Review of Economic Dynamics 12 (2009) 23–36

Contents lists available at ScienceDirect

Review of Economic Dynamics

www.elsevier.com/locate/red

Lifetime aggregate labor supply with endogenous workweek length ☆

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ARTICLE INFO

Article history:
Received 9 November 2007
Revised 25 July 2008
Available online 5 August 2008

JEL classification:
E2
J2

Keywords:
Lifetime aggregate labor supply
Workweek length

ABSTRACT

This paper studies lifetime aggregate labor supply with endogenous workweek length. Such a theory is needed to evaluate various government policies. A key feature of our model is a nonlinear mapping from hours worked to labor services. This gives rise to an endogenous workweek that can differ across occupations. The theory determines what fraction of the lifetime an individual works, not when. We find that constraints on workweek length have different consequences for total hours than for total labor services. Also, we find that policies designed to increase the length of the working life may not increase aggregate lifetime labor supply.

As an empirical matter, the amount of labor supplied by an individual over his or her lifetime is effectively characterized by two numbers: the fraction of lifetime spent in employment, and the hours worked when employed. In this paper we develop a tractable dynamic general equilibrium model that delivers this characterization as an equilibrium outcome and present some of its implications for policy analysis and data interpretation.

The key feature of our model is a nonlinear mapping from hours of work in a given period to labor services provided in that same period. Specifically, at low hours of work this mapping is convex, due to such factors as the costs associated with getting set up in a job, communicating with coworkers, meeting with supervisors, and so on. At high hours of work this mapping is assumed to be concave, due to fatigue.[1] Similar to Hornstein and Prescott (1993), this nonlinearity implies that workweeks of different lengths are not perfect substitutes in generating labor services, but does so in a much more tractable manner.

We embed this feature of technology into a dynamic model populated by a continuum of identical individuals and study efficient allocations and competitive equilibrium outcomes for this economy. Two key findings emerge. First, efficient allocations are completely characterized by two numbers: the fraction of lifetime spent in employment by each individual, and hours worked while employed. Second, although this economy possesses an important nonconvexity, we show that efficient allocations can be achieved as competitive equilibria with only a standard set of Arrow–Debreu markets: markets for consumption and labor services at each date. In particular, there is no need to allow for trade in lotteries or sunspots in

☆ Prescott thanks the National Science Foundation (Grant 0422539), Rogerson thanks the National Science Foundation (Grant 0417822) and Wallenius thanks the Yrjo Jahnsson Foundation for supporting the research. We also thank our colleagues with whom we discussed this research, as well as an anonymous referee for useful comments. We want to thank Simona Cociuba for providing exceptional research assistance. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

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[1] Rosen (1978) also noted that this formulation was a tractable way to think about intensive and extensive margins of labor supply. See also the discussion in Barzel (1973).

1094-2025/$ – see front matter
doi:10.1016/j.red.2008.07.005

order to implement efficient allocations, as in Prescott and Townsend (1984a, 1984b), Rogerson (1988), or Shell and Wright (1993).

To illustrate the usefulness of the model, we use it to consider the effects of several policies: a tax and transfer policy, a restriction on workweek, and a restriction on fraction of lifetime devoted to work. Several interesting findings emerge. First, the model implies a large aggregate labor supply elasticity in response to tax and transfer programs, and at the same time it predicts a very small (in fact, zero) elasticity for hours of work of continuously employed individuals. In this regard, the model mimics the implications of a model that simply assumes labor is indivisible. A key message is that in our model, the aggregate labor supply elasticity with respect to changes in taxes is a function not only of preference parameters, but also of technology parameters. Specifically, features of the mapping from hours of work to units of labor services are critical in determining the aggregate labor supply elasticity.

A second finding is that any distortion to one component of lifetime labor supply will be at least partially offset by movements in the other component. Increasing working life by changing the nature of social security benefits, for example, will lead to a decrease in the workweek. This has important implications for how policy makers forecast budget implications associated with social security reform. Third, distortions to lifetime labor supply can also lead to changes in hours of work and labor services in opposite directions. For example, we show that a decrease in the workweek can lead to greater aggregate hours of work but lower output.

An additional implication of an exogenous restriction on workweek length in our model is that the equilibrium wage per hour of work necessarily decreases. In practice, many governments that adopt workweek restrictions in an attempt to increase employment (and thereby total hours of work) also simultaneously adopt policies that lead to higher wages per hour of work. When the hourly wage rate is not allowed to fall, it no longer follows that a restriction on hours will necessarily increase aggregate hours of work. This is consistent with the findings of the empirical literature.[2]

Any theory of workweek length should be able to account for the simple observation that workweek length differs significantly across occupations. By emphasizing the role of technology as a determinant of optimal workweek length, our theory provides a natural explanation for such differences. We illustrate this by developing a two-occupation version of our model with endogenous occupational choice. This extension provides an interesting implication about the relationship between labor supply elasticities estimated from a cross-section of workers and the aggregate elasticity associated with a change in taxes. Specifically, in our model the cross-section elasticity of hours with respect to wages produces an estimate of the preference parameter that determines the curvature in the disutility of work function. However, because of the nonconvexity in technology, this preference parameter is irrelevant for the response of aggregate hours to the tax and transfer program we study.

An outline of the paper follows. Section 1 presents some motivating observations from the data. Section 2 introduces the nonconvex technology in a static setting, and Section 3 analyzes equilibrium in the dynamic setting. Section 4 presents the policy analysis, and Section 5 considers the extension to a two-occupation setting. Section 6 concludes.

1. Motivating facts

In this section we present five facts concerning labor supply over the lifetime that serve as motivation for the model that we develop in the next section. The first two facts concern changes in the nature of work over the life cycle for individuals with at least a moderate attachment to the labor force. We consider the cutoff for this to be working more than 800 hours during the year, which is just over 15 hours per week.

Fact 1. In the United States, the fraction of people working at least 800 hours declines significantly with age.

The supporting evidence is shown in Fig. 1, which shows the fraction of individuals working more than 800 hours per year as a function of age, based on the 2004 CPS.[3]

Note that the fraction of individuals working above this threshold level begins to decrease in the late 40s and falls relatively smoothly through to the early 70s, at which point it flattens out somewhat. This value drops by roughly a quarter between the ages of 48 and 60.

The next fact considers what happens to the amount of work performed by those individuals working more than 800 hours per year.

Fact 2. In the United States, hours worked per person for those individuals who work at least 800 hours per year declines little with age.

The supporting evidence is shown in Fig. 2, which plots annual hours of work conditional on working at least 800 hours per year, again using data from the CPS for 2004.

[2] See, for example, Erbas and Sayers (2001).

[3] Annual hours of work for the year 2004, are constructed by multiplying usual hours worked per week (CPS variable UHRSWORK) by actual weeks worked per year (CPS variable WKSWORK1). People under the age of 16 and above the age of 80 are deleted from the sample.