

Labor Income Shocks along the Business Cycle

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Abstract

This paper analyzes the determinants of labor income shocks along the business cycle. My main finding is that sorting between firms and workers is a key component of idiosyncratic risk. Labor income shocks are analyzed through the lenses of a dynamic search-and-matching model, which I estimate using US data. Because of search frictions and mismatches between firms and workers, the *laissez-faire* equilibrium is not necessarily optimal. My results underline that the government can tame business cycle fluctuations by designing a simple unemployment policy improving sorting between firms and workers.

Keywords: Sorting, Labor Income Risk, Business Cycle

JEL Classification: E32, J31

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1 Introduction

This paper has a triple objective. The first one is to deepen our understanding on the sources of labor income shocks. That is, the unpredictable part of labor income changes. It is now well established that fluctuations in earnings at the individual level is an order of magnitude bigger than fluctuations at the macro level ([Parker and Vissing-Jorgensen \(2009\)](#)). The assumption of normality of labor income shocks has been attacked by several recent publications, in particular in [Guvenen et al. \(2014\)](#) and [Guvenen et al. \(2015\)](#). Recessions are periods marked by intense negative labor income shocks, underlined by a spike in left-skewness in the distribution of labor income changes. The aim of this paper is to unpack the black-box of the complex labor income process and to analyze its determinants. Why should we care? What does left-skewness mean for an average worker? In practical terms, it means that some categories of workers are badly hurt by recessions, with persistent consequences. The scarring effects of recessions are now well identified (see [Ouyang \(2009\)](#)). The persistence of labor income shocks can be in part explained by search models with human capital depreciation, which creates a negative feedback loop on aggregate variables, as in [Valentin and Westermarck \(2018\)](#). If negative feedback loops are involved, preventing bad shocks from happening or helping workers to recover from them is probably a welfare enhancing policy.

This paper shades light on a previously ignored component of idiosyncratic income risk: sorting between workers and firms. By sorting, I mean the extent to which the market allocates the right workers to the right jobs, where "right" is captured by complementarities in the production function. Why is sorting an important mechanism for the labor income process? When considering a labor market with search frictions and random search, the pairing between firms and workers is not necessarily optimal. An inefficient match in turn translates into lower wages as long as the match persists. Being fired not only has a direct consequence on someone's labor income, it also has dynamic consequences. To go back to her/his previous income level, a newly unemployed worker has to climb up the *intra-firm wage ladder* and the *inter-firm ladder*.

That is, a worker has to spend some time searching on the labor market before finding a firm that is the right match, and conversely. Numerical simulations show that the inter-firm ladder is far from being negligible. Long-tails in the distribution of labor income shocks crucially hinges on the economy featuring heterogeneous firms, hence an inter-firm ladder. To the best of my knowledge, empirical work on this component of risk is rather scarce. One notable exception is [Huckfeldt et al. \(2016\)](#), who shows that earnings costs of job loss are concentrated among workers who find reemployment in lower-paying occupations. Using CPS and PSID data, the author estimates that the initial earnings losses of workers losing their job and subsequently switching occupations are *four times larger* than of workers finding a job in their previous occupation. Persistence of the initial wage loss is only observed for occupation switchers. These empirical facts can be consistently explained by the existence of an inter-firm ladder combined with some degree of random search on the labor market.

Related literature on sorting includes the seminal contribution of [Abowd et al. \(1999\)](#), decomposing real total annual compensation per worker into an employee, an employer and a residual effect. [Bonhomme et al. \(2019\)](#) introduce a framework that can accommodate interactions between worker and firm attributes. In a variance decomposition exercise, [Song et al. \(2018\)](#) show that two-thirds of the rise in the dispersion of log earnings between 1978 and 2013 can be attributed to a rise in the dispersion of average earnings *between* firms. In the search-and-matching literature, [Lise and Robin \(2017\)](#) study how sorting patterns are altered along the business cycle. To study labor income shocks across the cycle, my strategy is to use and extend their model. In terms of modeling exercise, my contribution is twofold. Firstly, I extend the model of [Lise and Robin \(2017\)](#) by solving for the wages, which were left implicit in their contribution. Secondly, I re-estimate the model using the simulated method of moments (SMM) and wage moments. In particular, I focus on starting wage moments, which are particularly well-defined within the model and have strong identification power.

A second objective of this paper explores new techniques to solve and estimate dynamic search-and-matching models with heterogeneity. Solving labor models with

both search frictions and heterogeneous agents is a notoriously difficult task. If workers do not have access to full information on the state of the labor market, which includes the number of vacancies posted by each firm and their associated wage, a commonly held view is that such frameworks cannot be solved using standard numerical techniques. To avoid these complications, the literature on dynamic search-and-matching models has focused on *block-recursive* equilibrium, following the seminal contribution of [Menzio and Shi \(2010\)](#). In short, a block-recursive model is one in which value functions and market tightness are independent from the distribution of employment across worker types. Such knife-edge conditions are met when search is *directed*. That is, (i) when firms make public the wage associated to each vacancy they post (ii) workers have full information over wages and the types of vacancy posted. Armed with full knowledge of the labor market conditions, workers direct their search efforts towards a specific sub-market.¹ The concept of block-recursivity led to many papers improving our understanding of frictional markets, in particular the labor and housing markets. While particularly clever and numerically cheap, block-recursive models have the particularity that they are constrained efficient as a by-product of the modeling tricks involved (see [Schaal \(2017\)](#)). Thus, in a block recursive model, the *laissez-faire* equilibrium is necessarily optimal. When the goal of a paper is to explain a mechanism through the eyes of a model, constrained efficiency is mostly harmless. However, if the objective is to understand how a government may or may not improve the market outcome, it seems more appropriate to come up with a new concept of equilibrium that does not rule out inefficiencies in the first place. This the route I explore in this paper. The strategy I use to solve a non block-recursive search model can be seen as a variant of the [Krusell and Smith \(1998\)](#) algorithm. Agents are endowed with a simple forecasting rule that needs to be estimated via Monte-Carlo. The particularity in my setting is that the time series needed to estimate the forecasting rule are independent from value function to be calculated. This property, specific to the model under scrutiny, leads me to design an algorithm that is both rapid and robust to solve

¹A free entry condition for firms is also needed.

the model. Because the model is half way between a fully non-block recursive model and a block recursive one, I propose to name it as *semi-block recursive*.

To a lesser extent, my work is related to the burgeoning literature on how to solve and estimate models with both aggregate uncertainty and heterogeneity. Following the seminal contribution of [Krusell and Smith \(1998\)](#), several techniques have been developed (see [Reiter \(2009\)](#), [Algan et al. \(2014\)](#) and [Winberry \(2018\)](#)). While some of these techniques are global and the other ones use linearization around the non-stochastic steady-state, the common denominator of the above mentioned methods is that they rely on the recursive representation of a multi-stage decision process. An interesting line of research has recently used the sequence representation of the dynamic choice problem (see [Le Grand et al. \(2017\)](#), [Boppart et al. \(2018\)](#) and [Auclert et al. \(2019\)](#)). In this paper, I stick to the more commonly used recursive form, but I note that the sequence form is particularly well-suited in my setting.

A third objective of this paper is to analyze the potential gains from designing an optimal unemployment insurance. Having defined a concept of equilibrium in which the *laissez-faire* equilibrium is not optimal by design, I explore simple unemployment policies that have the potential of being welfare-improving. Related work includes [Lise et al. \(2016\)](#). The authors show how an optimal replacement rate might improve the market equilibrium and transfer utility across groups of workers. They find that the optimal unemployment scheme can deliver a welfare improvement of 1.4%, concentrated on low-skill workers. I contribute to this literature by analyzing a similar unemployment insurance scheme in a dynamic setting. I find that the optimal unemployment insurance scheme generates a 0.25% increase in welfare at the steady-state. The gains are realized by improving the sorting between firms and workers. While the gains are rather modest at the steady-state, the policy is successful in stabilizing labor income shocks over the business cycle by approximately 2%. These gains are achieved by transferring income from high-skilled to low-skilled workers and by a stabilization of the inter-firm channel caused by an improved sorting between firms and workers.

References

- John M Abowd, Francis Kramarz, and David N Margolis. High wage workers and high wage firms. *Econometrica*, 67(2):251–333, 1999.
- Yann Algan, Olivier Allais, Wouter J Den Haan, and Pontus Rendahl. Solving and simulating models with heterogeneous agents and aggregate uncertainty. In *Handbook of Computational Economics*, volume 3, pages 277–324. Elsevier, 2014.
- Adrien Auclert, Bence Bardóczy, Matthew Rognlie, and Ludwig Straub. Using the sequence-space jacobian to solve and estimate heterogeneous-agent models. Technical report, National Bureau of Economic Research, 2019.
- Stéphane Bonhomme, Thibaut Lamadon, and Elena Manresa. A distributional framework for matched employer employee data. *Econometrica*, 87(3):699–739, 2019.
- Timo Boppart, Per Krusell, and Kurt Mitman. Exploiting mit shocks in heterogeneous-agent economies: the impulse response as a numerical derivative. *Journal of Economic Dynamics and Control*, 89:68–92, 2018.
- Fatih Guvenen, Serdar Ozkan, and Jae Song. The nature of countercyclical income risk. *Journal of Political Economy*, 122(3):621–660, 2014.
- Fatih Guvenen, Fatih Karahan, Serdar Ozkan, and Jae Song. What do data on millions of us workers reveal about life-cycle earnings risk? Technical report, National Bureau of Economic Research, 2015.
- Christopher Huckfeldt et al. Understanding the scarring effect of recessions. *Report, Economics Department*, 2016.
- Per Krusell and Anthony A Smith, Jr. Income and wealth heterogeneity in the macroeconomy. *Journal of political Economy*, 106(5):867–896, 1998.
- François Le Grand, Xavier Ragot, et al. Optimal fiscal policy with heterogeneous agents and aggregate shocks. *Document de travail*, 2017.

- Jeremy Lise and Jean-Marc Robin. The macrodynamics of sorting between workers and firms. *American Economic Review*, 107(4):1104–35, 2017.
- Jeremy Lise, Costas Meghir, and Jean-Marc Robin. Matching, sorting and wages. *Review of Economic Dynamics*, 19:63–87, 2016.
- Guido Menzio and Shouyong Shi. Block recursive equilibria for stochastic models of search on the job. *Journal of Economic Theory*, 145(4):1453–1494, 2010.
- Min Ouyang. The scarring effect of recessions. *Journal of Monetary Economics*, 56(2):184–199, 2009.
- Jonathan A Parker and Annette Vissing-Jorgensen. Who bears aggregate fluctuations and how? *American Economic Review*, 99(2):399–405, 2009.
- Michael Reiter. Solving heterogeneous-agent models by projection and perturbation. *Journal of Economic Dynamics and Control*, 33(3):649–665, 2009.
- Edouard Schaal. Uncertainty and unemployment. *Econometrica*, 85(6):1675–1721, 2017.
- Jae Song, David J Price, Fatih Guvenen, Nicholas Bloom, and Till Von Wachter. Firming up inequality. *The Quarterly journal of economics*, 134(1):1–50, 2018.
- Karl Walentin and Andreas Westermarck. Learning on the job and the cost of business cycles. 2018.
- Thomas Winberry. A method for solving and estimating heterogeneous agent macro models. *Quantitative Economics*, 9(3):1123–1151, 2018.