Cultural Change as Learning:

The Evolution of Female Labor Force Participation over a Century

AER(2013)

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Motivation

A fundamental change over the last century has been the vast increase in female labor force participation, particularly for married women.

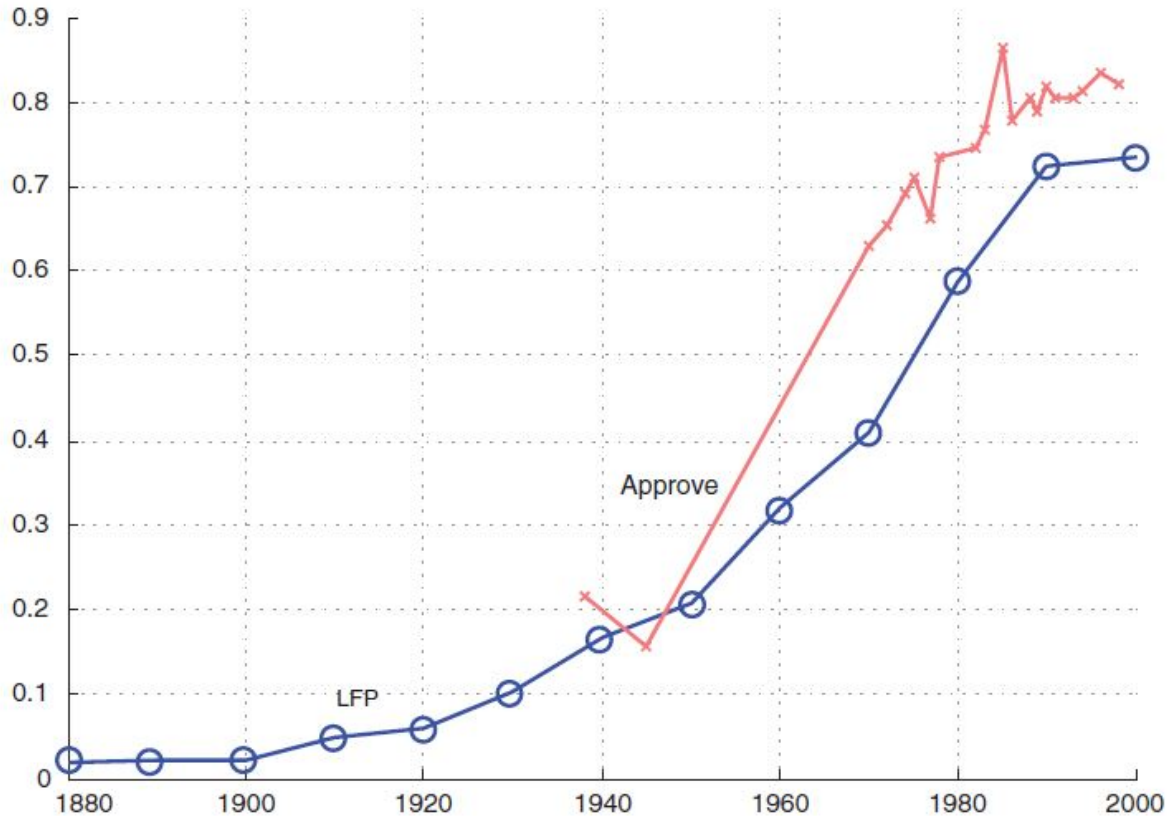

Figure 1: Changes in LFP and Beliefs in the Data

Explanations

- Structural change in the economy, technological change in the workplace and in the household, medical advances, decreases in discrimination, institutional changes in divorce law, and the greater availability of child care.
- None of these theories has addressed the accompanying revolution in social attitudes toward married women working.
- Social transformation can be seen everywhere, from changes in laws governing women's work (e.g., the "marriage bar") to the depiction of married women in literature and the popular press.

Contribution

- To understand why social attitudes (i.e., culture) and female labor force participation moved in tandem requires a framework that is able to address both phenomena.
- The objective of this article is to provide such a framework and to examine whether the suggested mechanism may be quantitatively significant.
- This article develops a model in which cultural change is the result of a rational, intergenerational learning process in which individuals are endogenously learning about married women's long-run payoff from working.

Model Description

- Married women's work decision
- Women possess private information about the long-run costs of working.
- These payoffs are revealed gradually over a long period of time.
- They also observe a noisy public signal indicatory of past beliefs concerning this value.
- Women use this information to update their prior beliefs and then make a decision whether to work.

A Simple Learning Model

The Work Decision

A woman makes her work decision to maximize:

$$U\left(w_f, w_h, v_i\right) = \frac{c^{1-\gamma}}{1-\gamma} - 1\left(E_{ii} v_i\right), \quad \gamma \geq 0$$

A woman's disutility of working is the sum of a known idiosyncratic component I_i (whose distribution in the population is $G(I)$ which we take to be $N\left(0, \sigma_I^2\right)$) and an unknown component B_i which is the individual-level realization of a random variable that is i.i.d. across women.The realization of this variable is revealed only if the woman works, it is the long-run disutility from working.

Model

$$c = w_h + 1w_f, \quad v_i = l_i + B_i, \quad B_i = \beta + u_i \quad \text{with} \quad E(u_i) = 0$$

- Note that since v_i enters linearly in utility, only the expected value of B_i, β, enters women's work decisions.
- $\beta \in \{\beta_H, \beta_L\}$ where $\beta_H > \beta_L \geq 0$
- Prior to making her work decision, a woman inherits her mother's private signal s_i that yields (noisy) information about the true value of β.
- $s_i = \beta + \varepsilon_i$
  where $\varepsilon \sim N\left(0, \sigma_\varepsilon^2\right)$ with a c.d.f. $F(\cdot; \sigma_\varepsilon)$ and p.d.f. $f(\cdot; \sigma_\varepsilon)$

Model

- After inheriting her private signal s_i , each woman updates her prior belief using Bayes's rule.
- Consider a woman i in period t who has a prior belief about β as summarized in the log likelihood ratio (LLR)

$$\lambda_t = \frac{\ln \Pr(\beta=\beta_L)}{\Pr(\beta=\beta_H)}$$

- By Bayes's rule, her beliefs given her private signal s can be summarized in a new LLR:

$$\lambda_{it}(s) = \lambda_t + \ln\left(\frac{\Pr(s|\beta=\beta_L)}{\Pr(s|\beta=\beta_H)}\right) = \lambda_t - \left(\frac{\beta_H-\beta_L}{\sigma_\varepsilon^2}\right)(s-\overline{\beta})$$

- Higher realizations of s increase the likelihood that $\beta = \beta_H$

Model

- Woman i will work if and only if

$$W\left(w_{ht}, w_{ft}\right) \equiv \frac{1}{1-\gamma}\left[\left(w_{ht}+w_{ft}\right)^{1-\gamma}-w_{ht}^{1-\gamma}\right]-E_{it}(\beta) \geq l_i$$

- Let's define:

$$\underline{l}\left(w_{ht}, w_{ft}\right) \equiv W\left(w_{ht}, w_{ft}\right)-\beta_H$$

$$\bar{l}\left(w_{ht}, w_{ft}\right) \equiv W\left(w_{ht}, w_{ft}\right)-\beta_L$$

- The overall proportion of women who will work in period t is given by

$$L_t\left(\beta ; \lambda_t\right)=G(\underline{l})+\int_{\underline{l}}^{\bar{l}} F\left(s_l^*\left(\lambda_t\right)-\beta ; \sigma_\varepsilon\right) g(l) dl$$

- $(i) \frac{\partial s_l^*}{\partial \lambda}>0; \quad (ii) \frac{\partial s_l^*}{\partial w_f}>0; \quad \frac{\partial s_l^*}{\partial w_h}<0$

Intergenerational Transmission of Beliefs

Assume that women observe a noisy signal of L_t , given by y_t , where

$$y_t(\beta; \lambda_t) = L_t(\beta; \lambda_t) + \eta_t$$

and where $\eta_t \sim N(0, \sigma_\eta^2)$ with a p.d.f. denoted by $h(.; \sigma_\eta)$.

Using Bayes's law after observing y_t generates an updated common belief for generation $t+1$

$$\begin{aligned}\lambda_{t+1}(\lambda_t, y_t) &= \lambda_t + \ln \frac{h(y_t|\beta = \beta_L)}{h(y_t|\beta = \beta_H)} \\ &= \lambda_t + \left(\frac{L_t(\beta_L; \lambda_t) - L_t(\beta_H; \lambda_t)}{\sigma_\eta^2}\right)(y_t - \overline{L}_t(\lambda_t))\end{aligned}$$

Timeline of Learning Model

Individuals start period t with a common prior,λ_t . Each woman updates the common prior with her inherited private signal and makes her work decision. This generates an aggregate L_t and a noisy public signal y_t .Generation $t+1$ observes y_t and uses it to update the old common prior (λ_t), generating λ_{t+1}, the "culture" of generation $t+1$

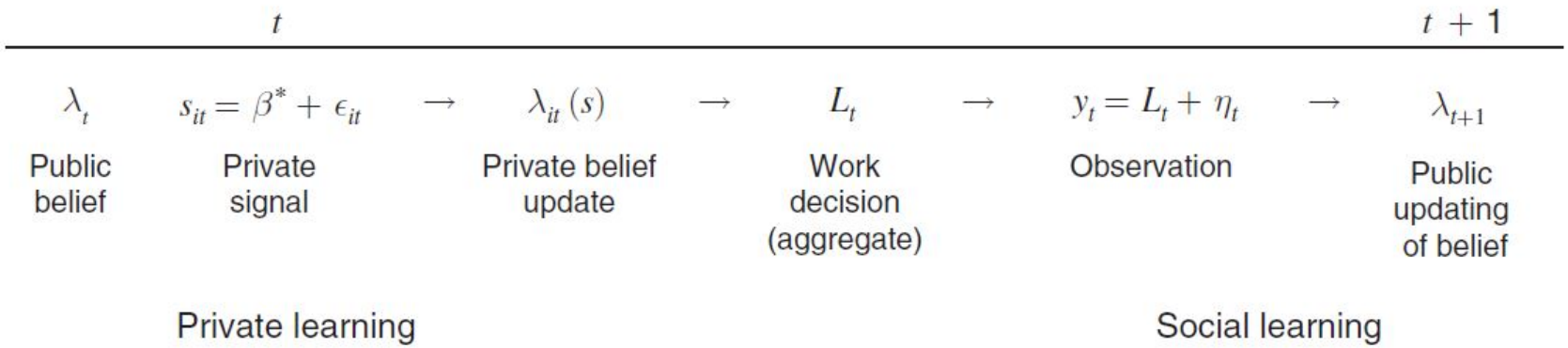

Figure 2: Timeline of Learning Model

Generating an S Shape in Culture and LFP

Note that for a given $I \in \left(\underline{I}, \overline{I}\right)$:

$$\Delta L_{It} = F\left(s_I^*\left(\lambda_t\right) - \beta_L; \sigma_\varepsilon\right) - F\left(s_I^*\left(\lambda_t\right) - \beta_H; \sigma_\varepsilon\right)$$

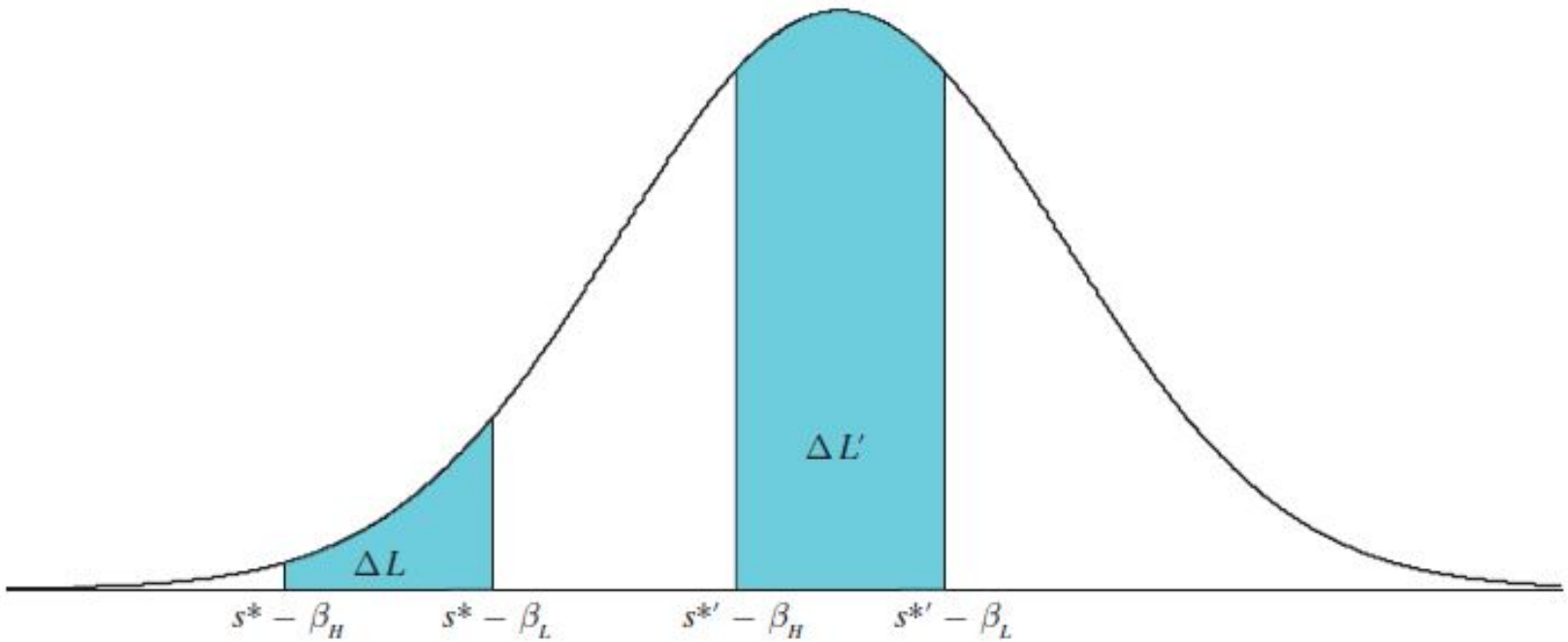

Figure 3: Signal Extraction

Calibration

Calibration targets						Model with known β		Learning model
Own-wage elasticity (2000)				0.30		**0.30**		**0.29**
Cross-wage elasticity (2000)				−0.13		**−0.13**		**−0.13**
Female LFP (2000)				0.734		**0.734**		**0.744**
Female LFP (1990)				0.725		0.725		**0.716**
Cross-wage elasticity (1990)				−0.14		−0.13		**−0.14**
Female LFP (1980)				0.586		0.687		**0.585**
Work risk ratio (1980)				1.13		1.00		**1.13**
Parameters	γ	σ_L	β	β_H	β_L	$P_0(\beta = \beta_L)$	σ_ε	σ_η
Model with known β	0.503	2.293	0.321					
Learning model	0.503	2.085		4.935	0.001	0.086	5.288	0.055

Quality of Matching

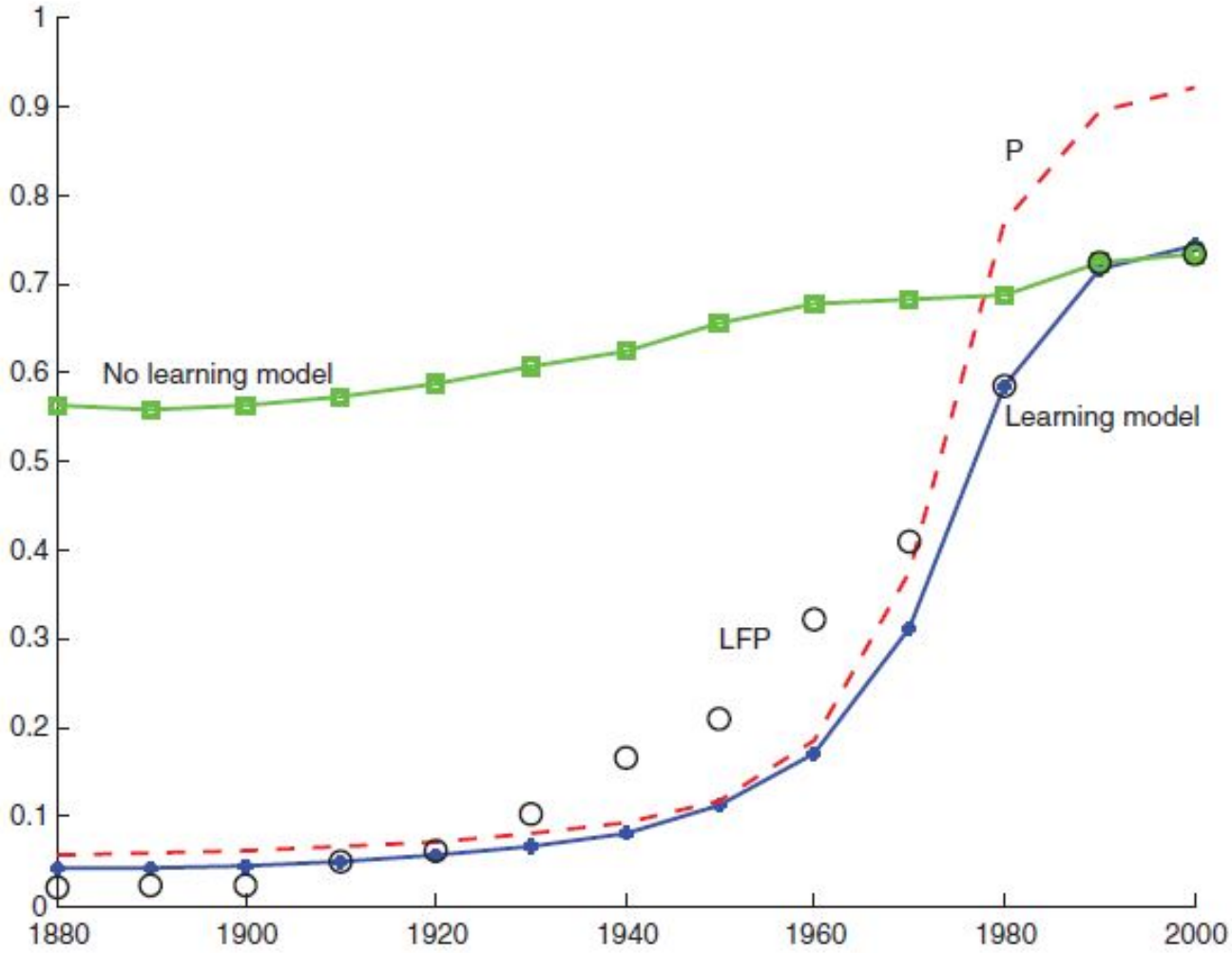

Figure 4: Prediction Accuracy

Evolution of Beliefs

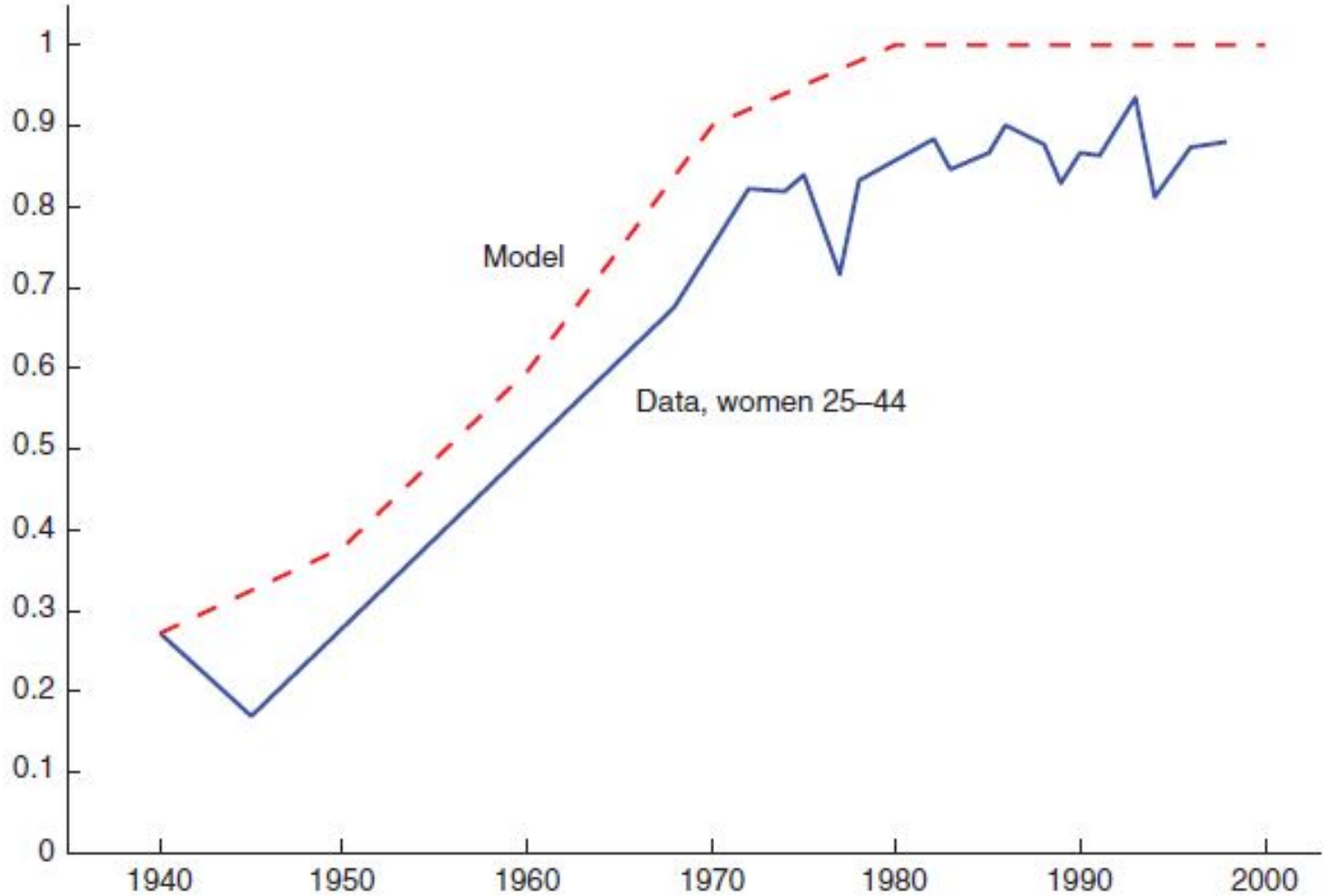

Figure 5: Proportion who Approve of Woman Working if Husband Can Support Her, Data versus Model

Contributions of Wages and Beliefs

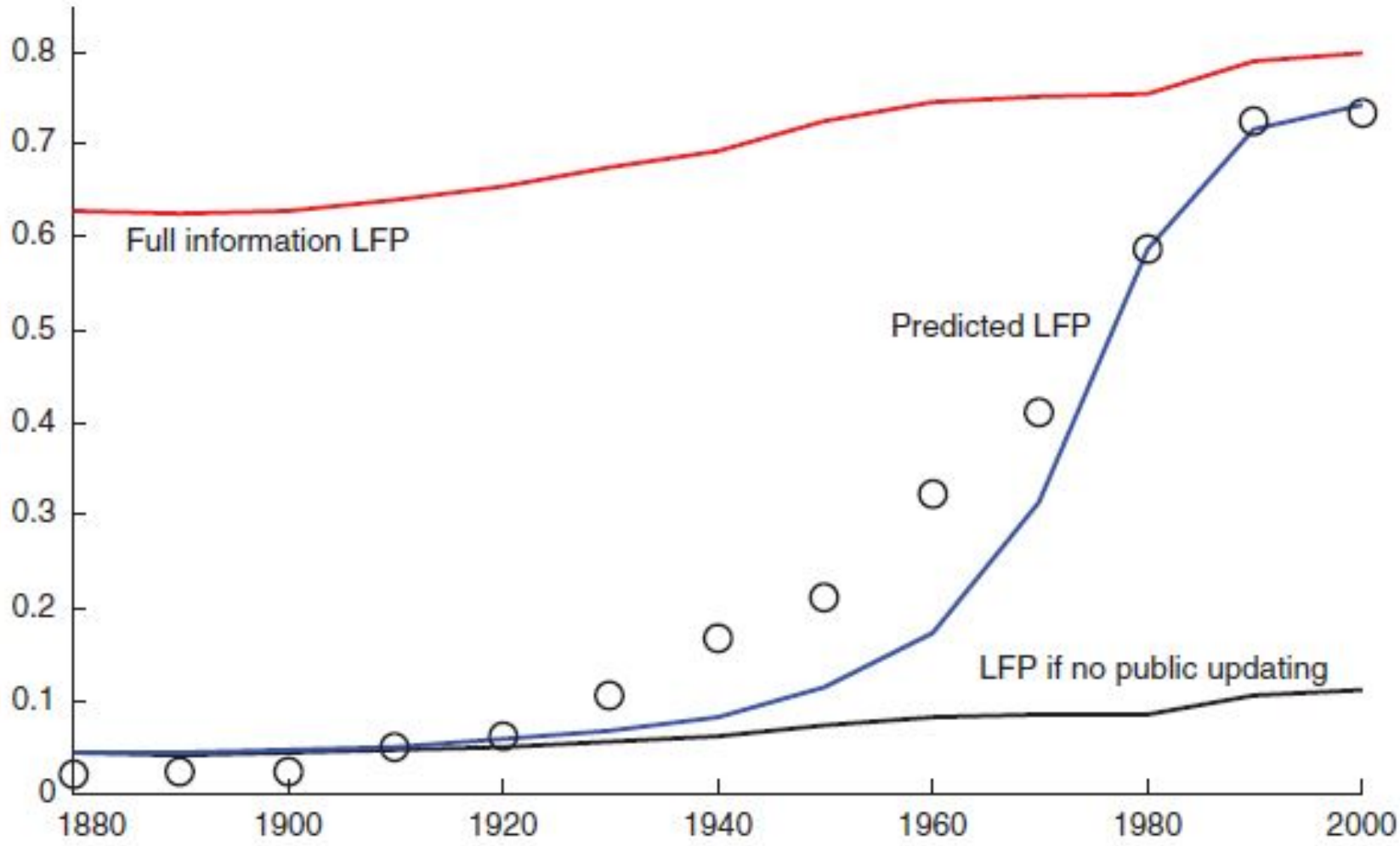

Figure 6: Solution Parameters from Calibrated Model

Static vs. Dynamic Effects of Wage Changes

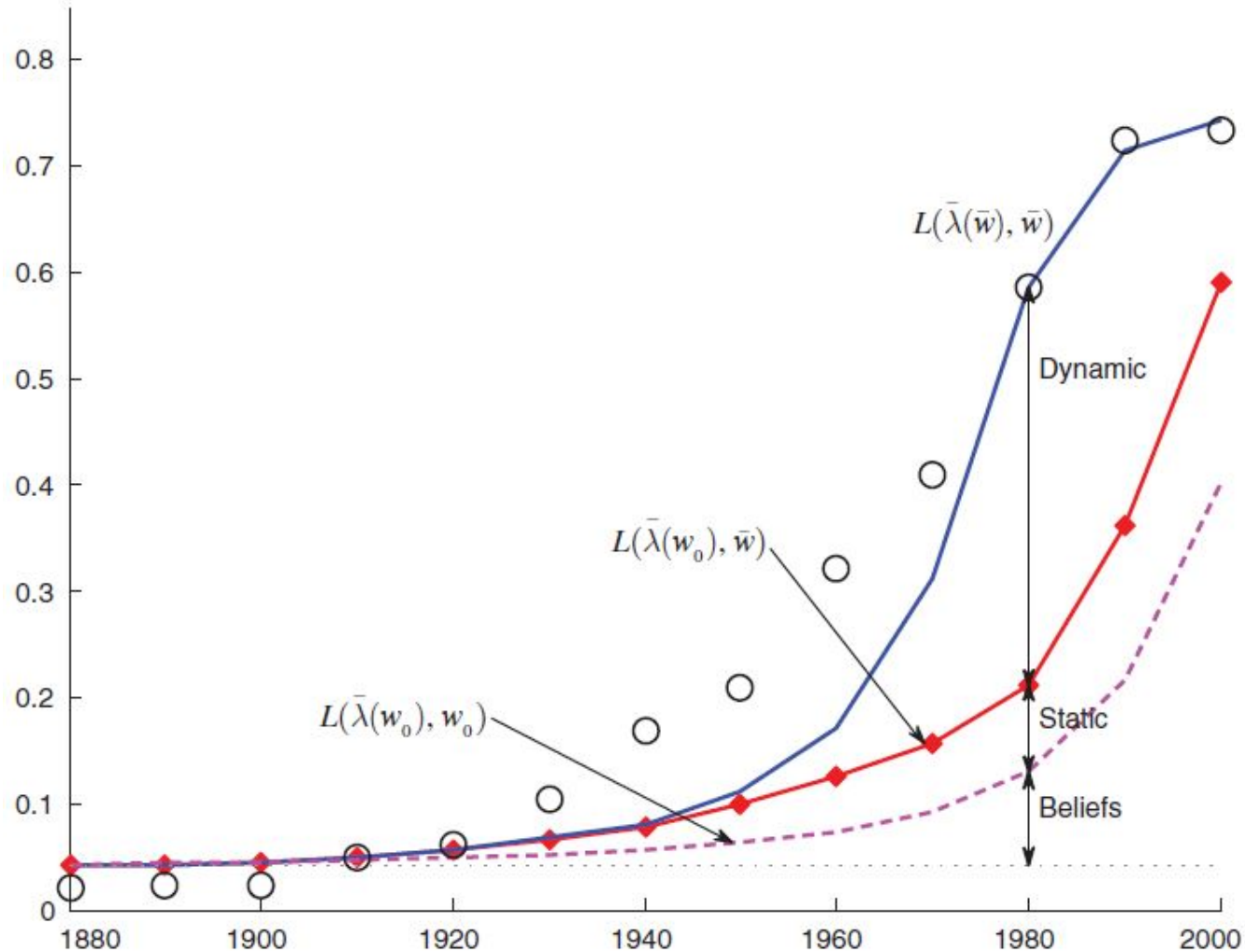

Figure 7: Decomposition of LFP

Some Testable Implications of the Model

- The model can be used to derive levels of female LFP in out-of-sample years.The model predicts female LFP of 76.58 percent as compared to 75.57 percent in CPS (2007).
- States with greater mobilization rates during World War II should have greater female labor supply not only in 1950, but also in the next generation.
- Generating LFP paths for women of different education levels.
- Do other countries' path of married women's LFP also look S shaped? If they did, this would help support the case that a process of cultural change driven by learning took place.

LFP Paths by Education, Model vs. Data

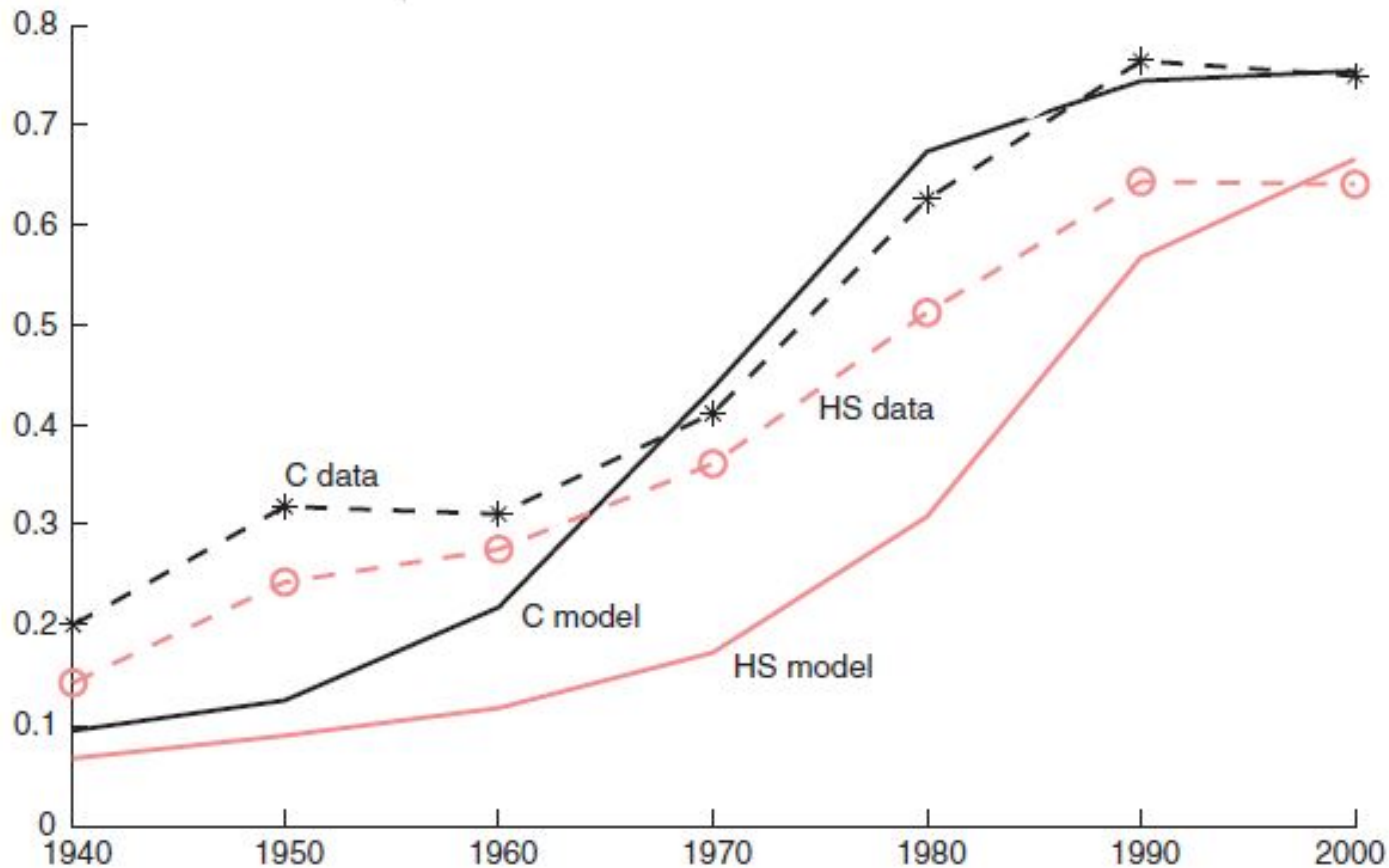

Figure 8: Predictions of the Calibrated Learning Model for College (C) and High School (HS) Types

S shaped LFP

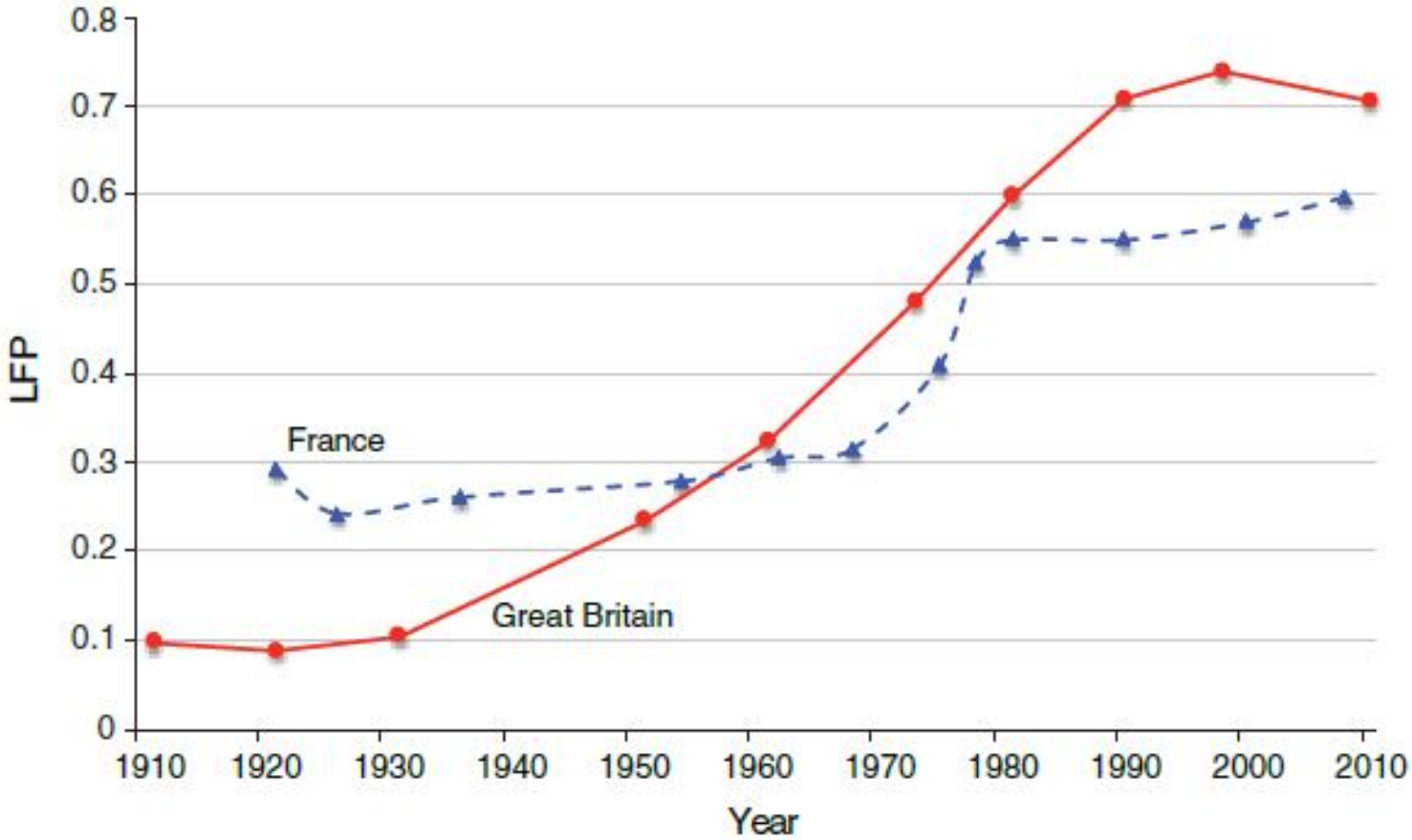

Figure 9: Womens Labor Force Participation in France and Great Britain, 1910-2010

To Sum Up

- This article modeled the joint dynamics of married women's labor force participation and cultural change.
- In the model, married women compared the benefits of increased consumption from labor earnings with the expected utility cost of working.
- This cost was unknown, and womens beliefs about it evolved endogenously over time in a Bayesian fashion.
- The calibrated model finds that at the outset women were pessimistic about the true cost of working.

Thanks for your attention!