Replication of "The Macrodynamics of Sorting between Workers and Firms" by Jeremy Lise and Jean-Marc Robin

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Abstract

This paper replicates key aspects of Lise and Robin (2017). The main focus is placed on the variation of the cross-sectional distribution of unemployed worker types over the business cycle, since the original paper does not report this. It is shown that the expected unemployed worker type varies between 0.161 (trough) and 0.156 (peak), making this measure counter-cyclical.

1 Model

The economy consists of workers with ability $x \sim Beta(\beta_1, \beta_2)$ and firms with productivity $y \sim U(y)$, both with a measure of one. The beginning of period mass of employed and unemployed workers, $h_t(x, y)$ and $u_t(x)$, are such that $u_t(x) + \int h_t(x, y)\, dy = l(x)$. An aggregate shock, z, which follows a Markov chain with transition probability $Q(z, z')$, hits the economy and might result in the termination of a job. The post-shock measure are $h_{t+}(x, y)$ and $u_{t+}(x)$.

It is assumed that workers costlessly search with different intensities: employed workers search with s and unemployed with 1. The aggregate effort is $L_t = \int 1 \cdot u_{t+}(x)\, dx + \int\int s \cdot h_{t+}(x, y)\, dx\, dy$. Firms post $v_t(y)$ job opportunities and pay a cost $c(v)$. Aggregate opportunities are $V_t = \int v_t(y)\, dy$.

Meetings are assigned randomly with meeting technology $M_t = M(L_t, V_t) = \min\left(\alpha L_t^{\omega} V_t^{1-\omega}, L_t, V_t\right)$. The meeting probabilities for an unemployed and an employed worker are $\lambda_t = \frac{M_t}{L_t}$ and $s\lambda_t$. The meeting probability per posted opportunity is $q_t = \frac{M_t}{V_t}$.

The joint value of a match, $P_t(x, y)$, is the value of a match and includes continuation values of the worker and the firm. The value of being unemployed is $B_t(x)$. A fraction of matches is dissolved $\mathbb{1}\left(P_{t+1}(x, y) < B_{t+1}(x)\right) + \delta \cdot \mathbb{1}\left(P_{t+1}(x, y) \geq B_{t+1}(x)\right)$, where δ is the exogenous separation rate.

The unemployed worker engages in home production $b(x, z_t) = 0.7 \cdot p(x, y{*}(x, 1), 1)$, where $y{*} = argmax_y S(x, y, 1)$, and values being unemployed:

$$B(x) = b(x) + \frac{1}{1+r} B(x)$$

Let $S_t(x, y) = P_t(x, y) - B_t(x)$ be the match surplus, then proposition 1 defines the equilibrium to be such that:

$$S(x, y, z) = s(x, y, z) + \frac{1-\delta}{1+r} \int S(x, y, z')^{+} \pi(z, z')\, dz' \tag{1}$$

where $s(x, y, z) = p(x, y, z) - b(x, z)$ and $x^{+} = \max\Big(x, 0\Big)$.

2 Results

The equilibrium is fully described by a solution to equation 1. With this a deterministic steady state distribution of h can be calculated. This distribution is then used as the starting point for a 700 year long simulation from which fully stochastic stationary distributions are approximated.

The parameter estimates from the paper are used throughout this section.

2.1 Deterministic Steady State

The surplus and production function is shown in figure 1. The production function shows the non-monotonicity of output with respect to firm type. For workers with type below 0.6 the efficient firm is in the interior.

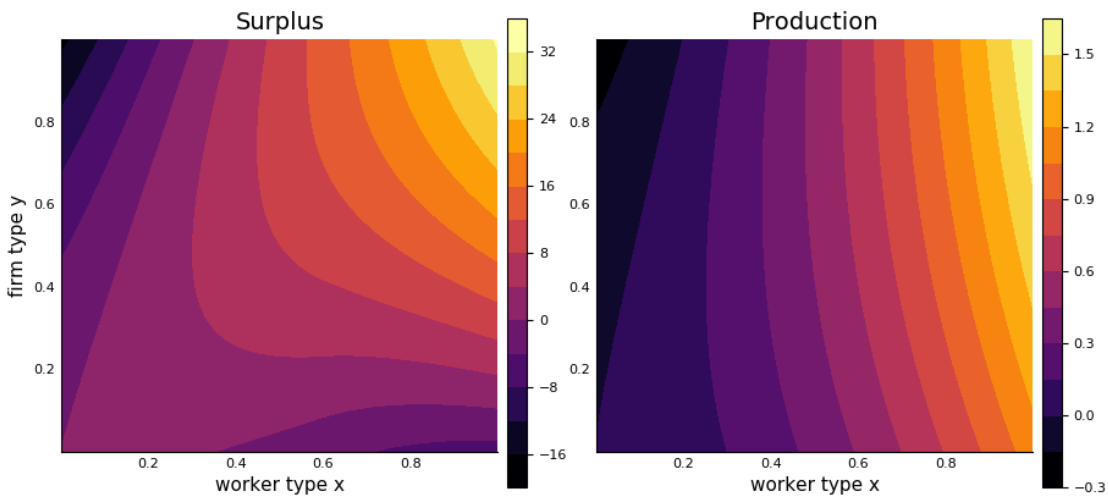

Figure 1:

Figure 2 shows the stationary distribution of aggregate productivity and the unconditional probability of a match to survive endogenous termination.
The upper left triangle are impossible matches. A firm would not employ a worker below a certain type, vice versa a worker would not work at a firm with too high type, because his outside option it too good. This is a bit unintuitive and is discussed later.

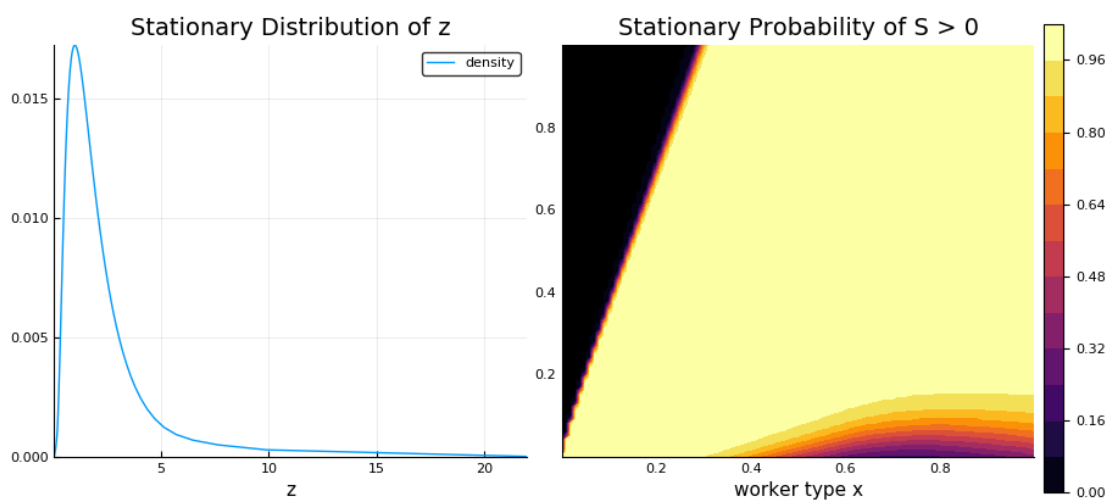

Figure 2: Stationary distribution of z and stationary endogenous survival probability of a match

Figure 3 shows the deterministic steady state distribution of employed workers. There is a lot of mass at the cutoff, because workers switch employer whenever they get an offer from a higher type firm and hence move up the ladder. The second ridge is along the maximal surplus per worker type.

The initial wage that is payed to a new worker is positive but low. Wage increases, and hence increases in the value of employment, come from outside offers.

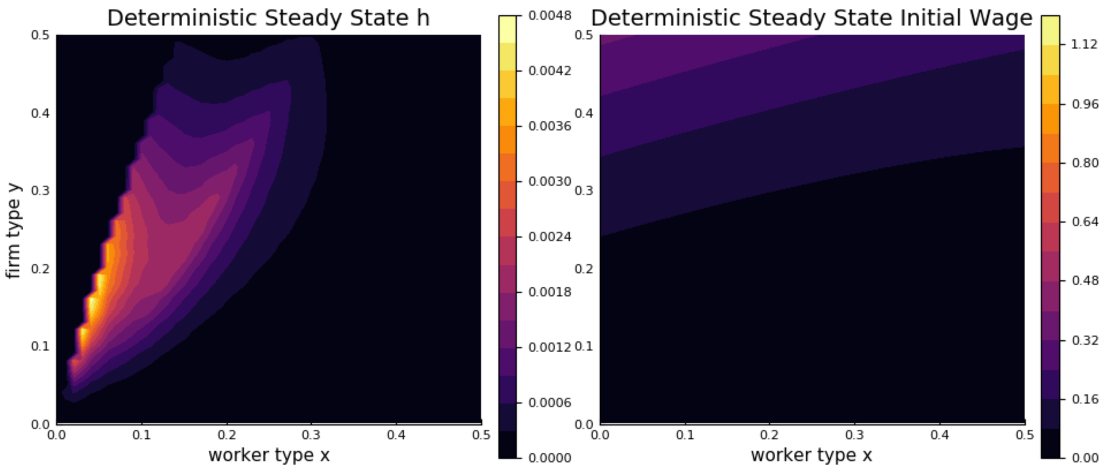

Figure 3: Deterministic steady state of h and corresponding wage

2.2 Simulation

Figure 4 shows the random draw of productivity. The grid for z might be too dense and numerical cancellation could cause the missing mass on the right tail.

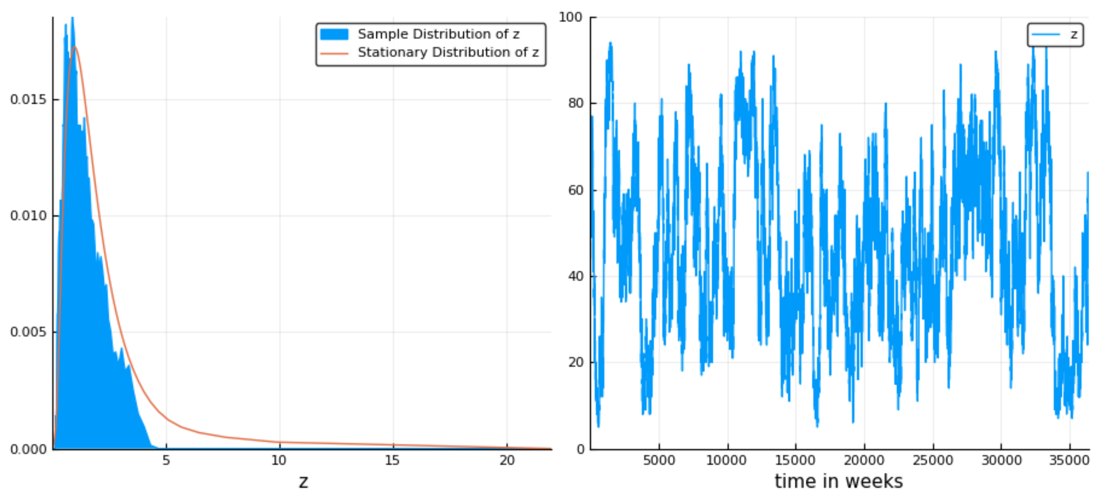

Figure 4: Random sample of productivity

The fully stochastic simulation in figure 5 yields a similar picture to figure 3. But in a recession (left panel) the main ridge is more pronounced than in an expansion (right panel).
In figure 6 it is shown that the employed type distribution does not vary much over the business cycle. The unemployment rate is counter-cyclical.
Figure 7 shows that there is also very little variation of the type distribution conditional on unemployment. The first moment varies counter-cyclically between 0.161 and 0.156. In a recession this implies a minor

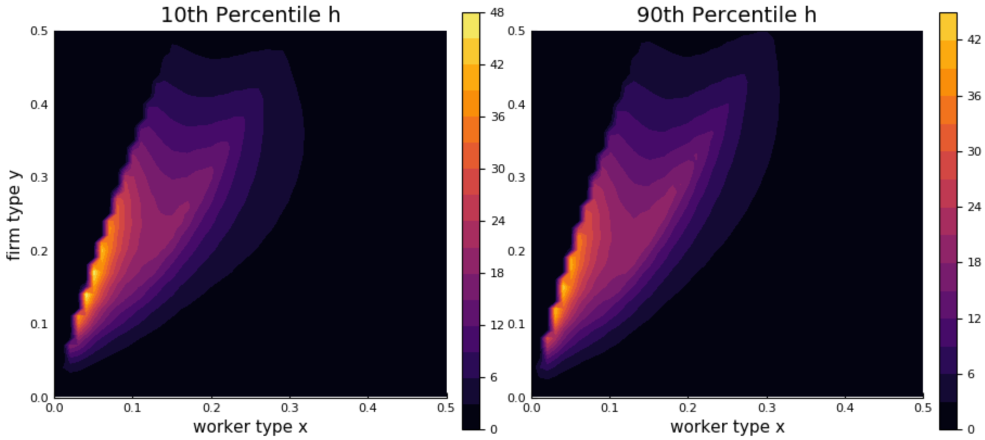

Figure 5: Distribution of employed workers in a recession/expansion

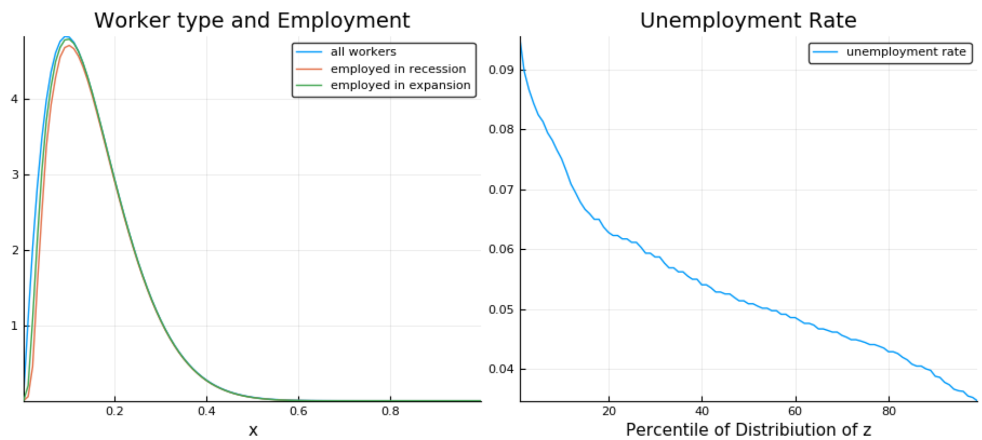

Figure 6: Employed workers in a recession/expansion and unemployment rate

increase of expected surplus from a posted vacancy, but, as the original paper points out, this effect is overwhelmed by decreased aggregate productivity, making posted vacancies pro-cyclical.

3 Discussion

3.1 Constant value of unemployment

The modeling choice of making the home production, b, not to vary with z together with zero worker bargaining power over an initial job, this yields the following consequence: The value of being unemployed, B, also does not vary with z, while in reality a worker should be better off being unemployed if the job finding rate is high. This choice leads to an overstatement of endogenous terminations.
On the other hand, this could be a short cut to induce downward wage rigidity. If B would decrease in a recession, the wage would fall.

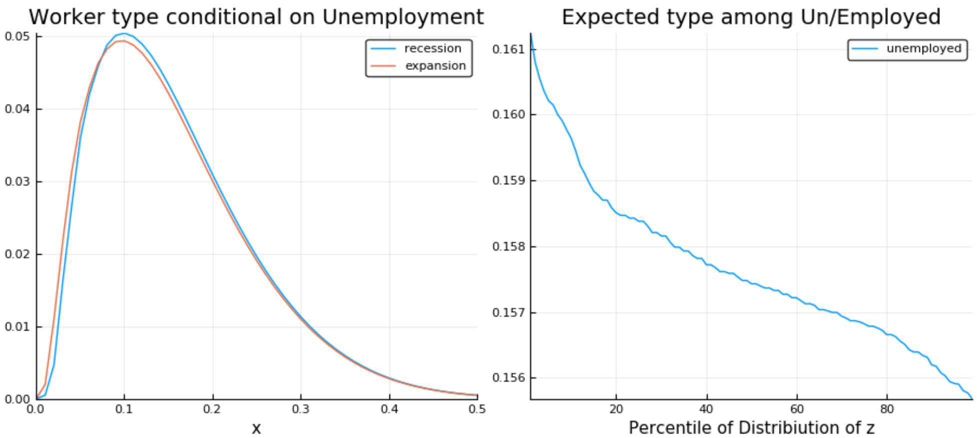

Figure 7: Unemployed workers in a recession/expansion and expected type over business cycle

3.2 Non-monotonicity of production function

A worker of type 0.2 is most productive at a firm with type about 0.3 and is not employed by a firm of above 0.7 to mutual benefit. This pattern is also reflected in the surplus function.
An interesting thought could be that workers do not like being employed at a firm where they are on the lower end of the worker type distribution, because they would be fired rather likely. The concentration of mass at the cutoff contradicts this. Workers willingly accept offers from higher type firms, because he receive higher wages, and firms engage in any positive surplus match, because their outside value is zero.
This might be because in reality firms often wait for a better candidate than hire an applicant.

3.3 Regions of surplus function

The authors discuss figure (4) in Lise and Robin (2017), or the right panel in figure 2, by attributing the upper right triangle on the unwillingness of a firm to hire a worker and the lower right region on the unwillingness of a worker to be employed by a low type firm. This interpretation is not well founded.
The bargaining protocol makes a newly employed worker indifferent between his new job and the previous unemployment. The two sides of the match can not easily be disentangled.
Furthermore, the authors suggest that the most movement on the labor market over the business cycle comes from the lower right region. This is untrue since their is almost no mass of workers above a type of 0.4.

3.4 Wage

The model is built with the goal in mind to eliminate worker or firm specific value functions and characterize the equilibrium only in terms of joint value functions. The initial wage a newly employed worker gets is:

$$w_{0,t}(x,y) = b(x) - \frac{1-\delta}{1+r}\mathbb{E}_t\Big[s\lambda_{t+1}\mathbb{1}_{t+1}(x,y)\Big(S_{t+1} + \int \max\big(0, P_{t+1}(x,y') - P_{t+1}(x,y)\big)\frac{v_{t+1}(y')}{V_{t+1}}\,dy'\Big)\Big]$$

where $\mathbb{1}_{t+1}(x,y) = \mathbb{1}\big(P_{t+1}(x,y) \geq B_{t+1}(x)\big)$
The right panel of figure 3 shows that the wage is indeed positive. If one did not follow the author's choice of making the value of unemployment very high as suggested by Hall (2005), unemployed workers might pay to be initially employed, that is to get on the ladder.

3.5 Ideas

- Firm behavior is very linear. When a match yields even a tiny surplus the firm would engage in it. This is because there is no option value of waiting after the firm posted the vacancy.

  $\Longrightarrow$ Make unfilled vacancies longer lived, especially if the duration of a period is a week. Or, first have a number of applicants chosen and then take the maximal type to be the one considered for hiring. Maybe an extreme value distribution could be helpful.

- If firms could not instantly observe a worker's type, the poaching activity would become very interesting. Variations in the cross-sectional distribution of un/employed workers could explain variation in where firms hire from.

References

R. E. Hall. Employment fluctuations with equilibrium wage stickiness. *American Economic Review*, 95(1): 50–65, March 2005. doi: 10.1257/0002828053828482. URL `http://www.aeaweb.org/articles?id=10.1257/0002828053828482`.

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