Notes on Measuring the Labor Wedge

Integral

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Abstract

This document was prepared as a response to the question, "How exactly is the labor wedge calibrated/calculated?" especially in reference to Ohanian's "The Economic Crisis from a Neoclassical Perspective," JEP 2010. I reference Ohanian's paper throughout.

1 The Basic Idea

The labor wedge is defined as

$$\tau_L = \frac{MPN}{MRS} \tag{1}$$

the ratio of the firm's marginal product of labor to the consumer's marginal rate of substitution. Brief background: consumer optimization implies $MRS = W$, firm optimization implies $MPN = W$, so in a competitive market with no distortions, $MRS/MPN = 1$. If $MRS/MPN \neq 1$, there is a wedge between the labor supply curve and the labor demand curve.

So far we have little to go on: what the heck are MRS and MPN, and how do we measure them? Let's put some structure on the problem. In a textbook model, consumer utility and firm production possibilities are set up as:

$$U(C, H) = \frac{C_t^{1-\sigma}}{1-\sigma} - \chi \frac{H_t^{1+\eta}}{1+\eta}$$
$$F(K, L) = Y_t = Z_t K_t^{\alpha} H_t^{1-\alpha}$$

which in turn implies (do the optimization yourself):

$$MRS = \chi H_t^{\eta} C_t^{\sigma}$$
$$MPN = (1-\alpha)\frac{Y_t}{H_t}$$

Now the wedge can be calculated:

$$\tau_L = \frac{MPN}{MRS} = \frac{1-\alpha}{\chi} \frac{Y_t/H_t}{H_t^{\eta} C_t^{\sigma}} \tag{2}$$

This is an expression for the labor wedge in a standard model with standard preferences and standard production possibilities. In a canonical RBC model, the wedge is always unity; in a New Keynesian model, the labor wedge is equal to the markup of price over marginal cost. In more complicated models, the labor wedge is made up of a combination of many of the frictions in the model.

2 Measuring the Labor Wedge with Data

In principle, we just take

$$\tau_L = \frac{MPN}{MRS} = \frac{1-\alpha}{\chi}\frac{Y_t/H_t}{H_t^{\eta}C_t^{\sigma}}$$

plug in data, and out pops the wedge. In practice, two problems arise. First, we need to calibrate parameters η and σ; we're going to use a normalizing trick to avoid calibrating χ and α. Second, we need to figure out how to map national accounts data onto the model objects (Y_t, H_t, C_t). Let's set $\sigma = 1$ for now, and try other calibrations later. When $\sigma = 1$, the labor wedge expression reduces to:

$$\tau_L = \frac{1-\alpha}{\chi}\left(H_t^{1+\eta}\frac{C_t}{Y_t}\right)^{-1} \tag{3}$$

and this is the equation I take to the data. It contains two objects: hours worked and the consumption-output ratio. How do we map those concepts to national accounts data?

1. H_t: I measure H_t by aggregate hours worked divided by the civilian noninstitutional population (FRED: `HOANBS` divided by `CNP16OV`). This gives me a measure of average hours worked. I then normalize the resulting series so that its mean is 0.3 throughout the 1950-2014 period; I do this to make the data conform to the model. H_t is constrained to lie between zero and one; so our data ought to also respect those bounds. A mean value of 0.3 means that, on average, individuals spend three-tenths of their time working. A graph of H_t is available in figure 1.

2. C_t/Y_t: I measure C_t/Y_t by the ratio of aggregate consumption to aggregate income (FRED: `PCECC96` divided by `GDPC96`). If I were being more careful, I would use only nondurable consumption and services (FRED: `PCESV` plus `PCND`, turned into real values via their price deflators). I leave that extension to the reader. A graph of C_t/Y_t is in figure 2.

3. The wedge: Set $\eta = 1$ for now. Multiply $H_t^{1+\eta}$ by C_t/Y_t, invert the resulting object, then normalize the series so that it equals 0.3 in 2000:Q1. My normalization at this stage follows Karabarbounis (2014 RED). The wedge is plotted in figure 3.

4. The growth rate of the wedge is 100 times the log difference of the wedge and its value four periods (one year) ago. I plot the growth rate of the labor wedge in figure 4.

3 Results

Figure 4 is the closest we have to what Ohanian is talking about in his paper; compare figure 4 to Ohanian's Table 2. He and I measure things a bit differently, so I don't get exactly the same results as him, but you can clearly see that the change in the labor wedge is much larger in the 2007-09 recession than it was in previous recessions. I'm getting something like 15% change in 2007-09 and a 7-10% change in prior recessions; Ohanian's figures are more stark (12.9% and 2.4% respectively), possibly due to different calibration decisions. Note that the scale is flipped, so negative numbers for Ohanian's Table 2 are positive numbers for figure 4.

4 Variations on a Theme

Suppose utility is instead:

$$U = \log C_t + A \log(1 - H_t)$$

then the labor wedge is

$$\tau_L = \frac{1-\alpha}{A} \frac{Y_t}{C_t} \frac{1-H_t}{H_t}$$

which might be the exact expression Ohanian is using. (I don't know, he doesn't tell us, but he uses the log-log specification in other papers.) I plot that object in figures 5 and 6. I still don't get the really stark variation that Ohanian gets, but at I come closer. Normally the wedge deteriorates (grows) by about 5% in recessions; in the Great Recession it deteriorated by 12%.

5 The Labor Wedge in a Model

This is an illustration. Take the New Keynesian model,

$$\begin{aligned} MRS &= \chi H_t^\eta C_t^\sigma = W_t \\ MPN &= \frac{(1-\alpha)}{\mu_t} \frac{Y_t}{H_t} = W_t \end{aligned}$$

where μ_t is the markup. If we calculate the labor wedge,

$$\begin{aligned} \tau_L &= \frac{(1-\alpha) Y_t / H_t}{\chi H_t^\eta C_t^\sigma} \\ &= \frac{\mu_t W_t}{W_t} \\ &= \mu_t \end{aligned}$$

so that the labor wedge in this model is equal to the markup of price over marginal cost.

6 Further Reading

Karabarbounis, "The Labor Wedge: MRS vs MPN" (2014 *Review of Economic Dynamics*) contains a longer discussion with a more involved setup; he explicitly covers the case with taxes, where I abstract from taxes (in practice: taxes are absorbed into my wedge, and cleaned out of his wedge). He's pretty careful about all of his definitions and such. Compare my figure 1 to his figure 1. Compare my description of creating the wedge to his, Section 4 paragraph 1, esp "The labor wedge is normalized to 0.3 in 2000(1)."

7 Figures

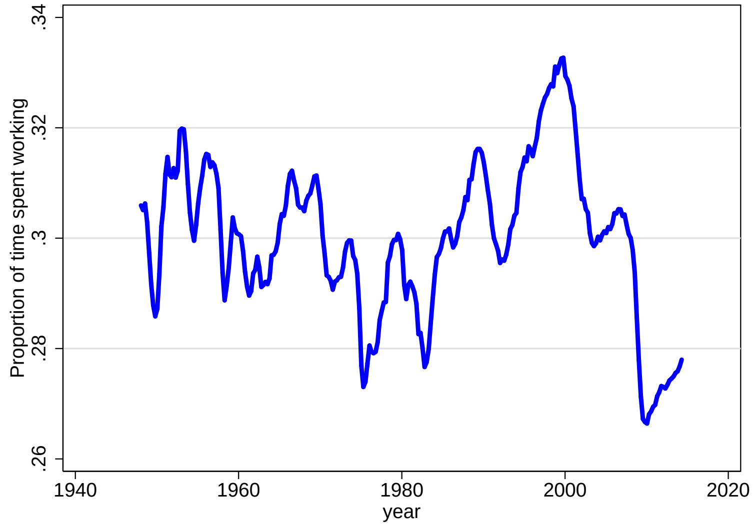

Figure 1: Hours Worked Per Capita, normalized to have mean 0.3. Data: FRED.

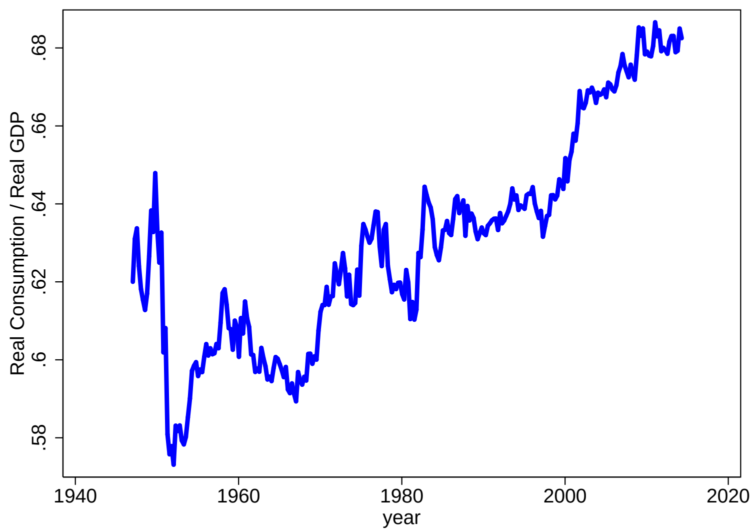

Figure 2: Consumption-Output Ratio. Data: FRED.

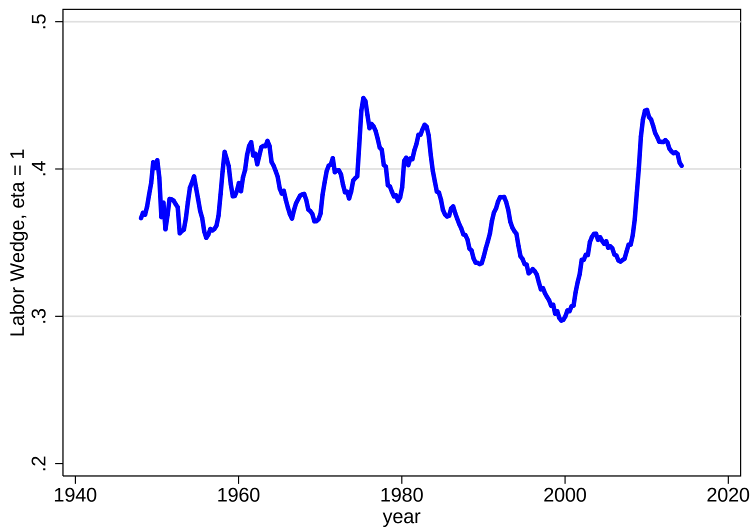

Figure 3: The Labor Wedge, $\eta = \sigma = 1$. Data: author's calculation. Larger values indicate a larger spread between the MRS and MPN.

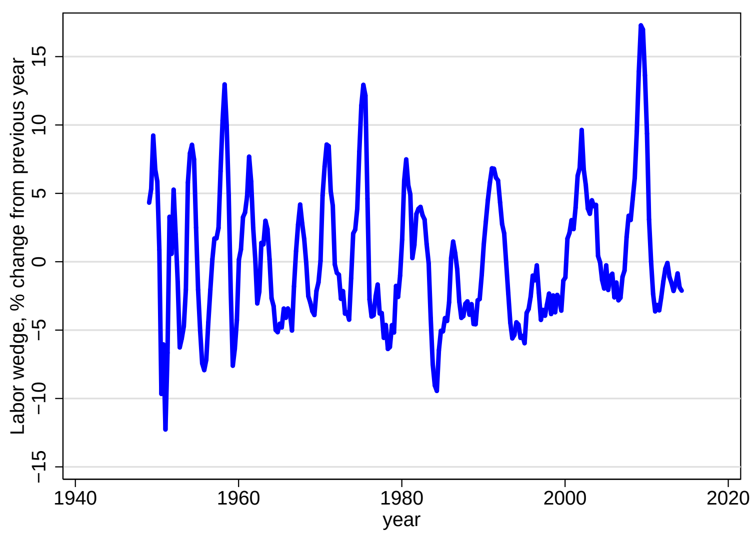

Figure 4: Year-over-year change in labor wedge, $\eta = \sigma = 1$. Data: author's calculation.

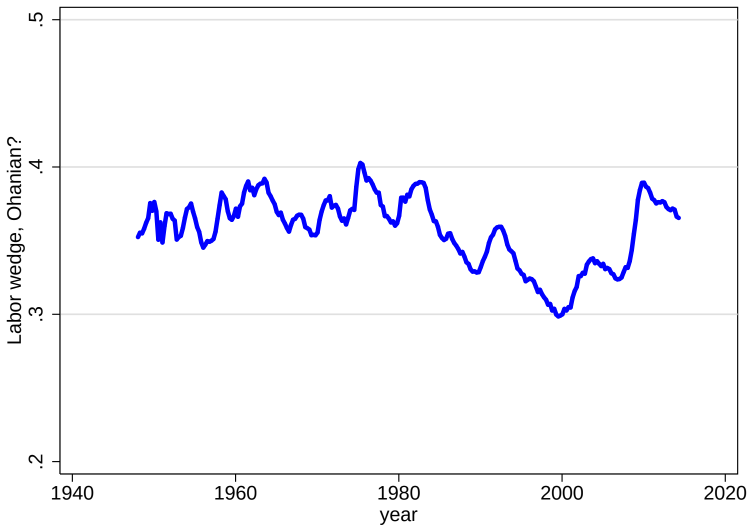

Figure 5: The Labor Wedge, log-log preferences. Data: author's calculation. Larger values indicate a larger spread between the MRS and MPN.

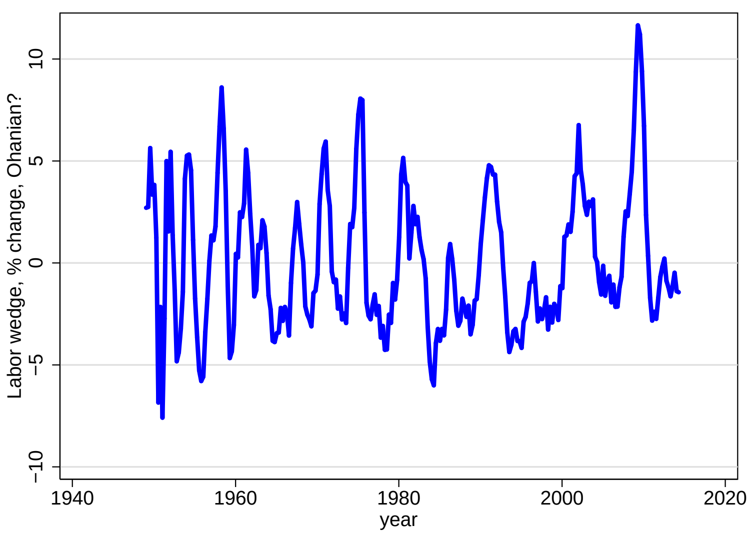

Figure 6: Year-over-year change in labor wedge, log-log preferences. Data: author's calculation.