investment in children) and how the model can be extended.

In the model, a married woman's consumption is constant over time. It is easy to allow their consumption to increase over time by, for example, introducing a household public good g and correspondingly modifying individual preferences to include an additive separable term $\gamma \log g$. The new budget constraint becomes $Ak - c_h - c_w - g - nk'_h - nk'_w \geq 0$ and the husband's optimization problems yield $g^{NR} = \gamma c_h^{NR}$ and $g^{ER} = 2\gamma c_h^{ER}$. Thus, with this modification a component of married women's consumption increases at the same rate as the husband's consumption. All the results derived previously go through as before. Hence, the paper's results are not dependent on the wife's consumption remaining constant.

Similarly, the assumption that parents care equally about their sons and daughters or that the *ER* regime places equal weight on the welfare of both spouses is made only for simplicity. The model easily accommodates parents valuing sons more than daughters, or placing a weight less than half on a wife's welfare under *ER*. The "non-paternalistic" dynastic welfare assumption is also very easy to relax. In general, any formulation in which parents have concave utility over their children's average consumption will work.

The use of log preferences over consumption is critical insofar as it allows the model to be solved analytically. The cost of using logs, however, is that it requires the assumption that a husband places no weight on his wife's utility. If he did value her welfare, log preferences imply that her total consumption would grow at the same rate as his and thus the utility differential would remain constant. In that case, there would never be a reform of the patriarchal system. This is not a property of preferences in general, however, and thus not particularly troubling. Theoretically, preferences need to satisfy the property that the welfare cost stemming from the disparity in one's children's consumption outweighs at some point the consumption benefits a man obtains from being selfish with his wife (i.e., from not sharing consumption equally with her). What this requires is easiest to understand in a simpler setting

with two periods and no allocation decisions. Suppose that under *NR* a husband consumes $y-x,\ x < y/2$, his sons consume $Ay-x,\ A > 1$, and his daughters (and his wife) consume x, whereas under *ER* their consumptions are given by, respectively, $y/2,\ Ay/2$, and $Ay/2$. Comparing the utility differential under the two regimes, yields:

$$\Delta V_h = u\,(y-x) - u\,(y/2) + \beta/2\,[u\,(Ay-x) + u\,(x) - 2u\,(Ay/2)]$$

Differentiating this with respect to y yields the comparative statics with respect to higher income. If the marginal utility of consumption becomes sufficiently low at high levels of y, then eventually this expression is guaranteed to become negative. If x is increasing with y, then its rate of increase needs to be sufficiently small so that, in the long run, it is outweighed by the difference in marginal utilities under the two regimes.

The assumption that the marriage market is large and competitive (yielding efficient bequests given to children) is also not essential. Assuming that matching is random, for example, yields inefficient investment in children but the basic results of the model still hold.[29]

Introducing endogenous fertility while preserving an analytical solution requires a formulation with time cost and human capital as in Doepke and Tertilt (2009).[30] The disadvantage of this alternative is that it doesn't explicitly deal with property and that it is hard to interpret the production function. Given that white married women did not work outside the home over this time period, the most natural interpretation is home production but that makes it difficult to think about growth of per capita income and other issues central to development.

Preferences over the property rights regime will vary across the population if a household's ratio of sons to daughters is stochastic. Suppose that families have the same number of children, $2n,\ n \in \{1, 2, \ldots \bar{n}\}$, but now allow the sex of a child to be determined by a random draw. Taking the probability of a girl to be 1/2 and the sex to be iid draws, a proportion $p_n \equiv \sum_{k=n+1}^{2n} \binom{2n}{k} \left(\frac{1}{2}\right)^{2n}$ of the population will have more girls than boys and the same proportion will have more boys than girls. Thus, the median preferences in the population will be held by those individuals who have the same number of girls as boys, i.e. a proportion $\binom{2n}{n} \left(\frac{1}{2}\right)^{2n}$. Hence, one can interpret the preceding theory as an analysis of the regime preferences of the median voter, i.e., the preferences of individuals with equal numbers of boys and girls.[31]

4 Empirical analysis

The objective of the empirical analysis is to use variation across states in the timing of reform of women's property rights to study the empirical validity of the key correlations implied by the model. The model predicts that, ceteris paribus, lower fertility should be correlated with a higher probability of reform and that laws that increased the welfare of married women should be correlated with a lower probability of reform.[32] The relationship of per-capita

[29] Results available from the author on demand.

[30] The authors use a Cobb–Douglas production function in husband's and wife's human capital (each proportional to the time spent producing rather than rearing children).

[31] This discussion is a bit loose as one needs to show that the same investment rule would be followed.

[32] One can think of the timing of reform as being probabilistic by adding a random variable ε_{it} to men's relative valuation of the two regimes, ΔV_h, in state i at time t.

wealth to the timing of reform is non-monotonic (and may be complicated by heterogeneity in wealth).[33]

The next subsections introduce the main empirical variables, discuss the sample, and conduct a Probit and OLS regression analysis using state fixed-effects in addition to year fixed-effects.[34] A subsequent section proxies survival-fertility (FERTILITY10) with child mortality. The empirical analysis concludes with an examination of several alternative hypotheses as well as some robustness checks.

4.1 Data, key variables, and sample

The empirical analysis requires extensive use of state-level data from the Census, the construction of an appropriate fertility variable, and the dating of the property and earnings reforms. Below I discuss the key variables constructed for each decade between 1850 and 1920 and some characteristics of the sample before presenting the empirical analysis. Tables 10 and 11 in the Appendix shows the means, standard deviations, and correlations of the main variables.

4.1.1 Married women's property rights

The property rights variable is from Geddes and Lueck (2002).[35] The authors used legal treatises and original state session laws to determine the dates for which a property act gave women management and control of their separate estate and when they obtained ownership and control of their earnings.[36] I use the same property/earnings rights outcomes as the authors, employing a dummy variable denoted "BOTH" which takes the value one when *both* of these rights have been granted (and a zero otherwise). Using this variable rather than the date at which one of the rights was granted allows the results to be compared directly with those obtained by the authors.

There was considerable time variation in the granting of property rights to women. The first state to grant both property rights was Massachusetts in 1846 and the last was Louisiana in 1980. By 1920, all states with the exception of four (Florida, Arizona, New Mexico, and Louisiana) had passed both property acts. Although the exact date that should be imputed to these last four states is debatable since the legal system affecting women had changed radically over this long time period, we can ignore these complications by ending the analysis in 1920s (as in Geddes and Lueck). Figure 4 shows the time-line for adoption of these rights from 1845 to 1920 and Fig. 5 provides a map of the US with the timing of the reforms.[37] Note

[33] See the discussion in Sect. 3.5.

[34] Another possible specification is a hazard model although the theory does not call for it since, had the key variables evolved differently, reform could have been overturned. While this did not occur in the US, it has happened elsewhere (see, e.g., Przeworski (2007) for a discussion of how the extension of the suffrage in France or Spain was overturned several times). In addition to this objection, there are several other reasons why a hazard model is not included. First, as will be seen later, some states were part of territories during portions of this time period raising the issue of how duration for these states should be measured. Second, and more importantly, state fixed-effects cannot be incorporated in this specification, raising the usual omitted variable issue.

[35] I thank the authors for providing me with the data set containing the timing of the reforms and several state variables.

[36] See their working paper (2000) for details on the construction of this variable.

[37] Alaska and Hawaii are excluded from the analysis.

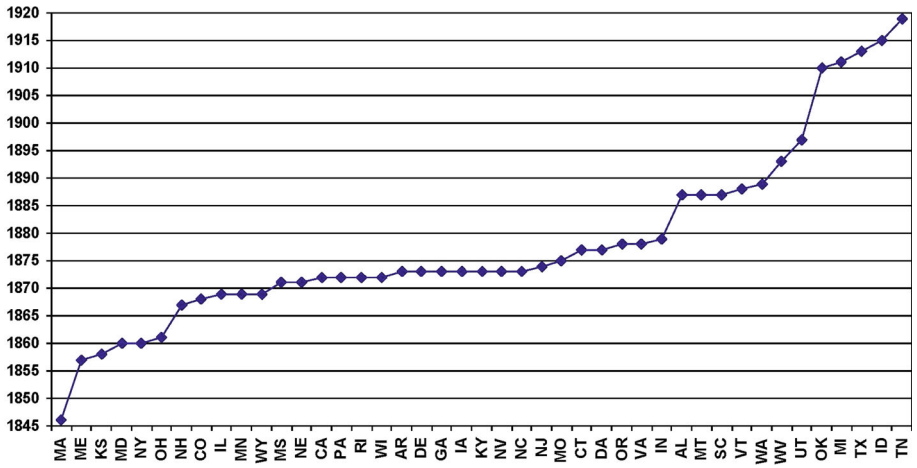

Fig. 4 Time-line: Women's property rights (BOTH)

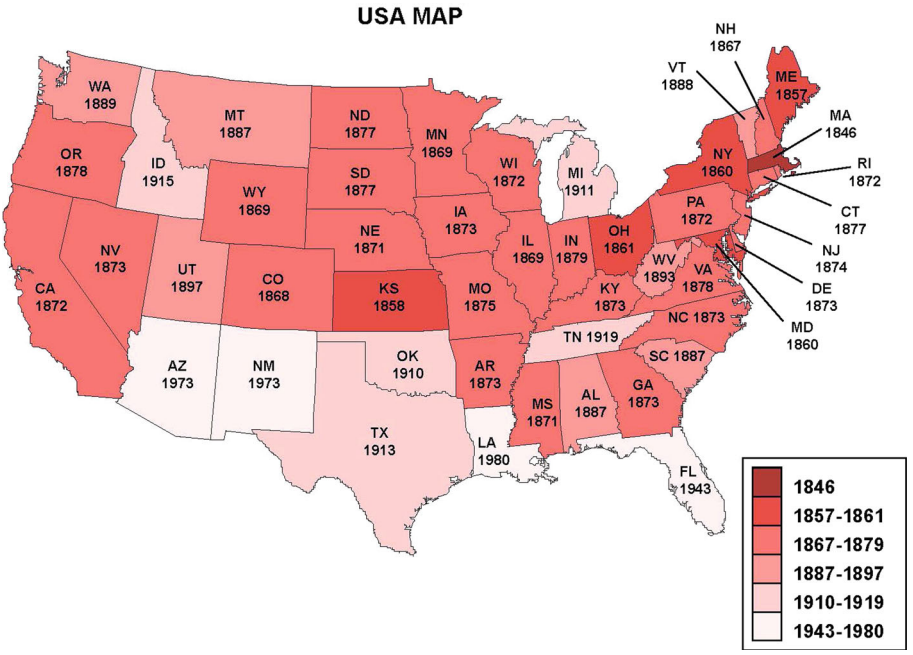

Fig. 5 Map with dates of property rights reform

that while many states instituted this reform between 1870 and 1880, there is also a sizable number of states that reformed before (11 states) or after (16 states) this time interval.

4.1.2 Survival-fertility and wealth

According to the theory the variable of interest is not fertility, but rather the number of sons and daughters that survive to adulthood. In particular, fathers care about the consequences

of the property laws as they apply to *married sons and daughters* which requires children to survive to that age. During the 80 years that concern us, the mortality of infants and young children decreased significantly in the US. infant mortality (for Whites), for example, is estimated to have dropped from 216.8 (per 1,000 births) in 1850 to 110.8 in 1900 and then to 82.1 in 1920.[38] Thus, it would be a mistake to examine fertility measures (e.g. "children ever born" or a total fertility rate) that did not take into account childhood mortality. This is fortunate as the US Census did not ask women how many children they had ("children ever born") until 1900.

To obtain a measure of survival-fertility, I use the number of (older) children per woman residing in the state as this variable can be constructed by using state census data from the relevant decade (1850–1920). Since the computation of a children-per-woman ratio requires data only on the population by age and sex, it provides an index of fertility when reliable birth statistics are not available and is consequently widely used in the demographic and development literature. Children is defined to include all between the ages of 10 and 19 years and women includes all females between the ages of 20 and 39 years.[39],[40] I restrict the sample to whites (non-blacks) as men in this racial category were the ones with political power. This variable, hereafter denoted FERTILITY10, has the additional advantage that, by only counting children age ten and over, it alleviates reasonable concerns about reverse causality (i.e. women's fertility behavior responding to the reforms rather than vice versa) since these children would have been born before the reform was instituted.

There is considerable variation in FERTILITY10, not only over time, but also across states. FERTILITY10 went from an average across states of 1.66 in 1850 to 1.26 in 1920. Figure 6 shows, for each decade in the period 1850–1920, the evolution of the average value of FERTILITY10 across states (the bold line), its range (as given by the upper and lower bars), and its SD (as shown by the dots) for all the states-years in the sample.

As a proxy for capital I use Geddes and Lueck's variable of "taxable" wealth per capita (WEALTHpc) deflated into 1982 dollars.[41] As described by the authors, WEALTHpc is the value of all private real and personal property and excludes such "exempt" property as government, charitable, and religious property. The mean of WEALTHpc over the sample is $13,664 with a SD of $9,579. Throughout the regression tables, this variable is divided by 10,000. Unfortunately there is no data that allows one to measure how wealth was distributed within the state.

4.1.3 Variation across states: territorial status and legal system

During this time period, the territorial organization of the United States was still evolving. In particular, during some portion of this period several states belonged to an organized territory and a few to an unorganized territory. Although states that belonged to a territory were able to reform their property rights laws before becoming independent states (e.g. Wyoming in 1869

[38] See Haines (2008). The decrease in mortality was large in every decade with the exception of 1880.

[39] A more traditional definition is to include women from age 15 to 44 but I use a tighter age range since I am looking at changes from decade to decade. As shown in the robustness section, the results are robust to the choice of alternative age ranges.

[40] I wish to thank Michael Haines for providing me with the raw census data to perform these calculations.

[41] This variable was constructed by Geddes and Lueck (2002) to test their hypothesis. See their working paper (2000) for details on how the data was deflated to 1982 dollars. The wealth data is from a special Census publication published in 1924 that compiled all Census wealth estimates from 1850 to 1922 (Wealth, Public Debt and Taxation 1922).

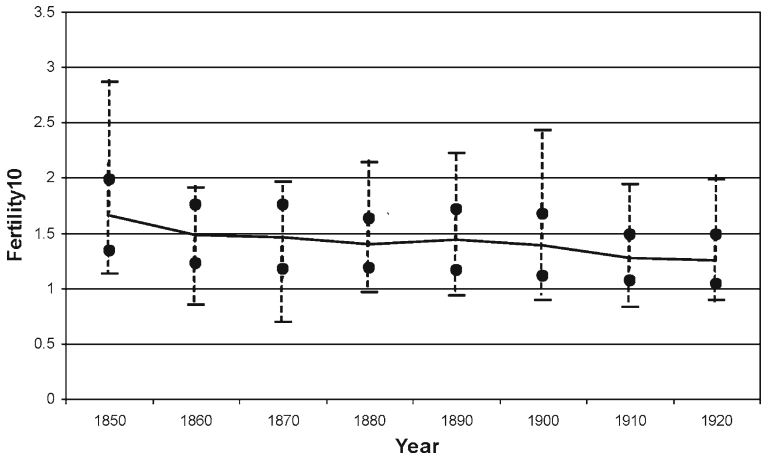

Fig. 6 Survival-fertility over time

and Colorado in 1868), they may nonetheless differ in important ways from independent states. Consequently, the empirical analysis controls throughout for territorial status.[42]

Another potentially important difference across states is with respect to their legal systems. The vast majority of states closely followed English common law.[43] Under common law, all property except land and improvements (realty) were owned by the women's husband and the woman's realty (and its profits) came under the husband's control. If a child had been born during the marriage, then a husband continued to possess his wife's real estate for life (a practice known as "curtesy"). If a wife survived her husband, she was guaranteed a dower of one-third of the profits from the realty he owned during the marriage.

In England, a special court known as chancery court had developed over the centuries to deal with the rigidities of the common law and the hardships it imposed on special cases. Equity law—the jurisprudence dispensed through the chancery court—allowed a woman, with her husband's consent, to transfer property to be administered by trustees either prior to or after the marriage. This arrangement primarily allowed wealthy women (or their fathers) with strong bargaining position relative to their spouses to shield their family's property.[44]

Fourteen states had equity courts.[45] As equity law afforded more protection to women's property, the theory predicts (Proposition 3) that, ceteris paribus, this would tend to delay the reform of property rights. On the other hand, since this provision primarily benefited a small minority of wealthier women and given that some states did not enforce equitable doctrines relating to married women's separate estates, it may not have had much of an impact on the timing of reform.[46]

[42] Note that it is important not to over-represent states by assigning to each one individually the variable outcome that belongs to the aggregate territory. There is an error in this respect in Geddes and Lueck (2002), though it does not appear to affect the conclusions of the analysis (see Table 2).

[43] Basch (1982), pp. 16–17 cites nineteenth century legal analysts as noting that in no other area was the correspondence between the American and English legal systems closer than in the law of wife and husband.

[44] See Bishop (1873) for a thorough discussion of how common law and equity differed.

[45] The states are: CT, DE, ME, MD, MA, MI, MN, NJ, NH, NJ, NY, RI, SC, and VT.

[46] See Salmon (1986) and Chused (1983).

Another potentially important source of legal differences is that some states with French or Spanish influence did not adopt a common law arrangement for family property and instead chose or inherited a community property system (as in most of continental Europe and Mexico).[47] The continental (civil law) model, like the common law model, gave tremendous power to the husband over the wife, but it treated property (at least what was acquired during marriage) as joint. This system was thus more favorable to wives as they automatically inherited half of marital property relative to the third that was customary under common law. The theory would predict that, ceteris paribus, reforms would happen later (i.e., they would require higher levels of per-capita wealth) in these states.

The legal system of the states did not change during this period with the exception of Nevada, Idaho, and Washington which went from being under common law while they were territories to having a community law system once they became independent.

4.1.4 The sample

The sample consists of all those states-decadal years (including those states that belonged to territories) for which data was available for the key variables. For any regression specification that required wealth, there are 356 state-year observations.[48]

Table 1 summarizes the mean FERTILITY10 and WEALTHpc levels for each decade between 1850 and 1920, dividing the sample into those states/territories which had already granted women property rights, i.e., BOTH = 1 (the column headed by "yes"), and those that had not (the column headed by "no"). The number of observations in each category is also reported.[49] As can be seen, for every decade, states in which women had obtained property rights on average had lower FERTILITY10. Furthermore, with the exception of 1860, per-capita wealth levels were also on average higher in those states.

4.2 Regression analysis: probit and OLS

The basic empirical exercise consists of estimating the probability that women had been granted both types of property rights in a given state/territory in a given decade, i.e.,

$$y_{it}^{*} = x_{it}'\beta + d_t + \varepsilon_{it} \text{ where } i = 1, \ldots, n; \quad t = 1850, 1860, \ldots, 1920$$
$$y_{it} = \begin{cases} 1 & \text{if } y_{it}^{*} > 0 \\ 0 & \text{if } y_{it}^{*} \leq 0 \end{cases}$$

where y_{it} is the observed state law variable BOTH in state i at time t and y_{it}^{*} is the unobserved legal rights "response" in that state and year, x_{it} is the column vector of exogenous variables, d_t is a year t dummy, and ε_{it} is normally distributed. Thus a state/territory is observed a maximum of eight times. Throughout standard errors are clustered at the state level.

Before proceeding with the analysis, I first examine the effect of contemporaneous per-capita wealth at the state level (WEALTHpc) on the probability that both reforms were

[47] The states are: AZ, CA, ID, LA, NV, NM, TX, and WA. See Warbasse (1987) for the experience of Louisiana which was the sole state that had this system in the first quarter of the nineteenth century. See Glaeser and Shleifer (2002) for a discussion of the important differences in other arenas between the English common law and French civil law.

[48] If wealth was not required, then the sample size could be increased by three observations. Since the increase was so small, I keep the same 356 sample throughout.

[49] The number of observations changes over time since some states were not yet part of the US in some decades and because wealth data was unavailable for some states (territories) in the earliest decades.

Table 1 Both women's rights?

		No		Yes	
		Mean	# Obs	Mean	# Obs
1850	Real wealth per capita	4,707	33	9,586	1
	Fertility10	1.69	33	1.14	1
	Community states		4		0
	Common law states		18		0
1860	Real wealth per capita	9,908	33	6,856	5
	Fertility10	1.53	33	1.32	5
	Community states		5		0
	Common law states		20		1
1870	Real wealth per capita	6,162	35	8,581	11
	Fertility10	1.51	35	1.32	11
	Community states		8		0
	Common law states		20		6
1880	Real wealth per capita	7,895	15	11,511	31
	Fertility10	1.44	15	1.36	31
	Community states		6		2
	Common law states		6		20
1890	Real wealth per capita	12,333	11	15,735	37
	Fertility10	1.57	11	1.38	37
	Community states		5		3
	Common law states		5		23
1900	Real wealth per capita	11,745	9	16,569	39
	Fertility10	1.49	9	1.34	39
	Community states		5		3
	Common law states		3		25
1910	Real wealth per capita	16,188	8	21,180	40
	Fertility10	1.35	8	1.25	40
	Community states		5		3
	Common law states		2		26
1920	Real wealth per capita	19,333	4	23,394	44
	Fertility10	1.33	4	1.24	44
	Community states		3		5
	Common law states		1		27

Notes: 356 Observations; fertility10 = # of children between 10 and 19 /# of women between 20 and 39. *Source* US Census

undertaken without including FERTILITY10. The purpose of this exercise, reported in Table 2, is to verify that the data replicates the main finding of Geddes and Lueck (2002) who argued that the reforms were a result of the greater inefficiency associated with increased wealth under the system of coverture. The coefficients reported in this table (as in Table 3) are the marginal effects of the independent variables, where the latter are evaluated at their mean values.

Table 2 Wealth and property rights

Probit; dependent variable = BOTH				
	(1)	(2)	(3)	(4)
WEALTHpc	0.264**	0.124*	0.124*	0.224**
	(2.71)	(2.06)	(1.99)	(3.68)
TERRITORY			−0.454**	−0.297+
			(2.03)	(1.70)
EQUITY				0.088
				(0.56)
COMMUNITY				−0.623**
				(4.24)
Year dummies	No	Yes	Yes	Yes
Obs.	356	356	356	356
Pseudo R^2	0.16	0.37	0.41	0.52

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust z statistics in parentheses account for clustering at state/territory level. *Notes*: marginal effects evaluated at the mean of the independent variables; WEALTHpc is wealth per capita divided by 10,000

Table 3 Property rights: probit analysis

Dependent variable = BOTH					
	(1)	(2)	(3)	(4)	(5)
FERTILITY10	−0.902**	−0.690**	−0.627**	−0.875**	−0.979**
	(6.43)	(3.62)	(3.00)	(3.98)	(4.41)
WEALTHpc			0.036	0.002	0.098
			(0.62)	(0.03)	(1.60)
TERRITORY				−0.531**	−0.481**
				(2.89)	(4.36)
EQUITY					−0.13
					(0.70)
COMMUNITY					−0.644**
					(4.76)
Year dummies	No	Yes	Yes	Yes	Yes
Obs.	356	356	356	356	356
Pseudo R^2	0.14	0.39	0.39	0.46	0.56

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust z statistics in parentheses account for clustering at state/territory level. *Notes*: FERTILITY10 is the number of children between 10 and 19 divided by the number of women between 20 and 39; see Table 2 additional notes

As shown in Probit analysis reported in Table 2, the marginal effect of per-capita wealth is always positive and significant. The first column includes only wealth as a control and the second column adds a year fixed-effect to the Probit estimation. The third column introduces a dummy variable for whether the state was still a territory that year since, as explained previously, many present-day states were organized into territories during some of the time under consideration and they may have characteristics that differ from independent states. The introduction of this variable, absent in Geddes and Lueck, doesn't change the magnitude and significance of wealth though it is associated with a delay in married women's rights.

The last column in Table 2 controls for important differences in legal systems across states, in particular for whether the state had a common law system either with or without an equity

court (the latter is the omitted variable) or a community property system. As discussed earlier, the equity court made it easier for wealthier women to contract around coverture whereas a community property system stipulated that spouses equally owned property acquired during marriage although only the husband had control of joint property and wealth. Thus, married women were, ceteris paribus, better off in these states which, according to the model, would decrease the pressure to give women fuller property rights. Indeed, as shown in the table, territories and states with a community property system were slower to adopt both reforms (they were 62 % less likely to do so than an equivalent state under common law). The effect of an equity court, on the other hand, is statistically insignificant. In the last specification, an increase in per-capita wealth of $6,000 (a bit over the SD of the variable net of the variation due to year fixed effects) is associated with approximately a 13 % increase in the probability that the reform is adopted (where all variables are evaluated at their mean).[50]

I next turn to the main analysis that incorporates all the variables of interest. Table 3 displays the results of the Probit estimation. As in Table 2, the first column shows the simple negative correlation that exists between FERTILITY10 and BOTH and the second column adds year fixed effects. The third column includes per-capita wealth. This variable, however, is no longer statistically significant at conventional levels. The fourth column adds a dummy variable for whether the state belonged to a territory at that time, and the fifth column controls for state differences in legal system. Belonging to a territory or possessing a community property system are negatively correlated with changing the property rights regime. A community property system, ceteris paribus, reduces the probability of a reform by 64 %; belonging to a territory decreases the probability of reform by 48 %. The effect of an equity court is now negative but still statistically insignificant. Throughout, the effect of FERTILITY10 is always negative and significant, as predicted by the theory. In the last specification, a decrease in FERTILITY10 by 0.12 children per women (this is a one-SD decrease in the variable where the variation is net of year fixed effects) is associated with a increase in the probability of women's property rights of around 12 %. This is larger than in the specification without controls for differences in legal systems, indicating that on average states with community and equity systems had lower FERTILITY10 levels.

Table 4 repeats the same set of exercises with OLS in order to facilitate comparison with the state fixed effects analysis that follows. The pattern of results is very similar. Fertility continues to be statistically significant and negatively associated with the probability of changing women's property rights regime as is the existence of a community property legal system or belonging to a territory. Wealth per capita is significant in one of the specifications but this result does not survive the introduction of state or regional fixed effects, as shown below. Column 6 checks whether there is a non-linear relationship between reform and per-capita wealth, but it does not appear to be present.

4.2.1 State fixed effects

A more challenging test of the theory is posed by introducing state fixed-effects in the regression analysis. To construct these, I use the configuration of states and territories that existed in September 1850 as shown in Fig. 7.[51] At this point in time, all but 16 states had their actual borders. If a current-day state was also a state in 1850, it is assigned its own

[50] Throughout, instead of using the raw standard deviation of the variable, I use the SD of the residuals from a regression of the pertinent variable (e.g. wealth) on the relevant fixed effects (e.g., on year dummies or on both year and state dummies). The magnitudes of these are reported in Table 10.

[51] See http://en.wikipedia.org/wiki/Territorial_evolution_of_the_United_States.

Table 4 Property rights: OLS

Dependent variable = BOTH						
	(1)	(2)	(3)	(4)	(5)	(6)
FERTILITY10	−0.769** (7.53)	−0.369** (3.28)	−0.323** (3.00)	−0.401** (3.65)	−0.378** (3.71)	−0.357** (3.10)
WEALTHpc			0.03 (0.86)	0.012 (0.36)	0.056+ (1.88)	0.121 (1.37)
WEALTHpc ^{2}						−0.012 (0.97)
TERRITORY				−0.391** (3.27)	−0.247** (4.15)	−0.246** (4.17)
EQUITY					−0.041 (0.52)	−0.044 (0.57)
COMMUNITY					−0.383** (4.87)	−0.379** (4.82)
CONSTANT	1.663** (11.07)	0.648** (3.30)	0.556** (2.82)	0.729** (3.65)	0.716** (3.49)	0.654* (2.72)
Year dummies	No	Yes	Yes	Yes	Yes	Yes
Obs.	356	356	356	356	356	356
Adjusted R^2	0.17	0.44	0.44	0.49	0.56	0.56

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust t statistics in parentheses account for clustering at state/territory level; see Tables 2 and 3 for additional notes

(state) fixed effect. If, on the other hand, it was part of a territory in 1850, I assign it a fixed effect based on the territory to which it belonged to then. Hence Washington, Oregon, and Idaho are assigned to Oregon territory; Utahand Nevada are assigned to Utah territory; New Mexico and Arizona are assigned to New Mexico territory; Montana, Wyoming, Colorado, Nebraska, Kansas, and Oklahoma are assigned to the same unorganized territory; and lastly North Dakota, South Dakota, and Minnesota are part of the Minnesota territory.[52] If a state belonged to two territories in 1850, I assign it to the territory that encompassed most of its land.

The OLS results are shown in the first five columns of Table 5.[53] Comparing these results with those reported in Table 4, the inclusion of state fixed effects leaves almost unchanged the negative effect of belonging to a territory as well as the insignificant and close to zero effect of per-capita wealth. It also decreases slightly the magnitude of the coefficient associated with FERTILITY10, though the variable remains economically and statistically significant. A one-SD decrease in FERTILITY10 is now associated with approximately a 6.5 % increase in the probability of property-law reform.[54] With state fixed effects, equity is absorbed whereas the community property system is identified only off the three states that switched once they became independent. Not surprisingly, the effect of community law is now statistically insignificant. Column 5 repeats the non-linear specification for wealth from Table 4. The coefficients on the other variables are basically unchanged and the effect of wealth is

[52] At this point in time, North and South Dakota are not distinct—they constitute Dakota.

[53] Using a Probit specification instead drops over 100 observations. The results go through as well with robust standard errors corrected for clustering at the state level.

[54] The SD of fertility net of the variation from year and state fixed effects is 0.21.

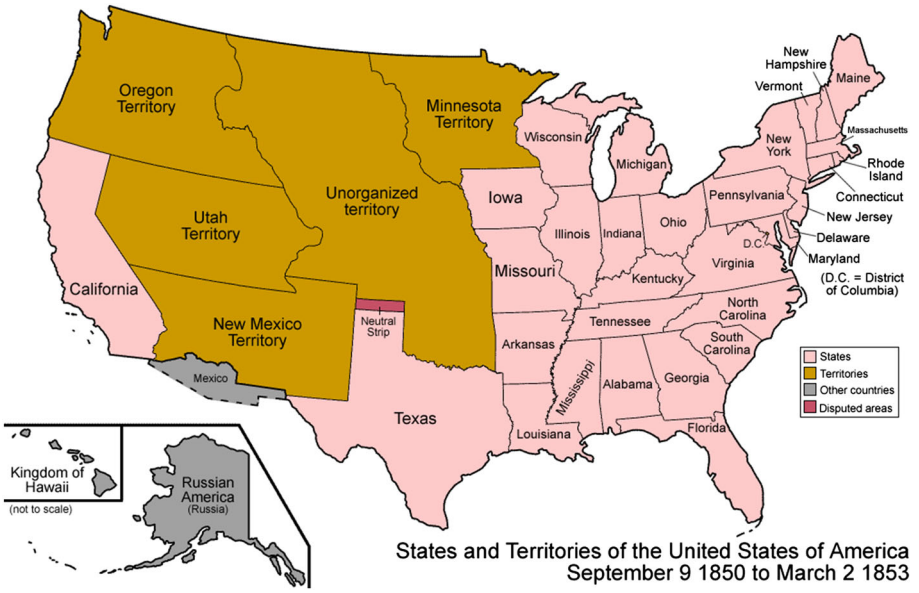

Fig. 7 US territory configuration, september 9 1850

insignificant. Thus it is fair to conclude that the positive relationship between wealth and reform found by Geddes and Lueck disappear once fertility is taken into account.[55]

One can also repeat the regression analysis using regional fixed effects instead of state fixed-effects. Columns 6–9 of Table 5 show the results, employing the nine regional dummies used by the US Census. The pattern of results is very similar to those with state fixed-effects but now the community variable regains its statistical significance. A one-SD decrease in FERTILITY10 is associated with approximately a 7 % increase in the probability of property-law reform. A community property law system is associated with a 40 % decrease in the probability of reform relative to a common law system.

4.3 Endogeneity

The analysis presented above shows that, as predicted by the theory, there is a robust negative correlation between women's property rights and both FERTILITY10 and community property law even after controlling for various covariates and including state fixed effects. This is an important finding as it indicates that theories that attempt to address the issue of women's economic rights should be capable of generating these partial correlations. We next turn to the issue of endogeneity.

First, it may be that the presence of a community property law (which reflects either Spanish or French influence) also signals a more favorable attitude in general towards women. To the extent that this is true, however, the results demonstrate that these attitudes do not accelerate the reform of women's property rights. Instead, as predicted by the model, they delay granting women the ability to manage and control their property and earnings.

[55] I have also experimented with using other measures that may proxy for wealth. For example, columns 4 and 5 in Table 8 control for the percentage of school-age children (excluding slaves) that attend school. As shown, neither schooling measure is statistically significant.

Table 5 Property rights: OLS with state or regional fixed effects

Dependent variable = BOTH									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FERTILITY10	−0.218+	−0.205*	−0.266*	−0.307*	−0.307*	−0.309*	−0.247+	−0.314+	−0.366**
	(2.00)	(2.07)	(2.37)	(2.32)	(2.32)	(2.07)	(1.80)	(1.95)	(3.02)
WEALTHpc		0.01 (0.28)	−0.024	−0.018	0.022		0.047	−0.001	0.009
			(1.03)	(0.68)	(0.32)		(1.24)	(0.02)	(0.29)
WEALTHpc ^{2}					−0.007				
					(0.71)				
TERRITORY			−0.260**	−0.266**	−0.258**			−0.314**	−0.284**
			(4.16)	(3.79)	(3.87)			(4.74)	(4.09)
EQUITY									−0.044
									(0.29)
COMMUNITY				−0.187	−0.188				−0.399**
				(1.29)	(1.31)				(5.35)
CONSTANT	0.403+	0.380+	0.505*	0.578*	0.572*	0.641**	0.523*	0.660*	0.770**
	(1.80)	(1.82)	(2.17)	(2.18)	(2.16)	(2.80)	(2.55)	(2.71)	(2.78)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Region dummies	No	No	No	No	No	Yes	Yes	Yes	Yes
Obs.	356	356	356	356	356	356	356	356	356
Adjusted R^2	0.64	0.64	0.65	0.65	0.65	0.51	0.51	0.53	0.57

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust z statistics in parentheses account for clustering at state/territory level; see Tables 2 and 3 for additional notes

Second, fertility is an endogenous variable. This raises the question as to whether FERTILITY10 is simply proxying for an omitted variable. To the extent that the main variable driving fertility is wealth, the analysis attempts to distinguish between it and FERTILITY10 by including them simultaneously in the regression analysis. To eliminate other concerns, however, requires an instrumental variable. It is hard to think of a candidate for an instrument that might not have a direct causal effect on women's rights (e.g., the degree of urbanization, the ratio of men to women, etc.). Rather than insist on an instrument, in this section I use child mortality as a proxy for FERTILITY10. Since it is a proxy rather than an instrument, causality cannot be inferred. Nonetheless, this exercise serves as an additional check and rules out some potential channels through which an omitted variable might be responsible for the results.

Child mortality is potentially a good proxy for FERTILITY10. To see why, we can start with the definition of survival-fertility below:

$$\frac{surviving\ children}{women} \equiv avg.\ fertility\ per\ woman \times (1 - child\ mortality\ rate) \tag{30}$$

Thus, survival-fertility is a function of the child mortality rate both directly and through any effect it may have on average fertility. If a family desires to have some ideal number of children, for example, a higher child mortality rate makes it costlier to achieve this ideal, leading to a lower number of surviving children. Risk aversion, on the other hand, could lead to higher fertility. Higher than expected child mortality shocks may also lead families to have a lower number of surviving children.[56] Thus, both expected and unexpected higher levels of child mortality may tend to be associated with a lower number of surviving children per woman (i.e., with FERTILITY10). In any case, this is an empirical issue. As will be shown below, for any given decade the correlation between the two variables is negative.

During this period in US history, both fertility and child mortality dropped rapidly. Using statistics reported for the US in Haines (2008), between 1850 and 1920 white infant mortality decreased by 62.1 % whereas the total fertility rate for White women decreased by 41.5 % (alternatively the white birth rate—births per 1,000 population per annum—decreased by 37.9 %).[57] As can be seen from Eq. (30), whether the number of surviving children per woman increases or decreases is determined by whether the percentage increase in the child survival rate (one minus the child mortality rate) is greater or smaller than the percentage decrease in fertility. For the numbers given above, the percentage change in children's survival rate is smaller (in absolute value) than the percentage change in children born, giving rise to the decreasing FERTILITY10 pattern that we saw in the data in Fig. 1.

Unfortunately it is very difficult to find numbers for infant/child mortality by state over most of this time period. I rely on estimates provided by Murphy et al. (2008) for child mortality prior to the age of ten.[58] The authors construct their estimates using official death registrations (which first become available in 1890 for some states and are reported in the

[56] On the other hand, if there is variance in the child mortality rate, risk aversion may lead to a positive correlation.

[57] The American experience is distinctive from most other Western countries in that its fertility decline started very early (in the late eighteenth or early nineteenth century) and it preceded the mortality decline. See Haines (2008).

[58] I wish to thank Robert Tamura for very kindly making this data available to me.

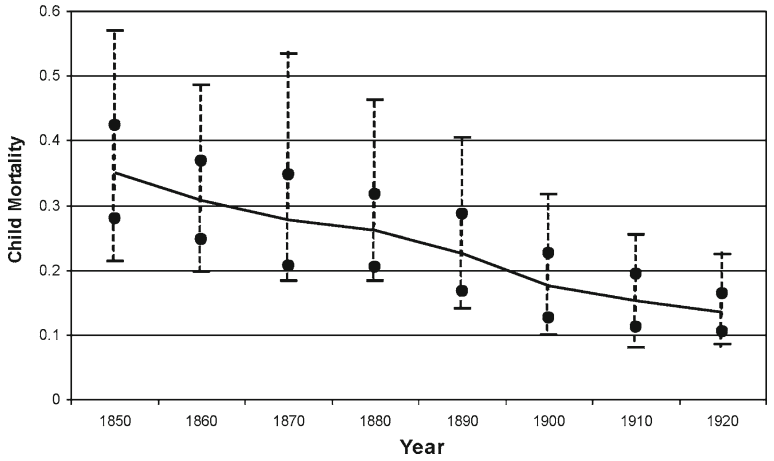

Fig. 8 Child mortality over time

Statistical Abstract of the United States) and the Census (which is less reliable since it is based on answers to survey questions rather than official data).[59]

Child mortality varies significantly by state/territory and by decade as can be seen in Fig. 8; it averaged 35 % across states in 1850 and decreased to a mean of 13 % in 1920. Over this time period the leading causes of children's death were gastrointestinal diseases (e.g., cholera infantum, enteritis, and diarrhea), respiratory diseases (e.g., pneumonia and bronchitis), and other infectious diseases (e.g. measles, scarlet fever, diphtheria, whooping cough, and smallpox).[60] Much of the decline in infant mortality came from improvements in overall hygiene, the water supply, the construction of sewers, and the quality and cleanliness of the milk supply.

The correlation between FERTILITY10 and child mortality is positive over this time period since both variables are decreasing over time. Once year dummies are introduced, however, the correlation between the variables is negative as can be seen by comparing columns 1 and 2 of Table 6. In particular, in every decade, the cross-state correlation between FERTILITY10 and child mortality is negative.

The factors responsible for the cross-state variation in the reduction of child mortality are not clear. It mostly seems to be driven by idiosyncratic differences in the diffusion of knowledge and best practice across municipalities. Preston and Haines (1991) book, *Fatal Years,* a fascinating study of child mortality in the nineteenth century US, cites the description given by the first professor of pediatrics at Harvard in 1891 about the state of knowledge of

[59] The authors use a fairly complicated procedure to produce their estimates. For each state/territory, they run a quadratic specification of the infant survival rate on time for the years 1890–2000 using the number of observations that exist in the official death registration data (this ranges from a maximum of 12 observations for Massachusetts to seven for Texas). This allows them to obtain extrapolated predictions for infant mortality for each state between 1850 and 1920. They then combine these predictions with the Census data on infant mortality between 1850 and 1920 for each state, and find the convex combination, for each census year, that when aggegated (with appropriate population weights) across states best matches the national infant mortality rate reported in the *Historical Statistics of the United States*. This procedure yields, for each state and year, their estimate of infant mortality. For measures of mortality to age ten, they apply the same weights obtained for infant mortality on the age-appropriate Census data and death registration extrapolations. See Murphy et al. (2008) for more details.

[60] See Preston and Haines (1991) for a thorough account.

childhood diseases: this consisted of "a poor subterfuge of unreal facts forming structures of misleading results which in the scientific medicine of adults would not for a second be tolerated."[61] For many people (including doctors), the high death rates of infants and young children seemed to be the result of a natural and inevitable vulnerability in this stage of life. Preston and Haines' analysis concludes that there was relatively little differentiation in child mortality levels according to father's occupation, so that (controlling for race) it is unlikely that state differences in the distribution of income played an important role. Large cities, on the other hand, had higher child mortality levels and thus a variable capturing urbanization will be included in the regression analysis as well as differences in per-capita wealth. State fixed effects will capture geographic differences and differences in racial composition. Nonetheless, as I am unable to rule out the existence of an omitted variable, the exercise must be treated as suggestive.[62]

The OLS regressions showing the relationship between the FERTILITY10 and child mortality inclusive of state and year fixed-effects are given in Table 6, columns 3–8. As shown, child mortality enters negative and statistically significant throughout as does per capita wealth and territorial status. In column 8, a decrease in child mortality by one SD is associated with an increase in FERTILITY10 of close to 0.1, which is almost 50 % of the SD in this variable.[63] A one-SD increase in per-capita wealth is associated with a decrease in FERTILITY10 of about 0.12. Belonging to a territory or having a community property law system relative to common law system also decreases FERTILITY10 by 0.15 and 0.24 children per women respectively. The variable CITY measures the percentage of the population in the state that lived in cities with more than 100,000 inhabitants. A one-SD increase in this variable is associated with a reduction in FERTILITY10 of 0.01. The relationship between child mortality and FERTILITY10 remains economically and statistically significant in all specifications.

The results from using the proxied value of FERTILITY10 (the equivalent of a second-stage regression in an IV analysis) are shown in columns 1–5 of Table 7. In all specifications, the effect of survival-fertility remains negative and statistically significant albeit at a lower level. In the most complete specification shown in column 5, a one-SD decrease in FERTILITY10 is associated with an increase in women's rights slightly over 36 %. The presence of a community legal system is associated with a decrease in the probability of reform of 53 %.

Although the inability to specify with certainty the source of exogenous variation prevents one from interpreting the results using child mortality in a causal fashion, we can nonetheless rule out several important alternative channels. One might speculate, for example, that states in which women had greater political influence might both reform their property rights system earlier and have better children mortality outcomes. Indeed, as shown in a very interesting paper by Miller (2009), states that granted women suffrage saw large increases in local public health spending and declines in child mortality. This would imply that states in which child mortality was lower, ceteris paribus, should also have earlier reform of their property rights regime. One finds the opposite relationship, however. Those states with higher child mortality, and hence with lower levels of FERTILITY10, see earlier reform. Thus, this cannot be the mechanism that is responsible for the results.

[61] Preston and Haines (1991), p. 12.

[62] What then is driving the variation in child mortality across states? From my reading of the literature, there appears to have been a great deal of idiosyncratic variation in the rate in which municipalities adopted sanitation reforms though it would be good to have systematic evidence for this.

[63] All quantitative statements using standard deviations are of SDs net of the variation due to state and year fixed effects.

Table 6 Child mortality as a proxy for FERTILITY10

Dependent variable = FERTILITY10								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CHILD MORT.	0.416	−1.557**	−1.108**	−1.144**	−1.353**	−1.253**	−1.253**	−1.109**
	(1.68)	(3.37)	(3.89)	(4.18)	(5.11)	(5.33)	(5.30)	(4.56)
WEALTHpc				−0.111**	−0.128**	−0.116**	−0.115+	−0.112**
				(7.15)	(7.86)	(4.83)	(1.76)	(4.65)
$WEALTHpc^2$							0.000	
							(0.01)	
TERRITORY					−0.163+	−0.161+	−0.161+	−0.153+
					(1.70)	(1.84)	(1.73)	(1.73)
COMMUNITY						−0.212+	−0.212+	−0.236+
						(1.72)	(1.71)	(1.95)
CITY								−0.004*
								(2.56)
CONSTANT	1.307**	2.224**	2.281**	2.280**	2.354**	2.316**	2.316**	2.247**
	(24.72)	(−14.06)	(19.75)	(20.43)	(20.62)	(21.83)	(20.85)	(23.12)
Year dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	356	356	356	356	356	356	356	356
Adjusted R^2	0.02	0.29	0.56	0.63	0.64	0.66	0.66	0.67

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust *t* statistics in parentheses account for clustering at state/territory level. *Notes*: CHILD. MORT. is the fraction of children who died prior to the age of ten; see Tables 2 and 3 for additional notes

Table 7 Property rights: uses proxied value of FERTILITY10

Dependent variable = BOTH					
	(1)	(2)	(3)	(4)	(5)
FERTILITY10	−2.008+	−1.955+	−1.474+	−1.645+	−1.737+
	(1.97)	(1.97)	(1.82)	(1.98)	(1.78)
WEALTHpc		−0.184+	−0.175+	−0.168	−0.175
		(1.75)	(1.70)	(1.52)	(1.42)
TERRITORY			−0.427*	−0.452*	−0.460*
			(2.51)	(2.61)	(2.40)
COMMUNITY				−0.491*	−0.530*
				(2.60)	(2.19)
CITY					−0.003
					(0.59)
CONSTANT	3.833+	3.710+	2.808+	3.124+	3.281+
	(1.98)	(1.97)	(1.83)	(1.98)	(1.79)
Year dummies	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes
Obs.	356	356	356	356	356

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust t statistics in parentheses account for clustering at state/territory level. *Notes*: FERTILITY10 is proxied by CHILD MORT. and other covariates as indicated in the appropriate column of Table 6; see Tables 2 and 3 for additional notes

Similarly, it may be that both women's rights and public health (or concern about children's welfare) are normal or luxury goods. This would lead wealthier states (measured presumably in ways not captured completely by the per-capita wealth variable) to have both lower levels of child mortality and a higher probability of reform. Once again, we find the opposite relationship: states with higher levels of child mortality, ceteris paribus, reform their property rights system sooner. Thus, this channel cannot be responsible for the results.

5 Alternative hypotheses and robustness

Below I discuss a few alternative hypothesis for the reform of married women's property rights, such as underinvestment in human capital, urbanization, and women's bargaining strength. I also examine the robustness of the results to different ways of dating the reform and to alternative measures of fertility.

5.1 Underinvestment in human capital

As discussed in the literature review, Doepke and Tertilt (2009) hypothesize that women were granted greater economic rights in order to increase children's human capital. In their model, random matching in the marriage market leads to underinvestment in children's human capital. They assume that women care more about children than men and hence, when allowed to influence household decisions, invest more in their children's human capital. An increase in the return to human capital will increase the incentive for men to grant women greater rights as this would allow the latter to have greater influence on household decisions.

A possible objection to their hypothesis is that, if the main reason to grant women greater economic rights is to ameliorate the problem of underinvestment in children's human capital, compulsory schooling would have been a less costly choice for men. To deal with this, they

Table 8 Schooling

Dependent variable = BOTH					
	(1) PROBIT	(2) OLS	(3) OLS	(4) OLS	(5) OLS
FERTILITY10	−0.942**	−0.306*	−0.320*	−0.305*	−0.284*
	(4.26)	(2.29)	(2.72)	(2.41)	(2.29)
COMPSCHOOL	0.138	0.061			
	(0.88)	(0.71)			
COMPSCHOOLYR			−0.007*		
			(2.53)		
FSCHOOL				−0.001	0.009
				(0.29)	(1.14)
MSCHOOL					−0.01
					(1.36)
WEALTHpc	0.081	−0.024	−0.004	−0.015	−0.019
	(1.38)	(0.90)	(0.13)	(0.54)	(0.69)
TERRITORY	−0.477**	−0.255**	−0.284**	−0.261**	−0.251**
	(4.07)	(3.70)	(4.57)	(3.51)	(3.27)
EQUITY	−0.151		−0.088		
	(0.85)		(0.59)		
COMMUNITY	−0.652**	−0.19	−0.400**	−0.187	−0.221
	(5.04)	(1.27)	(6.82)	(1.27)	(1.61)
CONSTANT		0.592*	13.053*	0.601*	0.603*
		(2.20)	(2.71)	(2.14)	(2.20)
Year dummies	Yes	Yes	Yes	Yes	Yes
State dummies	No	Yes	No	Yes	Yes
Region dummies	No	No	Yes	No	No
Obs.	356	356	356	355	355
PseudoR^2/Adj. R^2	0.56	0.65	0.58	0.65	0.65

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust t/z statistics in parentheses account for clustering at state/territory level. *Notes*: COMPSCHOOL and COMPSCHOOLYR are defined in the text; FSCHOOL is percentage of girls 5–19 years old that attend school (excluding slaves); MSCHOOL is percentage of boys 5–19 years old that attend school (excluding slaves); see Tables 2 and 3 for additional notes

develop an extension of their model in which parental time investment and time spent in school are complements in the production of children's human capital. In this extension, a higher return to human capital makes it more attractive to increase both inputs.

If the mechanism highlighted by Doepke and Tertilt were quantitatively significant, one would expect to find a positive correlation between the timing of property rights reform and the introduction of compulsory education which also happened around the same time period.[64] According to their theory, a state that reformed its property rights law earlier should also have an earlier compulsory schooling date and vice versa, reflecting the complementarity of the two inputs in the production of human capital. Indeed, the raw correlation between the two dates is 0.35.

To examine the impact of the compulsory schooling law, we create a dummy variable—COMPSCHOOL—that takes the value one if the state has enacted the law (by that decadal year) and zero otherwise.[65] The results obtained from including this variable in the regression

[64] Massachusetts passed the first compulsory school attendance laws in 1852, followed by New York in a year later.

[65] The data is from the Department of Education, National Center for Educational Statistics, Digest of Education Statistics, 2004. A table can be found at http://www.infoplease.com/us/states/compulsory-school-attendance-laws.html. The years coincide with those used by Goldin and Katz (2008).

analysis of the determinants of property rights reform are shown in Table 8. In the first column the specification is a Probit with year fixed-effects. The second column reports the coefficients of an OLS regression with both state/territory and year fixed-effects. Note that in both specifications the compulsory-schooling dummy is insignificant whereas fertility remains negative and significant. Lastly, the third column repeats the OLS analysis but this time with the exact year in which the state enacted the compulsory schooling law (COMPSCHOOLYR) and hence with regional rather than state/territory fixed-effects. The year of the schooling law is now significant in the regression but it enters with the opposite sign (negative) than the one predicted by Doepke and Tertilt's model, whereas FERTILITY10 remains negative and significant. As a last check, instead of using variation in the year the compulsory schooling law was enacted, one can include a measure of schooling by controlling for the percentage of school-age children (excluding slaves) between the ages of 5 and 19 that attend school. Column four includes only girls (FSCHOOL) and column five also controls for boys' schooling (MSCHOOL). The results are unaffected.

5.2 Urbanization

The degree of urbanization across states also varied significantly over this time period. Urbanization was associated with both greater wealth, lower FERTILITY10 and, at least for the first few decades of this time period, higher child mortality (see Table 11). Higher urbanization also tends to be associated with lower welfare levels for married women since these women were more likely to be isolated from extended families and widows were less likely to be able to support themselves.[66] We can include a proxy for urbanization, denoted CITY, that measures the percentage of the population in the state that lived in cities with more than 100,000 inhabitants. Including this variable in the regression analysis does not affect the main results as shown in column 1 of Table 9.

5.3 Women's bargaining strength

An alternative hypothesis is that women obtained rights as their bargaining position in society grew stronger. A factor that has been conjectured to affect women's bargaining power is their relative scarcity in society. In particular, states in which females were relatively scarcer might attempt to make themselves more attractive to women by altering the legal system, particularly as pertaining to married women's property rights. To examine this hypothesis one can include in the regression analysis a variable that measures the percentage of the population that is male. Column 2 in Table 9 shows that the introduction of this variable, denoted MALE and defined as the percentage of the white population between 20 and 59 that is male, does not affect the results and that the variable is statistically insignificant.

As an additional test of women's bargaining-power hypothesis, one can also examine the relationship between women's suffrage at the state level and the reform of married women's property rights. The extremely low correlation (.038) between these variables indicates that this factor is unlikely to have played a role.[67] As shown in column 3 of Table 9, including

[66] See Chused (1983).

[67] To calculate the correlation, the states that voted against women's suffrage and were forced to allow women to vote when the 19th amendment was passed in 1920 were assigned 1930. Similar results are obtained if they are assigned the year 1925. For the regression analysis, the states that voted against women's rights were assigned a zero in 1920. Note that in general property rights preceded voting rights: only five states allowed women to vote prior to the reform of property rights.

Table 9 Robustness

OLS: dependent variable = BOTH						
	(1)	(2)	(3)	(4)	(5)	(6)
FERTILITY10	−0.272+	−0.295*	−0.308*	−0.317*		
	(2.01)	(2.36)	(2.28)	(2.36)		
CITY	0.003					
	(1.39)					
MALE		0.004				
		(1.05)				
SUFFRAGE			−0.062			
			(0.66)			
CHILDBORN					−0.072*	
					(2.26)	
FERTNEW						−0.153+
						(1.83)
WEALTHpc	−0.017	−0.019	−0.016	−0.039	−0.004	−0.008
	(0.66)	(0.67)	(0.58)	(1.33)	(0.13)	(0.29)
TERRITORY	−0.266**	−0.270**	−0.267**	−0.390**	−0.213**	−0.238**
	(3.86)	(3.37)	(4.06)	(4.15)	(2.98)	(3.18)
COMMUNITY	−0.161	−0.217	−0.196	−0.128	−0.140	−0.169
	(1.08)	(1.68)	(1.54)	(0.73)	(1.08)	(1.12)
CONSTANT	0528+	0.32	0.573*	0.543+	1.049**	0.467+
	(2.00)	(0.76)	(2.12)	(1.93)	(7.76)	(1.73)
Timing	Standard	Standard	Standard	Closest date	Standard	Standard
Obs.	356	356	356	356	322	356
Adjusted R^2	0.66	0.65	0.65	0.65	0.63	0.65

+ Significant at 10 %; * significant at 5 %; ** significant at 1 %; robust t statistics in parentheses account for clustering at state/territory level. *Notes*: CHILDBORN is defined in the text; CITY is the percentage of the population in the state that lived in cities with more than 100,000 habitan MALE is the percentage of white adults that are male; FERTNEW is the # of children between 10 and 19 divided by the number of women between 30 and 49; see Tables 2 and 3 for additional notes. All specifications include state and year dummies

the dummy variable suffrage (that takes the value one if suffrage had been introduced by that decade) leaves the main results unchanged. The suffrage variable has a statistically insignificant coefficient of −0.06.

5.4 Timing of property rights reforms

Throughout the empirical analysis, the reform of property rights is said to have been observed in year t if it occurred after year $t-10$ but before year t, $t = 1850, \ldots, 1920$. An alternative is to assign to each decade all the events that occurred in a symmetric 10 years interval around it, e.g. 1860 is assigned all observations of married women's property rights that occur between 1855 and 1864. This alternative timing strategy yields very similar results. Column 4 of Table 9 shows the result for the full specification including time and state fixed effects. The quantitative effect of survival-fertility is slightly higher with this timing alternative.[68]

[68] In this specification, as in others with state fixed effects, the coefficient on community is not statistically significant. The same specification but with regional rather than state fixed effects restores significance. This is true for all the specifications that follow as well.

5.5 Alternative fertility variables

Although the theory calls for using surviving-fertility rather than average fertility as the explanatory variable, we can nonetheless construct measures of average fertility by using responses to the question of "children ever born" included in the Census as of 1900.[69] For each cohort and state one can create a measure of fertility by calculating the average number of children born to women belonging to a given age bracket in that state. I chose to do this, whenever possible, for women between the ages of 38 and 42. For example, the fertility of women born in between 1908 and 1912 (labeled the 1910 cohort) is calculated using the responses of women 38–42 years old in the 1950 census. The decadal analysis uses the cohort's fertility level once the cohort is 20 years old, e.g., the variables for 1880 include the fertility of the cohort born in 1860.

Unfortunately, the above strategy for calculating fertility is sometimes infeasible for a number of reasons. First, this question was not asked prior to 1900. This implies that, for cohorts born prior to 1860, one needs to use the cohort's fertility numbers given by older women in the 1900 census (e.g. the number for the 1850 cohort is calculated using women 48–52 in the 1900 census). Although the cohort's fertility would be the same whether measured in the (non-existent) earlier census or in the 1900 census, the drawback to using 1900 is that the sample is likely to be more affected by inter-state migration and by survival selection (especially for the oldest cohorts). An additional complication is that both the 1920 and 1930 censuses omitted this question, affecting the feasibility of this strategy for the 1880 and 1890 cohorts. I obtain their average fertility by using older women from these cohorts (58–62 and 48–52 years old, respectively) in the 1940 Census. Throughout I restrict the sample to white married women born in the US and only include a state at a point in time if there are at least ten individual observations with which to construct the fertility measure.[70] This variable is denoted CHILDBORN. Its correlation with FERTILITY10 is 0.58. In order not to rely on observations of women above the age of 70 in the fertility measure, I start the analysis in 1860 (i.e., with the fertility of the cohort born in 1840).

The results from using this alternative fertility measure are reported in column 5 of Table 9. As can be seen, the significance of this variable is lower than FERTILITY10—the appropriate variable according to the theory. A one-SD decrease in CHILDBORN is associated with a 9.1 % increase in the probability of reform.

One can also use a survival-fertility measure with alternative age ranges. Column 6 of Table 9 shows the result of using an alternative measure of survival-fertility, denoted FERTNEW, in which the age range of women is from 30 to 49 (rather than from 20 to 39). The results obtained are similar. A one-SD decrease in FERTNEW (net of variation from fixed effects) is now associated with a 7 % increase in the probability of reform.

6 Conclusion

This paper developed a dynamic model to analyze how capital accumulation, fertility, and different legal traditions affect male preferences towards married women obtaining property rights. The main intuition delivered by the model is that lower fertility (or sufficiently high wealth) alters men's benefits from patriarchy relative to a system in which women have

[69] Women were asked to report all live births.

[70] The omitted category is Black and thus the sample contains women from other races but these constitute around a half percent of the sample. Throughout I use person weights.

fuller property rights. At some critical level of fertility or household wealth, the disparity in the welfare levels of their daughters versus their sons under patriarchy is such that men are willing to sacrifice the consumption benefits they enjoy under this system vis a vis their wives in order to ensure that their sons-in-law are likewise forced to be more generous towards their daughters. These critical levels arrive sooner (at lower levels of wealth) in patriarchal regimes that are less beneficial to married women (e.g., those that follow English common law relative to community property law). Although these regimes allow men to reap greater consumption benefits (and thus, at low levels of wealth, incline men to favor patriarchy even more strongly), they also imply that the welfare differential between their daughters and sons is larger. This greater welfare difference increases the attractiveness of reform, causing reform to happen at a lower level of household wealth and hence sooner.

The implications of the model were studied empirically using variation across US states in the timing of reforms to married women's property rights. A robust negative correlation was demonstrated between fertility and reform. The presence of a community property legal system was also shown to lead to later reform than English common law. Although the theory implied a non-monotonic relationship between per capita wealth and reform, there was no robust empirical relationship between these variables. One speculation is that the non-monotonic relationship combined with heterogeneity in wealth requires a better understanding of the exact political-economy mechanism for aggregating preferences.

The model also hints at why women's welfare may not have increased in line with economic growth. In particular, some historians have speculated that women may have been better off when the economy was poorer than in the mid nineteenth century (both in the US and in England).[71] As shown in the theoretical analysis of male regime preferences and growth, when the economy has very low wealth, men do not have much to gain from patriarchy. It is only as capital accumulation takes off that male preferences strongly favor patriarchy. This is later reversed once the economy reaches a critical level of wealth.

Many interesting questions remain open for future research. In general, it would be of interest to study more deeply the coevolution of economic and political rights and economic development.[72] The relationship between the organization of families (e.g., who gives consent in marriage, the existence of polygyny, the ease of divorce, etc.), women's rights, and economic outcomes also deserves to be explored, particularly if one wants to understand why women's rights were first extended in the West rather than elsewhere.[73] It would also be of interest to see whether the results of this analysis can be replicated elsewhere, particularly in the context of contemporary developing countries. It may be possible to find natural variation in survival-fertility (e.g. in the ease of access to/cost of contraception) and variation in local laws that allow more in depth examination of some of the main predictions of the model. Exploring variation in the timing of political rights within countries (e.g., across Swiss cantons), with an appropriately modified model, may also shed light on the evolution of women's political rights.[74]

[71] See Shammas et al. (1987). In England, dower rights for women shrank over time before the reform of married women's property rights.

[72] See Lagerlof (2009) for an interesting recent attempt to study the endogenous evolution of property rights in land and people (slavery).

[73] See Edlund and Lagerlof (2006), Iyigun and Walsh (2007b) and Tertilt (2006) for interesting work in this area. See Coontz (2005) for a history of marriage.

[74] In this case, endogenously different political preferences of men and women may come into play (see, e.g., Edlund and Pande (2002)).

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Appendix

Proofs of Lemmas 1 and 2

To prove Lemmas 1 and 2, I guess the following functional forms for the value functions:

$$V_h^{NR}\left(k_h,\widetilde{k}_h\right)=a_h+b_h\log\left(k_h+\widetilde{k}_h-\frac{\underline{c}}{d}\right) \tag{31}$$

$$V_w^{NR}\left(k_w,\widetilde{k}_w\right)=a_w+b_w\log\left(k_w+\widetilde{k}_w-\frac{\underline{c}}{d}\right) \tag{32}$$

$$V_h^{ER}\left(k_h,\widetilde{k}_h\right)=\phi+\theta\log\left(k_h+\widetilde{k}_h\right) \tag{33}$$

$$V_w^{ER}\left(k_w,\widetilde{k}_w\right)=\phi+\theta\log\left(k_w+\widetilde{k}_w\right) \tag{34}$$

where $\{a_h,b_h,a_w,b_w,d,\phi,\theta\}$ is the set of parameters that will be solved for using the method of undetermined coefficients. Recall that $k=k_w+\widetilde{k}_w$ and that to solve for the efficient equilibrium we impose $\widetilde{k}'_h\equiv k'_w$ and $\widetilde{k}'_w\equiv k'_h$ before optimizing. Substituting (31) and (32) in the RHS of (3) and (4), and substituting (33) and (34) in the RHS of (16), one obtains

$$V_h^{NR}(k)=\underset{c_h,k'_h,k'_w}{Max}\left\{\log c_h+\frac{\beta}{2}\left[a_h+a_w+(b_h+b_w)\log\left(k'_h+k'_w-\frac{\underline{c}}{d}\right)\right]\right\} \tag{35}$$

$$\text{s.t.}\quad Ak=c_h+\underline{c}+nk'_h+nk'_w$$

$$V_w^{NR}(k)=\log\underline{c}+\frac{\beta}{2}\left[a_h+a_w+(b_h+b_w)\log\left(k'_h+k'_w-\frac{\underline{c}}{d}\right)\right] \tag{36}$$

$$V_h^{ER}(k)+V_w^{ER}(k)=\underset{c_h,c_w,k'_h,k'_w}{Max}\left\{\log c_h+\log c_w+2\beta\left[\phi+\theta\log\left(k'_h+k'_w\right)\right]\right\}$$

$$\text{s.t.}\quad Ak=c_h+c_w+nk'_h+nk'_w \tag{37}$$

Taking the first-order conditions with respect to c_h, c_w, k'_h and k'_w, yields the following optimal policies.

$$c_h^{NR}=\frac{Ak-\underline{c}-\frac{n\underline{c}}{d}}{1+\frac{\beta}{2}(b_h+b_w)}$$

$$k'_{NR}=\frac{1}{n}\frac{\frac{\beta}{2}\left(Ak-\underline{c}\right)(b_h+b_w)+\frac{n\underline{c}}{d}}{1+\frac{\beta}{2}(b_h+b_w)}$$

$$c_w^{ER}=c_h^{ER}=\frac{1}{2}\frac{Ak}{1+\beta\theta}$$

$$k'_{ER}=\frac{1}{n}\frac{\beta\theta Ak}{1+\beta\theta}$$

We are now set to use the method of undetermined coefficients for the NR regime by substituting the optimal policies and the value functions in the RHS of (35) and (36), obtaining:

$$a_h + b_h \log\left(k - \frac{\underline{c}}{d}\right) = \log \frac{Ak - \underline{c} - \frac{n\underline{c}}{d}}{1 + \frac{\beta}{2}(b_h + b_w)} + \frac{\beta}{2}\left[a_h + a_w + (b_h + b_w)\log\left(\frac{1}{n}\frac{\frac{\beta}{2}\left(Ak - \underline{c}\right)(b_h + b_w) + \frac{n\underline{c}}{d}}{1 + \frac{\beta}{2}(b_h + b_w)} - \frac{\underline{c}}{d}\right)\right] \tag{38}$$

$$a_w + b_w \log\left(k - \frac{\underline{c}}{d}\right) = \log \underline{c} + \frac{\beta}{2}\left[a_h + a_w + (b_h + b_w)\log\left(\frac{1}{n}\frac{\frac{\beta}{2}\left(Ak - \underline{c}\right)(b_h + b_w) + \frac{n\underline{c}}{d}}{1 + \frac{\beta}{2}(b_h + b_w)} - \frac{\underline{c}}{d}\right)\right] \tag{39}$$

Following the same procedure for the ER regime yields:

$$2\left[\phi + \theta \log k\right] = 2\log\frac{1}{2}\frac{Ak}{1 + \beta\theta} + 2\beta\left[\phi + \theta \log\left(\frac{1}{n}\frac{\beta\theta Ak}{1 + \beta\theta}\right)\right] \tag{40}$$

After some lengthy algebra, we obtain:

$$\begin{aligned}
a_h &= \frac{\left(1 - \frac{\beta}{2}\right)\log\frac{A(1-\beta)}{\left(1-\frac{\beta}{2}\right)} + \frac{\beta}{2}\log\underline{c} + \frac{\beta/2}{(1-\beta)}\log\left(\frac{A}{n}\frac{\beta/2}{\left(1-\frac{\beta}{2}\right)}\right)}{(1-\beta)} \\
b_h &= \frac{1 - \beta/2}{1 - \beta} \\
a_w &= \frac{\frac{\beta}{2}\log\frac{A(1-\beta)}{\left(1-\frac{\beta}{2}\right)} + \left(1 - \frac{\beta}{2}\right)\log\underline{c} + \frac{\beta/2}{(1-\beta)}\log\left(\frac{A}{n}\frac{\beta/2}{\left(1-\frac{\beta}{2}\right)}\right)}{(1-\beta)} \\
b_w &= \frac{\beta/2}{1 - \beta} \\
d &= A - n \\
\phi &= \frac{\log(1-\beta)\frac{A}{2} + \frac{\beta}{(1-\beta)}\log\beta\frac{A}{n}}{(1-\beta)} \\
\theta &= \frac{1}{1 - \beta}
\end{aligned}$$

Descriptive statistics and correlations

see Tables 10 and 11

Table 10 Descriptive statistics

	OBS	Mean	ST. DEV	ST. DEV 1	ST. DEV 2	Min	Max
BOTH	356	0.58	0.49			0	1
FERTILITY10	356	1.40	0.27	0.12	0.21	0.70	2.86
WEALTHpc	356	1.37	0.96	0.60	0.77	0.12	8.22
TERRITORY	356	0.10	0.29			0	1
COMMUNITY	356	0.16	0.37			0	1
EQUITY	356	0.27	0.44			0	1
CHILD MORT.	356	0.23	0.09	0.07	0.09	0.08	0.57
FSCHOOL	355	56.60	16.20			0.90	93.60
MSCHOOL	355	57.81	16.00			3.20	90.90
CITY	356	8.45	13.49	4.49	1.26	0.00	65.55
MALE	356	54.51	7.49	1.10	5.66	44.59	95.93
CHILDBORN	322	3.60	1.42	1.07	1.26	1.25	9.40
FERTNEW	356	2.01	0.51	0.29	0.43	1.00	5.14

See text for variable definitions. *Notes*: ST. DEV 1 is SD net of variation due to year fixed effects. ST. DEV 2 is SD net of variation due to year and state fixed effects

Table 11 Correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	BOTH	1											
(2)	FERTILITY10	−0.42	1										
(3)	WEALTHpc	0.45	−0.59	1									
(4)	TERRITORY	−0.29	−0.04	−0.14	1								
(5)	COMMUNITY	−0.27	−0.06	0.17	0.30	1							
(6)	EQUITY	0.10	−0.34	−0.03	−0.20	−0.27	1						
(7)	CHILD MORT.	−0.46	0.14	−0.50	0.13	0.03	0.36	1					
(8)	FSCHOOL	0.44	−0.40	0.45	−0.28	−0.20	0.20	−0.39	1				
(9)	MSCHOOL	0.37	−0.32	0.35	−0.27	−0.25	0.23	−0.28	0.98	1			
(10)	CITY	0.34	−0.44	0.33	−0.20	−0.03	0.25	−0.07	0.18	0.17	1		
(11)	MALE	−0.12	−0.28	0.26	0.46	0.41	−0.34	−0.11	0.00	−0.06	−0.22	1	
(12)	CHILDBORN	−0.53	0.58	−0.61	0.29	0.04	−0.29	0.47	−0.59	−0.49	−0.40	0.08	1

See text for variable definitions

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