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A quantitative theory of the gender gap in wages

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ABSTRACT

This paper measures how much of the gender wage gap over the life cycle is due to the fact that working hours are lower for women than for men. We build a quantitative theory of fertility, labor supply, and human capital accumulation decisions to measure gender differences in human capital investments over the life cycle. We assume that there are no gender differences in the human capital technology and calibrate this technology using wage–age profiles of men. The calibration of females assumes that children involves a forced reduction in hours of work that falls on females rather than on males and that there is an exogenous gender gap in hours of work. We find that our theory accounts for all of the increase in the gender wage gap over the life cycle in the NLSY79 data. The impact of children on the labor supply of females accounts for 56% and 45% of the increase in the gender wage gap over the life cycle among non-college and college females, while the rest is due to the exogenous gender differences in hours of work.

1. Introduction

A striking but well-known feature of the US labor market is that the average hourly wage of women is much lower than that of men and that women face lower wage growth over the life cycle than men. A large empirical literature is aimed at understanding the sources of gender difference in wages. Empirical studies typically find that males earn higher wages (even after controlling for gender differences in observed characteristics) and face higher returns to labor market experience than females.[1] One problem in interpreting these results is that we cannot assess to what extent they are driven by (unobserved) investments in human capital. Economic theory suggests that this is a difficult problem to deal with. Since the return to human capital accumulation depends on future labor supply, theory implies that investments should be driven by expected labor supply (rather than by past labor supply). While economic theory prescribes that investment decisions are forward looking, obvious data limitations make it hard to incorporate labor supply expectations into the empirical analysis.

In the present paper, we use quantitative theory to assess the importance of (unmeasured) human capital investments in understanding gender differences in wage growth over the life cycle. In our theory, individuals decide how much (unobserved) effort to spend in accumulating on the job human capital and whether to work or stay at home. We assume that females also make fertility decisions. Clearly, any theory of gender differences needs to introduce some differences between males and females. While there are many ways one could introduce gender differences, our approach is to assume that the bearing and presence of children involves a forced reduction in hours of work that falls on females rather than on males and

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[1] See, for instance, Blau and Kahn (1997, 2000).

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that there is an exogenous gender gap in hours of work. We assume that there are no gender differences in the human capital technology and calibrate this technology using wage–age profiles of men. The model is calibrated to the fertility patterns and to the impact of children on career interruptions and labor supply of women in the data. The quantitative theory is then used to measure human capital accumulation of females during the life cycle and to compare it with that of males.[2]

The starting point of our analysis is that there are substantial gender differences in labor supply in the United States. Using data from the NLSY(1979) we build detailed labor market histories of men and women and add up weekly hours of work over the life cycle. We find that by age 40 the gender differences in cumulative hours of work are 45% among non-college individuals and 27% among college individuals (notice that gender differences in cumulative hours of work are much larger than the ones obtained by focusing on years of employment, which is the measure of experience typically used in empirical studies).[3] We also document that children have an important role in generating gender differences in labor supply by comparing labor market histories of mothers and non-mothers.[4] Human capital theory implies that gender differences in hours of work should translate into different incentives for human capital accumulation across genders. Furthermore, the data lends supports to the importance of human capital investments as determinants of wages since there is substantial wage growth during the first 20 years of labor market experience – wages of men more than double between age 20 and age 40. Moreover, the data suggests that differential investments in human capital can be large since over the first 20 years of labor market experience men's wages grow one percentage point higher per year than women's wages.

Our quantitative theory is built to match the males' age–employment profile and the age-profile of hours of work for college and non-college individuals. Regarding females, the theory replicates the birth rates by age and the impact of children on career interruptions and labor supply for college and non-college females. We find that gender differences in employment and hours lead to differential returns to experience across genders and a wage gap that increases with age. We find that the gender wage gap grows over the life cycle by 25 percentage points for non-college individuals and by 22 percentage points for college individuals. Altogether, the model accounts for all of the increase in the gender wage gap over the life cycle in the NLSY data for college individuals and slightly over predicts the increase in the gender wage gap for non-college individuals. We also find that the impact of children on the labor supply of females accounts for 56% of the increase in the gender gap in wages over the life-cycle of non-college females, and for about 45% of the increase in the gender wage gap among college females, while the rest is due to exogenous gender differences in hours of work. Children have a large negative effect on wages of females because they reduce labor supply at a stage of the life cycle when the returns to human capital accumulation on the job are high.

Our findings are consistent with the vast empirical literature that finds a substantial gender residual in wage regressions that measure human capital investments by past experience. To illustrate this point, we simulate non-college educated males and females in our model that are identical in terms of initial human capital and lifetime employment. Our simulated males and females only differ in lifetime labor supply because females work 10% less hours than males and because females expect to have children – with the associated negative impact on labor supply – even though ex-post no female is ever given an opportunity to have children. Since females in this experiment work more than 35 hours a week, we follow the empirical literature in counting them as full-time employed. Hence, the data generated by this experiment features no gender differences in experience as measured by full-time employment. Nevertheless, we find a gender wage ratio of 0.875 at age 40. Using the simulated data, a standard wage regression of log wages on experience (measured as full-time employment) and a sex dummy as explanatory variables, would attribute a negative wage effect to being a female worker and a lower return to (measured) experience by females relative to males. We conclude that, in the context of our model, standard measures of experience typically used in the empirical literature are not good measures of investment in human capital over the life cycle.

Our paper is motivated by some basic insights from human capital theory. The theories developed by Becker (1967) and Ben-Porath (1967) stress the importance of modeling human capital and labor supply decisions jointly in a life-cycle framework. Two crucial insights from these seminal papers are that the incentives to accumulate human capital vary along the life cycle and that these incentives are directly proportional to the time one expects to work over the lifetime. The idea that women may face different incentives to accumulate human capital than men due to a higher relative value of non-market activities can be traced back to the influential work of Mincer and Polachek (1974).[5] These authors provide evidence that married women tend to interrupt their labor market attachment with periods of non-participation and, using a regression

[2] Our model assumes that women start their life cycle with the same human capital as males (at 17 years of age for non-college and 23 years of age for college women). Hence, our theory abstracts from the initial gender wage gap of about 10% in the data. However, we emphasize that by age 40 the bulk of the gender wage gap (about 70%) is explained by gender differences in wage growth over the life cycle. Moreover, note that the forces that imply low employment and hours of work by females with young children in our model would also induce females to supply less hours of work and less effort in accumulating human capital before the initial age in our model economy.

[3] An advantage of the NLSY, relative to other data sources such as CPS or PSID, is that it provides week by week data on hours of work. This is important because we find large gender differences in working hours, even among full-time workers.

[4] Because the negative association between children and female labor supply could be an artifact of selection, we provide evidence that – conditional on education – mothers are not self-selected from females with low labor market attachment. For details, see discussion of children and labor market outcomes in Section 2.

[5] Gronau (1988) and Weiss and Gronau (1981) are also important early contributions studying how labor market interruptions affect women's investment in human capital.