Institute for Fiscal Studies

# Fluctuations in hours of work and employment across age and gender

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**Abstract**

This paper documents the heterogeneity in labor market volatility across ages and gender in the United States over 1976-2014. We separate fluctuations in hours worked into fluctuations in the average number of hours per worker (the intensive margin) and fluctuations in the number of individuals at work (the extensive margin) and examine the relative importance of these two margins for each demographic group. We then compute the contribution of each demographic group to the change in aggregate hours worked over the business cycle. We discuss the implications of our findings for theories of labor market fluctuations.

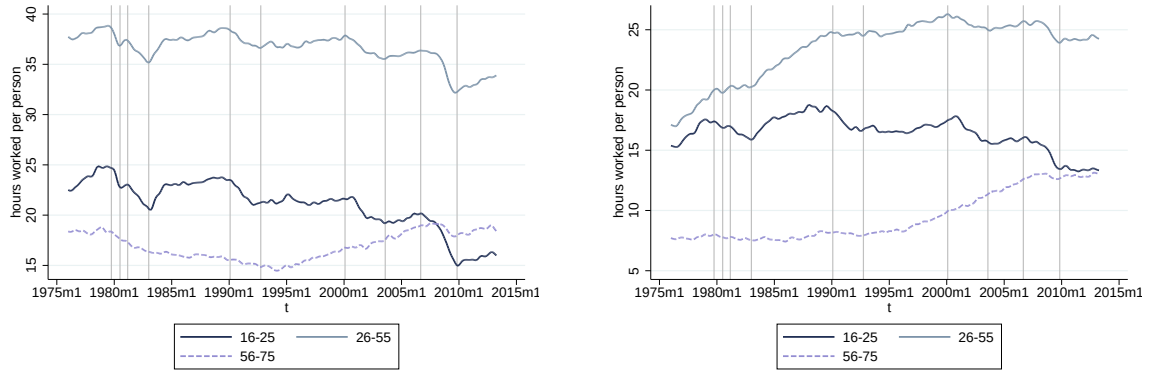
*JEL codes*: E24, E32, J21

## 1 Introduction

Business cycles affect workers differently depending on their age and gender. In the 2008 recession, total hours worked dropped more for men than for women and more for young workers than for prime age and old workers. This pattern is not specific to the great recession. As shown in Figure 1, and consistently with recent work by Elsby et al. (2010) and Hoynes et al. (2012), the same demographic groups that bore the brunt of the 2008-2009 shock were also the most affected in previous recessions.[1] In this paper, we separate total hours worked per person into the average number of hours per employed worker (the intensive margin) and the number of individuals at work (the extensive margin), and describe the heterogeneity across demographic groups on both margins. Fluctuations in aggregate hours of work have been shown to be mostly driven by fluctuations in the number of employed workers. Are the fluctuations in the number of employed workers the main driver for all demographic groups? Do young workers and male workers exhibit larger fluctuations both in their hours of work and in their employment? How important is each demographic group in contributing to the change in aggregate hours? We study these questions using the US monthly Current Population Survey (CPS) over 1976-2014.

[1] The heterogeneity in the sensitivity to the cycle across demographic groups has also been documented by Clark and Summers (1981), Gomme et al. (2005).

Figure 1: Weekly hours of work per person, by age group and gender




(a) men (b) women

Notes: The vertical lines mark recession dates, defined as peaks and troughs of aggregate hours worked per person.

## 2 Framework

We focus on the employment and average hours of work of various demographic groups. Suppose that there are $i = 1, ..., I$ demographic groups, where index $i$ designates an age class and gender. For each group $i$, we compute the fraction $E_i$ of the group that works ($E$ stands for extensive margin), the average number of hours $I_i$ supplied by the *workers* ($I$ stands for intensive margin), and the average number of hours $H_i$ supplied per *person* in the group.[2] For each demographic group, hours worked per person can be written $H_i = I_i E_i$. We then compute aggregate hours worked per person $H$ as the sum of the hours per person of each demographic group $H_i$ weighted by their population shares $n_i$: $H = \sum_{i=1}^{I} n_i H_i$.

We first analyze the importance of the extensive margin for each demographic group. The percent change in hours worked per person in group $i$ between the peak $s$ and the trough $t$ of a recession can be decomposed into the change in the employment rate (the extensive margin) and the change in the hours per worker (the intensive margin):

$$\frac{\Delta H_i}{H_i(s)} \simeq \frac{\Delta E_i}{E_i(s)} + \frac{\Delta I_i}{I_i(s)}, \tag{1}$$

where $\Delta X = X(t) - X(s)$ denotes the change between date $s$ and date $t$.

[2]The average hours of work and employment of each demographic group are computed using the CPS sample weights. In the survey, individual $h$ in month $t$ stands for $N_h$ persons. She is either employed ($E_h = 1$) or not employed ($E_h = 0$) and she works $I_h$ hours in the reference week. Total population belonging to category $i$ is $N_i = \sum_{h \in i} N_h$. The employment rate $E_i$ of category $i$ is given by $N_i E_i = \sum_{h \in i} N_h E_h$ while the weekly hours per worker $I_i$ are defined by $E_i I_i = \sum_{h \in i} E_h I_h$.

We then derive an accounting decomposition which gives the contribution of each age and gender group to the variation in aggregate hours worked over the recession:

$$\Delta H = S + \sum_{i=1}^{I} n_i(s)\Delta H_i. \tag{2}$$

The first term $S$ is captures changes in the composition of the population between date $s$ and $t$ and is given by $\sum_{i=1}^{I} \Delta n_i H_i(t)$, the second term measures the change in hours worked holding fixed the composition of the population at the time $s$ of the peak.[3]

# 3 Labor market fluctuations across demographic groups

We consider three age groups, young (age 16-25), prime age (age 26-55) and old (age 56-75), and analyze the fluctuations in the hours of work and employment of male and female workers in the three age groups over the five recessions observed since 1976.[4]

**Average hours worked per person**

Table 1 shows the relative change in hours worked by age class and gender over the five recessions. In line with previous work, we find that young workers are disproportionately affected by recessions. In the 2008 recession, young workers experienced a decline in their hours worked per person of 25.3% for men and 16.6% for women, more than twice the decline observed for prime age workers. Men also reduce their hours of work more than women do. Over the last recession, men reduced their hours of work by 12.9% while women experienced a 7.5% decline. Among all the categories that we considered, the larger decline in the total hours worked is found for the young male workers in all five recessions. Older workers experienced a smaller decline in hours worked than prime age workers in the last recession, but this was not the case in all recessions. Older workers experienced a decline in their hours of work as large as that of prime age workers in the 1981 and 1990 recessions, but it is important to note that the variations in the hours of work of older workers are likely due to non-cyclical factors. Figure 1 shows that the hours of work of older men have little correlation with the cycle; they are characterized by a downward trend until the mid 1990s followed by an upward trend until the 2008 recession.[5]

[3] Our results are not substantially modified if we use the other polar decomposition

$$\Delta H = \sum_{i=1}^{I} \Delta n_i H_i(s) + \sum_{i=1}^{I} n_i(t)\Delta H_i.$$

[4] The recessions are defined as the time between the peaks and troughs of the seasonally adjusted aggregate hours per person $H$. They differ from the NBER dates.

[5] Similarly, results on the variation in hours worked of prime age and older women should be interpreted with caution. The hours worked of prime age women follow an upward trend until the mid 1990s, which then translates into an upward trend in the hours worked of older women after the mid 1990s.

**The extensive and intensive margins**

Table 1 also provides the decomposition of the change in hours worked into an extensive and intensive margin components, from Equation (1). As expected, we find that the extensive margin contributes to a substantial part of the fluctuations in aggregate hours of work. Across all five recessions, the extensive margin accounted for between 56.8% and 77.7% of the decline in aggregate hours of work. Table 1 shows that the predominance of the extensive margin also holds within each gender and age group. The extensive margin represents more than 60% of the change in hours worked for most demographic groups. There are no systematic differences in the importance of the extensive margin across demographic groups, with the exception of old male workers who have a higher extensive margin share than prime age workers in all recessions. As noted above, the hours of old workers are dominated by low frequency variations and should therefore not be compared directly to the changes observed for young and prime age workers.

Young workers show a larger response of their hours worked than prime age workers at both the intensive and extensive margins. This fact suggests that the mechanisms underlying the higher volatility of young workers are at play at both margins. Hence, lower hiring and adjustment costs for younger workers can only be part of the story since they do not imply a larger adjustment at the intensive margin. By contrast, explanations based on larger variations in the demand for young workers (c.f Jaimovich and Siu, 2013) are consistent with the larger declines observed both at the intensive and extensive margins.

# 4 Contribution to aggregate fluctuations

Table 2 provides the decomposition of aggregate hours worked (Equation (2)). In all five recessions, we find that the prime age male workers contribute more than other categories to aggregate fluctuations in hours worked. Young workers experienced a larger percent change in their hours worked than prime aged workers, but since they represent a smaller share of the population and work shorter hours they did not contribute as much to aggregate fluctuations. While young workers account for 38% of the decline in overall hours per person during the 2008 recession, prime age workers account for 62%, with 44% for prime age male workers. The importance of prime age male workers suggests that explanations of labor fluctuations that rely on a high elasticity of labor supply will be difficult to reconcile with micro evidence, as micro estimates of prime-age male labor supply elasticities are typically low at both the intensive and extensive margins.

Using a similar decomposition, Blundell et al. (2013) analyze the secular increase in the US average hours of work over 1977-2007 and find that women account for the bulk of the increase. Our decomposition shows that women have a limited contribution to changes in hours worked

at business cycle frequency. In fact, the variations in the hours worked of prime age women is dominated by their increasing participation in the labor force. However, as women's participation stabilized to higher levels, their contribution to aggregate fluctuations increased. The contribution of women increased from 17% in the 1980 recession to 26% in the 2008 recession.

The decomposition in Table 2 also shows the role of demographic change. The change in the age and gender composition of the population (the first term in Equation (2)) has a non-negligible impact on the variations of the aggregate hours worked per person. Demographic change, which contributed to 6% of the decline in overall hours worked per person in the 2008 recession, had a surprisingly large impact in the early 1990s when it reduced the decline in overall hours per person by 20%.[6] These results complement Jaimovich and Siu (2009), who show that changes in the composition of the workforce account for a substantial part of the changes in the volatility of aggregate hours worked. Whereas they focus on secular changes in the composition of the workforce, our decomposition shows that changes that occur over the course of a recession can have a substantial impact on the variation in aggregate hours worked.

## 5 Conclusion

We document the fluctuations in the hours per worker and in the employment of young, prime age and old male and female workers. We find that (1) fluctuations in employment account for most of the fluctuations in the hours of work for all demographic groups; (2) young workers and male workers experience larger fluctuations both in their hours per worker and in the number of workers; (3) the variations in the hours of work of older workers appears to be unrelated to the cycle. We then compute the contribution of each demographic group to the fluctuations in aggregate hours of work. Our decomposition indicates that despite the increase in the labor force participation of women, male workers still account for the bulk of the fluctuations in aggregate hours of work.

[6]The contribution of demographic change is positive (and tends to reduce the decline in hours worked) for the recessions in 1981 and 1991, and is negative (and tends to amplify the decline in hours worked) in 2001 and 2008. Until the mid 1990s, with the baby-boomers reaching prime age, the share of young workers declined while the share of prime-age workers rose. This population shift raised the average hours worked per person and thereby reduced the magnitude of the decline in hours worked during the 1981 and 1991 recessions. After the mid 1990s, the aging of the baby-boomers lead to an increase in the population weight of older workers and to a decrease in the weight of prime-age workers, which lowered average hours worked per person and amplified the decrease in hours worked during the 2001 and 2008 recessions.

## Appendix: Data

Each month, the CPS collects information about the employment status and demographic characteristics of about 100 000 individuals aged 16 and older.[7] We restrict our sample to individuals aged 16-75. We use the CPS sample weights to aggregate hours worked and employment by age and gender category and then compute average hours per worker and the employment rate (i.e. the employment-population ratio) for each age and gender category over the period 1976-2013.[8] We adjust the weekly hours per *worker* and the employment rate for seasonal and irregular variations using the Census X-12-ARIMA method. The seasonally adjusted series are then used to compute the (seasonally adjusted) hours worked per *person* for each age and gender category and the corresponding aggregate series.

As we focus on per person and per worker series, there is no trend associated with population growth. Hours worked per person for men and women aged 16-25 exhibit a negative trend from 2000 onwards, but this trend seems to result from the succession of the 2001 and 2008 recessions rather than from structural factors (cf. Figure 1). Furthermore, since hours worked had not recovered from the 2008 recession at the end of our sample, detrending the data would lead us to attribute part of the decline in hours worked to the trend and thus substantially reduce the magnitude of the recession. Using detrended data, we find that overall hours worked per person declined by 7% while raw data indicate a 10% decline.

The variations in the hours worked per person of older workers, however, seem to have little correlation with the cycle. The hours worked of men and women aged 56-75 are characterized by an upward trend starting in the mid 1990s that makes it more difficult to analyze the cyclical fluctuations of these workers. As our objective is to compute the contribution of each category of workers to the observed fluctuations of aggregate hours worked, we choose to not detrend the data and show the robustness of our results to using detrended data in the online Appendix.

[7] The data are publicly available at http://www.nber.org/cps/. Each month, about 60,000 occupied dwelling units are selected to be interviewed. All members of the household aged 16 or older are asked to report their labor market activity during the reference week. The reference week is the week from Sunday through Saturday that includes the 12th day of the month.

[8] Employed persons refer to all persons who had a job during the reference week, whether at work or absent from work because of illness, leave, training, etc and the number of hours worked refers to hours worked during the reference week at all jobs.

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Table 1: The contribution of the extensive margin

| | Men | | | Women | | | All |
|---|---|---|---|---|---|---|---|
| | 16-25 | 26-55 | 56-75 | 16-25 | 26-55 | 56-75 | |
| 1979m10-1980m07 | | | | | | | |
| $\Delta H/H$ | -8.1 | -4.3 | -3.5 | -3.2 | -0.9 | -2.7 | -3.9 |
| $\Delta I/I$ | -2.7 | -2.0 | -1.0 | -1.6 | -0.7 | -1.2 | -1.7 |
| $\Delta E/E$ | -5.5 | -2.3 | -2.5 | -1.6 | -0.2 | -1.6 | -2.2 |
| $\Delta E/E$ as a share of $\Delta H/H$ | 68.3 | 54.2 | 73.1 | 50.2 | 26.5 | 57.8 | 56.8 |
| 1981m03-1983m01 | | | | | | | |
| $\Delta H/H$ | -10.4 | -5.6 | -6.1 | -6.7 | -0.5 | -3.5 | -4.6 |
| $\Delta I/I$ | -2.6 | -1.1 | -0.2 | -2.8 | 0.1 | -1.7 | -1.1 |
| $\Delta E/E$ | -8.0 | -4.5 | -6.0 | -4.0 | -0.6 | -1.9 | -3.5 |
| $\Delta E/E$ as a share of $\Delta H/H$ | 76.8 | 80.8 | 97.3 | 59.7 | 123.6 | 52.9 | 77.7 |
| 1990m02-1992m10 | | | | | | | |
| $\Delta H/H$ | -9.6 | -4.4 | -4.6 | -8.3 | -0.9 | -2.5 | -3.3 |
| $\Delta I/I$ | -3.7 | -1.0 | -0.2 | -3.1 | 0.2 | -0.8 | -0.8 |
| $\Delta E/E$ | -6.1 | -3.4 | -4.4 | -5.4 | -1.1 | -1.7 | -2.5 |
| $\Delta E/E$ as a share of $\Delta H/H$ | 63.8 | 77.6 | 95.7 | 65.0 | 123.1 | 67.9 | 77.3 |
| 2000m02-2003m08 | | | | | | | |
| $\Delta H/H$ | -11.4 | -5.8 | 4.8 | -10.1 | -4.7 | 14.2 | -5.1 |
| $\Delta I/I$ | -1.9 | -2.1 | 0.3 | -1.9 | -1.0 | 1.5 | -1.4 |
| $\Delta E/E$ | -9.7 | -3.8 | 4.5 | -8.4 | -3.7 | 12.6 | -3.7 |
| $\Delta E/E$ as a share of $\Delta H/H$ | 85.2 | 64.7 | 93.6 | 83.0 | 79.4 | 88.4 | 73.1 |
| 2006m09-2009m11 | | | | | | | |
| $\Delta H/H$ | -25.3 | -11.2 | -5.7 | -16.6 | -6.1 | 0.3 | -10.6 |
| $\Delta I/I$ | -6.9 | -4.1 | -1.9 | -4.6 | -2.0 | -0.7 | -3.2 |
| $\Delta E/E$ | -19.8 | -7.5 | -3.9 | -12.6 | -4.2 | 1.1 | -7.6 |
| $\Delta E/E$ as a share of $\Delta H/H$ | 78.3 | 66.5 | 68.3 | 75.9 | 68.3 | 311.7 | 71.8 |

Notes: The first three lines may not add up because of approximation errors. The first line gives the change in the hours per person $\Delta H/H$, the second line the change in the hours per worker $\Delta I/I$ and the third line the change in the employment rate $\Delta E/E$. The last line gives the ratio of the change in the employment rate $\Delta E/E$ over the change in the hours per person $\Delta H/H$. All the variables are expressed in percentage.

Table 2: A decomposition across ages and gender

| | Men | | | Women | | | $S$ | Total |
|---|---|---|---|---|---|---|---|---|
| | 16-25 | 26-55 | 56-75 | 16-25 | 26-55 | 56-75 | | |
| 1979m10-1980m07 | | | | | | | | |
| $n$ | 0.13 | 0.25 | 0.10 | 0.13 | 0.27 | 0.12 | . | 1.00 |
| $\Delta H$ | -1.99 | -1.64 | -0.63 | -0.56 | -0.19 | -0.22 | . | . |
| $n\Delta H$ | -0.25 | -0.41 | -0.06 | -0.07 | -0.05 | -0.03 | -0.02 | -0.90 |
| 1981m03-1983m01 | | | | | | | | |
| $n$ | 0.13 | 0.25 | 0.10 | 0.13 | 0.27 | 0.12 | . | 1.00 |
| $\Delta H$ | -2.40 | -2.09 | -1.07 | -1.14 | -0.10 | -0.27 | . | . |
| $n\Delta H$ | -0.30 | -0.53 | -0.11 | -0.15 | -0.03 | -0.03 | 0.11 | -1.04 |
| 1990m02-1992m10 | | | | | | | | |
| $n$ | 0.11 | 0.28 | 0.10 | 0.11 | 0.29 | 0.11 | . | 1.00 |
| $\Delta H$ | -2.25 | -1.67 | -0.71 | -1.52 | -0.21 | -0.20 | . | . |
| $n\Delta H$ | -0.24 | -0.47 | -0.07 | -0.16 | -0.06 | -0.02 | 0.20 | -0.82 |
| 2000m02-2003m08 | | | | | | | | |
| $n$ | 0.10 | 0.30 | 0.09 | 0.10 | 0.31 | 0.11 | . | 1.00 |
| $\Delta H$ | -2.46 | -2.19 | 0.81 | -1.76 | -1.23 | 1.41 | . | . |
| $n\Delta H$ | -0.24 | -0.65 | 0.08 | -0.17 | -0.38 | 0.15 | -0.10 | -1.30 |
| 2006m09-2009m11 | | | | | | | | |
| $n$ | 0.10 | 0.29 | 0.11 | 0.10 | 0.29 | 0.12 | . | 1.00 |
| $\Delta H$ | -5.09 | -4.07 | -1.09 | -2.67 | -1.57 | 0.04 | . | . |
| $n\Delta H$ | -0.50 | -1.17 | -0.11 | -0.25 | -0.46 | 0.01 | -0.16 | -2.65 |

Notes: Changes in total hours $\Delta H$ are decomposed according to Equation (2) into the variation in the hours worked per person $\Delta H$ of each demographic group times the weight $n$ of the group in the population at the time of the peak. Columns may not sum to total due to rounding.