

Jobless Recoveries and Gender-Biased Technological Change

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Abstract

The strong positive correlation between output and employment is probably one of the most widely accepted stylized facts about business cycles. However, the recoveries following the 1991-92, 2001, and 2007-09 recessions all turned out to be exceptions to this widely accepted pattern. These episodes are generally referred to as *jobless recoveries* since output growth was accompanied by slow employment growth or even continued employment decline in the aftermath of the recession. In this paper, we propose a new explanation for the onset of jobless recoveries, linking it to the behavior of female labor force participation and gender-biased technological change.

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1 Introduction

The strong positive correlation between output and employment is probably one of the most widely accepted stylized facts about business cycles. However, the recoveries following the 1991-92, 2001, and 2007-09 recessions all turned out to be exceptions to this widely accepted pattern. These episodes are generally referred to as *jobless recoveries* since output growth was accompanied by slow employment growth or even continued employment decline in the aftermath of the recession. In this paper, we propose a new explanation for the onset of jobless recoveries, linking it to the behavior of female labor force participation and gender-biased technological change.

Figure 1 shows the evolution of female and male labor force participation rates in the last 40 years. Female participation started to flatten in the early 1990s and all three jobless recoveries took place after the rise in female participation moderated. In this paper, we argue that there is a link between these two phenomena.

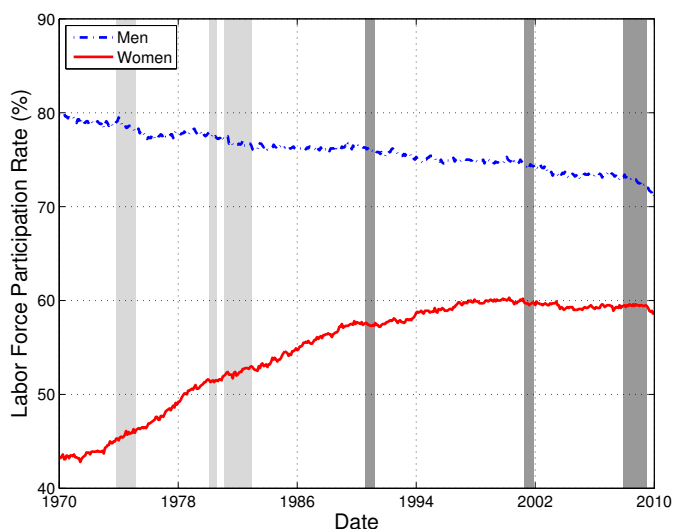


FIGURE 1: Labor force participation rate by gender. Gray shading represents NBER recessions. Recessions that correspond to subsequent jobless recoveries are shaded in darker gray. Source: Current Population Survey.

2 The Changing Role of the Participation Margin over the Business Cycle

We begin by describing the evolution of participation and employment for men and women during the last six NBER recessions. To do so, we plot the cumulative changes in the *log* of the labor force participation rate and employment-to-population ratio starting from the through of the aggregate unemployment rate in the preceding expansion, and ending three years after the unemployment rate peak. The choice of these variables is motivated by a well-known decomposition which relates

the variation in employment and labor force participation to the fluctuations in unemployment.¹ Figures 2 and 3 show the cumulative changes in the *log* of the labor force participation rate and the employment-to-population ratio for the last six business cycles.

As Figure 2 shows, in the 1970, 1974-75 and 1981-82 recessions, women were experiencing a strong positive trend in labor force participation. Their participation rate grew throughout the recession and the recovery periods, sustaining the growth in female employment throughout each cycle. Thus, after an initial small dip during the recessions, E/P rises strongly for women in each of the recoveries. The 1991-92 cycle marks a change in this pattern, as the trend growth in female participation slowed substantially. Female participation was flat during the recession and grew only modestly during the recovery. Correspondingly, the employment decline started to be more pronounced for women during the recession, with a slower and weaker recovery. In the 2001 and 2007-09 cycles—when the upward trend in female participation had completely stopped—female participation was flat or declining during recessions and dropped in the subsequent recoveries. During both of these cycles, E/P declined notably during the recession and recovered slowly during the subsequent recoveries.

Figure 3 presents the same statistics for men and shows that the labor force participation rate behaved very similarly for men in all six recessions displaying a declining pattern. E/P always declined for men during recessions, and with the exception of the 1981-82 cycle, E/P did not regain its pre-recession values. The recovery in employment was particularly sluggish in the most recent cycles.

These figures complement what we have seen in Figure 1 and show that the changing trend in female participation translated to a change in its cyclical behavior for women starting in early 1990s, while for men both the trend and the cyclical behavior of participation has been similar since 1970.

Figures 2 and 3 also highlight the convergence in the cyclical behavior of employment for men and women. Earlier recoveries are characterized by rapid increases in female employment and relatively sluggish growth in male employment. Since female employment continues to grow throughout the recessionary period, and experiences a very rapid rise in the recovery periods, the decline and the sluggish growth in male employment is masked. However, this pattern changes in the last three recessions. Both male and female employment decline during recessions with recovery taking place slowly for both men and women.

Given the observation that rapidly rising female participation and employment was driving employment recovery patterns, a natural question is to ask how important this affect is quantitatively. To answer this question, we compute some counterfactuals in the next subsection.

¹The decomposition is: $\Delta u_t \approx \Delta \log(L_t/P_t) - \Delta \log(E_t/P_t)$ where Δu_t is the change in the unemployment rate, $\Delta \log(L_t/P_t)$ is the *log* change in the labor force participation rate, and $\Delta \log(E_t/P_t)$ is the *log* change in employment-to-population ratio. See for example Elsby, Hobijn, Şahin (2010, 2012) for details.

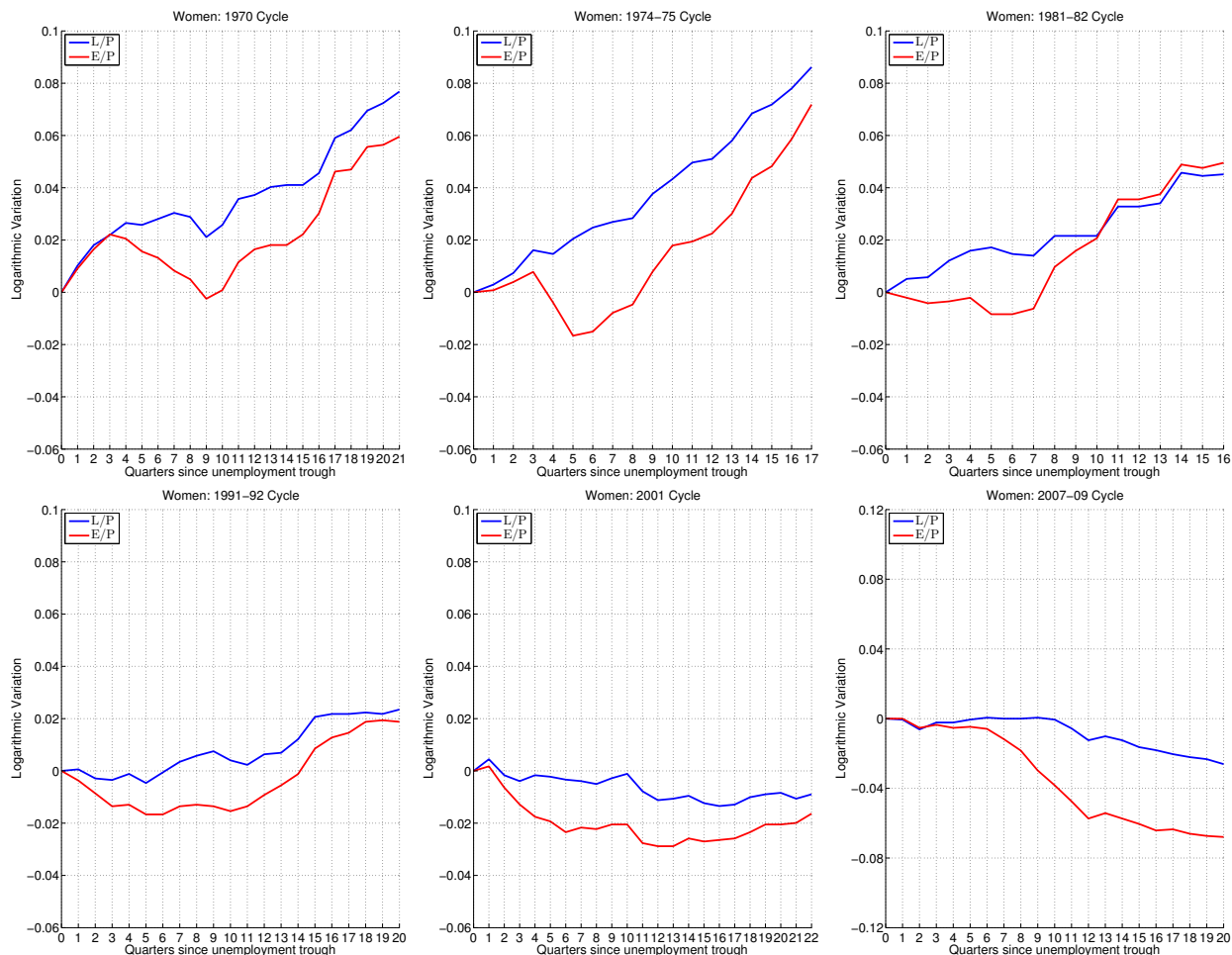


FIGURE 2: Log changes in the labor force participation rate and the employment-to-population ratio for women. Source: Bureau of Labor Statistics.

2.1 Jobless Recoveries

As we have shown, female employment continued to rise during recessions and the subsequent recoveries during business cycles before the 1990s. We now quantify how important this factor is in driving aggregate employment patterns. To do so, we compute counterfactual employment-to-population ratios for recent cycles by replacing the female growth rate of E/P in each of the last three cycles with the average growth rate in the early cycles. We keep the evolution of male employment-to-population ratio as it is in the data, and compute the counterfactual aggregate using period specific population weights. The results are presented in Figure 4.

These counterfactuals reveal that the change in female employment patterns is an important factor driving aggregate employment patterns during recoveries. For the 1991-92, and the 2001 cycles, the growth in counterfactual employment is approximately 3 and 5 percentage points higher than the actual 3 years after the peak in the aggregate unemployment rate. For the 2007-2009 cycle, the counterfactual aggregate employment would have reached pre-recession levels by the end of the

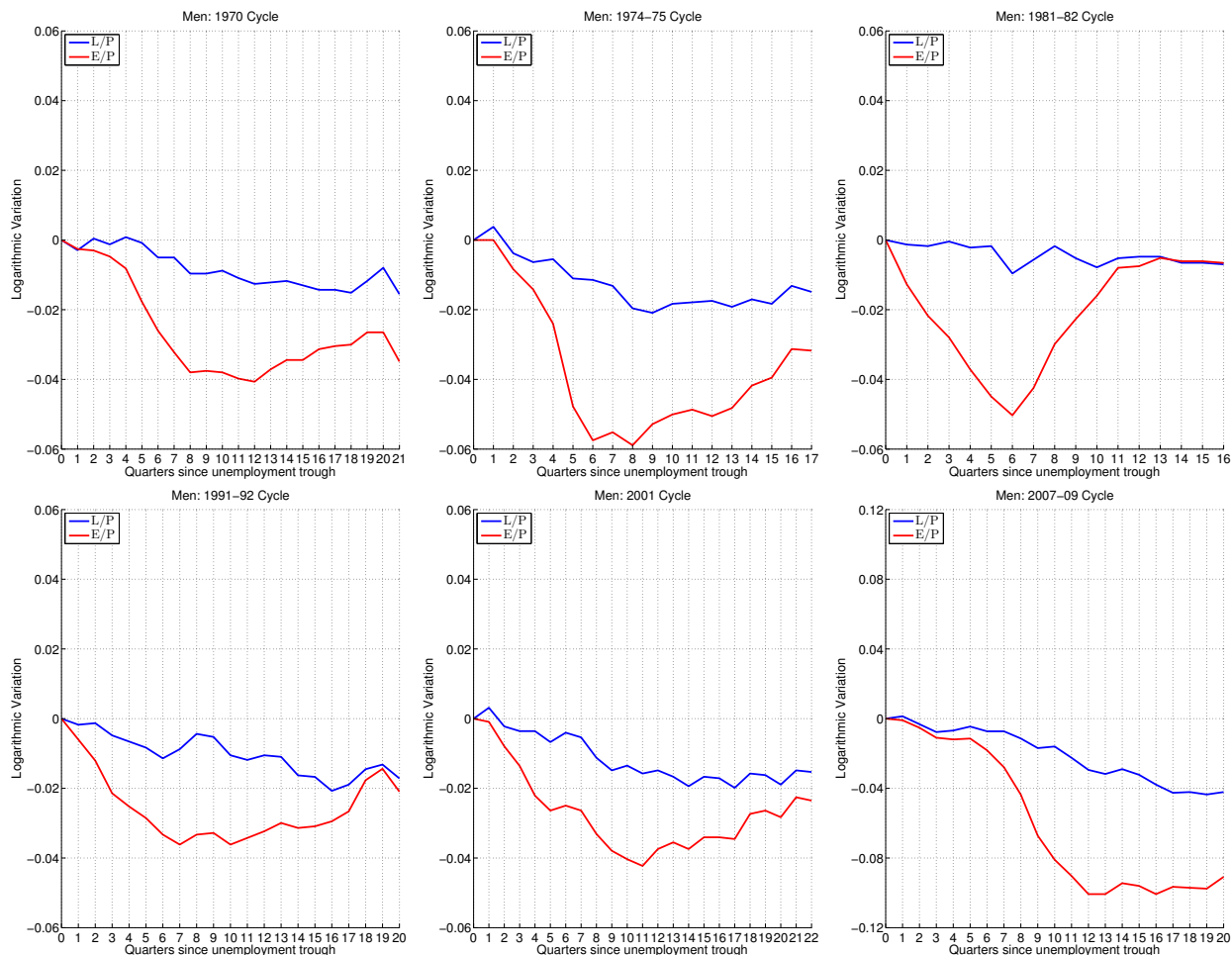


FIGURE 3: Log changes in the labor force participation rate and the employment-to-population ratio for men. Source: Bureau of Labor Statistics.

window, while actual employment is still approximately 8 percentage points below pre-recession values. Thus, if female employment growth had continued to exhibit the behavior seen for the early cycles, recoveries from the the last three recessions would not have been jobless.

We now examine some of the factors that have influenced the trend behavior of women’s participation and employment and we relate them of the evolution of cyclical employment growth.

3 Interaction of Supply and Demand Factors in Employment Trends

There is an extensive literature that focuses on the rise in women’s market work. However, much less is known on the interaction of labor supply choices and employment growth. It is clear that, mechanically, a strong rise in participation can sustain a rapid increase in employment. However, without a sustained rise in the demand for female labor, rising participation per se may not lead to employment growth, especially in periods of economic contraction. Thus, to understand the

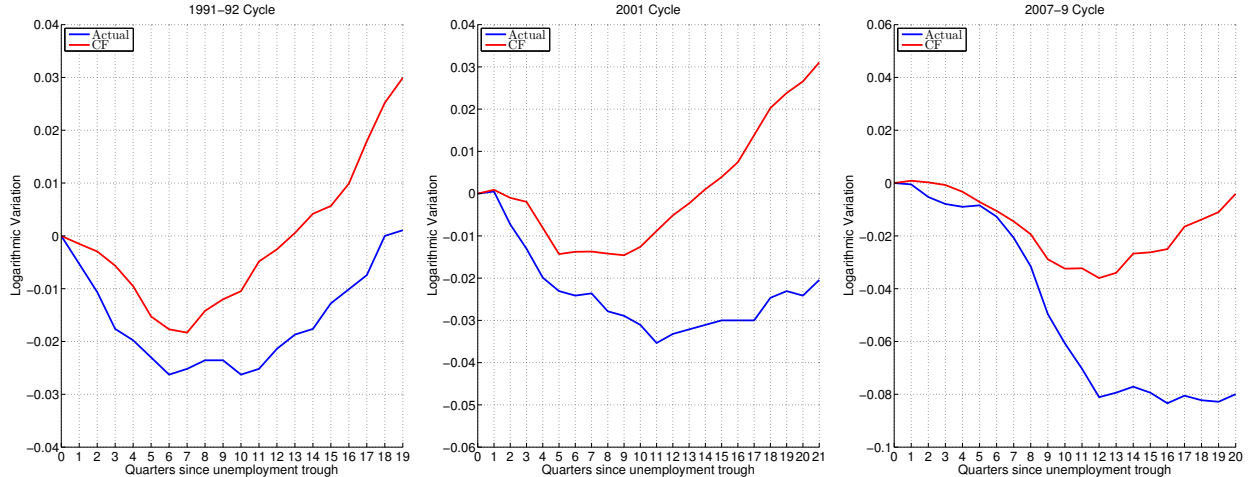


FIGURE 4: E/P counterfactual: Female E/P replaced with average for early recessions.

factors that jointly led to the evolution of female participation and the forces that sustained the corresponding growth in female employment, both supply and demand factors must be considered.

Many of the explanations of the rise in women’s market work have focussed on the role of technological advances in reducing barriers to women’s participation. Greenwood, Seshadri and Yorukoglu (2005) argue that advances in home appliances increased female participation by reducing the time married women had to devote to home production. Albanesi and Olivetti (2009) examine the role of improvements in maternal health and the introduction of infant formula, and find that these developments are key to explain the rise in participation of married women with children, and the rise in women’s education and wages relative to men. Goldin and Katz (2002) show that the diffusion of oral contraceptives reduced the costs and increased the returns to women’s education, and thus increased their participation when married.

An additional set of explanations focus on culture. Fernández, Fogli and Olivetti (2004) argue that the entry of married women in the workforce during World War II contributed to reducing the stigma attached to market work for married women, thus increasing their participation in later years. Fernandez (2012) and Fogli and Veldkamp (2012) explore learning models in which women’s participation rises as the perceived costs of women’s work fall over time. These learning models also predict a flattening out of the rise in participation at the end of the learning process. Albanesi and Prados (2011) explicitly analyze factors that contributed to the flattening out of married women’s participation starting in the 1990s. They show that the flattening out is driven by a decline in participation of prime age women with college degrees, and those married to high earning husbands. They identify the acceleration of the rise in the skill premium in the 1990s, and the corresponding sharp rise in top incomes for men, as the main contributor to the decline in the growth of female participation.

Galor and Weil (1996) are perhaps the first to focus on factors contributing to a rise in the demand for female labor. Specifically, they attribute the rise in women’s market work to techno-

logical innovations that increase the returns to intellectual skills, in which women have a biological comparative advantage, rather than physical skills. This phenomenon, in addition to increasing female participation, reduces the gender gap in wages.² Empirical evidence also supports this notion. Black and Juhn (2000) argue that the rising demand for skilled workers may have contributed to the rise in participation of skilled women, as skilled men’s participation has always been very high. This in turn increased the fraction of women in professional and managerial occupations, which were traditionally male.

Part of the rise in the demand for skilled workers has been driven by the rise in the service sector, for which the share of employment grew from 57.3% to 75.3% between 1950 and 2000 (Lee and Wolpin, 2006). Buera and Kaboski (2012) analyze the role of specialized high-skilled labor in the disproportionate growth of the service sector. They show that skill-intensive services have risen during a period of increasing relative wages and quantities of high-skilled labor, and they attribute this pattern to a shift in demand toward more skill-intensive output. As is well known (Blau et al. 1998), women are disproportionately employed in the service sector. Moreover, Lee and Wolpin (2006) show that of new entrants or re-entrants in employment, 80% of women (and 58% of men) work in the service sector for the period 1980-1993. Rendall (2013) shows that there is a positive cross-country correlation between the rise in the service sector and female participation, reinforcing the notion that women have a comparative advantage in service-providing industries.

Figure 5 shows the evolution of E/P by gender in service providing and goods producing industries.³ The growth in employment in the service sector, and the decline in employment in the goods sector are clearly more pronounced for women than for men. The gender difference is particularly pronounced for the decline in employment in the goods sector, starting in 2001.

Figure 6 shows the percentage change in the share of employment in each industry by gender over three decades. The decline in women’s share in the goods producing sector was greater than men’s in all periods. The decline in the share of employment in the goods sector was greatest in the 2000s, with a 36% drop for women and an 18% drop for men. The rise in the employment share in the service sector was smaller in percentage terms for women than for men, as women’s share of employment in the service sector was already 76% in 1981, while it was only 53% for men.

Another factor contributing to the rise in the demand for skilled workers is “job polarization,” which is the concentration of employment among the among the highest and lowest skilled occupations, due to the disappearance of jobs focused on routine tasks (Autor et. al, [2003, 2006], Acemoglu and Autor, 2010.) An occupation is routine if its main tasks require following explicit instructions and obeying well-defined rules. These tend to be the middle-skilled jobs. If the job involves flexibility, problem solving, or creativity, it is considered non-routine. Many non-routine occupations are indeed concentrated in the service sector, which accounts for a disproportionate fraction of female

²Jones, Manuelli and McGrattan (2003) examine the effect of a declining gender wage gap on married women’s participation in the post-war period. The decline in the gender wage gap can be interpreted as stemming from technological forces affecting the demand, as in Galor and Weil (1996), or the supply, as in Albanesi and Olivetti (2009), of female labor, or a reduction in gender discrimination, but it is treated as exogenous in this analysis.

³Here, E is the number of employed in each sector for each gender and P is the total working age population by gender. Summing E/P in each sector by gender delivers the total employment to population ratio by gender.

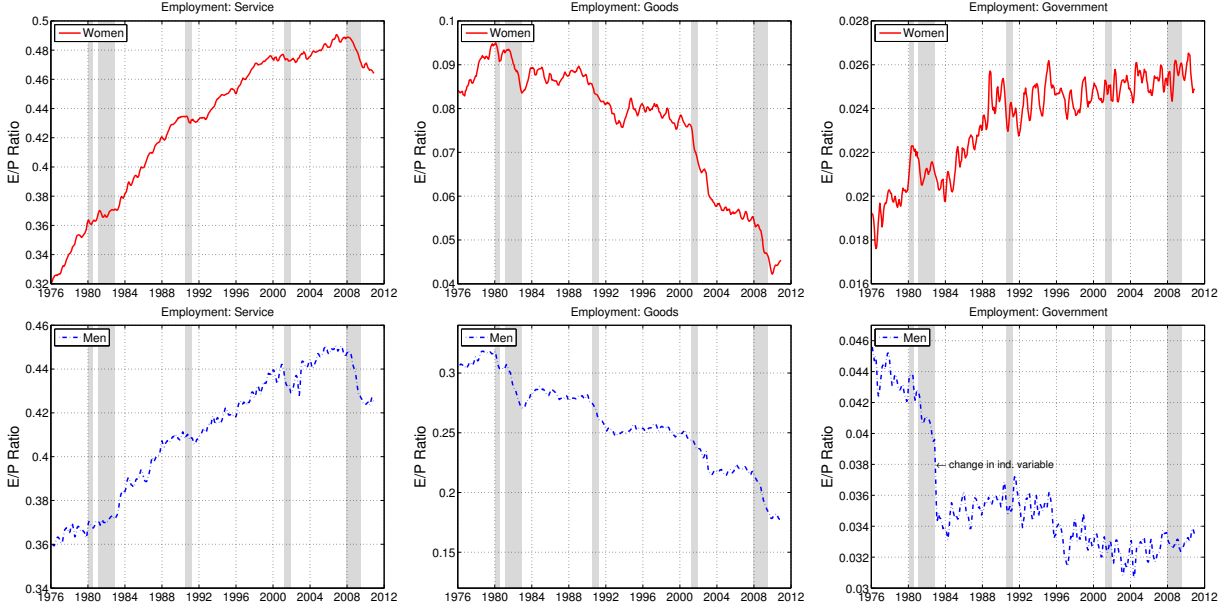


FIGURE 5: Growth in employment by industry: E/P by sex. Source: Current Population Survey.

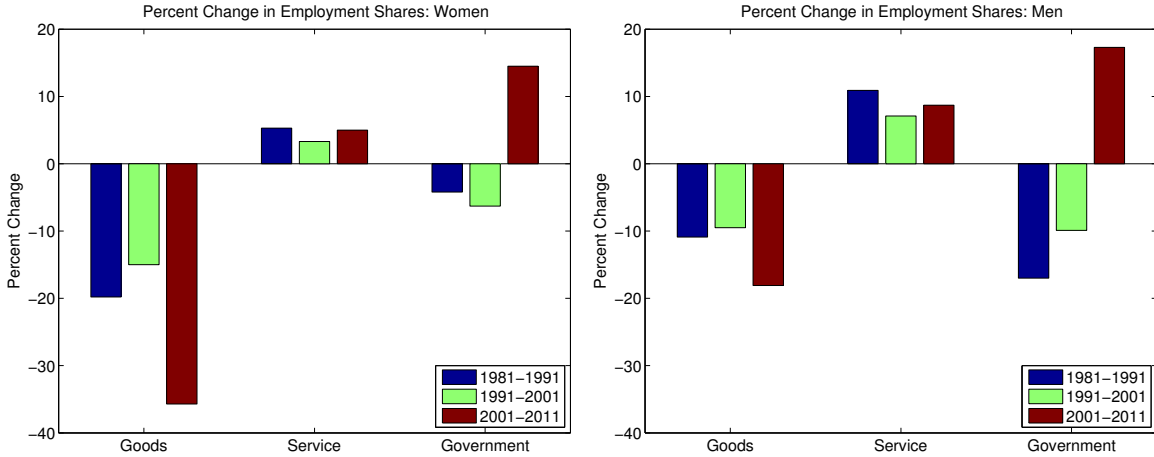


FIGURE 6: Growth in employment share by industry. Source: Current Population Survey.

employment. Additionally, Black and Spitz-Oener (2007), using data from West Germany, find that women have witnessed relative increases in non-routine analytic tasks and non-routine interactive tasks, associated with higher skill levels, with the most notable difference between the genders being a pronounced relative decline in routine tasks among women with little change for men. Rendall (2010) shows that, as job requirements have shifted from more physical to more intellectual attributes, women, who always worked in occupations with relatively low physical requirements, also shifted from occupations with low to high intellectual requirements.

To examine the relation between the growth of female market work and job polarization, we follow Acemoglu and Autor (2010) and group occupations into different task groups with each

occupation categorized as either routine or non-routine, and, within each of these categories, we further classify occupations into cognitive and manual, based on the amount of mental or physical activity done on the job. Cognitive jobs require mostly mental activity and manual jobs require mostly physical activity.

Figure 7 shows the evolution of E/P by gender in non-routine occupations, divided by cognitive and manual occupations, and Figure 8 shows the evolution of E/P by gender in routine occupations, divided by cognitive and manual occupations.

The growth in non-routine cognitive occupations is more pronounced for women for most of the sample period. For non-routine manual occupations, most of the growth in employment occurs in the last decade, while for men it is concentrated in the first twenty years of the sample. This pattern is confirmed with the behavior of the employment shares by sex, shown in figure 9. The employment share in non-routine cognitive occupations rises by a cumulative 84% over the sample period for women, while the rise for men is only 28%. By contrast, men experience a greater increase in non-routine manual occupations, with a cumulative rise in their employment share in this category of 33%, compared to women's 8% cumulated rise, which was mostly concentrated in the last decade.

For routine occupations, the decline in employment was much larger for women throughout the sample period, for both cognitive and manual occupations. This is reflected in the evolution of the corresponding employment shares. The employment share for routine cognitive occupations declined by a cumulated 35% for women between 1981 and 2011, as shown in figure 9, while it rose by 1% for men. For routine manual occupation, women's share of employment declined by 54%, while men's declined by 26% over the sample period.

This evidence on the evolution of employment by gender in the service sector and in non-routine and routine occupations suggests that the corresponding rise in the demand for these jobs was predominately met with female labor. This is consistent with the notion that women have a comparative advantage in these sectors. However, given the independent forces which at the same time were stimulating a growth in the supply of female labor, these supply factors may also have played a significant role in fueling the trend growth in employment in these sector.

4 Industry and Occupation in the Jobless Recoveries

The trend rise in the service sector, the corresponding structural decline in manufacturing, and job polarization have also been identified as important factors in the jobless recoveries experienced in recent cycles.

Groshen and Potter (2003) show that job losses in the 1991-92 and 2001 cycle were concentrated in industries in the goods producing sector undergoing structural decline. Jaimovic and Siu (2012) emphasize that most of the decline in employment in routine occupations occurred during recessions, and argue that job polarization can thus explain the jobless recoveries in the last three cycles. Since the decline in routine occupations is structural, the jobs lost during the recessions are permanently destroyed, preventing a rebound in employment growth during the recovery. However, Foote and

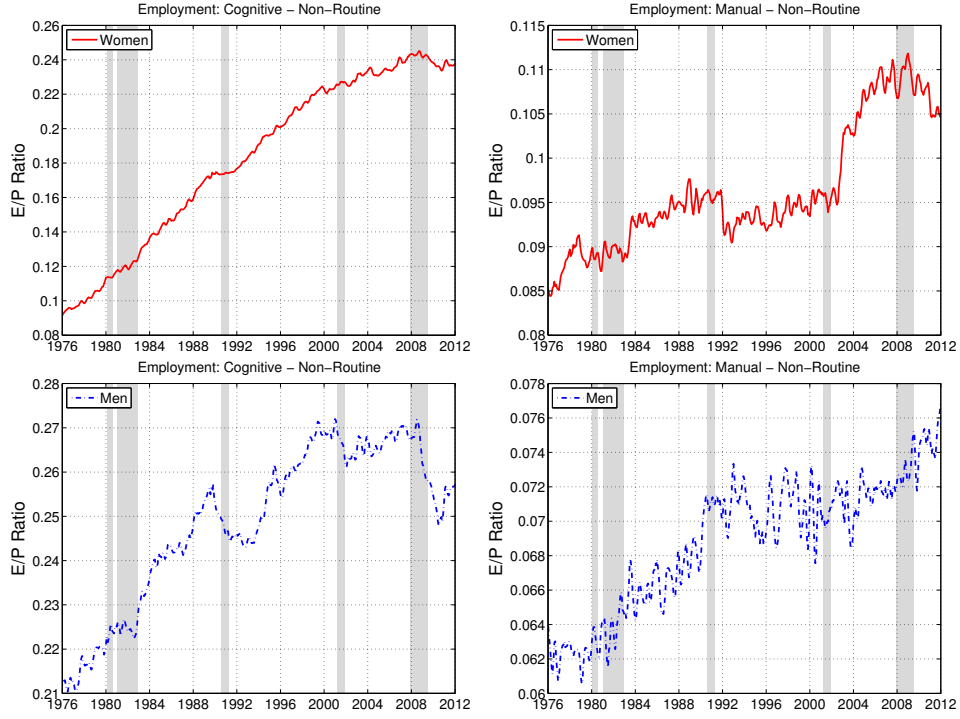


FIGURE 7: Growth in employment by occupation: E/P by sex, Non-Routine.

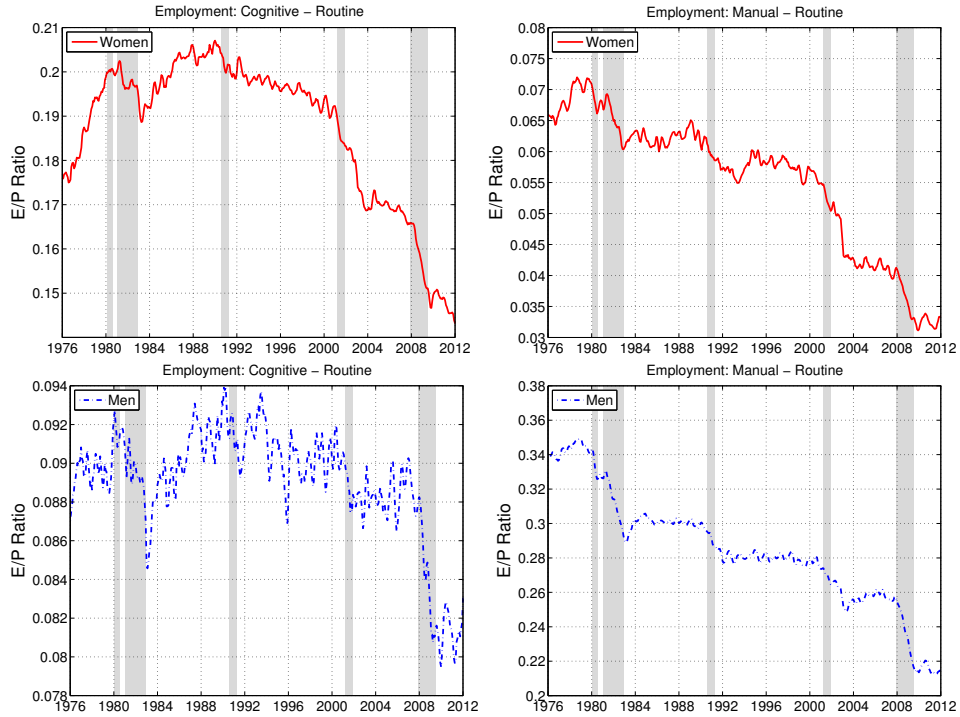


FIGURE 8: Growth in employment by occupation: E/P by sex, Routine.

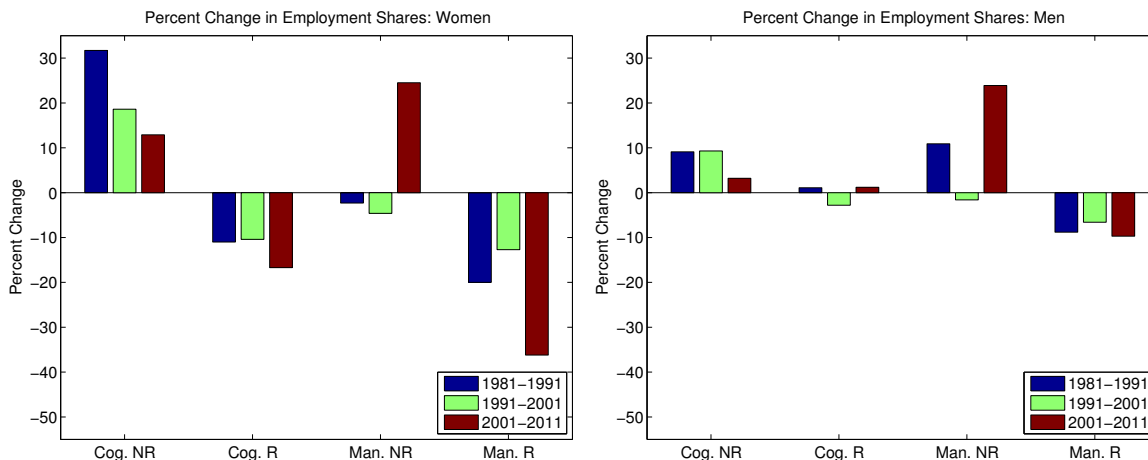


FIGURE 9: Growth in employment share by occupation.

Ryan (2012) show that jobless recoveries affected workers throughout the skill distribution, not only workers in routine jobs, suggesting that job polarization cannot be a cause for jobless recoveries.

The evidence laid out in the previous section points to a connection between the growth of female employment and the structural decline of the goods producing sector and job polarization. Moreover, as we show in Section 2.1, the decline in the trend growth of female employment plays a significant role in the jobless recoveries. We now investigate the role of the decline in the goods producing sector and job polarization in jobless recoveries by constructing a set of counterfactuals for the cyclical behavior of employment growth.

Figure 10 presents the results for industries. The counterfactual employment growth series is obtained by replacing the actual behavior of employment growth in the goods producing industry in each of the cycles with the behavior of employment growth in those industries for the 1981-1982 cycle,⁴ rescaled to match the depth of the recession in each cycle. For the 1991-92 and 2001 cycles, the counterfactual employment growth series do rebound to pre-recession levels, while for the 2007-09 cycle the counterfactual employment growth is only moderately higher than the actual, suggesting that the structural decline in the goods sector has only a small role in explaining the lack of recovery in employment.

Figure 11 presents the results for occupations. The counterfactual employment growth series is obtained by replacing the actual behavior of employment growth in routine occupations in each of the cycles with the behavior of employment growth in routine occupations for the 1981-1982 cycle, rescaled to match the depth of the recession in each cycle.⁵ For the 1991-92 cycle, if the behavior of employment in routine occupations had been the same as in 1981-1982, the recession would have actually have been longer and more pronounced, with a similar rate of growth in employment over the cycle. This is consistent with evidence in figure 9, which suggests that a large fraction of the decline in routine occupations occurs in the 1980s. For the 2001 cycle, the counterfactual

⁴Data limitations currently prevent us from including earlier cycles in the counterfactual calculations.

⁵These charts parallel figure 7 in Jaimovich and Siu (2012).

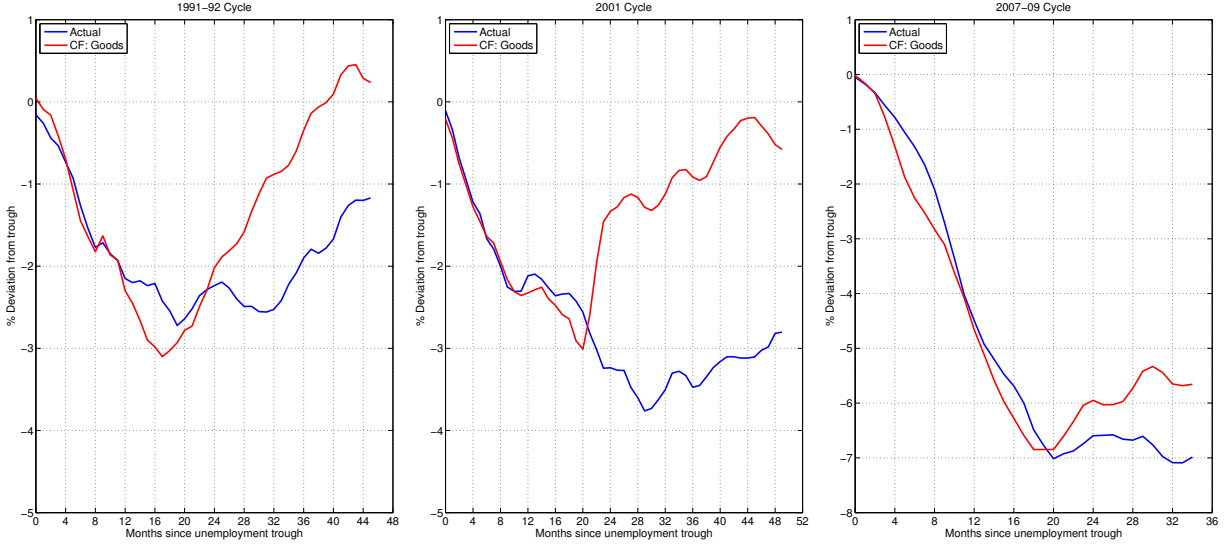


FIGURE 10: E/P counterfactual: Goods E/P replaced with average for 1981-82 recession.

employment growth is consistent with an important role of the decline in routine occupations in the jobless recovery, while for the 2007-09 cycle, this explanation seems less important.

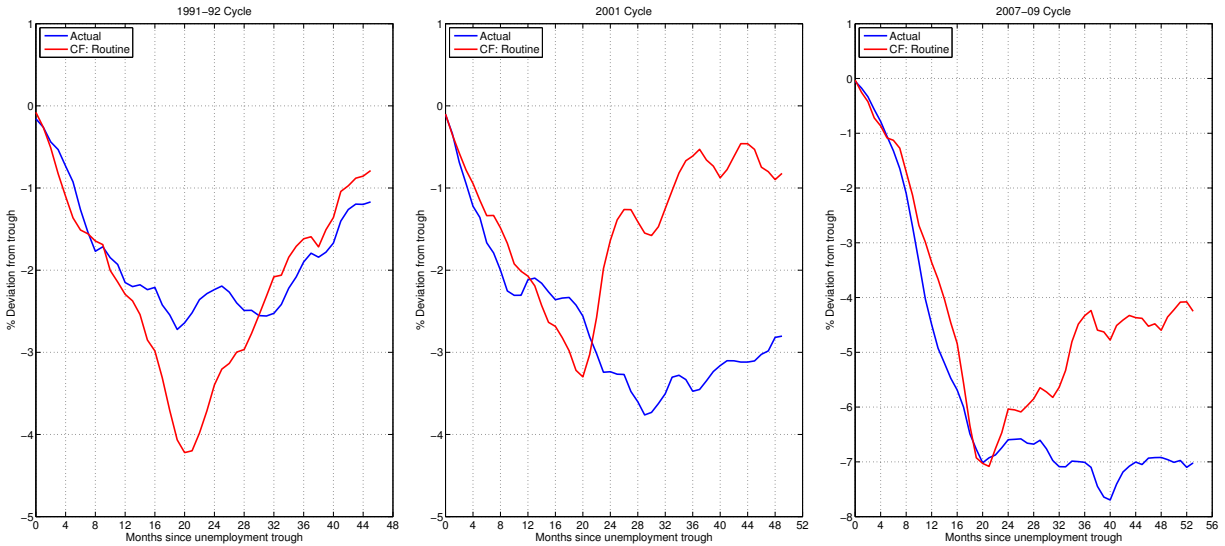


FIGURE 11: E/P counterfactual: Routine E/P replaced with average for 1981-82 recession.

Taken together, this evidence suggests that the structural decline in the goods sector played an important role in the jobless recoveries in the 1991-92 and the 2001 cycles, and the decline in routine occupations played an important role for the 2001 cycle. However, both factors can account only modestly for the slow recovery from the Great Recession. This is consistent with evidence in Foote and Ryan (2012), which cautions against linking job polarization and to the jobless recovery from the 2007-09 cycle, since workers from all skill classes suffer employment declines during the

recession and throughout the recovery. By contrast, as we show in Section 2.1, the flattening out of female employment growth can account for the slow recovery in aggregate employment in all recent cycles.

5 Discussion and Ongoing Work

The empirical analysis in the preceding sections has uncovered some interesting facts. Summarizing:

- The emergence of jobless recoveries coincides with the slowing down and subsequent flattening of female labor force participation, suggesting a possible link between these two phenomena;
- Fast employment growth in the pre-1990s recoveries can be traced back to the fast employment growth in female employment. There is little change in the behavior of male employment growth.
- A counterfactual analysis shows that if the growth rate of employment-to-population ratio had followed a pattern similar to pre-1990s recoveries, the last three recoveries should not have been jobless.

These observations all suggest that understanding female employment patterns is key in explaining the emergence of jobless recoveries in the US labor market. However, we argue that this issue can not be analyzed without analyzing supply and demand factors that shaped the female employment patterns in the last 40 years. There are exogenous factors that the previous literature identified as explanations for the rise in female labor supply. As we have shown, the same time period also coincides with a remarkable shift to service sector jobs and occupations emphasizing non-routine and cognitive tasks. We find that majority of the rise in these new type of jobs were filled by women. While exogenous factors drove women into the labor force, the emergence of a type of labor market that demanded jobs in which women have comparative advantage caused a big increase in female employment.

These findings raise an important question regarding jobless recoveries. Is the flattening of the female participation the reason behind the emergence of jobless recoveries? If so, can we trace jobless recoveries to exogenous labor supply factors, like change in preference towards home production or change in attitudes towards being a stay at home mother etc? Alternatively one could argue that the change in demand for the type of jobs in which women have comparative advantage might have caused the flattening of female participation, suggesting that jobless recoveries are a by product of demand factors. While these questions are empirical in nature, we believe that they are best answered using a quantitative model where demand and supply factors are explicitly taken into account and can be analyzed in isolation.

We plan to use is a two-sector search model of the labor market with endogenous participation, which extends the setting in Albanesi and Şahin (2012) by allowing for endogenous career choice, heterogenous gender specific productivity, and technological progress. This model has the attractive

feature that three labor market states are explicitly modeled to better understand the interaction between participation, employment and unemployment.

Men and women differ in their preference towards work, bargaining power with the firm, and productivity in the skilled and unskilled jobs. Here, we identify skilled jobs as those that are non-routine and cognitive in nature, which are generally in the service sector, and unskilled jobs as those that are routine and manual in nature, which are typically in the goods sector. Time varying technological progress changes the relative productivity in the skilled and unskilled sectors, affecting the relative demand for skilled jobs. Both men and women draw two shocks, a parameter reflecting their preference for market work, x , and a parameter capturing their relative productivity in skilled vs unskilled sectors, η . The distributions of these two parameters are gender specific, creating gender differences in participation and gender composition of sectors. Firms and workers split the surplus from production to determine wages, which are sector and gender specific, as in Albanesi and Şahin (2012).

We will use the model to conduct a quantitative analysis of the relative contribution of demand and supply factors to the occurrence of jobless recoveries, and to account for the role of the decline in the growth rate of women's participation. We will calibrate the economy to an initial early date (the earliest available is 1976) and simulate it over time to capture the following patterns:

- Evolution of labor force participation by gender;
- Evolution of the gender wage gap;
- Evolution of employment in the skilled and unskilled sectors by gender.

This exercise will allow us to identify the relative importance of exogenous factors that drive women's labor supply, and labor demand factors that are captured by sector specific productivity differences.

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