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# Heterogeneity and long-run changes in aggregate hours and the labor wedge



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## ABSTRACT

From 1961 to 2007, U.S. aggregate hours worked increased and the labor wedge—measured as the discrepancy between a representative household's marginal rate of substitution and the marginal product of labor—declined substantially. The labor wedge is negatively related to hours and is often attributed to labor income taxes. However, U.S. labor income taxes increased since 1961. We examine a model with gender and marital status heterogeneity which accounts for the trends in the U.S. hours and the labor wedge. Apart from taxes, the model's labor wedge reflects non-distortionary cross-sectional differences in households' hours worked and productivity. We provide evidence that household heterogeneity is important for long-run changes in labor wedges and hours in other OECD economies.

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## 1. Introduction

From 1961 to 2007, U.S. average hours worked—defined as total market hours per working-age person—increased by 13 percent. Concurrently, the U.S. labor wedge, measured as the discrepancy between a representative household's marginal rate of substitution between consumption and leisure (*MRS*) and the marginal product of labor (*MPL*), declined by 37 percent. Somewhat surprisingly, despite being much larger than the frequently studied short-run fluctuations, the long-run change in the U.S. labor wedge has received little attention in the literature.<sup>1</sup> Such long-run trends are negatively related to changes in hours and are often attributed to variations in taxes (e.g., Mulligan, 2002) because the labor wedge—denoted here by  $\Delta$ —resembles a labor income tax (i.e., by definition  $1 - \Delta \equiv MRS/MPL$ ). However, U.S. labor income taxes increased

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<sup>1</sup> Given a high labor supply elasticity (typically used in macro studies), Shimer (2010) documents a decline in the U.S. labor wedge from 1959 to 2007 of about 35 percent, consistent with our calculations (see Fig. 1.1 in his book). The U.S. labor wedge decline is about 1.5 times larger for a low labor supply elasticity. In addition, Shimer reports that business cycle fluctuations of the U.S. labor wedge have a standard deviation between 1.8 and 5.5 percent, the larger number corresponding to a low labor supply elasticity.

since 1961. As a result, standard representative agent models (e.g., Prescott, 2004; Ohanian et al., 2008) deliver counterfactual predictions for the U.S., as higher taxes imply lower hours and a higher labor wedge.

In this paper, we show that incorporating gender and marital status heterogeneity in an otherwise standard growth model is quantitatively important in accounting for the observed trends in U.S. hours and the labor wedge. Our focus on household heterogeneity is motivated by the large changes in hours and wage rates by gender and marital status since 1961. Married women's hours more than doubled and men's hours declined, while gender wage gaps decreased substantially. In our model, shrinking gender wage gaps contribute to an increase in aggregate and women's hours and deliver a decline in the measured labor wedge, in spite of higher taxes. A key takeaway is that large changes in cross-sectional heterogeneity over time are reflected in long-run changes in the measured labor wedge.

The intuition for why cross-sectional heterogeneity in wages and hours impacts the measured labor wedge is straightforward. In a representative agent model, the labor wedge is measured from the intratemporal equilibrium condition which relates the *MRS* to the *MPL*, using aggregate data which averages out cross-sectional heterogeneity. In a heterogeneous agent model, the labor wedge is derived from a weighted aggregate of the households' intratemporal equilibrium conditions. These equations are nonlinear relationships between consumption, hours and wages, and, thus, cross-sectional differences in hours and wages do not average out. We formalize this idea in a simple static model where households differ in their labor productivity. We show that, the larger the differences in productivity and hours across households are, the larger is the discrepancy between the aggregate *MRS* and the aggregate *MPL*, i.e. the labor wedge. It follows that changes in cross-sectional differences in productivity and hours map into changes in the measured labor wedge.

To quantify the contribution of this mechanism to long-run changes in U.S. hours and the labor wedge, we examine a standard model augmented with three types of households: married couples, single women and single men.<sup>2</sup> In our model, women receive a lower hourly wage rate compared to men, due to lower productivity and discrimination (as suggested by Goldin, 1992), and the labor income of all households is taxed. We evaluate the impact of taxes and cross-sectional wage heterogeneity on the documented trends in U.S. data. Higher taxes deliver counterfactual predictions for U.S. hours and the labor wedge. However, reductions in gender wage gaps for married couples and singles (reflecting lower discrimination, or higher relative productivity of women, or a combination of the two) generate a long-run increase in aggregate and women's hours and a long-run decline in the aggregate labor wedge.

A calibrated version of our baseline model—with gender wage gaps and taxes measured from U.S. data—accounts for 63 percent of the increase in average hours worked, 86 percent of the increase in married women's hours and about 30 percent of the decline in the labor wedge. To isolate the contribution of gender wage gaps, we consider a variation of our baseline model with constant taxes. This experiment accounts for virtually all of the increase in aggregate and women's hours and about 54 percent decline in the labor wedge. The model does not account for all of the decline in the labor wedge, since it has difficulty capturing the observed increase in the U.S. consumption to output ratio since the mid 1980s.

We consider two extensions of our analysis which have been suggested as possible explanations for the long-run increase in U.S. hours, and evaluate their impact on the labor wedge. Following Attanasio et al. (2008), we incorporate child care costs in our model. We find that reductions in this cost lead to additional increases in married women's hours and in aggregate hours, but contribute only a further 6 percentage points to the decline in the labor wedge. Second, we examine whether changes in leisure time which reflect non-market hours (e.g. time spent in home production) can improve predictions for the U.S. labor wedge, as suggested by Ohanian et al. (2008). Our back-of-the-envelope calculations suggest that the increase in U.S. leisure time since mid-1960s—which varies from 2 percent in Ramey and Francis (2009) to a range of 5.4–15 percent in Aguiar and Hurst (2007)—can account for 6.5–50 percent of the decline in the U.S. labor wedge. We view both extensions as complementary to our analysis.

A natural question is whether the mechanism we analyzed in detail for the U.S. is quantitatively important in other economies. We extend our analysis of long-run changes in hours and labor wedges to Canada and Germany. In Canada, similar to the U.S., the closing of the gender wage gaps and increases in female hours dominate the increase in taxes and lead to a decline in the labor wedge over the last four decades. Germany is especially interesting, since taxes increased by more than the increase in the labor wedge over the last two decades. Reductions in cross-sectional heterogeneity in Germany (captured by a shrinking gender wage gap for married couples and higher married women's hours) are important as they partly undo the effect of higher taxes, bringing the model's labor wedge closer to that measured from aggregate data. The improved predictions for the labor wedges lead us to conclude that heterogeneity also helps account for changes in hours in Canada and Germany.

Lack of *long-run* microsurvey data prevents us from extending this analysis to a larger number of countries. However, our mechanism is broadly consistent with aggregate data on hours worked, tax rates and measured labor wedges for a number of other OECD economies where gender wage gaps shrunk. In economies with large changes in hours and the labor wedge, cross-sectional heterogeneity can be quantitatively important in reversing the effects of higher taxes (as observed in Spain, Italy and Belgium), or in accounting for reductions in labor wedges which are larger than reductions in tax rates (as observed in Netherlands, Finland and the U.K.).

<sup>2</sup> It is possible to extend the model to allow for other types of heterogeneity, e.g. differences in skill levels implied by the rise in the education premium. Such extensions are beyond the scope of this paper.

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