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Comment

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It is open to men to debate whether economic progress is good for men or not, but for women to debate the desirability of economic growth is to debate whether women should have the chance to cease to be beasts of burden, and to join the human race.
—W. Arthur Lewis, *The Theory of Economic Growth,* 1955[1]

I. Introduction

The secular decline in the relative price of durables and equipment is one of the most significant dimensions of technological progress of the twentieth century. Greenwood, Hercowitz, and Krusell (1997) argue that it can account for approximately 60% of the growth in aggregate output in the United States in the postwar period. The decline in price and resulting diffusion of home appliances are part of this phenomenon. While Long (1958) was possibly the first to link technological progress in this area to rising female labor force participation, Jeremy Greenwood and several coauthors have extensively explored its impact on fertility (Greenwood, Seshadri, and Vandenbroucke 2005), the growth in leisure (Greenwood and Vandenbroucke 2005), and women's participation (Greenwood, Seshadri, and Yorukoglu 2005). Given the deep changes in the allocation of market and nonmarket time within the household potentially linked to the diffusion of home appliances, it is natural to conjecture that household formation should also be affected.

Greenwood and Guner explore this conjecture and conclude that the decline in price of home durables can account for virtually all the rise in divorce rates and the decline in marriage rates experienced by the United States since World War II. This outcome arises in their model because home production weighs more heavily on single households and the gains from marriage decline as home appliances become cheaper and incomes rise.

I will first discuss the link between technological progress and the gains from marriage in the theory and on the empirical evidence in support of this mechanism. I will then comment on the related trends in fertility and on the role of gender, as well as on the potential endogeneity of progress in home production. In my final remarks, I relate the paper to the broader context and delineate several challenges for future work.

II.   Theory

The main premise of the theoretical analysis is that a decline in the price of home appliances reduces the gains from marriage. Two critical assumptions generate this result. The first is the presence of nonconvexities in consumption. Specifically, there are economies of scale in the consumption of home and market goods, with a household equivalence scale of 2^{ϕ} with $\phi \in (0, 1)$ for married households. In addition, there is a fixed household setup cost, **c**, denominated in market goods, which is the same for singles and married households. These nonconvexities imply that singles are poor relative to married households. The per capita time endowment net of the household setup costs is lower for singles, plus singles need to finance higher levels of consumption per capita. The second critical assumption is that marginal utility declines faster for home than for market goods.

Taken together, these features imply that singles' home production output and input per capita are higher than for married households as a fraction of their potential labor earnings. Singles also spend a larger share of their adjusted time endowment on home appliances. This property of the model determines the evolution of the utility gains from marriage. Singles benefit more from a reduction in the price of home durables since they devote a larger fraction of their time to home production. They also benefit more from a rise in wages since this entails a reduction in the fixed household setup cost, which weighs more heavily on them. Progress both in the home and in the market contributes to a decline in the utility gains from marriage. Is this mechanism plausible?

The long-run predictions of the model critically rely on the assumption that the household setup cost is constant across household types and over time. This assumption seems rather unrealistic. Consider children who contribute to the fixed household setup cost in terms of market and home consumption. While they are notably absent from the model, children are typically present in married households but not in single households. This suggests that the fixed household cost should depend on the type of household and may in part be endogenous.

More problematic is the assumption that the household setup cost is constant over time. Clearly, standards in the level of indispensable consumption rise with income. For example, the quality of acceptable housing, an expenditure item that can be considered part of the household setup cost, increases with income. Allowing for the fixed household setup cost to rise with wages would not only make the model more realistic but also isolate the effect of the decline in the price of home appliances on the gains from marriage.

The assumption that the marginal utility of home goods declines faster than that of market goods implies a negative relation between the demand for home-produced goods and household income. Instead, there is substantial qualitative evidence in support of a positive relation between home hours and household income for the early decades of the twentieth century (Ramey, forthcoming). This positive correlation was driven in part by the smaller living quarters for low-income households as well as by lower levels of home production output. For example, studies of wage earners' diets suggest that historically the working classes relied on ready-made rather than home-produced foods. If we adopt Becker's broader interpretation of home production output, which includes joint production of leisure activities that involve market goods and time of the household members, the assumption that the demand for home-produced goods declines with income becomes even harder to motivate.

Finally, the model features multiple channels through which a reduction in the price of home appliances reduces the gains from marriage. The presence of economies of scale in consumption is often justified with fixed consumption costs that have a lower per capita impact in larger households. Why then is it necessary to also include a fixed household cost in the model? Both these features imply that singles are poor relative to married households, which combined with the inferiority of home goods drives the qualitative properties of the model. A model with fixed household setup costs in home goods, without any special assumptions on preferences, would presumably deliver the same qualitative properties. The presence of these multiple channels tends to amplify the impact of technological progress on household formation. If the quantitative performance of the model depends on this amplification, it would be useful to clarify this property.

III.   Link between Evidence and Theory: Has Home Production Declined?

One of the key predictions of the model is that household time devoted to home production should decline, especially for single households.

Evaluating this prediction requires detailed data on home hours by
marital status and by gender starting as early as 1900. Unfortunately,
a nationally representative data source for home hours prior to World
War II is not available. Still, with a variety of surveys that were con-
ducted in the early decades of the twentieth century, it is possible to
compile reliable estimates of home hours by marital status for women
and in the aggregate for men. Ramey (forthcoming) has carefully re-
viewed and reconciled the available sources to generate an accurate
and comprehensive set of estimates of home hours that provide consis-
tent information on this variable for the entire course of the twentieth
century. I will be drawing from these estimates in my discussion.

A.   Aggregate Home Hours

The path of per capita home hours is reported in figure 1 (left axis). The
figure also displays the time series for an index of the time price of
home durables, starting in 1920 (right axis). The details on the construc-
tion of this index can be found in Albanesi and Olivetti (2007). The time
price of home durables declines linearly between 1920 and 1965, with
small additional progress after that date. Per capita home hours decline
from 26 hours per week in 1900 to 21.5 per week in 2005, but the decline
is clearly nonmonotone. Specifically, the path of aggregate home hours
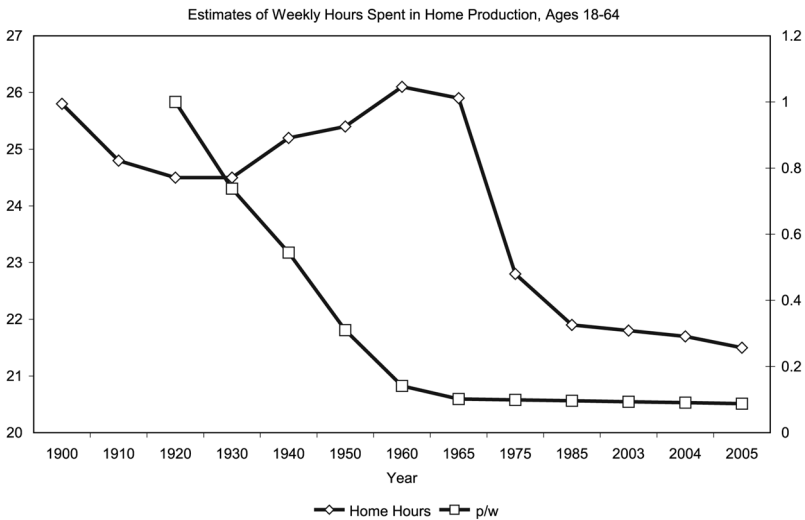seems to have evolved in three distinct phases.

Fig. 1.   Home hours and the time price of home appliances. Sources: Albanesi and
Olivetti (2007); Ramey (forthcoming).

i) 1900–1930: Per capita home hours decline from 26 per week to 24.5 per week. In this period, progress in home production amounted mostly to the installation of modern plumbing facilities and electrification. Home appliances were still expensive and unreliable. Urbanization and declining fertility may in part rationalize the decline in home hours in this period since the diffusion of home appliances was still very restricted. All measures of fertility experienced a decline in this period. Specifically, the total fertility rate[2] declined from just under 4 in 1900 to 2.6 in 1930 (Jones and Tertilt, forthcoming).

ii) 1930–60: Per capita home hours rise from 24.5 to 26.2. The rise in home hours starting in the 1930s is a puzzle precisely because in the second part of this time period the diffusion of laborsaving home appliances is more substantial.[3] Why was there "more work for mother"? This question serves as the subject of Ruth Schwartz Cowan's seminal 1983 book. Mokyr (2000) offers an interesting perspective on the so-called Cowan paradox. He argues that the scientific discoveries that occurred between the end of the nineteenth and the beginning of the twentieth century increased knowledge of the causes and transmission mechanisms for infectious diseases. The awareness of a connection between hygiene, nutrition, and health contributed to an increase in the demand for certain home-produced goods and services, as housewives strived to incorporate these new principles in the conduct of such basic activities as food preparation and house cleaning. Home hours experienced an increase, despite the availability of laborsaving home appliances. Perhaps the most obvious force behind the upsurge in home hours in this period is the rise in fertility. The presence of an additional child adds 1.6 hours per week if the child is over the age of 5 (Ramey, forthcoming) and at least 15 hours per week if under the age of 1 (Albanesi and Olivetti 2007), mostly accounted for by the time required for (breast) feeding. Since the total fertility rate grew from 2.3 in 1940 to 3.7 in 1960 (Jones and Tertilt, forthcoming), the increase in home hours seems rather less surprising.

iii) After 1960: Per capita home hours decline from 26 to 21.5 per week. The decline mostly takes place between 1960 and 1985, when home hours reach 22 per week. Fertility over this period exhibits a sharply declining trend, with the total fertility rate dropping to 1.8 in 1980. But this is also the phase that corresponds to the introduction of modern and efficient versions of standard home appliances, including the microwave, as well as additional complementary innovations, such as frozen meals.

B. Home Production and Fertility

The strong link between home hours and the presence of children in the household has dominated my discussion. All available time use evidence clearly establishes this link, and it also emerges from the strong positive correlation between household size and per capita home hours in the aggregate, plotted in figure 2. Again, the baby boom years stand out with a marked rise in the hours per household. However, the effect of the baby boom is to increase the demand for home hours not just through an increase in household size but also through a change in household composition. Schoellman and Tertilt (2007) report that the number of adults per household declined from three to two between 1940 and 1960, whereas the number of children per household increased from two to three. While each additional child increases the time devoted to home production, additional adults have the opposite effect (Ramey, forthcoming).

C. Home Hours by Marital Status and Gender

My discussion has so far concentrated on aggregate home hours, though the key predictions of the theory concern the distribution of
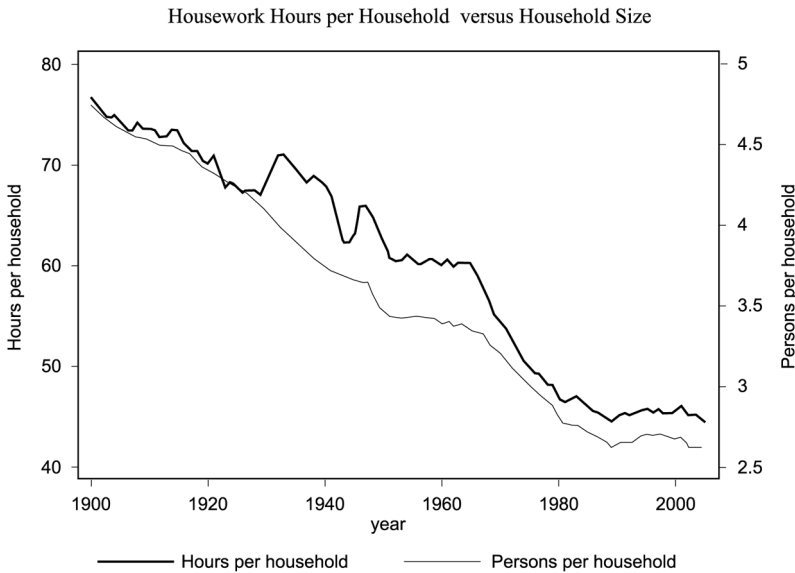

Fig. 2. The correlation between home hours and household size. Source: Ramey (forthcoming).

Table 1
Estimates of Home Production

| | Women | | | | | |
Year	Nonemployed	Ever-Married, Employed	Single, Employed	All	Men	All
1900	54.9	27.1	7.0	46.8	3.9	24.7
2000	38.1	27.6	17.7	29.1	16.5	22.9

Source: Ramey (forthcoming).
Note: Average hours per week, ages 18–64.

home hours by marital status. Table 1 and figure 3 present data on home hours by marital status and gender.

Two striking observations emerge. First, home hours for all categories, except nonemployed women, actually rise between 1900 and 2000, with the most substantial rise occurring up until 1965. Starting in 1984, home hours start rising again for all categories. The increase in home hours is most notable for single employed women and men. Second, the decline in aggregate home hours is mostly driven by changes in behavior of women, in particular, the increase in the fraction of employed women (see fig. 4 below) and the decline in home hours for nonemployed women. A back of the envelope calculation suggests that the rise in the fraction of employed women plays by far the dominant role since it accounts for 141% of the decline in aggregate home hours, whereas the decline in average weekly home hours of nonemployed
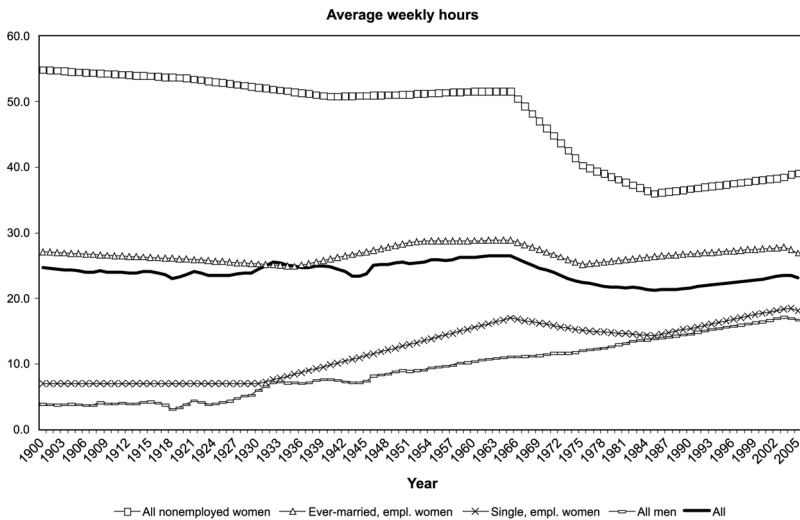

Fig. 3. Estimates of home production, ages 18–64. Source: Ramey (forthcoming)

women accounts for only 62% of the decline in aggregate home hours. By contrast, the change in home hours of employed males accounts for −53% of the decline in aggregate home hours.[4] While it is not possible to decompose male home hours by marital status, time use evidence for the United States from the postwar period suggests that the rise in male home hours is strongly driven by the behavior of married men,[5] and total home hours for single men are lower than the male average.

Taken together, the cross-sectional evidence suggests that the decline in home production input in the aggregate was mostly driven by the entry of women into the workforce, a fact that the model fails to address. In addition, home hours for single households, male or female, were and remain significantly lower than for married households, though there has been a convergence in the postwar period. This convergence is driven by a decline in the home hours of married women and an increase in home hours for single women. These facts contradict the main predictions of the theory.

IV.   Is Progress in Home Production Exogenous?

The principal premise of the analysis is that the progress in home technologies is exogenous. While it is undisputable that the development of the basic technologies used in home appliances was the outcome of scientific discoveries that can be considered independent from home production and household formation, a variety of other considerations suggest that the application of these technologies to the production of home appliances might have been at least in part driven by demand. For one, as previously noted, scientific discoveries on disease transmission and nutrition may have increased the demand for home production output, thus fueling the growth of home appliances. Even without this development, three observations suggest that the diffusion of home appliances may have been endogenous. First, the female/male earnings ratio and married women's labor force participation started rising before (functional) laborsaving home appliances became available. Second, market substitutes for home hours and appliances were in use before the introduction of home appliances. Third, changes in the wage structure in the early decades of the twentieth century likely induced a decline in the supply and a consequent rise in the cost of domestic workers.

Evidence in Goldin (1990) supports the first observation. She reports that the female/male earnings ratio in manufacturing rose from approximately 35% in 1820 to above 50% in the early decades of the twentieth
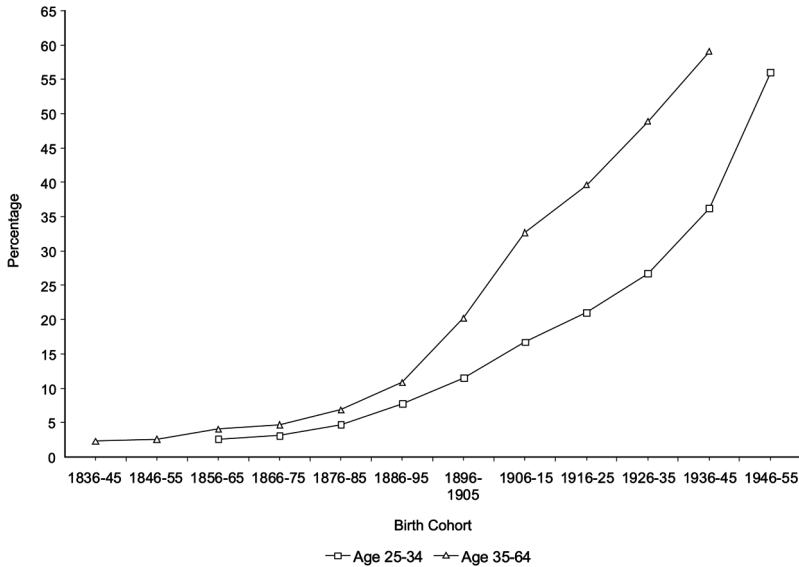
Fig. 4.   Labor force participation of married women by cohort and age. Source: Author's calculations based on Goldin (1990).

century, the biggest increase ever experienced by this variable.[6] Figure 4 documents the positive trend in women's participation, which starts in the earliest 1900s. Participation of women at ages 25–34 and 35–64 rose from 3% and 5%, respectively, for the 1876–85 birth cohort to 15% and close to 20% for the 1906–15 birth cohort.

The availability of market substitutes for home hours even before the introduction of home appliances is corroborated first of all by the fact that home hours of employed married women are virtually constant over time, conditional on the number of children, as seen in figure 3. Evidence from the 1917–19 Cost of Living Services in Moehling (2001) suggests that households outsourced many basic chores. For example, 70% of households were using commercial laundry services, 33% were eating meals at restaurants, and only 16% employed servants.

The number of households employing domestics declined sharply between 1900 and 1970, though this decline was not monotone, as shown in figure 5. A sharp decline occurred between 1900 and 1930. Several factors likely contributed to this decline. The increase in the skill level of the workforce, owing to the effects of the high school movement, a rise in manufacturing wages, and the emergence of the clerical sector, reduced the appeal of domestic service occupations. Increasingly restrictive immigration legislation introduced in the 1920s also limited
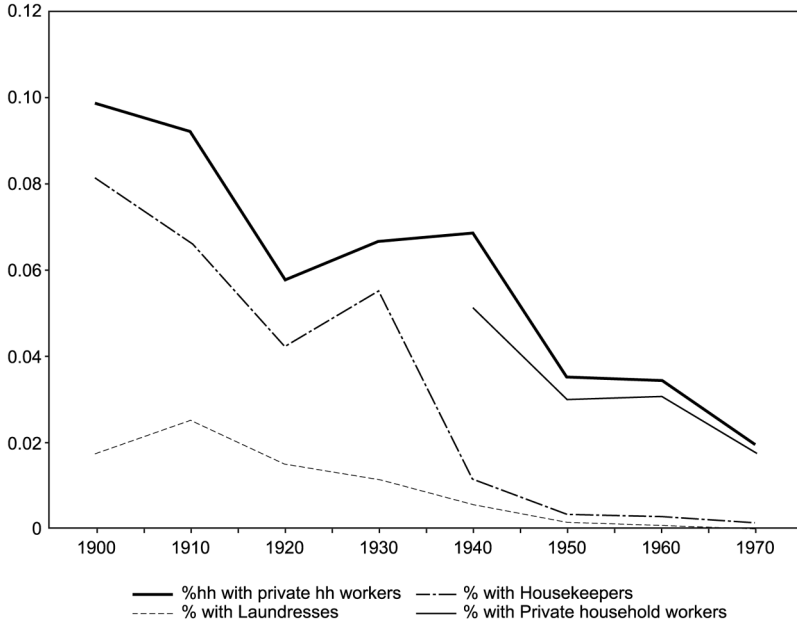
Fig. 5. Percentage of households with domestic servants, 1900–1970. Source: *Historical Statistics of the United States, Colonial Times to 1970*, series D 236–682 and series A 350–52.

the supply of workers to this market.[7] The temporary rise in the number of domestics during the 1930s may have been a response to the scarcity of other more desirable jobs as the Great Depression unfolded. The postwar period is characterized by a continued drop in the percentage of households with domestic servants.

Taken together, these observations point to a hypothesis alternative to the one proposed by Greenwood and Guner. The development of home appliances is an endogenous response to the following factors: a rise in the demand for home-produced goods originating from scientific discoveries on the importance of hygiene and nutrition for health and a rise in the demand for substitutes for labor input into home production, due to the rising labor force participation of married women and a decline in the supply of domestics.

The potential endogeneity of progress in home appliances does not diminish its role in the transformation of home and market work and the resulting evolution in the gains from marriage. However, it does raise questions on the interpretation of the results in the paper. The quantitative analysis suggests that technological progress can account for virtually all the trend in marriage and divorce between 1950 and

2000. Should we conclude from this finding that the phenomena that were responsible for the diffusion of home appliances do not exert any independent effects? This conclusion would perhaps be warranted if the model's implications for home hours were broadly consistent with the empirical evidence. However, the data on home hours by marital status are strongly at odds with one of the key predictions of the theory. In light of this conflict, we should be cautious in interpreting the success in matching aggregates as evidence in favor of its basic mechanism.

V.   Challenges

The historical decline in aggregate home hours is mostly driven by changes in behavior of women, in particular, the increase in the fraction of employed (married) women. This has led to a remarkable transformation in women's economic role and initiated a path toward gender equality in economic outcomes that should affect both the nature and the distribution of the gains from marriage. One may dispute the role of technological progress since there is nothing intrinsically gendered about a washing machine or rising productivity and the rise in women's participation precedes the diffusion of home appliances.[8] If there is a link between the transformation of women's economic role and technological progress, it must be found in the endogenous response of household behavior.

   A growing literature explores the determinants of the rise in women's participation. Greenwood, Seshadri, and Yorukoglu (2005) concentrate on the diffusion of home appliances. Since they simply assume the attribution of roles within the household, their analysis cannot shed light on its determinants over time. Other technological explanations that have been proposed endogenize gender roles on the basis of biological differences. Galor and Weil (1996) explore the rise in demand for jobs that require intellectual, as opposed to physical, skills. Albanesi and Olivetti (2007) analyze the impact of medical progress in the area of pregnancy and childbirth. Cultural factors are also important empirically (Fernandez and Fogli 2005), and their endogenous evolution has been studied to explain the historical transformation of women's role (Fernandez 2007; Fogli and Veldkamp 2008). Cultural and technological factors may of course interact. Goldin (2002) explores the endogenous changes in the degree of job and wage discrimination by gender resulting from technological change.[9]

   This body of work mostly abstracts from modeling household decisions explicitly, a critical step in the analysis for the gains from marriage,[10] and

does not draw implications for household formation.[11] This points to a clear direction for future research. Before embarking on this program, however, it is necessary to inspect more closely the contribution of the various determinants of gender roles. Two strategies for doing this immediately come to mind. All the existing hypotheses are based on the same broad stylized facts, but they have different cross-sectional implications. This variation could be exploited to inspect the mechanism inherent in each theory. Accurate measurement based on detailed historical evidence is key to make progress in this dimension. Additionally, each theory has so far been considered in isolation. Each factor may in fact be relevant only in specific time periods or for different types of agents. For example, Albanesi and Olivetti (2007) show that improvements in reproductive medicine can fully account for the rise in participation of married women in childbearing age between 1920 and 1950, and progress in home technologies is essential to match the labor market behavior of older married women after 1950.

Why is it important to attempt to isolate the effect of the various forces? For one, it would enable us to reach a deeper understanding of their impact, which is valuable in itself. It is also critical for policy analysis. The potential distortions and the benefits associated with different government programs are sensitive to the mechanism through which key outcomes, such as female participation, marriage patterns, or fertility, are determined. Finally, it would enable a potentially fruitful spillover from macroeconomics to development economics. The nature of the link between gender equality and development is disputed (Duflo 2005). A structural analysis of the historical experience in the United States and other advanced countries could provide important insights into how technological diffusion can affect gender equality and influence development.

Endnotes

1. Citation reproduced from Goldin (1994, 3).

2. The total fertility rate is defined as the sum of the age-specific birth rates over all women alive in a given year. See Jones and Tertilt (forthcoming) for a discussion of different fertility measures.

3. Though production of home appliances was interrupted during World War II.

4. The data for female and male participation for this calculation are from Goldin (1990).

5. The wife/husband ratio of home hours drops from 1.89 in 1965 to 1.59 in 2003. See Knowles (2007).

6. See tables 3.1 and 3.2 in Goldin (1990). Data are for full-time workers where available.

7. The Immigration Act of 1917 was the first intervention. The Emergency Quota Act of 1921, soon followed by the more restrictive Immigration Act of 1924, or Johnson-Reed Act, established a national origins quota system that was effectively in place until 1952.

8. Doepke and Tertilt (2008) argue that the process of "women's liberation" begins before their entry into the labor force.

9. Jones, Manuelli, and McGrattan (2003) examine the effect of a declining gender wage gap on married women's participation in the postwar period. Since they treat this gap as exogenous, their analysis cannot explain the endogenous evolution of gender roles. Albanesi and Olivetti (2009) build a model in which gender wage gaps arise endogenously, but they focus on the cross-sectional variation in gender earnings inequality.

10. Knowles (2007) shows that the change in the distribution of work within married households in the postwar period can be rationalized only with a nonunitary model of household behavior.

11. There is a dearth of quantitative research linking the transformation in gender roles with household formation. The existing work concentrates on household size via fertility. See Galor and Weil (1996), Doepke, Hazan, and Maoz (2007), and Albanesi and Olivetti (2008).

References

Albanesi, Stefania, and Claudia Olivetti. 2007. "Gender Roles and Technological Progress." Working Paper no. 13179, NBER, Cambridge, MA.

———. 2008. "Mother's Health and the Baby Boom." Working paper, Columbia University.

———. 2009. "Home Production, Market Production and the Gender Wage Gap: Incentives and Expectations." *Review of Economic Dynamics* 12 (January): 80–107.

Cowan, Ruth Schwartz. 1983. *More Work for Mother*. New York: Basic Books.

Doepke, Matthias, Moshe Hazan, and Yishay Maoz. 2007. "The Baby Boom and World War II: A Macroeconomic Analysis." Manuscript, Northwestern University.

Doepke, Matthias, and Michele Tertilt. 2008. "Women's Liberation: What's in It for Men?" Manuscript, Northwestern University.

Duflo, Esther. 2005. "Gender Equality in Development." BREAD Policy Paper no. 011, Bureau for Research in Economic Analysis of Development, Duke University, http://ipl.econ.duke.edu/bread/papers/policy/p011.pdf.

Fernandez, Raquel. 2007. "Culture as Learning: The Evolution of Female Labor Force Participation over a Century." Manuscript, New York University.

Fernandez, Raquel, and Alessandra Fogli. 2005. "Culture: An Empirical Investigation of Beliefs, Work and Fertility." Working paper, NBER, Cambridge, MA.

Fogli, Alessandra, and Laura Veldkamp. 2008. "Nature or Nurture? Learning and the Geography of Female Labor Force Participation." Manuscript, New York University.

Galor, Oded, and David N. Weil. 1996. "The Gender Gap, Fertility and Growth." *American Economic Review* 86:374–87.

Goldin, Claudia. 1990. *Understanding the Gender Wage Gap: An Economic History of American Women*. Oxford: Oxford University Press.

———. 1994. "The U-Shaped Pattern of Female Labor Force Participation in Economic Development and Economic History." Working Paper no. 4707, NBER, Cambridge, MA.

———. 2002. "A Pollution Theory of Discrimination." Working Paper no. 8985, NBER, Cambridge, MA.

Greenwood, Jeremy, Zvi Hercowitz, and Per Krusell. 1997. "Long-Run Implications of Investment Specific Technological Change." *American Economic Review* 87, no. 3:342–62.

Greenwood, Jeremy, Ananth Seshadri, and Guillaume Vandenbroucke. 2005. "The Baby Boom and Baby Bust." *American Economic Review* 95:183–207.

Greenwood, Jeremy, Ananth Seshadri, and Mehmet Yorukoglu. 2005. "Engines of Liberation." *Review of Economic Studies* 72:109–33.

Greenwood, Jeremy, and Guillaume Vandenbroucke. 2005. "Hours Worked: Long-Run Trends." Research Report no. 10, Economie d'Avant Garde, http://www.jeremygreenwood.net/EAG.htm.

Jones, Larry E., Rodolfo E. Manuelli, and Ellen R. McGrattan. 2003. "Why Are Married Women Working So Much?" Staff report, Research Department, Federal Reserve Bank of Minneapolis.

Jones, Larry E., and Michele Tertilt. Forthcoming. "An Economic History of Fertility in the U.S.: 1826–1960." In *The Handbook of Family Economics*, ed. Peter Rupert.

Knowles, John. 2007. "Why Are Married Men Working So Much? Home Production, Household Bargaining and Per Capita Hours." Manuscript, University of Pennsylvania.

Long, Clarence. 1958. *The Labor Force under Changing Income and Employment*. Princeton, NJ: Princeton University Press.

Moehling, Carolyn M. 2001. "Women's Work and Men's Unemployment." *Journal of Economic History* 61, no. 4:926–49.

Mokyr, Joel. 2000. "Why Was There More Work for Mother? Technological Change and the Household, 1880–1930." *Journal of Economic History* 60:1–40.

Ramey, Valerie. Forthcoming. "Time Spent in Home Production in the 20th Century: New Estimates from Old Data." *Journal of Economic History*.

Schoellman, Todd, and Michele Tertilt. 2007. "Families as Roommates: Changes in U.S. Household Size from 1850 to 2000." Manuscript, Stanford University.