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Japano-Sclerosis?

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Abstract

There exist many symptoms and emerging economic trends suggesting that the Japanese economy is headed in the direction where many European economies ended up in much of 1980s and 1990s. This paper makes highly speculative long-run 'forecast', based upon a comparison of two stylized models of the Japanese and "Euro" labor markets. We argue that Japano-Sclerosis, if there is one, should look rather different from Eurosclerosis in 1980s and 1990s.

Our forecasts are the following.

(1) Because of the resilience of the unique recruiting system of the school leavers, the Japanese economy is unlikely to face chronic high unemployment and joblessness, which plagued the Euro economies for decades, whereas (2) the chronic problem in the labor market is more likely to manifest itself as extremely low labor turnovers, and stagnant output growth and earnings. (3) Both circumstantial evidence and model implication suggest that the core characteristics of the Japanese labor market will remain unchanged even if the stagnation of the economy continues or even worsens in the future..

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1 Introduction

After two decades of the stagnation, the Japanese economy appears to follow the path taken by many European economies in the past. Ageing population, rising demand for social security that threatens the long run fiscal balance, dwindling productivity growth, declining saving rate, etc, etc, all of which, twenty years ago, the Japanese only heard about as some malaise reported in distant Europe. There now exists a sense of urgency, and, simultaneously, a sense of helplessness and resignation in Japan — that the economy and society of Japan seem unable to lift itself out of the quagmire. In the backdrop of even more dismal news on economy, in the last summer, the Democratic Party of Japan won the general election over the reigning Liberal Democratic Party. The political platform of Democratic Party mimics many of the popular policy packages already in place in many European countries[1]. Within less than one year, however, the new government and their new policy packages suffered a few clear defeats, and many important setbacks, and one of the underlying problems is the worsening fiscal balance that took the heavy blow from the global recession started in 2008.

There is little doubt that, in many dimensions, the Japanese economy will inevitably confront issues that Euro area have tackled for the decades. On the other hand, given the differences in the socioeconomic legacy of the post war period, the two regions might well respond differently to a similar underlying problem.

The current paper considers one such issue, the structural issues in the labor market. The unique institutional setting in Japan that we focus is the market for school graduates. In this paper, we place this particular segment of the labor market at the centre of the Japanese employment system and argue that many, if not most, of the characteristics of the Japanese labor market are critically linked to the institutional set up of the market for school leavers. We argue, therefore, that the likely response to a similar negative shock is going to differ from what we have seen in Europe.

As a matter of fact this paper argues that the practice, — of separating school graduates from the rest in the labor market, — is a key ingre-

[1] To name a few:: higher minimum wage, beefing up unemployment compensation, subsidy programs for the disabled and jobless, new subsidy programs for families with children under age 15, a proposal to undergo whole sale restructuring of social security system, means to promote in various manners and in dimension a society and workplace amenable to parents with kids and full time jobs, beefing up the nursery and other support programs for those parents; building facilities for the elderly, etc,etc. These policy packages, at least taken at face values, do resemble the platform of Euro social democrats' big government.

dient responsible for the persistence of unique features of the Japanese labor market. Stepping stone mobility of the youth is a rare exception in the Japanese labor market, limited to a handful of highly specialized markets for professionals. Success in the work life is largely synonymous with the success in the first job after school. A corollary of the argument, which is the focus of the paper, is that Japan Sclerosis cannot be the same as Euroscelorsis.

We argue that the symptom of Japano-sclerosis should differ in many important ways from those familiar from Euroscelorsis. We argue that the Japanese economy is not likely to experience unemployment rate anything closer to what Euro-sclerosis brought about. Instead, the symptom appears mostly in reduced output, productivity and income, and lower labor mobility across jobs, except for temporary and part time jobs.

For the purpose of a broad brush comparison of the two labor markets, we employ a model of job search with two features. We distinguish two (EU and Japan) economies in terms of the market for school graduates. We model the unique setting in the Japanese case as a submarket provided for school leavers only. We assume that in Euro version of the model economy, school leavers compete for jobs with other jobs searchers without proper training. The second feature of the model is the specificity of training. To highlight the difference, we assume that all the trainings are job (firm) specific in Japan, whereas in Europe all the trainings are completely general. With this setting, our comparisons are done mainly by numerical examples. We have three main findings. First, we show that indeed the school leavers have much better chance of getting a job in Japan than in Europe. On the other hand, the job finding rate is lower in Japan if they do not succeed in the first market. This occurs because the better qualified workers are far more likely to be successful in the first job so that in the market for general untrained workers, the market has much lower job availability per job searchers. Given the specificity of training, even workers separated from jobs for exogenous reasons do not do much better than those without past training.

Assuming that firm specific training raises productivity more than general training, we find that the permanent negative productivity shock brings about different impacts on the two economies. In Japan, the difficulty of getting a second or third job, coupled with larger gains from training reduces labor mobility. Thus the negative productivity shock lowers the returns from match, but the impact on unemployment rate is relatively limited, the precise opposite of the Euro case, wherein the shock brings about a large increase in unemployment but the impact on wage income is modest.

The remainder of this paper is organized as follows. In the next section, we review the two decades of the Japanese labor market and compare the experience with Europe in the 1990s. Section 3 develops a competitive search model in which workers with different productivity search for jobs that require training. In the latter half of the section, we propose a comparison of Europe in 1990s and the current state of Japan by employing two toy models of labor markets. Section 4 consolidates these models and use numerical examples to characterize two toy economies in key dimensions. Section 5 concludes.

2 Japanese labor market in the last two decades versus Eurosclerosis

The dismal performance of the Japanese economy, especially the labor market, display many symptoms of the European experience earlier, which have been extensively discussed and analyzed. This short section compares the two cases. We start our comparison with the youth labor market as it is our focus of the subsequent analysis. In the next subsection, our focus is on the long term employment, a common feature in both regions, at least in comparison with the U.S. In the last sub-section, we review the major empirical findings in the interactions between labor mobility and productivity growth.

2.1 School to work transition

According to an OECD study by Manfredi and Quentini (2009), average durations of school to work, time after leaving school until the first employment, varies considerably not only across countries, but also vary widely across different cohorts (in terms of level of education, gender, ethnic groups, etc). Yet it is fair to say that the school to work in Europe takes much longer time than Japan, even than the United States.

It is a customary practice of the Japanese firms to set aside job openings for school graduates. These openings are distinct from regular job vacancies posted on ad hoc basis. In the latter case, job openings are mostly for specific positions, whereas the openings for school leavers generally do not correspond to any specific positions. As such, qualifications for school leavers are in more general terms and rarely requires specific skills or expertise or work experiences. Most of the entry positions are designed primarily for the new school leavers, and only jobs left for the rest of workers come primarily as ad hoc openings for specific positions, or the host of lower pay non-regular jobs.

Even in the year 2009, the worst year for college graduates seeking jobs since late 1990s, 92% of them had regular full time jobs upon graduation. The figure is 95% for high school graduates[2]. Even including non-standard (temporary or part time) jobs, Manfredi and Quentini shows that the overall average duration is longer than one year (16.9 months) for the European countries as a whole[3], and this figure can be contrasted against 5.6 months in the United States. No comparable data exists for Japan, but, as we explained above, at least for those who finish schools, dominant majority of school leavers will have secured regular full time job when they graduate.

Impressive as these records might look, it is important to take note of the following facts. To begin with, students, schools, local public employment offices, and employers spend considerable resource for job placements of school leavers. Given the dominant role of this market in the over all labor turnovers, failures in this market leaves the youth with long lasting negative effects and the stigma[4]. The fact that firms rely mostly on recruiting school leavers imply that regular job openings for mid career workers are limited, especially if they had been stigmatized by the failure of the job search while in school, or separations from the first job within a short spell of employment. The employers also have to pay for this system by committing to long term employment and investment in training.

What are the alternatives to the segregated market for school graduates? Stepping stone mobility, i.e., progression of skills and career through spells of different (but related) jobs, is considered the major alternative. For vocational school graduates in central Europe, the major track is through apprenticeship, which comprises the major part of schooling in their last year. The school to work transition in European countries are distributed between US type stepping stone mobility and combination of apprenticeship and a Japan like direct job placement. Manfredi and Quintini finds that in spite of many similarities with the US system, they find:

"*pathways in the United States tend to be characterized by significantly more dynamism than in Europe.... Pathways identified for the*

[2] These statistics are somewhat misleading, especially for the high school graduates because those who did not get a job offer tend to report themselves as "helping home chores", "preparing for college", "attending vocational college," etc, rather than "continue to search for a job" as their plans after graduation.

[3] Needless to say, there exists significant variations in Europe even among EU15 members: Manfredi and Quentini estimates the duration is roughly 6 months in Denmark,Germany, and U.K, whereas the duration is about 2 years or longer in Italy, Spain and Greece.

[4] Kondo (2007), and Genda, Kondo and Ohta (2010) estimate the negative impact on school graduates of entering the labor market in recession years. They find the impact is large and long lasting in Japan than in the United. States. For Europe, see Burgess, Propper, Rees and Shearer (2003).

United States are also characterized by significantly less unemployment than European ones."

Roughly speaking, Manfredi and Quintini finds that the youth in Europe is far more divided (than in the U.S) into two polar groups: the one more successful group complete transition in relatively short period of time without much experience of unemployment, whereas the unsuccessful group tend to go through prolonged period of transition with many extended unemployment spells and unstable jobs.

The difference between the US and Europe perhaps reflects several important elements of the rigidity in the European labor market. First is a variety of social and legal system that protects the job of permanent employees, thus making the entry into "insiders" difficult for the youth. The second is possibility of "trap" for the youth who start out their career with a temporary job: they do not offer much of training or pathway towards more permanent higher pay jobs.

Both in Japan and Europe, the youth leaving school to search for jobs face a serious risk of being trapped in temporary jobs and unemployment[5]. The difficulty in both regions reflects relative job security and protection given to the permanent workers. Stagnant job creations coupled with limited labor mobility place heavy burden on the new entrants.

2.2 Resilience of the status-quo: long term employment

Even after two decades of low economic growth, the core of the Japanese employment system remain largely intact, although the size of the core employment — employment with long term mutual commitment and relative job security — have shrank considerably. As Kato and Kambayashi (2011) put it, the prolonged stagnation of the economy had strong negative impact on women and lower educated groups, or, "expansion members of lifetime employment" (Kato).

Given the limited scope for downward adjustments of the core employment size, the Japanese firms relied heavily on adjustments in work hours, and also on the dismissals of temporary and part time workers. The single most important change in the overall employment picture in Japan is the steady increase in the share of non-standard (part time and/or temporary) employment. As Kato and Kambayashi argues, it

[5] In Ariga, Kurosawa, Ohtake and Sasaki (2009), we conducted a survey of youth with less than college education and find that the impact of first job after school persists for a long time. The median probability of having regular full time job at age 26 (8 years after high school) is .61 if they had regular full time job at graduation, compared to .27 otherwise.

would be misleading to consider this as a reflection of structural changes in the employment system as the increase of non standard employment is the other side of the same coin, the stability of the core long term employment.

The other side of sluggish employment adjustment, especially the core employment, is the sizable wage adjustments, even nominal wage cuts. Ariga and Kambayashi (2010) investigate the choice of employment and base wage adjustment of the firms under severe distress. Using a unique survey of Japanese firms, they found that downward adjustments, even the base wage cut was indeed used if the target reduction of labor cost is of moderate size. Some firms under distress, especially when faced with the need to reduce labor cost by substantial margin (anything beyond 5%), they did lay off some permanent employees.

Without disputing the fact that indeed in 1990s and onward even major firms did lay off some of their permanent employees, the balance in comparison at least with U.S. experience indicates that the overall rigidity of the core employment remains as the basic feature in Japanese labor market.

The stability of core employment resulted in lower level of new hires, especially from school leavers. Several studies have shown that firms with core employees with long tenure and high average age are less likely to hire school graduates[6]. Thus some view that the job security of mature employees are retained at the cost of depriving school leavers to land on permanent jobs.

The resemblance of the argument with 'insider-outsider' views of the rigidity of European labor market is unmistakable. In both regions, the job security is protected by legal or social barriers against laying off permanent employees. Court precedents effectively rule out discretionary dismissals of regular employees unless the employer can demonstrate that such an extreme action is indispensable for the survival of the firm[7].

At the same time, institutional background as well as underlying mechanism that give rise to the state differ substantially. In the case of Japan, there is little reason or empirical studies suggesting that the job security is the result of the labor union bargaining power, which is often perceived as the major culprit for the excessive protection of insiders in European labor market. Moreover, as we have shown above,

[6] See Genda (2004)

[7] OECD's *EPL* is the popular index used as a proxy for the strength of employment protectionist legislations in each country. The Japan EPL figures is close to the EU15 average reported in *OECD employment Outlook.* Boeri and Garibaldi finds the relaxation of various protection measures in EU accounts for a significant portion of the total decline in unemployment rate during the last decade.

the wage concession by the employee side played significant role in moderating the downward pressure on the employment in Japan, whereas many empirical studies point out that real wage rigidity aggravated the Eurosclerosis.

2.3 Limited labor mobility as (at least a part of) the cause of slow productivity growth

The 'lost decade' in Japan was the period also of depressed metabolism of the economy overall, and labor market is no exception. Of special importance is dwindling rate of start-ups and hence job creations by entry of new firms. There has been some weak recovery in the last few years before the onset of the recession in 2008, but, even that is way too small, even after taking account of the weak over all recovery of the economy. Through several series of important studies to review and analyze the cause of the long stagnation of productivity growth, a consensus is that at least part of the stagnation is attributable to the limited labor mobility[8]. The weak recovery from 2002 until 2007 brought about some recovery also in TFP growth, but studies indicate that the recovery was more of an outcome of employment restructuring. Hence we tend to observe a perverse tendency that sectors with higher TFP growth have lower or negative growth in labor inputs.

The European experience of the limited labor mobility has been also analyzed extensively . van Ark, O'Mahony and Timmer (2008) compares productivity growth in Europe and the United States and find that European growth rate lag behind the US primarily because of the limited impact of ICT, finance and newer service sector in Europe, whereas they do not find any visible impact of Sclerosis. I.e., their estimate shows modest gains from reallocation from labor both in Europe and the US, which as noted above contrasts sharply with the Japanese experience. Using industry-level evidence, Arnold, Nicoletti, and Scarpetta (2008) show that tight regulation in continental EU countries hinder the reallocation of resources toward more efficient firms and thereby gives a negative impact on productivity growth in ICT using sectors.

The very name 'Eurosclerosis' is invented to describe apparently conflicting coexistence of (moderately high) GDP growth and high unemployment rate. According to this view, the limited labor mobility is the cause of high unemployment and (at least partially) responsible for lower productivity growth. Needless to say, different views also exists. For example, Hornstein et al (2007) calibrates a search theoretic model

[8] See, for example, Fukao,Kim, and Kwon (2006), and Miyagawa, Sakuragawa, Takizawa (2006).

of job destruction and show that *high* productivity growth is the *cause* of higher structural unemployment for Europe when it is combined with generous unemployment benefit and expensive firing cost. On the other hand, Pissarides and Vallanti (2007) and Cahuc and Zylberberg (2004) dispute the claim made in Hornstein et al (2007) that creative job destruction is responsible for high unemployment in the presence of decent economic growth. Pissarides and Vallanti use their estimate to argue that GDP growth and unemployment are negatively correlated even after taking account of the short run adjustment in the unemployment. Important, yet controversial, contributions by and Ljunqvist and Sargent (1998) calibrate a search model that features the loss of human capital by laid off workers. They conclude that their calibrated model identifies the generous unemployment benefit combined with increased microeconomic turbulence are jointly responsible for high unemployment.

Boeri and Garibaldi (2008) draw a different picture: they found that the escape from sclerosis was made possible in Europe primarily because of the increased labor turnover, higher hazard from unemployment back to job. On the other hand, the decline in inflows into unemployment has contributed relatively little to the overall decline of EU unemployment rate for the last decade or so. They estimated inflows and outflows of unemployment for EU-15 spanning two decades from mid 1990s to mid 200s shows clearly that the high unemployment is associated with declined labor mobility, and vice versa.

Thus two different views seem to coexist: 'creative job destruction' view asserts that the high unemployment is an outcome of increased mobility, i.e., high unemployment of Eurosclerosis is primarily attributable to higher rate of job destruction, whereas 'stagnation' view considers the lower job creations and lower rate of unemployment escape rate is responsible.

Our own contribution (Ariga and Okazawa 2011) employing a somewhat similar search model calibrated for the lost decade of Japan finds that the increased turbulence in Japan during the lost decade resulted in lower, not higher, labor mobility and lower productivity. The results are largely in line with many empirical studies on the cause of TFP growth slowdown in Japan. We also find that the long run impact of 'turbulence' on unemployment is modest, primarily because of the two factors.

First, Japanese economy now has a large segment of secondary labor market for low paying jobs. Given the limited scope of unemployment benefit and relatively low minimum wage, these low pay jobs are easy to find. As a result, those without regular full time jobs take up these peripheral jobs, rather than being unemployed. Second, relatively heavy investment in training which is largely specific to jobs reduces the labor mobility and enhance the job security. Hence the negative productivity shock results not so much on increased job destructions, but primarily on lower output[9].

In conclusion, it seems fair to say that both Europe in 1990s and Japan now have (had) low labor mobility and likely to suffer from the resulting inefficiency. On the other hand, the underlying factors responsible for low mobility seem rather different: in Japan, it is primarily the reflection of the internal labor market that rewards long term employment and heavy investment in training, whereas in Europe, strict industry regulations and protection of the permanent employees are considered as the prime suspects[10].

2.4 The impasse

Between 1998 and 2008, real GDP of Japan grew at 1.1% per year. The number will look even more dismal if we include the year 2009 and 2010. EU-15 is much better in the GDP growth at 2.3% per year for the same ten year period ending 2008. It is difficult to expect significant departure of the economy from the stagnation which is now two decades in length. Even in comparison with Europe during the 1990s, the situation seems bleaker for Japan now than Europe in the midst of Eurosclerosis.

Just as many policy makers and economists in Europe during the EuroSclerosis found the labor market riddled with institutional rigidities and conflicts, many Japanese policy makers and (some) economists view the current state of the Japanese labor market at the impasse. There is little doubt that the lack of labor mobility hinders or at least greatly slow down the pace of the much needed shifts: shifts from declining to growing industries, and also from lower productivity to higher productivity sectors. On the other hand, given the extremely low job creation rates (which is also highly stable around 3.5% for the last two decades or so), there does not seem any miracle cure to increase labor mobility. After all, at least some part of the seniority related wage structure does reflect the productivity enhancement due to training and experience which are largely specific to the firms.

[9] One important concern on high unemployment in Europe is the deterioration of human capital due to extremely long unemployment duration. A related concern for the Japanese labor market is that the recent increase of temporary and part time jobs among the youth may have strong negative impact in the long run as most of these low pay jobs do not provide training and considered dead end,

[10] As we already noted above, one common factor found in both Europe and Japan might be social and judicial protections against dismissals of permanent employees. On the other hand,Ariga and Okazawa [2011] finds the impact of firing regulations to be rather insignificant in curtailing labor mobility in Japan.

We believe that at the root of the impasse is the system of recruiting school leavers. In a sense, the current Japanese employment is an outcome of the recruiting decision made in the last three or four decades. As such, the system has enormous built-in inertia. If there is any bright side of the two decades of the stagnant economy, the system has shown surprising resilience: the fact still remains that the unemployment rate is still barely over 5%.

3 A labor market model with heterogenous workers and training

The main objective of the model analysis in this and the next section is to provide a coherent framework in which we can identify the interactions between different segments of the labor market, focusing on the trade-off between worker quality and experience.

In this section, we lay out base model and then build two model economies, which is meant to capture the key differences in Europe in Eurosclerosis and current Japan after two decades of stagnation.

3.1 Building blocks

The economy is populated by a unit mass of workers. At each point in time, d of workers retire and replaced by the new entrants of the same size. Although extremely simplified, constant inflows of school leavers and retirement outflows are represented by this assumption. The workers are composed of two types, H and L. They differ only in their innate productivity, e_j with

$$e_H > e_L$$

We denote by β_j^0 the constant population share of type $j(=H,L)$ workers.

We assume that the output of a job slot employing a type j worker is given by

$$\begin{aligned} y &= q^i(e_j + x), \\ i &= S, G \end{aligned}$$

with x being a random draw from a known probability distribution, $F(x)$, and, q^i is the job productivity which depends upon the type of training given to the worker.

We consider two types of training, general and firm specific. The latter training is tailored for idiosyncrasy of individual jobs so the impact on productivity is larger than general training.

$$q^S > q^G$$

We assume both types of training incurs c. The advantage of general training is just that, it is general and the effect of training applies equally to other firms adopting general training. On the other hand, specific training is assumed useless once a worker is separated from the trained job. Thus, a worker needs to be re-trained when he is matched to a new job, irrespective of the training type at the new job. Moreover, we assume that no output is produced if a worker is not trained.

We assume that posting a vacancy costs k per unit of time. The matching process is standard. Denote by m the size of the match per unit of time. Assuming linear homogeneity of the matching function, we have

$$\begin{aligned} m &= m(u, v) \\ &= u\psi(\theta) = v\phi(\theta), \\ \theta &\equiv \frac{v}{u}, \\ \psi'(\theta) &> 0, \phi'(\theta) < 0 \end{aligned}$$

wherein u,and v are number of job searchers and posted vacancies, and θ is the ratio of the two, known as the labor market tightness. We assume that the employed workers do not search so that job searchers and unemployed workers are synonymous. Crucially, we assume that matching is random in the sense that job slots cannot restrict the matching to a particular type of workers.

On the other hand, we assume that worker types can be observed once a worker is matched to a job slot. Hence the employment contract can be made contingent upon the worker type .Finally, the analysis that follows is limited to the steady state.

3.2 Wage posting and competition in search market

We assume that each job searcher can choose the job slot that they apply. Each job slot posts its wage and other payoff relevant information. Firms posting offers are able to fully commit to the posted offers. One twist of our model is that worker types are unobservable in the search market. Thus unless workers self select into different types of jobs, employers cannot exclude particular types of workers[11]. On the other hand, we assume that the past work experience of individual workers is publicly

[11] When we allow heterogenous job slots to be posted, different types of workers may self select and the worker type may be revealed. See our discussion in Appendix.

available information. Hence, the search market is divided only in terms of the past work experience. Thus workers with different types are mixed in both markets. We assume, however, upon matching, the worker type is revealed. Therefore the posted contract between the employer and the worker can be made contingent upon the worker type.

Given these assumptions, a wage offer is given as

$$w = w_j^s(x)$$

wherein j is worker type, $s(=U,T)$ denotes the work experience, and x is the match specific productivity, drawn randomly from $F(x)$ for each match. In the model of competitive search, posted vacancies compete against each other to attract job searchers to apply. At equilibrium, vacancies can expect to attract strictly positive (expected number of) job applicants if and only if their offer has the highest returns from search. Therefore, the expected returns from search $[\omega]$ for each type of workers are equated across vacancies in each sub-market. At such an equilibrium, each vacancy treats this market 'price' of job applicants as given and maximize the profit by choosing the expected number of job applicants, i.e., the market tightness ratio, θ. In what follows, we show how θ and ω are determined in each sub-market (U,T) for each type of workers (H,L).

3.2.1 Workers

The procedure we use for solving the equilibrium is standard. We build Bellman equations that determine asset values of workers and job slots with or without partners. We start with workers. There are two sub-markets, depending upon the work experience. We denote by superscript U for sub-market for workers without past work experience, and by T for those with past work experience. If the training is general (type G), workers with past work experience do not need re-training. We have

$$rU_j^U = \psi(\theta^U) \int_{x_j^U} \left[\left(E_j(x) - U_j^U \right) \right] f(x)dx - dU_j^U, \tag{1}$$

$$rE_j(x) = w_j^U(x) - dE_j(x) - \delta \left(E_j(x) - U_j^T \right), \tag{2}$$

$$j = H, L \tag{3}$$

wherein U_j^U denotes the asset value of an unemployed worker of type j without training, and U_j^T for the trained workers[12]. Similarly, $E_j(x)$ is the asset value of an employed worker of type j with match specific

[12] We ignore the unemployment benefit in the model analysis that follows. In model calibrations in the next section, we incorporate unemployment benefits.

productivity draw x. δ is the probability of exogenous separation. The first Bellman equation states that the required rate of return, rU_j^U, equals the expected flow benefits on the right hand side of the equation. Its first term is the expected capital gain from the match given by the probability of match $(\psi(\theta^U))$ times the expected gain from employment. Notice two types of workers are pooled in the market so they face the same matching probability. The match is formed if and only if the draw of the match specific productivity is not smaller than the threshold, x_j^U which we will determine later on. The second term is the capital loss due to retirement which occurs with probability d. The second equation is for the asset value of the employed workers. The expected return is equal to the wage minus capital loss which occurs due to retirement or exogenous separation, which occurs with probability δ. Note that a worker separated from the job becomes unemployed, but with the past work experience, hence his asset value becomes U_j^T.

Similarly for the trained workers, we have

$$rU_j^T = \psi(\theta^T) \int_{x_j^T} \left[\left(E_j(x) - U_j^T \right) \right] dF - dU_j^T, \tag{4}$$

$$rE_j(x) = w_j^T(x) - dE_j(x) - \delta \left(E_j(x) - U_j^T \right), \tag{5}$$

We can rewrite asset equations for the unemployed and obtain

$$(r+d)U_j^U \equiv \omega_j^U = \psi(\theta_j^U) \int_{x_j^U} \left[\left(E_j(x) - U_j^U \right) \right] dF,$$

$$(r+d)U_j^T \equiv \omega_j^T = \psi(\theta_j^T) \int_{x_j^T} \left[\left(E_j(x) - U_j^T \right) \right] dF$$

The expected returns from search ω_j^s plays the role of market price as workers compare ω_j^s and choose the vacancy with the highest expected return. We have

$$R\omega_j^T = \psi(\theta^T) \int_{x_j^t} \left[w_j^T(x) - \omega_j^t \right] dF \tag{6}$$

Similarly, for the untrained workers, we obtain

$$R\omega_j^U = \psi(\theta^U) \int_{x_j^t} \left[w_j^U(x) - \omega_j^U + \frac{\delta(\omega_j^T - \omega_j^U)}{r+d} \right] dF \tag{7}$$

3.2.2 Job vacancies

The job vacancies side are also standard. We start with the job slot for the untrained workers.

$$rV_j^U = \phi(\theta^U) \int_{x_j^U} \left[J_j^U(x) - V_j^U - c\right] dF - k \tag{8}$$

wherein we assume (without the loss of generality) that the training cost is incurred upon the employer[13]. Similarly for job slots for the trained workers, we have

$$\begin{aligned} rV_j^T &= \phi(\theta^T) \int_{x_j^U} \left[J_j^T(x) - V_j^T - D^i c\right] dF - k, \\ D^G &= 0, D^S = 1 \end{aligned} \tag{9}$$

wherein re-training cost depends upon the type of training. On the other hand the value of a filled job (J_j^s) is given by

$$\begin{aligned} rJ_j^s(x) &= q(s)(e_j + x) - w_j^s(x) - (d+\delta)(J_j^s(x) - V_j^s), \\ s &= U, T \end{aligned}$$

3.2.3 Competitive search equilibrium (Euro model)

The expected returns from search for unemployed workers are reproduced below.

$$R\omega_j^T = \psi(\theta^t) \int_{x_j^t} \left[w_j^T(x) - \omega_j^T\right] dF$$

$$R\omega_j^U = \psi(\theta^U) \int_{x_j^t} \left[w_j^U(x) - \omega_j^U + \frac{\delta(\omega_j^T - \omega_j^U)}{r+d}\right] dF$$

Suppose that β_j^s of the job searchers are type j in market $s(= T, U)$. The returns from creating a vacancy and the value of a filled job jointly satisfy the following.

$$\begin{aligned} rV^s &= \phi(\theta^s) \left(\beta_H^s \int_{x_H^s} \left[J_H^s(x) - V_j - c(s)\right)\right] dF + \beta_L^s \int_{x_L^s} \left[J_L^s(x) - V^s - c(s)\right)\right] dF \right) - k, \\ c(U) &= c, c(T) = D^i c, \\ rJ_j^s(x) &= q(e_j + x) - w_j^s(x) - (d+\delta)\left[J_j^s(x) - V^s\right] \end{aligned}$$

[13] Posted wage rate can be freely adjusted to re-allocate (if necessary) training cost to the employee. See Moen and Rosen (2004).

We have

$$(J_L^s(x) - V^s) = \frac{q(e_j + x) - w_j^s(x) - rV^s}{R}$$

We use the value functions for the workers to get

$$\psi(\theta^T)\int_{x_j^t} w_j^T(x)dF = R\omega_j^T + \psi(\theta^t)\int_{x_j^t} \omega_j^T dF,$$
$$\psi(\theta^U)\int_{x_j^n} w_j^U(x)dF = R\omega_j^U + \psi(\theta^U)\int_{x_j^n} \left[\omega_j^U - \frac{\delta(\omega_j^T - \omega_j^U)}{r+d}\right] dF$$

Inserting these expressions into (8) and (9), we have

$$\begin{aligned}
rV^U\theta^U = {} & \psi(\theta^U)\beta_H^U \int_{x_H^s} \left[\frac{q(e_H + x) - \omega_H^U - rV^U}{R} - c + \frac{\delta(\omega_H^T - \omega_H^U)}{r+d}\right] dF \\
& + \psi(\theta^U)\beta_L^U \int_{x_L^s} \left[\frac{q(e_L + x) - \omega_L^U - rV^U}{R} - c + \frac{\delta(\omega_L^T - \omega_L^U)}{r+d}\right] dF \\
& - \beta_H^U\omega_H^U - \beta_L^U\omega_L^U - k\theta^U, \\
rV^T\theta^T = {} & \psi(\theta^T)\beta_H^T \int_{x_H^s} \left[\frac{q(e_H + x) - \omega_H^T - rV^T}{R} - D^i c\right] dF - \beta_H^T\omega_H^T \\
& + \psi(\theta^T)\beta_L^T \int_{x_L^s} \left[\frac{q(e_L + x) - \omega_L^T - rV^T}{R} - D^i c\right] dF - \beta_L^T\omega_L^T - k\theta^T, \\
& D^G = 0, D^S = 1
\end{aligned}$$

As we stated above, at the competitive search equilibrium, each job slot takes ω_j^s as given. The model is closed by imposing two equilibrium conditions. First, at equilibrium, creating vacancy cannot generate positive profit. Thus, the zero profit condition implies

$$V^s = 0,$$
$$s = U, T$$

The second condition is that each vacancy optimally choose the market tightness (θ^s) to maximize the asset value of vacancy, treating as given the expected returns from search for each type of worker in each submarket[14]. The optimal choice of the tightness is obtained by

$$\frac{\partial V^s}{\partial \theta^s} = 0$$

[14] The gist of the underlying idea is the following. In competitive search equilibrium, each worker can select the vacancy to apply. Each vacancy post all the payoff relevant information as the employment contract, to which employers are assumed

Thus we have

$$\psi'(\theta^s)\Omega_s = k$$

$$\begin{aligned}\Omega_U = & \beta_H^U \int_{x_H^U} \left[\frac{q(e_H+x)}{R} - c + \frac{\delta(\omega_H^T - \omega_H^U)}{r+d}\right] dF \\ & + \beta_L^U \int_{x_L^U} \left[\frac{q(e_L+x)}{R} - c + \frac{\delta(\omega_L^T - \omega_L^U)}{r+d}\right] dF, \\ \Omega_T = & \beta_H^T \int_{x_H^T} \left[\frac{q(e_H+x)}{R} - D^i c\right] dF + \beta_L^T \int_{x_L^T} \left[\frac{q(e_L+x)}{R} - D^i c\right] dF\end{aligned}$$

and

$$\psi(\theta^s)\Omega_s = k\theta^s + \beta_H^s \omega_H^s + \beta_L^s \omega_L^s$$

Putting these to together, we have

$$\begin{aligned}\gamma k \psi(\theta^s) = & \psi'(\theta^s)\left(\beta_H^s \omega_H^s + (1-\beta_H^s)\omega_L^s\right), \qquad \text{(FOCP)} \\ \gamma \equiv & \frac{\psi(\theta^s) - \theta^s \psi'(\theta^s)}{\psi(\theta^s)}\end{aligned}$$

Notice that the equation above determines the equation. value of θ in market s as an increasing function of β_H^s, the share of the type H workers. Putting this condition back to (6) and (7), we have

$$\omega_j^U = \gamma\psi(\theta^U) \int_{x_j^U} \left(\frac{q(e_j+x) - \omega_j^U}{R} - c + \frac{\delta(\omega_j^T - \omega_j^U)}{r+d}\right) dF, \qquad (10)$$

$$\omega_j^T = \gamma\psi(\theta^T) \int_{x_j^U} \left(\frac{q(e_j+x) - \omega_j^T}{R} - D^i c\right) dF \qquad (11)$$

Thus the worker receives γ of the surplus generated from the match, a result known as Hosio's law[15].

Note that the shares of type H workers in two markers $[\beta_H^s]$ are endogenous variables. To solve for these shares, we compute the steady state employment and unemployment shares . The results are:

able to commit. Thus, in order to induce workers to apply for a vacancy, the firm must offer the maximum expected returns from search (ω_j^s) in each sub-market for each type of workers. Hence all the active vacancies in each sub-market must guarantee this market return. As far as a job slot offers this market value, it can attract as many expected number of job applicants as they choose.

[15] If you prefer, the identical equilibrium can be obtained by employing conventional Nash bargaining solution for wage determination using γ as the surplus share given to workers.

$$u_j^U = \frac{d\beta_j^0}{d + \psi(\theta^U)(1 - F(x_j^U))}, \tag{12}$$

$$u_j^T = \frac{\delta\beta_j^0\psi(\theta^U)(1 - F(x_j^U))}{(d + \delta + \psi(\theta^T)(1 - F(x_j^T)))\left[d + \psi(\theta^U)(1 - F(x_j^U))\right]}, \tag{13}$$

$$m_j = \frac{\beta_j^0\psi(\theta^U)(1 - F(x_j^U))\left[d + \psi(\theta^T)(1 - F(x_j^T))\right]}{(d + \delta + \psi(\theta^T)(1 - F(x_j^T)))\left[d + \psi(\theta^U)(1 - F(x_j^U))\right]} \tag{14}$$

Thus we have

$$\frac{\beta_H^U}{1 - \beta_H^U} = \frac{u_H^U}{u_L^U} = \frac{\left(d + \psi(\theta^U)(1 - F(x_L^U))\right)\beta_H^0}{\left(d + \psi(\theta^U)(1 - F(x_H^U))\right)(1 - \beta_H^0)} < \frac{\beta_H^0}{(1 - \beta_H^0)} \tag{15}$$

the inequality follows from the fact that

$$x_H^s < x_L^s$$

Similarly, we have

$$\frac{\beta_H^T}{1 - \beta_H^T} = \frac{u_H^T}{u_L^T} = \frac{u_H^U}{u_L^U} \cdot \frac{(1 - F(x_H^U))(d + \delta + \psi(\theta^T)(1 - F(x_L^T)))}{(1 - F(x_L^U))(d + \delta + \psi(\theta^T)(1 - F(x_H^T)))} \tag{16}$$

Under the assumption[16]

$$\frac{(1 - F(x_H^U))(d + \delta + \psi(\theta^T)(1 - F(x_L^T)))}{(1 - F(x_L^U))(d + \delta + \psi(\theta^T)(1 - F(x_H^T)))} > 1 \tag{17}$$

The share of type H workers are smaller than population share at the market for the trained, and even smaller at the market for the untrained.

Thus we have

$$\beta_H^0 > \beta_H^T > \beta_H^U$$
$$\omega_j^T > \omega_j^U$$

Therefore, (focp) implies

$$\theta^T > \theta^U$$

[16] In the calibrations reported in the next section, this condition is always satisfied. We suspect that this always holds at equilibrium, but, have not been able to prove the claim.

Lemma 1 *The competitive search equilibrium with pooling of worker types is given by the following set of equations.*

$$
\begin{aligned}
\gamma k \psi(\theta^s) &= \psi'(\theta^s)\left(\beta_H^s \omega_H^s + (1-\beta_H^s)\omega_L^s\right), \\
& s = U, T \\
\omega_j^U &= \gamma\psi(\theta^U)\int_{x_j^U}\left[\frac{q(e_j+x)-\omega_j^U}{R} - c + \frac{(\omega_j^T-\omega_j^U)}{r+d}\right]dF, \\
\omega_j^T &= \gamma\psi(\theta^T)\int_{x_j^T}\left[\frac{q(e_j+x)-\omega_j^T}{R} - D^i c\right]dF, \\
\frac{\beta_H^U}{1-\beta_H^U} &= \frac{\left(d+\psi(\theta^U)(1-F(x_L^U))\right)\beta_H^0}{\left(d+\psi(\theta^U)(1-F(x_H^U))\right)(1-\beta_H^0)}, \\
\frac{\beta_H^T}{1-\beta_H^T} &= \frac{u_H^U}{u_L^U}\cdot\frac{(1-F(x_H^U))(d+\delta+\psi(\theta^T)(1-F(x_L^T)))}{(1-F(x_L^U))(d+\delta+\psi(\theta^T)(1-F(x_H^T)))}, \\
x_j^U &= \frac{\omega_j^U + Rc - \frac{(\omega_j^T-\omega_j^U)}{r+d}}{q} - e_j \\
x_j^T &= \frac{\omega_j^T + RD^i c(s)}{q} - e_j, \quad j = L, H
\end{aligned}
$$

If (17) is satisfied, the solution satisfies:

$$
\begin{aligned}
\theta^T &> \theta^U, \\
\omega_H^s &> \omega_L^s, \\
\omega_j^T &> \omega_j^U, \\
\beta_H^0 &> \beta_H^T > \beta_H^U
\end{aligned}
$$

The pooling equilibrium is comprised of two markets which differ in worker quality and training. In *both dimensions*, unemployed workers with the past training are better. Not only their past work experience save training cost, but they are on average higher quality. This is in reflection of the simple fact that they have been employed and received training elsewhere, as a result of (noisy) selection reflecting both match specific productivity (luck) and the worker quality. Thus in this highly stylized model of the European labor market, school leavers face uphill battle. Not only they are statistically discriminated due to the fact that they have never been employed, but also the lack of the past training place them at added disadvantage.

3.3 Labor market for the school graduates (Japan model)

Consider now what happens if the institutional set up insulates a part of market participants from the rest: a market accessible only to those who have never been matched to an employer before. This is our model equivalent of the market for school graduates. There will be three sub-markets, E, U and T. E is the marker for school leavers: workers who have never been matched to a job before. We assume that school leavers have only one chance: as soon as they are matched to a vacancy, he is disqualified from being a new graduate. Thus if they are not successful in the first match, they need to search for the job in U market, the sub-market for those without training but have been matched to a firm in the past. T is the market for the trained workers. We continue to assume that each sub market is pooled in the sense that both types of workers are mixed.

We skip the lengthy derivations of the competitive search equilibrium in this setting as they are analogues to the preceding cases. The optimal condition for the tightness ratio for each sub-market is given by

$$k\gamma\psi(\theta_l) = \psi'(\theta_l)\left(\beta^l_H\omega^l_H + (1-\beta^l_H)\omega^l_L\right), \qquad l = E, U, T \tag{FOCE}$$

$$\omega^E_j = \gamma\psi(\theta^E)\int_{x^E_j}\left[\frac{(q(e_j+x)-\omega^U_j}{R} - c + \frac{\delta(\omega^T_j-\omega^U_j)}{r+d}\right]dF - \gamma\psi(\theta^E)(\omega^E_j-\omega^U_j), \tag{18}$$

$$\omega^U_j = \gamma\psi(\theta^U)\int_{x^U_j}\left[\frac{q(e_j+x)-\omega^U_j}{R} - c + \frac{\delta(\omega^T_j-\omega^U_j)}{r+d}\right]dF, \tag{19}$$

$$\omega^T_j = \gamma\psi(\theta^T)\int_{x^T_j}\left[\frac{q(e_j+x)-\omega^T_j}{R} - D^i c\right]dF, \tag{20}$$

$$x^E_j = x^U_j = \frac{\omega^U_j + Rc - \frac{(\omega^T_j-\omega^U_j)}{r+d}}{q} - e_j, \tag{21}$$

$$x^T_j = \frac{\omega^T_j + RD^i c(s)}{q} - e_j, \quad j = L, H \tag{22}$$

wherein the ratio of two types of workers in each sub market is given by

$$\frac{\beta_H^E}{1-\beta_H^E} = \frac{\beta_H^0}{1-\beta_H^0}, \tag{23}$$

$$\begin{aligned}\frac{\beta_H^U}{1-\beta_H^U} &= \frac{\beta_H^E}{(1-\beta_H^E)} \cdot \frac{F(x_H^U))}{F(x_L^U))} \times \\ &\quad \frac{(d+\psi(\theta^U)(1-F(x_L^U)))}{(d+\psi(\theta^U)(1-F(x_H^U)))} \\ &< \frac{\beta_H^E}{(1-\beta_H^E)},\end{aligned} \tag{24}$$

$$\begin{aligned}\frac{\beta_H^T}{1-\beta_H^T} &= \frac{\beta_H^U}{1-\beta_H^U} \times \frac{F(x_L^U))}{F(x_H^U))} \times \\ &\quad \frac{(1-F(x_H^U))}{(1-F(x_L^U))} \cdot \frac{\left[d+\delta+\psi(\theta_T)(1-F(x_L^T))\right]}{\left[d+\delta+\psi(\theta_T)(1-F(x_H^T))\right]}\end{aligned} \tag{25}$$

Again, if we assume[17]

$$\frac{F(x_L^U))(1-F(x_H^U))}{F(x_H^U))(1-F(x_L^U))} \cdot \frac{\left[d+\delta+\psi(\theta_T)(1-F(x_L^T))\right]}{\left[d+\delta+\psi(\theta_T)(1-F(x_H^T))\right]} > 1 \tag{26}$$

We have

$$\frac{\beta_H^U}{1-\beta_H^U} < \frac{\beta_H^T}{1-\beta_H^T} < \frac{\beta_H^E}{1-\beta_H^E} \tag{27}$$

and we get

$$\theta^E > \theta^T > \theta^U \tag{28}$$

Intuitively, the results are easy to understand: in market E, two types of school leavers face exactly the same matching probability. The outcome of the match differs, however, so that type H workers are more likely to succeed in the first match. Since they leave the market anyway once they are matched, the mix of two types remain unaltered at the population average, β_j^0. Since U market is populated with workers who did not succeed in the previous matches, the average quality is the lowest. It is interesting to note that once matched to a job slot, the threshold level of x is exactly the same in E and U sub-markets. This is due to the once-and-for-all nature of the E market. Once matched, school leavers expect that they have to move to U market in the event of the failure. Hence their default option is ω_j^U, not ω_j^E.

[17] Similar to (17) above, we find that this condition is always satisfied in calibrations. This restriction always holds if (17) holds. Again, we suspect, but have not proven that this inequality always hold.

Naturally, sub-market U has the lowest average quality and lowest ratio of vacancy per job searchers (θ^U). The job searchers with the past training experience is in between these two sub-market.

It is interesting to note that in this equilibrium, the quality and work experience do not match. If we place the emphasis on the worker quality, it is the E market that you should search, whereas the work experience is more valued, then T market is the best choice. In both accounts, workers in U market are adversely selected: they tend to be low quality and without past work experience. As a matter of fact, the fear that you end up searching for job in U market that drives the job searchers in E market to be as accommodative as possible.

Assuming that the training is totally specific, then, the overall picture of the toy Japan economy differs sharply from the toy European economy.

In toy Japanese economy, the past work experience is not valued per se because the past training is useless at a new job. It only signals the average quality of workers. Because of the market segmentation and training specificity, this toy labor market cares only about the worker quality. Naturally, the workers have the best chance when they leave the school. The fear that they will be adversely selected in the untrained market lowers their reservation level of match specific productivity. This makes workers in E market doubly attractive for potential employers.

3.4 Interactions between market for school leavers and choice of training

Before we get into comparisons of the two toy labor markets, we consider the interactions between training types and the labor market settings. We assume that in toy European economy all the jobs adopt general training, and in the toy Japanese economy, all the jobs adopt specific training. In Appendix, we consider explicitly the choice of training types when each job slot is free to choose between the firm specific and general training.

Without getting into technicalities, we make three observations. First of all, the presence of the market for school graduates favors firm specific training. This is the case as far as the firm specific training improves job productivity more than general training. The reason is simple: the impact of training is larger on type H workers than type L. Hence the returns from quality is higher if training is specific. Since the market for school leavers is the best in terms of quality, this feature places an advantage on the firm specific training.

Second, if we allow each job slot to choose from two types of training, there are two additional types of equilibria, on top of the two which we focused: all firms adopting firm specific training (Japan), and all firms adopting general training (Europe). Two other types of equilibrium is possible, depending upon configurations of parameters. First, a separating equilibrium in which type H workers choose firm specific training, and type L workers choose general training. In this equilibrium, training types perfectly sort out two types of workers. There exists another type of equilibrium, a mixed equilibrium in which some of type L workers apply to general training, yet, other type L workers choose specific training. Thus, in general training jobs, we have only type L workers, whereas in specific training jobs, both types are mixed.

The last point is the interaction between the market for school leavers and types of training. In Appendix, we show that the market for school leavers lose its significance in two other types of market equilibrium. To see why, recall that the only meaningful distinction between market E and U are in the mixtures of worker types. E market has higher share of type H workers. In two other equilibrium, this difference disappears and the school leavers do not find it advantageous to search in E. The role of the market for school leavers is essentially a (noisy) screening device. If worker types are revealed in the types of jobs they apply, the market for school leavers lose its substance. The presence (or the absence) of the market for school leavers has substantive influence on the labor market outcome only in two leading cases we consider in the main text: EU type economy with all general training, and Japan with all specific training, as two types of workers are mixed in all sub markets.

4 Comparing two toy economies

4.1 Base calibration results

In this section, we compare two hypothetical economies representing key features of Europe and Japan. The major features of two model economies are shown in Table 1. As we discussed above, we have three sub-markets in Japan labor market, E for the school leavers, U for the untrained workers (school leavers who failed in the past matches), and T is the sub-market for the trained, i.e., those who worked at different firms in the past but separated. In the European labor market, only U and T markets exist and school leavers start their job search in U.

The jobs in Japan adopt firm specific training. Thus, the past work experience is not valued per se as they need to incur the full cost of specific training at each new job. Nevertheless, the fact that they have work experience in the past distinguish themselves from those in sub market U, where those who failed in the past matches continue to search for the job. The difference in training types results in different job productivity and we assume that specific training enhances job productivity more than general training (otherwise, there should not be any reason to adopt specific training which is useless at other firms). In line with the fact that school leavers search for jobs *before* they finish schools, we assume that they are not eligible for unemployment benefit. The same should apply for workers in U markets in both regions if the benefit represented by b covers only the unemployment insurance. On the other hand, in many countries other types of assistance to the unemployed workers are available even to workers without past work experience[18]. Thus we consider two sub-cases below depending upon the availability of b to untrained workers.

Table 2 summarize the bench mark parameter specifications. On top of the selection of training types and sub market compositions, we distinguish two economies in the two details of specifications. First, the unemployment benefits. We use 2.25 for the Europe and 1.5 for Japan. As we will see below, these figures give the unemployment benefit replacement ratios roughly in line with empirical estimates for the two regions[19].

We also exclude school leavers from the unemployment insurance in Japan as they are modeled as searching for jobs while in school. We also distinguish two economies in terms of exogenous separation rate, 4% in Europe[20] and 2% for Japan. Finally, in line with the difference in training type, we set q (job productivity) to be higher in Japan than Europe by 10%.

Table 3 compares two model economies at baseline specifications. Our base line results assume that all workers except those in E market in Japan receive unemployment benefits. The figures in the square brackets show the results when we exclude those workers in U markets from unemployment benefits.

Although we should not read too much into these figures, the over all characterizations of two model economies are supposed to capture the key differences in Europe during the 1990s and Japan now. By far the most outstanding difference is in unemployment rate, about 11% for Europe model economy, and 5.6% for Japan model economy. If we exclude job searchers in E market (as they are representing students searching for jobs), the figure is close to 4%, about the average unemployment rate

[18] See Tatsiramos (2006) for Europe. For unemployment insurance and other benefits in Japan, see ** for details. The most important point about UI benefits in Japan is its length: the maximum coverage is one year. This places Japan as the country with one of the lowest replacement ratio.

[19] See, for example, Blanchard (2004).

[20] See Boeri and Garibardi (2009) for Europe, and Genda, Ohta and Teruyama (2008) for Japan.

in the last two decades. Three major factors account for the difference. First, the difference in exogenous separation rates. Second, unemployment benefit is more generous in Europe than Japan. At the bench mark values, the replacement for Europe relative to average wage income is .28-.48, whereas the ratio is .17-.26 for Japan.

The presence of the market for school leavers help reduce the unemployment rate as the market attract more vacancies per job searcher than in any other market, reflecting the premium attached to the average high quality of workers in the market.

The job finding rate, or the hazard rate out of unemployment to employment are shown in second to fourth rows. The difference across worker types and across two economies are easy to interpret. Naturally type H workers are more likely to find a job, irrespective of the market they search. Yet, it is by far the market E that offers the highest probability. If you lose the chance in E market, the situation deteriorates dramatically. In Japan case, the prospects for the trained workers fall in between two sub markets. In Europe model, trained workers fare better as expected. These differences across sub markets reflect the differences in the type mixtures. The U market in Japan has the lowest share of type H market, followed by the European counterpart. The difference is that school leavers enter E market first, whereas in Europe, they have to compete with past school leavers who did not succeed in the previous matches.

The last three rows of the table reports returns from search in respective sub-market and worker types. Returns are uniformly higher in Japan than in Europe. Indeed, with lower separation rate and unemployment benefits, specific training offer higher returns for every worker.

When we compare the base results with those in square brackets, the results are qualitatively the same for Europe. As the untrained workers are excluded from the benefits, unemployment rate is lower in Europe model. The difference between untrained and trained now reflects also the difference due to the eligibility for unemployment benefits. Since the exclusion lowers the reservation values, untrained workers are more willing to accept employment with lower match specific productivity. Hence the difference in job finding rates between U and T shrinks. In Japan model, however,the job finding rate for school leavers *declines*. In the baseline case, the reservation productivity for school leavers is lower than those in U because of the difference in the eligibility for the benefits. If those in U markets are also excluded, then, this wedge disappears. In the base line case, school leavers looked doubly attractive for employers: they are of highest average quality, yet lower reservation wage because they are not covered by unemployment benefit. When

U market is excluded from the benefits, this second wedge disappears. Hence lower job finding rate for the school leavers. As a matter of fact, as far as we include school leavers as a part of unemployment, then the unemployment rate is somewhat *higher* when U market is excluded from benefits. This reflects the increase in job searchers in E. When they are excluded, unemployment rate decreases from 3.97 to 3.66%, as we expect.

All in all, we believe that results summarized in Table 4 capture the main characteristics of two model economies: the school leavers in Japan clearly benefit from having E market for themselves, avoiding mix up with workers who failed in the past matches. The effect of E market, together with lower unemployment benefit and lower separation rate generates a much lower unemployment in Japan model.

4.2 Long run impact of negative productivity shock

Figures 1 and 2 show the two key differences between Europe and Japan. We plot the job productivity (q) on horizontal axis and unemployment rate in Figure 1. Both are normalized by the bench mark values shown in Table 2. The same proportional change in long run productivity induces rather different impacts on unemployment. The impact on unemployment rate is much larger in Europe than in Japan. As we vary productivity from 1.62 to 1.98, the unemployment rate varies from 11.9 to 10.5%, the elasticity is about .6. In Japan model, as we vary q from 1.8 to 2.2, the unemployment rate varies from 5.3% to 5.7%: the elasticity is about .26. On the other hand, Figure 2 compares the impact on average wage income. It is significantly larger in Japan. Calibration results also show that the impact of changes in unemployment benefit is larger in Europe than in Japan. This reflects the fact that those in E market are not covered by unemployment benefit. As the E market plays key role in the labor turnovers in Japan, it is not surprising that the impact of unemployment benefits is limited in Japan. [Recall the counter-intuitive results in E market between two cases in Table].

The difference appears also in the job finding rate, an annual probability of unemployment to employment transition. Figure 3 shows clearly that the market for school leavers in Japan is far less responsive to the productivity change than the market for untrained workers in European model economy.

One of the reasons is the difference in unemployment benefits as the they raise the floor of earnings so that the variations in the surplus from a match become proportionately larger. But it is not the whole story. Because of the specificity of training, the labor mobility in Japan is much less responsive to changes in productivity, thus the impact is heavier on income than on unemployment rate.

The impact is strongest for the trained workers (not shown), then untrained workers is the second, and the school leavers is the least affected. This applies also to Europe model as well: the impact is stronger for the trained, than the untrained. The underlying reasoning is easy to see. The impact of productivity on job finding rate for the trained workers are sum of the direct impact on the returns from search and composition effects through the impact on the share of type H workers. The share of type H workers is higher if productivity is higher. Both favorable impacts of productivity increase reinforce each other and induce a major change in the composition of employment. Thus the favorable impact of productivity improvement on job finding rate is more on type L, than type H. To put it differently, the model predicts that the negative productivity shock hits harder for type L, and also for the trained workers.

The effect of training cost and the specificity plays an important role in labor turnover. Although we do not model microscopic turbulence, we show the calibrations results in our companion paper [Ariga and Okazawa forthcoming] reproduced here as Table 4. Table 4 shows the impact of increased permanent negative productivity shocks which occur with some probability to individual jobs. Filled jobs hit by the shock now has permanently lower productivity. Since it is idiosyncractic shock, workers can quit the job and search for the job which has not been hit by the shock. The results in Table 4 show that the specificity of training substantially reduces the worker mobility. Hence the impact on unemployment is modest but the impact on income and output are larger. The second column shows the impact of the same change when the re-training cost is reduced to a half of the bench mark case. The unemployment rate increases, and, at the same time, the turnover rate increases and the negative impact on output is reduced.

In a nutshell, these numerical examples show more or less what we expected. Most importantly, we have shown that the long run impact of productivity change on unemployment is far more pronounced in Europe than in Japan, whereas the opposite holds for the impact on income. The job finding rate, or the hazard rate from unemployment, is also shown to be far more sensitive to productivity change in Europe, especially so among the lower productivity types.

Thus the message is clear. In Japan, the model predicts no dramatic increase in unemployment or sharp increase in unemployment duration in the event of negative productivity shock. The shock is absorbed mostly by the decline in wage. This is largely the same finding in the calibration exercises in Ariga and Okazawa (forthcoming). In a manner of speaking, the great recession in Japan had devastating impacts on many dimensions of the economy, but they are not nearly as visible in the labor market compared to what Europe experienced in 1980s to 1990s. No explosion of unemployment. The shock instead imploded inside the firms as major wage concessions. Our calibrated model here reproduce the underlying mechanism of implosion. The negative productivity shock results in a large reduction in output and wage, but not in massive unemployment[21].

4.3 Japanese labor market with EU characteristics

What would happen to the Japanese labor market if Japan repeats the experience of Europe in 1990s? One very crude way to answer this question is to re-calibrate the Japanese labor market model using parameters that we used for Europe in the baseline case. We retain the two key features: E market and specific training in Japan. To put this experiment differently, the results below is also our crude prediction on what will happen to Europe if they set up the market for school leavers and adopt firm specific training.

The results are in Table 5. Not surprisingly, the unemployment rate increases by 1.6% to 7.1%, which is still almost 4% lower the European figure. Other indicators show that the difference between two regions shown in baseline results are largely driven by two key features: the market for school leavers and firm specific training. This is most clearly seen in the job finding rates. In this hypothetical economy, the job finding rates in E market are even higher than corresponding Japanese figures in the base line model. This somewhat paradoxical result is due to two factors. Higher unemployment benefits widens the gap between E and U markets. Because of larger unemployment benefits applicable to workers in U, school leavers have threshold productivity level even lower than the comparable workers in U market. This makes school leavers to accept offers that even workers in U market reject. Because of higher level of output, wage incomes are largely the same as in baseline results for Japan. The substantial increase in unemployment is due to the increase in separation rate. In terms of the returns from search for unemployed workers, the difference between Europe and Japan are narrowed, but the difference still remains and higher for Japan in every case. The biggest changes are in the returns from search. Both in U

[21] Note, however, that wage rigidity, nominal or real, plays no role in our model. Our calibrations results should not be treated as the one reflecting the difference in relative wage flexibility in the two regions. As a matter of fact, several empirical studies suggest that nominal wage rigidity aggravated the deep recession in Japan during the late 1990s. See, for example, Kimura and Ueda (2001).

and T markets, returns from the search are higher for European markets than in Japan with European parameters. At least in this aspect, higher separation rate and unemployment benefits shift the balance in favor of general training.

Nevertheless, this hypothetical model economy looks more like Japan than Europe. Figure 4 shows the permanent effect of productivity change on unemployment rate. It can be confirmed that the unemployment rate is still less responsive than Europe.

5 Concluding Remarks

Changing recruiting and employment system in Japan is a bit like social security reform. Even if a majority agree that in principle (say) pensions must be funded and each generation should live on their own accumulated wealth for retirement, this type of arguments does not make much of a headway towards a fundamental reform of the pension system, *if* the current retirees live on the status quo (say, pay-as-you-go) pension scheme.

Even if, in principle, the majority of workers agree that the current recruiting system is too rigid and leave little room for comeback to those who fail in the first job, those already with secure employment are unlikely to give up their current status. Where and how to stop the current system and move decisively towards the one more fluid and more risky school to work transition? — no one knows.

Besides, getting out of the current system looks very much like a textbook prisoner's dilemma. A majority of employers perhaps agree that the current recruiting system is geared too much towards the school leavers. *If they can be assured of the quality of job applicants as comparable to those in the market for school leavers,* they probably have no objection to make at least significant portion of vacancies available for general job searchers. Our model shows, however, that, as far as the market for school leavers are institutionally isolated from the other job vacancies, it is inevitable that those with previous work experiences face adverse selection. It is a simple fact that after (*albeit* noisy) screening, those who do not make it in their first job tend to be of lower quality, on average. To undo this stigmatizing mechanism, it is imperative that the barrier between the current and the past school graduates be lifted. We all know that every employer can benefit from the availability of skilled workers in the external labor market, yet, they have no strong incentive to initiate a change in the current recruiting method, *until* the change happens.

Is it possible that the current employment system, — particularly the unique arrangements for school leavers —, has become the hindrance to restore the labor mobility? Perhaps so, but undoing the E market comes at a large and immediate cost, at least for new school leavers facing a radically different job market. Most importantly, there is no way of telling if the reform will benefit the economy over all, even in the long run.

Our simple numerical examples have shown that prototype Japanese labor market exhibits several key characteristics, some shared with Europe but differ in many other important dimensions.

We have shown that the choice of firm specific training reinforces the advantage of the current system because the impact of training is likely to be more important for workers with higher productivity. The market for school leavers is the best place to search for quality. If the experience (past training) is important, general training is beneficial to the economy as a whole. In such a case, advantage from searching in market with higher quality workers is relatively limited. Hence an institutional complementarity between the choice of training and the market for school graduates.

We compared long run impacts of productivity change on unemployment in two regions. We have shown that the impact on unemployment is more pronounced in European system whereas the impact is stronger on wages in the Japanese system. Although very crude, this characterization seems to be supported by the data: in Japan, the impact of long term stagnation on unemployment is rather limited but the impact on earnings seem much larger than in Europe. If so, Japan is not likely to suffer from high unemployment that plagued Europe in 1980s and 1990s.

Are we going to see Japano Sclerosis? Our conclusion is No, at least not the kind that Europe had to suffer.

6 Appendix Choice over training types

In the main text, we assumed specific choices of training type for the two model economies. In this Appendix, we show that these model economies are both supported by the equilibrium strategies over the choice of training types, given a set of conditions on parameters. At the same time, we show that there are other types of equilibrium, depending upon the parameter configurations. To simplify the analysis, we continue to assume away unemployment benefits.

6.1 Choice of the training specificity

Suppose that each job slot can choose either general or firm specific training. If the former type is chosen, trained workers do not require further training if in the future he is matched to another firm employing the general training method. If, on the other hand, the firm chooses training specific to the firm, the productivity of the trained worker at the job is improved more than the general training. The cost of training specificity is that they are not valued outside the current firm (including firms who also employ their own firm specific or general training).

Recall

$$q^S > q^G$$

wherein $q^S\left(q^G\right)$ is the productivity when a worker receives specific (general) training. Crucial to the choice of training specificity is which type of workers prefer specific training.

$$\begin{aligned}
\omega_j^s &= \gamma\psi(\theta^s)\int_{x_j^s}\left(\frac{q(e_j+x)}{R}-\omega_j^s-c(s)\right)dF, \\
k\gamma\psi(\theta^s) &= \psi'(\theta^s)\left(\beta_H\omega_H+(1-\beta_H)\omega_L\right)
\end{aligned}$$

we have

$$\frac{\partial\omega_j^s}{\partial q} = \gamma\psi(\theta^s)\int_{x_j^s}\left(\frac{(e_j+x)}{R}-\frac{\partial\omega_j^s}{\partial q}\right)dF+\frac{\psi'(\theta^s)\omega_j^s}{\psi(\theta^s)}\left(\beta\frac{\partial\omega_H^s}{\partial q}+(1-\beta)\frac{\partial\omega_L^s}{\partial q}\right)$$

$$\frac{\partial\omega_j^s}{\partial q} = \frac{\gamma\psi(\theta^s)\int_{x_j^s}\left(\frac{(e_j+x)}{R}\right)dF+\frac{\psi'(\theta^s)\omega_j^s}{\psi(\theta^s)}\left(\beta\frac{\partial\omega_H^s}{\partial q}+(1-\beta)\frac{\partial\omega_L^s}{\partial q}\right)}{1+\gamma\psi(\theta^s)(1-F(x_j^s))}$$

which is clearly increasing in e_j. Thus, if some workers choose for general training, the first one will be type L.

6.2 Strategic interdependence

Not surprisingly, whenever the equilibrium involves simultaneous choices over job types and sub-markets, individual choice depends upon the expectation of the choices made by other workers and job slots.

Consider a sub market wherein two types of workers are mixed. Our analysis of the equilibrium shows that the tightness of the market is given by

$$k\gamma\psi(\theta) = \psi'(\theta)\left(\beta_H\omega_H + (1-\beta_H)\omega_L\right)$$

Hence both types of workers expect higher return if more type H workers are expected to participate in this market. Thus the choice over markets for job search is complementary for type H, but it is strategic substitutes for type L workers.

6.3 Four types of equilibrium

Four types of equilibria are possible. Two of them are already analyzed in the main text: (1) all the existing jobs adopt general training (*Gall*), and (2) all the existing jobs adopt specific training (*Sall*). In the two other equilibria, both types of training coexist in the economy. In separating equilibrium (*Separating*), training choices are different depending upon the worker type: type H workers choose type S training, and type G chosen by type L workers. In the last type of equilibrium (*Mixed*), type L workers are divided into type S and type G training, whereas all the type H workers choose type S training.

For each case, we can obtain the equilibrium conditions in a manner similar to the ones we had in the main text. We only show the results below

6.3.1 Separating Equilibrium

For type H workers, they all choose specific training. Since all the workers in this market are type H and the fact that training are all specific imply that market does not distinguish worker with or without the past training. It simply does not matter because all the workers are homogenous in quality and the past training experience does not reduce the training cost at a new match. Hence we have

$$\begin{aligned}(1-\sigma)k\theta^S &= \sigma\omega_H^S \\ \omega_H^S &= \gamma\psi(\theta^S)\int_{x_H^s}\left(\frac{q^S(e_H+x)-\omega_H^S}{R} - c\right)dF\end{aligned}$$

At type G training market, all the workers are type L. We have

$$
\begin{aligned}
(1-\sigma)k\theta^U &= \sigma\omega_L^U, \\
\omega_L^U &= \gamma\psi(\theta^U)\int_{x_L^U}\left(\frac{q^G(e_L+x)-\omega_L^U}{R}-c+\frac{\delta(\omega_L^T-\omega_L^U)}{r+d}\right)dF, \\
(1-\sigma)k\theta^T &= \sigma\omega_L^T, \\
\omega_L^T &= \gamma\psi(\theta^T)\int_{x_L^T}\left(\frac{q^G(e_L+x)-\omega_L^T}{R}\right)dF
\end{aligned}
$$

6.3.2 Mixed equilibrium

For general training market, the equilibrium conditions are the same as shown above for the separating equilibrium. Note that

$$\omega_L^U < \omega_L^T$$

so that if type L workers are indifferent between type G and type S training when they are untrained, they should choose type G training if they are trained in type G job in the past. The market for specific training jobs now have both types of workers searching for the job. Equilibrium is given by the following equations.

$$
\begin{aligned}
(1-\sigma)k\theta_S^U &= \sigma\left(\beta_H^{US}\omega_H^{US}+(1-\beta_H^{US})\omega_L^{US}\right), \\
(1-\sigma)k\theta_S^T &= \sigma\left(\beta_H^{TS}\omega_H^{TS}+(1-\beta_H^{TS})\omega_L^{TS}\right) \\
\omega_j^{US} &= \gamma\psi(\theta_S^U)\int_{x_j^n}\left(\frac{q^S(e_j+x)-\omega_j^{US}}{R}-c+\frac{\delta(\omega_j^{TS}-\omega_j^{US})}{(r+d)}\right)dF, \\
\omega_j^{TS} &= \gamma\psi(\theta_S^T)\int_{x_j^t}\left(\frac{q^S(e_j+x)-\omega_j^{TS}}{R}-c\right)dF, \quad j=L,H
\end{aligned}
$$

$$
\begin{aligned}
(1-\sigma)k\theta_G^U &= \sigma\omega_L^{UG}, \\
\omega_L^{UG} &= \gamma\psi(\theta_G^U)\int_{x_L^N}\left(\frac{q^G(e_L+x)-\omega_L^{UG}}{R}-c+\frac{\delta(\omega_L^{TG}-\omega_L^{UG})}{r+d}\right)dF, \\
(1-\sigma)k\theta_G^T &= \sigma\omega_L^{TG}, \\
\omega_L^{TG} &= \gamma\psi(\theta_G^T)\int_{x_L^T}\left(\frac{q^G(e_L+x)-\omega_L^{TG}}{R}\right)dF
\end{aligned}
$$

Since the decision on the choice of training is made when they are not trained, we need that type L workers are indifferent between the two choices. Hence we require

$$\omega_L^{US} = \omega_L^{UG}$$

6.4 Local stability of equilibria (1) Case without E market

We will show that these four types of equilibrium appears in the following order: if we start from (*Gall*) and change the parameter configurations in favor of type S training, the next equilibrium that appears is *Separating*, then, *Mixed*, and finally *Sall*.

Recall that we have two sub markets, one for the trained and the other for untrained. Since the analysis is easier when there is no separate market for school leavers (E market), we start with this case.

Let us start from (*Gall*) equilibrium. Their equilibrium conditions are given in *Lemma 1* of the main text. Given the comparative advantage of type G training for type L workers, we only need to consider deviations by type H workers. Suppose a single type H worker deviates from the equilibrium choice of training and choose type S training (we assume zero profit condition ensures that imminent profit making opportunities immediately induce employers to set up type S jobs which does not exist in *Gall* equilibrium). Since type L workers have no incentive to deviate, the share of type H workers in type S training market is unity (no type L workers apply for type S). The expected pay off from deviation is equal to ξ_H^U given by

$$\begin{aligned}(1-\sigma)k\theta_S^U &= \sigma\omega\xi_H^U,\\ \xi_H^U &= \gamma\psi(\theta_S^U)\int_{y_H^N}\left(\frac{q^S(e_H+x)-\xi_H^U}{R}-c\right)dF,\end{aligned}$$

Whereas his payoff in U market for general training is given by

$$\begin{aligned}(1-\sigma)k\theta_G^U &= \left(\beta_H^{UG}\omega_H^U+(1-\beta_H^U)\omega_L^U\right),\\ \omega_H^U &= \gamma\psi(\theta_G^U)\int_{x_H^U}\left(\frac{q^G(e_H+x)-\omega_H^U}{R}-c+\frac{\delta(\omega_H^T-\omega_H^U)}{r+d}\right)dF,\\ (1-\sigma)k\theta_G^T &= \left(\beta_H^{TG}\omega_H^T+(1-\beta_H^{TG})\omega_L^T\right),\\ \omega_H^T &= \gamma\psi(\theta^T)\int_{x_H^T}\left(\frac{q^G(e_H+x)-\omega_H^T}{R}\right)dF\end{aligned}$$

And the deviation is not profitable and hence *Gall* equilibrium is viable if

$$\xi_H^U \le \omega_H^U$$

Notice that this is the stability condition for *Gall* equilibrium. The stability condition of *Separating* relative to *Gall* is not the same. In this case, we need to consider the deviation by type H worker to choose G training when all the other type H workers choose type S training. The expected return from type S training for type H worker is the same as the value of deviation given above, ξ_H^U, because in both cases, only type H workers choose type S so that the equilibrium payoffs are the same. (Because of constant returns to scale, equilibrium in the markets for specific training does not depend upon the size of type H workers in the market). The difference arises in the expected return for type H workers in G training: In this case, only type L workers choose type G (except for the deviating type H worker) so that the return $\widetilde{\omega}_H^U$ is given by

$$(1-\sigma)k\theta_G^U = \omega_L^U,$$

$$\widetilde{\omega}_j^U = \gamma\psi(\theta_G^U)\int_{x_j^N}\left(\frac{q^G(e_j+x)-\widetilde{\omega}_j^U}{R} - c + \frac{\delta(\widetilde{\omega}_j^T - \widetilde{\omega}_j^U)}{r+d}\right)dF,$$

$$(1-\sigma)k\theta_G^T = \omega_L^T,$$

$$\widetilde{\omega}_j^T = \gamma\psi(\theta_G^T)\int_{x_j^T}\left(\frac{q^G(e_j+x)-\widetilde{\omega}_j^T}{R}\right)dF,$$

Hence we need

$$\widetilde{\omega}_H^U \leq \xi_H^U$$

Hence whenever

$$\widetilde{\omega}_H^U < \xi_H^U < \omega_H^U$$

both types of equilibria are possible.

Next, we consider the choice between *Separating* and *Mixed*. Starting from the *Separating* equilibrium, we need to consider deviations by type L workers. The expected return from applying to type G training job is

$$(1-\sigma)k\theta_G^U = \sigma\omega_L^{UG},$$

$$\omega_L^{UG} = \gamma\psi(\theta_G^U)\int_{x_L^U}\left(\frac{q^G(e_L+x)-\omega_L^{UG}}{R} - c + \frac{\delta(\omega_L^{TG} - \omega_L^{UG})}{r+d}\right)dF,$$

$$(1-\sigma)k\theta_G^T = \sigma\omega_L^{TG},$$

$$\omega_L^{TG} = \gamma\psi(\theta_G^T)\int_{x_L^T}\left(\frac{q^G(e_L+x)-\omega_L^{TG}}{R}\right)dF$$

as we have shown above. At *Separating* equilibrium, only type H workers apply for type S jobs. Hence a single worker of type L deviating to apply for S job expects to earn ξ_L^{US} given by

$$
\begin{aligned}
(1-\sigma)k\theta_S^U &= \sigma\omega_H^{US}, \\
(1-\sigma)k\theta_S^T &= \sigma\omega_H^{TS}, \\
\xi_L^{US} &= \gamma\psi(\theta_S^U)\int_{x_L^{US}}\left(\frac{q^S(e_L+x)-\xi_L^{US}}{R}-c+\frac{\delta(\xi_L^{TS}-\xi_L^{US})}{R(r+d)}\right)dF, \\
\xi_L^{TS} &= \gamma\psi(\theta_S^T)\int_{x_L^{TS}}\left(\frac{q^S(e_L+x)-\xi_L^{TS}}{R}-c\right)dF,
\end{aligned}
$$

Hence the non-deviation condition in *Separating* equilibrium is

$$
\omega_L^{UG} \geq \xi_L^{US}
$$

As we have noted earlier, *Mixed* equilibrium is locally stable. The stability condition of *Sall* equilibrium is easy to find. We need that type L workers have no incentive to deviate to type G training, whose expected return is ω_L^{UG} above. Denoting the expected return from the deviation by ξ_L^{US}, we have

$$
\begin{aligned}
(1-\sigma)k\theta_S^U &= \sigma\left(\beta_H^{US}\omega_H^{US}+(1-\beta_H^{US})\xi_L^{US}\right), \\
(1-\sigma)k\theta_S^T &= \sigma\left(\beta_H^{TS}\omega_H^{TS}+(1-\beta_H^{TS})\xi_L^{TS}\right), \\
\xi_L^{US} &= \gamma\psi(\theta_S^U)\int_{x_L^{NS}}\left(\frac{q^S(e_L+x)-\xi_L^{US}}{R}-c+\frac{\delta(\xi_L^{TS}-\xi_L^{US})}{R(r+d)}\right)dF, \\
\xi_L^{TS} &= \gamma\psi(\theta_S^T)\int_{x_L^{NT}}\left(\frac{q^S(e_L+x)-\xi_L^{TS}}{R}-c\right)dF
\end{aligned}
$$

and we need

$$
\omega_L^{UG} \geq \xi_L^{US}
$$

Notice that the size of the type L workers in G training market does not matter in the determination of equilibrium returns because of the linear homogenous matching function. (Zero profit condition is also independent from the size of the unemployment pool).

6.5 Local Stability (2) The economy with E market

We now consider the four types of equilibrium with a separate submarket for school leavers. Recall that we assume, in line with the Japanese case, that it is a privilege of school leavers. There is nothing that prevents school leavers applying for other qualified vacancies. I.e., if they so wish, they can search jobs in general untrained (U) market.

With this key ingredient, we immediately see that in *Separating* equilibrium, the assumption of school leaver market is inconsequential because in this equilibrium, types of workers are fully revealed by self selection. Thus there is no meaningful distinction between the school leavers and other untrained workers. Moreover, in *Separating* equilibrium, there is no meaningful distinction between the trained and untrained workers for type S jobs. By assumption, the previous training is useless if they received type S training. Since only type H workers are in S market, there is no information gain from the past work experience either.

The E market complicates the matter on other types of equilibrium because we now have to consider the deviations at two stages, viz., at the market for school leavers, and the market for the general untrained workers.

Let us start from ($Gall$) equilibrium as we have done above. It is the deviation of type H workers we need to consider. Note that type L workers have no incentive to deviate when type H workers are indifferent between type S and type G jobs because of the smaller impact of productivity gain from specific training. Unlike the economy without E market, type H untrained workers have two options to deviate: at E market, i.e., immediately after they enter the labor market, or in U, the market for the untrained.

If type H worker deviates at E, he will reveal his type by applying to S job. Thus to prevent this from happening, we need the expected return from search in $Gall$ for type H must be at least large as ξ_H^U given by

$$\begin{aligned}\gamma k \psi(\theta_S^U) &= \psi'(\theta_S^U)\xi_H^U, \\ \xi_H^U &= \gamma\psi(\theta_S^U)\int_{y_H^N}\left(\frac{q^S(e_H+x)-\xi_H^U}{R}-c\right)dF,\end{aligned}$$

Now recall that the expected return from search is strictly lower for both types at U market because of the larger share of type L workers. Thus the relevant condition is not market E, but the returns from search for type H in market U.

$$\omega_H^U \geq \xi_H^U$$

What will happen if this condition is violated? Then, type H workers see the opportunities and they all switch to type S jobs when they are in U market. Then what about their choice in E market? Now that they understand that it will be optimal to apply for type S jobs if he fails in E market, does it still make sense to apply for type G jobs in E? At first glance, it seems impossible to rule out this case. As a matter of fact, this type of equilibrium is unstable. Suppose that at E market, type H finds it better to apply for type G although they optimally choose type S if they fail in E market. This switch occurs not because the pay off from applying to type S differs between the two timings, but only because in E market the share of type H is larger. Then the deviation of type H workers shifts the balance in favor of type S jobs. If all type H workers decide to apply for type S jobs in E market, then, the advantage of applying for G jobs in E market is washed out. Consequently, we can rule out this type of equilibrium and the condition above is the necessary and sufficient condition for *Gall* equilibrium.

As before, the stability of *Separating* equilibrium relative to *Gall* equilibrium differs. We need to consider the deviation by type H workers to type G jobs, wherein only (except for the deviating worker himself) type L workers search. Since there is no meaningful distinction between E and U markets, the argument is identical to the one above and we get

$$\widetilde{\omega}_H^U \leq \xi_H^U$$

as the necessary condition. Therefore if

$$\widetilde{\omega}_H^U < \xi_H^U < \omega_H^U$$

both types of equilibria are possible.

Now we compare *Separating* and *Mixed* equilibria. In the *Mixed* equilibrium, we require that type L workers are indifferent between type S and type G choices. We also know that there is no meaningful distinction between E and U sub-markets for type G jobs because only type L workers are in G markets. How about the S markets? E and U sub markets can differ in respective returns if and only if the share of type L workers in the two markets differ. Since school leavers can always search in both E and U, the only possibility is that returns are equal or returns is higher in E market.

But if the latter is the case, and if the returns from the search for type L workers are the same in E market between S and G training, it implies that no type L workers will search in U market for S jobs, a contradiction. Is it then possible that only in market E type L workers search for type S jobs? No, because in that case the share of type H workers in U market for type S jobs is unity hence the returns must be higher in U if you apply for a type S job than in E market. Hence it is impossible that market returns differ between E and U for type G, which means that there really is no meaningful distinction between E and U markets in this mixed equilibrium either.

Consequently, the comparison between *Separating* and the *Mixed* equilibria is identical to the one without E market. In a nutshell, the distinction between E and U markets are meaningful only in *Gall* and *Sall* equilibria wherein two types of workers are mixed in all sub-markets.

Finally, we compare the *Mixed* equilibrium wherein E and U markets are integrated, with *Sall* equilibrium. Again, the deviation of type L is our interest. Starting from *Mixed* equilibrium, as we move parameter configuration in favor of S jobs, untrained type L workers consider the deviation to apply for S jobs. Since type G equilibrium does not depend upon the size of type L workers, we need to consider the threshold case wherein the return from applying for G job is equal to the return from applying to S job for type L workers when all but one type L workers have applied to type S jobs.

Thus we have the same stability condition as the case without E jobs except that the we need to incorporate the fact the composition of type L workers in U market for S jobs differ from the one without E market.

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Table 1 Two Model Economies

	EU	Japan
Sub-markets	U, T	E, U, T
Worker Types	H, L	
Training	General	(Firm) Specific
Job Productivity	q^G	$q^S (> q^G)$
Unemployment benefits	b^E	b^J
Benefits applicability	$T, (U)$	$T, (U)$

Table 2 Parameter Specifications

Symbol	Parameter description	EU	Japan
r	discount rate	0.02	
d	retirement (= school graduation) rate	0.025	
δ	exogenous separation rate	0.04	0.02
A	efficiency of matching function[1]	1	
σ	matching function parameter	0.5	
$sdev$	standard deviation of match specific productivity[2]	0.8	
μ	mean of match specific productivity	0	
q	job productivity	1.8	2.0
k	cost of keeping vacancy	0.8	
b	unemployment benefits	2.25	1.5
c	cost of training	1	
β_0^H	population share of type H workers	0.5	
e_H	Innate productivity of type H worker	2	
e_L	Innate productivity of type L worker	0.5	

[1] Matching function is specified as $m = Av^{\sigma}u^{(1-\sigma)} = Au\theta^{\sigma}$

[2] Match specific productivity is assumed to follow a normal distribution with mean μ and standard deviation *sdev*.

Table 3 Base Results

Symbol	Description	EU		Japan	
		Type H	Type L	Type H	Type L
U	Unemployment rate	11.1%[10.2%]		5.57%[5.92%] (3.97%[3][3.66%])	
Jfr	Annual job finding rate (E market)	n.a.		.771[.691]	.678[.614]
Jfr	Annual job finding rate (U market)	.485 [.491]	.330 [.351]	.513[.521]	.369[.383]
Jfr	Annual job finding rate (T market)	.512 [.508]	.388 [.369]	.542 [.539]	.399 [.389]
$Repr$	U benefit replacement ratio (T market)	.282[.282]	.426 [.426]	.169 [.169]	.261 [.260]
w	Average wage (net of training cost)	7.92 [7.51]	5.23 [5.06]	9.04 [8.93]	6.96 [6.82]
β_U^H	The share of type H (L) workers in U	.375 [.389]	.625 [.611]	.356 [.373]	.644 [.627]
β_T^H	The share of type H (L) workers in T	.411 [.399]	.589 [.601]	.406 [.405]	.594 [.595]
ω_j^E	Returns from search in E market	--	--	7.57(0†)	4.34(0†)
ω_j^N	Returns from search in U market	7.25(2.25†)	4.68(2.25†)	8.21(1.5†)	5.21(1.5†)
ω_j^T	Returns from search in T market	7.34(2.25†)	4.76(2.25†)	8.27(1.5†)	5.46(1.5†)

Figures in [] shows the results when workers in U markets are not covered by unemployment benefits.

†Unemployment benefit

Table 4 The effect of increased micro turbulence in two cases [in Airga and Okazawa 2011]

	benchmark	Retraining cost reduced to a half
Gross output (% change)	-4.9%	-3.9%
Unemployment rate	+1.4%	+1.6%
Annual worker turnover (full-time %)	+3.2%	+4.7%

[3] The figure excludes school leavers.

Table 5 Japan with Europe Parameters

Symbol	Description	EU (the same as Table 1)		Japan with Europe Parameters	
		Type H	Type L	Type H	Type L
u	Unemployment rate	11.1%		7.12% (4.37%[4])	
jfr	Annual job finding rate (E market)	n.a.		.824	.756
jfr	Annual job finding rate (U market)	.495	.330	.511	.349
jfr	Annual job finding rate (T market)	.512	.368	.545	.384
repr	U benefit replacement ratio(T market)	.282	.426	.259	.397
w	Average wage (net of training cost)	7.92	5.23	8.93	6.93
β_U^H	The share of type H (L) workers in U	.375	.625	.332	.668
β_T^H	The share of type H (L) workers in T	.411	.589	.397	.603
ω_j^E	Returns from search in E market	--	--	7.41(0†)	4.21(0†)
ω_j^N	Returns from search in U market	7.25(2.25†)	4.68(2.25†)	7.25(2.25†)	4.37(2.25†)
ω_j^T	Returns from search in T market	7.34(2.25†)	4.76(2.25†)	7.29(2.25†)	4.41(2.25†)

Figures above assume that all workers except in E markets in Japan receive unemployment benefits

[4] The figure excludes school leavers.

Figure 1 Impact of Permanent Productivity Change on Unemployment

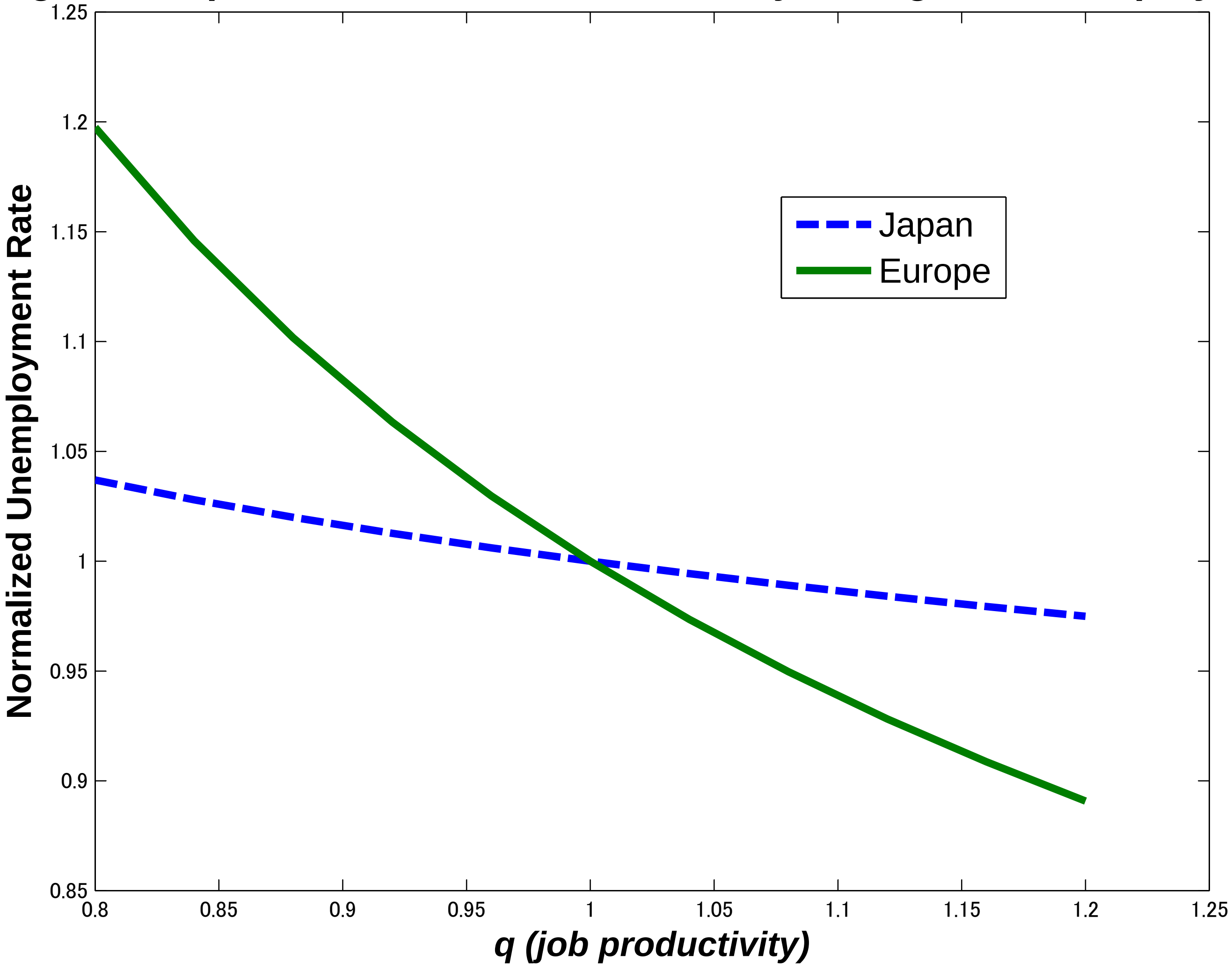

Figure 2 Impact of Permanent Productivity Change on Average Wage

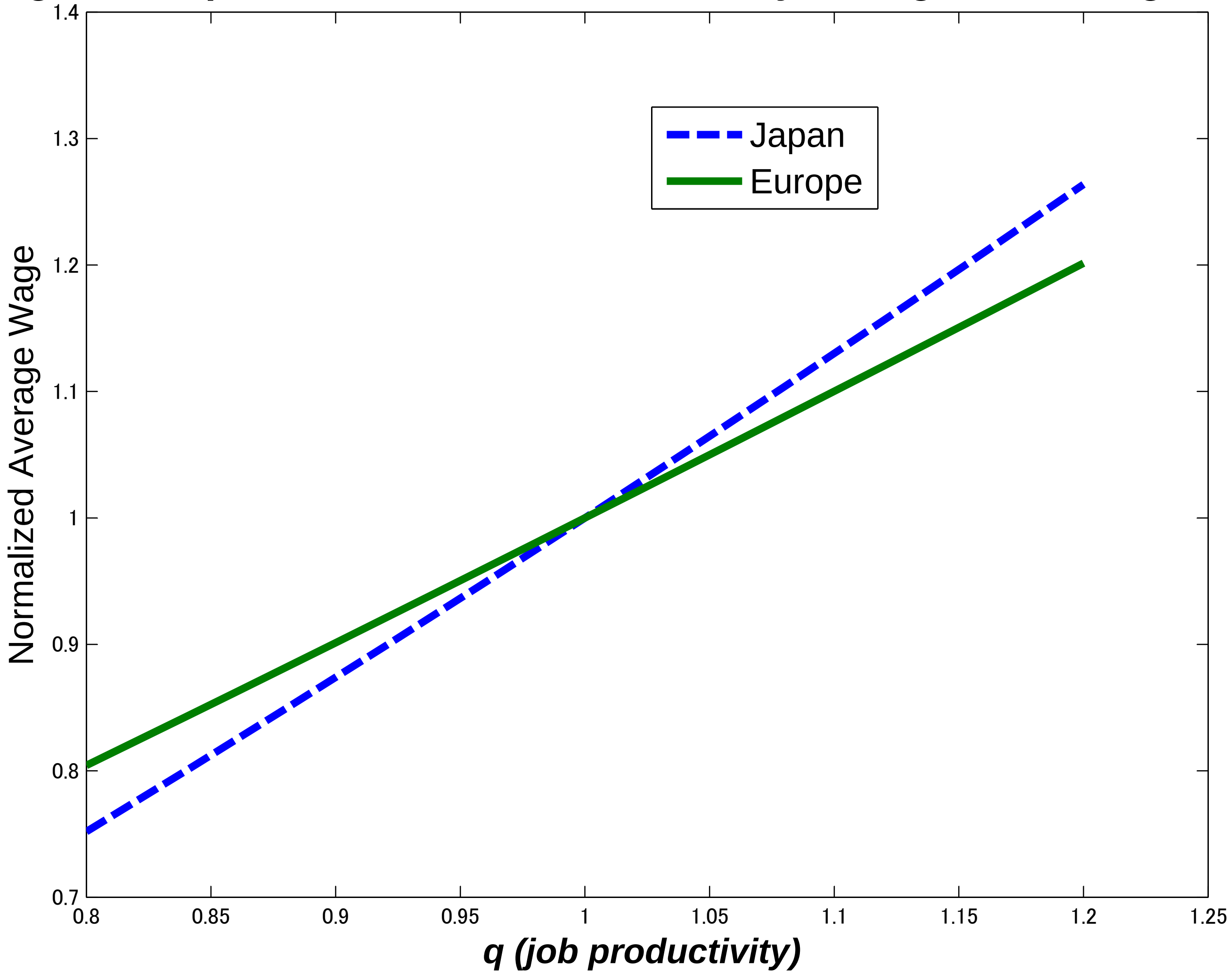

Figure 3 Impact of productivity on Job Finding Rate

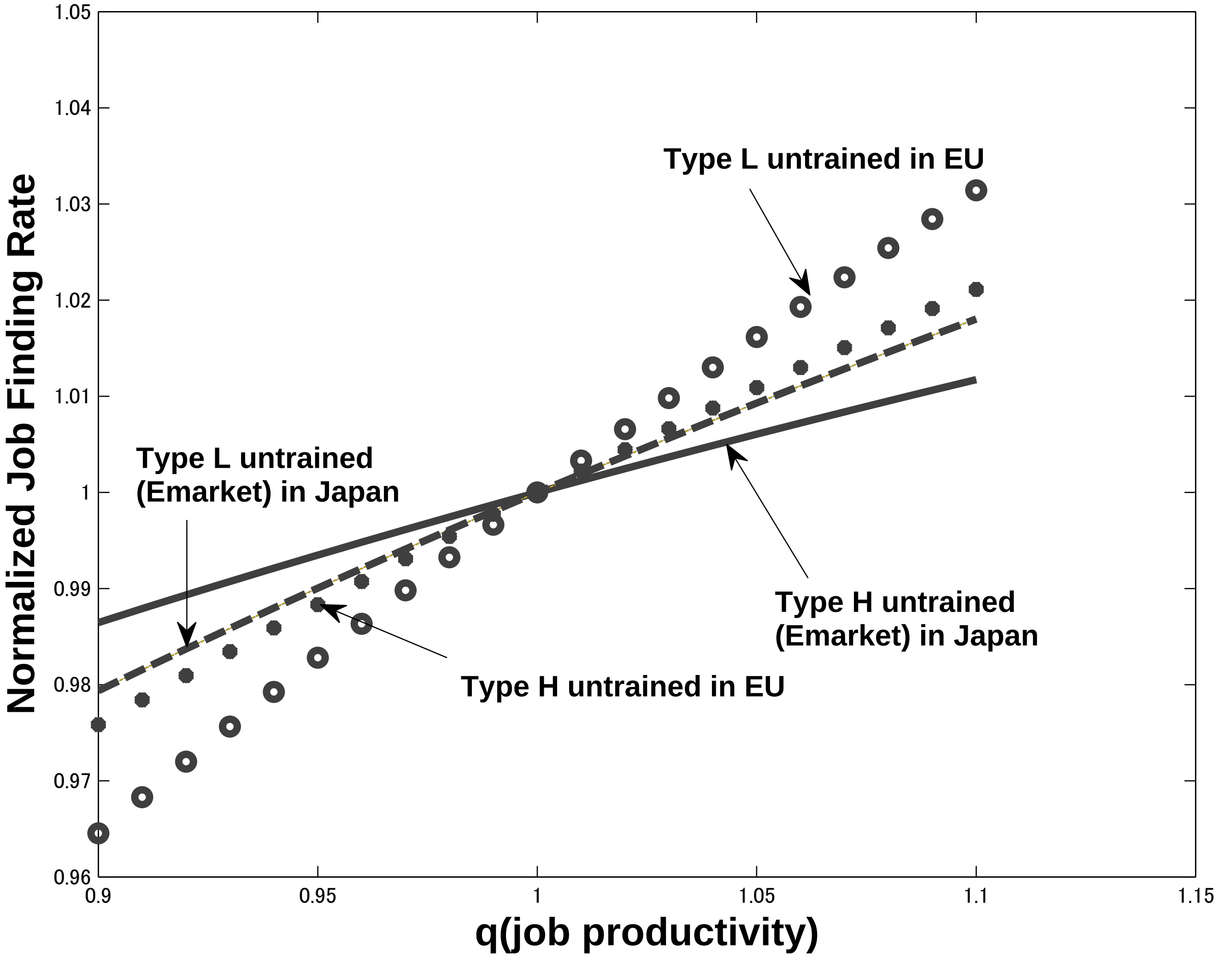

Figure 4 Japanese Economy With European Parameters