



# Effects of labor taxes and unemployment compensation on labor supply in a search model with an endogenous labor force <sup>☆</sup>

Been-Lon Chen <sup>\*</sup>, Chih-Fang Lai

*Institute of Economics, Academia Sinica, 128 Academia Road Section 2, Taipei 11529, Taiwan*

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## ABSTRACT

Labor taxes and unemployment compensation were blamed for causing relative declines in labor supply in the EU to the US in the past decades. We propose a model with an endogenous labor force and compare with the model with an exogenous labor force. Because of discouraging the labor force, labor taxes decrease employment in our model less than the model with an exogenous labor force, have ambiguous effects on hours, and decrease less labor supply in our model. Due to boosting the labor force, unemployment compensation increases employment in our model and decreases in the model with an exogenous labor force, but with opposite effects on hours, labor supply is ambiguous in both models. To understand the net effect on labor supply, we feed in the data of increases in labor taxes and unemployment compensation in the EU relative to the US. We find that the model with an exogenous labor force explain excessively of decreases in employment and labor supply, with increases in hours against the data. In contrast, our model explains reasonable decreases in labor supply, with sensible decreases in employment and in hours. Thus, with an endogenous labor force, our model explains relative declines in labor supply better than the model with an exogenous labor force.

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## 1. Introduction

Average labor supply in the EU declined about one fourth relative to those in the US from the early 1970s to the early 2000s. A growing body of literature has sought to understand the relative importance of the various policies and institutional factors that have been proposed as competing explanations. In particular, two important labor market policies are blamed for causing declining labor supply in the EU relative to the US over the past 30 years. One of these is higher labor taxes that were advocated by Prescott (2002, 2004) and his followers (e.g., Ohanian et al., 2008; Jacobs, 2009; Rogerson and Wallenius, 2009) and the other is generous unemployment benefits that were stressed by Alesina et al. (2006) and Ljungqvist and

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<sup>\*</sup> Corresponding author. Tel.: +886 (2)27822791x309; fax: +886 (2)2785 3946.

E-mail addresses: [bchen@econ.sinica.edu.tw](mailto:bchen@econ.sinica.edu.tw) (B.-L. Chen), [cflai@econ.sinica.edu.tw](mailto:cflai@econ.sinica.edu.tw) (C.-F. Lai).

Sargent (2007a, 2008). The former studies involve only an intensive margin (working hours per worker), whereas the latter papers include only an employment margin. The only exception is Fang and Rogerson (2009) who took both margins into account.<sup>1</sup> Thus, these existing models considered either the intensive margin, the employment margin, or both margins of labor supply.

A notable feature in the data is that differences in average labor supply in the EU relative to the US are due to differences along three margins: the intensive margin, the employment margin and the participation margin (the labor force). According to OECD (2010a, 2010b), the US added more to the labor force than the EU over the past 30 years. See Table 1. While there are models that incorporate an endogenous labor force, no paper incorporates all three margins when explaining declining labor supply in the EU relative to the US.<sup>2</sup> In this paper we attempt to fill the gap by studying a model with all these three margins. Our paper compares the long-run effects on labor supply of increases in labor taxes and unemployment compensation in models with and without participation margins. These two policies may not fully explain the difference in labor supply between the EU and the US in the past 3 decades, because there are differences in other labor market policies and institutions.<sup>3</sup> Yet, by considering the participation, our model serves as a first step in understanding the effects of the two major labor market policies on labor supply.

Specifically, our model is the large household model of Fang and Rogerson (2009) extended to consider the participation margin. The large household pools all resources for its members and decides between consumption and savings. Employment is a predetermined state and the employed members choose between working and leisure time. The large firm creates and maintains multiple vacancies and produces goods. Job vacancies and job seekers are brought together by the matching technology and, upon a successful match, bargain over wage and working hours. Unlike Fang and Rogerson (2009), here the nonemployed are free to choose between searching for jobs and engaging in nonmarket activities. A novel feature of our work is that the participation margin is modeled as a control variable, not a state variable, and thus can be introduced into the framework within a representative large household. Our model renders as a special case the model studied by Fang and Rogerson (2009) wherein the labor-force participation is exogenous.

In analyzing the long-run effects regarding the policies of increases in labor tax rates and unemployment compensation on labor supply, main results are as follows. First, with increases in labor taxes, due to discouraging labor-force participation, the employment in our model is decreased less than that in the model with an exogenous labor force and, with ambiguous effects on hours worked per worker in both models, labor supply is decreased by less in our model. Next, with increases in unemployment compensation, due to inducing the labor force, employment increases in our model but decreases in the model with an exogenous labor force and, with effects on hours worked per worker opposite to those on employment, the effects on labor supply are ambiguous in both models, depending on whether the effect on employment or that on hours worked per worker dominates.

To quantify the net effect on labor supply, we calibrate our model to the US economy. By feeding in the data of increases in the labor tax and unemployment compensation in the EU relative to the US from the early 1970s to the early 2000s, we find that the model with an exogenous labor force explains too much of the decreases in employment and labor supply between the EU and the US. In particular, this model predicts an increase in hours worked per worker, but the data indicates a decrease. By contrast, with an endogenous labor force, our model explains a more reasonable decrease in labor supply, with a sensible decrease in employment and a modest decrease rather than an increase in hours worked per worker in the EU relative to the US. Thus, with the participation margin, our model explains the difference in labor supply better than the model with an exogenous labor force.

We must point out that Tripier (2004) and Shimer (2011) have considered non-participation as a control wherein the nonemployed decide to be unemployed or inactive.<sup>4</sup> Tripier (2004) used his model to quantitatively account for the allocation of time among employment, unemployment and non-participation in the US. Shimer (2011) applied his model to study counter-cyclical unemployment rates and persistent fluctuations in the vacancy-unemployment ratio in the US. Unlike these two papers, our paper explores the effects of increases in labor taxes and unemployment compensation on labor supply as a result from changes in hours per worker, employment and the labor force. Kim (2003) is also close to our paper in that he analyzed the effect of unemployment benefits in a search model with an endogenous labor force. However, non-participation is a state rather than a control in Kim (2003), so it is difficult to offer analytical analysis.

This paper is outlined as follow. In Section 2, we document differences in the aggregate labor supply between the US and EU along intensive, employment and participation margins. In Section 3, we set up a matching model with the three margins and then characterize the steady state equilibrium in models with and without an endogenous participation margin. In

<sup>1</sup> Fang and Rogerson (2009) is the Andolfatto (1996) model that abstracted from capital but allowed for an employee to choose between working time and leisure time. Their paper analyzed the implications of increases in the labor tax and increases in the cost of job creation on labor supply of the intensive and extensive margin in a steady state.

<sup>2</sup> There are existing papers that studied different topics with an endogenous labor force. Early theoretic analyses of labor force participation include Burdett et al. (1984) and Andolfatto and Gomme (1996). Pissarides (2000, Ch. 7) developed a general equilibrium matching model with labor force participation wherein there were no flows in and out of the labor market. Garibaldi and Wasmer (2005), Pries and Rogerson (2009) and Krusell et al. (2011) extended this model to generate flows into and out of the labor market. These models did not analyze changes in an average labor supply. Moreover, in these papers the participation margin is a state with exogenous random arrival rates such that the participation decision is a discrete, binary choice.

<sup>3</sup> Other policies and institutions that were argued to cause declining labor supply in the EU include working-time regulation and employment protection (Causa, 2008), home production (Ngai and Pissarides, 2008; Olovsson, 2009) and preferences (Blanchard, 2004; Azariadis et al., 2013).

<sup>4</sup> Tripier (2004) and Shimer (2011) are large household models a la Merz (1995) with standard preferences and technologies.

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