

Discussion:
"Marriage and Divorce Since WWII: Analyzing the The Role of
Technological Progress on the Formation of Households," by
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August 8, 2008

"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 Growth¹.

1. 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 US in the post-war period. The decline in price and resulting diffusion of home appliances is 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), as well as on women's participation (Greenwood, Seshadri and Yorugoklu, 2005). Given the deep changes in the allocation of market and non-market 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 US since World War II. This outcome arises in their model due to the fact that 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.

¹Citation reproduced from Goldin (1994)

2. 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 non-convexities 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 non-convexities imply that singles are poor relative to married households. The per capita time endowment net of the household set up 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 market goods.

Taken together, these features imply that singles' home production output and input per capita is *higher* than for married households as 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 set up cost, which weighs more heavily on them. Both progress in the home *and* in the market contribute 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 set up cost is constant across household type and over time. This assumption seems rather unrealistic. Consider children who contribute to the fixed household set up 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 set up 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 set up cost, increases with income. Allowing for the fixed household set up 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 for 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 20th century (Ramey, 2008). 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 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 set up 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.

3. Link Between Evidence and Theory

3.1. 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, using a variety of surveys that were conducted 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 (2008) has carefully reviewed and reconciled the available sources to generate an accurate and comprehensive set of estimates of home hours that provide consistent information on this variable for the entire course of the twentieth century. I will be drawing from these estimates in my discussion.

3.1.1. 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 construction 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 non-monotone. Specifically, the path of aggregate home hours seems to have evolved in three distinct phases.

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 in 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 rate² declined from just under 4 in 1900 to 2.6 in 1930 (Jones and Tertilt, 2007).

ii) 1930-1960: 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 labor saving home appliances is more substantial³. Why was there *"more work for mother?"* This question serves as the subject of Ruth Schwarz Cowan's seminal 1983 book. Mokyr (2000) offers an interesting perspective on the so called Cowan paradox. He argues that the scientific

²The 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 (2007) for a discussion of different fertility measures.

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



Figure 1: Home hours and the time price of home appliances. Source: Ramey (2008), Albanesi and Olivetti (2007)

discoveries that occurred between the end of the 19th and the beginning of the 20th century increased knowledge of the causes and transmission mechanisms for infectious diseases. The awareness of a connection between hygiene, nutrition and health contributed to increase 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 labor saving 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, 2008) 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, 2007), the increase in home hours seems rather less surprising.

iii) Post 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 on standard home appliances, including the microwave, as well as additional complementary innovations, such as frozen meals.

3.1.2. 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 not just to increase the demand for home hours via an increase in household size, but also through a change in household composition.

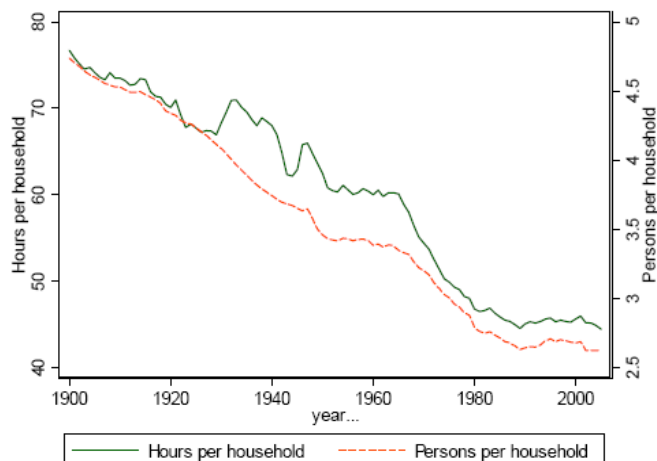


Figure 2: The correlation between home hours and household size. Source: Ramey (2008)

Schoellman and Tertilt (2007) report that the number of adults per household declined from 3 to 2 between 1940 and 1960, while the number of children per household increase from 2 to 3. While each additional child increases the time devoted to home production, additional adults have the opposite effect (Ramey, 2008).

3.1.3. 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 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 non-employed 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 fraction of employed women (see Figure 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, while the decline in average weekly home hours of non-employed women only accounts for 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 hours⁴. While it is not possible to decompose male home hours by marital status, time use evidence for the US from the post-war period suggests that the rise in male home hours is strongly driven by the behavior of married men⁵ and total home hours for single men are lower than the male average.

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

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

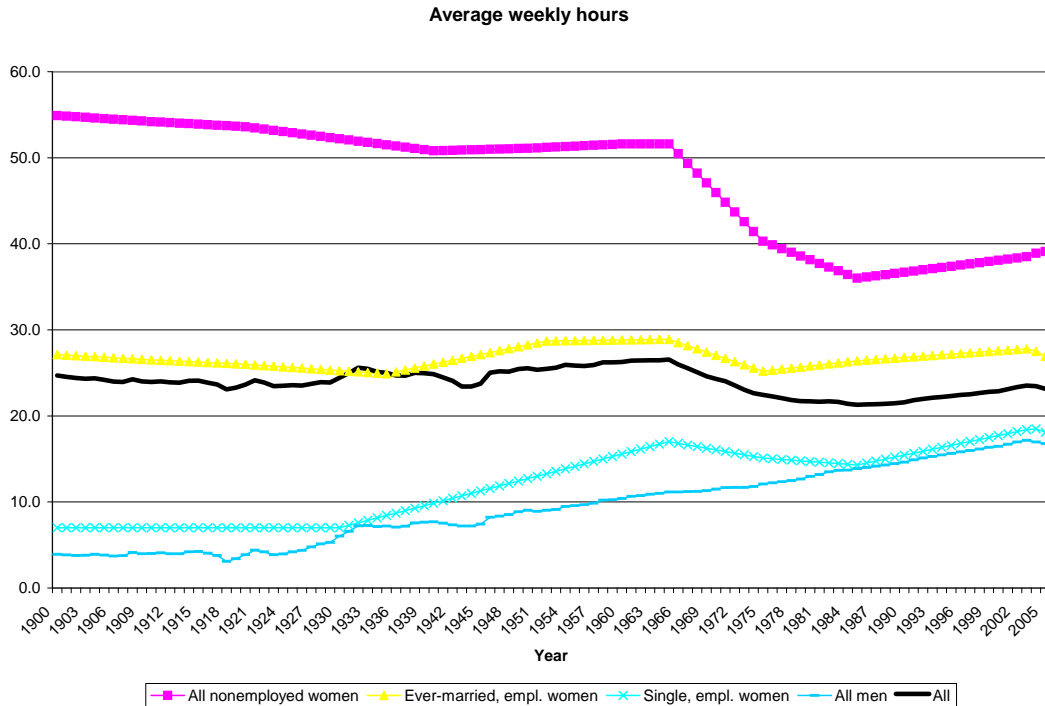


Figure 3: Estimates of home production. Ages 18-64. Source: Ramey (2008).

Year	Women			All	Men	All
	Nonemployed	Ever-Married, empl.	Single, empl.			
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

Average Hours per week, Ages 18-64. Source: Ramey (2008)

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 in 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 post-war 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.

4. Is progress in home production exogenous?

The principal premise of the analysis is the progress in home technologies is exogenous. While it is undisputable that the development of the basic technologies used in home appliances were 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

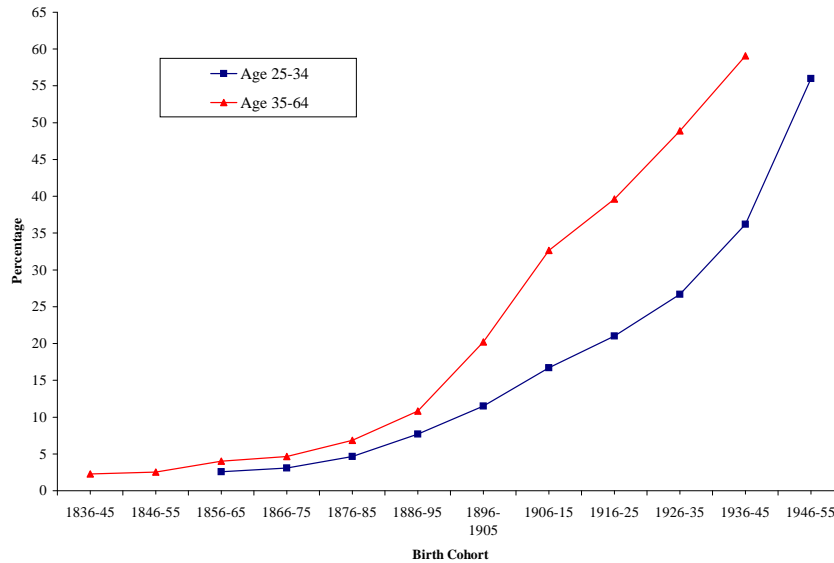


Figure 4: Labor force participation of married women by cohort and age. Source: Author’s calculations based on Goldin (1990).

demand. For one, as previously noted, scientific discoveries on disease transmission and nutrition may have increased the demand for home production output, thus fuelling 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) labor saving 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 20th 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 century, the biggest increase ever experienced by this variable⁶. Figure 4 documents the positive trend in women’s participation, which starts in the earliest 1900s. Participation of women at age 25-34 and 35-64 rose from 3% and 5%, respectively, for the 1876-1885 birth cohort to 15% and close to 20% for the 1906-1915 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, while only 16% employed servants.

The number of households employing domestics declined sharply between 1900 and 1970,

⁶See Tables 3.1 and 3.2 in Goldin (1990). Data is for full time workers where available.

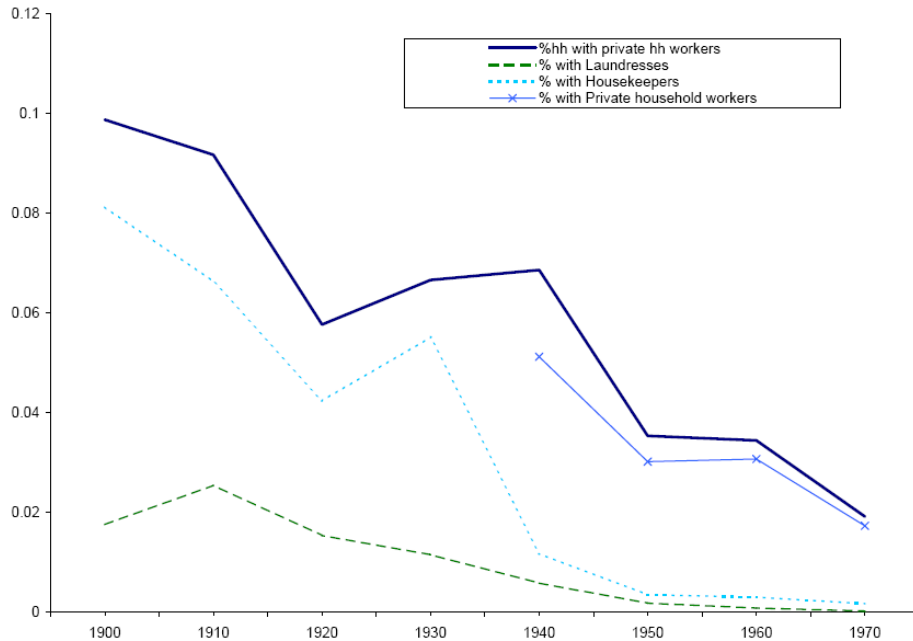


Figure 5: Percentage of households with domestic servants: 1900-1970. Source: Historical Statistics of the United States, Colonial times to 1970, Series D 236-682 and Series A 350-352.

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, as well as the emergence of the clerical sector, reduced the appeal of domestic service occupations. Increasingly restrictive immigration legislation introduced in the 1920s also limited the supply of workers to this market⁷. 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 post-war period is characterized by a continued drop in the percentage of households with domestic servants.

Taken together, these observations point to an alternative hypothesis 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; 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

⁷The 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.

and divorce between 1950 and 2000. Should we conclude from this finding that the effect of 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 is 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.

5. Challenges

The historical decline in aggregate home hours is mostly driven by changes in behavior of women, in particular, the increase in fraction of employed (married) women. This has led to a remarkable transformation in women's economic role and initiated a path towards gender equality in economic outcomes that should effect 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 appliances⁸. 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 Yorugoklu (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 based on 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 medical progress in the area of pregnancy and childbirth. Cultural factors are also important empirically (Fogli and Fernandez, 2006), 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 change⁹.

This body of work mostly abstracts from modelling household decisions explicitly, a critical step in the analysis for the gains from marriage¹⁰, and does not draw implications for household formation¹¹. 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

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

⁹Jones, Manuelli and McGrattan (2003) examine the effect of a declining gender wage gap on married women's participation in the post-war period. Since they treat this gap as exogenous, their analysis cannot explain the endogenous evolution of gender roles. Albanesi and Olivetti (2008a) build a model where gender wage gaps arise endogenously, but they focus on the cross-sectional variation in gender earnings inequality.

¹⁰Knowles (2007) shows that the change in the distribution of work within married households in the post-war period can only be rationalized with a non-unitary model of household behavior.

¹¹There 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 (2008b).

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 child-bearing age between 1920 and 1950, while 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 use 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 U.S. and other advanced countries could provide important insights on how technological diffusion can affect gender equality and influence development.

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