CHAPTER 23

Families in Macroeconomics

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Abstract

Much of macroeconomics is concerned with the allocation of physical capital, human capital, and labor over time and across people. The decisions on savings, education, and labor supply that generate these variables are made within families. Yet the family (and decision making in families) is typically ignored in macroeconomic models. In this chapter, we argue that family economics should be an integral part of macroeconomics and that accounting for the family leads to new answers to classic macro questions. Our discussion is organized around three themes. We start by focusing on short- and medium-run fluctuations and argue that changes in family structure in recent decades have important repercussions for the determination of aggregate labor supply and savings. Next, we turn to economic growth and describe how accounting for families is central for understanding differences between rich and poor countries and for the determinants of long-run development. We conclude with an analysis of the role of the family as a driver of political and institutional change.

Keywords

Family economics, Macroeconomics, Business cycles, Growth, Households, Fertility, Labor supply, Human capital, Gender

JEL Classification Codes

E20, E30, J10, J20, O40

1. INTRODUCTION

First impressions suggest that family economics and macroeconomics should be the two fields within economics at the greatest distance from each other: one looks at interactions between at most a handful of members of the same family, whereas the other considers the aggregated behavior of the millions of actors in an economy as a whole. Despite this contrast between the small and the large, we argue in this chapter that family economics and macroeconomics are in fact intimately related, and that much can be learned from making the role of the family in the macroeconomy more explicit.[a]

There are two different ways in which family economics and macroeconomics intersect. One side of the coin is to focus on questions that originate in family economics, but

[a] The basic point that family economics matters for macroeconomics was made by Becker in his AEA Presidential Address (Becker, 1988). At the time, Becker placed a challenge that inspired a sizeable amount of follow-up research. However, much of the early work at the intersection family economics and macroeconomics was focused on economic growth, whereas we argue in this chapter that family economics is equally relevant for other parts of macroeconomics.

use the methodology of dynamic macroeconomics to answer the questions. For example, macroeconomic models can be adapted to answer questions about how fertility rates, marriage rates, divorce rates, or the assortativeness of mating are determined and how they evolve over time. There is an active and exciting literature that takes this approach, but it is not the focus of this chapter.[b] Rather, our interest here is in the reverse possibility, namely that incorporating family economics into macroeconomics leads to new answers for classic macroeconomic questions. These questions concern, for example, the determination of the level and volatility of employment, the factors shaping the national savings rate, the sources of macroeconomic inequality, and the origins of economic growth.

We choose this path because, so far, it has been less traveled, yet we believe that it holds great promise. This belief is founded on the observation that many of the key decision margins in macroeconomic models, such as labor supply, consumption and saving, human capital investments, and fertility decisions, are made in large part within the family. The details of families then matter for how decisions are made; for example, the organization of families (eg, prevalence of nuclear vs extended families or monogamous vs polygynous marriage) changes the incentives to supply labor, affects motives for saving and acquiring education, and determines possibilities for risk sharing. Yet typical macroeconomic models ignore the family and instead build on representative agent modeling that abstracts from the presence of multiple family members, who may have conflicting interests, who might make separate decisions, and who may split up and form new households.

One might argue that subsuming all family details into one representative household decision maker constitutes a useful abstraction. This would perhaps be the case if the structure and behavior of families were a given constant. However, the structure of the family has changed dramatically over time and is likely to continue to do so in the future. Large changes have occurred in the size and composition of households. Fertility rates have declined, divorce risk has increased (and then decreased), the fraction of single households has grown steadily, and women have entered the labor force in large numbers. Given these trends, the nature of family interactions has changed dramatically over time, and so have the implications of family economics for macroeconomics.

There is a small, but growing, literature that opens the family black box within macro models. The goal of this chapter is to survey this literature, to summarize the main results, and to point to open questions and fruitful avenues for future research. We also aim to introduce macroeconomists to the tools of family economics.

There are multiple ways in which families can be incorporated into macroeconomics. The first generation of macroeconomists who took the family more seriously added home production to business cycle models (eg, Benhabib et al., 1991; Greenwood and Hercowitz, 1991). The insight was that home production cannot be ignored if

[b] See Greenwood et al. (2016b) for an excellent recent survey of that kind of family economics.

the cyclicality of investment and labor supply is to be understood. A large part of investment happens within the household in the form of consumer durables, a large part of time is spent on home production, and both vary over the cycle. The interaction of market time and business investment with these variables that are decided within the family is therefore important for understanding business cycles. In the home production literature, the family is a place of production, but decision making is still modeled in the then-standard way using a representative household with a single utility function.

In this chapter, we take the notion of families a step further. We emphasize that families consist of multiple members and that the interaction between these multiple members is important. We look at both horizontal interactions in the family, ie, between husband and wife, and vertical interactions, ie, between parents and children. Family members may have different interests, resources, and abilities. How potential conflicts of interests within the family are resolved has repercussions for what families do, including macrorelevant decisions on variables such as savings, education, fertility, and labor supply.

This chapter has three parts. We first consider how the family matters for short- and medium-run fluctuations. Second, we turn to economic growth. Third, we consider the role of families for understanding political and institutional change.

Our discussion of short- and medium-run fluctuations uses the US economy as an example to demonstrate how changes in family structure feed back into macroeconomics. We start by documenting how US families have changed in recent decades, including a decline in fertility rates, a large increase in the labor force participation especially of married women, and changes to marriage and divorce. We then analyze how these changes affect the evolution of aggregate labor supply over the business cycle and the determination of the savings rate. With regard to labor supply, we emphasize that couples can provide each other with insurance for labor market risk. For example, a worker may decide to increase labor supply if the worker's spouse becomes unemployed, and couples may make career and occupation choices that minimize the overall labor market risk for the family. The extent to which such insurance channels operate depends on family structure (eg, the fraction of single and married households and divorce rates) and on the relative education levels and labor force participation rates of women and men. We argue that recent changes to family structure have likely changed the volatility of aggregate labor supply and contributed to the "Great Moderation" in economic fluctuations observed between the 1980s and the Great Recession. We also discuss research that suggests that changes in female labor force participation are the main reason behind the recent phenomenon of jobless recoveries. Regarding savings rates, we emphasize how changes to divorce risk affect couples' incentives to save. We conclude this part of the chapter by discussing alternative models of the family and their use within macroeconomics. We argue that there is a need for more detailed dynamic modeling of family decision making, an area where methods widely used in macroeconomics may be fruitfully applied to family economics.

The second part of the chapter focuses on the long run, ie, economic growth. Here education, human capital accumulation, and fertility are the key choices of interest. We start by documenting sharp correlations between measures of family structure and measures of economic development in cross-country data. In a series of simple growth models, we then show how different family dimensions affect the growth rate. The first dimension is the interaction between parents and children, noting that, typically, parents make education decisions for their children. We then add fertility choice and discuss government-imposed fertility restrictions such as the one-child policy in China. Next we move from one-gender to two-gender models by first adding a second person in decision making and then adding a distinction between the two in technology. We use the framework to discuss the implications of the widely observed son preference for economic growth. We conclude the section with a discussion on the importance of nonwestern family structures (such as polygyny) and endogenous marriage.

The third part examines the role of the family in the context of political economy. We argue that the family is an important driver of political and institutional change in the course of development. Throughout the development process, all of today's rich countries (except a few countries whose wealth is built on oil) went through a similar series of reforms. Democracy was introduced, public education was initiated, child labor laws were implemented, the legal position of women was improved, and welfare and social security systems were established. Two important questions are why these reforms were implemented at a particular stage of development, and why many poorer countries failed to introduce similar reforms. We emphasize that most of these reforms concern the nature of the family. Public schooling moved the responsibility of education from the family to the public sphere, and public pension did the same for old age support. Child labor laws put constraints on the power parents have over their children. The introduction of women's rights changed the nature of the interaction between husband and wife. We discuss mechanisms linking the family and political change and the possibility of a two-way feedback between economic development and political reform. We then focus on the political economy of two specific reforms, namely the expansion of women's economic rights and the introduction of child labor laws.[c]

Throughout this chapter, we point out promising directions for future research. In line with the overall theme of the chapter, most of these research directions concern using family economics to generate new answers for questions that originate from macroeconomics. However, we also see a lot of potential for intellectual arbitrage in the opposite direction, namely using tools that are widely used in macroeconomics to build improved models of the family. In particular, a striking difference between the fields is that almost all macroeconomic models are dynamic, whereas in family economics static modeling is still

[c] The political economy of women's rights is addressed in more detail by Doepke et al. (2012).

common. In reality, dynamic considerations should be just as important in family economics as in macroeconomics. For example, if a woman decides to stay at home with her children, she will usually be aware that her absence from the labor market decreases her outside option. Similarly, when a woman and a man decide on whether to have a child, how the child will affect their future interactions will be an important consideration. There is a small literature that documents the importance of dynamics for the family. In particular, Mazzocco (2008) shows empirically that Euler equations hold at the individual but not the household level, and Mazzocco (2007) and Lise and Yamada (2015) provide evidence suggesting that bargaining power within the household evolves over time. To capture such phenomena and to better understand the link between family decisions and aggregate outcomes, more dynamic family bargaining models are needed. Tools that are widely used in macroeconomics, such as dynamic contracting under limited commitment and private information constraints, should prove useful for building such models.

In the following section, we start our analysis by considering the implications of the family for macroeconomic outcomes in the short and the medium run. In Section 3, we investigate the role of the family for economic growth, and Section 4 puts the spotlight on the family as a driver of political change. Section 5 concludes by discussing yet other dimensions in which the family matters for macroeconomics and by providing thoughts on promising directions for future research. Proofs for propositions are contained in the Appendices.

2. THE FAMILY AND THE MACROECONOMY IN THE SHORT AND MEDIUM RUN

Ever since micro-founded modeling became dominant in the 1970s and the 1980s, explicit models of household decision making have been a standard ingredient in macroeconomic models. Depending on the application, the household may face a variety of decisions, such as choosing labor supply, accumulating assets, or investing in human capital. However, within macroeconomics comparatively few attempts have been made to explicitly model families. By modeling families, we mean to account for the fact that households may contain multiple members, who may have different interests, who may make separate decisions, and who may split up in divorce or join others and form new households.

In the following sections, we argue that modeling families can make a big difference in understanding aggregate household behavior in the short and the medium run. We focus on the most basic role of the household sector in macroeconomic models, namely to provide a theory of labor supply and savings.

2.1 The Point of Departure: Representative Households

Traditional macroeconomic models used for business cycle and monetary analysis are populated by an infinitely lived, representative household, who derives utility from consumption and leisure and derives income from supplying labor and accumulating savings. A prototype household problem looks like this (eg, Cooley and Prescott, 1995):

$$\max_{\{c_t, l_t\}} E\left\{\sum_{t=0}^{\infty} \beta^t U(c_t, l_t)\right\} \tag{1}$$

subject to:

$$\begin{aligned} c_t + a_{t+1} &= w_t l_t + (1 + r_t) a_t, \\ a_{t+1} &\geq -B, \\ a_0 &= 0, \\ 0 \leq l_t &\leq T. \end{aligned}$$

Here c_t is consumption, l_t is labor supply, w_t and r_t are the wage and the interest rate (taken as given by the household), β is a discount factor that satisfies $0 < \beta < 1$, and $B > 0$ defines a slack borrowing constraint that rules out running a Ponzi scheme. The first-order conditions for the household's maximization problem are:

$$-\frac{U_l(c_t, l_t)}{U_c(c_t, l_t)} = w_t, \tag{2}$$

$$U_c(c_t, l_t) = \beta E\{(1 + r_{t+1}) U_c(c_{t+1}, l_{t+1})\}. \tag{3}$$

Here (2) is the requirement that the marginal rate of substitution between labor and leisure is equal to the wage, and (3) is the intertemporal Euler equation for consumption. Condition (2) pins down average labor supply and the elasticity of labor supply as a function of the relative wage and overall wealth, and (3) determines savings as a function of wealth, interest rates, and expectations over future leisure and consumption.

A representative household based on a problem similar to (1) underlies most of the macroeconomic modeling in the real business cycle literature, the monetary DSGE literature, and many other subfields of macroeconomics. A theory of labor supply and savings that is build on a representative household has a number of limitations, including the obvious one that such a theory has nothing to say about questions that involve heterogeneity and inequality across households. Of course, there is nothing wrong with simplifying assumptions in principle; after all, models are intended to be simplified representations of reality. The limitations of the representative household become a bigger concern, however, when some of the driving forces the model abstracts from are subject to changes over time that substantially alter macroeconomic behavior.

There is already a sizeable literature that extends the representative-household framework in other key dimensions, in particular by accounting for heterogeneity in age (ie, allowing for the life cycle) and heterogeneity in wealth and income.[d] This literature has characterized some of the macroeconomic changes brought about by the changing economic environment in recent decades, such as the large rise in income inequality and returns to education since the 1970s, and the population aging in industrial societies that resulted from rising life expectancy and low fertility. There is much less work on the dimension that this chapter focuses on, namely allowing for the fact that many households have multiple members, ie, accounting for families.

In the following sections, we argue that accounting for families is just as important as the existing extensions of the representative-agent framework. The main reason for this is that families have changed substantially in recent decades; for example, there have been large changes to rates of marriage and divorce, to female labor force participation, and to fertility rates. We start by outlining the main facts of changing families in the United States (to the extent that they are relevant from a macroeconomic perspective), and we then outline channels for how these changes are relevant for determining aggregate labor supply and savings. We note that while there is a lot of existing work documenting and explaining the family trends, there are few papers that focus specifically on the implications of these changes for macroeconomics. In our view, this presents a high-return area for future research, with a lot of low-hanging fruit.

2.2 The Facts: Changing Families in the United States

Throughout the 20th century, the major industrialized countries underwent large changes in the composition and behavior of families. We illustrate this transformation with statistics from the US economy as an example. In the following sections, we explain the relevance of these trends for macroeconomics.

The first transformation concerns changes in fertility over time. Fig. 1 displays the number of children ever born to US women by birth cohort (ie, the horizontal axis is the year in which a mother is born; the corresponding births mostly take place 20–40 years later). As in all industrialized countries, the main trend associated with long-run development is declining fertility. In the case of the United States, fertility fell almost threefold from the cohorts born in the mid-19th century to those born in the late 20th century. The trend was not uniform, however. In the middle of the 20th century there was a phase of rising fertility: the US baby boom. In the course of the baby boom, fertility rose from about two to about three children per woman, and then sharply reversed course to fall back toward two again. These changes have led to large variations

[d] Much of this literature is surveyed by Heathcote et al. (2009) and in the chapter "Macroeconomics and household heterogeneity" by Krueger, Mitman, and Perri (in this volume).

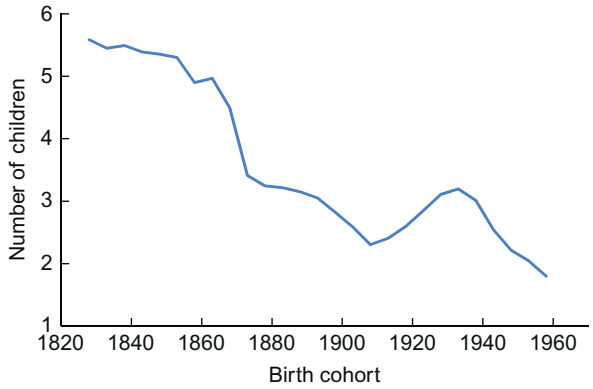

Fig. 1 Children ever born by cohort, United States (ie, average number of children for women born in a given year). *Jones, L.E., Tertilt, M., 2008. An economic history of the relationship between occupation and fertility—U.S. 1826–1960. In: Rupert, P. (Ed.), Frontiers of Family Economics, vol. 1. Emerald Group Publishing Limited, Bingley, UK (Table 1A).*

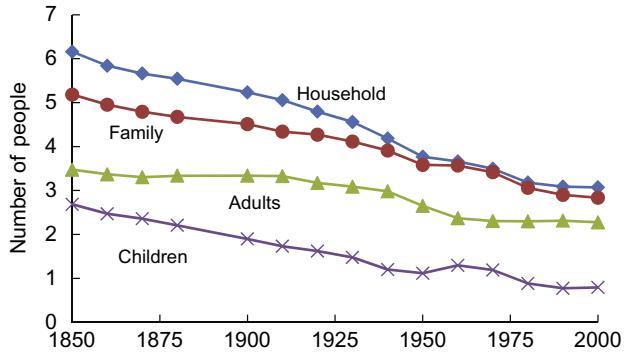

Fig. 2 Household size over time, United States. *Salcedo, A., Schoellmann, T., Tertilt, M., 2012. Families as roommates: changes in US household size from 1850 to 2000. Quant. Econ. 3 (1), 133–175 (Figure 1).*

in cohort sizes, which will affect the macroeconomy for decades to come now that the baby boom cohorts (ie, the babies, not the mothers) are reaching retirement age.

Fig. 2 displays a closely related change: a secular decline in the average size of households. Fertility decline is a main driver of this change; ie, the decline in fertility resulted in fewer children per household and thus a lower household size. However, there are additional factors because the number of adults per household also declined over time. This is in part due to fewer adults within families; ie, a smaller fraction of families include multiple generations of adults, and more families are headed by a single adult. In addition, fewer households include adults who are not related to each other.

Fig. 3 shows that there is not just a decline in the size of households but also a dramatic change in the composition of household types. As recently as 1950, most households

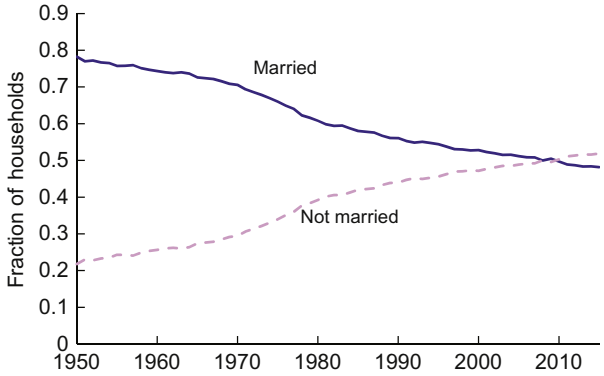

Fig. 3 Proportion of households including a married couple vs all other households over time, United States. *US Census Bureau, Historical Time Series, Current Population Survey, March and Annual Social and Economic Supplements, 2015 and earlier.*

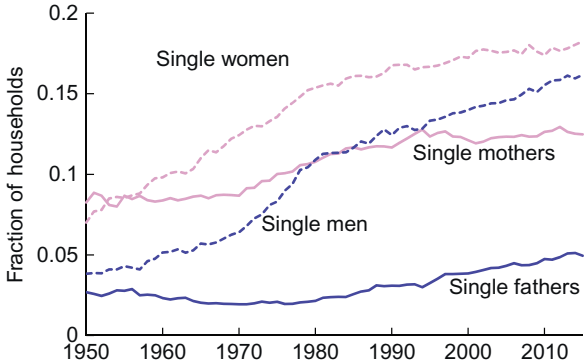

Fig. 4 Nonmarried households by type over time, United States. *US Census Bureau, Historical Time Series, Current Population Survey, March and Annual Social and Economic Supplements, 2015 and earlier.*

(about 80%) included at least one married couple. Now, married-couple households are no longer the majority. Fig. 4 breaks down the nonmarried households into further subcategories, with increases in every subcategory. The figures for single women and single men rise most, indicating primarily lower marriage rates, a higher age at first marriage, and a higher divorce rate. Single mother and single father households have also increased since the 1970s. Fig. 5 looks specifically at the role of marriage and divorce. The figure shows that the decline in the fraction of married women is due in almost equal parts to a rise in the number of never married women and a rise in the number of divorced women. Fig. 6 shows the divorce rate (defined as the number of divorces per 1000 women). Apart from the spike after World War II, the divorce rate was roughly constant from 1940 until the late 1960s and then increased sharply over the course of a decade. It has been relatively constant since the early 1980s, albeit at a much higher level.

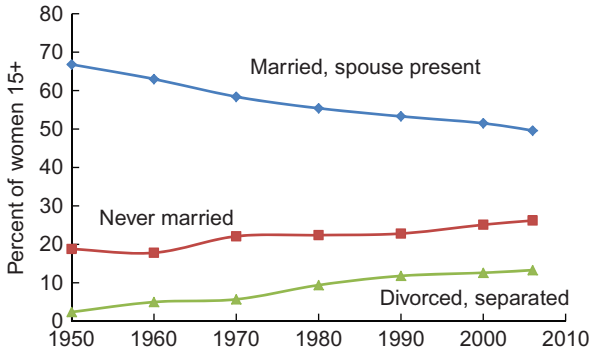

Fig. 5 Breakdown of marital status of women age 15+ over time, United States. *US Census Bureau, Families and Living Arrangements, Current Population Reports.*

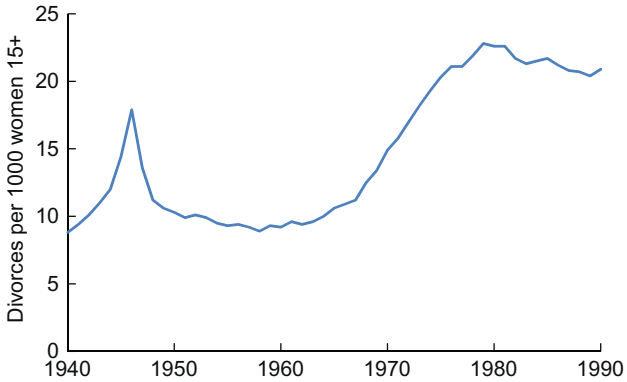

Fig. 6 Divorce rate over time, United States. *US Vital Statistics; Clarke, S.C., 1995. Advance report of final marriage statistics, 1989 and 1990. Monthly Vital Stat. Rep. 43 (12), 3–5.*

Another key trend linking family economics and macroeconomics is the rise in female labor force participation in the postwar era. From the beginning of the 20th century until the 1950s, for married households the single male breadwinner model was the norm. Since then, female labor force participation has risen steadily over a number of decades. As Fig. 7 shows, overall female participation rose from about 30% to more than 60% of the adult population between 1950 and 1990. In the late 1990s, female participation flattened out and declined a little in the current century. Female participation still falls short of male participation, but by a small margin compared to the 1950s. As we will see later (Fig. 13), the rise in female participation is predominantly due to married women. There is also a compositional effect due to the increase in the share of single women coupled with the fact that single women are more likely to work than married women are.

A trend closely related to the rise in female labor market participation is a decline in time spent on home production by women. Figs. 8 and 9 display the average hours men

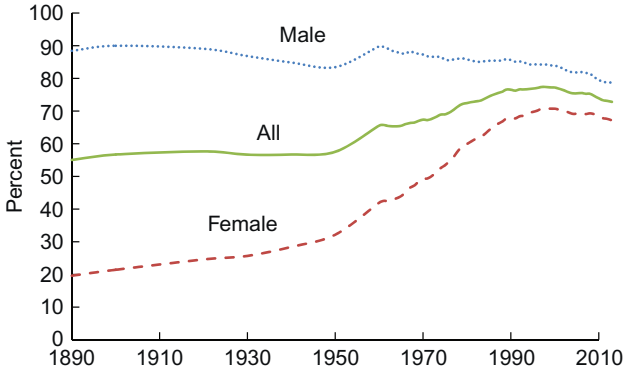

Fig. 7 Labor force participation by gender over time, all persons 16–64 years old, United States. *OECD LFS Sex and Age Indicators and US Department of Commerce, Bureau of the Census, "Historical Statistics of the United States: Colonial Times to 1970," Bicentennial Edition, Part 1, 1975, Tables A119–134 and D29–41.*

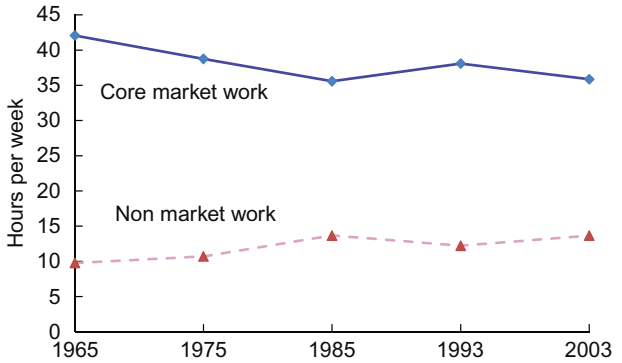

Fig. 8 Men's weekly market vs nonmarket (ie, home) work hours over time, United States. *Aguiar, M., Hurst, E., 2007. Measuring trends in leisure: the allocation of time over five decades. Q. J. Econ. 122 (3), 969–1006 (Table II).*

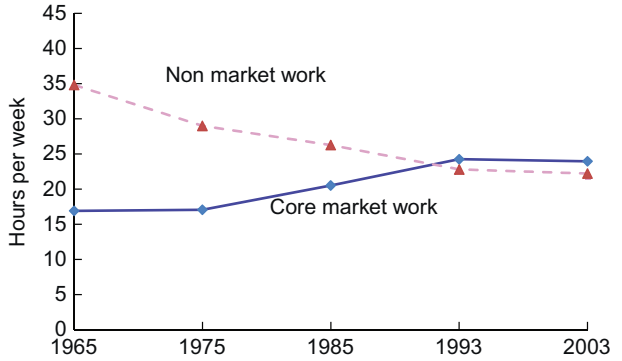

Fig. 9 Women's weekly market vs nonmarket (ie, home) work hours over time, United States. *Aguiar, M., Hurst, E., 2007. Measuring trends in leisure: the allocation of time over five decades. Q. J. Econ. 122 (3), 969–1006 (Table II).*

and women spent per week on market work vs nonmarket work, ie, home production (activities such as child care, cleaning, and preparing food). For men, there is a small decline in market work and an equally small corresponding rise in nonmarket work. For women, in contrast, since 1965 there has been a major transformation in time use: time spent on nonmarket work has dropped sharply while market work has risen, and now exceeds nonmarket time use.

Another closely related fact is the change in relative wages of men and women. Over the course of the 20th century, women have been catching up dramatically in terms of pay. Fig. 10 displays women's median earnings relative to men's earnings. In both cases only full-time, year-round workers are considered. As the figure shows, at the beginning of the 20th century, women earned less than half of what men earned. The ratio increased steadily and had reached 65% by 1955. There was a drop in the late 1960s and 1970s, but from the 1970s onward, the ratio continuously increased again. Today, female relative earnings have reached an all-time high of 80%.

While our focus here is on changes over time in the United States, an interesting pattern in cross-country data is that there is a positive correlation between the fertility rate and the female labor-force participation rate across industrialized countries (Fig. 11). That is, the OECD countries with the highest fertility rates (the United States, France, and the Scandinavian countries) all have relatively high female labor force participation rates, whereas in low fertility countries (such as Italy and Spain) fewer women work in the labor market. The pattern is important because it goes against the relationship between these variables in time-series data: within most countries, the trend through the last 100 years or so has been toward lower fertility and higher female participation. Working in the market and caring for children are alternative uses of women's time. If a single force (say, a rise in

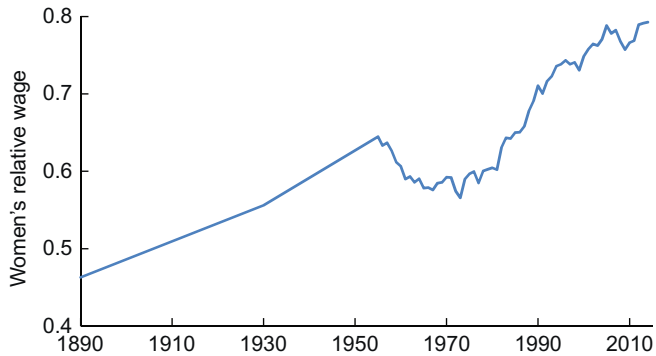

Fig. 10 Gender wage gap: median earnings of full-time, year-round, female workers 15 years and older, relative to men, United States. *US Census Bureau, Historical Income Tables. Numbers for 1890 and 1930 are from Goldin, C., 1990. Understanding the Gender Gap: An Economic History of American Women. Oxford University Press, Oxford (Table 3.2).*

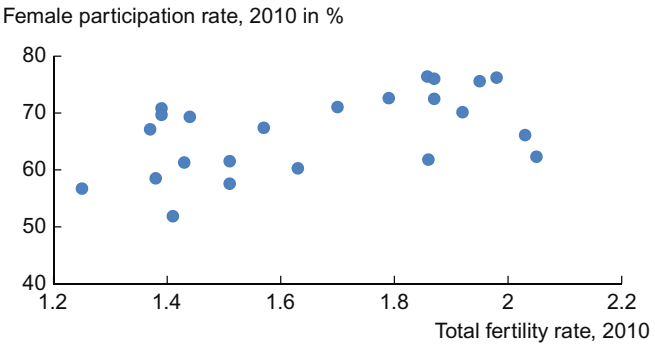

Fig. 11 Fertility vs female labor force participation across European OECD countries. *OECD LFS sex and age indicators and world development indicators.*

relative female wages) was responsible for changes to both labor force participation and fertility, we would expect these variables to always move in opposite directions. The observation in Fig. 11 that, across countries, these variables are positively correlated suggests that such a one-dimensional explanation is at odds with the data and is informative for which kind of theories can explain the family trends described here.

2.3 Explaining the Facts

There is a large literature (spanning family economics, labor economics, development economics, and macroeconomics) that provides explanations for the transformation of the family described above. We keep our discussion of this literature brief, since the goal of this chapter is not explaining these family facts but rather studying their importance for macroeconomic analysis. For a comprehensive survey of the literature on the drivers of changes in the family, we refer the reader to Greenwood et al. (2016b).

The best-known explanations for the historical fertility decline are based on the quantity–quality trade-off together with the idea that returns to education were increasing over time due to technological progress (see also Section 3.3). The more recent fertility decline that followed the baby boom is often connected to the increasing value of female time. The baby boom itself still presents a bit of a puzzle. The conventional wisdom of women catching up on their fertility after the war is clearly not the main driver, as it was young women (not of child-bearing age during the war) who had most children during the baby boom, as Fig. 1 shows. Doepke et al. (2015) suggest that the increase in labor force participation during the war was a major driver for the baby boom. The war generation of women accumulated valuable labor market experience, and after the war these women provided strong competition in the labor market for younger women who lacked that experience. Doepke, Hazan, and Maoz argue that many of these younger women were crowded out of the labor force and decided to

start having children earlier instead.[e] Other papers provide a complementary explanation by attributing part of the baby boom to a decline in the cost of child bearing, for example, due to medical progress that made childbirth less risky to mothers (Albanesi and Olivetti, 2014) or improvements in household technology that lowered the time cost of children (Greenwood et al., 2005a).[f]

The causes for the secular increase in female participation have also been widely explored. Some of the explanations focus on the alternative uses of female time and argue that the time required for home production (such as child care, preparing food, or cleaning the home) fell, freeing up time for work. Greenwood et al. (2005b) attribute the reduction in time required for home production to technological progress, and in particular the introduction of time saving appliances. Even if technology had stayed as it was, home production time would have fallen because of the large reduction in the average fertility rate from the baby boom period of the 1950s to the present. Figs. 8 and 9 show that time use data indeed display a large reduction in nonmarket work (ie, home production) for women that closely mirrors the rise in market work. We also observe a small rise in home production for men, suggesting that some of the reduction in female home production arises from substitution within the household. However, the rise in male home production is quantitatively small compared to the decline in female home production. A related theory put forth by Albanesi and Olivetti (2016) is based on technological advances in health. Innovations such as infant formula made it much easier to reconcile work and motherhood and thus were an important contributor to the contemporaneous increase in fertility and female participation between 1930 and 1960.

Another factor contributing to the rise in female participation in the labor market is the decline in the gender wage gap between men and women, as shown in Fig. 10. While some of the overall rise in relative female pay is due to endogenous decisions such as education and the accumulation of work experience, other factors such as the disappearance of marriage bars can be regarded as exogenous driving forces.[g] The gender gap may also have narrowed because of technological change in the market sector that made male and female work more similar. If men have the comparative advantage in brawn and women in brain, then as knowledge becomes more important, female relative wages go up.[h] The role of the

[e] See also Goldin (1990) and Goldin and Olivetti (2013) for other perspectives on the long-run impact of World War II on the female labor market.

[f] Yet another possibility is a link between economic and demographic cycles; Jones and Schoonbroodt (2015) provide a model in which the baby boom arises due to the recovery from the Great Depression in terms of both income and fertility.

[g] Eckstein and Lifshitz (2011) decompose the effect of rising education and the decline in the gender gap conditional on education and find that rising female education accounts for a larger fraction of the increase in female participation.

[h] This idea was first formally modeled by Galor and Weil (1996). See Albanesi and Olivetti (2009) for an alternative theory of how a gender wage gap can arise from private information on work effort and specialization within the household.

declining gender gap in explaining the rise in participation is emphasized by Jones et al. (2015), who also allow for technological improvements in home production, but find them not to be quantitatively important. Attanasio et al. (2008) study the life-cycle labor supply of three cohorts of American women, born in the 1930s, 1940s, and 1950s. Their model allows for a number of potential determinants of labor supply, including changes in the gender wage gap, the number and cost of children, and changes in the returns to labor market experience. They find that for the cohorts considered, both a reduction in the costs of children and a decrease in the gender wage gap need to be allowed to explain the rise in participation. More recent contributions connect the decline in the gender wage gap explicitly with the rise of the service sector (Rendall, 2010; Ngai and Petrongolo, 2014).

Another channel that can affect relative male and female labor supply is endogenous bargaining within the household. In explicit household bargaining models (see Section 2.5), the outside options of the spouses are usually important determinants of bargaining power. Improved labor market opportunities for women (through whichever channel they occur) improve women's outside options and thus should improve women's bargaining power in marriage. Using a quantitative model, Knowles (2013) argues that an endogenous increase in female bargaining power is important in explaining the rise in female labor supply over the 1970–2000 period without implying a (counterfactual) large decline in male labor supply. Eckstein and Lifshitz (2015) estimate a labor supply model in which couples differ in how bargaining takes place (eg, cooperative vs noncooperative bargaining) and find that bargaining has a large impact on female, but not male labor supply.

The link between fertility and employment decisions is likely to have become more important throughout the last few decades. Before the 1960s, in industrialized countries most mothers were not in the labor force, so that for many the employment margin was not operative as far as decisions on additional births were concerned. Today, in the United States and other industrialized countries, most mothers are in the labor force. Hence, having children interacts with employment more directly, through margins such as deciding to work full or part time or the choice between career paths that differ in flexibility for dealing with child care needs. Recently, Adda et al. (2016) have provided a detailed study of the costs of children in terms of mother's careers based on a detailed life cycle model of female employment and fertility matched to German data. They show that the career costs of having children are substantial and that realized and expected fertility can account for a large fraction of the gender wage gap.[i] Based on the same data,

[i] See also Miller (2011) who estimates the career costs of children, using US data on biological fertility shocks as instruments. Guvenen et al. (2014) provide a recent analysis of the gender pay gap at the very top of the income distribution. They argue that a large part of the underrepresentation of women among top earners is due to the "paper floor," ie, a higher likelihood of women dropping out of the top pay percentiles, part of which may be due to fertility decisions.

Bick (2016) provides a quantitative analysis of the importance of the availability of market-based child care for fertility and female labor supply.

As discussed in Section 2.2, if a single force was responsible for both the upward trend in female labor force participation and the downward trend in fertility, we would expect these variables to always move in opposite directions. However, if we look at the cross section of industrialized countries, a positive correlation between female labor force participation and fertility emerges (see Fig. 11).[j] A number of recent studies have developed theories that are consistent with this pattern. The general intuition for these results is that many women now want to have both children and careers. In places where policies (or cultural expectations) are such that mothers can easily combine having children and careers, fertility and female labor force participation will both be high. In contrast, if there are obstacles to combing motherhood with working, many women will choose one or the other, and both fertility and participation will be lower. One of the first papers to formalize this intuition is Da Rocha and Fuster (2006), who focus on differences in labor market frictions across countries. Using a quantitative model, they find that in countries where unemployment risk is high, women both work less and are more likely to postpone births. Similarly, Erosa et al. (2010) find that more generous parental leave policies can increase both fertility and female labor force participation. Another source of variation can be cultural expectations for the roles of mothers and fathers in raising children. Doepke and Kindermann (2015) show that in European countries with exceptionally low fertility rates, women bear a disproportionately large share of the burden of caring for children. In a model of household bargaining over fertility decisions, they show that this leads to many women being opposed to having (additional) children. Hence, once again fertility will be lower, while at the same time many mothers are not able to work due to their child care duties.

The causes behind the decline in marriage, rise in divorce, and increase in single motherhood (as shown in Figs. 3–6) are likely related to the increase in female labor force participation. For a discussion of the causes behind these changes in the family structure, see Greenwood et al. (2016b).

2.4 Changing Families and Aggregate Labor Supply

We now turn to the main focus of this section, namely how changes to the family affect how labor supply and savings are determined in the aggregate. We start with aggregate labor supply, where the role of changes in female labor market behavior takes center stage.

A common thread through the studies of the rise in female participation is that the female participation decision is qualitatively different than the male participation decision. At least in part, this is due to a higher fixed cost of participation for women,

[j] A similar phenomenon has emerged recently in cross-sectional data in the United States. Hazan and Zoabi (2015a) document a U-shaped relationship between female education and fertility.

who often bear the primary responsibility for child care. The different nature of female labor supply suggests that today, aggregate labor supply is determined in a qualitatively different fashion compared to a few decades ago. We now consider a deliberately simplified model to illustrate the main channels through which the joint determination of female and male labor supply within a family affects the macroeconomic properties of labor supply.

2.4.1 Joint Labor Supply in the Family

To focus on the extensive margin, we consider a setting where an individual can either work full time or not at all.[k] The utility function of an individual of gender $g \in \{f,m\}$ is given by:

$$U_g(c_g, l_g) = \log(c_g) - \eta_g l_g,$$

where $l_g \in \{0,1\}$ is labor supply and c_g is consumption.[l] The relative weight of leisure in utility η_g varies in the population. People can live either as singles or as married (or cohabiting) couples. The budget constraint for a single individual is:

$$c_g + \psi l_g = w_g l_g + \gamma_g,$$

where w_g is the wage for gender g, γ_g is unearned income (ie, endowment or transfer income), and ψ represents the fixed cost of running a household conditional on working. The implicit assumption is that a person who does not work can replace the cost ψ through costless home production. We assume that ψ is a scalar that satisfies $0 < \psi < \min(w_f, w_m)$. The model is static, but alternatively we can interpret the decision problem as representing the labor-supply decision of a long-lived individual/household with exogenous saving in a given period, in which case γ_g represents exogenous net saving/dissaving in the period.

For a married couple, the same fixed cost of running a household applies, but only if both spouses are working.[m] The joint budget constraint for a couple then is:

$$c_f + c_m + \psi \min(l_f, l_m) = w_f l_f + w_m l_m + \gamma, \tag{4}$$

[k] We focus on the extensive margin for tractability. However, similar forces will be effective at the intensive margin as well.

[l] Here we assume that consumption is a private good. Many family models assume that consumption in the family is a public good. We consider pure public goods in Section 3. In reality, there are some private and some public elements in household consumption (see Salcedo et al., 2012 for a detailed analysis of this point).

[m] See Cho and Rogerson (1988) for an early contribution on the implications of this type of fixed cost of participation for the elasticity of labor supply.

where $\gamma = \gamma_f + \gamma_m$. In this setting, the decision problem for a single person is straightforward. Comparing the utility conditional on working vs not working, an individual chooses to work if the condition,

$$\log(w_g + \gamma_g - \psi) - \eta_g \geq \log(\gamma_g),$$

is satisfied, or, equivalently, if the opportunity cost of working is sufficiently low:

$$\eta_g \leq \log\left(\frac{w_g + \gamma_g - \psi}{\gamma_g}\right).$$

For a married couple, we have to take a stand on how the inherent conflict of interest between the spouses given their different preferences is resolved. We assume cooperative bargaining, ie, the household solves a Pareto problem with welfare weights λ_f and λ_m for the wife and the husband, with $\lambda_f + \lambda_m = 1$. The problem solved by a married couple is then given by:

$$\max\{\lambda_f[\log(c_f) - \eta_f l_f] + \lambda_m[\log(c_m) - \eta_m l_m]\} \tag{5}$$

subject to the budget constraint (4). The maximization problem can be solved by using first-order conditions to characterize the consumption allocation conditional on a given pattern of labor supply, and then comparing utilities to determine optimal labor supply. To simplify notation, we focus on the case where husbands always work as long as $w_m > 0$. If the wife does not work, household income is given by $w_m + \gamma$ and the consumption allocation is $c_f = \lambda_f(w_m + \gamma)$, $c_m = \lambda_m(w_m + \gamma)$. If the wife also works, household income net of the participation cost is $w_f + w_m + \gamma - \psi$, and the consumption allocation is $c_f = \lambda_f(w_f + w_m + \gamma - \psi)$, $c_m = \lambda_m(w_f + w_m + \gamma - \psi)$. Denote by $V(l_f, l_m)$ the value of the objective function of the household (5) given labor supply and the optimal conditional consumption allocation. The wife will work if $V(l_f = 1, l_m = 1) \geq V(l_f = 0, l_m = 1)$, which can be written as[n]:

$$\log(w_f + w_m + \gamma - \psi) + \lambda_f \log(\lambda_f) + \lambda_m \log(\lambda_m) - \lambda_f \eta_f - \lambda_m \eta_m \geq \log(w_m + \gamma) + \lambda_f \log(\lambda_f) + \lambda_m \log(\lambda_m) - \lambda_m \eta_m.$$

Simplifying, women will work if and only if:

$$\eta_f \leq \frac{1}{\lambda_f} \log\left(\frac{w_f + w_m + \gamma - \psi}{w_m + \gamma}\right).$$

Hence, women are more likely to work if the participation cost ψ or male wages w_m are low, and if female wages w_f are high. A low bargaining power for women λ_f also translates into higher participation because households then place less value on the wife's leisure.

[n] For now we assume full commitment, ie, people get married before disutilities from working are realized, and they stay together even if being single would provide higher utility.

Note that the assumption of full commitment is important here. If the bargaining power of women is low, women pay the utility cost of working and consume little. Such a woman may prefer not to be a married at all. Later we endogenize the bargaining weights to ensure that participation constraints hold.

We can now consider the implications of the simple model for the variability of labor supply. Consider, first, the own-wage elasticity of labor supply. Consider the case where the only dimension of heterogeneity in the population is in leisure preference η_g, the distribution of which is described by the distribution function $F(\eta_g)$ with continuous marginal density $f(\eta_g) = F'(\eta_g)$. We assume that the density satisfies the assumptions $F(0) = 0$, $F'(\eta_g) > 0$ for $\eta_g > 0$, $\lim_{\eta_g \to 0} f(\eta_g) = 0$, and $\lim_{\eta_g \to \infty} f(\eta_g) = 0$. That is, all individuals place at least some value on leisure and the distribution thins out at each tail (one example is a log-normal distribution for η_g). For singles of gender g, the fraction working N_g^s given wage w_g is given by:

$$N_g^s = F\left(\log\left(\frac{w_g + \gamma_g - \psi}{\gamma_g}\right)\right).$$

The aggregate wage elasticity of labor supply is then given by:

$$\frac{\partial N_g^s}{\partial w_g}\frac{w_g}{N_g^s} = \frac{w_g}{w_g + \gamma_g - \psi}\frac{F'\left(\log\left(\frac{w_g + \gamma_g - \psi}{\gamma_g}\right)\right)}{F\left(\log\left(\frac{w_g + \gamma_g - \psi}{\gamma_g}\right)\right)}.$$

Note that this elasticity focuses on the extensive margin and hence is different from what is typically measured in the micro data (eg, Pistaferri, 2003 measures only the intensive margin elasticity).[o]

Consider now married couples. By assumption, we focus on the case where married men always work if they are able to. The fraction of married women working is then given by:

$$N_f^m = F\left(\frac{1}{\lambda_f}\log\left(\frac{w_f + w_m + \gamma - \psi}{w_m + \gamma}\right)\right)$$

and the elasticity of their labor supply is:

$$\frac{\partial N_f^m}{\partial w_f}\frac{w_f}{N_f^m} = \frac{w_f}{\lambda_f(w_f + w_m + \gamma - \psi)}\frac{F'\left(\frac{1}{\lambda_f}\log\left(\frac{w_f + w_m + \gamma - \psi}{w_m + \gamma}\right)\right)}{F\left(\frac{1}{\lambda_f}\log\left(\frac{w_f + w_m + \gamma - \psi}{w_m + \gamma}\right)\right)}.$$

[o] Recent contributions that explicitly consider the extensive margin include Chetty et al. (2011, 2012) and Attanasio et al. (2015).

The relative size of single and married women's labor supply elasticity cannot be unambiguously signed, because this depends on the shape of the distribution function F and the size of unearned income. However, married women's labor supply will be more elastic than the labor supply of single women if unearned income γ_f is sufficiency small:

Proposition 1 (Labor Supply Elasticity of Single vs Married Women) *If unearned income* γ_f *is sufficiently small, married women's labor supply elasticity is higher than that of unmarried women.*

Intuitively, if unearned income is small, singles have to work if they want to consume, whereas a married woman can rely in part on her spouse's income. This result is in line with the empirical observation that married women's labor supply is much more elastic than that of married men or single women at the microlevel (see, eg, the survey by Blundell and MaCurdy, 1999). Of course, if the labor supply of married men were endogenized, they would also have more scope for variability in supply compared to single men. In practice, as long as the gender wage gap was sizeable and social expectations were that women do more child care and home work, the assumption that men are the default earners was broadly realistic. But as gender roles have become more equalized over time, we can expect the labor supply behavior of men and women to converge also.

Ultimately we would like to assess the implications of changes in the family for the behavior of aggregate labor supply. The results so far may seem to suggest that a higher proportion of married households should make aggregate labor supply more variable. However, so far we have only considered the own wage elasticity of female labor supply. Another important dimension of the family is the possibility of insurance within the family. Specifically, if in a marriage the working husband experiences a negative shock such as a layoff, the wife may be able to offer insurance by starting to work. Hence, in the aggregate, the variable labor supply of married women may dampen fluctuations in total labor supply, by offsetting shocks experienced by men.[p]

To analyze the possibility of insurance within the family, consider an extension of the environment with unemployment shocks. With probability u, a given individual is unable to work, or equivalently, the potential wage is zero. The realization of the shock is independent across spouses. We can now consider how aggregate labor supply reacts to changes in u, where an increase in u can represent a recession.

As before, we start by considering singles. Their aggregate labor supply is:

$$N_g^s = (1-u)F\left(\log\left(\frac{w_g + \gamma_g - \psi}{\gamma_g}\right)\right).$$

[p] An early study of this insurance channel is provided by Attanasio et al. (2005).

For singles, the elasticity of labor supply with respect to the probability of employment $1 - u$ is unity:

$$\frac{\partial N_g^s}{\partial(1-u)}\frac{1-u}{N_g^s}=1.$$

For married couples, labor supply is driven by two different thresholds for the wife's leisure preference, depending on whether the husband is working or not. Denote these thresholds by:

$$\hat{\eta}_e=\frac{1}{\lambda_f}\log\left(\frac{w_f+w_m+\gamma-\psi}{w_m+\gamma}\right),$$
$$\hat{\eta}_u=\frac{1}{\lambda_f}\log\left(\frac{w_f+\gamma}{\gamma}\right).$$

The average labor supply per married couple is then:

$$N^m=(1-u)(1+(1-u)F(\hat{\eta}_e))+u(1-u)F(\hat{\eta}_u).$$

Here the first term corresponds to employed husbands, and the second term corresponds to unemployed husbands. Wives of unemployed husbands work with a strictly higher probability than wives of employed husbands, because the cost ψ does not have to be paid (a substitution effect) and overall income is lower (an income effect working in the same direction). The derivative of labor supply with respect to $1 - u$ for the married couples is:

$$\frac{\partial N^m}{\partial(1-u)}=(1+(1-u)F(\hat{\eta}_e))+(1-u)F(\hat{\eta}_e)+uF(\hat{\eta}_u)-(1-u)F(\hat{\eta}_u),$$

$$\frac{\partial N^m}{\partial(1-u)}=(1+2(1-u)F(\hat{\eta}_e))-(1-2u)F(\hat{\eta}_u).$$

The elasticity of married labor supply with respect to $1 - u$ is then:

$$\frac{\partial N^m}{\partial(1-u)}\frac{1-u}{N^m}=\frac{1+2(1-u)F(\hat{\eta}_e)-(1-2u)F(\hat{\eta}_u)}{1+(1-u)F(\hat{\eta}_e)+uF(\hat{\eta}_u)}.$$

If it were the case that $F(\hat{\eta}_u)=F(\hat{\eta}_e)$, the expression once again would yield an elasticity of unity as for the singles. However, in fact we have $\hat{\eta}_u>\hat{\eta}_e$ and hence $F(\hat{\eta}_u)>F(\hat{\eta}_e)$, so that the elasticity of labor supply by married couples is strictly smaller than one. Intuitively, there is a fraction of women (given by $F(\hat{\eta}_u)-F(\hat{\eta}_e)$) who do not work if their husband is working, but choose to enter the labor force if the husband is unemployed. Hence, there is insurance in the family that dampens fluctuations in aggregate

employment. Even though married female labor supply is more elastic at the microlevel, it contributes to a dampening of the volatility of aggregate labor supply due to this intra-family insurance effect.[q]

In the data, married female employment rose massively in the second half of the 20th century (see Fig. 7), and there were also large shifts in the composition of household types (see Figs. 3 and 4). The model suggests that these changes should affect the volatility of aggregate labor supply. The following proposition summarizes the main results.

Proposition 2 (Family Determinants of Volatility of Aggregate Labor Supply) *Consider a population of measure one consisting of* M *married households (with two members each) and 1–2*M *single households. We then have:*

1. *The elasticity of aggregate labor supply* N *with respect to* $1 - u$ *(the fraction of workers not affected by the unemployment shock) is equal to one if the fraction of married people is* $M = 0$ *and decreases with* M *for* $M > 0$.
2. *For a fixed* $M > 0$, *the elasticity of aggregate labor supply* N *with respect to* $1 - u$ *is strictly smaller than one, but approaches one when* w_f *converges to zero or to infinity.*

The first premise suggests that the large shifts in the composition of households in the past few decades may have had a marked effect on the response of aggregate labor supply to shocks. The second premise suggests that, in addition, the increase in female labor supply should also affect the behavior of aggregate labor supply, albeit in a nonmonotone way. Regarding the married households, what is at stake is the potential for insurance within the family. When conditions are such that women do not work even if their husbands are unemployed (captured here by the case of a female wage close to zero), there is no potential for insurance, and hence the labor supply of married households will be just as elastic as that of single households. Conversely, when conditions are such that all women work regardless of the employment status of their husbands (captured by the case of the female wages approaching infinity), there is no potential for insurance either. Insurance does play an important role when there is a sizeable group of women who do not work if their husbands are employed, but are willing to enter the market when the husband loses his job. Hence, the mechanism would predict the greatest role for insurance at a time when the rise in female employment is well underway, but still not close to being completed.

Fig. 12 displays how the elasticity of total labor supply by married households with respect to the unemployment shock depends on relative female wages in a computed example.[r] The male wage is normalized to one, and the source of variation is the relative

[q] There is an active debate in the literature on how micro- and macroestimates of labor supply elasticities can be reconciled (see Chetty et al., 2011, 2012; Keane and Rogerson, 2012 for recent contributions).

[r] Parameter values: $w_m = 1$, $\gamma = 0.1$, $\psi = 0.1$, and $\lambda_f = 0.5$. The distribution of leisure preferences is log-normal with $\mu = 0.5$ and $\sigma = 1$, and the elasticity of labor supply is evaluated at an unemployment rate of $u = 0.1$.

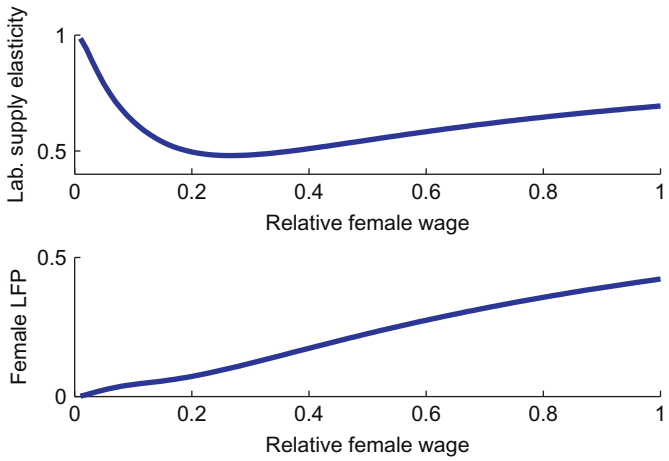

Fig. 12 Aggregate labor supply elasticity and female labor force participation (LFP) as a function of relative female wage in labor supply model.

female wage. The lower panel shows female labor supply as a function of the relative female wage. Not surprisingly, at a zero female wage, female labor supply is zero as well. However, even with very low wages some women work, namely those whose husbands are unable to work and who have a low leisure preference. The upper panel shows that this implies that the aggregate elasticity is U-shaped in relative female wages. In light of the observed decline in the gender wage gap and the increase in female labor force participation in US data (see Figs. 7 and 10), the findings suggest that the aggregate labor supply elasticity should have changed substantially in recent decades.

2.4.2 Endogenous Bargaining

The analysis of married couples' decisions has been carried out so far under the assumption of exogenous bargaining weights and full commitment. As mentioned above, if female bargaining power is low and female wages are high, women are likely to work a lot and consume little, and hence such women may prefer not to be married at all. Without full commitment, ie, if women were allowed to leave such a marriage, efficient bargaining subject to the limited commitment constraint would dictate that bargaining weights adjust to ensure that married women get at least as much utility as they would if they were single. Adjusting bargaining weights in this way is possible as long as the surplus from marriage is positive, which is guaranteed in our setting as long as $\psi > 0$ (married couples economize on the cost of running a household).[s]

[s] Other reasons for a positive marital surplus include consumption being a public good (see Section 3) and a utility benefit from being married (see Section 2.5).

Now consider how bargaining weights would adjust to changing wages w_g in this setting.[t] The utility of a single female is the maximum value between working and not working as a single:

$$U_f^s = \max\{\log(w_f + y_f - \psi) - \eta_f, \log(y_f)\}.$$

Assume that w_f is high enough (or y_f low enough) so that as a single, she always prefers to work. Comparing her utility as a single with that when married, she will prefer to be single if:

$$w_f + y_f > \frac{\lambda_f}{1-\lambda_f}(w_m + y_m) + \psi.$$

This condition will hold, for example, when her wages are high or her bargaining power is low. In such a case, the bargaining power in marriage should adjust to guarantee her at least her reservation (ie, single) utility:

$$\lambda_f = \frac{w_f + y_f - \psi}{w_m + y_m + w_f + y_f - \psi}.$$

Of course, any λ_f higher than the expression above would also guarantee that her participation constraint is satisfied.

We can use this logic to assess what would happen in a dynamic model with shocks to wages and participation cost. Suppose the couple starts out with a large marital surplus and bargaining weights such that neither participation constraint is binding. Suppose now that her wage increases unexpectedly such that, holding λ_f constant, her participation constraint would be violated. In response, her bargaining weight will increase. Similarly, a fall in the participation cost ψ may also lead to a tightening of the participation constraint and hence a shift in bargaining weights.[u] Bargaining positions will also be affected by changes in unearned income such as lottery winnings or an inheritance.

Now consider how such changes in bargaining weights affect the elasticity of labor supply. Qualitatively, the effects described in Propositions 1 and 2 rely on the possibility of insurance within the family and do not depend on the assumption of fixed bargaining weights. However, endogenous bargaining may well matter for the quantitative size of the effects. Both Knowles (2013) and Voena (2015) examine this issue, although their

[t] The model is static of course so there is no adjustment over time. Rather, one should think of bargaining weights differing across couples in an economy with heterogeneity in relative wages. However, the basic logic would carry over to a dynamic model with limited commitment where similar forces would lead to adjustments in the bargaining weights over time, see Mazzocco (2007) and Voena (2015).

[u] Since a decline in ψ affects both the male and female participation constraint, the direction of the change will depend on the details and in particular the status quo bargaining weight. Suppose her constraint is exactly binding before the shock lowering ψ is realized. Then, clearly, since he is currently reaping the entire surplus, her weight will have to go up to ensure continued participation in marriage by the female.

analyses are concerned with longer-term changes rather than with the business cycle. Nevertheless, the forces they identify should also be active at the business cycle frequency. If a higher wage increases bargaining power, it also increases the weight in the bargaining process on the leisure of the spouse who is receiving the raise. This effect lowers the response of labor supply to wage changes. Indeed, Knowles (2013) argues that the overall response of aggregate labor supply to the increase in female wages is dampened because of shifts in bargaining power. Whether such shifts in bargaining power also dampen aggregate labor volatility is less clear, as the opposite effect will apply to the other spouse. We view this as a fruitful area for future research.

2.4.3 Linking Changes in the US Labor Market to Family Labor Supply

We now relate the theoretical channels linking the family to variations in aggregate labor supply outlined above to empirical evidence on fluctuations in employment and output in the United States. We are interested in how the variability of aggregate labor supply varies between men and women and single and married individuals, and how these factors changed over time. Our analysis is based on annual data from the Current Population Survey (CPS) for the years 1962–2014. We focus on average weekly hours worked per person for the population aged 25–65.[v] Fig. 13 shows how this measure of labor supply

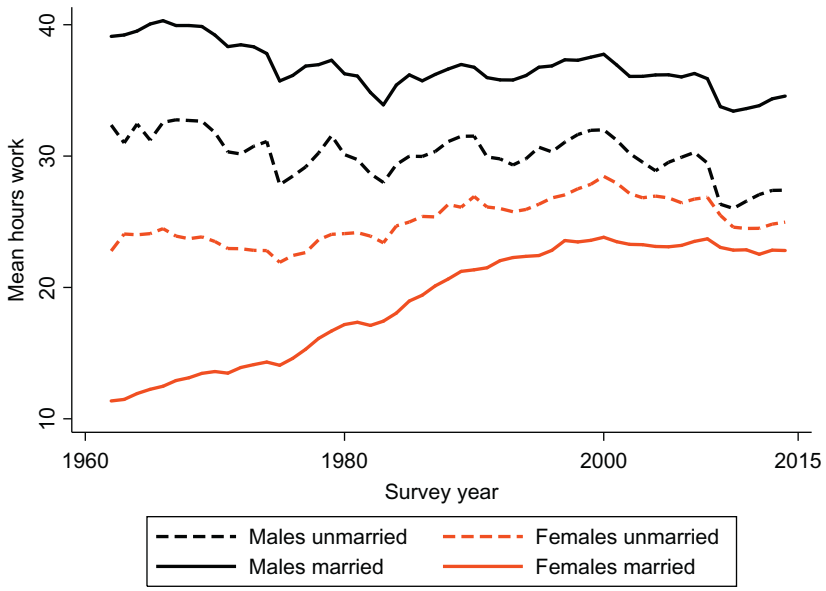

Fig. 13 Average weekly work hours by gender and marital status over time, United States. *Current Population Survey, March and Annual Social and Economic Supplements, 1962–2014.*

[v] The sample includes self-employed individuals.

evolves over time by gender and marital status. The sharp upward trend in married women's labor supply from the 1960s to the 1990s is apparent, as well as the comparatively larger drop in male labor supply since the Great Recession of 2008.

To focus on fluctuations at the business cycle frequently, we compute the cyclical component as the residual after subtracting a Hodrick–Prescott trend from the logarithm of each series (with a smoothing parameter of 6.25). The cyclical component of labor supply by gender and marital status is displayed in Fig. 14. It is immediately apparent that aggregate male labor supply is more volatile than aggregate female labor supply. Single men experience the largest fluctuations in labor supply over the cycle, whereas the smallest fluctuations are observed for married women.

The large differences in the volatility of female and male labor supply together with the large increase in female labor supply suggest that family trends may have had repercussions for the cyclical properties of aggregate labor supply over the observed period. To examine this possibility more formally, Table 1 provides detailed information on fluctuations in aggregate labor supply in the United States in relation to gender and marital status. In the table, the total volatility of a given series is the percentage standard deviation of the cyclical component of average labor supply per person in the group. Cyclical volatility is the percentage standard deviation of the predicted value from a regression of the cyclical component of employment in each group on the cyclical component of real GDP per capita (also computed using the HP filter). Cyclical volatility captures the

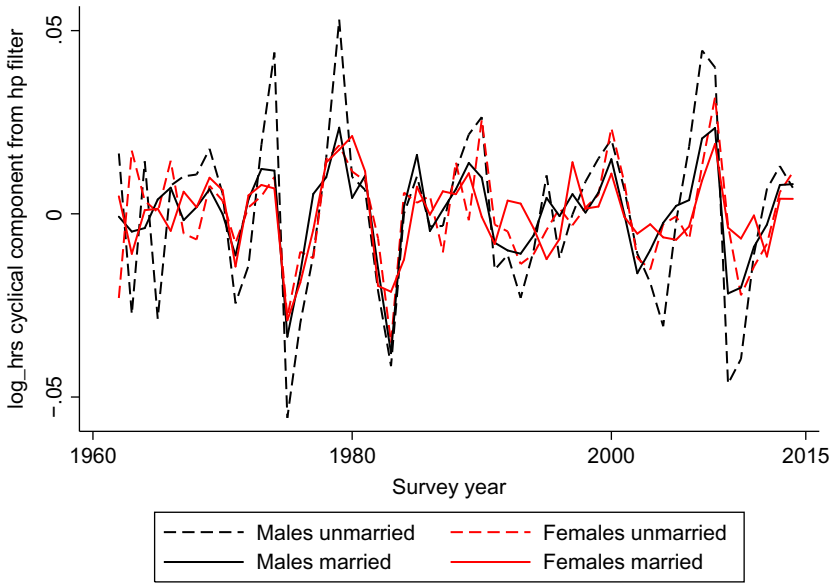

Fig. 14 Cyclical component of average weekly work hours by gender and marital status over time, United States (cyclical component is deviation from Hodrick–Prescott trend, smoothing parameter 6.25). *Current Population Survey, March and Annual Social and Economic Supplements, 1962–2014.*

Table 1 Volatility of hours worked in the United States, by gender and marital status

	All			Married		Single	
	Total	Women	Men	Women	Men	Women	Men
1962–2014							
Total volatility	1.25	1.04	1.46	1.04	1.25	1.33	2.33
Cyclical volatility	0.99	0.72	1.18	0.67	1.01	0.74	1.68
Hours share		38.09	61.91	23.90	47.71	14.19	14.20
Volatility share		27.22	72.78	16.20	48.98	10.64	24.17
1962–88							
Total volatility	1.35	1.19	1.48	1.26	1.36	1.37	2.44
Cyclical volatility	1.08	0.87	1.19	0.87	1.09	0.79	1.65
Hours share		33.71	66.29	21.99	55.29	11.72	11.00
Volatility share		27.14	72.86	18.02	56.29	8.67	17.02
1989–2014							
Total volatility	1.15	0.87	1.47	0.79	1.16	1.30	2.25
Cyclical volatility	0.91	0.51	1.23	0.38	0.95	0.70	1.82
Hours share		42.64	57.36	25.89	39.83	16.75	17.53
Volatility share		23.68	76.32	10.80	41.51	12.88	34.81

Notes: All data from Current Population Survey, March and Annual Social and Economic Supplements, 1962–2014. Total volatility is the percentage standard deviation of the Hodrick-Prescott residual of average labor supply per person in each group. Cyclical volatility is the percentage deviation of the predicted value of a regression of the HP-residual on the HP-residual of GDP per capita. Hours share is the share of each component in total hours. Volatility share is share of each group in the cyclical volatility of total hours.

component of employment volatility that is related to aggregate economic fluctuations. The hours share and volatility share break down the contribution of each component to aggregate hours and to the cyclical volatility of aggregate labor supply.[w]

The first column displays the volatility of aggregate labor supply (women and men combined), and the next two columns break down labor supply between women and men. Over the entire sample, women's labor supply is less volatile than men's labor supply. Moreover, for women cyclical volatility is a smaller fraction of total volatility compared to men; ie, less of the variation in female labor supply is related to aggregate economic fluctuations. As a consequence, even though over the entire sample women contribute close to 40% of total hours, they account for less than 30% of volatility in aggregate labor supply.

A key observation is that female labor supply is less variable than male labor supply in the aggregate, even though at the microlevel women have a much higher labor supply

[w] The computation of cyclical volatility and hours and volatility shares follows the methodology used by Jaimovich and Siu (2009) and Jaimovich et al. (2013) to characterize the contributions of the young and the old to aggregate fluctuations.

elasticity than men. These facts can be reconciled if some of the microvariability in female labor supply is due to adjustments that move in the opposite direction of aggregate changes, such as women increasing labor supply in a recession. We would expect such movements to be especially likely to arise among married households, where the spouses can provide each other with some insurance. To evaluate this possibility, in the further columns the fluctuations in labor supply are further broken down into married vs single individuals. Consistent with a role for insurance, we see that, for both women and men, fluctuations are much smaller for the married than for the single individuals.

At first sight, the lower variability of married labor supply may appear to contradict Proposition 1, which states that married women should have a higher wage elasticity of labor supply than single women. However, Table 1 captures macroeconomic fluctuations rather than microelasticities, and we would expect married women to have lower aggregate volatility precisely if their higher microelasticity arises from a fraction of married women adjusting their labor supply countercyclically in response to changes in their husbands' earnings.[x]

Some of the lower variability of female labor supply is related to the fact that a larger share of women is employed in the service sector, which is less cyclical than the manufacturing sector where men dominate. However, when we compare workers employed in manufacturing and services, we find that within each sector women experience a lower cyclical volatility than men. Moreover, the link to the sector of employment does not contradict a role for insurance within the family, because the choice of sector (and also occupation) is endogenous and may be made in part precisely to offset risk encountered by a worker's spouse.[y]

The theoretical mechanisms outlined in the previous section suggest that the aggregate elasticity of labor supply should respond to changes in female labor force participation. To explore this possibility, the remainder of Table 1 compares fluctuations during the first half of our sample (1962–88), when female labor supply was rising quickly from an initially low level, to the period 1989–2014, when female labor supply had reached a

[x] A second factor driving the higher aggregate volatility of single labor supply (which is not captured in the model) is that singles tend to be younger than married people, and the young generally have more variable labor supply for other reasons (such as a more important education margin, see Jaimovich et al., 2013). We can control for the effect of age by considering narrower age brackets. For example, among people aged 25–30, the total volatility of the labor supply of married and single women is about the same.

[y] The special role of the service sector in the rise of female employment is analyzed by Buera et al. (2013), Ngai and Petrongolo (2014), and Rendall (2015). Olivetti and Petrongolo (2016) provide an empirical study of the role of industry structure for trends in female employment, working hours, and relative wages in a cross-section of developed economies, and argue that the rise of the service sector accounts for at least half of the long-term variation in female hours. Albanesi and Şahin (2013) study the role of industry composition for male-female differences in cyclical fluctuations in employment in the United States, and show that that industry composition was not important for pre-1990 recessions, but mattered more once female participation flattened out in the 1990s.

higher plateau. The most important observation here is that whereas the volatility of male labor supply is essentially unchanged, the volatility of female labor supply has substantially decreased, and particularly so the cyclical volatility. The breakdown by marital status shows that this change is driven primarily by married women. Married women already have a low total volatility of about 0.8% in the second half of the sample, and less than half of this total volatility is accounted for by cyclical volatility. These numbers suggest, as predicted by the simple theoretical model in the previous section, that the rise in female labor force participation had a substantial dampening effect on the volatility of total labor supply. In contrast, there are no substantial changes in the cyclical volatility of the labor supply of singles, with a small decrease in volatility for single women and a small increase for single men.

The overall result of the changes is that at the same time women increased their share of total hours (from 34% to 43%), they accounted for a smaller share of total volatility (24% in 1989–2014 compared to 27% in 1962–88). As a consequence, the total volatility and cyclical volatility of aggregate labor supply fell substantially (see first column), even though the volatility of male labor supply slightly increased over the period. Hence, the rise in female participation dampened the volatility of aggregate labor supply over the cycle, in line with Proposition 2 and the declining portion of the aggregate elasticity in Fig. 12. Rising female participation may thus have been one of the driving forces of the "Great Moderation" in US aggregate fluctuations observed from the mid-1980s to the onset of the Great Recession in 2007.[z] Of course, the Great Recession appears to have brought the Great Moderation to an end, and hence one may wonder whether this dampening effect is still operative. The data suggest that female labor supply continues to partially offset aggregate fluctuations. A division of the sample into three periods shows that the most recent era displays the lowest volatility of female labor supply, with a cyclical volatility for married women of only 0.37%. The dampening role of married women's labor supply was particularly pronounced during the Great Recession itself. From 2007 to 2010, the average labor supply by married men declined by more than 8%, whereas the decrease was less than 3% for married women.

If the trend toward more gender equality continues, according to Proposition 2 the volatility of female and male labor supply should ultimately become more similar again (see also Fig. 12). In part, as married women become even more strongly attached to the labor force (eg, in the sense of more women being the main breadwinner for their family), their labor supply will become less elastic (this can already be observed at the

[z] See Galí and Gambetti (2009) for an overview of the discussion on the Great Moderation, and Jaimovich and Siu (2009) for an explanation that focuses on changes in the age composition of the labor force. Mennuni (2015) also considers the impact of demographic trends on the Great Moderation (although without considering the distinction of single and married individuals), and finds that demographics (including the rise in female participation) account for about 20% of the Great Moderation in the United States.

microlevel, eg, Heim, 2007). Conversely, men will become more able to rely on their wives' incomes, which should make their labor supply more elastic at the microlevel but also less cyclical in the aggregate. Hence, family trends will continue to play a role in shaping aggregate fluctuations.

2.4.4 Jobless Recoveries

A phenomenon that has received a lot of attention recently in business cycle research is the so-called jobless recoveries. This term refers to a recent change in the employment response to recessions in the United States. Before the 1990s, most postwar recessions were characterized by a strong rise in employment from the trough of the recession. In contrast, since the 1990s the increase in employment during the recovery has been anemic.

A variety of explanations have been proposed for the recent jobless recoveries, including structural change (Groshen and Potter, 2003), an increase in "job polarization" (the disappearance of jobs in the middle of the skill distribution in recessions; see Jaimovich and Siu, 2014), and fixed costs of labor adjustment (Bachmann, 2012). However, in recent work, Albanesi (2014) makes a strong case for jobless recoveries at least in part being due to changes within families, and more specifically to changes in female labor force participation. In a nutshell, Albanesi argues that employment differed in the aftermath of pre-1990 and post-1990 recessions because the earlier recessions took place in the context of a strong secular upward trend in female labor force participation, whereas the more recent ones did not. As Fig. 7 shows, female labor force participation in the United States followed a sharp upward trend, but participation leveled out after about 1990, and even declined somewhat in the last 15 years.

Table 2 summarizes the employment response to recent recessions and breaks them down by male vs female employment. Each entry in the table is a percentage change in the employment to population ratio (E/P) in the 4 years following the trough of the recession. The first column reproduces the basic fact of jobless recoveries. In the pre-1990 recessions, employment had fully recovered (and even increased a little) 4 years after the downturn, whereas for the post-1990 recessions the E/P ratio is on average close to 3% lower at that point of the recovery (1.35% if the Great Recession is excluded). Hence, it appears that recoveries after 1990 are qualitatively different from earlier recoveries. The next two columns break down the overall employment change into changes in the E/P ratio for women and men. The main message from these data is that, statistically, the jobless recoveries are due to changes in the behavior of female but not male employment. For men, recoveries have been "jobless" even before 1990, in the sense that the E/P ratio is down by 2.62% on average 4 years after the trough. The decline in E/P after 1990 is of a similar order of magnitude, and in fact a little smaller when the Great Recession is excluded. In contrast, we see a dramatic change for women. In the pre-1990 recessions, the female E/P ratio recovers strongly after each recession, with an average increase of

Table 2 Jobless recoveries: change in employment/population ratio in 4 years after peak in unemployment rate, in percentage points, by gender (includes three pre-1990 and tree post-1990 recessions)

	Change in E/P		
Period	**Total**	**Men**	**Women**
Pre-1990	0.65	−2.62	5.85
Post-1990	−2.78	−3.94	−1.41
Post-1990, excl. Great Recession	−1.35	−2.47	−0.07

Notes: Pre-1990 recessions include the 1969, 1973, and 1981 recessions. Post-1990 recessions include the 1990, 2001, and 2007 recessions.

close to 6% after 4 years. In contrast, in the post-1990 downturns female employment declines and now follows a pattern similar to that of male employment.

Table 2 suggests that, in a statistical sense, the change in the trend in female labor supply is responsible for jobless recoveries. Specifically, for men recoveries have always been jobless, whereas for women, before 1990 recession-related job losses were quickly made up by the secular upward trend in female participation. Of course, the empirical findings alone are not conclusive evidence in favor of such an explanation. For example, it is conceivable that if in the pre-1990s recessions female employment had risen more slowly, male employment would have suffered fewer losses. To fully evaluate the role of the changing trend in female labor supply for explaining jobless recoveries, one needs to spell out an economic model. Albanesi (2014) considers a model in which the increase in female participation is driven by gender-biased technological change, ie, tasks at which women have a comparative advantage become more important compared to those that favor men (such as those relying on physical strength). Albanesi shows that the model can reproduce both the long-run trend in female participation and the occurrence of jobless recoveries after female employment levels out.

2.4.5 Additional Notes on Related Literature

Whereas few papers explicitly consider how family trends change business cycle dynamics, there is a larger literature that incorporates at least some of the features of the family labor supply model described above into business cycle research. An early example is the literature on home production in macroeconomics (see Greenwood et al., 1995 for an early overview of this work). The first models did not explicitly distinguish between male and female labor supply, but by incorporating the possibility of working in the home (on child care, food production, and so on), the literature took implicit account of the different nature of female labor supply. Benhabib et al. (1991) is an early contribution focusing on the importance of home production for explaining business cycle facts. In their model, households derive utility from home and market consumption and supply both home and market hours. They find that the model with home production is much

better at matching various volatilities and correlations over the business cycle than standard macro models. Closely related arguments are made by Greenwood and Hercowitz (1991) and Ríos-Rull (1993).

The role of family labor supply in the context of search models of the labor market has been analyzed by Guler et al. (2012). Spouses who are both in the labor force can provide each other insurance in the case of unemployment. They find that the possibility of insurance lowers the search effort of unemployed workers and also provides higher welfare compared to a setting where all workers are singles. Ortigueira and Siassi (2013) use a quantitative model to assess the importance of risk sharing within the family, and find that insurance through spousal labor supply is particularly important for wealth-poor households who lack access to other insurance mechanisms.

Family labor supply also plays a central role in a recent macroeconomic literature on the effects of tax reform. Using a quantitative life-cycle model with single and married households calibrated to US data, Guner et al. (2012a) explore the economic consequences of revenue-neutral tax reforms that adopt either a flat income tax or separate taxation of married couples (ie, separate filing). In either case, the reform generates a large increase in labor supply, which is mostly driven by married women (see also Guner et al., 2012b). Guner et al. (2014) extend this work to consider the effects of child care subsidies. They find that such subsidies have large effects on female labor supply, in particular at the bottom of the skill distribution. Bick and Fuchs-Schündeln (2014) document differences in labor supply of married couples across 18 OECD countries, and find that variation in tax systems (in particular joint vs separate taxation) can account for most of the differences.[aa]

In the labor literature, the phenomenon of a wife entering the labor market in response to her husband's unemployment that partly underlies Proposition 2 is known as the "added worker effect" (Lundberg, 1985). Empirical studies using data from the early 1980s or earlier have generally only found weak evidence in favor of the added worker effect. Using CPS data over a long time period, Juhn and Potter (2007) find evidence in support of the added worker effect but also argue that it has diminished in strength recently, in part because assortative mating has led to a higher intrahousehold correlation of the labor market shocks faced by wives and husbands.

The large differences in the cyclical volatility of the labor supply of single and married women and men documented above suggest that insurance within the family goes beyond a narrow added worker affect (which specifically concerns wives entering the labor force *after* their husbands become unemployed). Other forms of insurance include entering employment already in response to higher unemployment risk for the spouse (rather than the actual realization of unemployment, when entering the labor force quickly may be difficult), and adjustments on the intensive margin when both spouses

[aa] See also Chade and Ventura (2005) for an analysis of the welfare consequences of different tax treatments for married couples.

are in the labor force. Hyslop (2001) and Shore (2010, 2015) provide evidence in favor of a more general sharing of labor market risk in terms of the correlation of earnings within couples. Using a structural model of life cycle decisions, Blundell et al. (2016) similarly find strong evidence in favor of insurance within the family. Using CPS data, Mankart and Oikonomou (2015) document a substantial response of female labor force participation to spousal unemployment, where the response is more drawn out over time compared to early tests of the added worker effect. Moreover, Shore (2010) provides evidence that intrahousehold risk sharing is particularly strong within recessions. Our findings of a shift over time in the aggregate behavior of labor supply by gender and marital status suggest that it would be productive to expand on these findings by examining whether insurance within the family has undergone similar shifts at the microlevel.[ab]

Our analysis of family labor supply has focused on the interaction between husbands and wives. Another dimension of insurance within the family concerns the interaction between young and old family members. Quantitative studies that focus on this dimension include Jaimovich et al. (2013), who aim to explain age differences in the volatility of labor supply, and Kaplan (2012), who quantifies the role of the option of moving in and out of the parental home as an insurance mechanism for young workers. Building on this work, Dyrda et al. (2016) develop a business cycle model that allows for the option of young people moving in with their parents. They find that living arrangements matter a lot for labor supply elasticities: the elasticity is three times larger for young people who live with their parents compared to those who live alone. Accounting for household formation also implies that the aggregate labor supply elasticity is much larger than the microelasticity for stable households.

2.5 Changing Families and Aggregate Savings

In addition to providing a theory of labor supply, the representative household that populates baseline macroeconomic models also provides a theory of savings. In this section, we argue that models that go beyond representative households by explicitly modeling families have important implications for the determination of savings in the macroeconomy.

There are a few different channels through which families matter for savings; they relate to the life cycle savings motive and the precautionary savings motive. First, changes in the size of the household over time (eg, through marriage, divorce, and having children) imply that consumption needs vary over the life cycle, which is reflected in the optimal level of saving. Second, the precautionary savings motive also plays an important role in macroeconomic models (at least since Aiyagari, 1994). The strength of the precautionary motive depends on the insurance mechanisms people have access to. Similar to our analysis of labor supply above, we will argue that insurance within the family plays

[ab] Some evidence in this direction is provided by Blau and Kahn (2007), who show that married women's labor supply has become less responsive to their husbands' wages since the 1980s.

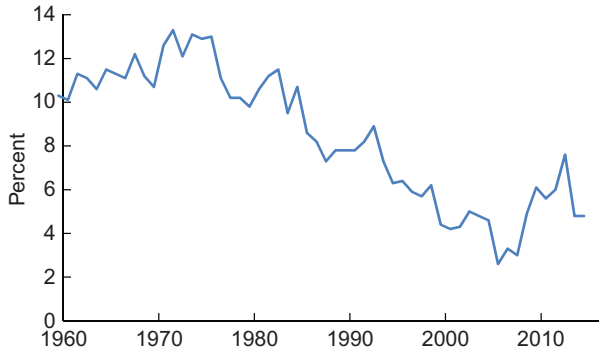

Fig. 15 Personal savings rate, United States. *Bureau of Economic Analysis, retrieved from FRED, St. Louis Fed.*

an important role in the sharing of income risk and hence in the determination of savings. Third, not only do families affect the sharing of existing sources of risk, but accounting for families also introduces new sources of risk. Getting married and having children can lead to (sometimes large) additional expenses, and to the extent that people face uncertainty over marriage and fertility, this should affect their precautionary savings. Equally important is the probability that a family dissolves: divorce is common and in many cases represents a sizeable financial risk.

The large shifts in fertility, marriage, and divorce over the last few decades suggest that the family determinants of savings may have been responsible for some of the changes in aggregate savings behavior over time. In particular, in the United States the personal savings rate has declined steadily from more than 10% in the late 1970s to less than 5% in the mid-2000s (see Fig. 15). Various explanations have been proposed for this change, although no single explanation is widely accepted (see Guidolin and Jeunesse, 2007 for an overview and discussion). In this section, we examine the possibility that changes at the family level may have played a role.

As far as the life cycle savings motive is concerned, there is a substantial literature within macroeconomics that accounts for the life cycle using a unitary model of the household, ie, without making an explicit distinction between the interests of different household members. Life cycle models were first introduced to modern business cycle research by Attanasio and Browning (1995) and Ríos-Rull (1996). In such models, the varying consumption needs due to changes in family composition over the life cycle can be incorporated through consumption equivalence scales.[ac] There is a small literature that uses life cycle models to quantify the impact of population aging on savings (Miles, 1999; Ríos-Rull, 2001). Depending on future population growth, these effects on the

[ac] See, for example, Fernández-Villaverde and Krueger (2007) and Fernández-Villaverde and Krueger (2011).

savings rate can be large, although they generally occur too slowly to explain much of the rapid decline in the savings rate in recent decades.

Given that there is already a sizeable literature on the life-cycle motive for saving, our discussion here is focused primarily on the implications of marriage and divorce for aggregate savings, a topic on which relatively few papers exist.

2.5.1 Savings and Divorce

In the models discussed in Section 2.4, we examined differences in the behavior of single and married households, while taking the existence of these different types of households as given. In reality, most adults start out as singles, marry at some point in their life, and many return to being single, eg, due to divorce. We now consider the implications for savings of the possibility of divorce. We start by taking marital bargaining power as given and by modeling divorce as an exogenous shock; endogenous bargaining and endogenous divorce will be considered below.

We consider a married couple whose life extends over two periods. The couple is married in the first period, and in the second period the union continues with probability $1-\pi$, whereas with probability π a divorce occurs. The divorce regime is that in the case of a divorce the wife retains fraction κ_f of assets, and the husbands receives $\kappa_m = 1 - \kappa_f$.

We focus on implications for savings and take as given that both spouses work in both periods.[ad] Let a' denote savings. The couple bargains cooperatively with bargaining weights given by λ_f and $\lambda_m = 1 - \lambda_f$. The couple's decision problem in the first period can be formulated as follows:

$$\max_{c_f, c_m, a'} \{\lambda_f \log(c_f) + \lambda_m \log(c_m) + \beta[\lambda_f(\pi V_f^D(a') + (1-\pi) V_f(a')) + \lambda_m(\pi V_m^D(a') + (1-\pi) V_m(a'))]\}$$

subject to the budget constraint:

$$c_f + c_m + a' = w_f + w_m.$$

Here $V_g(a')$ is the second period value function for spouse $g \in \{f,m\}$ if the union continues, and $V_g^D(a')$ is the value function in the case of divorce.

In the case of divorce, in the second period each spouse simply consumes earnings and savings, which earn interest at rate r. We therefore have:

$$V_g^D(a') = \log(w_g' + (1+r)\kappa_g a').$$

[ad] Clearly, the possibility of divorce also affects the incentive to work, in part by altering the marginal utility of wealth, and in more complex environments also through the accumulation of individual-specific labor market experience.

In contrast, if the marriage continues, consumption shares are given by bargaining weights:

$$V_g(a') = \log\left(\lambda_g\left(w'_f + w'_m + (1+r)a'\right)\right).$$

We can now consider the savings problem in the first period. The first-order condition for a' is given by:

$$\begin{aligned}\frac{1}{w_f + w_m - a'} = \beta\pi\left[\frac{\lambda_f(1+r)\kappa_f}{w'_f + (1+r)\kappa_f a'} + \frac{\lambda_m(1+r)\kappa_m}{w'_m + (1+r)\kappa_m a'}\right] \\ + \beta(1-\pi)\frac{1+r}{w'_f + w'_m + (1+r)a'}.\end{aligned} \tag{6}$$

The optimal savings in the case of no divorce risk ($\pi = 0$) are:

$$\tilde{a} = \frac{\beta(1+r)(w_f + w_m) - w'_f - w'_m}{(1+\beta)(1+r)}.$$

Now consider the case $\pi > 0$. The optimal savings will be unchanged at $\tilde{a}$ if the following condition is satisfied:

$$\frac{w'_g + (1+r)\kappa_g\tilde{a}}{\lambda_g} = w'_f + w'_m + (1+r)\tilde{a}$$

for $g \in \{f, m\}$, or:

$$\begin{aligned}\kappa_f = \widetilde{\kappa} f \equiv \frac{-\lambda_m w'_f + \lambda_f w'_m + \lambda_f(1+r)\tilde{a}}{(1+r)\tilde{a}}, \\ \kappa_m = \widetilde{\kappa} m \equiv \frac{\lambda_m w'_f - \lambda_f w'_m + \lambda_m(1+r)\tilde{a}}{(1+r)\tilde{a}},\end{aligned}$$

where we have $\widetilde{\kappa}_f + \widetilde{\kappa}_m = 1$ as required. Intuitively, this specific divorce regime recreates the same consumption allocation that would have been obtained had the marriage continued, and hence savings incentives are unchanged. What happens when κ_f does not equal $\widetilde{\kappa}_f$ depends on relative female and male bargaining power. The derivative of the right-hand side of (6) with respect to κ_f is given by:

$$\beta\pi(1+r)\left(\frac{\lambda_f w'_f}{\left(w'_f + (1+r)\kappa_f a'\right)^2} - \frac{\lambda_m w'_m}{\left(w'_m + (1+r)\kappa_m a'\right)^2}\right)$$

Evaluating this expression at $a' = \tilde{a}$, $\kappa_f = \widetilde{\kappa}_f$, and $\kappa_m = \widetilde{\kappa}_m$ gives:

$$\frac{\beta\pi(1+r)}{\left(w'_f + w'_m + (1+r)\tilde{a}\right)^2}\left(\frac{w'_f}{\lambda_f} - \frac{w'_m}{\lambda_m}\right).$$

Hence, the derivative is positive if $w'_f/\lambda_f > w'_m/\lambda_m$, which is equivalent to $\widetilde{\kappa}_f < \lambda_f$. A positive derivative, in turn, implies that when $\kappa_f > \widetilde{\kappa}_f$, the optimal savings a' satisfy

$a' > \tilde{a}$, ie, the presence of divorce risk increases savings. More generally, divorce risk increases savings if for the spouse who is made worse off by divorce the asset share in divorce exceeds the relative bargaining power in marriage. Intuitively, under this condition increasing savings lowers the additional inequality across spouses brought about by divorce, which generates a precautionary demand for savings.[ae] If the couple starts out with equal bargaining power and there is an equal division divorce regime $\lambda_f = \lambda_m = \kappa_f = \kappa_m = 0.5$, the possibility of divorce always leads to precautionary savings, except in the knife edge case where the divorce regime that exactly reproduces the married allocation. The intuition is the same as for the usual motive for precautionary savings with preferences that display prudence. Under divorce, one spouse ends up with less consumption and the other one with more consumption compared to the married state. Due to the curvature in utility, the outcome of the less fortunate spouse receives higher weight when savings are determined in the first period, leading to an increase in precautionary savings.

We derived these results under the assumption that the divorce leaves the consumption possibilities of the couple unchanged. Realistically, there are also direct costs of divorce and forgone returns to scale from having a joint household. Hence, the possibility of divorce would also induce a negative income effect, which further increases desired savings.

To summarize the results, the effect of divorce risk on savings depends on the divorce regime (ie, the property division rule in divorce) and also on the relative bargaining power of the spouses. In practice, the most common divorce regimes in the data are the title-based regime and the equitable distribution regime.[af] Under the title-based regime, each spouse gets to keep the marital assets that are already in her or his name; ie, real estate goes to the owner listed in the title, bank accounts go to the account owner, and so on. Under the equitable distribution regime, judges have discretion in dividing assets in divorce. Often an equal division of marital assets is a starting point, but judges can make allowances for different needs (eg, the spouse with custody for children may receive more assets). When men are the main breadwinners and also hold title to major assets such as real estate, cars, and bank accounts, we would expect divorce under the title-based regime to lead to a precautionary demand for savings, because the wife is likely to be worse off in divorce compared to marriage. However, the precautionary demand only arises if the wife is able to save in her own name, because otherwise she would not be able to increase her outcome in divorce. Predictions are more ambiguous under the equitable distribution regime, because in this regime the wife may obtain more consumption in divorce compared to marriage. Comparing across regimes for a given divorce rate, as long as equitable distribution is more advantageous for the spouse with less power than the title-based system (as seems likely), a switch to equitable distribution (which occurred

[ae] This is a local result close to the marriage allocation.

[af] Additional possibilities include an equal division regime, and a regime where the division of assets is set through enforced prenuptial agreements.

in most US states in the 1970s) will weaken the precautionary motive and hence lead to lower savings.

What is more, individual labor earnings are likely to make up a large fraction of income in divorce. The rise in married women's earnings over time also implies that women are better able to support themselves after divorce (under either divorce regime). Hence, for a given divorce risk, the rise in married women's labor force participation and the decline in the gender pay gap are likely to have lowered the precautionary demand for savings associated with divorce over time.

2.5.2 Savings and Divorce with Endogenous Bargaining Power

The analysis so far suggests that divorce may have a substantial impact on a country's personal savings rate. Divorce is one of the largest and most common risks people face today (along with unemployment and ill health). Moreover, changes in the divorce rate, the divorce regime, and female labor force participation all affect how much precautionary saving arises from divorce risk, and thus may be in part responsible for changes in the savings rate over time.

In the preceding analysis, we introduced divorce as an exogenous shock, and the impact of divorce risk on couples' behavior was proportional to the probability with which this shock occurred. In this setting, the possibility of divorce has large effects only if the divorce rate is high. We now extend our analysis by endogenizing the divorce decision and the evolution of bargaining power within the marriage. We will see that in this extended model, the mere possibility of divorce can affect household behavior, so that large impacts on behavior can arise even if few couples divorce in equilibrium. Hence, the extension further amplifies the potential role of divorce for explaining how a country's savings rate is determined.

We consider a variant of the model above in which bargaining and divorce are endogenous. The ability of the spouses to commit to future allocations is limited by the ability to divorce, so that divorce functions as a threat point that informs bargaining during the marriage. In the first period, the couple is married and starts out with initial bargaining power λ_f and λ_m, where $\lambda_f + \lambda_m = 1$. In the second period, the couple experience marriage quality shocks ξ_f, ξ_m, which can be positive or negative. There is a unilateral divorce regime; that is, the marriage continues in the second period only if both spouses are at least as well off married compared to being divorced.

In the first period, the couple's decision problem can be written as:

$$\max\left\{\lambda_f \log(c_f) + \lambda_m \log(c_m) + \beta\left[\lambda_f E(V_f(a', \xi_f, \xi_m)) + \lambda_m E(V_m(a', \xi_f, \xi_m))\right]\right\},$$

subject to the budget constraint:

$$c_f + c_m + a' = w_f + w_m.$$

Here $V_g(a', \xi_f, \xi_m))$ is the expected utility of spouse g in the second period as a function of the state variables a', ξ_f, and ξ_m.

In the second period, the decision problem of the couple is constrained by the possibility of divorce. If a divorce takes place, existing property is divided with share κ_f for the wife and $\kappa_m = 1 - \kappa_f$ for the husband. Utilities conditional on divorce are therefore given by:

$$V_g^D(a') = \log(w_g' + (1+r)\kappa_g a').$$

The full decision problem in the second period can then be written as:

$$\max_{D\in\{0,1\},\, c_f, c_m} \left\{\lambda_f \left[(1-D)\left(\log(c_f) + \xi_f\right) + DV_f^D(a')\right] + \lambda_m \left[(1-D)(\log(c_m) + \xi_m) + DV_m^D(a')\right]\right\} \tag{7}$$

subject to:

$$c_f + c_m = w_f' + w_m' + (1+r)a', \tag{8}$$

$$(1-D)\left(\log(c_f) + \xi_f\right) + DV_f^D(a') \geq V_f^D(a'), \tag{9}$$

$$(1-D)(\log(c_m) + \xi_m) + DV_m^D(a') \geq V_m^D(a'). \tag{10}$$

Here $D \in \{0,1\}$ denotes the endogenous divorce decision and c_f, c_m is the consumption allocation conditional on staying married. Clearly, by setting $D = 1$ (divorce) the constraints (9) and (10) can always be met. However, divorcing is optimal only if there is no consumption allocation that leaves both spouses at least as well off married compared to divorced.

The decision problem in the second period can be solved by first considering a spouse who ends up just indifferent between divorce and staying married. Let $\widetilde{\lambda}_g$ denote the consumption share that would make spouse g indifferent between these options, for a given ξ_g. The indifference condition is:

$$\log\left(\widetilde{\lambda}_g\left(w_f' + w_m' + (1+r)a'\right)\right) + \xi_g = \log\left(w_g' + (1+r)\kappa_g a'\right),$$

which can be solved to give:

$$\widetilde{\lambda}_g = \frac{w_g' + (1+r)\kappa_g a'}{\exp\left(\xi_g\right)\left(w_f' + w_m' + (1+r)a'\right)}.$$

The second period outcome can now be determined by comparing the implicit bargaining weights $\widetilde{\lambda}_f$ and $\widetilde{\lambda}_m$ to the actual ex ante bargaining weights λ_f and λ_m. In particular:

Proposition 3 (Divorce and Bargaining Power in Limited Commitment Model)

The outcome of the couple's decision problem in the second period can be characterized as follows:

- *If* $\widetilde{\lambda}_f \leq \lambda_f$ *and* $\widetilde{\lambda}_m \leq \lambda_m$, *the couple stays married* ($D = 0$), *and consumption is:*

$$c_f = \lambda_f \left(w'_f + w'_m + (1+r)a' \right),$$
$$c_m = \lambda_m \left(w'_f + w'_m + (1+r)a' \right).$$

- *If* $\widetilde{\lambda}_f > \lambda_f$ *and* $\widetilde{\lambda}_f + \widetilde{\lambda}_m \leq 1$, *the couple stays married* ($D = 0$), *but the wife's consumption share is increased to satisfy her participation constraint. Consumption is:*

$$c_f = \widetilde{\lambda}_f \left(w'_f + w'_m + (1+r)a' \right),$$
$$c_m = w'_f + w'_m + (1+r)a' - c_f.$$

- *If* $\widetilde{\lambda}_m > \lambda_m$ *and* $\widetilde{\lambda}_f + \widetilde{\lambda}_m \leq 1$, *the couple stays married* ($D = 0$), *but the husband's consumption share is increased to satisfy his participation constraint. Consumption is:*

$$c_m = \widetilde{\lambda}_m \left(w'_f + w'_m + (1+r)a' \right),$$
$$c_f = w'_f + w'_m + (1+r)a' - c_m.$$

- *If* $\widetilde{\lambda}_f + \widetilde{\lambda}_m > 1$, *the couple divorces* ($D = 1$), *and consumption is:*

$$c_f = w'_f + (1+r)\kappa_f a',$$
$$c_m = w'_m + (1+r)\kappa_m a'.$$

The implications of the possibility of divorce for savings are similar to those of the exogenous-divorce model above, but savings are affected already when one of the spouses' participation constraints is binding, even if the marriage continues.

Fig. 16 presents a computed example to show how the trend toward higher labor market participation of married women would affect divorce and the savings rate in the model with endogenous bargaining and divorce.[ag] Male earnings are normalized to $w_m = 1$, and the equilibrium savings rate and divorce rate are shown for female earnings varying from $w_f = 0.1$ to $w_f = 0.8$. The divorce regime is unilateral divorce with an equal division of marital assets upon divorce. Given that total earnings are constant and the interest rate equals the inverse of the discount factor, if there was no possibility of divorce, the savings rate would be equal to zero regardless of female earnings. Hence, any positive savings are due to the precautionary motive generated by the possibility of divorce.

[ag] The parameter values used are $\lambda_f = 0.4$, $\lambda_m = 0.6$, $r = 0.05$, and $\beta = 1/(1+r)$. The divorce regime features equal division of assets, $\kappa_f = \kappa_m = 0.5$, and the marriage quality shocks ξ_f and ξ_m are uniformly distributed on the interval $[-0.2, 1]$ and are independent across the spouses.

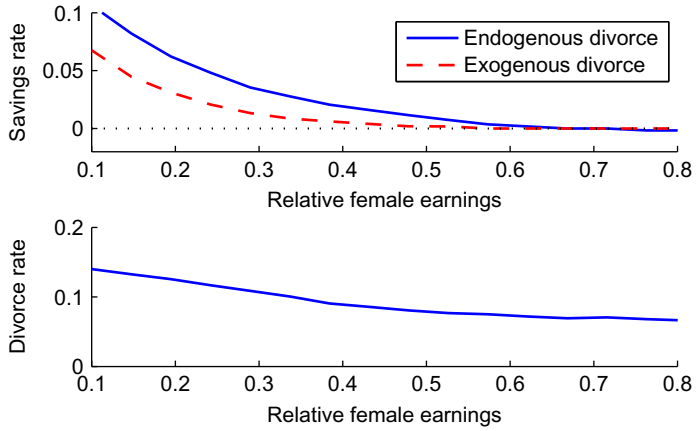

Fig. 16 Savings rate and divorce rate as a function of relative female earnings.

With endogenous bargaining and divorce, we see that the savings rate and divorce rate are both positive, and sharply decreasing in relative female earnings. Once female earnings are above 60% of male earnings, the savings rate approaches zero (the value that would be obtained without the possibility of divorce). The intuition for these findings is that for low female earnings, divorce leaves women much worse off compared to marriage. The equal division of assets only provides limited insurance, because most of the second period income of the couple is due to the husband's earnings. Thus, the possibility of divorce leads to a precautionary demand for savings primarily to insure women against the possibility of divorce. Own earnings provide an alternative route of insurance and also increase the overall share of income that women can claim in divorce. Hence, as earnings rise, precautionary savings are much reduced and ultimately disappear.

The picture also displays the savings rate in the exogenous divorce model when the equilibrium divorce rate (displayed in the lower panel) is fed as an exogenous variable into the model of the previous section (ie, the exogenous divorce rate varies together with female earnings). The exogenous divorce model generates qualitatively similar findings, but the impact on savings is much smaller in size. In the exogenous divorce model, as long as the couple stays married, bargaining power stays at the initial value. In contrast, in the endogenous divorce model, there are couples where, say, the husband is at the participation constraint (the realization of ξ_m is low), so that the wife has to offer additional compensation to the husband for the husband to stay. This need to compensate the other spouse generates an additional need for precautionary savings. Hence, the endogenous divorce model generally leads to a larger impact on the savings rate and can generate a feedback from the possibility of divorce on aggregate variables even if the realized divorce rate is low.

2.5.3 Additional Notes on Related Literature

There are only a few papers that use models of the type outlined here to address macroeconomic questions. Dynamic models of marriage under limited commitment with the possibility of divorce have been introduced by Mazzocco (2007), Mazzocco et al. (2013), and Voena (2015). In these models, the shifts in bargaining power that are necessary when one of the spouses' participation constraint is binding have persistent effects on the marital allocation. By specifically addressing how divorce law affects incentives for saving, Voena (2015) is the closest to the questions addressed here. Voena finds (using an estimated structural model) that the introduction of unilateral divorce (in states with an equal division of property) leads to higher savings and lower female employment. Intuitively, the introduction of unilateral divorce removes spouses' veto power in the divorce decision, which reduces risk sharing and increases precautionary savings. To our knowledge, there are no studies that analyze how the possibility of divorce (in a given divorce regime) affects the private savings rate (and other aggregate variables) in light of other observed changes to the family, such as the rise in female labor force participation and relative female earnings and the decline in fertility.

An early study that considers the role of divorce as an exogenous shock is Cubeddu and Ríos-Rull (2003). They assess the potential role of divorce for asset accumulation by comparing counterfactuals that differ in when (or if) people marry and divorce, and in how costly divorce is. Unlike in the model outlined above, consumption within marriage is constrained to be equal across spouses. They find that the impact of marriage and divorce can be large in their setting, but they do not directly relate this finding to observed changes in macro variables.[ah]

Love (2010) documents empirically (and analyzes in a quantitative model) how asset allocations change with marital-status transitions. As in Cubeddu and Ríos-Rull (2003) and Hong and Rios-Rull (2012), changes in marital status are modeled as exogenous shocks, and there is only public consumption in marriage. The theoretical model predicts that portfolio shares (ie, the fraction of wealth invested in stocks vs bonds) should react sharply to fertility, marriage, and divorce. Empirical results based on the Health and Retirement Study and the Panel Study on Income Dynamics are supportive of some of the predictions of the model, although not for all groups of households.

Fernández and Wong (2014a,b) use a quantitative life cycle model with exogenous divorce to study the importance of the likelihood of divorce for explaining the rise in female labor force participation from the 1960s to the 1990s. They argue that the increase in divorce risk accounts for a substantial fraction of the increase in female labor force participation. The main reason for this finding is that women (who often have lower wages

[ah] A similar framework is used by Hong and Rios-Rull (2012) in a setting that also accounts for the arrival of children, stochastic survival, and bequest motives, and uses information on life insurance holdings to infer how the utilities of different household members interact.

than their husbands and need to provide for their children) face lower consumption possibilities after a divorce, which increases desired savings. One way of increasing savings is to work more during marriage, which raises the total resources of the household and facilitates the smoothing of consumption between the married and divorced states. In Fernández and Wong (2014c) this analysis is extended to a setting with endogenous divorce.

In addition to increasing savings and increasing labor supply, another insurance mechanism that is likely to be relevant in the data is education. In Guvenen and Rendall (2015), women acquire education in part as insurance against a bad marriage. Guvenen and Rendall argue that the introduction of unilateral divorce increases this insurance motive, accounting for a sizeable fraction of the increase in female education and helping rationalize the observation that women now obtain more higher education than do men.[ai]

2.6 Private Information in the Household

Throughout Section 2, we have used a number of different approaches for modeling husband–wife interactions. We now step back from the applied questions to discuss the relative advantages of different models of the family and their uses within macroeconomics. The pioneering work of Gary Becker was largely based on the so-called unitary model of the family. A unitary model distinguishes between, say, male and female labor supply, but does so in the context of a single household utility function rather than allowing for separate preferences for each spouse. This approach is also how the family was first introduced into macroeconomics in the literature on home production and the business cycle (eg, Benhabib et al., 1991; Greenwood and Hercowitz, 1991). The limitation of the unitary approach is that since it does not distinguish individual utility functions, it does not allow for conflict of interest between spouses. This restricts the range of questions that can be addressed by the unitary model. Moreover, there is a sizeable literature in family economics that empirically tests the unitary model against richer alternatives that allow for bargaining, and finds strong evidence against the unitary model.[aj]

To go beyond the unitary model, one needs to start with women and men (characterized by separate utility functions) as primitives and then analyze how they act either together as couples or as singles. Within couples, one has to specify some form of bargaining process that determines how the couple resolves the conflict of interest between the spouses. Two broad classes of bargaining models that can be used for this purpose are

[ai] Another perspective on higher premarital investments by women is provided by Iyigun and Walsh (2007a), who focus on the impact of investments both on sorting of spouses and on bargaining power within marriage (see also Iyigun and Walsh, 2007b; Chiappori et al., 2009).

[aj] See Alderman et al. (1995) for an early summary of the evidence, and Attanasio and Lechene (2002) for an influential contribution based on Progresa data from Mexico.

noncooperative bargaining models (where the interaction between the spouses is modeled as a noncooperative game, using standard game theory tools) and cooperative bargaining models (where the spouses are able to achieve an outcome that is at least statically efficient). A common argument in favor of cooperative bargaining is that marriage is usually a sustained long-term relationship, which suggests that the spouses should be able to avoid major inefficiencies. However, while the majority of recent work in family economics uses a cooperative approach, other authors provide evidence in favor of inefficient bargaining outcomes within the family,[ak] and noncooperative models have been used by Lundberg and Pollak (1994), Konrad and Lommerud (1995), and Doepke and Tertilt (2014), among others.

Within the literature on cooperative bargaining in the family, many papers use explicit bargaining models such as Nash bargaining subject to divorce as the outside option.[al] Another popular approach, introduced by Chiappori (1988; 1992), is to only impose that the couple reaches a statically efficient outcome, but to remain agnostic about the details of the bargaining process. Empirical implementations of this approach often allow bargaining power to be a function of observables (called "distribution factors") such as the relative education or the relative age of the spouses, without specifying the mechanism through which these variables matter.[am] The advantage of this approach, labeled the "collective model," is its generality, because all (static) efficient allocations can be characterized in this way. The labor supply model employed in Section 2.4 is an example of a collective model (albeit with fixed bargaining power).

The collective approach is less suitable for dynamic contexts, because it does not provide an explicit theory for how bargaining within a couple evolves. This would perhaps not matter much if bargaining weights were constant over time, which would also imply ex-ante efficiency, ie, full insurance in the household. Yet there is plenty of empirical evidence of limited risk sharing in couples. For example, based on data from Kenya, Robinson (2012) documents that private expenditures increase in own labor income. Duflo and Udry (2004) use data from the Ivory Coast to show that the composition of household expenditure is sensitive to the gender of the recipient of a rainfall shock that affects male and female income differentially. The evidence is not exclusive to developing countries. Cesarini et al. (2015) document a larger fall in labor earnings after winning a lottery for the winners relative to their spouses in Sweden. One could rationalize such findings in a collective model where the bargaining weights move due to shifts in relative income, wages, or lottery winnings. However, this approach has the downside of

[ak] See, eg, Udry (1996), Duflo and Udry (2004), and Goldstein and Udry (2008).

[al] The classic papers are Manser and Brown (1980) and McElroy and Horney (1981). Another classic is the "separate spheres" bargaining model of Lundberg and Pollak (1993), which is an interesting hybrid between a cooperative and a noncooperative model.

[am] See, for example, Attanasio and Lechene (2014).

violating ex-ante efficiency without being explicit about the underlying bargaining friction. Moreover, the approach precludes transitions to a (presumably) noncooperative state such as divorce, which is an important limitation given that divorce is commonplace (see Fig. 6).

A more fruitful avenue in our view is to take a stand on the friction that prevents couples from achieving full insurance and model it explicitly. One obvious friction is limited commitment. Since spouses usually have the option to walk away from each other (ie, divorce or separation), at any point in time each spouse should get at least as much utility as his or her outside option. This is what we alluded to at the end of Section 2.4 and modeled more explicitly in the endogenous bargaining model of Section 2.5. A limited literature on dynamic household decisions pursues this avenue.[an] A model based on limited commitment will lead to endogenous shifts in bargaining power over time, namely whenever the commitment constraint becomes binding. When divorce is the outside option, limited commitment implies shifts in bargaining power only when a couple is close to divorce. An alternative is to consider an outside option of noncooperation within marriage as in Lundberg and Pollak (1993). Doepke and Kindermann (2015) is a recent example of a dynamic bargaining model with such an outside option. Such limited commitment models are consistent with the empirical evidence on continuously shifting bargaining power within couples provided by Lise and Yamada (2015).

An alternative friction that so far has received much less attention is private information within the household. Before showing how this friction can be modeled, let us discuss some indications that private information may indeed be relevant for bargaining between spouses. There are many things that spouses may not precisely know about each other, such as income, assets, consumption, work effort, or preferences. Contrary to the belief that love and altruism will lead to perfect information sharing between spouses, the evidence suggests otherwise. The most obvious example may be that people do not typically tell their partner when they are having an extramarital affair. Relatedly, some people do not disclose that they have HIV or other sexually transmitted diseases to their partner. Women sometimes hide from their partners that they are using birth control (or, depending on the context, that they are not using birth control).[ao] More directly related to the context of this chapter is that people do not always disclose income, spending, and savings behavior to their spouse. de Laat (2014) shows that husbands in split-migrant couples in Kenya invest significant resources into monitoring the spending behavior of their wives. When given the option, people often prefer to put money into private (and possibly secret) accounts.[ap] Hoel (2015) finds in Kenyan data that 31% of people say their spouse was not aware of any income they had received the preceding week.

[an] See in particular Mazzocco (2007) and Voena (2015).

[ao] For example, Ashraf et al. (2014) show that women in Zambia hide the use of birth control from their husbands when given the chance.

[ap] See Anderson and Baland (2002), Ashraf (2009), and Schaner (2015).

Further, evidence from lab and field experiments suggests that information treatments affect intrahousehold allocations, suggesting that information frictions are important.[aq] Most of this evidence is from developing countries and in some dimensions (such as uncertainty about a spouse's income) couples in industrialized countries with joint checking accounts and tax filings may be less affected by information frictions. However, private information about preferences and hidden effort is likely to be equally relevant all around the world.

In sum, there is ample evidence that private information plays an important role in household bargaining. Nevertheless, hardly any work has been done on this issue in terms of explicit models of the bargaining process. We believe this is an important area for future work. While most of this chapter concerns applying family economics to macroeconomics, the issue of information frictions presents an opportunity for intellectual arbitrage in the opposite direction: while in family economics static models are still common, in macroeconomics dynamic contracting models that make the underlying frictions explicit have been widespread for many years. In particular, it should be possible to apply some of the tools to analyze informational frictions currently used in theoretical macroeconomics and public finance to issues in family economics.[ar] Some work of this kind exists in development economics (eg, Townsend, 2010; Karaivanov and Townsend, 2014; Kinnan, 2014), but the question is a different one as the degree of insurance within a village—as opposed to within a couple—is analyzed.

We currently explore how to account for information frictions in household bargaining in ongoing work (Doepke and Tertilt, 2015). As a simple example for modeling such a friction, consider a variant of the model analyzed above under private information about each spouse's labor income w_g. To simplify the exposition, we assume that there is a private income realization only in the first period, whereas there is no income in the second period, $w'_f = w'_m = 0$. Bargaining is assumed to be efficient subject to the constraints imposed by private information, with initial welfare weights λ_f and λ_m. The constrained efficient allocation can be computed as a mechanism design problem. The revelation principle can be applied and implies that we can restrict attention to truth-telling mechanisms with truth-telling constraints imposed. Hence, the spouses will simultaneously report their income w_f and w_m to each other, and consumption is given by functions $c_g(w_f, w_m)$ and $c'_g(w_f, w_m)$, which depend on the reports. For simplicity, we

[aq] When income is private information in dictator games, less is transferred to the partner Hoel (2015). Migrants send home less cash to family members when their choice is not revealed to the recipients (Ambler, 2015). More is spent on goods that are hard to monitor or difficult to reverse and less on household public goods when a transfer is given privately to one spouse relative to a full information transfer (Castilla and Walker, 2013).

[ar] See Atkeson and Lucas (1992) and the follow-up literature for applications of models with information frictions in macroeconomics. For a survey of the literature incorporating information frictions into public finance, see Golosov et al. (2006).

assume that each income is drawn from a finite set $w_g \in W_g$ with independent probability distributions denoted by $p(w_g)$.

With these preliminaries, the optimization problem faced by the household can be written as follows:

$$\max E \ \{\lambda_f[\log(c_f(w_f,w_m)) + \beta \log(c'_f(w_f,w_m))]. \\ + \lambda_m[\log(c_m(w_f,w_m)) + \beta \log(c'_m(w_f,w_m))]\},$$

subject to the budget constraints:

$$c_f + c_m + a' = w_f + w_m,$$
$$c'_f + c'_m = (1+r)a.$$

The maximization problem is also subject to truth-telling constraints. Consider first the wife. For each w_f and each alternative $\widetilde{w}_f \in W_f$, we impose:

$$\sum_{w_m} p(w_m)[\log(c_f(w_f,w_m)) + \beta \log(c'_f(w_f,w_g))] \\ \geq \sum_{w_m} p(w_m)[\log(c_f(\widetilde{w}_f,w_m) + w_f - \widetilde{w}_f) + \beta \log(c'_f(\widetilde{w}_f,w_m))].$$

Similarly, for the husband we have:

$$\sum_{w_f} p(w_f)\left[\log(c_m(w_f,w_m)) + \beta \log(c'_m(w_f,w_g))\right] \\ \geq \sum_{w_f} p(w_f)\left[\log(c_m(w_f,\widetilde{w}_m) + w_m - \widetilde{w}_m) + \beta \log(c'_m(w_m,\widetilde{w}_m))\right].$$

A direct implication of this model is that consumption is more responsive to a change in own income than to a change in the spouse's income. The reason is that incentives need to be provided to tell the truth about own income shocks. Other frictions (such as unobservable effort or unobservable preference shocks) can be modeled along similar lines.

Models of bargaining with limited commitment frictions and private information frictions have distinct implications for how consumption and leisure depend on bargaining power. Consider, for example, a limited commitment model where the outside option responds to income shocks. In such a setting, a positive income shock for a given spouse increases this spouse's bargaining weight, which (all else equal) tends to increase leisure and lower labor supply. In contrast, in a hidden effort model it is costly to distort the effort of a productive spouse; hence, a more productive spouse may be provided more incentives to work and end up working more. This example shows that the underlying friction matters for how household bargaining reacts to family trends such as the increase in women's labor market attachment. We believe that further work on incorporating methods for dealing with dynamic contracting frictions into family economics will be productive for improving our understanding of these issues.

3. THE FAMILY AND ECONOMIC GROWTH

The most fundamental questions in macroeconomics concern economic growth. As Robert Lucas put it, once one starts to think about the determinants of cross-country income differences and policies that may allow poor countries to catch up with rich ones, "it is hard to think about anything else" (Lucas, 1988, p. 5).

Early theorizing on the sources of economic growth was focused on firms rather than families. The Solow model, for example, puts investment in physical capital by the business sector into the spotlight, coupled with exogenous improvements in productivity. To be sure, even in a model driven by capital accumulation families matter for growth; after all, investment has to be financed by savings, and savings are determined within the family. Both husband-wife and parent-child interactions are relevant for savings. First, as already shown in Section 2.5, a couple's savings rate responds to the possibility of divorce. More generally, if husbands and wives disagree about the consumption-savings trade-off (eg, because they differ in their degree of patience), then how spouses negotiate affects the savings rate. Second, a large part of long-run wealth accumulation is due to bequests, for which interactions between parents and children are crucial.

Family decisions have become even more central to growth theory with more recent developments that emphasize the importance of human capital accumulation and endogenous population growth. The importance of human capital accumulation for growth has been well recognized since the work of Lucas (1988). To fix ideas, consider a simple endogenous growth model based on accumulation of human capital H and physical capital K. Final output is produced using physical capital and effective units of labor as inputs. Effective units of labor depend both on time spent working u and the stock of human capital. Assuming a simple Cobb–Douglas production function, output is:

$$Y = K^{\alpha}(uH)^{1-\alpha}.$$

Human capital is accumulated by spending time studying. The higher the level of human capital and the more time spent in school $(1-u)$, the higher is tomorrow's human capital,

$$H' = B(1-u)H, \tag{11}$$

where B is a technology parameter. In the simplest model, the fraction of time spent in school is given exogenously. Then, the growth rate of output in the balanced growth path is simply $B(1-u)$. Growth thus depends not only on technology but also on the time spent in school.

So far we have taken u to be an exogenous parameter. But clearly the time spent on education is a choice. Who makes the choice? A large part of education happens during childhood and hence, leaving mandatory schooling laws aside, it is parents who make

education decisions for their children. In other words, education is a family decision. Note also that the formulation of the human capital production function above assumes past human capital enters into next period's human capital. Intuitively, the initial human capital stock of a new member in society is proportional to the level already attained by older members of the family. As Lucas put it, "human capital accumulation is a social activity, involving groups of people in a way that has no counterpart in the accumulation of physical capital" (Lucas, 1988, p. 19). Much of the time, the group in which the accumulation happens is the family, where children learn from parents both by imitating them and by being actively taught.

Understanding the human capital accumulation process is an active research area. Many open questions remain, but what is understood by now is that education and skill formation are complex processes that involve many ingredients. Inputs both in forms of time (own time, teacher time, parental time) and goods (textbooks, school buildings) are important, as is the age at which specific investments take place. For example, Jim Heckman and coauthors have emphasized the importance of early childhood education for long-run outcomes (Heckman, 2008). Citing Cunha and Heckmann (2007), "The family plays a powerful role [...] through parental investments and through choice of childhood environments." Recent research captures such links in formal models of human capital investments within families (eg, Caucutt and Lochner, 2012; Aizer and Cunha, 2012). Del Boca et al. (2014) find that both paternal and maternal time input are essential inputs into child development.

So far, we have motivated the importance of families for growth based on the intuitive argument that human capital and savings decisions are made in the family. An equally compelling argument for the importance of families can be made on the basis of empirical findings. As we will document in the next section, cross-country data show strong correlations between development indicators such as GDP per capita and measures of family structure. While such findings constitute no proof of causality, they suggest a close link between family structure and development. After documenting these facts, we will show in a sequence of simple growth models how modeling increasingly complex family interactions can affect economic growth in an economy. While the most straightforward link from families to growth concerns fertility decisions, we emphasize that there are many dimensions to families, their role in producing new people being only one of them. Families typically consist of many family members (husband, wife, sons, daughters), who may differ in preferences and skills. When preferences differ, the exact nature of the decision process in the family becomes important. When skills differ, ie, when men and women are not perfect substitutes in production, then the details of how they enter differently into the human capital and goods production functions will also matter for growth. Further, families may have different attitudes toward sons and daughters, affecting human capital investment, and institutions such as polygyny may also affect incentives for investing in human and physical capital.

3.1 Cross-Country Family Facts

In this section, we report strong correlations between indicators of economic development and measures of family structure. Perhaps the most well-known example is the close link between the fertility rate and development. Fig. 17 displays a strong negative relationship between the total fertility rate and GDP per capita across countries.[as] Fertility, in turn, is strongly negatively correlated with measures of schooling (Fig. 18).

Many other measures of family structure are related to development as well. Fig. 19 displays the fraction of teenage girls (15–19 years) that has ever been married. The figure reveals a striking negative relationship between GDP per capita and early marriage. In poor countries, such as Ghana and Malawi, almost 50% of 15–19 year old girls are

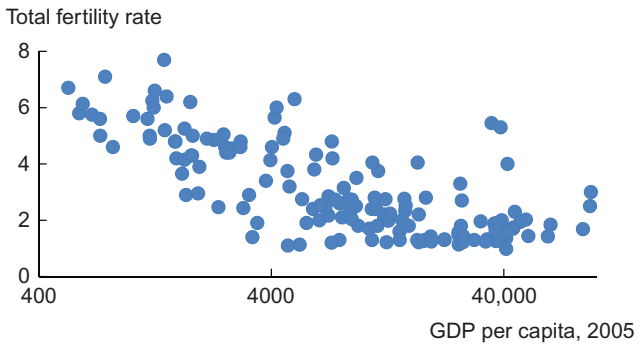

Fig. 17 TFR and GDP per capita across countries. *GID 2006 and World Development Indicators 2005.*

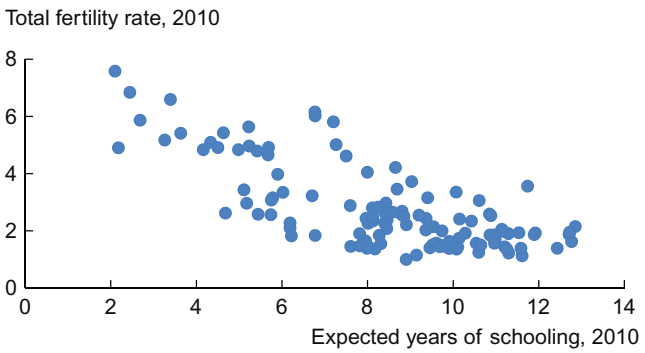

Fig. 18 Schooling and TFR across countries. *World Development Indicators.*

[as] A similar relationship can be observed over time within countries: in most cases, the demographic transition took place during times of rapid economic growth. For the United States, the decline in children ever born by birth cohort of mothers is shown in Fig. 1.

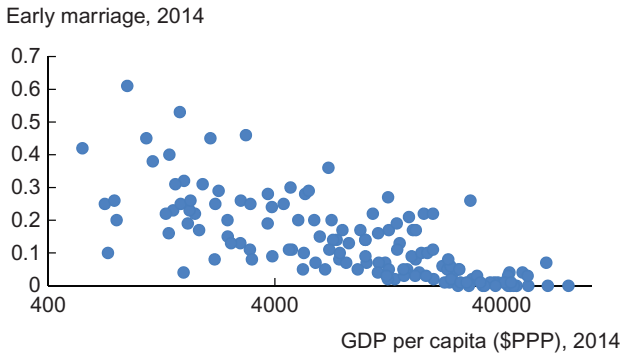

Fig. 19 Early marriage and GDP per capita across countries. *OECD Gender Statistics 2014 and World Development Indicators.*

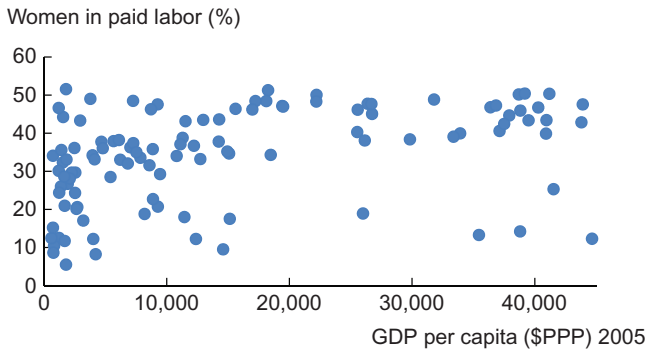

Fig. 20 Women in paid labor and GDP per capita across countries. *OECD Gender Statistics 2006 and World Development Indicators.*

married, compared to less than 5% in countries with a GDP per capita of more than $25,000 (in 2005 PPP terms). Fig. 20 plots the relationship between female labor force participation and GDP per capita. Since rates of formal employment are low for women and men alike in many poor countries, rather than plotting the absolute participation rate, Fig. 20 depicts the fraction of formal employment accounted for by women. In virtually all countries with a GDP per capita higher than $20,000, women make up 40% or more percent of the paid labor force, while in many poor countries women account for less than 20%.[at]

The figures discussed so far were chosen to highlight a few particularly interesting and pronounced relationships between family structure and development. Yet, essentially all indicators of family structure are related to development, including both measures of outcomes and measures of legal differences between men and women. Table 3 gives

[at] The few rich countries with low female labor force participation are oil-rich countries such as Saudi Arabia and the United Arab Emirates.

correlations of family variables with two measures of economic development, GDP per capita and the share of the agricultural sector in GDP (which is typically low in developed countries). The first three rows are about children: Fertility rates are high, child mortality is high, and schooling is low in poor countries. The next two rows show that a preference for sons is systematically related to development. First, people in poor countries are more likely to state that when resources are scarce, educating boys is more important than educating girls. Second, inheritance laws favor sons over daughters. The next three rows are about the education and work of women relative to men. Women are more likely to be illiterate than men in poor countries. They work less in the market and provide a larger burden of unpaid family care work, such as taking care of children and the elderly. The next set of indicators show that the legal position of women is negatively related to development. Women obtained access to politics (through representation in national parliaments) earlier in today's rich countries. They also have better access to land ownership and usage. There is also a tight relationship between the United Nations' Gender Empowerment Measure and GDP per capita. The last set of indicators show that the position specifically of married women is weaker in poor countries. Women in poor countries marry earlier than in rich countries and wife beating is more accepted. The legal position also favors men in poor countries: inheritance laws are more likely to favor

Table 3 Correlations between family variables and GDP per capita and share of agriculture across countries

Variable	GDP p.c.	Share agric.
Total fertility rate, GID 2006	−0.49	0.71
Child mortality rate, WDI 2014	−0.54	0.75
Average years of schooling, WDI 2003	0.76	−0.79
Son preference in education, GID 2014	−0.26	0.33
Inheritance discrimination against daughters, GID 2014	−0.24	0.45
Female literacy relative to male, GID 2006	0.37	−0.65
Percent females in paid labor force, GID 2006	0.32	−0.52
Unpaid care work by women, GID 2014	−0.37	0.43
Year first woman in parliament, UN 2004	−0.58	0.36
Women's access to land, GID 2014	−0.41	0.54
Gender empowerment measure, UN 2004	0.70	−0.60
Early marriage, GID 2014	−0.50	0.65
Agreement with wife beating, GID 2014	−0.42	0.57
Inheritance discrimination against widows, GID 2014	−0.21	0.42
Laws on domestic violence, GID 2014	−0.16	0.46

Notes: Data are from OECD gender, institutions, and development data base (GID 2006 and 2014), the world development indicators (WDI 2003, 2005, and 2014), and the UN Development Report 2004. Correlations are computed with GDP per capita and percentage of value-added in agriculture from the WDI in two different years: 2005 and 2014. See the Appendices for variable definitions and further details.

Table 4 Differences between polygynous countries and monogamous countries close to the equator

	Polygynous	Monogamous
Total fertility rate	6.8	4.6
Husband–wife age gap	6.4	2.8
Aggregate capital–output ratio	1.1	1.9
GDP per capita (dollars)	975	2798
Number of countries	28	58

Notes: Data are either from 1980 or an average for the 1960–85 time period. Details and sources are given in Tertilt (2005). Polygynous countries defined as countries with at least 10% of men in polygamous unions. Monogamous countries are all other countries within 20 degrees of latitude from the equator, to control for the fact that most polygynous countries are in sub-Saharan Africa.

widowers over widows, and laws against domestic violence (if they exist in the first place) are less strict compared to developed countries.

A family structure that has long been illegal in most developed countries but is still practiced in many poorer countries is polygyny, which is the practice of men being married to multiple wives. Table 4 shows that polygynous countries are among the poorest in the world, display extremely high fertility rates, invest little, and are characterized by large age gaps between husbands and wives.

3.2 Parents and Children

The strong empirical association between economic development and measures of family structure suggests that changes to the family are an integral part of the growth process. We now analyze a series of simple growth models to highlight a number of specific channels that tie development and families together.

We start with a simple view of the family. In this first version of the model, each family consists of a parent and a child. Parents care about children in a warm-glow fashion. Specifically, they derive utility from their children's full income.[au] Fertility is exogenous. In other words, we start with a single sex model where each parent has exactly one child. Since the children themselves will have children again, the model is an overlapping generations model. The difference to the standard OLG setup is that generations are explicitly linked through parent-child relationships.

Preferences are given by the utility function

$$u(c) + \delta u(\gamma'),$$

where c is the parent's consumption and γ' is the child's full income (as an adult in the next period). For simplicity, we assume consumption goods are produced at home with a

[au] Models with true altruism would yield qualitatively similar results, but are less tractable.

production function that uses effective units of time as the only input.[av] Let H denote the human capital of the parent and ℓ the units of time the parent devotes to production. Then consumption, or equivalently GDP (per adult), is given by:

$$c = A\ell H,$$

where A is a technology parameter. We define full income as the income that would be obtained if the parent was working full time:

$$y = AH.$$

Not all time will be devoted to production, because the parent will also spend some time educating the child. Let e denote this education time. Human capital of the child is given by the following production function:

$$H' = (Be)^{\theta} H,$$

where B and θ are technology parameters. Here θ is an especially important parameter as it captures the returns to education. Each parent is endowed with one unit of time. Thus, the parent faces the following time constraint: $\ell + e \leq 1$. Assuming log utility, we can write the objective function of the parent as follows:

$$\max \log(c) + \delta\theta \log(e).$$

The equilibrium is characterized by the optimal education choice $e^* = \dfrac{\delta\theta}{1+\delta\theta}$. The equilibrium growth rate (for both human capital and consumption) is:

$$\frac{H'}{H} = \left(B \frac{\delta\theta}{1+\delta\theta} \right)^{\theta}. \tag{12}$$

As in the simple Lucas model at the beginning of this section (Eq. 11), the human capital accumulation technology in part determines the growth rate. What is different from the Lucas model is that how much parents care about their children's well-being also enters. In contrast, in standard growth models that abstract from intergenerational links, it is the individual's discount factor that matters. There is no reason for the rate of time preference across periods for a given person to coincide with the intergenerational discount factor. A related point is that the intergenerational elasticity of substitution may differ from the intertemporal elasticity of substitution (IES). In other words, estimates of the IES in the business cycle context are not necessarily relevant for calibrating growth models based on trade-offs across generations.[aw] There is a need for empirical research in this

[av] This is isomorphic to a model with market production. The home production formulation has the advantage that we do not need notation for wages and, later, interest rates.

[aw] See Cordoba and Ripoll (2014) for a formal treatment of this point.

area, as good estimates of the intergenerational discount factor and the intergenerational elasticity of substitution are currently not available.

The model as written assumes that all families accumulate human capital independently from each other. An alternative vision of the process of human capital accumulation is that much of the increase in people's productivity over time is due to the dissemination of productive ideas, implying that exchange of knowledge between different families is crucial for growth. In a setting that makes this engine of growth explicit, de la Croix et al. (2016) examine the role of institutions that organize the exchange of knowledge for growth. They compare both family-based institutions (knowledge exchange within nuclear families or families/clans) and market-based institutions, and argue that institutions that facilitated the exchange of ideas across families were crucial for the economic ascendency of Western Europe in the centuries leading up to industrialization.

3.3 Adding Fertility Choice

Next, we enrich the model by endogenizing fertility choice. The analysis of fertility choices in explicit dynamic growth models was pioneered by Becker and Barro (1988) and Barro and Becker (1989). These papers assume an altruistic utility function (ie, the children's utility enters the parent's utility), whereas we will stick to the warm-glow motive for investing in children. This distinction makes no difference for most qualitative results and allows more closed form solutions. In contrast to Barro and Becker (1989), which features exogenous technological progress, our focus is on human capital as the engine of growth.

For simplicity (and in line with the majority of existing analyses of fertility in dynamic models), we stick with one-parent families. However, conceptually it is straightforward to consider fertility decisions in a two-parent model (see Doepke and Tertilt, 2009 for an example).[ax]

To give the parent a reason to want children, we modify the utility function as follows:

$$u(c) + \delta^n u(n) + \delta u(\gamma'),$$

where n is the number of children chosen by the parent. It takes ϕ units of time to raise a child in addition to the e units of education time devoted to each child. Note that ϕ is a fixed cost, while e is a choice variable. The time constraint is thus

[ax] Doepke and Kindermann (2015) document empirically that spouses often disagree about whether to have another child and present a bargaining model of fertility decisions to analyze the implications of this fact.

$$\ell + (\phi + e)n \leq 1.$$

We keep everything else (ie, production and human capital accumulation) as before. Assuming log utility, the objective function can be written as

$$\max \log(c) + \delta^n \log(n) + \delta\theta \log(e).$$

To guarantee that the problem is well defined, we assume $\delta^n > \delta\theta$.

The equilibrium is characterized by the following education and fertility choices:

$$e^* = \frac{\delta\theta}{\delta^n - \delta\theta}\phi,$$

$$n^* = \frac{(\delta^n - \delta\theta)}{\phi(1 + \delta^n)}.$$

The equilibrium growth rate is:

$$\frac{H'}{H} = \left(B\frac{\delta\theta\phi}{\delta^n - \delta\theta}\right)^{\theta}. \tag{13}$$

Comparing the expression for n^* and the equilibrium growth factor given in (13), it becomes apparent that many of the same features leading to high fertility, such as a low cost of children and low returns to education, also lead to a low growth rate. The negative dependence of fertility on growth was already a feature in Barro and Becker (1989), albeit in a model of exogenous growth. The importance of human capital as an engine for growth in a model with endogenous fertility was first analyzed by Becker et al. (1990). While the exact expression is different, they also derive a growth rate that depends positively on the returns to education, the fixed cost of children, and an altruism parameter.

Comparing the growth rate given in (13) with the growth rate in the model without fertility choice (12), two points emerge. First, two types of intergenerational preference parameters appear now: δ and δ^n. In other words, how much parents care about the quality vs the quantity of children is a determinant of the growth rate. Second, the return to human capital enters positively into the optimal education choice and negatively into the optimal fertility choice.

These results may help in understanding some empirical regularities, such as the negative relationship between fertility and schooling, on the one hand, and fertility and GDP per capita, on the other hand (Figs. 17 and 18). In the model, these relationships would arise if countries differ in the return to skill θ or the cost of children ϕ. Similarly, within most countries fertility decreased, while education increased over time. The model can generate this pattern if the return to education increases gradually from generation to generation. The resulting theory interprets the demographic transition to low fertility as driven by a move from investing in child quantity to emphasizing child quality (ie, education).

There is a substantial literature aiming to account for the historical relationship between fertility and growth based on this mechanism. Before the onset of industrialization in the 18th century, living standards around the world were stagnant, and fertility rates were high. In most countries, this "Malthusian" stage was followed by a transition to growing incomes and declining fertility rates. The first theory to fully account for such a transition is Galor and Weil (2000), which is based on the quantity–quality trade-off, a Malthusian constraint due to the role of land in agriculture, and human capital as an engine for growth. The role of structural change in the transition is highlighted by Hansen and Prescott (2002), who model the endogenous transition from a stagnant land-intensive technology to a capital-intensive growth technology. Population growth changes with growing incomes in their model. However, rather than explicitly modeling fertility choice, the authors assume a particular dependence of population growth on consumption. Greenwood and Seshadri (2002) introduce explicit fertility preferences when analyzing a similar transition from an agricultural to a manufacturing society. Doepke (2004) also models fertility preferences explicitly to analyze the importance of education and child labor policies for the transition from stagnation to growth. Some authors argue that the transition was triggered by declines in mortality, which increased the incentive to educate children. Soares (2005) provides a model where gains in life expectancy lead to reductions in fertility and increases in human capital accumulation, leading to an endogenous transition from a Malthusian to a long-run growth equilibrium.[ay] However, Hazan and Zoabi (2006) show that the impact of increasing longevity on human capital investment is mitigated by the fact that higher longevity also raises the incentive to have more children, which works against human capital investment through the quantity–quality trade-off.

One could also use variants of this setup to understand cross-country fertility differences today. For example, Manuelli and Seshadri (2009) study international fertility differences using a life-cycle version of the Barro–Becker model with human and health capital. They find that differences in productivity, social security, and taxes can go a long way in explaining the observed differences.

The empirical regularities that characterize differences across countries are also visible across families. There is a sizeable empirical literature documenting that in the cross section of families in a given country, quantity and quality of children are negatively related.[az] An augmented version of the model with heterogeneity across families in δ^n (or, similarly, δ) would deliver this empirical regularity. The overall economy-wide

[ay] The importance of changes in mortality for development is also analyzed in Cervellati and Sunde (2005).

[az] See, for example, Rosenzweig and Wolpin (1980) and Bleakley and Lange (2009). Vogl (2016) argues that the negative relationship of quantity and quality may be a relatively recent phenomenon. He documents that in many developing countries there was a reversal in the education-fertility relationship from positive to negative. Baudin et al. (2015) provide an analysis that also allows for the possibility of childlessness, and argue that childlessness is U-shaped as economies develop.

growth rate would then depend on how many parents of each type exist, and also on whether such preferences are passed on from parents to children or randomly distributed in the population.[ba] de la Croix and Doepke (2003) explore the association between inequality and growth based on the differential fertility channel and argue that it explains a large part of the observed relationship between inequality and growth across countries.[bb]

3.3.1 Fertility Restrictions

The link between fertility and human capital accumulation suggests that countries may be able to speed up economic development by limiting fertility rates. Out of the many policies that can affect a country's fertility rate, the most direct is a hard limit on how many children a couple can have. Several countries have implemented such fertility restrictions, the most famous example of which is the one-child policy of China. Another examples are forced sterilization policies implemented by the Indian government in the 1980s. Other countries have used more subtle family planning policies, either through monetary incentive schemes or in the form of media campaigns, often advocating a two-child norm.

We can incorporate such policies into the model by adding a fertility limit $\bar{n}$. Whenever the constraint is binding, the optimal education decision is:

$$e^* = \frac{\delta\theta[\frac{1}{\bar{n}} - \phi]}{1 + \delta\theta}.$$

Education increases with a tighter fertility restriction. Thus, fertility restrictions do speed up economic growth in our model. Yet, they are not the panacea one might have hoped for, as fertility restrictions also come with a cost. Fig. 21 illustrates these effects in a computed example of our model.[bc] The top panels show how fertility and education change with different levels of fertility restrictions, while the bottom panels depict the growth rate and steady state utility as a function of the restrictions. The optimal (unrestricted) fertility rate in the example is 3. Thus, only restrictions below 3 are binding. Tighter restrictions lead to higher levels of education and higher growth rates, but they lower equilibrium utility. In our simple model, this negative effect on utility comes from parents being deprived of (part of) the enjoyment they

[ba] Thus, whether differential fertility increases or decreases the growth rate depends on many factors. See Vogl (2016) for an analysis of this point. The specific role of preference transmission in the context of the British Industrial Revolution is analyzed by Doepke and Zilibotti (2008).

[bb] de la Croix and Doepke (2004, 2009) analyze the importance of this mechanism in the context of education policies.

[bc] The parameters in the example are: $\delta^n = 0.8$, $\delta = 0.5$, $\phi = 0.1$, $B = 1$, $\theta = 0.5$, $A = 10$. The initial level of human capital is normalized at $H = 1$ and the fertility restriction ranges from 1 to 5.

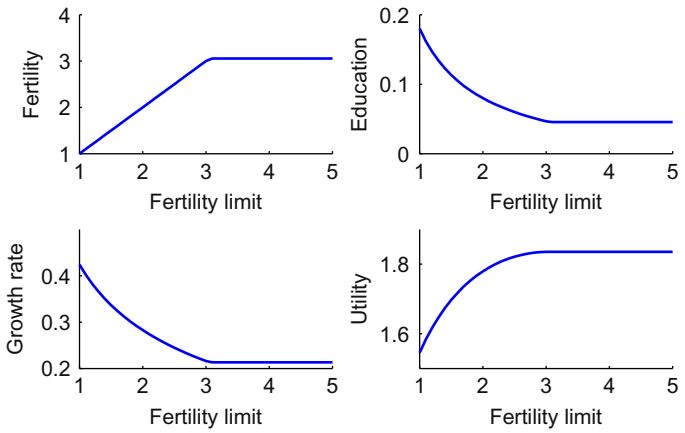

Fig. 21 Fertility restrictions.

obtain from children.[bd] In more elaborate settings, such negative effects can also arise from the differential effect of the fertility constraint on a heterogeneous population. Also, with a public social security system, lower fertility depresses future payouts, ie, the demographic dividend declines, a problem that is starting to become pressing in China right now.

These issues are analyzed in a small emerging literature. Liao (2013) analyzes how the one-child policy in China increased human capital and output. She simulates counterfactual experiments to analyze the effects of a relaxation of the policy. The main findings are that results differ across generations and skill groups. In particular, the initial old would benefit from a sudden unexpected relaxation of the policy, but future generations would be hurt. Moreover, such a policy would hurt unskilled people more than skilled people. Choukhmane et al. (2014) conduct a richer analysis using a life-cycle model and more detailed micro data. They argue that a large part of the rise in aggregate savings in China can be attributed to the one-child policy. The focus in Banerjee et al. (2014) is on the importance of general equilibrium effects when estimating how fertility restrictions (and their removal) would impact savings. These authors argue that appropriately taking general equilibrium effects into account reduces the size of such estimates. Coeurdacier et al. (2014) focus on the interaction between fertility policies and social security reform.[be] Since an expansion of social security lowers the incentives to have children (and thereby lowers the number of contributors to the system), the relaxation of the one child policy is likely to have smaller effects than typically anticipated. The authors find that this effect is quantitatively important for China.

[bd] The mechanism that lower fertility decreases utility is analyzed in Cordoba (2015), who finds that, during the 1970–2005 period, world growth in well-being was lower than the growth rate in per capita consumption precisely because fertility fell so dramatically during that period.

[be] Song et al. (2015) also analyze the consequences of low fertility for pension reform in China, albeit in a model with exogenous fertility.

3.4 Two-Parent Families: Decision Making

The vast majority of the literature on fertility and growth focuses on the interaction between parents and children in one-gender models. In other words, reproduction is asexual and differences between men and women in technology and preferences are abstracted from. We now expand our analysis by introducing two-gender families. In this version of our growth model, children have two parents: a mother and a father. For simplicity we return to exogenous fertility for now and assume that each couple has two children. Thus, families now consist of a husband, a wife, a son, and a daughter. Suppose men and women disagree about how much they care about their children's well-being.[bf] As in Section 2.4, suppose that the couple solves a Pareto problem with fixed bargaining weights, where λ_f is the bargaining weight of the woman, and λ_m is the weight of the man. Then the objective function is:

$$\lambda_f[u(c)+\delta_f u(\gamma')]+(1-\lambda_f)[u(c)+\delta_m u(\gamma')].$$

To keep the rest of the model comparable to the previous section, we assume that all consumption in marriage is public and the total time endowment (of the couple) is still one. We also make no distinction between sons and daughters in the parent's objective function. We will relax these assumptions further below. Assuming log utility, the objective function can be written as:

$$\max \lambda[\log(c)+\delta_f\theta\log(e)]+(1-\lambda)[\log(c)+\delta_m\theta\log(e)].$$

Equilibrium education now is

$$e^*=\frac{\widetilde{\delta}\theta}{1+\widetilde{\delta}\theta},$$

where $\widetilde{\delta}\equiv\lambda_f\delta_f+(1-\lambda_f)\delta_m$. Thus, the equilibrium growth rate is:

$$\frac{H'}{H}=\left(B\frac{\widetilde{\delta}\theta}{1+\widetilde{\delta}\theta}\right)^{\theta}. \tag{14}$$

A comparison of Eqs. (12) and (14) shows not only that gender preference gaps matter for the growth rate, but also how such preferences make their way into decisions within the family. Specifically, assuming mothers care more about children than fathers do ($\delta_f > \delta_m$), the economy grows faster, the larger the bargaining power of women. Doepke and

[bf] There could be many reasons for such a disagreement, ranging from biological/evolutionary arguments to cultural factors. See Alger and Cox (2013) for a survey.

Tertilt (2009) explore the endogenous evolution of women's rights based on such a mechanism (details will be discussed in Section 4). However, whether female empowerment enhances growth depends on the details of the bargaining process within the household. Doepke and Tertilt (2014) use a noncooperative model to show that what looks like gender differences in preferences may ultimately be due to specialization in tasks within the household. Based on this mechanism, Doepke and Tertilt (2014) show that monetary transfers to women may reduce growth, even if women are more likely to spend transfers on children. The reason is that the equilibrium is characterized by a division of labor in which women are in charge of time-intensive tasks such as education, while men provide money-intensive goods and hence are in charge of savings and physical capital accumulation. In such a world, exogenous transfers to women (financed by a tax on men) increase human capital accumulation but reduce physical capital accumulation. Depending on the production function, such a reallocation may increase or decrease growth. Specifically, when returns to physical capital relative to human capital are high, then such a policy would lower growth. To assess whether this is an issue in reality, more empirical research is needed. The current literature on the effects of transfers to women largely focuses on child expenditures, but there is little work analyzing effects on savings and investment.

3.5 Two-Parent Families: Technology

Empirical research (eg, Del Boca et al., 2014) has shown that mothers and fathers are both important factors in the human capital formation process of their children. In most families, both mothers and fathers spend a significant amount of time with children (Schoonbroodt, 2016). Further, men and women may not be perfect substitutes in market production.[bg] To address these issues, we now extend our view of the family to include fathers and mothers explicitly in the human capital formation process and also men and women as entering separately into production. To isolate the role of women in technology (vs their role as decision makers), we assume again that all consumption in families is public and that men and women have the same preferences regarding their children. In other words, we ignore here the additional complication that arises if fathers and mothers disagree (which we analyzed in Section 3.4). We also focus on the education decision (rather than fertility choice); however, it would be straightforward to include both margins in the same model.

[bg] Large and persistent gender wage differentials exist (see Blau and Kahn, 2000 for a survey). There is an extensive empirical literature trying to analyze their causes. We do not take a stand here on what the ultimate cause is, but rather explore the implications of men and women being imperfect substitutes in production. Whether the gap is due to different innate skills, different preferences, or cultural factors leading to differences in skill acquisition is largely irrelevant for our analysis.

In contrast to the previous versions of the model, men and women enter differently into technology. The consumption good is produced with a Cobb-Douglas production function using both male and female efficiency units of time as inputs,

$$c = A(\ell_f H_f)^{\alpha}(H_m)^{1-\alpha},$$

where $\alpha \in (0,1)$. For simplicity, we assume that only women raise children, while men work full time. The female time constraint is $\ell_f + e_f + e_m \leq 1$, where e_f is the time invested in educating daughters, and e_m is time devoted to the education of sons. Full income is defined as the production function evaluated at $\ell_f = 1$ and is therefore given by:

$$y = AH_f^{\alpha}H_m^{1-\alpha}.$$

Each couple has two children: a daughter and a son. Both mothers and fathers are essential for their children's human capital accumulation:

$$H_f' = (Be_f)^{\theta}H_f^{\beta}H_m^{1-\beta}, \tag{15}$$

$$H_m' = (Be_m)^{\theta}H_f^{\beta}H_m^{1-\beta}, \tag{16}$$

with $\beta \in (0,1)$. In summary, there are two gender differences in this setup: the relative importance of women vs men in transmitting own human capital to children (β) and the relative importance of women vs men in production (α).[bh]

Assuming log utility, the objective function can be written as:

$$\max \log(c) + \delta[\alpha\theta \log(e_f) + (1-\alpha)\theta \log(e_m)].$$

The equilibrium allocation is:

$$\ell_f^* = \frac{\alpha}{\alpha + (1-\alpha)\delta\theta + \alpha\delta\theta},$$

$$e_m^* = \frac{(1-\alpha)\delta\theta}{\alpha + (1-\alpha)\delta\theta + \alpha\delta\theta},$$

$$e_f^* = \frac{\alpha\delta\theta}{\alpha + (1-\alpha)\delta\theta + \alpha\delta\theta}.$$

The equilibrium ratio of female to male human capital is given by:

$$\frac{H_f}{H_m} = \left(\frac{e_f}{e_m}\right)^{\theta} = \left(\frac{\alpha}{1-\alpha}\right)^{\theta}.$$

Note that the asymmetry between mothers and fathers in the human capital production function captured by β does not appear in this expression. This is not a fundamental

[bh] A third asymmetry is that we have assumed that only women can spend time educating children. But this asymmetry is made for tractability and is not essential for the qualitative results.

result, but rather a feature of our warm-glow altruism. In an altruistic model, parents would take into account that educating their children will turn the children themselves into better parents, and hence enable them to provide grandchildren with more education. In such a formulation, the relative importance of fathers vs mothers in child development will also enter the relative human capital of men and women in equilibrium.

This model features a gender education gap and accordingly a gender wage gap.[bi] Specifically, the wage ratio per unit of time is $\frac{w_f}{w_m} = \frac{\alpha}{1-\alpha}$. The more productive women are in production (higher α), the smaller is the gender education gap. Higher female wage increase the opportunity cost of time and hence make children more costly. In a variant of the model with endogenous fertility, this logic would lead to fertility decline in response to rising female productivity. This mechanism is analyzed by Galor and Weil (1996), who explore how this channel contributed to the demographic transition.

In a fully altruistic model, parents would further take into account that their sons and daughters will be working different hours in the market (because of the child-bearing obligations of mothers) and accordingly invest less in daughters.[bj] This amplification channel is explored by Echevarria and Merlo (1999). Lagerlöf (2003) further explores the effect of the marriage market in this context and stresses the importance of multiple equilibria. If all families invest more into sons, then daughters on average expect high spousal income, which lowers the incentive for each individual family to educate daughters. However, complete gender equality is also an equilibrium in his model.

Plugging the ratio of human capital back into the human capital production function, we get the following equilibrium growth rate (for both male and female human capital, and hence also output and consumption):

$$\frac{H'}{H} = B^{\theta}(e_m)^{(1-\beta)\theta}(e_f)^{\theta\beta} = \left\{\frac{B\delta\theta}{\alpha+\delta\theta}(1-\alpha)^{1-\beta}\alpha^{\beta}\right\}^{\theta}. \tag{17}$$

Eq. (17) shows that the growth rate depends on many features of the family. As before, the more parents care about their children, the higher the growth rate. What is new is that gender differences in technology also matter for growth. This is true for both the role women play in production (as captured by α) and the relative importance of fathers and mothers in human capital transmission (captured by β). Moreover, the two dimensions of technology interact. For example, in a world where men and women enter symmetrically into production ($\alpha = 0.5$), the relative importance of mothers and fathers in human capital transmission becomes irrelevant. On the other hand, α always enters,

[bi] Strictly speaking there are no wages in our formulation with home production. However, the model can be reinterpreted as one with market production and wages given by marginal products.

[bj] Our warm-glow altruism does not capture this channel, because parents care about the full income of their children and do not take into account the time daughters will spend on child-bearing.

even in a world where mothers and fathers are equally important in human capital transmission ($\beta = 0.5$). Closer inspection of (17) shows that the growth rate is hump-shaped in α. Thus, whether an increase in α increases or decreases the growth depends on the starting point. Starting from a low role of women in production, an increase in α will lead to a reduction in the gender education gap, an increase in relative female wages, an increase in female labor force participation, and an acceleration of economic growth. This mechanism may well have been historically relevant: recall that Fig. 20 displays a strong positive relationship between GDP per capita and the role of women in paid labor. Similarly, recall that Table 3 showed a negative correlation between the gender education gap and development.

Since World War II, all developed countries went through a period of increasing female labor force participation and declining gender wage gaps. How women's role for production evolved over longer historical time periods is less clear. Humphries and Weisdorf (2015) construct measures of relative male and female wages in England dating back to 1270 and find large swings over the centuries. They also try to measure the wages of married and single women separately, using the distinction between casual work (more relevant for married women) and annual contracts (mostly used for unmarried women). Using their data and accepting their interpretation, we find that the relative wages of married vs single women over time have sometimes moved in the opposite directions (Fig. 22). There is also evidence suggesting that in the long run, the relationship between development and female market work is not always monotonic. Specifically, based on cross-country data, Goldin (1995) argues that female labor supply is U-shaped in development.[bk] A similar point is made by Costa (2000), who argues

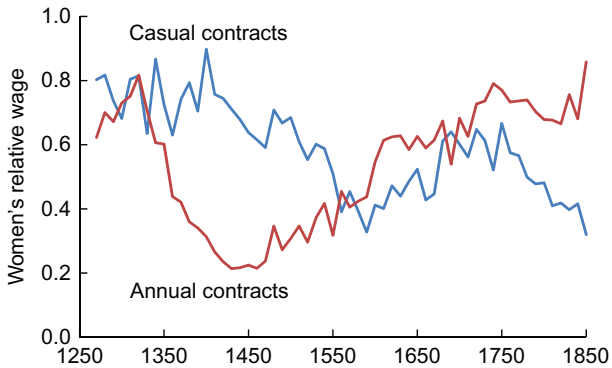

Fig. 22 Historical wage gap in England. *Humphries, J., Weisdorf, J., 2015. The wages of women in England, 1260–1850. J. Econ. Hist. 75 (2), 405–447 (Table A1).*

[bk] See also Olivetti (2014) for evidence of a U-shape in time series data of 16 developed countries (including the United States) and Mammen and Paxson (2000) for evidence from India and Thailand.

that female labor force participation is N-shaped if one goes back far enough in time. Establishing such historical facts is difficult not only due to lack of reliable data but also because of the lack of a sharp distinction between market and home production in agricultural economies.[bl]

A further complication arises when market production is made up of different tasks. If individuals differ in their ability to perform different tasks, then the allocation of talent to activities becomes important. Norms about gender roles (or other barriers) can then be an obstacle to the optimal allocation of talent to tasks. Hsieh et al. (2013) analyze the importance of this channel in the United States. They find that an improved allocation of talent across genders (and also ethnic groups) accounts for 15–20% of US growth during the 1960–2008 period. Lee (2015) explores the importance of misallocation of female talent for cross-country income differences. The paper finds that entry barriers for women in the nonagricultural sector play a large role for the observed low agricultural productivity in poor countries.

3.6 Two-Parent Families: Endogenous Bargaining

In Section 3.4, we have seen that who makes decisions in the household matters for growth. Hence, an important question is what determines bargaining power in marriage.[bm] Here we are interested in what changes bargaining weights across generations, which is distinct from the analysis of endogenous bargaining over time for a given couple (which we considered in Section 2). Initial bargaining power should be determined at time of marriage, which we do not model here. It is often assumed that relative educational attainments matter in the marriage market and hence for bargaining power. Relative education between men and women may itself be endogenous as we have seen in Section 3.5. In this section, we connect these two forces. To do so, we impose that the bargaining weight is a function of the gender education gap, which is itself chosen in the family. This assumption allows us to analyze the feedback from a gender education gap to bargaining power in the family.[bn]

We use a model that combines the setup with a gender preference gap in Section 3.4 with gender differences in technology as explored in Section 3.5. First, consider such a

[bl] For example, Goldin (1995) includes unpaid farm and family firm workers, while our Fig. 20 includes only paid workers.

[bm] There is a sizeable literature estimating models of household decision making. Key for identification is typically the existence of so-called distribution factors that affect bargaining weights but are exogenous to the bargaining process (see, for example, Blundell et al., 2005).

[bn] Basu (2006) also explores the implications of endogenous bargaining power, albeit in a different context. We are interested in how bargaining power changes across generations, while Basu (2006) analyzes the dynamic implications for a given couple. By adjusting labor supply, and thus income, spouses may affect their bargaining power in the household.

setup with exogenous bargaining power. Combining the features of the two models, the couple solves the following maximization problem:

$$\max_{c,\, e_f,\, e_m} u(c) + \widetilde{\delta}\left\{\alpha\theta \log(e_f) + (1-\alpha)\theta \log(e_m)\right\}$$

subject to:

$$1 = \ell_f + e_m + e_f,$$
$$c = A(\ell_f H_f)^{\alpha} H_m^{1-\alpha},$$

where $\widetilde{\delta} \equiv \lambda_f \delta_f + (1-\lambda_f)\delta_m$. As before, human capital evolves according to (15) and (16). This is the same problem as in Section 3.5, but with a modified δ. Thus, the equilibrium growth rate is:

$$1 + g^{exog} = \left\{\frac{B\widetilde{\delta}\theta}{\alpha + \widetilde{\delta}\theta}(1-\alpha)^{1-\beta}\alpha^{\beta}\right\}^{\theta}.$$

Now we can explore how endogenous bargaining differs from exogenous bargaining in this setup by assuming that λ is a function of relative education. A simple functional form assumption that captures this dependence and at the same time guarantees a bargaining weight between zero and one is $\lambda(e_f, e_m) = \frac{e_f}{e_f + e_m}$. Recall that relative education is a function of the relative importance of female labor in the market: $\frac{e_f}{e_f + e_m} = \alpha$. Thus, we can replace λ_f by α and write the growth rate as[bo]:

$$1 + g^{end} = \left\{\frac{B[\alpha\delta_f + (1-\alpha)\delta_m]\theta}{\alpha + [\alpha\delta_f + (1-\alpha)\delta_m]\theta}(1-\alpha)^{1-\beta}\alpha^{\beta}\right\}^{\theta}. \tag{18}$$

Proposition 4 *Assume* $\delta_f > \delta_m$. *If* $\lambda_f < \alpha$, *then the growth rate is higher in the endogenous bargaining model, while* $\lambda_f > \alpha$ *implies a higher growth rate in the exogenous bargaining model.* This result relates women's role in technology to women's role in decision making. Specifically when women's power in decision making is low relative to their importance for production, then endogenizing the link from education to bargaining power increases the growth rate. The opposite is true when women have a lot of bargaining power relative to their importance in production.

[bo] Note that with our warm-glow altruism, parents do not take into account that when increasing their daughter's education, they also increase the daughter's bargaining weight. de la Croix and Vander Donckt (2010) analyze a model with altruism where parents explicitly consider the impact of education choices on their children's future bargaining power.

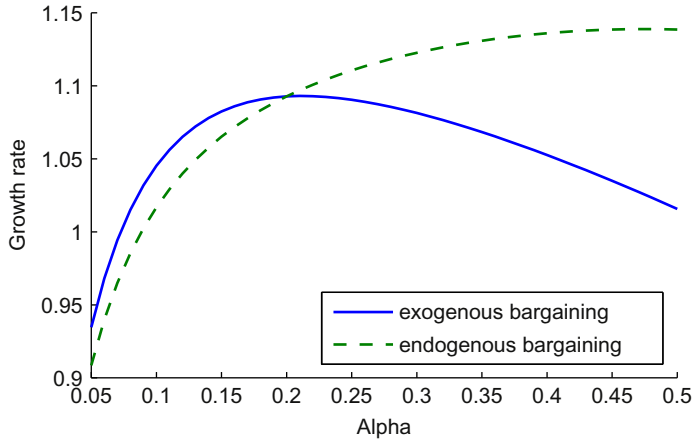

Fig. 23 Growth rate as a function of α, exogenous vs endogenous bargaining.

This result is illustrated in Fig. 23 with a numerical example.[bp] As was discussed in Section 3.5, the growth rate of the exogenous bargaining model is hump-shaped in α. This is not necessarily true in the endogenous bargaining model. In the example, growth monotonically increases in α. With fixed bargaining weights, an increase in women's role in production can lower growth because the resulting rise in female labor force participation decreases education time with children and thereby slows down human capital accumulation. This effect is mitigated in the endogenous bargaining model, where the resulting increase in bargaining power pushes toward more education (given that in the model women care more about children's education than men do). This example shows that the details of decision making in the family matter for growth and that asymmetries between men and women in decision making interact with asymmetries in technology.

3.7 Son Preferences

Many cultures are characterized by a preference for sons. This preference typically has effects on fertility behavior, where families that have only daughters are more likely to have another child (eg, Anukriti, 2014). Recently, sex-selective abortion has also been a concern (Ebenstein, 2010). Son preferences also manifest themselves in boys being treated better than girls. For example, Jayachandran and Kuziemko (2011) document gender differences in breast-feeding rates and Tarozzi and Mahajan (2007) document better nutritional status for boys in India. Further, such a preference is more pronounced in poorer countries (see Table 3).

[bp] The parameters in the example are: $\beta = 0.7, \theta = 0.5, B = 10, \delta_f = 0.5, \delta_m = 0.2, \lambda = 0.2$.

We now investigate the growth consequences of such a son preference in an extension of our model.[bq] First, consider an economy with physical capital in which parents leave bequests to sons and daughters. As before, consumption in marriage is public, fertility is exogenous, and each couple has one son and one daughter. Also as before, parents care about their children in a warm-glow fashion. In this case, parents derive utility from the bequest they give to their children. Output is produced using a linear technology in capital, ie, output is given by $y = AK$, where A is a parameter. All sons and daughters will be married. Without heterogeneity, it is irrelevant who marries whom. The capital of any given couple is made up of the sum of the bequests they each got, ie, $k = b_s + b_d$, where s denotes sons and d daughters.

Preferences are given by:

$$u(c) + \delta_s u(b_s) + \delta_d u(b_d),$$

where $\delta_s > \delta_d$ would capture a son preference. The budget constraint is $c + b_s + b_d \leq y$.

Assuming log utility, equilibrium bequests are

$$b_s = \frac{\delta_s}{1 + \delta_s + \delta_d} y,$$
$$b_d = \frac{\delta_d}{1 + \delta_s + \delta_d} y.$$

The equilibrium growth rate of income is:

$$\frac{y'}{y} = \frac{A(\delta_s + \delta_d)}{1 + \delta_s + \delta_d}.$$

The key result here is that the son preference is irrelevant for the growth rate. The only thing that matters is how much parents care on average about their children, ie, only the sum $\delta_s + \delta_d$ appears.

The finding changes if human capital accumulation is considered, as long as there are decreasing returns to educating a given person. In contrast to physical capital (where ownership does not matter for growth), it is plausible that total knowledge in an economy will be larger if knowledge is shared by more people. We now show how a son preference will interact with such decreasing returns in individual human capital.

The technologies for producing output and human capital are the same as in Section 3.5. Parents care only about their own children and hence they do not take into account that educating their daughter/son will also benefit the future son-in-law/daughter-in-law. Rather, they anticipate that their son-in-law will be endowed with the average male human capital in the economy, which we denote by $\bar{H}'_m$, and daughters-in-law are

[bq] Hazan and Zoabi (2015b) analyze endogenous son preferences in a related model with endogenous fertility.

anticipated to have human capital $\bar{H}'_f$. The optimization problem of a couple endowed with human capital (H_f,H_m) is thus given by:

$$\max_{e_f,\, e_m,\, \ell_f} u(c) + \delta_d u(y'_d) + \delta_s u(y'_s)$$

subject to:

$$\begin{aligned} c &= A(\ell_f H_f)^{\alpha} H_m^{1-\alpha}, \\ 1 &\geq \ell_f + e_f + e_m, \\ y'_d &= A(H'_f)^{\alpha}(\bar{H}'_m)^{1-\alpha}, \\ y'_s &= A(\bar{H}'_f)^{\alpha}(H'_m)^{1-\alpha}, \\ H'_f &= (Be_f)^{\theta} H_f^{\beta} H_m^{1-\beta}, \\ H'_m &= (Be_m)^{\theta} H_f^{\beta} H_m^{1-\beta}, \end{aligned}$$

where $\bar{H}'_f$ and $\bar{H}'_m$ are taken as given.

Assuming log utility, the maximization problem reduces to

$$\max_{\ell_f,\, e_f,\, e_m} \alpha \log(\ell_f) + \delta_d \alpha\theta \log(e_f) + \delta_s(1-\alpha)\theta \log(e_m)$$

subject to:

$$\ell_f + e_f + e_m \leq 1.$$

The resulting optimal education choices are

$$\begin{aligned} e_m^* &= \frac{\delta_s(1-\alpha)\theta}{\alpha + \delta_s(1-\alpha)\theta + \alpha\delta_d\theta}, \\ e_f^* &= \frac{\delta_d\alpha\theta}{\alpha + \delta_s(1-\alpha)\theta + \alpha\delta_d\theta}. \end{aligned}$$

As before, human capital, income, and consumption all grow at the same rate on the balanced growth path. The equilibrium growth rate is:

$$\left\{ \frac{B\theta}{\alpha + [\delta_d\alpha + \delta_s(1-\alpha)]\theta} (\delta_s[1-\alpha])^{1-\beta} (\delta_d\alpha)^{\beta} \right\}^{\theta}.$$

This expression shows how the effect of a son preference on the growth rate depends on the technology for goods production and human capital accumulation. First, consider the symmetric case where men and women are equally important in production (by setting $\beta = \alpha = 0.5$). Fix the total weight parents put on children: $\delta_s + \delta_d = 1$. In this case, the growth rate is maximized at $\delta_s = \delta_d = 0.5$. In other words, a son preference lowers growth. This is in contrast to the economy with only physical capital, where a son preference is irrelevant. Hence, a son preference is only growth-reducing when knowledge is

the engine of growth. But even in a knowledge economy a son preference is not always disadvantageous. If men have the comparative advantage in knowledge production ($\beta < 0.5$), the growth-maximizing weight on children will display a son preference, the strength of which depends on the extent of men's comparative advantage.

On the other hand, in a world where men have a comparative advantage in goods production ($\alpha < 0.5$), but we have $\beta = 0.5$, a slight daughter preference enhances growth. The reason is that human capital is the engine of growth, implying that educating sons and daughters equally is the growth-maximizing strategy. Parents, on the other hand, do not maximize the growth rate, but rather output in the next period, where sons have the comparative advantage in production. Thus, parents overinvest in sons (compared to growth-maximizing solution). A son preference amplifies this problem.

Empirical evidence also links son preferences to the increasingly asymmetric sex ratios in some countries. In China, for example, in 2005 over 120 boys were born for each 100 girls (Wei and Zhang, 2011). Such asymmetries may have important aggregate consequences, which are largely unexplored in the literature. A notable exception is Wei and Zhang (2011), who find that rising sex ratios are an important determinant of the high Chinese savings rate. Du and Wei (2010) take this idea a step further and show in a calibrated model that this channel explains more than 50% of the current account surplus in China.

3.8 Polygyny

The role model for the family considered in most of this chapter is the Western nuclear family. The dominance of the nuclear family consisting of a husband, a wife, and the couple's own children is a relatively recent phenomenon, and even today typical families in some parts of the world do not follow this norm. Historically, the extended family (with multiple generations living together) was more prevalent than it is today.[br] Moreover, many families today no longer include married couples, as single parents are on the rise and many individuals no longer live in families at all (see Figs. 3 and 4 in Section 2.2).

Another important type of family structure is polygamy. In many parts of Africa men marrying multiple wives (polygyny) is common to the present day.[bs] Does such a family structure matter for macroeconomic outcomes? Tertilt (2005) suggests it does. The paper builds a model of polygynous families in which men buy brides and sell daughters to future husbands. The family structure reduces output (relative to enforced monogamy) through two channels. The market for daughters turns women into a valuable asset. This has two implications. First, the revenues from selling daughters become a useful way of financing old age, which depresses savings and thus physical capital. Second, it increases fertility as men want many daughters. This results in higher population growth rates,

[br] Although, because of shorter life spans, perhaps not as prevalent as one might think. See Ruggles (1994) for an extensive historical account of changing household structures in the United States over the last 150 years.

[bs] Polyandry (women having multiple husbands) is extremely rare, but a few societies exist as well.

which depresses capital per person and thus GDP per capita. The paper uses a calibrated general equilibrium model to show that this effect is quantitatively important, and shows that the mechanism can account for a large part of the observed differences between polygynous and monogamous countries shown in Table 4.

Polygyny matters for growth through its effect on brideprices. Thus, the marriage market is essential for the mechanism. It is not the case that an individual polygynous couple would save less than a monogamous couple living in the same country. Rather, if a large fraction of households is polygynous, the equilibrium price of women is high, which changes incentives for all families. In other words, polygyny lowers output precisely because of the general equilibrium effects in the marriage market. We thus turn to the importance of marriage markets for growth in the next section.

A few papers attempt to understand why polygyny exists in some cultures and not in others. Gould et al. (2008) and Lagerlöf (2005) relate the disappearance of polygyny to economic development. Heterogeneity plays a key role in both papers. Gould, Moav, and Simhon argue that the increasing skill premium has led men to want fewer, higher quality children. To educate their children, they accordingly demand higher quality wives, but fewer of them, which naturally leads to fewer wives per men. Lagerlöf relates the disappearance of polygyny to the decline in male inequality over time. Primitive societies are arguably more unequal, which allows wealthy men to marry more wives and have more children. Over time, this dilutes their wealth, making societies more equal, which eventually leads to a more equal distribution of wives across men. In both papers, the decline in polygyny goes hand in hand with fertility decline and economic growth. Both papers explain the decline in polygyny prevalence, but are silent on the introduction of formal restrictions.

Two recent papers analyze the political economy of the introduction of monogamy. Lagerlöf (2010) proposes a theory related to inequality of wives across men. When polygyny is allowed, the elites have many wives, while poor men have none. This may lead to revolutions and thus creates an incentive for the elites to impose a formal ban on polygyny. de la Croix and Mariani (2015) provide a comprehensive political economy analysis of the switch from polygyny to monogamy and then to serial monogamy. The theory is based on the voting behavior of the entire population (including women), rather than the incentives of the elites. The transition between regimes is endogenously generated by human capital accumulation that changes the coalitions that stand to gain from a change in the marriage regime.

3.9 The Marriage Market

While there is a substantial literature on marriage choices within family economics, incorporating a marriage market into macroeconomic models is no trivial undertaking. One approach was proposed by Tertilt (2005), who models a competitive market for brides featuring an equilibrium brideprice that clears the market. However, such a

formulation works only if there is no heterogeneity; if potential spouses vary in "quality," it matters who marries whom.

A number of recent contributions analyze marriage formation with heterogeneous agents within macro models. This allows the analysis of questions such as the impact of changes in the assortativeness of mating on income inequality. An early example is Fernández et al. (2005).[bt] The paper investigates the relationship between inequality, assortative mating, human capital accumulation, and per capita GDP. Mating is modeled through a search model with random matching. The model also features an intergenerational transmission mechanism, because parental income is used as collateral that children need when investing in education. One main finding is that such a model can generate multiple steady states that differ in wage inequality. Across steady states, marital sorting and wage inequality are positively related, while marital sorting and GDP per capita are negatively related.

Eika et al. (2014) document empirically the importance of assortative mating for income inequality in the United States. While assortative mating is found to be an important determinant of inequality, the study finds that changes in inequality cannot be attributed to changes in sorting patterns. Greenwood et al. (2016a) analyze such a link in a structural quantitative model.

Beyond these few contributions, the importance of marriage for growth is largely unexplored. In part, this may be due to the computational complexity of models that feature sorting with heterogeneous agents. However, with recent advances in computational power allowing increasingly complex models to be analyzed, we expect this to be an active research area in the near future.

4. THE FAMILY AND THE POLITICAL ECONOMY OF INSTITUTIONAL CHANGE

Long-run economic development is characterized not just by economic transformations but also by a set of striking regularities in terms of political change. During the development process, almost all of today's rich countries went through a series of similar policy reforms: for instance, democracy spread, public education systems were built, and public pension systems were introduced. The only exception to this pattern are countries that are rich primarily because of endowments with natural resources such as oil. Among countries who owe their wealth to the productivity of their citizens, these political transformations are a universal characteristic of the development process.

The tight link between economic and political transformations raises the question of how the causality runs between the two realms. Does economic growth trigger political

[bt] Fernández and Rogerson (2001), Choo and Siow (2006), and Greenwood et al. (2014, 2016a) also analyze the relationship between marital sorting and income inequality, but do not consider broader macroeconomic implications.

change, or is political change a precondition for growth? Can today's poor countries, many of which have implemented only a subset of the political reforms that characterize rich countries, foster faster economic development by adopting rich-country political institutions and reforms?

In this section, we argue that in answering such questions the family once again plays a central role. Many of the political reforms that go along with development are directly about the family (such as the introduction of child labor laws and the expansion of women's rights). In other cases (such as education and pension reforms), the political changes concern areas that originally were organized within families but in which, over time, the state played an increasing role. We provide a brief overview of the facts of political change during the development process. We then discuss some of the political economy literature analyzing the causes and consequences of political change, arguing that in many cases changes in family life were driving reform. We illustrate the role of the family by zooming in on two specific reforms—the expansion of women's rights and the introduction of child labor laws.

4.1 Political Economy Facts

The main political transformations that go along with the development process are the introduction of democracy, public and compulsory schooling, and child labor regulation; the gradual expansion of women's rights; and more generally the creation of large welfare states that raise a significant fraction of GDP in tax revenue to provide welfare benefits and old-age pensions. Before the onset of modern economic growth (say, in 1750), no country in the world had any of these institutions. Most poor countries today have some but not all of these features.

There is considerable variation across countries in the timing of reforms. For some countries, the first transformation was the introduction of democracy, starting with the founding of the United States in 1776 and then followed by a series of franchise extensions in Britain. Other countries adopted other reforms first and achieved democracy later. Some European countries democratized after World War I, and others had to wait until after the fall of the Iron Curtain in the early 1990s. In some countries (such as South Korea and Taiwan), democracy was introduced only after most other political reforms had been implemented and after rapid economic growth had been achieved.

Initially, democracy generally meant that men, but not women, obtained the right to vote and run for office. In the United States, the first state to give women the right to vote was Wyoming in 1869, and most other states had followed by World War I.[bu] At the federal level, universal suffrage was introduced with the Nineteenth Amendment in

[bu] See Doepke et al. (2012) for a detailed timeline of the introduction of women's rights in the United States.

1920. In many European countries women were able to vote after World War I, but once again there is a lot of variation across countries. For example, in Switzerland women received the right to vote in federal elections only in 1972, and the last canton to allow women to vote was Appenzell Innerrhoden in 1990.[bv]

Compared to the spread of political rights, the timing of education reforms is more uniform across countries. In the United States, Canada, and the industrializing Western European countries, public and compulsory education was widely introduced in the late 19th and early 20th centuries. In many cases, these reforms went along with significant restrictions of child labor.

The first country to introduce a public pension system was Germany in 1891. Mandatory health and accident insurance for workers were introduced around the same time. Most other European countries, Canada, and the United States had followed these steps before the middle of the 20th century. The first unemployment benefit scheme was introduced in the United Kingdom with the National Insurance Act 1911. In the midst of the Great Depression, the US Congress passed the Social Security Act, which contained provisions for old age insurance, welfare, and unemployment insurance. Most European countries and Canada introduced similar provisions during the first half of the 20th century.

The timing of political reforms that affected families most directly (in particular the regulation of child labor, the public provision of education, and the spread of women's rights) is closely associated with a major transformation of families themselves. As discussed in Section 3, as countries transition from a preindustrial society to modern growth, they universally undergo a demographic transition from high to low fertility. In North America and Western Europe, the main phase of fertility decline took place between the middle of the 19th century and World War I. Access to primary education became near-universal during the same period. Given that formal schooling moved children from the family home (where many had been working from a young age) to schools, the rise of mass education implied a transformation of family life on its own.

4.2 The Family as a Driver of Political Change

To understand the political economy of reforms, one needs to understand who the winners and losers of a reform are. Political reforms happen if there is a constituency that stands to gain from the reform, and if this constituency has sufficient political power to implement the desired policy. The trigger for a reform can either be a change in how a policy affects specific groups, or an increase in the political power of a group that

[bv] In fact, the last canton to voluntarily introduce the right to vote for women was Appenzell Aussenrhoden in 1989. In Appenzell Innerrhoden women's suffrage was mandated by a Supreme Court decision in 1990.

stands to gain from a reform. One might expect that democratization, which increased the political power of broad parts of the population at the expense of established elites, should be a major engine for political change. While there are examples of democratization triggering reform, the introduction of the major reforms associated with economic development described above is not closely correlated with expansions in political rights. We therefore focus on mechanisms that change who gains and who loses from reforms, and take as given that the relevant groups have sufficient political power to be heard.[bw]

We argue that for most of the major political reforms associated with economic development, the reorganization of families is a key reason for why political incentives changed. Technological and structural change affects fertility choices, education choices, and the division of labor in the family, all of which determine how people are affected by reforms. For example, reforms such as mandatory schooling laws and public pensions move responsibilities from the family to the public sphere and affect the relationship between parents and children. How people feel about such changes will depend in part on how many children they have, on whether they plan to educate their children, and on whether they anticipate living with their children in old age. Other reforms—such as the expansion of women's rights—affect the interaction between spouses. How people are affected by such reforms depend in part on the division of labor in the household and on women's labor force participation, both of which vary with development.

Consider the introduction of public schooling systems. Before public schooling, most children were working with their parents from a young age. Hence, the spread of public and compulsory education implied a major change of parent-child relations. Galor and Moav (2006) provide a theory that explains the public provision of education as a consequence of the rising importance of human capital in the economy. They consider a model economy populated by capitalists and workers. The model features heterogeneity in wealth, and initially only capitalists are accumulating capital through bequests to their children. However, the model features complementary between physical and human capital, and as the stock of physical capital rises, over time the capitalists stand to gain from higher education among the workers. Ultimately, both workers and capitalists support a tax on capitalists to support public education. The accumulation of physical and human capital within families is central to this mechanism. The public provision of schooling was often followed by mandatory schooling laws. Such laws affect the family even more directly by forcing parents to send their children to school. A closely related policy is a child labor ban, which we will analyze in Section 4.4.

In the case of schooling and child labor bans, who is a winner and who is a loser from reform depends on people's factor endowments (physical capital and human capital) and

[bw] Key contributions examining the causes of expansions of political rights include Acemoglu and Robinson (2000) and Lizzeri and Persico (2004).

also on fertility. Thus, potential conflicts arise between capitalists and skilled workers on the one hand, and unskilled workers with large families and no desire to educate their children on the other hand. For other types of reforms, gender and marital status are the dividing lines. This point is emphasized in Edlund and Pande (2002), who analyze the importance of women as voters. The paper shows that the political gender gap in the United States—women are more likely to vote Democrat than men—is a relatively recent phenomenon. Up until the mid-1960s, women voted more conservative than men on average. The paper argues that the change in political preferences (which in turn may have impacted other reforms) was due to a specific change in the family, namely the increase in divorce. A large increase in divorce rates during the 1960s and 1970s (see Fig. 6) increased the fraction of relatively poor single women. These women tend to benefit from redistribution, which is typically favored by Democrats. The paper provides evidence in support of the hypothesis by showing that marriage tends to make a woman more Republican, while divorce tends to make her more Democrat.

There are also a few papers that emphasize the importance of women as policymakers. Chattopadhyay and Duflo (2004) use gender quotas in India to empirically analyze which public projects are implemented at the village level depending on the gender of the leader. While the paper is not specifically about reforms, it shows that the gender of the leader affects the types of public goods that are provided. A related point is made by Washington (2008) and Oswald and Powdthavee (2010), who show that the gender composition of children affects the voting behavior of (male) legislators in both the United States and the United Kingdom: having more daughters makes politicians take more liberal positions.

Another important reform is the introduction of public pension systems.[bx] Social security programs transfer resources from young and middle-aged workers to the elderly. Without public systems, such transfers typically happen within the family, with altruistic children voluntarily taking care of elderly parents. Because of the dramatic fertility decline during the 19th century (see Fig. 1), more people ended up without children caring for them during old age, increasing the risk of poverty. This fact probably played an important role in the introduction of public pension systems. At the same time, the existence of such systems further decreases the incentive to have children, which leads to a two-way interaction between the structure of the family and political reforms.

Finally, a large class of reforms affected the legal position of women. These include reforms affecting ownership rights of women (such as the Married Women's Property Act of 1870 in England), reforms affecting child custody laws, the introduction of suffrage for women, and laws banning labor market discrimination and removing occupational

[bx] There is a large literature on social security systems (see, for example, Cooley and Soares, 1996; Boldrin and Montes, 2005; Caucutt et al., 2013).

restrictions (such as allowing women to become judges and soldiers). Reforming the legal position of women also impacts the position of women in the household, eg, by changing their outside options. And conversely, changes in family structure (such as the decline in fertility and the increase in female labor force participation) affected the gains from such reforms. We will discuss the political economy of women's economic rights (such as married women's property rights) in Section 4.3. Other types of women's rights, such as suffrage or labor rights, imply different political economy trade-offs. While there is some empirical work on these other rights, there is a lack of work that formally analyzes the political economy of other types of rights for women.[by] We believe that this is an important issue to be addressed by future research.

4.3 Voting for Women's Rights

Throughout the course of development, all industrialized countries implemented reforms that changed the legal position of women. Doepke and Tertilt (2009) propose a mechanism that provides a causal link between women's rights and economic growth. The mechanism is based on women's role in nurturing children. In contrast, Geddes and Lueck (2002) argue that the initial expansion of women's rights was related to women's role in the labor market. Given that the main phase of expanding women's economic rights was in the 19th century, a time when female labor force participation was low, we argue that a mechanism related to a women's role in the family is more plausible.

We now illustrate the basic mechanism of Doepke and Tertilt (2009) in a simplified framework. The setup is similar to that in Section 3.4 with a modified utility function. We now assume that consumption is a private good, which allows for a stronger conflict of interest between husbands and wives. We also introduce grandchildren and assume that people derive utility from the human capital of children and grandchildren. This assumption introduces a conflict across generations: men want their grandchildren to have as much human capital as possible, but it is the next generation that makes the decision. Since the next generation also cares about their own consumption, fathers will not invest as much in their children's education as desired by the grandfathers. We will now show how this conflict across generations may induce men to vote for female empowerment.

Let the utility function of spouse of gender g be

$$\log(c_g) + \delta_g \log(H') + \delta_g^G \log(H'),$$

where δ_g is the weight spouse g attaches to the human capital of own children, while δ_g^G is the weight on grandchildren. As in Section 3.4, we assume that $\delta_f > \delta_m$.[bz] Given the private goods assumption, the budget constraint is

[by] See Duflo (2012) and Doepke et al. (2012) for two surveys.

[bz] While it may seem natural to assume the same for grandchildren, $\delta_f^G > \delta_m^G$, this assumption is not needed for the analysis.

$$c_m + c_f = A\ell H,$$

where ℓ is total working time of the couple. Assuming that each spouse has a time endowment of 1, the family time constraint is

$$\ell + 2e \leq 2,$$

where e is education time for each of two children.

We now consider two political regimes. In the first one—*patriarchy*—only men make decisions. In the second regime—*empowerment*—men and women make decisions jointly, ie, they solve a collective bargaining problem with equal weights. To find the equilibrium allocation under patriarchy, one can solve the following maximization problem:

$$\max_{\ell, e} \log(c_g) + \delta_g \log(H') + \delta_g^G \log(H')$$

subject to:

$$\ell + 2e \leq 2,$$

$$H' = (Be)^\theta,$$

$$c_m + c_f = A\ell H,$$

$$c_m, c_f \geq 0.$$

Note that $H'' = (Be')^\theta$, where e' is determined by the next generation and is taken as given by the grandparent. Given the technology, the choice of education for own children e will not affect H'', ie, there is no interdependence between the choices of different generations. Further, since a man does not derive utility from his wife's consumption, women's consumption will be zero, and hence male consumption equals production.[ca] The equilibrium allocation under patriarchy is:

$$e^P = \frac{\delta_m \theta}{1 + \delta_m \theta},$$

$$\ell^P = \frac{2}{1 + \delta_m \theta},$$

$$c_m^P = \frac{2AH}{1 + \delta_m \theta}.$$

[ca] This counterfactual result can be easily modified by introducing altruism, as we do in Doepke and Tertilt (2009).

In contrast, under empowerment, couples solve a joint maximization problem with equal bargaining weights. The objective function then is

$$\frac{1}{2}\log(c_m)+\frac{1}{2}\log(c_f)+\widetilde{\delta}\log(H')+\widetilde{\delta}^G\log(H''),$$

where $\widetilde{\delta}=\frac{\delta_f+\delta_m}{2}$ and $\widetilde{\delta}^G=\frac{\delta_f^G+\delta_m^G}{2}$. Given the objective function, women and men consume equal amounts, $c_f^E=c_m^E$. The optimal education and labor choices are:

$$e^E=\frac{\widetilde{\delta}\theta}{1+\widetilde{\delta}\theta},$$
$$\ell^E=\frac{2}{1+\widetilde{\delta}\theta}.$$

Consumption is equalized and depends on the initial human capital:

$$c_m^E=c_f^E=\frac{AH}{1+\widetilde{\delta}\theta}.$$

We are interested in understanding under what conditions men prefer to live in a patriarchal world and when they prefer empowering women. We focus on men's preferences because women's economic rights were expanded long before women gained the right to vote. Hence, the expansion of women's right can be viewed as a voluntary sharing of power by men. To understand men's political preferences, we compare the indirect utility function of a man in both regimes starting from the same initial human capital. Denote the indirect utility functions by U^E and U^P. Plugging in the equilibrium allocations and simplifying, we see that $U^E > U^P$ if and only if:

$$(\delta_m+\delta_m^G)\theta\log\left(\frac{\widetilde{\delta}}{\delta_m}\frac{1+\delta_m\theta}{1+\widetilde{\delta}\theta}\right)>\log\left(\frac{2(1+\widetilde{\delta}\theta)}{1+\delta_m\theta}\right). \tag{19}$$

From a man's perspective, there is a trade-off. Patriarchy implies strictly higher own consumption, since resources do not need to be shared with one's wife. On the other hand, from the grandfather's perspective, the son will underinvest in the education of the grandchild. Empowering women will lead the future daughter in law to have more bargaining power, and, given that women care more about children than men do ($\delta_f > \delta_m$), this will increase the education of the grandchildren.

We will now show how this trade-off changes with development. Assume that the human capital technology improves over time, ie, θ increases. When the returns to education are zero, ie, $\theta = 0$, men strictly prefer to live under patriarchy (this follows from

Eq. 19). The intuition is that with $\theta = 0$, there is no reason to educate children. With zero education, from a man's perspective empowering women imposes a cost in terms of lost consumption, but does not bring any benefits. However, as θ increases, the concern about the grandchildren's education becomes increasingly important. The next proposition shows that as long as the concern about grandchildren is above a threshold, when θ becomes large enough, the grandchild effect dominates and hence men gain from switching to the empowerment regime.

Proposition 5 *If the weight δ_m^G men attach to grandchildren is above a threshold (given in the proof), there is a threshold $\overline{\theta}$ such that men prefer empowerment if $\theta > \overline{\theta}$.*

Fig. 24 illustrates the result with a numerical example.[cb] The equilibrium education choice e increases with θ in both regimes. Initially, for low levels of θ, men prefer to live under patriarchy. However, as θ increases, patriarchy becomes too costly for men. By introducing women's empowerment, men gain because of the positive effect on grandchildren.

The result is in line with what was observed during the 19th century in both the United States and England. Primary education expanded rapidly at the same time when male legislators passed laws to grant property and other economic rights to married women. Fertility rates also decreased quickly and economic growth increased. These features can be incorporated by adding fertility choice and assuming that parental human capital is an input in children's human capital. In Doepke and Tertilt (2009), we analyze such an augmented model in a fully dynamic context. The main result of the model is also in line with cross-country data. Fig. 25 shows that the position

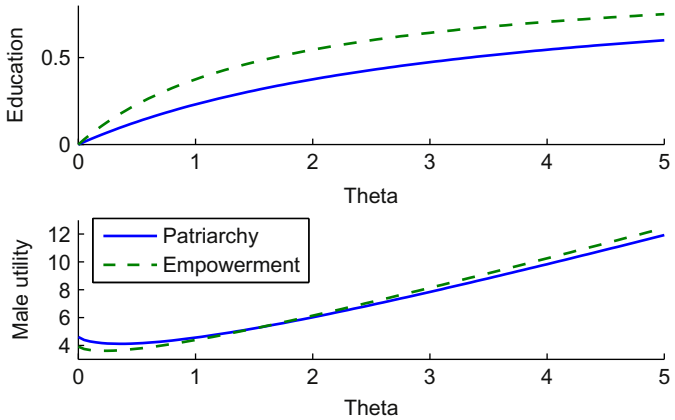

Fig. 24 Education and male utility as a function of θ, patriarchy vs empowerment.

[cb] The parameters used in the example are $\delta_m = 0.3, \delta_f = 0.9, \delta_m^G = 1.2, A = B = 5$. The initial level of human capital is set to $H_0 = 10$. The return to education θ varies between 0 and 5.

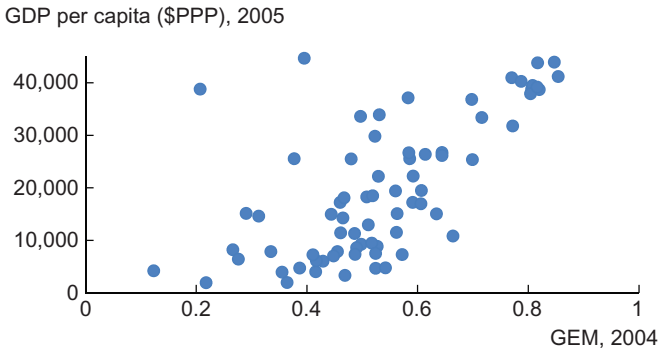

Fig. 25 Gender empowerment measure (GEM) and GDP per capita across countries. *GEM is an index constructed by the UN (Human Development Report, 2004), and GDP numbers are from the World Development Indicators.*

of women, as measured by the gender empowerment measure (GEM) constructed by the United Nations, is strongly positively correlated with GDP per capita. Assuming that returns to education differ systematically across countries, the model reproduces the same relationship.

A complementary theory is proposed by Fernández (2014). As in Doepke and Tertilt (2009), father's concern for their children is a central element. However, the key issue is not investment in education, but fathers preferring a more equal outcome between sons and daughters than what is produced under patriarchy. Economic growth widens disparities between sons and daughters in the patriarchy regime, which ultimately induces fathers to vote for empowerment. Fernández (2014) also provides empirical evidence based on the variation in extensions of women's economic rights across US states, showing that per capita wealth is positively associated with reform, whereas the association with fertility rates is negative (which is in line with the theories of both Doepke and Tertilt, 2009 and Fernández, 2014).

4.4 Voting for Children's Rights

Another near-universal policy reform associated with long-run development is the restriction of child labor. In preindustrial societies, child labor was the norm. In Western Europe and the United States, concern about child labor increased with industrialization, and ultimately industrializing countries introduced a variety of child labor restrictions such as minimum age laws and laws against working in hazardous occupations. A closely related policy reform that often coincided with child labor legislation is the introduction of compulsory schooling. This policy is usually the most effective constraint on child labor (in part because enforcement is straightforward). The close link between child labor and schooling is also part of the reason why

child labor reforms matter for growth, as rising educational attainment is one engine of long-run development.

Whereas child labor bans are now in place in all industrial countries, in many developing countries child labor continues to be widespread. Child labor is especially common among poorer families who depend on the additional income. In these countries, public support for introducing restrictions is low.

What explains the passing of child labor reform in some countries, and persistent failure to do so in others? These questions are addressed in Doepke and Zilibotti (2005a), who present an analysis of the political economy of child labor legislation within a dynamic framework that endogenizes skill premia as well as fertility and education decisions.[cc] Here we use a simpler, static framework to highlight the main trade-offs. To understand the political support for and opposition to child labor laws, it is necessary to identify which groups stand to gain or lose from the introduction of regulation. Doepke and Zilibotti argue that the group that stands to gain most from banning child labor consists of unskilled adult workers. To the extent that these workers compete with children in the labor market, by banning child labor they can reduce competition and potentially raise their own wages.[cd] However, the situation is complicated by the fact that the same workers may also have working children themselves, so that the potential wage gains have to be traded off against the loss of child-labor income. A family's fertility and education choices therefore also matter.

To analyze these trade-offs more formally, consider an economy with N_S skilled and N_U unskilled workers. We start under the assumption that each worker has n children, but that only the children of the unskilled workers are working. This is consistent with the observation that child labor is generally more prevalent among poorer families, whereas richer, more highly educated families tend to send their children to school rather than to work. The production technology is:

$$Y = AX_S^{\alpha} X_U^{1-\alpha},$$

where X_S is skilled labor and X_U is unskilled labor. Each working child supplies λ units of unskilled labor, where $\lambda < 1$, reflecting that children are less productive than adult workers. If child labor is legal (the *laissez faire* policy), labor supply is given by:

$$X_S^{\text{laissez faire}} = N_S,$$

$$X_U^{\text{laissez faire}} = N_U + \lambda n N_U,$$

[cc] An analysis of the welfare implications of banning child labor is contained in Doepke and Krueger (2008).

[cd] The feedback from regulation to wages is also central to the seminal analysis of Basu and Van (1998), which focuses on the possibility of multiple equilibria.

and, under the assumption of competitive production, wages are given by:

$$w_S^{\text{laissez faire}} = A\alpha\left(\frac{(1+\lambda n)N_U}{N_S}\right)^{1-\alpha},$$

$$w_U^{\text{laissez faire}} = A(1-\alpha)\left(\frac{N_S}{(1+\lambda n)N_U}\right)^{\alpha}.$$

Workers seek to maximize their total income (ie, consumption). Adding adult and child-labor income, total family income for the two types of workers is given by:

$$I_S^{\text{laissez faire}} = w_S = A\alpha\left(\frac{(1+\lambda n)N_U}{N_S}\right)^{1-\alpha},$$

$$I_U^{\text{laissez faire}} = (1+\lambda n)w_U = (1+\lambda n)^{1-\alpha}A(1-\alpha)\left(\frac{N_S}{N_U}\right)^{\alpha}.$$

Let us now see who would gain or lose if child labor were to be banned. Under a child labor ban, no children are working, so that labor supply is simply $X_S^{\text{Ban}} = N_S$ and $X_U^{\text{Ban}} = N_U$, and wages are:

$$w_S^{\text{Ban}} = A\alpha\left(\frac{N_U}{N_S}\right)^{1-\alpha},$$

$$w_U^{\text{Ban}} = A(1-\alpha)\left(\frac{N_S}{N_U}\right)^{\alpha}.$$

The ratios of wages under the two policies are:

$$\frac{w_S^{\text{Ban}}}{w_S^{\text{laissez faire}}} = \left(\frac{1}{1+\lambda n}\right)^{1-\alpha} < 1,$$

$$\frac{w_U^{\text{Ban}}}{w_U^{\text{laissez faire}}} = (1+\lambda n)^{\alpha} > 1.$$

Thus, the skilled wage falls and the unskilled wage increases. This happens because child labor is a substitute for unskilled but a complement for skilled adult labor. The result suggests that unskilled workers may be in favor of banning child labor. However, this is no longer clear when we look at what happens to total family income:

$$I_S^{\text{Ban}} = w_S^{\text{Ban}} = A\alpha\left(\frac{N_U}{N_S}\right)^{1-\alpha},$$

$$I_U^{\text{Ban}} = w_U^{\text{Ban}} = A(1-\alpha)\left(\frac{N_S}{N_U}\right)^{\alpha}.$$

The income ratios are:

$$\frac{I_S^{\text{Ban}}}{I_S^{\text{laissez faire}}} = \left(\frac{1}{1+\lambda n}\right)^{1-\alpha} < 1,$$

$$\frac{I_U^{\text{Ban}}}{I_U^{\text{laissez faire}}} = \left(\frac{1}{1+\lambda n}\right)^{1-\alpha} < 1.$$

We see that, in fact, income falls for both groups, including the unskilled. The reason is that the unskilled workers' gain in terms of higher wages is more than offset by the loss of child labor income. Intuitively, the loss of child labor income is proportional to the total reduction in the supply of unskilled labor, whereas the increase in the unskilled wage is less than proportional to the decline in labor supply.

The analysis suggests that in a country where unskilled workers' children are working as well, public support for introducing child-labor restrictions should be low. The support for child labor restrictions should rise, however, if there is a group of unskilled workers whose children are not working (say, because they send their children to school). Assume that fraction s of unskilled workers send their children to school, while only fraction $(1 - s)$ has working children. The wages then become:

$$w_S^{\text{laissez faire}} = A\alpha\left(\frac{(1+\lambda(1-s)n)N_U}{N_S}\right)^{1-\alpha},$$

$$w_U^{\text{laissez faire}} = A(1-\alpha)\left(\frac{N_S}{(1+\lambda(1-s)n)N_U}\right)^{\alpha}$$

Income is now given by:

$$I_S^{\text{laissez faire}} = w_S = A\alpha\left(\frac{(1+\lambda(1-s)n)N_U}{N_S}\right)^{1-\alpha},$$

$$I_U^{\text{laissez faire}}(\text{working children}) = (1+\lambda n)w_U = (1+\lambda n)A(1-\alpha)\left(\frac{N_S}{(1+\lambda(1-s)n)N_U}\right)^{\alpha},$$

$$I_U^{\text{laissez faire}}(\text{children in school}) = w_U = A(1-\alpha)\left(\frac{N_S}{(1+\lambda(1-s)n)N_U}\right)^{\alpha}.$$

If child labor is now banned, incomes are:

$$I_S^{\text{Ban}} = w_S^{\text{Ban}} = A\alpha\left(\frac{N_U}{N_S}\right)^{1-\alpha},$$

$$I_U^{\text{Ban}}(\text{working children}) = I_U^{\text{Ban}}(\text{children in school}) = A(1-\alpha)\left(\frac{N_S}{N_U}\right)^{\alpha}.$$

Thus, for the unskilled workers with children in school, the introduction of a child labor ban unambiguously increases income. This result explains why child labor reform tends to happen in times when child labor is already declining for other reasons, such as an increased demand for human capital and a higher propensity among unskilled workers to send children to school. It is unskilled workers who do not depend on child labor themselves who should be the strongest advocates of reform.

Notice that the basic mechanism outlined so far is similar to our analysis of the political economy of women's rights in Section 4.3. First, technological change (not modeled explicitly here) increases the demand for human capital; next, the higher demand for human capital induces families to start educating their children; and finally, the families who now send their children to school become supporters of a child labor ban, triggering reform.

So far, we have focused on the case of a country in which child labor is initially legal. Our results show that as long as child labor is widespread among unskilled workers, support for introducing a child-labor ban will remain low. In cross-country data, we observe that differences in child-labor regulations are highly persistent over time, which suggests the existence of a status-quo bias. To examine whether such a bias can arise in our model, let us now consider the opposite situation of a country where a child labor ban is already in place. Are there any reasons why people might be more supportive of banning child labor if a child labor ban is already in place? As we will see, a status-quo bias can indeed arise in our theory, but only if fertility decisions are endogenous and depend on the current political regime.

We would like to find conditions under which the electorate would be willing to abandon an already existing child-labor ban. Consider first the case where fertility is independent of the policy, ie, every household continues to have n children as before. In this case, the trade-off that arises from abandoning an existing ban is exactly the reverse of the trade-off following from introducing a ban described above. In particular, if all unskilled households would actually send their children to work once the ban is abandoned, they would stand to gain from introducing child labor and abandoning the ban. In other words, the preferred policy is independent of the current policy, and a status-quo bias does not arise.

The situation is different, however, if the number of children depends on the current state of the law. It is a common observation that parents face a quantity–quality trade-off in their decisions on children: Parents who invest a lot in their children in terms of

education tend to have fewer children than parents who send their children to work. We would therefore expect that once a child labor ban is in place (which effectively makes children more expensive), fertility would be lower. For concreteness, assume that fraction o of unskilled workers have already chosen their number of children under the assumption that the child-labor ban will stay in place, and that their fertility rate is $n^{\text{Ban}} < n$. The remaining families choose their family size later; in particular, if the ban is abandoned, they will optimally choose the larger fertility size n to maximize child labor income. What are now the relevant trade-offs? As above, in the presence of a ban, workers' incomes are $I_S^{\text{Ban}} = A\alpha(N_U/N_S)^{1-\alpha}$ and $I_U^{\text{Ban}} = A(1-\alpha)(N_S/N_U)^{\alpha}$, respectively. If the ban is now abandoned, income is:

$$I_S^{\text{laissez faire}} = A\alpha\left(\frac{(1+\lambda(on^{\text{Ban}}+(1-o)n))N_U}{N_S}\right)^{1-\alpha}$$

for the skilled,

$$I_U^{\text{laissez faire}}(\text{old}) = (1+\lambda n^{\text{Ban}})A(1-\alpha)\left(\frac{N_S}{(1+\lambda(on^{\text{Ban}}+(1-o)n))N_U}\right)^{\alpha}$$

for the "old" unskilled with small families, and:

$$I_U^{\text{laissez faire}}(\text{young}) = (1+\lambda n)A(1-\alpha)\left(\frac{N_S}{(1+\lambda(on^{\text{Ban}}+(1-o)n))N_U}\right)^{\alpha}$$

for the "young" unskilled with larger families. Comparing incomes, we can see that the old unskilled can now lose from the introduction of child labor. Their income ratio is:

$$\frac{I_U^{\text{laissez faire}}(\text{old})}{I_U^{\text{Ban}}(\text{old})} = \frac{1+\lambda n^{\text{Ban}}}{(1+\lambda(on^{\text{Ban}}+(1-o)n))^{\alpha}},$$

which is smaller than one if n^{Ban} is sufficiently small relative to n. These families made their low fertility choice under the assumption that child labor would not be an option. Given that they cannot change fertility ex-post, they have little to gain from making their own children work, but lose from the lower wages due to other families' children entering the labor force.

This mechanism induces policy persistence: Once a ban is in place, families start to make decisions that in the future increase political support for maintaining the ban. This mechanism can explain why differences in child labor and its regulations can be highly persistent across countries. In particular, the theory predicts that some countries can get locked into steady state equilibria featuring high fertility, high incidence of child labor, and little political support for the introduction of child labor regulation. In contrast, other countries with otherwise identical economic fundamentals have low fertility, no child labor, and widespread support for the ban of child labor.

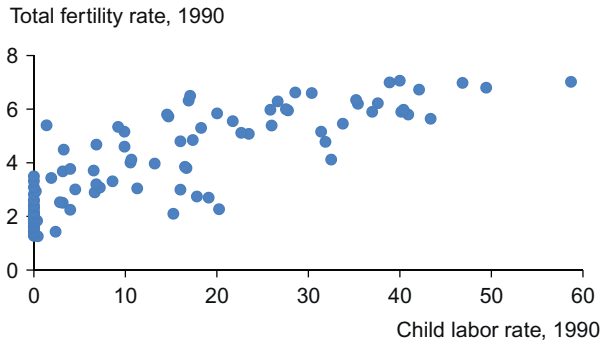

Fig. 26 The child labor rate (percentage of children aged 10–14 economically active) and total fertility rate across countries. *World Bank Development Indicators.*

Consistent with these predictions, we observe large cross-country differences in child labor rates, even among today's developing countries that are at similar levels of income per capita. The theory also predicts a positive correlation between fertility and child labor rates, even after controlling for other variables that might affect child labor or fertility. As Fig. 26 shows, there is a strong positive relationship between fertility rates and child labor rates across countries in contemporary data. Doepke and Zilibotti (2005a) examine the prediction more formally using an international panel of 125 countries from 1960 to 1990. They regress child labor rates on fertility rates, controlling for time dummies, GDP per capita, the Gini coefficient, and the share of agriculture in employment (arguably an independent factor affecting child labor) and find a positive and highly significant coefficient on the fertility rate, implying that a one standard deviation increase in fertility is associated with an increase in the child labor rate of 2.5 percentage points. The results are robust to the inclusion of country fixed effects.

The preceding analysis shows that the key feature of the political economy of child-labor regulation is that the group that most stands to gain from banning child labor (unskilled workers) is often simultaneously economically invested in child labor (because their own children are working). This observation leads to an explanation of why child labor was banned only after an increasing share of parents sent their children to school instead of work, and why differences in child labor and child-labor regulation across countries can be highly persistent over time. The analysis can also be used to help in designing policies that facilitate the passing of child labor regulations in developing countries today. Doepke and Zilibotti (2009, 2010) examine interventions such as international labor standards and trade restrictions aimed at reducing child labor from this perspective and argue that such well-intentioned policies can backfire and reduce the likelihood of comprehensive action of child labor within developing countries.

5. CONCLUSION

In this chapter, we have argued that accounting for the family should be an integral part of macroeconomics. The family is where many of the key decisions that are relevant for macroeconomics are made. Since families have been changing, with fewer marriages, more single households, lower fertility, and higher female labor supply, the answers to standard macroeconomic questions concerning, say, how labor supply and savings react to the business cycle have likely changed, too. Family structure also differs across countries. Developing countries are characterized by higher fertility, more traditional gender roles, often a son preference, and sometimes polygyny. These differences matter for the decisions that families make, and hence for the size and age structure of the population, for the accumulation of human and physical capital, and ultimately for the rate of economic growth.

The family matters not just for its role in household-level decisions but also through its effect on the evolution of institutions. Long-run economic development is characterized by a strikingly universal process of political change. Almost all of today's rich countries went through a series of similar reforms: democracy spread, public education systems were built, women and children gained rights, and public pension systems and the welfare state were introduced. We argue that many of these reforms transfer responsibility from the household to the public sphere, and that the ultimate triggers behind the reforms were often related to changes in the family.

There are additional ways in which the family matters for macroeconomics which we did not cover in this chapter. For example, the issues we discussed here are largely positive in nature. We touched only briefly on normative questions in a few places, for example, the discussion of the one child policy. We purposely did not talk about efficiency in this context, since this is not straightforward to do. The regular notion of Pareto efficiency is not defined in models where population size is endogenous, which includes all models with endogenous fertility. To evaluate policies that may affect fertility—such as education policies, child labor laws, policies banning abortion, or subsidies for single mothers—new concepts are required. Golosov et al. (2007) propose two new notions—$\mathcal{A}$- and $\mathcal{P}$-efficiency—and show how they can be used in standard fertility models. Schoonbroodt and Tertilt (2014) use the concepts to explore under what conditions fertility choice may be inefficiently low and hence pronatalist policies may be desired.

There is also a burgeoning literature on the role of the family for the transmission of preferences, cultural values, and attitudes, which can also feed back into macroeconomic outcomes. Theoretical models of the transmission of preferences and values in the family are developed by Bisin and Verdier (2001) and Doepke and Zilibotti (2005b, 2008). Empirical evidence for the intergenerational transmission of risk attitudes is provided by Dohmen et al. (2012). In Fernández et al. (2004), men's

preferences for working vs stay-at-home wives are formed in childhood by the work behavior of their mothers. This leads to a dynamic process affecting female labor supply over time. Cultural transmission may also occur in society more generally. For example, in Fogli and Veldkamp (2011) and Fernández (2013), women learn from others about the costs of working. Both papers argue that a reduction in the perceived cost of working through this learning process is key to understanding the increase in female labor supply. The cultural transmission of fertility and female labor supply decisions is established empirically using data from second-generation immigrants to the United States by Fernández and Fogli (2006). Alesina and Giuliano (2010, 2014) argue that the strength of family ties varies across countries, and that these differences matter for cultural attitudes and macroeconomic outcomes. Alesina et al. (2013) take a historical perspective and trace unequal gender norms back to plough agriculture (and ultimately to soil type).[ce] Doepke and Zilibotti (2015) expand theories of preference transmission in the family to account for different parenting styles and link changes in parenting to macroeconomic trends such as increasing demand for human capital and increasing occupational differentiation in society.

Another important research area focuses on the importance of the family for understanding inequality. For example, de Nardi (2004) emphasizes the importance of bequest motives for the wealth distribution. Scholz and Seshadri (2009) build on this insight by investigating more generally the importance of children and fertility choice for the US wealth distribution. The interaction between parents and children is also analyzed for insights into the causes of intergenerational persistence of earnings.[cf] For example, parental inputs may amplify persistence if high-skill parents spend more resources and time on their children than low-skill parents. Other authors have emphasized the role of differences between women and men (and their interactions as couples) for understanding the distribution of earnings (and changes in earnings inequality over time). For example, Heathcote et al. (2010b) explicitly include male and female labor supply in their analysis of the US rising wage inequality. Other authors take this a step further and analyze how sorting and changes in sorting pattern have impacted inequality.[cg] Recent research also makes an explicit distinction between individual and household inequality.[ch] True consumption inequality may be lower than what is measured based on individual income data if the family plays a role in providing insurance (Blundell et al., 2008). Conversely, if family members do not provide full insurance

[ce] This hypothesis was first put forth by Boserup (1970), but had not been tested empirically until recently.
[cf] See, for example, Restuccia and Urrutia (2004), Lee and Seshadri (2015), and Yum (2015).
[cg] See, for example, Fernández and Rogerson (2001), Fernández et al. (2005), Choo and Siow (2006), and Greenwood et al. (2014, 2016a).
[ch] See Heathcote et al. (2010a).

to each other, true consumption inequality may be higher than what is measured based on household expenditure data (Lise and Seitz, 2011). Further, the mapping between individual and household inequality may change over time if the structure of the family is changing.

In our view, the intersection of family economics and macroeconomics offers many promising avenues for future research. Throughout this chapter, we have pointed out a number of particular questions that are in need of answers, and which could be addressed with the data, models, and methods available today. There is also a need to push out the frontier of theoretical modeling; in particular, we see a strong potential for intellectual arbitrage by applying methods of dynamic modeling that are common in macroeconomics to better understand the dynamics of household bargaining under commitment and private information frictions. Finally, there are promising applied topics that have barely been explored yet. For example, an important topic in recent macroeconomics concerns house price dynamics (see the chapter "Housing and macroeconomics" by Piazzesi and Schneider). Changes in family structure—such as the rise in single households—have a direct impact on housing demand. Further, singles are more eager to live in cities (where they can meet other singles) compared to families, who place higher value on space. Hence, changes in family formation and family structure should matter for the housing market. We hope that this and other research topics will be picked up by more researchers as family economics continues to become an integral part of macroeconomics.

APPENDICES

A Proofs for Propositions

Proof of Proposition 1 *As γ_f approaches zero, the density $f(\eta_g) = F'(\eta_g)$ approaches zero, so that the elasticity of labor supply approaches zero also. In contrast, for married women, the fact that $w_m > 0$ guarantees that the elasticity of labor supply is bounded away from zero.* □

Proof of Proposition 2 *The first part follows from the fact that aggregate labor supply elasticity for single households equals one, whereas for married households, it is strictly smaller than one.*

For the second part, for any $w_f > 0$, we have $\hat{\eta}_u > \hat{\eta}_e$, which implies that the elasticity is smaller than one. As w_f converges to zero, $\hat{\eta}_e$ and $\hat{\eta}_u$ both converge to zero. Since $F(0) = 0$ and F is continuous, we then have that $F(\hat{\eta}_e)$ and $F(\hat{\eta}_u)$ both converge to zero, which implies that the elasticity of labor supply converges to one. Conversely, as w_f converges to infinity, $\hat{\eta}_e$ and $\hat{\eta}_u$ both converge to infinity, implying that $F(\hat{\eta}_e)$ and $F(\hat{\eta}_u)$ both converge to one and once again resulting in an elasticity of one. □

Proof of Proposition 3 *If $\widetilde{\lambda}_f \leq \lambda_f$ and $\widetilde{\lambda}_m \leq \lambda_m$, neither participation constraint (9) and (10) is binding. Hence, it is optimal to stay married, $D = 0$, and the consumption allocation follows from maximizing (7) subject to the budget constraint (8). If $\widetilde{\lambda}_f > \lambda_f$ and $\widetilde{\lambda}_f + \widetilde{\lambda}_m \leq 1$, the wife's*

participation constraint is binding. Staying married ($\mathrm{D} = 0$*) continues to be optimal, however, because it is possible to increase the wife's consumption share to make her indifferent between marriage and divorce, with the husband continuing to be better off married. The wife's consumption can then be solved from solving for* c_f *in her participation constraint (9) (imposed as an equality) while setting* $\mathrm{D} = 0$*. The husband's consumption then follows from the budget constraint (8). The case where the husband's participation constraint is binding is parallel. Finally, when there is no allocation of ex-post bargaining power that keeps both spouses at least as well off married compared to being divorced, divorce (*$\mathrm{D} = 1$*) is the optimal choice, and consumption follows from the individual budget constraints in the divorced state.* □

Proof of Proposition 4 *The ratio of the growth factors is*

$$\frac{1+g^{end}}{1+g^{exog}} = \left\{ \left(\frac{\alpha\delta_f + (1-\alpha)\delta_m}{\lambda_f\delta_f + (1-\lambda_f)\delta_m} \right) \left(\frac{\alpha + [\lambda_f\delta_f + (1-\lambda_f)\delta_m]\theta}{\alpha + [\alpha\delta_f + (1-\alpha)\delta_m]\theta} \right) \right\}^{\theta}.$$

Thus the result follows trivially, given the assumption $\delta_f > \delta_m$ *and* $\theta < 1$*.* □

Proof of Proposition 5 *Take the limit as* $\theta \to \infty$ *on both sides of Eq. (19) separately. The limit of the left-hand side can be written as:*

$$\lim_{\theta\to\infty} (\delta_m + \delta_m^G) \lim_{\theta\to\infty} \frac{\log\left(\frac{\widetilde{\delta}}{\delta_m} \frac{1+\delta_m\theta}{1+\widetilde{\delta}\theta} \right)}{\frac{1}{\theta}}.$$

Note that both numerator and denominator converge to zero. Applying L'Hopital's Rule, canceling terms and rearranging, the limit can be written as:

$$(\delta_m + \delta_m^G) \lim_{\theta\to\infty} \left(\frac{(\widetilde{\delta} - \delta_m)}{\left(\frac{1}{\theta} + \widetilde{\delta}\right)\left(\frac{1}{\theta} + \delta_m\right)} \right).$$

From this expression, we can see that the limit exits and is equal to:

$$(\delta_m + \delta_m^G) \left(\frac{\widetilde{\delta} - \delta_m}{\widetilde{\delta}\delta_m} \right).$$

The limit of the right hand side of (19) is $\log\left(\frac{2\widetilde{\delta}}{\delta_m}\right)$*. Thus, in the limit* $\mathrm{U}^{\mathrm{E}} > \mathrm{U}^{\mathrm{P}}$ *if and only if* $(\delta_m + \delta_m^G)\left(\frac{\widetilde{\delta} - \delta_m}{\widetilde{\delta}\delta_m}\right) > \log\left(\frac{2\widetilde{\delta}}{\delta_m}\right)$*. Using the definition of* $\widetilde{\delta}$ *and rearranging, this can be expressed as:*

$$\delta_m^G > \log\left(\frac{\delta_f + \delta_m}{\delta_m}\right)\left(\frac{(\delta_f + \delta_m)\delta_m}{\delta_f - \delta_m}\right) - \delta_m.$$

Hence, as long as δ_m^G is large enough, the equation is satisfied. □

B Data Definitions and Sources

The data used in Table 3 are from two different editions of the OECD Gender, Institutions and Development Data Base (GID 2006 and 2014), the World Development Indicators (WDI 2003, 2005, and WDI 2014) and the United Nations Human Development Report 2004. Here we give the definition of each variable and its source.

GDP per capita: GDP data were used from two different years. The variables from GID 2014 and WDI 2014 were correlated with GDP p.c. from the WDI 2014. The variables from WDI 2003, UN 2004, and GID 2006 were correlated with GDP p.c. from the WDI 2005.

Share of agriculture: Measured as the value-added share of agriculture in GDP. Data were used from two different years. The variables from GID 2014 and WDI 2014 were correlated with percent agriculture from the WDI 2014. The variables from WDI 2003, UN 2004, and GID 2006 were correlated with percent agriculture from the WDI 2005.

Total fertility rate: Source: GID 2006.

Child mortality rate: Under-five mortality rate. Source: WDI 2014.

Average years of schooling: Source: WDI 2003.

Boy/girl sex ratio at birth: Measured as boys born per girl. Source: GID 2006.

Son preference in education: Percentage of people agreeing that university is more important for boys than for girls. GID 2014.

Inheritance discrimination against daughters: Whether daughters have the same inheritance rights as sons. Reported in three categories between 0 ("equal") and 1 ("unequal"). Source: GID 2014.

Female literacy relative to male: Female literacy as percentage of male literacy. Source: GID 2006.

Percent females in paid labor force: Percentage of women among wage and salaried workers. Source: GID 2006.

Unpaid care work by women: Female to male ratio of time devoted to unpaid care work. Source: GID 2014.

Year first woman in parliament: Source: Human Development Report 2004.

Women's access to land: Whether women and men have equal and secure access to land use, control and ownership. Categorical (three categories = 0, 0.5, 1), where 1 ("full") and 0 ("impossible"). Source: GID 2014.

Gender empowerment measure: Measures inequality between men's and women's opportunities, combining measures of inequality in political participation and decision making, in economic participation and decision making, and in power over economic resources. The level is between 1 ("full equality") and 0 ("no equality"). Source: UN 2004.

Early marriage: Share of female population between ages 15 and 19 ever married. GID 2014.

Agreement with wife beating: Percentage of women who agree that a husband/partner is justified in beating his wife/partner under certain circumstances. Source: GID 2014.

Inheritance discrimination against widows: Whether a widow has the same inheritance rights as a widower. Reported in three categories (0, 0.5, 1), where 0 means equal rights. Source: GID 2014.

Laws on domestic violence: Whether the legal framework offers women legal protection from domestic violence. Reported in five categories = 0, 0.25, 0.5, 0.75, 1, where 1 means no protection and 0 full protection. Source: GID 2014.

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