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Toshihiko Mukoyama

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On the Establishment Dynamics in the United States and Japan

Toshihiko Mukoyama*

Abstract

This paper compares the establishment-level dynamics of the United States and Japan. I find that there are substantial differences in entry and exit behavior, the average size of establishments, and the amount of job reallocation. First, entry and exit rates are much lower in Japan. Second, the average size of establishments is much smaller in Japan, while the average size of opening/closing establishments are similar in the U.S. and Japan. Third, the amount of job creation and job destruction is much smaller in Japan, especially for continuing establishments. I first examine whether these differences are accounted for by sectoral compositions, and find that the differences in sectoral composition do not explain these facts. Then I construct a general equilibrium industry dynamics model and explore the roles of various frictions in generating these differences. The model experiments suggest that in Japan, there may be important impediments for establishment entry/exit and there may be factors impeding productive establishments from growing larger.

Keywords: Establishment Dynamics; Sectoral Composition; Industry Dynamics Model; Reallocation
JEL classification: E23, H25, J62, L25

* University of Virginia and CIREQ (E-mail: tm5hs@virginia.edu)

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1 Introduction

An economy evolves over time through reallocations. New goods are created, old goods disappear, firms and establishments enter and exit, and workers switch jobs and occupations. In recent years, economists have started to learn that the amount of reallocation is massive and reallocation has important consequences on aggregate productivity. For example, Foster, Haltiwanger, and Krizan (2001) decompose the sources of multifactor productivity growth in U.S. manufacturing into three factors: productivity gain within each plant, change in output shares across plants, and entry/exit. They find that the contribution of the latter two, which is the productivity growth coming from reallocation, accounts for more than half of total productivity growth—the second accounts for 34% and the third accounts for 24% of total productivity growth.

This paper focuses on the reallocation process at the establishment level. In particular, I highlight the differences in the establishment-level dynamics between the U.S. and Japan. I first present some summary statistics from the establishment-level data in both countries. It turns out that the establishment-level dynamics are very different in many aspects. In particular, the turnover of establishments is much more frequent in the U.S. than in Japan. The amount of the job reallocations is much lower in Japan. Additionally, the average size of all establishments is smaller in Japan, while the average sizes of opening and closing establishments are similar in the U.S. and Japan.

Next, I make an attempt to explain these differences. One possibility is that these differences are due to the disparity in the composition of sectors. For example, in the manufacturing sector, the establishment (plant) size tends to be larger than in the other sectors. The difference in the average size of the establishment can be due to the difference in the share of the manufacturing sector in each country. It turns out that the difference in the sectoral composition is not a main source of the U.S.-Japan disparity in the establishment sizes and entry/exit rates.

Since the difference is not due to sectoral composition, it has to be the case that the establishment behavior in each sector is different in the U.S. and Japan. What, then, would account for the difference in the behavior? Here, I utilize a general equilibrium industry dynamics model, based on Hopenhayn and Rogerson (1993), to investigate the possible institutional elements that account for these differences.

The strategy taken here is to consider the U.S. economy to be the benchmark, and examine what kind of "frictions" can account for the establishment dynamics in Japan. I consider several possible frictions. The first is a lower value received by the establishment upon exiting. If, for example, the secondary market for the capital stock is less developed, the exiting establishment cannot benefit from the sale of used capital. The second is a higher entry cost. Using a similar model and cross-country data, Moscoso Boedo and Mukoyama (2008) argue that entry regulation can have a substantial impact on output and productivity. The third is a high labor adjustment cost. A large hiring cost and firing cost may reduce the reallocation of labor across establishments. The fourth is the tax on size. When there are restrictions on establishment size, it has a direct effect on establishment dynamics.

The paper is organized as follows. In the next section, the characteristics of the establishment-level dynamics in the U.S. and Japan are summarized. In Section 3, I examine whether the differences in the establishment dynamics in these two countries can be accounted for by the differences in sectoral composition. In Section 4, I build a general equilibrium industry dynamics model to explore the possible institutional differences that can account for the disparity. Section 5 concludes.

2 Establishment dynamics in the U.S. and Japan

Table 1 describes the establishment size distributions in the U.S. and Japan. The U.S. data is from Statistics of U.S. Businesses (SUSB) dataset.[1] The table is calculated from the 2003–2004 data. The Japanese data is taken from the Establishment and Enterprise Census (EEC) 2006.[2] From the table, it can clearly be seen that the Japanese

[1]See `http://www.census.gov/csd/susb/` for more details of this dataset. This table is created as a customized table. The SUSB dataset is also used by Rossi-Hansberg and Wright (2007).

[2]See `http://www.stat.go.jp/english/data/jigyou/2006/zenkoku/index.htm` for the details of the data. The table is created from their Table 11. It is always difficult to compare micro-level

	U.S. (%)	Japan (%)
$1-4$	48.52	60.94
$5-9$	21.52	19.16
$10-19$	14.24	10.89
$20-49$	9.77	6.30
$50-99$	3.32	1.63
$100-499$	2.35	0.91
$500-999$	0.17	0.06
$1000-$	0.10	0.02

Table 1: The size distribution of establishments in the U.S. and Japan

	U.S.	Japan
Entry rate (annual, %)	11.6	4.4
Exit rate (annual, %)	10.2	4.4

Table 2: Entry and exit rates

establishments tend to be smaller.[3]

Table 2 documents the entry rates and the exit rates of the establishments in the U.S. and Japan. The U.S. data is taken from the SUSB dataset (2003-2004),[4] and

business datasets across countries, but the SUSB dataset and the EEC datasets are reasonably comparable since both are Census-based datasets that cover all the establishments in most of the industries. The basic data of the SUSB is from the Business Register and it is augmented by the information in the Company Organization Survey, the Annual Survey of Manufactures, and Current Business Surveys, as well as from administrative records of the Internal Revenue Service, the Social Security Administration, and the Bureau of Labor Statistics. The EEC data is based on the questionnaires that are collected by the enumerators sent from the municipal supervisors or directly by the governments.

[3]Different datasets, such as the Quarterly Census of Employment and Wages (QCEW) dataset document somewhat smaller sizes for the U.S. establishments. However, the same tendency holds for the QCEW datasets—QCEW establishments are still larger than Japanese establishments.

[4]Pinkston and Spletzer (2004) estimate somewhat larger numbers based on the Business Employment Dynamics dataset—the entry rate is 13.0% annually and the exit rate is 12.0% on average for 1998-2002 (their Table 4). The SUSB dataset provides similar numbers as Table 2 during 1995-2003 except for 1996-1997 and 2001-2002 data (during these years, except for 1996-1997 and 2001-2002, entry rates range 11.3% to 11.9% and exit rates range from 10.3% to 10.8%). In 1996-1997, the entry rate was 13.8% and the exit rate was 11.3%; in 1996-1997, the entry rate was 12.4% and the exit rate was 11.8%. Both rates are higher than the other years and closer to the numbers reported by Pinkston and Spletzer. This may be due to the fact that 1997 and 2002 are both Census years. I

	U.S.	Japan
JC by expanding establishments (annual, %)	10.3	4.2
JC by opening establishments (annual, %)	5.5	4.5
JD by contracting establishments (annual, %)	9.2	3.9
JD by closing establishments (annual, %)	5.2	3.7

Table 3: Job creation and job destruction statistics

the Japanese data is taken from the White Paper on Small and Medium Enterprises in Japan 2007 (Japan Small Business Research Institute, 2007),[5] Fig 1-2-4. They are dramatically different—the U.S. establishments experience much more turnover than the Japanese establishments.[6]

Table 3 compares the job creation rate (JC) and job destruction rate (JD) in the U.S. and Japan. JC by continuing establishments and opening establishments are calculated separately. Similarly, JD by continuing establishments and closing establishments are calculated separately. JC is defined as

$$JC \equiv \frac{\displaystyle\sum_{\{i|n_{it}>n_{i,t-1}\}} (n_{it} - n_{i,t-1})}{\displaystyle\sum_{i} n_{i,t-1}}, \tag{1}$$

where n_{it} is the employment of the establishment i at time t. In words, this is the sum of employment gains in expanding establishments, divided by the total number of

thank Yoonsoo Lee for pointing this out.

[5]See `http://www.chusho.meti.go.jp/pamflet/hakusyo/h19/download/2007hakusho_eng.pdf` for the details. There, other methods for counting the numbers of establishments are also explored. Although the other methods deliver the entry/exit rates in different frequencies, the annual average seems to accord with the numbers documented in Table 2.

[6]The entry rate can also be calculated from EEC 2006 (Figure 16)—one can divide the number of establishments created in 2005 by the total number of establishments. This delivers 2.9%. Note that the EEC table indicates that there are less entry during 2005 compared to an average year. For example, there are more establishments that entered during 2004 and survived until 2006 survey compared to the ones that entered during 2005.

	U.S.	Japan
Average size of all establishments	17.6	9.4
Average size of opening establishments	8.3	9.6
Average size of closing establishments	9.0	7.9

Table 4: Establishments in the U.S. and Japan: average sizes

employment. The value of $n_{i,t-1}$ is zero for an opening establishment. JD is defined as

$$JD \equiv \frac{\displaystyle\sum_{\{i|n_{it}<n_{i,t-1}\}} (n_{i,t-1} - n_{it})}{\displaystyle\sum_{i} n_{i,t-1}}. \tag{2}$$

This is the sum of the employment loss in shrinking establishments divided by the total number of employment. The value of n_{it} is zero for a closing establishment. Here, the U.S. data is taken from the SUSB.[7] The Japanese values are from Genda (1998)[8] for the period 1991-1994.[9] Both JC and JD are smaller for Japanese establishments. In particular, JC and JD by continuing establishments are much smaller in Japan than in the U.S. JC by opening establishments and JD by closing establishments in the U.S. and Japan are comparable.

Table 4 calculates the average sizes of all establishments, opening establishments, and closing establishments. The U.S. sizes are calculated from the SUSB (2003-2004).[10] The Japanese total average is calculated from EEC 2006. Since I do not have annual data that can directly calculate the average sizes for opening and closing establishments

[7]Pinkston and Spletzer (2004) also estimate the job creation and job destruction rates. For the average of 1998-2002, their numbers are 8.2, 5.2, 8.8, and 4.9 in the order of Table 3.

[8]JC can also be calculated by opening establishments from EEC 2006 (Figure 16)—one can divide "employment by establishments created in 2005" by "total employment." This delivers 2.7%. Note that (as in footnote 6) the EEC table indicates that there are less entry during 2005 compared to an average year.

[9]Genda (2004) conducts a similar calculation (only for continuing establishments) for 1995-2000 and obtains similar numbers. Ohta, Genda, and Teruyama (2008) updates the total JC and JD until 2004. There is some increase in the total JD from late 1990s to early 2000s, but the maximum is 5.5% in 2001, so it is still small compared to the U.S. total number.

[10]In the Business Employment Dynamics data, created from QCEW (2000-2007), the average size of opening establishments is 4.6 and the average size of closing establishments is 4.6. The average size of all establishments is 13.6.

in Japan,[11] I use the following procedure to calculate them indirectly.[12] First, note that from (1) with $n_{i,t-1} = 0$, JC by entrants (JC_t^e) can be calculated as

$$JC_t^e = \frac{\sum\limits_{\text{entrants}} n_{it}}{\sum\limits_i n_{i,t-1}} \approx \frac{\sum\limits_{\text{entrants}} n_{it}}{\sum\limits_i n_{it}}.$$

The entry rate E_t is calculated as

$$E_t = \frac{N_t^e}{N_t},$$

where N_t^e is the number of entrants at time t and N_t is the total number of establishments at time t. Thus, the average size of entrants is calculated by

$$\frac{\sum\limits_{\text{entrants}} n_{it}}{N_t^e} \approx \frac{JC_t^e}{E_t} \times \frac{\sum\limits_i n_{it}}{N_t} = \frac{JC_t^e}{E_t} \times [\text{Average size of all establishments}].$$

The average size of closing establishments can be calculated similarly, using an equation derived from (2). The result, shown in Table 4, reveals that the average sizes of all establishments are very different in the U.S. and Japan, while the average sizes of the opening and closing establishments are similar.

Summarizing, there are three main differences in the establishment dynamics, comparing the U.S. and Japan.

1. (Entry/exit fact): Entry and exit rates are lower in Japan.
2. (JC/JD fact): Job creation and job destruction rates for existing establishments are much lower in Japan, while job creation by opening establishments and job destruction by closing establishments are relatively similar across these countries.
3. (Size fact): The average size of all establishments is much smaller in Japan, while the average sizes of opening and closing establishments are similar across these countries.

In the following two sections, I attempt to account for these differences.

[11] For opening establishments, the average size can be calculated from EEC 2006 (Figure 16). This delivers the average size of 8.9.

[12] I can, in principle, apply this method to the U.S. data as well. This results in 7.9 for opening establishments and 8.5 for closing establishments.

3 Does sectoral composition explain the differences?

In this section, I first examine whether differences in sectoral composition explain the difference in the average size of all establishments, the average size of opening and closing establishments, and the entry and exit rates in the U.S. and Japan. (I do not have sufficient information to examine the "JC/JD fact.")

Table 5 is the share in terms of the number of establishments, calculated from the SUSB dataset and the EEC dataset used in the previous section. Table 6 shows the employment share. There are, indeed, some differences in sectoral composition between the U.S. and Japan. For example, "Manufacturing" and "Wholesale and Retail Trade" are significantly larger (both in terms of the number of establishments and the employment share) in Japan, while "Finance and Insurance" and "Health Care and Social Assistance" are significantly larger in the U.S. Below, I use the sector-level information, including Table 5, to explore the effect of sectoral composition.

	U.S.	Japan
Forestry, Fishing, Hunting, and Agricultural Support[a]	0.3	0.4
Mining[b]	0.3	0.1
Construction[c]	9.4	9.4
Manufacturing[d]	5.0	9.3
Utilities[e]	0.3	0.2
Information[f]	2.0	1.0
Transportation and Warehousing[g]	2.8	2.2
Wholesale and Retail Trade[h]	22.0	27.3
Finance and Insurance[i]	6.6	1.4
Real Estate and Rental and Leasing[j]	4.4	5.5
Accommodation and Food Services[k]	7.9	13.4
Health Care and Social Assistance[l]	10.3	6.0
Education Services[m]	1.5	3.9
Other Services[n]	27.7	19.9

[a] For Japan, this is categories from A to C in the EEC table.
[b] For Japan, this is category D.
[c] For Japan, this is category E.
[d] For Japan, this is category F.
[e] For Japan, this is category G.
[f] For Japan, this is category H.
[g] For Japan, this is category I.
[h] For Japan, this is category J. For the U.S., this is "Wholesale Trade" and "Retail Trade" combined.
[i] For Japan, this is category K.
[j] For Japan, this is category L.
[k] For Japan, this is category M.
[l] For Japan, this is category N.
[m] For Japan, this is category O.
[n] For Japan, this is categories P and Q. For the U.S., this the sum of "Professional, Scientific, and Technical Services," "Management of Companies and Enterprises," "Administrative and Support and Waste Management and Remediation Services," "Arts, Entertainment, and Recreation," "Other Services (except Public Administration)," and "Unclassified." The size of "Unclassified" is very small (less than 0.3% of the total).

Table 5: The share in the number of all establishments (%)

	U.S.	Japan
Forestry, Fishing, Hunting, and Agricultural Support	0.2	0.4
Mining	0.4	0.1
Construction	5.6	7.3
Manufacturing	12.5	17.5
Utilities	0.6	0.5
Information	3.2	2.8
Transportation and Warehousing	3.6	5.1
Wholesale and Retail Trade	18.3	21.8
Finance and Insurance	5.7	2.5
Real Estate and Rental and Leasing	1.8	1.8
Accommodation and Food Services	9.2	8.6
Health Care and Social Assistance	13.6	9.8
Education Services	2.4	5.2
Other Services	22.9	16.5

Table 6: The employment share in each sector (%)

3.1 Average size

Let $\bar{n}_i$ be total employment in sector i and $\bar{n}$ be total employment in the whole economy. Let $\bar{N}_i$ be the total number of establishments in sector i, and $\bar{N}$ be the total number of establishments in the whole economy. The economy-wide average size of establishments, AS, is calculated as

$$AS = \frac{\bar{n}}{\bar{N}} = \frac{\sum_i \bar{n}_i}{\bar{N}} = \sum_i \frac{\bar{n}_i}{\bar{N}_i}\frac{\bar{N}_i}{\bar{N}} = \sum_i (AS_i)(SH_i),$$

where $AS_i \equiv \bar{n}_i/\bar{N}_i$ is the average size of an establishment in sector i and $SH_i \equiv \bar{N}_i/\bar{N}$ is the share of sector i in terms of the number of establishments. I can measure the pure effect of sectoral composition by calculating AS using the U.S. values of AS_i and Japanese values of SH_i. If the main reason that the U.S. has a larger average establishment size is because the sectors with larger establishments have higher shares, imposing the Japanese SH_i would bring the value of AS down close to the Japanese size (9.4). However, this exercise results in the value of 19.3, which is even larger than the U.S. value in the data (17.6). Indeed, Japan has a larger manufacturing share than

	U.S.	Japan
Forestry, Fishing, Hunting, and Agricultural Support	8.4	11.5
Mining	21.1	11.1
Construction	10.5	7.6
Manufacturing	44.1	18.1
Utilities	38.3	31.1
Information	28.5	26.8
Transportation and Warehousing	22.8	22.3
Wholesale and Retail Trade	14.6	7.7
Finance and Insurance	15.2	17.0
Real Estate and Rental and Leasing	7.1	3.2
Accommodation and Food Services	20.5	6.2
Health Care and Social Assistance	23.4	15.9
Education Services	41.1	12.7
Other Services	14.5	8.0

Table 7: Average size in each sector

the U.S., and the manufacturing plants are on average larger than the establishments in other sectors.

This experiment shows that the smallness of the average Japanese establishment is not due to the sectoral composition. In fact, if I look at AS_i in Table 7 individually, AS_i is smaller for Japanese establishments in most of the sectors.

3.2 Average size of opening and closing establishments

The economy-wide average size of opening establishments, denoted AS^e, is calculated as

$$AS^e = \frac{\bar{n}^e}{\bar{N}^e} = \frac{\sum_i \bar{n}_i^e}{\bar{N}^e} = \sum_i \left(\frac{\bar{n}_i^e}{\bar{N}^e} \right) = \sum_i \left(\frac{\bar{n}_i^e}{\bar{N}_i^e} \frac{\bar{N}_i^e/\bar{N}_i}{\bar{N}^e/\bar{N}} \frac{\bar{N}_i}{\bar{N}} \right) = \sum_i (AS_i^e)(RE_i)(SH_i),$$

where the superscript e denotes entering establishments. $RE_i = ER_i/ER$ measures the entry rate in sector i, $ER_i \equiv \bar{N}_i^e/\bar{N}_i$, relative to the total entry rate $ER \equiv N^e/\bar{N}$. This captures the fact that some sectors have higher entry rate than other sectors. To measure the sectoral composition effect, I can calculate the AS^e with the U.S. values of AS_i^e and RE_i,[13] and the Japanese values of SH_i. If the sectoral composition has an effect, this exercise will affect the value of AS^e. However, this results in the value of 8.6, which is similar to the original U.S. value (8.3). The same counterpart can be calculated for the closing establishments, and this results in the value of 9.1, again similar to the original U.S. value (9.0). Here I find that the differences in sectoral composition have almost no effect on the average sizes of opening and closing establishments.

3.3 Entry and exit rates

The entry rate, ER, can be calculated as

$$ER = \frac{\bar{N}^e}{\bar{N}} = \frac{\sum_i \bar{N}_i^e}{\bar{N}} = \sum_i \frac{\bar{N}_i^e}{\bar{N}_i}\frac{\bar{N}_i}{\bar{N}} = \sum_i (ER_i)(SH_i).$$

With this formula, I can evaluate the pure sectoral composition effect by using ER_i in the U.S. and SH_i in Japan. If the sectoral composition is the main cause of the U.S.-Japan difference, then this exercise should result in a similar entry rate as the Japanese rate (4.4%). However, this gives 11.3%, which is very similar to the original U.S. value (11.6%). I can conduct the same experiment for the exit rate, and I obtain 10.1%. Again, this is closer to the original U.S. value (10.2%) than the Japanese value (4.4%). Thus, the sectoral composition has little effect on the entry and exit rates.

In all three experiments above, I obtained values that are very similar to the original U.S. value after adjusting the sectoral composition to the Japanese values. Therefore, I conclude that the differences between the U.S. and Japan in these dimensions are not due to the differences in sectoral composition. Rather, the behavior of each establishment is different across these countries in determining the average size of establishments and the entry/exit rates. Below, I use the original unadjusted values when I evaluate the model.

[13] These can be calculated from the SUSB dataset.

4 Model

In this section, I set up a dynamic general equilibrium model of entry and exit. The strategy here is to calibrate the model to the U.S. data and examine what kind of "frictions" can be responsible for the properties of Japanese data.

The model is based on Hopenhayn and Rogerson (1993). I modify the exit process to match the model to the data. In particular, I make two modifications. First, there are endogenous and exogenous exits (in Hopenhayn and Rogerson (1993), there is only endogenous exit). Second, I add positive exit values, as in Lee and Mukoyama (2008).[14]

4.1 Establishments

Time is discrete. There are two kinds of entities in the economy: establishments and consumers. The establishments produce the consumption goods for consumers. Consumers supply labor (the only production factor) to the establishments. The consumers also own the establishments and receive profits.

Here I describe the behavior of the establishments. First, I describe the timing of incumbent establishments. Then I describe the entrants' timing.

An incumbent establishment starts period t with the individual state (s_{t-1}, n_{t-1}). s_{t-1} is the productivity level of the establishment in period $t-1$. n_{t-1} is its employment level in period $t-1$. The value function of an establishment at this stage is denoted as $W(s_{t-1}, n_{t-1})$. Then, it receives an "exogenous exit" shock, $\psi_t \in \{0, 1\}$. If $\psi_t = 1$, it has to exit (without receiving any value). If $\psi_t = 0$, it has a choice of whether to stay or to exit after seeing the exit value. ψ_t follows an i.i.d. stochastic process and ψ_t is 1 with probability δ and ψ_t is 0 with probability $(1 - \delta)$. Then the establishment

[14] The exit values can be interpreted as the value of the used capital or the value of the land sold upon exit. In the model, the cost of obtaining new capital or land upon entry is considered to be included in the entry cost. As is argued in Lee and Mukoyama (2008), the stochastic exit value is necessary in order to account for the exit rate and the average size of the exiting establishments at the same time. If the exit value is the same across establishments, either the exit rate in the model becomes too large or the average size of the exiting establishments in the model becomes too small compared to the data. An alternative assumption is to introduce a stochastic fixed cost for operation, as in Moscoso Boedo and Mukoyama (2008) and Samaniego (2008).

observes the exit value. The exit value $x_t \in \{0, \bar{x}\}$ also follows an i.i.d. process and $x_t = \bar{x}$ with probability ξ and $x_t = 0$ with probability $(1 - \xi)$. I assume that adjusting employment costs $\gamma|n_t - n_{t-1}|$ amount of adjustment cost (where $\gamma \geq 0$)—thus an exiting establishment has to pay γn_{t-1} for adjusting the employment down to zero. If it decides to stay, it observes the current period's productivity s_t. The distribution of s_t given s_{t-1} is expressed by the conditional distribution $\eta(s_t|s_{t-1})$. The value function at this point is denoted as $V(s_t, n_{t-1})$. Then it decides the amount of employment in the current period, n_t, and produces. The production function is $f(n_t, s_t)$, which is increasing and concave in n_t. If $n_t \neq n_{t-1}$, it pays adjustment costs $\gamma|n_t - n_{t-1}|$. I also assume that there is a size tax: if $n_t \geq \hat{n}$, it has to pay $\kappa(n_t - \hat{n})$ where $\kappa \geq 0$. The size tax is rebated to the consumer in a lump-sum manner.

The entrant draws the initial productivity s_t from the distribution $\nu(s_t)$. Then it decides the employment n_t and produces. It has to incur the adjustment cost—since it increases employment from zero, it has to pay γn_t. It is also subject to the size tax.

The incumbent solves the Bellman equation

$$W(s, n) = (1 - \delta)E_x \left[\max \left\langle \int V(s', n) d\eta(s'|s), x - \gamma n \right\rangle \right] + \delta(-\gamma n),$$

and

$$V(s', n) = \max_{n'} \left\{ f(s', n') - wn' - \gamma|n' - n| - \kappa \max\langle 0, n' - \hat{n} \rangle + \beta W(s', n') \right\}.$$

Here, $E_x[\cdot]$ denotes the expectation with respect to x, and β is the discount factor. Let the decision rule of n' be $n' = \phi(s', n)$. Also define the decision rule for endogenous exiting when $x = \bar{x}$ realizes as $\chi(s, n)$: $\chi(s, n) = 1$ when the establishment exits and $\chi(s, n) = 0$ when the establishment stays. In the following, I will assume a production function under which there is no endogenous exiting when $x = 0$ realizes.

The entrant's value is calculated as

$$V^e = \int V(s', 0) d\nu(s').$$

I assume free entry, therefore

$$V^e = c_e \tag{3}$$

holds in an equilibrium with positive entry.

4.2 Consumers

The representative consumer maximizes the expected utility:

$$\mathbf{U} = E\left[\sum_{t=0}^{\infty} \beta^t [\log(C_t) - AL_t]\right],$$

where C_t is consumption and L_t is the labor supply. A is a constant parameter. The budget constraint is

$$C_t = w_t L_t + \Pi_t + R_t, \tag{4}$$

where Π_t is the total profit (including the exit value) and R_t is the rebate of the size tax. The first-order condition is

$$\frac{w_t}{C_t} = A. \tag{5}$$

4.3 General equilibrium

From here, I will focus on the stationary equilibrium where all of the aggregate variables are constant. The total profit is given by

$$\Pi_t = Y_t - w_t L_t - H_t - R_t - N_t c_e + X_t, \tag{6}$$

where Y_t is the total output given by

$$Y_t = \int f(s_t, \phi(s_t, n_{t-1})) d\mu(s_t, n_{t-1}),$$

where $\mu(s_t, n_{t-1})$ is the (stationary) distribution of establishments that are going to produce at period t (including the new entrants, whose $n_{t-1} = 0$). H_t is the total adjustment cost:

$$H_t = H_t^p + H_t^x,$$

where H_t^p is the adjustment cost paid by the establishments which produce in period t, and H_t^x is the adjustment cost paid by the establishments which exit at the beginning of period t.

$$H_t^p = \int \gamma |\phi(s_t, n_{t-1}) - n_{t-1}| d\mu(s_t, n_{t-1}).$$

From stationarity,

$$H_t^x = H_{t+1}^x = \delta \int \gamma\phi(s_t, n_{t-1})d\mu(s_t, n_{t-1}) + (1-\delta)\xi \int \gamma\chi(s_t, \phi(s_t, n_{t-1}))\phi(s_t, n_{t-1})d\mu(s_t, n_{t-1}).$$

The first term is the adjustment cost for exogenous exit and the second term is the adjustment cost for endogenous exit. N_t is the total amount of entrants. The total exit value can be calculated by

$$X_t = X_{t+1} = \bar{x}(1-\delta)\xi \int \chi(s_t, \phi(s_t, n_{t-1}))d\mu(s_t, n_{t-1}).$$

From (4) and (6),

$$C_t = Y_t - H_t - N_t c_e + X_t.$$

Combining this with (5),

$$\frac{w_t}{Y_t - H_t - N_t c_e + X_t} = A \tag{7}$$

holds. The total labor demand is

$$L_t = \int \phi(s_t, n_{t-1})d\mu(s_t, n_{t-1}). \tag{8}$$

Since the establishment decision rules are only affected by w_t, I can solve the Bellman equations and obtain the equilibrium w_t from (3). Given the decision rules obtained from the optimization, I can calculate $\mu(s_t, n_{t-1})$ for any given amount of entry. Let $\mu^1(s_t, n_{t-1})$ be the stationary distribution when the number of entrants is assumed to be one. Then, $\mu(s_t, n_{t-1}) = N_t\mu^1(s_t, n_{t-1})$ holds. Therefore, given the decision rules and w_t, (7) pins down the equilibrium value of N_t.

4.4 Calibration and benchmark results

The strategy here is to match the model moments with no adjustment costs ($\gamma = 0$) and no tax ($\kappa = 0$) to the U.S. data and use the matched model as the benchmark. Then I will ask what kind of parameter changes would help explain the differences between the U.S. and Japan.

I set one year as one period. I assume that the production function is

$$f(s_t, n_t) = s_t n_t^\theta.$$

	Data	Model
$1-4$	72.04	72.04
$5-9$	14.03	14.03
$10-19$	7.32	7.32
$20-49$	4.27	4.27
$50-99$	1.37	1.37
$100-499$	0.88	0.88
$500-999$	0.06	0.06
$1000-$	0.04	0.03

Table 8: Size distribution of entrants (%), U.S. data and model

As in the standard real business cycles literature, I set $\beta = 0.94$ and $\theta = 0.64$. Following Hopenhayn and Rogerson (1993), I set the benchmark value of $w = 1$. This is achieved by setting c_e so that the free-entry condition (3) holds under $w = 1$. I set the value of A so that the benchmark value of L becomes 0.6. This is done by first finding an N that satisfies (8) with $L = 0.6$, and then setting A so that (7) holds with this N.

For the stochastic processes, I use the following method. First, I discretize the domain of s_t. In particular, I pick eight grids of s_t so that the optimal amount of employment without adjustment cost at each s_t corresponds to the midpoint of the cells in Table 1.[15] (For the largest cell, I pick $n_t = 1001$.) Then I try to match the model outcome to the cross-section property of the data. The entrant's distribution $\nu(s)$ is set so that the size distribution of the entrants match the data, as in Table 8.

The stochastic exit probability δ is set at 0.044. This value is somewhat arbitrary—the number is set so that if all exiting is exogenous, the exit rate matches the Japanese value. To match the distribution of exit rates, I could instead consider a more elaborate distribution for the exit values x_t (as in Lee and Mukoyama 2008). Here, in effect, I am making all of the exits by large establishments exogenous (and all of the exit by Japanese establishments exogenous in the later experiments). The advantage of this approach is that the exit value (at both micro and macro levels) does not have to be

[15] In contrast, I make sure that I have enough grids on n, so that the optimal choice is not constrained by the discreteness of the grid.

	Data	Model
$1-4$	14.88	18.74
$5-9$	6.72	4.40
$10-19$	5.57	4.40
$20-49$	4.91	4.40
$50-99$	4.58	4.40
$100-499$	4.10	4.40
$500-999$	4.25	4.40
$1000-$	4.21	4.40

Table 9: Exit rates (%), U.S. data and model

unrealistically high. The disadvantage is that I cannot analyze the policy responses of large establishments' exits.

The exit value $\bar{x}$ is set at $\bar{x} = 35$, which is just above the value of the establishment with the lowest s. This choice is motivated by the pattern of exit rates shown in Table 9. There, the exit rate of the smallest size cell is markedly different from the other cells. The probability of receiving a positive exit value, ξ, is set so that the average size of the closing establishments is similar to the data. Since $\bar{x}$ is just above the value of the smallest establishments that stay, any parameter changes that make the value of staying higher would make them stay. This will happen, for example, when I raise the entry cost (higher entry cost reduces the wage, and through lower costs raises the value of operating).

For the transition probabilities of s_t, I first assume that it follows an AR(1) process:

$$\log(s_{t+1}) = a + \rho \log(s_t) + \epsilon_{t+1},$$

where $\epsilon_{t+1} \sim N(0, \sigma^2)$. Then, I approximate this on the s grids, in a similar manner as Tauchen (1986). I set $\rho = 0.98$. This value is motivated from the highly persistent employment process in the U.S. manufacturing sector, as documented in Lee and Mukoyama (2008). The value of σ is set so that the total job creation rate becomes similar to the data. a is set at -0.004 and this brings the average size of all establishments close to the data. Table 10 summarizes the statistics from the U.S. data and

	Data	Model
Average size of all establishments	17.6	17.8
Average size of opening establishments	8.3	10.0
Average size of closing establishments	9.0	8.8
Entry rate (%)	11.6	10.9
Exit rate (%)	10.2	10.9
Total JC rate (%)	15.8	15.4
JC rate by opening establishments (%)	5.5	6.1
Total JD rate (%)	14.4	15.4
JD rate by closing establishments (%)	5.2	5.3

Table 10: Summary statistics

	Data	Model
1 – 4	48.52	45.02
5 – 9	21.52	26.34
10 – 19	14.24	15.53
20 – 49	9.77	7.95
50 – 99	3.32	3.52
100 – 499	2.35	1.24
500 – 999	0.17	0.27
1000–	0.10	0.11

Table 11: The size distribution of establishments in U.S. data and model (%)

the model. Table 11 depicts the size distribution of establishments in the U.S. data and the model. Given that the calibration target is only the average value, this shows a very good match.

4.5 Experiments

Here, I run four experiments using the model. I add different "frictions" to the benchmark model in each case. In all four cases, I do not have appropriate data to pin down the policy parameter values. Therefore, these experiments should be seen as suggestive—showing theoretical possibilities—that these frictions may contribute to

	Data	Model
Average size of all establishments	9.4	12.4
Average size of opening establishments	9.6	10.3
Average size of closing establishments	7.9	12.4
Entry rate (%)	4.4	4.4
Exit rate (%)	4.4	4.4
Total JC rate (%)	8.7	13.9
JC rate by opening establishments (%)	4.5	3.7
Total JD rate (%)	7.6	13.9
JD rate by closing establishments (%)	3.7	4.4

Table 12: Summary statistics for Experiment 1: Japanese data and model

the differences in the establishment behavior between the U.S. and Japan.

4.5.1 Experiment 1: no exit value

First, I consider the change in the exit value. The exit value directly affects the exit decision. Regulations regarding exiting,[16] underdeveloped used capital market, and illiquid real estate market would reduce the value of exiting. An additional (somewhat more likely) possibility is that the influences of "specific capital" and "organizational capital" are stronger in Japan than in the U.S. The values of these types of capital disappear when the establishment exits, and therefore the existence of these types of capital reduces the exit value.

Here, I run an experiment with $\bar{x} = 0$. This is, in effect, assuming that there is no endogenous exit.[17] Therefore, I can match the entry and exit rate of 4.4% by construction, which is similar to the Japanese value.

Table 12 summarizes the result. The "Data" column in the experiments is the Japanese data. Somewhat surprisingly, the average size of all establishments falls

[16]This could include the structure of legal systems surrounding the bankruptcy and liquidation.

[17]If, alternatively, a continuous distribution for the exit value is assumed (as in Lee and Mukoyama (2008)) instead of the current two-point distribution, it would be possible to find a parametrization where some endogenous exit survives. The current formulation should be regarded as a shortcut so that the outcome of the low exit value can easily be evaluated.

	Data	Model
Average size of all establishments	9.4	16.3
Average size of opening establishments	9.6	13.6
Average size of closing establishments	7.9	16.3
Entry rate (%)	4.4	4.4
Exit rate (%)	4.4	4.4
Total JC rate (%)	8.7	13.9
JC rate by opening establishments (%)	4.5	3.7
Total JD rate (%)	7.6	13.9
JD rate by closing establishments (%)	3.7	4.4

Table 13: Summary statistics for Experiment 2: Japanese data and model

substantially and becomes close to the Japanese data. The reason is that small establishments exit less frequently—therefore, many small establishments remain operating. Therefore, here I match the "size fact" on the establishments by forcing the match of the "entry/exit fact." This experiment fails to match the "JC/JD fact" since the JC rate by existing establishments (which is the total JC rate minus the JC rate by opening establishments) remains high.

4.5.2 Experiment 2: higher entry cost

Another possibility in generating a lower entry/exit rate in Japan is that a Japanese establishment may be facing a larger entry cost. In practice, it is difficult to measure all of the aspects of the entry cost. However, there are some indications that the entry cost is somewhat higher in Japan due to regulations. For example, the "Doing Business" dataset[18] (constructed by the World Bank) shows that in 2006 the monetary cost of starting a business was 7.5% of income per capita in Japan, while it was 0.7% of income per capita in the U.S. While both numbers are very small,[19] other measures also consistently show that it is more costly to start up a business in Japan.

Here, for illustration, I let c_e be 20% higher than the benchmark. Table 13 shows

[18]See `http://www.doingbusiness.org`.

[19]In particular, compared to countries like Sierra Leone (1194.5%) and Angola (486.7%). See Moscoso Boedo and Mukoyama (2008) for analysis of these extreme cases.

	Data	Model
Average size of all establishments	9.4	13.1
Average size of opening establishments	9.6	9.2
Average size of closing establishments	7.9	13.1
Entry rate (%)	4.4	4.4
Exit rate (%)	4.4	4.4
Total JC rate (%)	8.7	8.4
JC rate by opening establishments (%)	4.5	3.1
Total JD rate (%)	7.6	8.4
JD rate by closing establishments (%)	3.7	4.4

Table 14: Summary statistics for Experiment 3: Japanese data and model

the outcome. The results are similar to Experiment 1. The entry/exit rates fall and the average size of the all establishments also falls. The decline in the average size is somewhat smaller, since the decline in wages encourages the establishments to expand. The JC/JD rates by the existing establishments remain high. In other words, it is difficult to differentiate a low exit value against a high entry cost in this model. Here, the experiments suggest that either (or both) may have important effects on accounting for the "entry/exit fact" and the "size fact." They also suggest that these factors are not sufficient to explain the "JC/JD fact." Below, I investigate additional institutional differences that may explain the "JC/JD fact," while maintaining the low exit value (the results would be similar if I instead assume a high entry cost).

4.5.3 Experiment 3: labor adjustment cost (with no exit value)

Here I investigate the possibility that Japanese establishments face a higher labor adjustment cost. It is often suggested that the labor market in Japan is more "rigid" than the U.S. labor market, in the sense that it is more costly to reallocate labor across different production units. For example, OECD (2004, Chart 2.1) shows that Japan has stronger employment protection regulations overall compared to U.S., in particular in the forms of "regulation on temporary forms of employment" and "protection of permanent workers against (individual) dismissal."

	Data	Model
Average size of all establishments	9.4	9.5
Average size of opening establishments	9.6	8.5
Average size of closing establishments	7.9	9.5
Entry rate (%)	4.4	4.4
Exit rate (%)	4.4	4.4
Total JC rate (%)	8.7	8.7
JC rate by opening establishments (%)	4.5	4.0
Total JD rate (%)	7.6	8.7
JD rate by closing establishments (%)	3.7	4.4

Table 15: Summary statistics for Experiment 4: Japanese data and model

Here, I let $\gamma = 0.4$, while maintaining the assumption in Experiment 1 ($\bar{x} = 0$). Table 14 summarizes the result. Now the "JC/JD fact" is also matched. All of the model statistics are in line with the data, except that the average size is still somewhat higher in the model.

4.5.4 Experiment 4: size tax (with no exit value)

Finally, I consider a tax on size.[20] In particular, I tax an establishment which is larger than $\hat{n}$, with the amount that is proportional to the number of the workers in excess to $\hat{n}$.[21] A well-known example of this type of regulation in Japan is the "Large Scale Retail Store Law" (replaced in 2000 by the "Large Scale Retail Location Law") introduced in 1974. It restricts the entry of a large-scale retail store by requiring it to go through special procedures. Not surprisingly, in Table 7, "Wholesale and Retail Trade" establishments are much smaller in Japan than in the U.S. This "size tax" can also be a reflection of the extra cost of operating on a large scale, such as the cost of constructing a large factory or the cost of obtaining a large piece of land.

Here, I assume that $\kappa = 0.4$ and $\hat{n} = 10$, in addition to the assumptions from Experiment 1 ($\bar{x} = 0$). That is, there is an annual size tax that is 40% of the benchmark

[20] Guner, Ventura, and Yi (2008) analyze this type of policy in a broader context.

[21] Although here I consider a positive tax, if taxed negatively this type of tax can also reflect policies that favor large establishments or credit market conditions that favor large projects.

	w	C	L	Y/L	Y/L^{θ}
Baseline	1.00	0.72	0.60	1.56	1.30
Experiment 1	0.98	0.70	0.54	1.54	1.23
Experiment 2	0.89	0.64	0.54	1.39	1.11
Experiment 3	0.88	0.63	0.52	1.49	1.18
Experiment 4	0.76	0.54	0.41	1.61	1.17

Table 16: Wage, consumption, employment, and productivity

annual wage for each worker in excess of 10 workers. Table 15 shows the result. All of the statistics are in line with the data. One aspect that is superior to Experiment 3 is that the average size also decreases to the level of what the data shows.

In sum, combinations of

1. low exit value and/or high entry cost, and

2. labor adjustment cost and/or size regulations

bring the model close to the Japanese data. Whether the values of the policy parameters that I set are reasonable or not remains to be studied in the future.

4.5.5 Wages, consumption, employment, and productivity

In Table 16 I show the values of wages, consumption, employment, and productivity in each experiments. It can be seen that each policy generates substantial changes in the aggregate variables. One puzzling observation is that in these experiments, L is much lower in Japan than in the U.S. (baseline). This is particularly puzzling since the working hours in Japan are typically considered to be higher than in the U.S.[22] This may be due to the elements that the model is missing. For example, Prescott (2004) argues that a large part of the difference in the U.S.-Europe (and the U.S.-Japan) labor supply can be explained by the difference in the tax system.

The low wage reflects a low labor productivity. I present two measures of productivity, Y/L and Y/L^{θ}. Both indicate, in general, that productivity is lowered by

[22]See, for example, Prescott (2004, Table 1).

the frictions. The only exception is a high Y/L in Experiment 4, which is due to a very low level of production (the level of L is very small) and decreasing returns to scale.[23] The value of Y/L^θ (conceptually closer to total factor productivity) indicates that productivity is indeed lower in this case as well.

Because of the low level of exits (due to low exit value or low entry pressure), many low-productivity establishments continue to survive. This somewhat resembles the "zombie firms" hypothesis by Caballero, Hoshi, and Kashyap (2008). One important difference is that here the lower number of exits does not have to be due to the malfunction of the banking sector, which is emphasized by Caballero, Hoshi, and Kashyap (2008). In particular, the frictions in the entry margin can also generate the low exit rate through general equilibrium effects. In relation to the banking sector, it is also possible that insufficient funding of the entering production units allows inefficient establishments to survive.[24] In addition, the labor adjustment cost inhibits the reallocation of labor from low-productivity establishments to high-productivity establishments. When there is a size tax, it suppresses the growth of high-productivity establishments.

Past studies using firm-level data seem to have a similar message. For example, Fukao and Kwon (2006) analyze Japanese firm-level data in the manufacturing sector from 1994-2001 using a method similar to Foster, Haltiwanger, and Krizan (2001). They conclude that the productivity gain from reallocation was very small in the Japanese manufacturing sector during that period.[25]

[23] Recall that the wage is determined by the free-entry condition (3). The wage level reflects the profitability of the establishment. (The wage is high if the establishment is profitable for a given wage.) Here, the profitability is low because of the low exit value and the size tax. Note that the wage is not necessarily equal to the marginal product of labor (which is proportional to the output-labor ratio in each establishment) given the size tax.

[24] Hosono (2008) applies the model of Gomes (2001) to the Japanese economy and emphasizes the role of external finance cost. As is discussed in Lee and Mukoyama (2008), it is possible that the financial cost is an important part of the entry cost. A subtle issue is that the current model is about an "establishment" as a production unit, while one should construct a model of a "firm" as a financial unit when the financial cost is explicitly analyzed.

[25] The current paper focuses on the size, rather than the productivity of establishments. However, in the current model, the size reflects the productivity, and there is a strongly positive relationship between them. Recent empirical papers using firm-level datasets in Japan, such as Ahn, Fukao, and

5 Conclusion

In this paper, I explored the differences between the U.S. and Japan in establishment-level dynamics. I found that there are three substantial differences. First, entry and exit rates are much lower in Japan. Second, the average size of establishments is much smaller in Japan, while the average size of opening/closing establishments are similar in the U.S. and Japan. Third, the amount of job creation and job destruction is much smaller in Japan, especially for continuing establishments.

I investigated whether these differences can be explained by differences in sectoral composition. I found that the differences in sectoral composition do not explain the aforementioned facts. Then I built a general equilibrium industry dynamics model to analyze what type of frictions can account for these facts.

I ran four experiments using the model. First two experiments suggest that there may be important impediments for establishment entry/exit in Japan. It also suggests that the lack of the selection at the exit margin explains some part of the smaller establishment size in Japan. The third and fourth experiments indicate that there may be factors impeding productive establishments from growing larger. Searching for these impediments in reality is the important next step ahead. Some of them would reflect government regulations, but they may also reflect malfunctions of the credit market. Once these impediments are identified, it will be possible to prescribe policies that enhance reallocation of resources for more productive use.

In this paper, I have stayed away from discussing the detailed issues of international data comparison, by using the official data at face value. As Bartelsman, Haltiwanger, and Scarpetta (2007) discuss, there are many delicate issues regarding the comparison

Kwon (2004), Nishimura, Nakajima, and Kiyota (2005), and Fukao and Kwon (2006), find cases where the average productivity of exiting firms are higher than the average productivity of surviving firms. If interpreted as a model of "firms," it is difficult for the current model to replicate this empirical result, unless the exit value of a firm is negative. Further investigation of this firm-level phenomenon is beyond the scope of this paper. This phenomenon may be due to the malfunction of the financial sector as the literature above suggests. My conjecture is that the strong aversion of Japanese firms to file bankruptcy, in addition to the lack of competition (due to the difficulty of entry) and the poor financial sector (which also contributes the difficulty of entry) including the "zombie lending," plays an important role in explaining the firm-level entry/exit facts.

of micro-level data across countries. Although the statistics used in this paper are relatively clear-cut and straightforward, it is generally difficult to avoid subtle inconsistencies in the way in which data is collected and the way in which the variables are defined. A more rigorous comparison of the data is also a promising future research topic.

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