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**Wage and Productivity Differentials in Japan:
The Role of Labor Market Mechanisms**

Donatella Gatti
Ryo Kambayashi
Sébastien Lechevalier

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D. Gatti, R. Kambayashi and S. Lechevalier*

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Abstract

Two stylized facts characterized Japan during the so-called Lost Decade (1992–2005): rising wage inequalities and increasing productivity differentials at the firm level. Surprisingly, these features have never been connected in the literature. This paper attempts to fill this gap by proposing an explanation focusing on labor market mechanisms. We first construct an efficiency wage model with two types of firms distinguished by their job security schemes and associated incentive mechanisms. We show that a comparable negative productivity shock at the aggregate level leads to different firm reactions; namely, the model predicts increasing effort from workers in firms employing an efficiency wage mechanism. This leads to increasing productivity and wage differentials and a rise of the share of these firms in the total population of firms. We test this model using Japanese micro data. For the first time, we match the Basic Survey on Wage Structure and the Employment Trend Survey for 2005. The matched worker–firm dataset we obtain allows us to confirm the existence of an efficiency wage mechanism on average. We also divide our sample of firms into two groups using the unknown regime switching regression à la Dickens and Lang (1985), and find that the primary sector, unlike the secondary, is characterized by efficiency wages. We confirm this result with various robustness checks. Finally, we simulate the evolution of the share of the primary sector in the economy and find that it substantially increased between 1981 and 2005 in line with the predictions of our model.

JEL Classification: L23, J24, J31, J42

Keywords: heterogeneity of firms, efficiency wages, job security, effort, productivity differentials, wage inequalities.

*Respectively: CEPN-Paris 13, PSE, CEPREMAP and IZA; Hitotsubashi University, Institute of Economic Research; EHESS (Paris). Contact: kambayas@ier.hit-u.ac.jp. We would like to thank the participants to the 2009 CAED conference (Hitotsubashi University, Tokyo, October 2 - 4) for their helpful comments. Usual caveats apply.

1 Introduction

For several decades, wage inequality has substantially increased in the US, the UK and many other OECD countries. Japan is no exception. However, until recently, there was no consensus on whether income inequality widened during the 1990s and afterward (OECD, 2006). For example, Tachibanaki (2005) claimed that income inequality increased during the 1980s and 1990s. Conversely, Ohtake (2005) found that the increase in income inequality was partly due to the aging population. By focusing on the wage rate, Kambayashi et al. (2008) attempted to reconcile these two views. Employing the DiNardo et al. (1996) decomposition technique, they concluded the following: “although simple aggregate statistics may give the impression that wage inequality did not change during the period, the decomposition analysis reveals that the seemingly steady trend is a product of two opposing trends: 1) declining between-group (defined by education, experience, tenure and firm/establishment size) wage inequality; and 2) increasing within-group inequality among male workers.”

The central purpose of Kambayashi et al. (2008) was to assess the reality of increasing wage inequality. Moreover, in employing DiNardo et al.’s (1996) methodology to decompose the change in the wage distribution into the relative contributions of changes in the skill distribution of workers and factor prices, their results can be mobilized to add a further piece of evidence to the ongoing debate between the proponents of skill-biased technical change and “revisionists” (Card & DiNardo, 2002). However, there is another possible interpretation. In the UK, Faggio et al. (2007) found that rising wage inequalities primarily concern workers with equivalent observable characteristics. To explain these rising within-group inequalities, Faggio et al. (2007) analyzed its counterpart of increasing productivity dispersion across firms between and within sectors, and showed a link between the two phenomena.

Other researchers, including Mortensen (2003), have also conducted this type of analysis. Although some studies (e.g., Kambayashi et al., 2008, and Tachibanaki, 2005) consider the wage differential between firms of different sizes in Japan, there has been no recent investigation of between-firm wage dispersion in connection with productivity differentials. This is even more surprising as recent work has established yet another stylized fact: namely, increasing heterogeneity of the performance of firms belonging to the same sectors and categories of size (Fukao & Kwon, 2006; Ito & Lechevalier, 2009). One reason for the absence of this type of study is that a dominant concern has been the within-firm wage differential between regular and nonregular workers: the rising share of nonregular workers, which has more than doubled in 20 years to almost one-third of the workforce, has been a popular explanation for the rising wage inequalities in Japan (Ota, 2005). Another possible reason for the neglected study of the link between increasing productivity dispersion and rising wage inequality is that studies that have taken into account the firm size differential have found that it does not explain the increasing wage gap (e.g., Kambayashi et al., 2008).

Of course, the focus on wage differentials among firms of different sizes is understandable in a country that was (and still is to a certain extent) characterized by a dual structure according to the size of the firm. However, the fact that the separation by firm size is not a key determinant of the increasing wage differential should not lead to the conclusion that the between-firm wage differential is not important: as in the US, Japan is characterized by a decentralized wage system (though with some important differences) that make crucial the analysis of the interfirm wage differential. If one aims at connecting the evolution of productivity and wage differentials, one has to take into account the fact that the increasing productivity differentials since the mid-1990s mainly occurred in firms of similar size belonging to the same narrowly defined sectors.

The contribution of this paper is twofold. First, we propose a theoretical framework that focuses on labor market mechanisms without referring to other factors such as the impact of technical progress and internationalization. Second, we test our theoretical model using a rich employer–employee dataset. More specifically, in a first step we construct an efficiency wage model with just one sector but two types of firms of similar size. The difference between the two types of firms is interpreted in terms of productive models, such as in Oi (1983), rather than in terms of monitoring technology, as in Bulow and Summers (1986). More precisely, in one type of firm, productivity is assumed to be endogenous and determined by workers’ production effort, while in the other type of firm, productivity is exogenous. In solving the model, we determine employment in the primary sector (that is, in terms of the number of firms), the rate of hiring and separation, worker effort and the wage. We find that a productivity slowdown at the aggregate level leads interdependently to rising productivity and wage differentials and an increasing share of primary firms.

In a second step, we test this model using micro data. For the first time, we merge two databases, the Basic Survey on Wage Structure and the Employment Trend Survey for 2005. This allows us to obtain information on (hourly) wages and accession and separation rates. We also control for the characteristics of firms (size and sector) and workers (age, gender and education). The results are as follows. First, we confirm the existence of efficiency wages on average. Second, we divide our sample of firms into two groups using the unknown regime switching regression *à la* Dickens and Lang (1985), and find that the primary sector, unlike the secondary, is characterized by efficiency wages. Finally, we run a simulation for the period 1981–2005 and find that the share of the primary sector in the economy substantially increased in line with the predictions of our model.

2 The model

We consider a simple dual labor market model.¹ This dualism corresponds to two alternative labor organization structures. Firms active in the primary labor market must implement a more productive (but more costly) organizational structure. Other firms (active on the secondary labor market) implement a less costly and less productive organizational structure, and hire workers in the secondary labor market. We assume that one firm equals one job. Hence, the levels of employment in the primary/secondary markets stem from the distribution of firms across the two productive models.

The model's timeline is as follows:

- $t = 0$, firms are matched with a given productive model, and employment in the primary and secondary markets is derived;
- $t = 1$, wages and tenure are determined for primary and secondary jobs;
- $t = 2$, workers' effort in primary jobs is determined.

Primary jobs require the incentivization of workers' efforts. An incentive mechanism is at play yielding real wage growth in line with effort. Secondary jobs are perfectly competitive. No incentive is required, so the workers' utility is equal to that of unemployed workers. Unemployment benefits depend on taxes raised on wages. To ensure progressive taxation, only primary market workers are taxed:

$$w_u = \frac{t \cdot w_1 \cdot L_1}{U} \quad (1)$$

with $U = N - L_1 - L_2$, N being the total labor force. The tax rate t is exogenous.

2.1 Incentives and effort

We solve the model through backward induction starting at Stage 2.² We consider two types of firms: *type1*—firms are active in the primary market, while *type2*—firms hire workers only in the secondary market. The endogenous number of firms is determined in Stage 0 (see Section 2.3 below).

Here, we provide the dynamic equations for the utilities of shirker (V_1^S) and nonshirker workers (V_1^{NS}) employed in primary market jobs, along with the utilities of the unemployed (V^U) and workers employed in secondary market jobs (V_2):

¹Our main inspiration is Amable & Gatti (2004).

²We need to determine the values of seven endogenous variables: w_1 , w_2 , e , a_1 , s_1 , L_1 , L_2 . Seven equations are required to ensure that all our endogenous variables are determined at equilibrium.

$$r \cdot V_1^{NS} = w_1 \cdot (1 - t) - e + s_1 \cdot (V^U - V_1^{NS}) \quad (2)$$

$$r \cdot V_1^S = w_1 \cdot (1 - t) + (s_1 + q) \cdot (V^U - V_1^S) \quad (3)$$

$$r \cdot V^U = w_u + a_1 \cdot (V_1^{NS} - V^U) \quad (4)$$

$$r \cdot V_2 = w_2 \quad (5)$$

We assume that there is no hiring and firing in the secondary labor market.

From the no-shirking condition ($V_1^{NS} = V_1^S$) we obtain the standard incentive-compatible real wage schedule (efficiency wage) applying to workers in primary jobs:

$$w_1^e = \frac{e \cdot [a_1 + s_1 + r + q \cdot w_u]}{q \cdot (1 - t)} \quad (6)$$

Given this condition, *type1*-firms endogenously generate an effort function by maximizing the job's value. The values of jobs in the primary and secondary markets (respectively J_1 and J_2) are given by the following equations:

$$J_1 = \frac{m_1 - w_1}{r + s_1} \quad (7)$$

$$J_2 = \frac{m_2 - w_2}{r} \quad (8)$$

with:

$$m_1(e) = A \cdot \sqrt{e} \quad (9)$$

Hence, the productivity of primary market jobs is endogenous and determined by workers' productive effort. All other things being equal, the more intense the effort, the higher is productivity. However, there is a drawback to more intense effort as it also yields higher disutility for workers; that is, the utility cost of effort increases.

This is a crucial aspect of the model. Unlike standard Shapiro & Stiglitz (1984)-type models, we consider that effort is endogenous. Therefore, firms have an interest in trying to improve effort. In fact, given equation (9), we can see that increasing effort allows firms to increase their productivity. Nevertheless, it is clear from equation (2) that increasing effort yields a higher utility cost for workers. However, workers are paid for their increased effort because real wages are set according to an incentive-compatible efficiency wage mechanism. Hence, subject to the efficiency wage constraint, workers are indeed willing to increase their effort. In terms of firms, equation (6) clearly shows that firms are obliged to pay higher wages when effort increases to prevent shirking. Profit maximization yields an endogenous effort function:

$$\begin{aligned} \frac{dJ_1}{de} &= 0 \Rightarrow \frac{\partial m_1}{\partial e} - \frac{\partial w_1^e}{\partial e} = 0 \\ e &= \left[\frac{A \cdot q \cdot (1 - t)}{2 \cdot (a_1 + s_1 + r + q)} \right]^2 \end{aligned} \quad (10)$$

2.2 Wages and tenure

We now turn to Stage 1 of the model. As in standard labor market models, firms compete to attract workers. In our framework, firms can compete on both wages and working conditions. In particular, *type1*–firms can offer various degrees of job tenure (measured by s_1). Better job security increases workers’ utility and effort, and lowers the incentive wage. Hence, there is a trade-off for firms between higher wages or better tenure for workers.

Because of (perfect) competition across firms, wages and tenure are set to ensure that job values are driven down to zero:

$$J_2 = 0 \Rightarrow m_1(e) = w_1 \quad (11)$$

$$J_1 = 0 \Rightarrow m_2 = w_2 \quad (12)$$

This implies that w_2 is simply set equal to exogenous productivity m_2 . Regarding condition (11), one should recall that m_1 is determined according to equation (9). Substituting (9) in condition (11) yields the following zero-profit wage schedule:

$$w_1^{zp} = \frac{A^2 \cdot q \cdot (1-t)}{2 \cdot (a_1 + s_1 + r + q)} \quad (13)$$

In our model (as in other standard dual labor market models) secondary market jobs provide no extra rents for workers. Hence, for workers employed in *type2*–firms, utility is set equal to V^U :

$$V^U = V_2 \quad (14)$$

Substituting equations (4) and (5) for V^U and V_2 in condition (14), we obtain an additional relation between w_1 and w_2 . We call this a “no-migration” condition as it prevents flows from (to) the secondary market to (from) unemployment:

$$w_2^{nm} = \frac{a_1 \cdot [(1-t)w_1 - e] + (r + s_1) \cdot w_u}{a_1 + r + s_1} \quad (15)$$

with w_u determined according to equation (1).

Finally, we need to ensure that flows on the labor market are at equilibrium. Hence, a flow equilibrium condition is considered, ensuring that hiring always matches firing:

$$a_1 \cdot U = s_1 \cdot L_1 \quad (16)$$

Recall that $U = N - L_1 - L_2$, and that employment is determined by the number of firms in the primary/secondary market.

At the equilibrium, the efficiency wage and the zero-profit wage schedules should intersect. By substituting equations (10), (1) and (16) for e , w_u and a_1

in equation (6), and then equating (11) and (6), we determine the separation rate as a function of hiring conditions:

$$s_1(a_1) = \frac{2 \cdot t \cdot a_1}{1 + t} \quad (17)$$

We now turn to the no-migration condition. At the equilibrium, workers should be indifferent between secondary jobs and unemployment. We substitute equations (10), (1) and (16) for e , w_u and a_1 in equation (15), and then impose (12). This allows us to determine the equilibrium hiring rate:³

$$a_1^* = \frac{\left[\frac{A^2 \cdot q \cdot (1-t)^2 - 4 \cdot (q+r) \cdot (1+t) \cdot m_2 + A \cdot \sqrt{q} \cdot (1-t)^{3/2} \cdot \sqrt{A^2 \cdot q \cdot (1-t) - 4 \cdot (q+r) \cdot (1+t) \cdot m_2}}{4 \cdot (1+t) \cdot m_2} \right]}{4 \cdot (1+t) \cdot m_2} \quad (18)$$

We now solve the model recursively. From (17), one easily obtains the equilibrium separation rate:

$$s_1^* = \frac{2 \cdot t \cdot a_1^*}{1 + t} \quad (19)$$

From equation (10), we have:

$$e^* = \left[\frac{A \cdot q \cdot (1-t)}{2 \cdot (a_1^* + s_1^* + r + q)} \right]^2 \quad (20)$$

Finally, equation (13) yields:

$$w_1^* = m_1^* = \frac{A^2 \cdot q \cdot (1-t)}{2 \cdot (a_1^* + s_1^* + r + q)} \quad (21)$$

2.3 Productive model and employment

In Stage 0, firms are distributed across the existing productive models. We simply assume that adopting a *type1*- productive model is costly. This cost depends on the specificity of this productive model. Moreover, the cost is likely to be higher under poor macroeconomic conditions.

Let us take the simple situation where the cost of adopting a *type1* productive model is equal to:

$$c(U) = \alpha + \beta \cdot U \quad (22)$$

Hence, if firms want to adopt the more productive organizational model, they will only become indifferent between the *type1*- and *type2*- models when the following condition is satisfied:

³We actually have two roots for a_1^* . However, we can prove that there is a unique positive root.

$$m_1^* - c(U) = m_2 \quad (23)$$

From (16) and (19) we know that $U = \frac{s_1 \cdot L_1}{a_1} = \frac{2 \cdot t \cdot L_1}{1+t}$. The above condition thus yields:

$$L_1^* = (1+t) \cdot \frac{m_1^* - m_2 - \alpha}{\beta \cdot 2 \cdot t} = \frac{1+t}{\beta \cdot 2 \cdot t} \cdot (m_1^* - m_2) - \alpha \quad (24)$$

This allows us to determine the number of firms adopting the *type1*-productive model. It is important to note that this value is a linear combination of the productivity differential between *type1*-firms and *type2*-firms (or equivalently, the wage differential between the two types of firms). Given the assumption of a “one worker–one firm” match, the number of *type1*-firms equals the employment level in the primary market (L_1^*). We can then easily derive unemployment as $U = \frac{2 \cdot t \cdot L_1^*}{1+t}$.

2.4 Consequences of a lower A

We now analyze the consequences of exogenous changes in given parameters of the model on the equilibrium values of the relevant endogenous variables. We are particularly interested in assessing the consequences of an economic crisis. As the Japanese economy during the Lost Decade (1992–2005) was characterized by a slowdown in productivity growth at the aggregate level (Yoshikawa, 2008), the relevant parameter in our model is therefore A , the exogenous productivity component of primary market jobs. We can regard crisis in our model as yielding a one-off fall in A . In this section, we assess the consequences of this fall on macroeconomic equilibrium in the model.

We can show that:

$$\frac{\partial s_1^*}{\partial A} > 0$$

A fall in A yields a lower s_1^* . Hence, one consequence of the crisis is higher tenure for employed workers and greater job security.

From equations (20) and (21), we can see that increased tenure (i.e., lower s_1^*) yields higher effort and wages for primary market workers. As a direct consequence, the share of primary firms in the economy increases; this result will be used in the empirical section. We can show that these results hold despite the direct offsetting effect of the lower A :

$$\begin{aligned} \frac{\partial e^*}{\partial A} &< 0 \\ \frac{\partial w_1^*}{\partial A} &= \frac{\partial m_1^*}{\partial A} < 0 \\ \frac{\partial L_1^*}{\partial A} &= \frac{1+t}{\beta \cdot 2 \cdot t} \cdot \frac{\partial m_1^*}{\partial A} < 0 \end{aligned}$$

One should note that the overall productivity of firms offering primary market jobs increases following the crisis. This is entirely because of the increase in productive effort, i.e., to the endogenous intensification of work in primary jobs. As a consequence, productivity differentials across firms proposing primary as against secondary market jobs increase because of the crisis.

To summarize, let us assume that the crisis brings about a fall in the exogenous component of productivity (because of a reduction in technological capabilities and/or other demand-driven factors). As a consequence, firms seek the intensification of productive effort to compensate for the fall in productivity. However, work intensification yields higher utility costs for workers. Hence, firms need to compensate to avoid shirking. To ensure higher effort, firms act on two distinct grounds. First, real wages w_1 associated with primary market jobs increase to offset the growing utility cost of effort. This is a standard result. However, in our model, job security is also endogenous. Hence, firms can provide higher job security to primary market workers so they favor an increase in effort, as indicated in equation (20). This is what happens at the equilibrium: primary market workers receive better job security and higher wages as a consequence of the exogenous productivity fall.

Moreover, because of the increased m_1^* , the productivity differential across the two types of firms increases. This encourages firms to adopt a *type1*–productive model up to the point where condition (23) is again satisfied. According to (24), this yields a higher proportion of *type1*– firms, as well as higher unemployment, at the equilibrium.

One should note that all of the above results can be derived under more general assumptions concerning the productivity of *type2*– firms. In particular, we can assume that m_2 also depends on A . Hence, a lower A yields a fall in the productivity of *type2*– firms. Our main results still hold under this assumption, but are more contingent on any specific parametric restrictions.

2.5 Comments

The result we obtain deserves some further comment, especially before turning to the empirical part of the paper. The first remark concerns the nature of the differences between the two types of firms. In our model, these differences are interpreted in terms of productive models, as in Oi (1983), rather than in terms of the monitoring technology used in different sectors, as in Bulow and Summers (1986). More precisely, in one type of firm, the productivity is assumed to be endogenous and determined by workers’ production effort, while in the other type of firm, it is exogenous. The main novelty of our model in comparison to previous formalization is that the *type1*– firms endogenously generate an effort function. Put differently, in this case the adjustment is made through effort. The difference between these two types of firms does not concern the ability of some to restructure or downsize while the others are more rigid. The key mechanism we emphasize is job security and the associated incentive scheme

(efficiency wages): firms may either decide to adopt this organization or prefer a competitive scheme.⁴

A second remark concerns the causes of the evolution of the wage and productivity differentials. Layard et al. (2005) show how the link between workers' wages and employer productivity can be modeled in a variety of ways (union bargaining, efficiency wages, rent-sharing and search-based). Whether efficiency wages apply in Japan is a matter of empirical investigation and we provide a new test. However, the most important element in the choice of our model is that it represents a noncompetitive environment and that the difference in productive organization provides the reason for the productivity differential. After having characterized the two types of productive models, we interpret the increasing wage and productivity differentials as the result of the differentiated reactions of the two types of firms to a similar shock at the aggregate level. The question of the nature of this shock is completely open. Most important is that we are able to study the evolution of the differential without introducing any assumptions regarding technical progress or internationalization. The origin of the growing wage differential then lies in the initial differences in the productive models and in their differentiated response to the productive shock. This means that we focus on labor market mechanisms, without referring to any technological account, as in, say, Faggio et al. (2007) or Dunne et al. (2004).⁵

A third and final remark is related to our dynamic result regarding the increase in the share of the primary sector (Subsection 2.4). This prediction of our model could be considered as not only counterintuitive but also in contradiction with a basic stylized fact characterizing the Japanese labor market for more than two decades, namely, the increasing share of nonregular workers. However, our definition of the primary/secondary sectors is based not on considerations regarding the employment status of workers, but rather on the "productive model" adopted by firms. The validity of this prediction is confirmed in the empirical section (Subsection 3.5).

⁴Our interpretative framework is also distinguished from other explanations focusing on labor market mechanisms, including the role of labor unions (Freeman & Medoff, 1983), the role of size and/or human capital (Haltiwanger et al., 1999), and the differences in the capital/labor ratio (Leonardi, 2007), for example.

⁵Both papers provide a test of Caselli's (1999) model, where the increasing dispersion of productivity (and thus, average wages among firms) can be explained by the differentiated rate of introduction of new technologies.

3 An empirical test using Japanese micro data

3.1 Empirical strategy

According to the model presented in the previous section, we should find a negative relationship between flow behavior and wage levels in the primary sector (as in equation (21)), whereas there should be no correlation between these in the secondary sector. The goal of this empirical section is to explain actual differentials in productivity and wages by applying the above dichotomy to the Japanese economy.

Ideally, testing our model would require a micro panel dataset that includes data on wages and accession and separation rates. Moreover, the sample period should correspond more or less to the so-called Lost Decade (1992–2005) when the Japanese economy was characterized by a long stagnation and increasing wage and productivity differentials. Unfortunately, to our best knowledge, such a database does not publicly exist in Japan. However, we can obtain access to the Basic Survey on Wage Structure (BSWS) and the Employment Trend Survey (ETS) for 2005. From the BSWS we obtain information on wages and from the ETS we acquire accession and separation rate data. Then, using an identification key provided by the Ministry of Health, Labor and Welfare (MHLW), we are able to match these two datasets at the establishment level. In so doing, we construct a matched employer–employee dataset. The use of this kind of database to study the type of question we are interested is well known (Abowd et al., 1999).

Using these one-time cross-sectional data, we first detect the existence of an efficiency wage mechanism through the criterion described above: the existence of a negative correlation between the flow structure and wage. To do this, we estimate a Mincerian equation for male regular workers where the dependent variable is the logarithm of scheduled hourly wage rates and the explanatory variables are worker characteristics, including sex, education, tenure and prefecture dummies (Kambayashi et al., 2008). The mean of the residual of this equation for each establishment can be interpreted as establishment-specific components. In this model, when an establishment belongs to the primary sector, the mean residual of the establishment should be negatively correlated with the magnitude of the outflow.

In the following step, we use the unknown regime switching technique (Dickens & Lang, 1985; Ishikawa & Dejima, 1994) to decompose the economy into two types of establishments. This is because we do not have any explicit *ex ante* criteria to define to what sector an establishment belongs. We then check for a similar relation between the mean residual and the flow structure in both sectors. Finally, we are able to simulate the evolution of productivity and wage differentials induced by our model by extending the decomposition for the two sectors to the Lost Decade.

3.2 The dataset

In this part, we match the BSWS and the ETS for 2005. As the BSWS is an individual survey and the ETS an establishment survey, we thereby obtain a matched worker–establishment database. The key issue is the size of the sample after matching.

3.2.1 The BSWS individual survey and the ETS establishment survey

The BSWS individual survey is conducted by the MHLW each year at the end of June. It covers private establishments with more than five employees and public establishments with more than 10 employees. All industries (except agriculture) are surveyed. Workers are resampled within an establishment. Each year, the sample includes about 78,000 establishments and 1.6 million workers. While the BSWS provides a rich set of information on establishment and individual characteristics, the most important attribute for us is the data on wages.

As for the ETS, this is an establishment survey also conducted by the MHLW, twice a year at the end of June and December. The ETS covers public and private establishments with more than five employees in all industries (except agriculture). Newly separated and newly hired workers (within the sampling period) are resampled within an establishment. The sample size each year is about 10,000 establishments, 80,000 inflow workers and 90,000 outflow workers. These data provide information on the numbers of new entrants and separations.

3.2.2 Matching the two surveys

With the BSWS, the data are collected at the end of June 2005 and the sample is restricted to regular full-time employees. As for the ETS, inflow/outflow refers to the numbers of acquisition/leaves for regular full-time workers between July and December 2005 (six months after the BSWS data point). The ratio is based on the stock of regular full-time employees at the beginning of July 2005.

We match these two surveys using a key provided by the MHLW. Although the size of the matched sample is 2,733, we found some possible inconsistencies in the data. The data point of the BSWS is the end of June 2005 and that of the ETS is the beginning of July 2005 (the day following the BSWS data point). We proceed to a sample restriction as follows: four establishments are excluded because of a negative employment stock at the beginning of July; 250 establishments are excluded because of an inconsistency in industry classification between the BSWS and the ETS; and 435 establishments are excluded because of an inconsistency in firm sizes and establishment size classifications between the BSWS and the ETS. As a result, the final size of the matched sample is 2,044 establishments. For the BSWS, the matching rate is only 5%, but it is 30% for the ETS; this is quite acceptable. Finally, note that this restriction is relatively conservative in that there is a possibility for an establishment and/or firm to move to another classification at the beginning of July.

3.3 Detecting the existence of efficiency wage schemes

Whether an efficiency wage is a satisfactory model for the Japanese labor market is a matter of empirical investigation. However, depending on the exact nature of the efficiency wage model, the empirical strategy may drastically vary. Moreover, the results may be ambiguous, as it is sometimes difficult to empirically distinguish between the predictions of different models (Manning, 2003). For example, Abe and Ohashi (2004) confirm the existence of an efficiency wage model in Japan by analyzing wage profiles. In our case, in order to detect the existence of an efficiency wage on average, we proceed as follows.

First, according to a conventional procedure in the usage of the BSWS, we calculate the scheduled hourly wage as the monthly salary (excluding various allowances) per scheduled working hour ($w_{i,2005}$). Second, we limit the sample to regularly employed males in private firms with more than 30 employees (except for the construction industry) to retain comparability with the public data. Third, we regress the log of the scheduled hourly wage on dummy variables for educational level, age, age squared divided by 100, tenure, tenure squared divided by 100, and prefecture dummies ($X_{i,2005}$), according to the standard Mincerian equation (see Kambayashi et al., 2008) as follows:

$$w_{i,2005} = \alpha + X_{i,2005}\beta + u_{i,2005} \quad (25)$$

Here $u_{i,2005}$ is, given $X_{i,2005}$, a normally distributed unobservable term with mean zero. By using the estimated coefficients in equation (25), we can produce the residual for each individual. If human capital markets are perfect, the residual of (25) can be interpreted as the unobserved matching rent (or establishment–individual specific component) a certain worker can enjoy just because he belongs to a specific establishment. Summary statistics of the residuals are reported in Table 1.

Table 1: Summary Statistics for the Residual of the Mincerian Equation at the Individual Level

	Obs.	Mean	Std. Dev.	Min.	Max.
Residual	48,681	0.000	0.323	-3.978	3.819

We use the mean of the residual for each establishment to produce the establishment fixed effect. The summary statistics of the mean residual for each establishment are reported in Table 2.

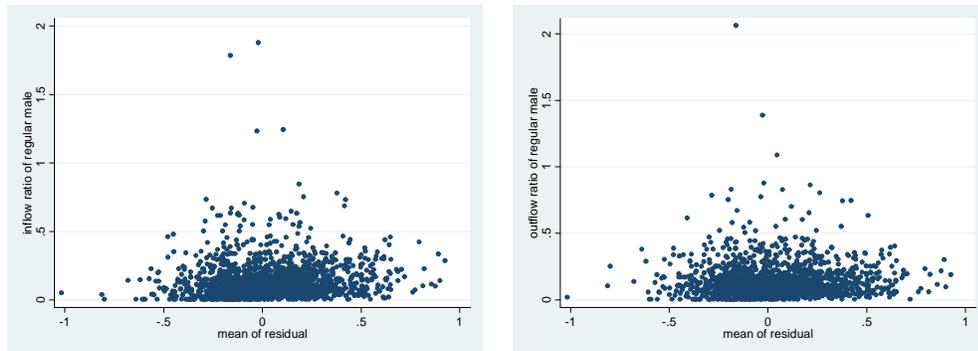
The next step is to observe the nature of the wage premium from the viewpoint of flow structure. According to equation (21), the wage premium should be negatively correlated with the separation rate as well as the accession rate

Table 2: Summary Statistics for the Residual of the Mincerian Equation at the Establishment Level

	Obs.	Mean	Std. Dev.	Min.	Max.
Residual	31,852	-0.039	0.249	-1.673	1.934

in the primary sector. The next figure (Figure 1) is a scatterplot of the mean residual and flow ratios at the establishment level. As shown, there appears to be a slight negative relationship, meaning that turnover decreases as the average residual increases, as implied by equation (21).

Figure 1: The Mean Residual and Flow Structure



We can confirm these negative relationships using the following simple regression reported in Table 3. After controlling for industry, firm size and the overtime ratio, we find a slightly significant negative correlation between the outflow ratio and the mean of the residuals. Therefore, we obtain empirical evidence to support the predictions of (21).

Although we can confirm the existence of an efficiency wage mechanism on average, the negative correlation does not appear to be universal when we consider Figure 1. This leads to further investigation to divide the matched sample into two categories for the primary and secondary sectors.

Table 3: OLS Estimates of the Effect of Flow Structure on the Mean Residual
(1) Sample: 2005 BSWS and ETS matched sample

Dependent Variables	(3a)	(3b)	(3c)	(3d)
	Mean of Residual			
Inflow Ratio	0.010 (0.036)			
Outflow Ratio		-0.067 (0.039)*		
Gross Flow Ratio			-0.016 (0.021)	
Excess Flow Ratio				-0.012 (0.024)
Observations	1899			
R-squared	0.28	0.28	0.28	0.28

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. The remaining explanatory variables include the average overtime ratio, four firm size dummies, nine industry dummies and a constant. Gross flow ratio is the inflow ratio plus the outflow ratio. Excess flow ratio is the gross flow ratio minus the absolute value of the employment growth rate.

3.4 Identifying the two types of firms: a switching regression approach

To empirically test our model, the ideal would be to simultaneously obtain the following results: 1) identification of the two types of firms; 2) detection of efficiency wages for one type and a competitive wage setting for the other according to same criterion used in the former step (a negative correlation between the mean residual and the outflows). To divide the sample of firms into two tiers, criteria such as firm size and industry can offer the key for identification. However, in adopting such *a priori* classification, the problem is not only one of misclassifying some firms. More profoundly, this process obscures the possibility of within-group heterogeneity; for example, two firms of a similar size or belonging to the same sector may choose different wage and productive systems. This is why we adopt the unknown regime switching regression *à la* Dickens and Lang (1985).⁶ With this methodology, the sample separation is *a priori* unknown and the segmental choice between the two sectors is explicitly endogenized (Sousa-Poza, 2004). The system of estimation is as follows:

⁶ A well-known limit of this methodology, already applied to the Japanese labor market by Ishikawa and Dejima (1994), is that it provides a test for dual labor markets and does not recognize the prospect of three market segments. However, from the point of view of the question we address in this paper, this is not a problem as we explicitly focus on the separation between two types of productive models.

$$\left\{ \begin{array}{l} R_{j,p} = \lambda_p + Y_{j,p}\gamma_p + Z_{j,p}\delta_p + \epsilon_{j,p} \\ R_{j,s} = \lambda_s + Y_{j,s}\gamma_s + Z_{j,s}\delta_s + \epsilon_{j,s} \\ z = \lambda_3 + V_j\gamma_3 + Z_j\delta_3 + \epsilon_3 \end{array} \right\} \text{ and } \left\{ \begin{array}{l} R_j = R_{j,p} \quad \text{if } z \geq 0 \\ R_j = R_{j,s} \quad \text{if } z < 0 \end{array} \right\} \quad (26)$$

where :

$R_{j,k}$ is the mean residual of establishment j in sector k (p : primary, s : secondary);

Y_j is the separation ratio of establishment j ;

Z_j are control variables;

z is a latent variable that splits the sample into two kinds of sectors;

ϵ_j provides the key to identifying the division of the sectors.

Because $R_{j,k}$ is the mean residual and can be interpreted as a quasi-rent, industry and firm size should matter. Therefore, we include nine industry dummies and four firm size dummies as controls. $R_{j,k}$ may also be affected by unobserved temporary demand shocks, causing omitted variable bias. To cope with the potential bias, we first limit the hourly wage to the scheduled wage as this is unlikely to be affected by temporary demand shocks. We then introduce the average overtime ratio within the establishment to directly control for any temporary demand shock.

Table 4: Summary Statistics for Separation Rate by Gender

	Obs.	Mean	Std. Dev.	Min.	Median	Max.
Male	1,933	0.249	0.232	0	0.19	3.84
Female	1,908	0.304	0.551	0	0.21	16.00

Our next issue before estimating the system of equations (26) is to define the key to identify the two sectors, V_j . Our strategy is to use the difference in gross job flow between males and females as the identifier.⁷ This refers to a stylized fact characterizing the Japanese labor market, namely, discrimination against female workers (Wakisaka, 1997). For example, it is well documented that the average wage of female workers is almost 30% lower than the average male wage, even after controlling for human capital characteristics. Several economists have also run the so-called “market test” for female discrimination and found further supporting empirical evidence of discrimination. More profoundly, it has been shown that the wage differential between Japanese male and female workers fundamentally arises from differences in job stability; in particular, the number of female workers tends to be adjusted as a buffer for temporary shocks. This is

⁷Because the BSWS individual survey does not contain educational levels for part-time workers, we cannot compare full-time workers and part-time workers under the Mincerian specification.

confirmed with our dataset: in calculating the turnover rate by gender, we find an apparent difference in the gross flow rates between male and female regular workers (table 4). More precisely, the gross flow rate is higher and more volatile for female regular workers than for males. As a result, these turnover rates are not very strongly correlated.⁸ Therefore, this is quite consistent if we assume on the basis of conventional wisdom that female workers are usually treated as more flexible inputs in many Japanese firms.

Our basic hypothesis to differentiate between the primary group of firms (those characterized by an efficiency wage mechanism) and a secondary group of firms (where competitive mechanisms apply) is as follows.

At first, we assume female workers never join the primary sector; therefore, the exogenous demand shock directly affects the flow ratio of female workers.⁹ If the turnover rate of male employees is no more than that of female workers within the same firm, the male workers in this establishment are more or less likely to be shielded from the exogenous demand shock. We interpret that these male workers likely belong to the primary sector. Therefore, if the turnover rate of male regular workers is lower than that of females, the male workers in such establishments may belong to the efficiency wage sector. On the other hand, if the turnover rate of male regular workers is higher than or equal to that of females, they may belong to the competitive sector. After having chosen this identifier, we run the estimation based on equation (26).

The estimated results are shown in Table 5. (3b) is the same as in Table 3, in which we can find a weakly negative correlation on average between the separation rate and the mean residual. We focus here on the key relations between the mean of the residual and outflow ratio reported in Table 5. When we divide the sample into two parts according to the switching equation (5c), this negative relation is exhibited more strongly and significantly in the primary sector (5b), whereas it is rather small and statistically insignificant in the secondary sector (5a). As a whole, these results imply that firms in the primary sector resort to efficiency wages, whereas firms in the secondary sector do not.

The system of equations is consistently estimated not only based on our assumption but also in reference to the literature on the wage premium. First, the difference between the male and female outflow negatively affects the establishments' probability of belonging to the primary sector as well as significantly in the switching equation (5c). This implies that our identification strategy works well. Moreover, the overtime ratio positively affects the wage premium only in the secondary sector (5a) but insignificantly in the primary sector (5b). As

⁸In fact, the simple correlation coefficient, while statistically significant, only has a value of 0.30

⁹This assumption is, of course, rather strong but can be justified as follows. Let us recall that our definition of primary/secondary sectors is based not on employees' characteristics, but rather on firms' characteristics. In this context, the fact that female workers never join the primary sector in our model can be understood as a consequence of an extreme stylization of flow differences characterizing male and female workers in Japan (Wakisaka, 1997).

Table 5: Estimated Results of Switching Regression: Effect of Flow Structure on Mean Residual, 2005 BSWS and ETS matched sample

	(3a)	(5a)	(5b)	(5c)
Dependent Variables	Full Sample OLS	Secondary Sector Mean of Residual	Primary Sector	Switch (latent)
Outflow Ratio	-0.067 (0.039)*	0.030 (0.031)	-0.215 (0.069)***	
Gross Flow Ratio Difference between Male and Female Workers				-0.868 (0.015)***
Overtime Ratio	0.970 (0.090)***	1.253 (0.070)***	0.179 (0.240)	
Firm Size Dummies (more than 1,000 workers)		Base		
(300-999)	-0.070 (0.013)***	-0.069 (0.010)***	-0.081 (0.033)**	0.037 (0.016)**
(100-299)	-0.170 (0.013)***	-0.161 (0.010)***	-0.206 (0.032)***	-0.071 (0.016)***
(30-99)	-0.218 (0.016)***	-0.215 (0.011)***	-0.219 (0.0395)***	-0.273 (0.019)***
Industry Dummies				
(Mining)	0.176 (0.039)***	0.203 (0.027)***	0.421 (0.094)***	-1.100 (0.051)***
(Manufacturing)		Base		
(Electricity and Utilities)	0.260 (0.029)***	0.260 (0.022)***	0.107 (0.067)	-0.304 (0.037)***
(Transportation and Communications)	0.073 (0.019)***	0.015 (0.013)	0.131 (0.038)***	1.870 (0.023)***
(Retail, Wholesale and Restaurants)	-0.051 (0.019)***	-0.064 (0.014)***	0.027 (0.045)	0.314 (0.022)***
(Finance and Insurance)	0.165 (0.029)***	0.166 (0.019)***	0.164 (0.061)***	1.050 (0.035)***
(Real Estate)	0.143 (0.037)***	0.185 (0.025)***	0.083 (0.077)	1.230 (0.045)***
(Services)	0.127 (0.014)***	-0.003 (0.010)	0.165 (0.032)***	2.238 (0.016)***
Constant	0.004 (0.013)***	-0.033 (0.010)***	0.080 (0.037)**	-1.362 (0.010)***
Observations		1874		
R-squared	0.28	0.46	0.13	0.94

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Gross flow ratio is inflow ratio plus outflow ratio.

the overtime ratio is an indicator of a temporary idiosyncratic demand shock, it is natural that wages increase during the boom period in the competitive market, whereas the wage setting mechanism in the primary sector is somewhat

shielded from temporary fluctuations in demand. This finding is in accordance with the coexistence of efficiency wage and competitive markets. Third, as in the firm size literature, we also find that workers in larger firms enjoy a larger wage premium in both the primary and the secondary sectors ((5a) and (5b)). Fourth, the switching equation implies that smaller firms are less likely to belong to the primary sector (compared with the largest firms), and that firms in the services industry are more likely to be in the primary sector (compared with those in the manufacturing industry). As equation (5c) is a type of probit model, we cannot directly distinguish the magnitude of the marginal effect of the variables. Instead, we decompose the sample by the *ex post* estimated probability to be in the primary sector and, by comparing the summary statistics in Table 6, can confirm the difference in firm characteristics between the more-likely-primary-sector-firms and the less-likely-primary-sector-firms.

Table 6: Summary Statistics

Variable	Full Sample Used in the Regression				Less Prob. of Primary Sector < 0.1		More Prob. of Primary Sector >0.1	
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Mean	Std. Dev.
Mean of Residual	0.043	0.237	-1.015	0.928	0.025	0.21	0.063	0.261
Outflow Ratio	0.126	0.126	0	2.058	0.111	0.112	0.141	0.138
Gross Flow Ratio Difference between Male and Female Workers	-0.046	0.384	-7.058	2.615	0.059	0.178	-0.155	0.495
Overtime Ratio	0.083	0.057	0	0.298	0.091	0.055	0.074	0.058
<u>Firm Size Dummies</u>								
(more than 1,000)	0.498	0.5	0	1	0.486	0.5	0.511	0.5
(300-999)	0.196	0.397	0	1	0.15	0.358	0.244	0.43
(100-299)	0.187	0.39	0	1	0.211	0.408	0.161	0.368
(30-99)	0.118	0.323	0	1	0.153	0.36	0.083	0.276
<u>Industry Dummies</u>								
Mining	0.014	0.117	0	1	0.027	0.163	0	0
Manufacturing	0.605	0.489	0	1	0.91	0.286	0.287	0.453
Electricity and Utilities	0.026	0.16	0	1	0.046	0.21	0.005	0.074
Transportation and Communications	0.07	0.255	0	1	0	0	0.143	0.35
Retail, Wholesale and Restaurants	0.077	0.266	0	1	0.017	0.128	0.14	0.347
Finance and Insurance	0.029	0.169	0	1	0	0	0.06	0.238
Real Estate	0.017	0.13	0	1	0	0	0.035	0.184
Services	0.162	0.368	0	1	0	0	0.33	0.471

As expected, the average quasi-rent is larger in the more-likely-primary-sector-firms. The difference in gross flows between male and female workers is much smaller in the more-likely-primary-sector-firms. It is also apparent there are fewer smaller firms among the more-likely-primary-sector-firms. For example, among the firms whose probability of belonging to the primary sector is more than 0.1, smaller firms (those with fewer than 299 employees) account

for 24.4% whereas they account for up to 36.4% in less-likely firms. In other words, firms in manufacturing industries have a lower probability of being a more-likely-primary-sector-firm whereas firms in the services industry have a higher probability of being a more-likely-primary-sector-firm.

Overall, the estimation of the system of equations does not explicitly contradict the existence of efficiency wages in the primary sector and competitive wages in the secondary sector. In this sense, our analysis provides an *ex post* justification for the use of the unknown switching regression methodology à la Dickens and Lang.

3.5 Robustness of switching regression

The existence of an efficiency wage is thus far not contradicted by our estimation. However, it is necessary to conduct some robustness checks to make this conclusion stronger. In particular, our results may have been affected by a demand shock or a change in worker composition. On-the-job search may also be a mechanism underlying the negative relation we found between wages and flows through a sorting effect. In this section, we attempt to control for the first two effects and test for an on-the-job search mechanism.

3.5.1 Controlling for a demand shock

Our theoretical model assumes a steady state. Therefore, transition when the establishment suffers from a temporal demand shock is out of the scope of our analysis. However, in reality, a temporal demand shock is unobservable and may affect both the residual of the wage equation and turnover behavior. In this context, the estimated coefficients may lose consistency if the error terms in (26) include unobservable temporal demand shocks.

There are several strategies to remove the effects of the unobservable demand shocks from the error terms. In the previous subsection, we conducted two types of treatment (Table 5). First, we define the wage premium as the residual of the scheduled hourly wage. Generally speaking, scheduled hourly wages are not directly affected by temporal demand shocks as Japanese legal regulations require almost all employers to prepare a “Workplace Rule” (*Shugyo Kisoku*) to regulate *ex ante* the basic wage and labor hour scheme. In the survey, respondents are instructed to base the scheduled wages and hours reported on the wage and labor hour scheme set out in the Workplace Rule. Therefore, the scheduled hourly wages in our data are not directly affected by temporary shocks. In practice, *ex post* adjustments in wages and working hours are usually made using bonus payments and overtime.

Second, it is possible for employers and employees to perceive future trends in overtime and raise scheduled wages to (at least partially) compensate in advance. As the expected overtime may be reflected in the medium-term situation of the company, it also affects gross flows via the labor demand functions. Because

of this potential bias, limiting the scheduled hourly wage will not be sufficient. To cope with this problem, we include the average ratio of actual overtime per worker as a control. If one assumes that the trend in labor demand is anticipated by the overtime ratio, we can consider that this control variable absorbs the compensated portion of the unobservable trend in demand shocks from the residuals of the scheduled wage equation.

These two treatments should reduce any spurious negative relationship relating to our dataset or measurement strategy. However, some unobservable correlation between demand shocks and gross outflow may remain because of an insufficient control of demand shocks. To cope with more persistent demand shocks and to check the robustness of our result, we select two types of proxy: the gross inflow rate and the net employment growth of male regular workers. The switching regression system (26) is a simultaneous estimate. When we include a different set of explanatory variables, the whole system (including the switching equation) is estimated differently. This implies that the probability weight for each observation, which is used in estimating wage premium equations, is also estimated differently when we add variables. To distinguish between the effects of adding control variables and changing the probability weights, we reserve the probability weight of each observation used in estimating (5a) and (5b) (Table 5), and reestimate only the wage premium equations with the extra controls for each sector.

Table 7: Robustness Check of Switching Regression (1): 2005 BSWs and ETS matched sample

	(7a)	(7b)	(7c)	(7d)
Dependent Variables	Secondary Sector	Primary Sector	Secondary Sector	Primary Sector
	Mean of Residual (latent)			
Outflow Ratio	-0.04 (0.05)	-0.25 (0.10)***	0.00 (0.04)	-0.14 (0.06)***
Inflow Ratio	0.04 (0.04)	0.11 (0.10)		
Net Growth			0.04 (0.04)	0.11 (0.10)
Overtime Ratio	1.08 (0.09)***	0.60 (0.19)***	1.08 (0.09)***	0.60 (0.19)***
Observations	1874			
R-squared	0.35	0.16	0.35	0.16

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The other explanatory variables include four firm size dummies, nine industry dummies and a constant. The probability weight for each sector is the same as in (5a) and (5b).

The estimated results are shown in Table 7. From (7a) to (7d), the extra variables to control for more persistent demand shocks do not alter the results.

The gross outflow is still negatively correlated with the wage premium in the primary sector, whereas it is not in the competitive sector. Additional controls for demand shocks do not significantly affect the wage premium, although all of the estimated coefficients are positive. This is consistent with the interpretation of a demand shock.

3.5.2 Compositional effect

In the estimation shown in Table 5, we assumed that the scheduled hourly wage is solely determined by observable human capital attributes. In this case, any change in workforce composition does not affect the residual in the wage equations. However, increased gross outflow may introduce a change in the composition of the company’s workforce and this may affect the average level of the scheduled hourly wage. For example, let us assume some establishments are characterized by a backloaded wage profile. Any increase in younger and more inexperienced workers within these companies will then temporarily produce a larger wage premium, even though this change in the composition of the workforce will not alter the aggregated wage premium throughout the workers’ lifetimes. As our dataset draws on a one-time cross-sectional survey, the unobservable deviation from the cross-sectional mean in each establishment may arise from a temporal imbalance in worker composition. To correct this, we use the difference in the average age of the worker stock and worker inflow. If the difference is sufficiently large—for example, if the inflow workers are much younger than the incumbents—the employers can receive some temporary benefit in hiring younger workers. In other words, given the backloaded wage profile, the unobservable wage premium will be larger in firms with a younger workforce.

The results are shown in columns (7e) and (7f) of Table 8. It appears that the additional variables controlling for any potential composite change do not alter the results. That is, the coefficients for gross outflow remain positive in the primary sector and almost zero in the secondary sector. The coefficient of the composition effect is positive and significant in both sectors, showing that this effect matters given long-term employment practices in Japan.

3.5.3 On-the-job search

The on-the-job search mechanism may also be an explanation for the observed negative relation between the wage premium and gross outflow, as shown in Mortensen and Pissarides (1994). Workers in most productive establishments do not have any incentive to search for another job, because they receive enough match-specific benefits. Therefore, voluntary quits in these establishments will be lower. As a result, gross outflow and productivity will be negatively correlated. To control for this potential bias, we use the ratio of voluntary quits as an additional control variable. It is almost the same to specify gross involuntary outflows on the RHS. The results of the estimations are shown in (7g) and (7h) of Table 8. As noted earlier, the inclusion of variables to control for on-the-job

Table 8: Robustness Check of Switching Regression (2): 2005 BSWS and ETS matched sample

	(7e)	(7f)	(7g)	(7h)
	Secondary Sector	Primary Sector	Secondary Sector	Primary Sector
Dependent Variables	Mean of Residual (latent)			
Outflow Ratio	-0.01 (0.04)	-0.15 (0.06)***	0.00 (0.04)	-0.15 (0.05)***
Difference in Average Age	0.01 (0.00)***	0.01 (0.00)**		
Ratio of Voluntary Quits			-0.06 (0.01)***	-0.11 (0.02)***
Overtime Ratio	1.12 (0.09)***	0.65 (0.19)***	1.10 (0.08)***	0.64 (0.18)***
Observations			1874	
R-squared	0.35	0.17	0.35	0.18

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The other explanatory variable includes four firm size dummies, nine industry dummies and a constant. The probability weight for each sector is the same as in (5a) and (5b).

search incentives does not affect our results. The ratio of voluntary quits negatively affects the wage premium. This implies that on-the-job search incentives exist in both sectors. However, apart from the on-the-job search incentives, gross outflow still affects the wage premium negatively and significantly, but only in the primary sector. Overall, these results illustrate the robustness of our estimation.

3.6 Simulation

Ideally, the purpose of this section is to simulate the evolution of the productivity and wage differentials on the basis of the relationships observed for 2005. In so doing, we are able to check whether our model can replicate the stylized facts emphasized in the introduction. More precisely, from our model, we expect that a negative productivity shock at the aggregate level (similar to what was observed in Japan during the Lost Decade) should lead to increasing wage differentials.

However, because of a lack of data, we are not able to directly confirm (or otherwise) the predictions of our model regarding the evolution of the wage and productivity differentials. Instead, we focus on another relation, given by equation (24), which describes the share of primary firms as a linear combination of the productivity (respectively wage) differential between the two sectors. As shown in Section 2.4, the increase in the productivity and wage differentials

from a negative productivity shock at the aggregate level goes hand in hand with an increase in the share of the primary sector. Moreover, we are able to calculate the respective impact of two mechanisms at the origin of the evolution of the primary sector: the efficiency wage mechanism and the structural effects regarding the industry and firm size changes.

From the switching regression estimates at the establishment level (Table 5), we deduce the probability that establishment j belongs to the primary sector as:

$$F\left(\hat{\lambda}_3 + V_j\hat{\gamma}_3 + Z_j\hat{\delta}_3\right) \quad (27)$$

Here F is the c.d.f. of the standard normal distribution, V_j is the difference in gross worker flow between male and female workers, and Z_j are dummies for industry and firm size. For the 1,875 establishments in the sample, the mean of the imputed probability of belonging to the primary sector is 0.27.

To evaluate the share of the primary sector in the economy, it is necessary to summarize the probabilities with some weights. The number of male regular workers is an available and consistent weight. In this case, the weighted average of probabilities will be equivalent to the share of regular male workers under the efficiency mechanism, that is, 0.21. For consistency throughout the analysis, we assume female regular workers are under a competitive mechanism. Then the share of primary sector workers is within about 0.16 of regular workers.

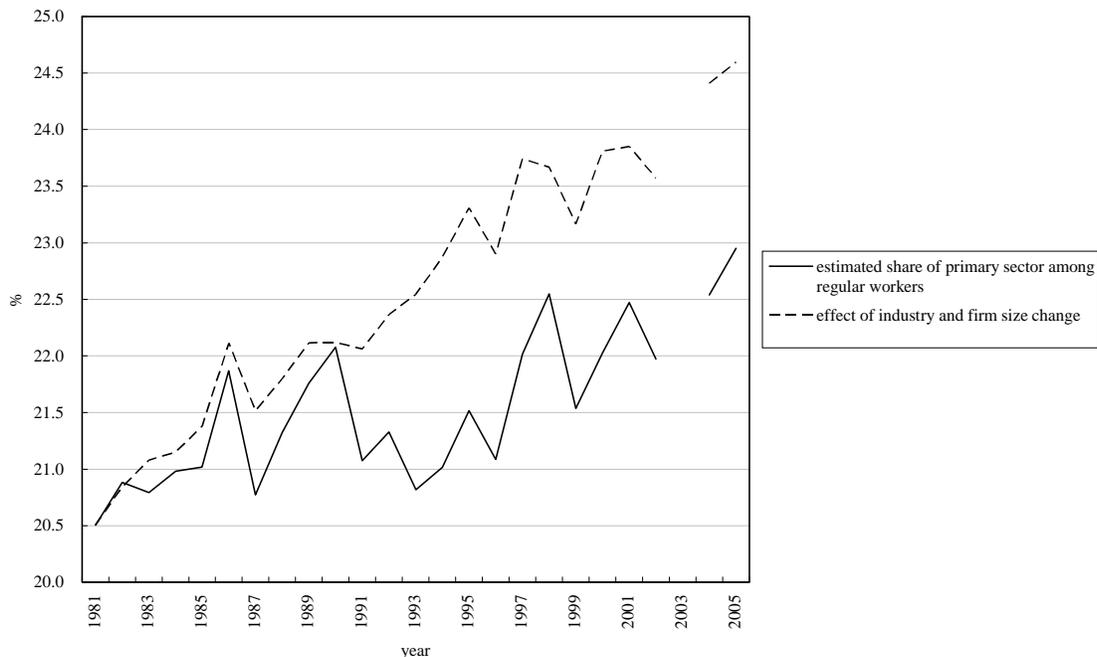
In the next step, our concern is to determine the evolution of the share of the primary sector. As the published ETS provides the aggregated worker flows by gender, firm size, and industry since 1981, we are able to put in perspective the evolution during the Lost Decade by taking into account the evolution in the 1980s. If we assume that the switching equation has been stable over time, we can impute the probability of the average firm belonging to the primary sector in a certain industry, for a certain size class and for a certain year. By using the imputed probability, we can deduce the average share of the primary sector, under the assumption that female workers are always in the secondary sector. Let us define S_t as the share of primary sector, E_t as the number of regular workers and M_{kt} as the number of male regular workers of industry firm size k in year t . V_{kt} is the difference in aggregated gross worker flow between male and female workers, and Z_{kt} are dummies for industry and firm size classification. S_t should be defined as follows:

$$S_t = \frac{\sum_k F\left(\hat{\lambda}_3 + V_{kt}\hat{\gamma}_3 + Z_{kt}\hat{\delta}_3\right) \cdot M_{kt}}{E_t} \quad (28)$$

In Figure 2 we depict the transition in the imputed shares of the primary sector among regular workers between 1981 and 2005.¹⁰ We show other com-

¹⁰Data for 2003 are missing.

Figure 2: Transition of Share of Primary Sector



puted shares by fixing the worker flow in each industry and firm size as in 1981 (\bar{V}_{k1981}):

$$\bar{S}_t = \frac{\sum_k F \left(\hat{\lambda}_3 + \bar{V}_{k1981} \hat{\gamma}_3 + Z_{kt} \hat{\delta}_3 \right) \cdot M_{kt}}{E_t} \quad (29)$$

The difference in the two lines is produced by the effect of the changes in the worker flows.

In Figure 2, we can see that the estimated share of the primary sector is 0.23 for all regular workers in 2005. Perhaps because of aggregation, this figure is much higher than the micro-data-based mean probability of 0.16. Therefore, we should be cautious when interpreting the simulated probability using aggregated data.

Putting aside the level of shares, a more interesting feature in Figure 2 is the upward trend in the primary sector over the decades. We can distinguish two steps in the increase in this share, between 1981 and 1991 (an increase of 0.6) and between 1992 and 2005 (an increase of 1.9). It is then possible to say

that this trend has accelerated from the early 1990s, even if it is characterized by fluctuations.

Moreover, a second conclusion is that this upward trend largely arises from the shift in industry and firm size. As shown in the full estimates of the switching regression (Table 5), male regular workers in larger firms or in the services industry are more likely to be in the primary sector than those in smaller firms or in manufacturing. Thus, the mean probability will change when the distribution of industries and firm size shifts. It is well known that during the past few decades, structural changes in the Japanese economy have been characterized by a rising share of nonmanufacturing industries. This may be the underlying mechanism at the root of the increasing share of the primary sector in Japan, as depicted by Figure 2. Furthermore, this trend would have been more rapid if the difference in gross flows between males and females had stayed at the 1981 level. In other words, the effect of the change in outflow—as a proxy for the strength of the efficiency wage mechanism—has been somewhat negative. This means that, especially between 1990 and 1993 when the trends of the two lines apparently reversed, Japanese firms have weakened the efficiency wage mechanism by using male outflow relatively more than female outflow.

As a whole, the simulated evolution of the share of the primary sector confirms the prediction of our model. However, the specific and relative impacts of the efficiency wage mechanism in the rising share of the primary sector have declined since the 1990s.

4 Conclusion

In this paper, we proposed a framework aiming at connecting two stylized facts that characterized the Japanese economy during the Lost Decade (1992–2005): rising wage inequality and increasing productivity differentials. First, we built an efficiency wage model with two types of firms: in the primary sector, firms adopt an efficiency wage scheme, whereas the labor market in the secondary sector is competitive. A key feature of this model is that the first type of firms endogenously generate an effort function. In this model, a negative productivity shock at the aggregate level produces increasing productivity and wage differentials, as well as a rising share of the primary sector.

Second, we tested this model using Japanese micro data. For the first time, we match the BSWS and the ETS. The matched worker–firm cross-section dataset we obtain allows us to establish that there is a negative correlation between the mean of the wage residuals and outflow. Thus, we are able to confirm the existence of an efficiency wage mechanism on average. Moreover, by using the unknown regime switching regression methodology à la Dickens and Lang (1985), we distinguish between the two sectors and show that only one can be characterized by an efficiency wage according to the same criterion used previously (a negative correlation between the mean of the wage residuals and outflows). Finally, we study the evolution of the share of primary sector through

simulation. The fact that the primary sector substantially increased between 1981 and 2005 conforms to the predictions of our model. However, the relative importance of the efficiency wage mechanism to the structural evolution of the industry and firm size changes over the same period has to be nuanced.

Several important implications can be drawn from this paper. First, we confirmed that rising wage inequalities can be related to increasing productivity dispersion among Japanese firms. Second, our focus on labor market mechanisms shows that it is possible to generate a similar trend of rising wage inequalities to that observed in Japan during the Lost Decade, without resorting to hypotheses concerning skill-biased technical change or globalization. Third, the rising share of a primary sector characterized by high wages and tenure is somewhat counterintuitive if one considers the state of the debate on the end of the so-called “Japanese employment system”. Thus, we confirm previous research showing that the reality is in fact more complex than the story usually told (Kato, 2001).

At the same time, this paper has some limitations that need to be overcome in order to draw stronger conclusions on the role of efficiency wage mechanisms in rising wage inequalities in Japan. From this standpoint, it is possible to consider at least two extensions of this work. First, it would be desirable to study directly the evolution of the interfirm wage and productivity differentials, rather than indirectly through the share of primary firms. Second, it would be necessary in the future to precisely decompose the overall wage differential into the within-firm and between-firm differentials.

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