



# Aggregate implications of indivisible labor, incomplete markets, and labor market frictions<sup>☆</sup>

Per Krusell<sup>a</sup>, Toshihiko Mukoyama<sup>b</sup>, Richard Rogerson<sup>c,\*</sup>, Ayşegül Şahin<sup>d</sup>

<sup>a</sup> Princeton University, IIES, CAERP, CEPR, and NBER, USA

<sup>b</sup> University of Virginia and CIREQ, USA

<sup>c</sup> Department of Economics, Arizona State University and NBER, Tempe, AZ 85287, USA

<sup>d</sup> Federal Reserve Bank of New York, USA

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## ABSTRACT

We study the impact of tax and transfer programs on steady-state allocations in a model with search frictions, an operative labor supply margin, and incomplete markets. In a benchmark model that has indivisible labor and incomplete markets but no trading frictions we show that the aggregate effects of taxes are identical to those in the economy with employment lotteries, though individual employment and asset dynamics can be different. The effect of frictions on the response of aggregate hours to a permanent tax change is highly nonlinear. There is considerable scope for substitution between “voluntary” and “frictional” nonemployment in some situations.

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## 1. Introduction

Although labor market outcomes have always figured prominently in macroeconomic analyses, the way in which macroeconomists model the labor market has changed dramatically over the last 40 years. In particular, two underlying premises that bear on how to model the labor market have become commonplace during this period: the first is that labor supply matters for aggregate labor market outcomes, and the second is that trading frictions matter for aggregate labor market outcomes. Interestingly, both of these views can be traced to contributions that appeared in the Phelps (1970) volume, and each represented a radical departure from the canonical macroeconomic model of that time period. From the household perspective, the canonical model prevailing at the time assumed that desired hours of work were independent of any features of the economic environment, including such factors as wages, taxes, and transfer programs, and from the firm perspective this model assumed that employment could be costlessly and immediately increased in line with any increase in the demand for labor.

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\* Corresponding author. Tel.: +1 480 727 6671; fax: +1 480 965 0748.

E-mail address: [Richard.Rogerson@asu.edu](mailto:Richard.Rogerson@asu.edu) (R. Rogerson).

Although these two premises are not in any sense in conflict, almost all work on aggregate labor market outcomes adopts one or the other but not both. This is reflected in the fact that the two standard frameworks for addressing issues related to the aggregate labor market are either the one-sector growth model (extended to include an endogenous labor supply decision as in Kydland and Prescott, 1982), or a version of the Diamond–Mortensen–Pissarides matching model. The former abstracts from any trading frictions in the labor market, while the latter abstracts from any labor supply considerations. One interpretation of this state of affairs is that each feature is important for its own particular subset of issues; in fact, however, both frameworks are routinely used to address the same set of issues, ranging from the nature of business cycle fluctuations to the effect of permanent policy changes. Moreover, in some cases the two models deliver results that are sharply different.

In view of this situation, we believe that it is important to develop a better understanding of the relative importance of these two features for specific issues of interest, and to assess whether there are important interactions among them. The goal of this paper is to take a first step in this agenda. Specifically, the contribution of the paper is twofold. First, we develop a general equilibrium model that incorporates both labor market frictions and a standard labor supply problem. Second, we use our model to address one important issue in aggregate labor market analysis: the effect of tax and transfer programs on steady-state hours of work. Following the work of Prescott (2004), this issue has attracted considerable attention and serves as a useful starting point for thinking about the relative importance of labor supply considerations and frictions.<sup>1</sup>

The model that we develop possesses three key features: indivisible labor, frictions, and incomplete markets. If one wants to capture trading frictions in the labor market, then indivisible labor is a natural assumption. While one can certainly formulate models of indivisible labor and trading frictions with complete markets, we believe that a market structure that does not include either markets for employment lotteries or insurance markets for the idiosyncratic income shocks that frictions generate is of particular interest.

Our analysis provides several interesting results. First, we provide analytic solutions to a benchmark model that includes indivisible labor and incomplete markets in the absence of trading frictions. We show that steady-state equilibrium allocations are identical to those that obtain in the economy when one permits trade of employment lotteries. Our result extends the similar finding of Prescott et al. (2007) that considered continuous time, finite horizons, and no discounting.<sup>2</sup> We also provide a complete characterization of the individual decision rules that obtain in this equilibrium. Two interesting properties emerge. One is that wealth effects are nonlinear in wealth. For either low or high wealth, increases in wealth lead to equal increases in consumption, but for intermediate levels of wealth the effect on consumption is zero. In contrast, for low and high levels of wealth the effect of wealth on labor supply is zero, but for intermediate levels the effect is positive, but only in a lifetime sense. This last statement follows from another interesting property: current labor supply is indeterminate for intermediate levels of wealth. Specifically, equilibrium imposes structure on the amount of labor supplied over one's lifetime but imposes very little structure on the timing of labor supply. This indeterminacy has important implications for how individuals respond to the presence of frictions.

Second, we find that the extent to which labor market frictions affect the response of aggregate steady-state hours to permanent changes in tax and transfer programs is also highly nonlinear. Specifically, in some regions of the parameter space the presence of frictions has effectively no effect on the response, while in other regions of the parameter space the presence of frictions leads to a dramatic reduction in the response of hours of work. But importantly, this effect is not linear. For example, in the case of tax reductions, the effect of frictions may only manifest itself for reductions beyond some threshold. Moreover, the magnitude of this threshold depends very much on the initial equilibrium: starting from some equilibria, frictions manifest themselves even for small changes. An important message is that one cannot generally conclude that frictions do or do not matter for a specific issue. Whether they matter depends very much on what region of the parameter space one is in and on the nature of the policy change being considered.

Third, we find that there is considerable scope for substitution between “voluntary” and “frictional” nonemployment in some regions. Specifically, an increase in frictions need not have any effect on steady-state equilibrium employment. Moreover, this can be true even though the length of nonemployment spells is completely determined by the extent of frictions. That is, individual level data on employment spells is not necessarily informative about the response of aggregates to changes in policy.

An outline of the paper follows. In the next section we provide some background information that helps to describe the context of the more general research issue concerning the interaction of labor supply and frictions. This section also summarizes some related literature. Section 3 describes and analyzes the benchmark frictionless model that features indivisible labor and incomplete markets. Section 4 introduces frictions into the model, and Section 5 presents quantitative results for the effect of permanent tax changes and how the effects depend upon frictions. Section 6 concludes and discusses directions for future research.

## 2. Motivation

In this section we report the results of a simple policy exercise in the context of two prototype models that are used for thinking about aggregate employment. The first is the indivisible labor model of Rogerson (1988), embedded into the

<sup>1</sup> Ljungqvist and Sargent (2008) also consider taxes in a model with incomplete markets, frictions and indivisible labor. But whereas we focus on how the presence of frictions matters for the effects of taxes, they focus on how the presence of human capital matters.

<sup>2</sup> Also see Mulligan (2001), Ljungqvist and Sargent (2006, 2008) and Nosal and Rupert (2007) for related analysis.

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