Empirical Implications of Joint Wealth Maximizing Turnover

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PRELIMINARY AND INCOMPLETE

Abstract

This paper revisits the hypothesis that turnover in the labor market is joint wealth maximizing. A straightforward empirical test of this hypothesis is not available. Rather than aiming at providing such a test, this paper ask a more limited question: in models of turnover currently in use, does joint wealth maximization manifest itself through robust empirical implications. I argue that it does. Specifically, I adopt the simple working hypothesis that in these models $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$, where w and τ are current tenure, Q and L are subsequent quits and layoffs, and wL measures the strength of the association between the current wage and subsequent quits. I find that it describes the behavior of currently used models of joint wealth maximizing turnover very well.

Taking this hypothesis to the data, I show for several NLS data sets that $\frac{wL}{wQ} \approx 0$ while $\frac{\tau L}{\tau Q} = 1$, out of line with the empirical implications of the model.

To shed further light on why $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$ is a useful restriction, I provide conditions under which it is satisfied exactly.

Keywords: .

JEL Classification:

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This paper revisits the hypothesis that turnover in the labor market is joint wealth maximizing. Becker, Landes, and Michael (1977), proposing this hypothesis in the context of marriage markets, argued in favor of its applicability to turnover in the labor market. According to this hypothesis, the division of the gains from the employment relationship can be adjusted at little or no cost. The worker and the firm are symmetrically informed, and dissolve the relationship if and only if the joint wealth in the event of separation exceeds the joint wealth of continuation. Inefficient separations are avoided by renegotiation of the employment contract. An alternative view according to which renegotiation of employment contracts is limited and separations are often inefficient has been put forward by Hall and Lazear (1984), among others. Mortensen (1978) called for the development of a discriminating test. Such a test, however, is not yet available. The state of affairs is such that both joint wealth maximizing models as well as models with inefficient separations are in widespread use, with little empirical guidance as to which is more appropriate in a given application.

As I will argue below, there are good reasons why as of yet there is no test of joint wealth maximization (JWM) which requires few auxiliary assumptions. Therefore this paper, rather than aiming at providing such a test, pursues a less ambitious objective: I ask whether, in models currently in use, JWM manifests itself through robust empirical implications.

First, why is there no straightforward test of JWM? The key implication of the hypothesis is the following: two employment relationships that are exactly identical except for their employment contracts should exhibit the same separation behavior. This does suggest a straightforward test: conditional on all variables that matter for turnover (a set which does not include the employment contract), the employment contract should not affect turnover. Of course, implementation of this test is hampered by the fact that some relevant variables are not observed. Nevertheless, if one would find that the employment contract *does not* matter conditional on *observable* characteristics of the employment relationship, this would certainly provide strong evidence in favor of JWM.

In practice however, one finds that the employment contract does matter conditional on observables, see McLaughlin (1991). This is not surprising, for example if rent sharing is prevalent, one may expect that the employment contract is a good proxy for unobservable qualities of the relationship. For practical purposes, this approach is not helpful in discriminating between models.

Thus a straightforward test that works without auxiliary assumptions may be an elusive goal. Therefore, the present paper adopts a less ambitious approach. Specifically, my approach is to consider those models of JWM currently in use in the literature. In essence, these models are sets of auxiliary assumptions. I ask whether, for these models, JWM manifests itself by generating a distinct pattern in the data. The approach is motivated by previous empirical work, which has document the following pattern in several data sets (see for example Antel (1985)): there is a strong negative relationship between the current wage and the event of a subsequent quit, while the relationship between wages and layoffs is much weaker. This pattern has already been interpreted as evidence against JWM. The logic is as follows. If employment relationships with high wages are not dissolved through quits, then it must be that the quasi-rent of these relationships, i.e. the difference between joint wealth and joint outside option, is relatively high. If this is so, and separations are JWM, then this high quasi-rent should also afford protection against shocks that induce layoffs. Thus there should also be a negative relationship between the current wage and the event of a subsequent layoff.

What remains unclear, however, is how strong this negative relationship between wages and layoffs should be. Does JWM imply that it should be as strong as the relationship between wages and quits? It does not, as the relative strength will depend on the distribution of shocks that generate quits and layoffs, respectively. To see this clearly, consider the extreme case in which shocks inducing layoffs take only two values: either zero, or so large as to obliterate any level of quasi-rents. In this case layoffs are unrelated to wages. While this extreme case appears *prima facie* unreasonable, it makes the point that any strength of the association of wages and layoffs between zero and the strength of the association between wages and quits (and beyond) may in principle be consistent with JWM. Moreover, I will show that for this reason currently used models of JWM have no trouble generating the empirical pattern described above.

What is needed then is some discipline on the structure of shocks generating quits and layoffs. I argue that the relationships between current tenure and subsequent quits and layoff, respectively, provide such discipline. For example, in the extreme case above, there is no relationship between wages and layoffs, but there is also none between tenure and layoffs. This leads me to adopt the following simple working hypothesis. Let wQ and τQ denote the strength of the association between the current wage w and current tenure τ, respectively, and subsequent quits Q. Let wL and τL denote the corresponding values for layoffs. The simple working hypothesis is that $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$, that is the relative strength of the associations is similar for both wages and tenure.

The objective of the paper is to examine this simple hypothesis for a superset of models with JWM currently in use. Presently, I consider only a generalization of Cahuc, Postel-Vinay, and Robin (2006). In the model employment relationships are subject to three types of shocks: productivity shocks, changes in the utility the worker derives from amenities associated with the job, and job offers. Following Becker, Landes, and Michael (1977) and McLaughlin (1991), the distinction between quits and layoffs is based on the type of shock inducing separation. The first shock induces layoffs, the latter two shocks induce quits. Wages are set through bargaining and renegotiated by mutual consent.

I start by adopting a brute force approach: I simulate the model for a large number of parameter configurations, and for each parameter configuration check whether $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$. This approach does not require the model to capture any features of the data. Using this approach, I find that the working hypothesis closely describes the behavior of the model if p and z follow random walks. It continues to do so if p and z follow geometric random walks, unless shocks to both are very large and similar to each other in magnitude. My next step will be to refine this brute force approach by retaining only parameter configurations that match some features of the data. Specifically, I plan to do this through inequalities, thereby "partially calibrating" the model. Using this refinement, I hope to show that the working hypothesis closely describes the behavior of the partially calibrated model in the geometric random walk case, permitting in principal that shocks to both p and z are large as well as similar in magnitude. The partial calibration approach may also be useful when extending the analysis to more general shock processes.

My tentative conclusion is that $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$ is a quite robust implication of JWM models currently in use. Thus I turn to the data to obtain evidence on these two ratios. Antel (1985) demonstrates that $\frac{wL}{wQ} \approx 0$ in the National Longitudinal Survey of Young Men (NLSYM). I find that in this data set $\frac{\tau L}{\tau Q} \approx 1$. I confirm these findings for the NLSY79. Finally, I discuss evidence from Bartel and Borjas (1979) according to which $\frac{wL}{wQ} \approx 0$ and $\frac{\tau L}{\tau Q} \approx 1$ also holds for older workers, namely those in the National Longitudinal Survey of Mature Men (NLSMM).

Following the empirical analysis I return to the model, with the goal of shedding additional light on why $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$ is a useful restriction to consider. Specifically, I provide conditions under which this restrictions holds exactly.

1 Model

The model is based on Cahuc, Postel-Vinay, and Robin (2006), which is extended to incorporate both idiosyncratic productivity shocks, similar to Yamaguchi (2007), as well as idiosyncratic shocks to utility of amenities associated with the job and enjoyed by the worker.

Time is continuous. There is a unit mass of identical infinitely lived workers and a continuum of identical infinitely lived firms. Both workers and firms are risk neutral. A single good is sold in competitive markets.

The productivity of an employment relationship is denoted p, flow utility from amenities is denoted z. Employment relationships are subject to three different types of shocks. First, employed workers contact other employers at rate λ_1, drawing job offers associated with a pair $(\tilde{p}, \tilde{z})$ from a distribution F. Second, productivity changes arrive at rate γ_Z. The new productivity level p' is drawn from $G_P(p, p')$. Third, the amenity value z changes with arrival rate γ_Z with the new level z' drawn from $G_Z(z, z')$. The two transition functions G_P and G_Z are assumed to be stochastically monotone.

In the event of separation, the worker receives a payoff U, while the payoff of the firm is assumed to be zero for simplicity, so the joint payoff is also given by U.

Wage contracts specify a fixed wage which can only be renegotiated by mutual consent. Thus renegotiations only occur if one party can credibly threaten to leave the match if the other party refuses to renegotiate. I assume that negotiations following a job offer occur as in Cahuc, Postel-Vinay, and Robin (2006).

Following Becker, Landes, and Michael (1977) and McLaughlin (1991) I introduce a distinction between quits and layoffs based on the type of shock inducing the separation. If a job offer or a change in the amenity value z induce a separation, then I classify it a quit. If a separation is induced by a productivity change, I classify it as a layoff. This completes the description of the model.

Since turnover is JWM, one can split the analysis into two parts: first, the maximization of joint wealth; second, the determination of wages.

Let $V(p, z)$ denote the joint wealth of a match with productivity p and amenity value z. It satisfies

$$\begin{aligned}
&\rho V(p,z) \\
&= p + z \\
&+\gamma_P \int \{\max[V(p',z),U] - V(p,z)\}\, G_P(p,dp') \\
&+\gamma_Z \int \{\max[V(p,z'),U] - V(p,z)\}\, G_Z(z,dz') \\
&+\lambda_1 \int \{\max\left[V(p,z),(1-\beta)V(p,z) + \beta V(\tilde{p},\tilde{z})\right] - V(p,z)\}\, dF(\tilde{p},\tilde{z})
\end{aligned} \tag{1}$$

The flow payoff is $p+z$, the sum of productivity and amenity value. Productivity shocks arrive at rate γ_P. In the event of a productivity change the match either continues with $V(p', z)$, or a separation occurs. The latter is associated with the joint continuation value U. The event of a change in the amenity value is symmetric. The worker receives a job offer at rate λ_1. This only induces a separation if the offer is for a more valuable job with $V(\tilde{p}, \tilde{z}) > V(p, z)$. The negotiation game of Cahuc, Postel-Vinay, and Robin (2006) implies that in this case the worker starts with a wage in the new job which gives him utility $(1-\beta)V(p, z) + \beta V(\tilde{p}, \tilde{z})$, which looks like the outcome of generalized Nash bargaining with the new employer using the value of the old relationship as a threat point. Since the old employer is left with nothing, this is also the joint continuation value.

Next consider wage renegotiation. The current wage can only be renegotiated by mutual consent, otherwise it remains unchanged. While the current wage is not a state variable that matters for the separation decision, it is a state variable that matters for the division of the value $V(p, z)$ between the firm and the worker.

Let $W(w, p, z)$ denote the present discounted utility of the worker in a match with current wage w, productivity p and amenity value z. It satisfies

$$
\begin{aligned}
&\rho W(w, p, z) \\
&= w + z \\
&+\gamma_P \int \left(\max\left\{\min[V(p', z), W(w, p', z)], U\right\} - W(w, p, z)\right) G_P(p, dp') \\
&+\gamma_Z \int \left(\max\left\{\min[V(p, z'), W(w, p, z')], U\right\} - W(w, p, z)\right) G_Z(z, dz') \qquad (2) \\
&+\lambda_1 \int \Big\{\mathcal{I}\left[V(\tilde{p}, \tilde{z}) > V(p, z)\right]\left[(1-\beta)V(p, z) + \beta V(\tilde{p}, \tilde{z})\right] \\
&\qquad +\mathcal{I}\left[V(\tilde{p}, \tilde{z}) \leq V(p, z)\right]\max\left[W(w, p, z), (1-\beta)V(\tilde{p}, \tilde{z}) + \beta V(p, z)\right] \\
&\qquad -W(w, p, z)\Big\} dF(\tilde{p}, \tilde{z})
\end{aligned}
$$

The flow payoff of the worker is the wage $w + z$, the sum of the wage and the amenity value.

Several things can happen in the event of a productivity change. If $W(w, p', z) > V(p', z) \geq U$, then the relationship is viable, but the firm can credibly threaten to walk away unless the wage is cut. In this case the wage is reduced such that the firm is indifferent between separation and continuation, and the worker's continuation utility is

$V(p', z)$. If $V(p', z) \geq U > W(w, p', z)$ the relationship also continues to be viable, but now the worker needs to be given a raise. The raise is such that the worker is indifferent, so his continuation utility is U. If $U > V(p', z)$ a separation occurs, leaving the worker with U. In all other cases the match simply continues with the old wage, and the worker obtains $W(w, p', z)$. The case of a change in the amenity value is analogous.

Next consider the event of a job offer. Here $\mathcal{I}$ is an indicator function. The offer is accepted if $V(\tilde{p}, \tilde{z}) > V(p, z)$. As described in the discussion of equation (1), in this case the worker continues with $(1-\beta)V(p, z)+\beta V(\tilde{p}, \tilde{z})$. If $V(\tilde{p}, \tilde{z}) \leq V(p, z)$ the relationship continues, and the wage may or may not be renegotiated. The negotiation game in Cahuc, Postel-Vinay, and Robin (2006) implies that renegotiation allows the worker to obtain $(1-\beta)V(\tilde{p}, \tilde{z})+\beta V(p, z)$, which is analogous to the case of an accepted job offer but with the roles of incumbent and new firm reversed. Since renegotiation requires mutual consent, it only occurs if it is beneficial to the worker, that is if $(1-\beta)V(\tilde{p}, \tilde{z})+\beta V(p, z) > W(w, p, z)$.

The new level of the wage after a renegotiation or in the event of an accepted job offer is determined as follows. The continuation value of the worker is known from the analysis above, so the new wage is simply set at the level that precisely gives the worker this continuation value. For example, in the event of a downward renegotiation after a productivity change, the new wage w' must solve $W(w', p', z) = V(p', z)$. As a second example, the new wage $\tilde{w}$ if a job offer is rejected but triggers a raise must solve $W(\tilde{w}, p, z) = (1-\beta)V(\tilde{p}, \tilde{z}) + \beta V(p, z)$.

2 Model Simulations

To complete the specification of the model for the purpose of simulation, I have to choose the offer distribution $F(\tilde{p}, \tilde{z})$ and the transition functions $G_P(p, \cdot)$ and $G_Z(z, \cdot)$. I assume independence $F = F_P \times F_Z$ and specify $\log(p) \sim \mathcal{N}\left(0, \sigma^2_{0,P}\right)$ as well as $\log(z) \sim \mathcal{N}\left(0, \sigma^2_{0,Z}\right)$. I assume that G_P and G_Z are either random walks or geometric random walks. In either case I allow for drift, and augment the process with a fixed probability

Table 1: Parameter Space for Simulation

b	$[0, 2]$	σ_P	$[0, 0.2]$
ρ	$[0.002, 0.01]$	$\sigma_{0,P}$	$[0, 0.2]$
λ_0	$[0, 2]$	σ_Z	$[0, 0.2]$
λ_1	$[0, 2]$	$\sigma_{0,Z}$	$[0, 0.2]$
γ_P	$[0, 3]$	φ_P	$[-0.05, 0.05]$
γ_Z	$[0, 3]$	φ_Z	$[-0.05, 0.05]$
δ_P	$[0, 0.02]$	β	$[0, 1]$
δ_Z	$[0, 0.02]$		

of destruction. Specifically, in the geometric random walk case for $p > 0$

$$G_P\left(p, e^{-\sigma_P} p\right) = \left(\frac{1}{2} + \varphi_P\right)(1 - \delta_P),$$
$$G_P\left(p, e^{\sigma_P} p\right) = \left(\frac{1}{2} - \varphi_P\right)(1 - \delta_P),$$
$$G_P(p, \underline{p}) = \delta_P.$$

where $\underline{p}$ is chosen sufficiently low to induce separation.

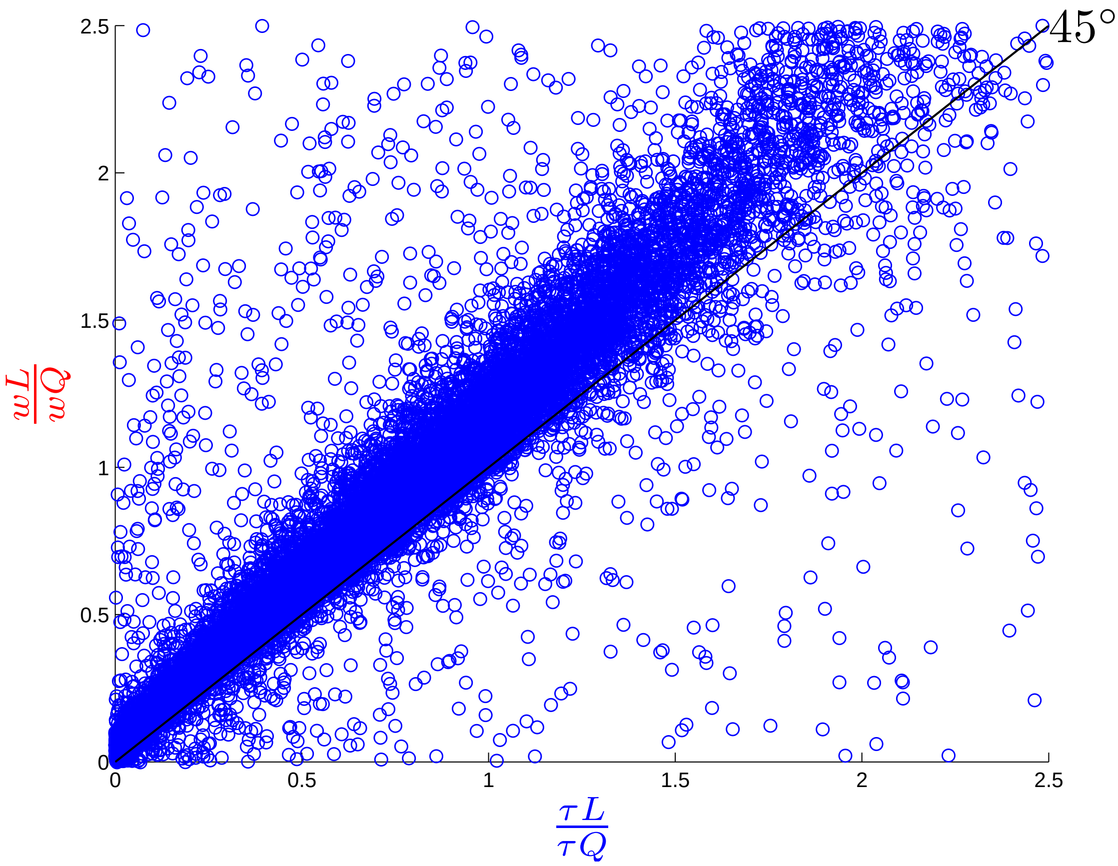
For the simulations I also need to specify the continuation utility of separated workers U, as well as the distribution of wages in new jobs. Rather than specifying them directly, I generate them through search of unemployed workers

$$\rho U = b + \lambda_0 \int \{\max\left[U, (1-\beta)U + \beta V(p, z)\right] - U\}\, dF(p, z) \tag{3}$$

where b is the flow payoff during search, λ_0 is the arrival rate of job offers, and wages in new matches are set through generalized Nash bargaining.

Table 1 shows the range of parameters over which the model is simulated. The ranges are large and meant to cover any values that could be considered reasonable. All rates are interpreted as monthly. To obtain a parameter configuration, I independently draw a value for each parameter from a uniform distribution over the respective range. For

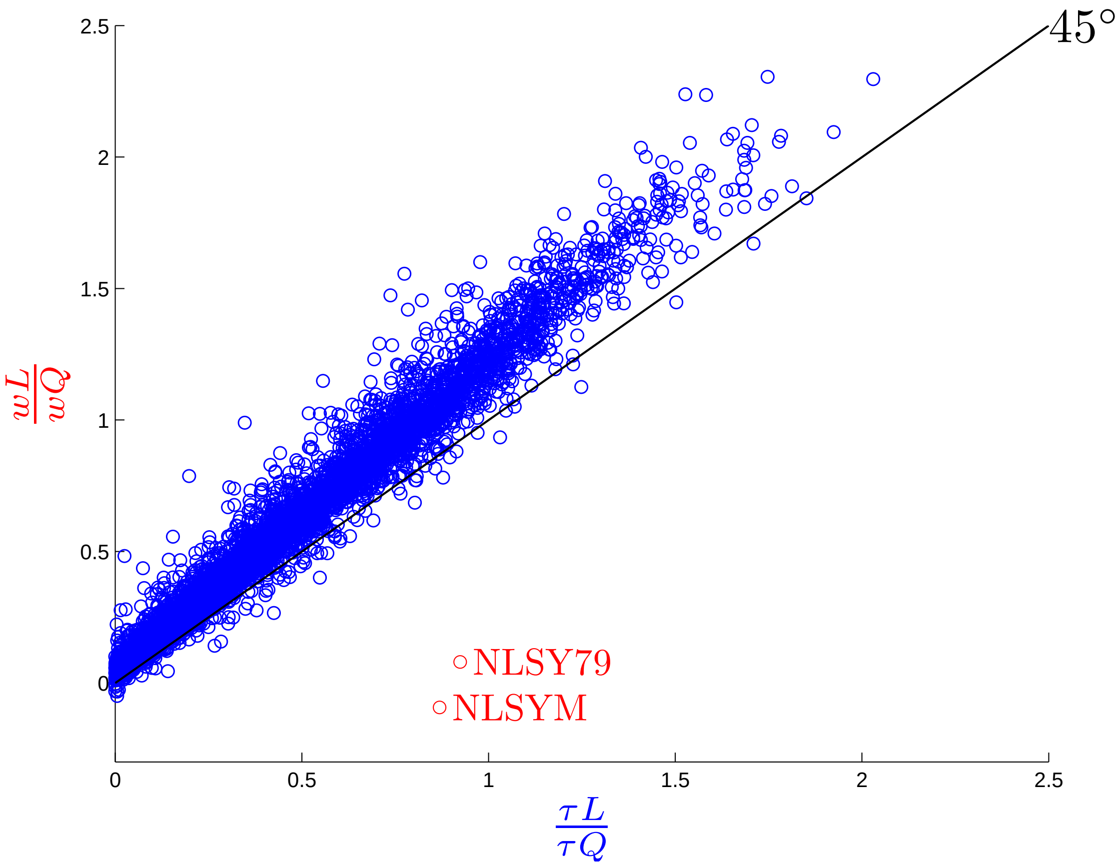
Figure 1: Geometric Random Walk, p only



each parameter configuration I compute one million subsequent annual observations. For each observation I obtain the current wage w_t, current tenure τ_t, and whether a quit Q_{t+1} or layoff L_{t+1} occurs over the subsequent year. Let wL denote the coefficient from the OLS regression of w_t on L_{t+1}, and let wQ, τL and τQ be defined analogously. The two objects of interest for examining the working hypothesis are the ratios $\frac{\tau L}{\tau Q}$ and $\frac{wL}{wQ}$.

Figure 1 shows the results from 50000 parameter configurations in which productivity p follows a geometric random walk and z is degenerate, i.e. the restriction $\sigma_Z = \sigma_{0,Z} = 0$ is imposed. The ratio $\frac{\tau L}{\tau Q}$ is on the horizontal and $\frac{wL}{wQ}$ on the vertical axis. According to the working hypothesis $\frac{\tau L}{\tau Q} \approx \frac{wL}{wQ}$, the results should cluster around the 45° line. This is the case, but there are also some "outliers". Upon further inspection, there are

Figure 2: Geometric Random Walk, p only, Inequality Restriction



two reasons behind these outliers. Either turnover rates are so low that even among one million observations there are only a few quits and/or layoffs, making estimates of the ratios imprecise. Or the parameter configuration is such that the association between wages and/or tenure and quits is very weak, making the denominators wQ and/or τQ very small and imprecisely computed. Parameter configurations with these characteristics are of very little interest, however, since in the data turnover rates are high and both wages and tenure show a strong negative association with quits. In order to obtain a clearer picture I remove these outliers by imposing that both turnover rates are at least half as large as in the data, and the associations between wages and tenure and quits are at least half as strong as in the data, where the data set is the NLSY 79

Table 2: Inequality Restrictions

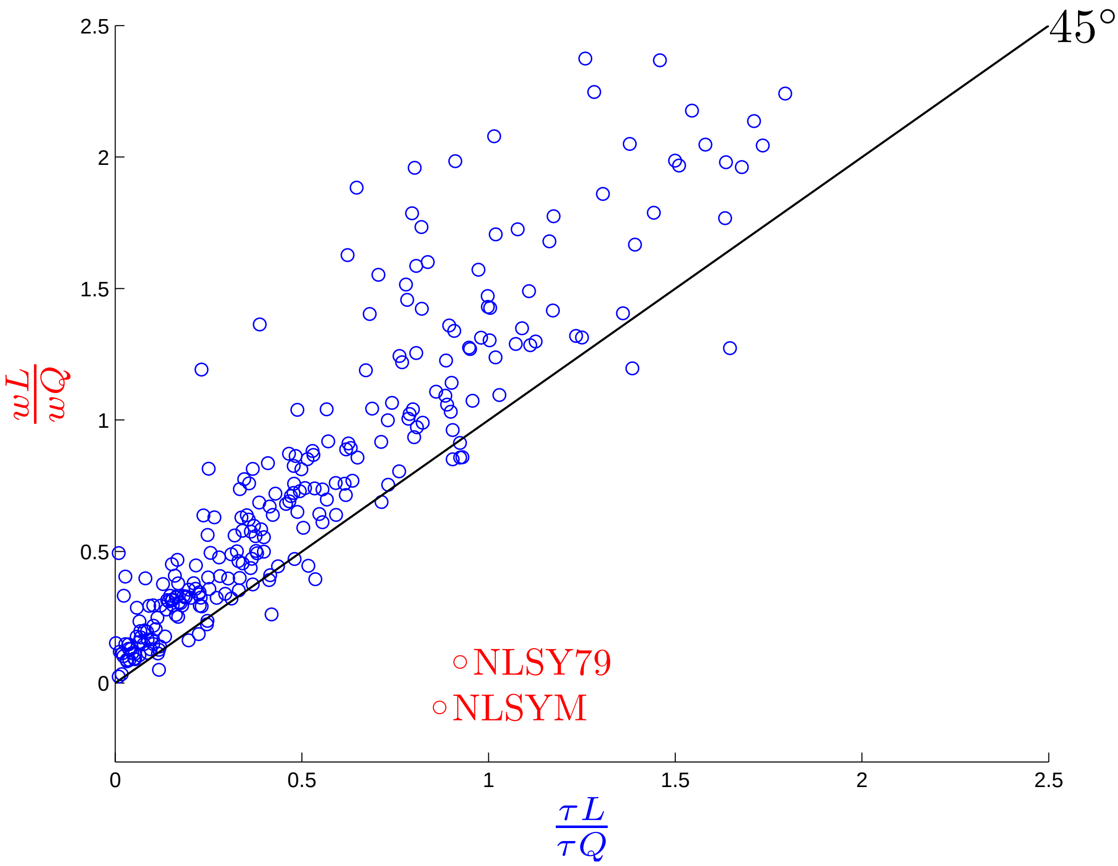
annual quit rate	at least 0.1
annual layoff rate	at least 0.05
τQ	below -0.3
wQ	below -0.02

to be examined the following section. These inequality restrictions are summarized in Table 2. They are already along the lines of "partial calibration" as discussed in the introduction, although here the purpose is not primarily to insure that the model is close to the data, but to insure that the two ratios can be computed reliably. The parameter configurations satisfying these restrictions are shown in Figure 2. The ratios for these parameter configurations are tightly clustered around a line slightly above and slightly steeper then the 45° line. The dots close to the horizontal axis are the location of the ratios obtained in the empirical analysis, and will be discussed in the next section.

Now I turn to the general case in which both z and p fluctuate. Figure 3 shows the results for the case in which both follow a random walk, again imposing the inequality restrictions of Table 2 [THIS CASE IS MORE COMPUTATIONALLY DEMANDING, SO FAR ONLY 3000 PARAMETER CONFIGURATIONS COMPUTED]. Here the working hypothesis describes the behavior of the model less precisely. Importantly, however, departures from the working hypothesis go in a specific direction, namely above the 45° line. The dots close to the horizontal axis once again indicate the location of the ratios obtained in the empirical analysis of the next section, so ratios above the 45° line are even further away from the data.

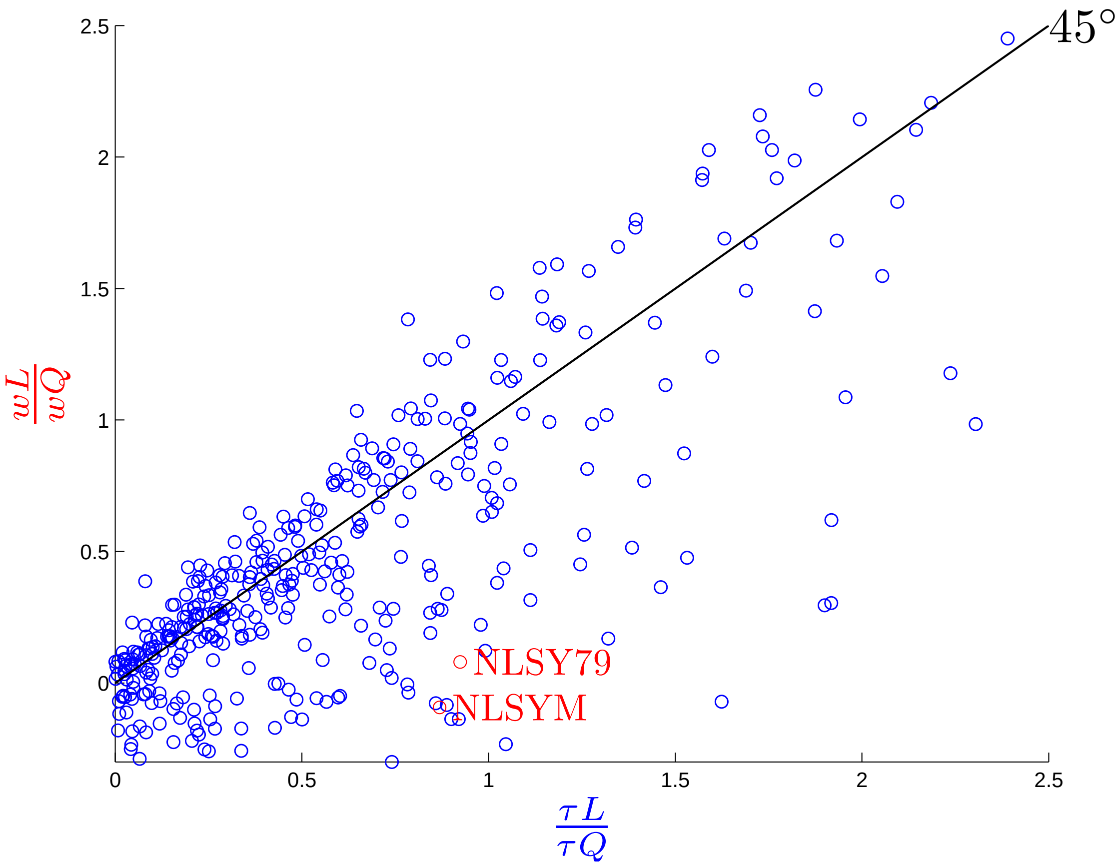
Figure 4 shows the case of the geometric random walk with both p and z fluctuating. Now the working hypothesis does a poor job of capturing the behavior of the model for many parameter configurations, and the deviation goes in the direction of explaining the data. Upon inspection, parameter configurations close to the data, that is with

Figure 3: Random Walk, p & z, Inequality Restriction



$\frac{wL}{wQ} \approx 0$ and $\frac{\tau L}{\tau Q} \approx 1$ are characterized by very large fluctuations of both z and p with a similar magnitude, that is σ_Z and σ_P are close. To make this point, Figure 5 retains only those parameter configurations with $\sigma_Z < \frac{1}{2}\sigma_P < 0.1$. Why does the working hypothesis describe the behavior of the model so poorly if the random walk is geometric and shocks are large? In this case there are both jobs with high wages and jobs with low wages close to the separation margin. Those with high wages have very low z, compensated by not so poor productivity. Those with low wages have very low p, compensated by not so poor amenities. Since the random walks are geometric, the former experience shocks to p which are much larger than shocks to z, so layoffs are relatively likely. The latter experience shocks to z which are much larger than shocks to p, so quits are relatively

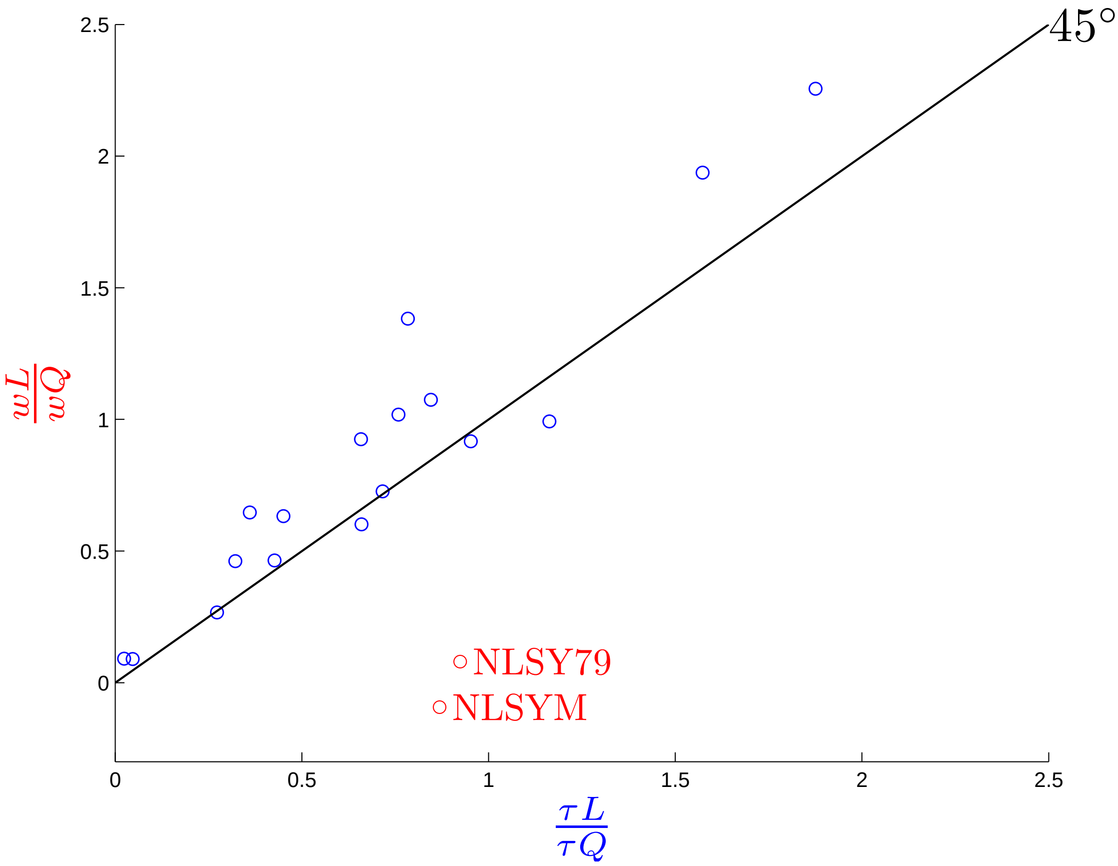
Figure 4: Geometric Random Walk, p & z, Inequality Restriction



likely. Together, this means that higher wages are associated with more layoffs and fewer quits. In Section 4 I study analytically the conditions under which the working hypothesis describes the behavior of the model exactly, and will return to the discussion why it fails in this case.

While the working hypothesis describes the behavior of the model poorly in this last case, recall that so far, except for the mild restrictions of Table 2, I do not require the model to match any features of the data. One could push the "partial calibration" approach further by imposing additional inequality restrictions to insure that the model is close to some moments of the data. I conjecture that this will allow me to eliminate parameter configurations in which σ_Z and σ_P are both very large and close to each other.

Figure 5: Geo. Random Walk, p & z, Ineq. Restriction, $\sigma_Z < \frac{1}{2}\sigma_P < 0.1$



3 Empirical Analysis

3.1 Data

As discussed in the introduction, the paper is in part motivated by the finding of Antel (1985) that in the National Longitudinal Survey of Young Men (NLSYM) quits are negatively related to wages, while layoffs are unrelated to wages, that is $\frac{wL}{wQ} \approx 0$. Antel interprets this is as evidence against JWM. But the results of the previous section show that the JWM model considered here has no difficulties generating this pattern: for example, in Figure 2 there are many parameter configurations with $\frac{wL}{wQ} \approx 0$. But the simulations also show that if $\frac{wL}{wQ} \approx 0$, then this goes along with $\frac{\tau L}{\tau Q} \approx 0$. The objective

Table 3: Summary Statistics

	NLSYM		NLSY79					
	1969	1970	1981	1982	1983	1984	1985	1986
% Q	0.197	0.193	0.313	0.225	0.312	0.283	0.272	0.266
% L	0.109	0.107	0.141	0.182	0.082	0.098	0.114	0.111
mean τ	1.84	1.96	1.30	1.44	1.81	2.06	2.21	2.48
mean age	22.8	23.2	20.93	21.61	22.32	22.96	23.87	24.85
N	1110	1215	1223	1496	1517	1580	1759	1781

of this section is to extend Antel's analysis of the NLSYM to provide evidence on both $\frac{wL}{wQ}$ and $\frac{\tau L}{\tau Q}$. In addition, I extend the analysis to the NLSY79. Finally, I summarize evidence on the two ratios for older workers from a paper by Bartel and Borjas (1977).

Following Antel, the data for the NLSYM is for 1968-1970. For the NLSY79 I study data from 1981-1987. In each case, the sample is restricted to white men employed in the private sector with regular working time of at least 35 hours per week and not enrolled in school.

An observation in the sample is constructed as follows. Consider an individual which is working for an employer at the time of the interview in year t. I observe the wage w_{it}, tenure τ_{it}, and a vector of worker characteristics x_{it}. I then examine the responses of this individual in the year $t+1$ interview to determine whether the worker left this employer. If so, I determine whether the separation is a quit or a layoff based on the self reported cause of separation by the worker. Layoffs include plant closures, the end of temporary jobs, as well as discharges. For each survey I pool observations across years.

3.2 Specifications

Essentially the approach is to run the same regressions on actual data and simulated data. Thus I run OLS regressions of the current wage (in logs) and current tenure on

Table 4: Benchmark Results

	NLSYM			NLSY79		
	Q_{t+1}	L_{t+1}	xL/xQ	Q_{t+1}	L_{t+1}	xL/xQ
w_t	-0.087	0.026	-0.299	-0.126	-0.01	0.080
	(-5.64)	(1.32)		(-13.37)	(-0.80)	
τ_t	-0.802	-0.716	0.893	-0.800	-0.739	0.924
	(-8.33)	(-5.73)		(-19.06)	(-13.56)	
N	2300	2300		9277	9277	

(t-statistics in parentheses)

subsequent quits and layoffs, respectively. The model, however, does not include ex ante heterogeneity of workers. Thus in the regressions I control for observable characteristics. The latter include quadratics in education and potential experience, marital status, health status (only NLSY79), 10 occupations, 4 regions, and SMSA. With the exception of occupation, I allow the effects of these characteristics to be survey year specific.

3.3 Results

The benchmark results are shown in Table 4. I confirm Antel's finding that in the NLSYM quits are negatively related to the wage, while layoffs are more or less unrelated to the wage. Thus $\frac{wL}{wQ} \approx 0$. I find that the same pattern holds in the NLSY 97 for the survey years studied here. For an interpretation of the magnitude of the coefficients, consider the results for quits in the NLSYM. The estimates imply that quitters have 8.7 percent lower wages and 0.802 fewer years of tenure that non-quitters.

The key finding is that the association with tenure is similar for both quits and layoffs in both surveys, that is $\frac{\tau L}{\tau Q} \approx 1$. The ratios from the empirical analysis are indicated in Figures 2-5 in order to contrast them with the simulation results. [ADD CONFIDENCE ELLIPSOID TO FIGURES]. Except for the geometric random walk with σ_P and σ_Z large and close to each other, the data is far from what the model can

Table 5: Robustness Checks

	NLSYM			NLSY79		
	(a) no collective bargaining					
	Q_{t+1}	L_{t+1}	xL/xQ	Q_{t+1}	L_{t+1}	xL/xQ
w_t	-0.76	-0.24	0.33	-0.097	-0.019	0.196
	(-4.35)	(-0.95)		(-9.77)	(-1.42)	
τ_t	-0.736	-0.751	1.02	-0.787	-0.734	0.933
	(-6.64)	(-4.55)		(-17.43)	(-11.89)	
N		1546			7471	
	(b) no manufacturing					
	Q_{t+1}	L_{t+1}	xL/xQ	Q_{t+1}	L_{t+1}	xL/xQ
w_t	-0.081	0.066	-0.81	-0.115	0.003	-0.026
	(-3.68)	(2.28)		(-10.04)	(0.82)	
T	-0.735	-0.694	0.944	-0.760	-0.762	1.003
	(-6.33)	(-4.50)		(-15.73)	(-11.77)	
N		1292			6309	

(t-statistics in parentheses)

generate.

Table 5 provides two robustness checks. Dropping employees whose wage is set by collective bargaining weakens the result somewhat for the NLSYM, but the pair of ratios is still far below the 45° line. It does not substantially alter the result for the NLSY 97. Dropping employees in manufacturing yields a positive association between wages and layoffs in the NLSYM, inreasing the distance between data and model, while again there is little change in the results from the NLSY 97.

Workers in the surveys studied here are very young, so it is natural to ask whether the empirical findings are specific to young workers. Table 6 reproduces estimates from Bartel and Borjas (1977) who study worker turnover using the National Longitudinal

Table 6: Bartel and Borjas (1977)

	NLSYM		
	Q_{t+1}	L_{t+1}	xL/xQ
w_t	-0.0160	0.0086	-0.583
	(-2.33)	(1.99)	
τ_t	-0.0089	-0.0098	1.1011
	(-12.48)	(-7.05)	
N	1724	1679	

(z-statistics in parentheses)

Survey of Mature Men (NLSMM). This survey started in 1966 with workers aged 45-59, and Bartel and Borjas use the survey years 1966-1971. The specification is slightly different, as they run logit regressions of subsequent quits and layoffs on the left hand side, including current wage and tenure simultaneously as regressors on the right hand side. They find a positive association between wages and layoffs, while tenure effects are similar, so once again $\frac{\tau L}{\tau Q} \approx 1$ while $\frac{wL}{wQ} \leq 0$. [REDO THEIR ANALYSIS USING OLS SPECIFICATION]

4 Analytical Investigation

The objective of this section is to shed further light on why it is useful to consider the restriction $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$. I do so by providing conditions under which this restriction holds exactly.

Let p_t denote productivity of an employment relationship at time t. Let w_t and τ_t denote the current wage and current tenure of the relationship. Let Q_{t+1} be an indicator for whether this relationship ends in a quit between time t and time $t+1$, and let L_{t+1} be the corresponding indicator for a layoff.

First, consider the covariance between wages and subsequent layoffs, which can be written as

$$\text{Cov}\{w_t, L_{t+1}\} = \text{Cov}\{w_t, \mathbb{E}[L_{t+1}|w_t, p_t, z_t]\}.$$

Now, JWM implies that conditional on (p_t, z_t), the current wage does not help in predicting turnover. Thus

$$\text{Cov}\{w_t, L_{t+1}\} = \text{Cov}\{w_t, \mathbb{E}[L_{t+1}|p_t, z_t]\},$$

so the current wage is only associated with turnover to the extent that it is associated with the state (p_t, z_t). The object of interest is the ratio

$$\frac{\text{Cov}\{w_t, L_{t+1}\}}{\text{Cov}\{w_t, Q_{t+1}\}} = \frac{\text{Cov}\{w_t, \mathbb{E}[L_{t+1}|p_t, z_t]\}}{\text{Cov}\{w_t, \mathbb{E}[Q_{t+1}|p_t, z_t]\}}. \tag{4}$$

Now suppose the model satisfies the following

Property 1 *There exists a function R such that*

$$\mathbb{E}[L_{t+1}|p_t, z_t] = a_L + b_L R(p_t, z_t),$$
$$\mathbb{E}[Q_{t+1}|p_t, z_t] = a_Q + b_Q R(p_t, z_t).$$

This property requires that there exists an index of the state such that both the probability of a layoff and the probability of a quit can be written as a linear function of this index. Equivalently, it requires that $\mathbb{E}[L_{t+1}|p_t, z_t]$ is a linear transformation of $\mathbb{E}[Q_{t+1}|p_t, z_t]$.

To some extent, this assumption captures the informal argument discussed in the introduction. Think of $R(p_t, z_t)$ as some measure of the quasi-rent of the relationship. Then the property states that the probability of a quit as well as the probability of a layoff depend only on the quasi-rent. Moreover, as the quasi-rent increases, it should protect the relationship against shocks that induce either type of separation, so both quits and layoffs should become less likely. However, Property 1 is more flexible. It allows for the possibility that one effect is much weaker than the other, the slopes b_L and b_Q could even have different signs. What is important is that the relative slope is fixed. Clearly, in general the model of Section 1 does not satisfy this property exactly.

It comes close, however. I will now show that if Property 1 is satisfied, then $\frac{wL}{wQ} = \frac{\tau L}{\tau Q}$. As the model of Section 1 comes close to satisfying Property 1, this result sheds some light on why the model generates $\frac{wL}{wQ} \approx \frac{\tau L}{\tau Q}$.

Substituting Property 1 into equation (4) yields

$$\frac{\text{Cov}\left\{w_t, L_{t+1}\right\}}{\text{Cov}\left\{w_t, Q_{t+1}\right\}} = \frac{\text{Cov}\left\{w_t, a_L + b_L R(p_t, z_t)\right\}}{\text{Cov}\left\{w_t, a_Q + b_Q R(p_t, z_t)\right\}} = \frac{b_L}{b_Q} \frac{\text{Cov}\left\{w_t, R(p_t, z_t)\right\}}{\text{Cov}\left\{w_t, R(p_t, z_t)\right\}} = \frac{b_L}{b_Q}.$$

In other words, wage variation identifies the relative slope. Now, exactly the same argument applies to tenure, so

$$\frac{\text{Cov}\left\{\tau_t, L_{t+1}\right\}}{\text{Cov}\left\{\tau_t, Q_{t+1}\right\}} = \frac{b_L}{b_Q} = \frac{\text{Cov}\left\{w_t, L_{t+1}\right\}}{\text{Cov}\left\{w_t, Q_{t+1}\right\}}.$$

Finally, rewriting this as regression coefficients yields

$$\frac{\frac{\text{Cov}\{\tau_t, L_{t+1}\}}{\text{Var}\{L_{t+1}\}}}{\frac{\text{Cov}\{\tau_t, Q_{t+1}\}}{\text{Var}\{Q_{t+1}\}}} = \frac{\frac{\text{Cov}\{w_t, L_{t+1}\}}{\text{Var}\{L_{t+1}\}}}{\frac{\text{Cov}\{w_t, Q_{t+1}\}}{\text{Var}\{Q_{t+1}\}}}$$

or in shorthand notation $\frac{wL}{wQ} = \frac{\tau L}{\tau Q}$.

Why does the working hypothesis fail in the case where p and z follow geometric random walks with both σ_P and σ_Z large and close to each other? A natural candidate for a function R is something that captures how good the employment relationship is, i.e. something related to quasi-rents. Here, however, employment relationships with similar quasi-rents can be subject to very different shocks. Compare two employment relationships with similar quasi-rents, one with high z and low p, the other with high p and low z. The former is subject to large shocks to z, while shocks to p are small. The situation is reversed for the latter. As a consequence, writing quits and layoffs as linear functions of an index of quasi-rents is not a good approximation.

As discussed above, in general the model of Section 1 does not satisfy Property 1 exactly. To conclude this section, I now provide a special case of the model, clearly a very restricted case, in which it is satisfied exactly. In this case z takes only two values, 0 and $\underline{z}$, where the latter again is sufficiently low to induce separation. The job offer distribution is not restricted: F_P can be any distribution and without loss of generality

$F_Z(\{0\}) = 1$. The amenity transition function is simply $G_Z(0, \{\underline{z}\}) = \delta_Z$. The key restriction is on the transition function for productivity, which will be constructed to mimic the behavior of job to job transitions:

$$Q_P(p, \{\underline{p}\}) = \delta_P + (1 - \delta_P)(1 - F_P(p))$$

where again $\underline{p}$ is chosen sufficiently low to induce separation. Finally, the restriction $\delta_P = \frac{\gamma_Z \delta_Z}{\gamma_Z \delta_Z + \lambda_1}$ must be imposed. For this specification one obtains

$$\mathbb{E}[L_{t+1}|p_t, z_t] = \frac{1}{1 + \gamma_Z \delta_Z + \lambda_1} \left(1 - e^{-(\gamma_Z \delta_Z + \lambda_1(1-F_P(p)) + \delta_P + (1-\delta_P)(1-F_P(p)))}\right),$$
$$\mathbb{E}[Q_{t+1}|p_t, z_t] = \frac{\gamma_Z \delta_Z + \lambda_1}{1 + \gamma_Z \delta_Z + \lambda_1} \left(1 - e^{-(\gamma_Z \delta_Z + \lambda_1(1-F_P(p)) + \delta_P + (1-\delta_P)(1-F_P(p)))}\right),$$

satisfying Property 1.

5 Conclusion

[TO BE COMPLETED]

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