



Backgrounds

- Debate: whether labor market is flexible enough?
- Support argument:
 - Flexibility allows firms to adapt to changing demand conditions, e.g. environment shocks
 - Flexibility contributes to employment as well as allows for higher economic growth and higher productivity growth (e.g. OCED job study, 1994; Nicoletti and Scarpetta, 2003)
- Counterargument:
 - Fair protection against dismissal
 - Longer-term commitments and loyalty



Japanese labor market

- Since 1990s, a shift from seniority wage and lifetime employment to more flexible labor market while non-regular workers are used.
- Currently using dual labor market model (flexicurity) but different from those in EU countries such as Denmark
 - Compared to permanent employees, lower payment, lower social security and lower protection from dismissal
- Flexible labor is used for economizing labor costs. Non-regular employees are common in low-tech sectors.



Forms of flexible labor contracts

- Numerical flexibility
 - Adjustment of labor intake, the number of workers from external labor market
 - Achieve by hire temporary workers, part-timers, dispatched workers or easy hiring and firing
- Functional flexibility
 - Adjustment of internal labor market, such as job rotation within a firm
- Wage flexibility
 - Wage levels are not decided collectively and there are more differences between the wages of workers, e.g. performance-based pay



Aim of our paper

- Builds on previous firm-level analysis on flexible labor and innovation from EU countries
- Focus on R&D-oriented start-ups (typically firms are categorized to schumpeter I regime)
- Focus on numerical flexibility (empirical results using EU firm-level data are rather mixed)
- Within a Japanese context where flexicurity (dual labor market model) is implemented.
 - Whether there is an additional effect of flexible labor than its role of cost saving?



Numerical flexibility might favor innovation

- **Walrasian view**
 - Difficult and expensive firing of redundant personnel frustrates labour-saving process innovations
 - With easier firing, shifting labour from old and declining industries to innovative activities is easier
 - Easier firing enhances the inflow of 'fresh blood' (i.e. of people with novel ideas and networks)
 - The (latent) threat of easy firing reduces shirking
 - Firms can more easily replace weak people by better personnel



Numerical flexibility might damage innovation

- **Schumpeterian view**
 - Principal argument: Flexible 'hire & fire' reduces loyalty and commitment. With easier firing, shifting labour from old and declining industries to innovative activities is easier
 - Lower investment in manpower training as pay-back periods become shorter.
 - Personnel have fewer incentives to invest in firm specific knowledge (e.g. safety instructions)
 - A larger personnel turnover weakens the 'historical memory' of organizations and the 'learning organization'.
 - Tacit knowledge for incremental innovation is in favour of continuity in labor relations, thus internal labor market ('functional flexibility') is preferred than via external labor market ('numerical flexibility')
 - People threatened by easy firing have incentives not to reveal knowledge relevant to labor-saving process innovation
 - Easy firing will change power relations in firms.



Numerical flexibility as an important means for start-ups to innovate?

- Schumpeter I model
 - 'Entrepreneurial model': new firm foundation (e.g. in ICT, biotechnology); inventor-entrepreneur ('Garage business').
 - Countries with more labor flexibility (e.g. Anglo-Saxon countries) perform better on Schumpeter I regime
 - Most start-ups are categorized as firms in Schumpeter I regime
- Resource-based view
 - Limited human capital, efficiently manage human resources is key to success
 - Flexibility allows start-ups having relatively greater freedom of capital interests to set the terms of utilization of labor
 - Flexible labor might be critical for start-ups due to the liabilities of newness and size
- Thus, we assume 'numerical flexibility positively → innovation of start-ups'



Data

- **Original questionnaire survey data for Japanese start-ups**
 - Repeated annual surveys from 2008 to 2011 in 4 waves
 - First survey in November 2008 sent to 13,582 firms in manufacturing and software sectors incorporated between Jan. 2007 and August 2008
 - Target firms obtained from a company database compiled by Tokyo Shoko Research (TSR)
 - Questions on founder's personal characteristics, firm characteristics at start-up, finance, employment, R&D and innovation, firm performance etc
 - Obtained a panel of 514 firms (931 observations)



Key variables

- **Innovation performance**
 - Technological innovation (no distinguish between innovativeness and imitativeness) ; *INN*
 - Number of product/process innovations
 - Patent (representing newness) ; *PAT*
 - Number of patent applications
- **Numerical flexibility**
 - External labor turnover for regular workers; *TURN*
 - Number of hired and retired workers between periods t and $t+1$, divided by total number of workers at period t
 - Share of temporary workers (including part-time and fixed-term employees); *TEMP*
 - Share of dispatched workers (employees hired from agency); *DISP*



Other variables

- *SIZE*; Logarithm of the number of employees (incl. the president)
- *AGE*; Logarithm of the number of months after the foundation
- *B2C*; Dummy variable: 1 if B to C industry, 0 otherwise
- *RD*; Logarithm of annual amount of research and development expenditures
- *PROFIT*; Dummy variable: 1 if the business is profitable, 0 otherwise
- *COMP*; 5-point Likert scale for perceived competitive pressure (1 less competitive ~ 5 fairly competitive)
- *IND*; Dummy variable: 1 if independent start-ups, 0 otherwise
- Other controls
 - High-tech dummy (categorized based on R&D intensity),
 - Year dummies



Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
(Dependent variable)					
<i>INN</i>	931	1.491	6.125	0	100
<i>PAT</i>	903	0.402	3.360	0	68
(Independent variable)					
<i>TURN</i>	931	0.277	0.948	0	18
<i>TEMP</i>	931	0.134	0.229	0	0.946
<i>DISP</i>	931	0.013	0.076	0	0.833
<i>SIZE</i>	931	1.128	0.965	0	5.994
<i>AGE</i>	931	3.048	0.650	1.386	4.060
<i>B2C</i>	931	0.063	0.244	0	1
<i>RD</i>	931	2.888	2.795	0	12.388
<i>PROFIT</i>	931	0.519	0.500	0	1
<i>COMP</i>	931	2.766	1.366	0	5
<i>IND</i>	931	0.871	0.335	0	1



Econometric methods

- Negative binomial regression model
 - Dependent variables are count data
- Alternative methods for robustness checks
 - Zero-inflated negative binomial model for excess number of zeros
 - Seemingly unrelated regression (SUR)



Estimation results: full sample

Variable	INN	PAT
<i>TURN</i>	-0.074 (0.060)	0.665** (0.287)
<i>TEMP</i>	0.857*** (0.324)	-2.126*** (0.818)
<i>DISP</i>	2.561*** (0.780)	1.764 (1.754)
<i>RD</i>	0.242*** (0.025)	0.364*** (0.060)
<i>SIZE</i>	0.150 (0.092)	0.299 (0.206)
<i>AGE</i>	0.618*** (0.234)	-1.134** (0.516)
<i>B2C</i>	0.511* (0.290)	-0.051 (0.668)
<i>PROFIT</i>	-0.352** (0.141)	-0.458 (0.305)
<i>COMP</i>	0.047 (0.051)	0.126 (0.108)
<i>IND</i>	0.685*** (0.225)	1.583*** (0.523)
<i>HIGHTECH</i>	-0.838*** (0.158)	-0.221 (0.345)
Constant term	-3.411*** (0.940)	-0.028 (1.999)
Year dummies	Yes	Yes
ln(α)	1.036*** (0.084)	2.273*** (0.139)
Log likelihood	-1259.438	-478.386
Pseudo R^2	0.067	0.076
Observations	931	903



Discussion: full sample results

- External labor turnover
 - Positive (*TURN*) on patent applications (*PAT*).
 - By hiring people flexibly, start-ups may be able to absorb with novel ideas and extend networks.
 - The (latent) threat of easy firing may reduce shirking.
 - Insignificant for technological innovations (*INN*)



Discussion: full sample results (cont.)

- Flexible labor
 - Positive (*TEMP*, *DISP*) on technological innovations (*INN*)
 - Negative (*TEMP*) on patent applications (*PAT*).
 - Non-regular workers are only used to conduct routines that produce output that does not require much knowledge especially novel knowledge.
 - Technological innovation (*INN*) may not necessarily capture the real innovativeness, because product/process innovations include incremental innovations as well as radical innovations.
 - In contrast, patents (*PAT*) require novel knowledge.
 - Therefore, we found a positive effect on *INN* but a negative effect on *PAT*.



Estimation results: sub-samples

Variable	High-tech		Low-tech	
	INN	PAT	INN	PAT
TURN	-0.027 (0.062)	0.635* (0.347)	-0.605 (0.434)	0.062 (0.271)
TEMP	0.615 (0.383)	-2.753** (1.212)	1.315** (0.527)	-0.752 (0.974)
DISP	-1.292 (1.098)	0.873 (2.117)	5.149*** (1.508)	6.040** (2.589)
RD	0.218*** (0.028)	0.372*** (0.078)	0.243*** (0.048)	0.395*** (0.090)
SIZE	0.315*** (0.101)	0.500* (0.271)	-0.340* (0.178)	-0.514* (0.307)
AGE	0.610** (0.254)	-1.478** (0.673)	0.659 (0.464)	0.298 (0.699)
B2C	0.460 (0.366)	-0.045 (1.109)	0.140 (0.491)	-0.126 (0.712)
PROFIT	-0.312** (0.153)	-0.344 (0.398)	-0.207 (0.290)	-0.026 (0.460)
COMP	0.230*** (0.057)	0.195 (0.141)	-0.284*** (0.098)	0.045 (0.175)
IND	0.650** (0.267)	1.456** (0.706)	0.385 (0.430)	1.596** (0.750)
Constant term	-4.980*** (1.046)	0.232 (2.586)	-1.733 (1.849)	-4.203 (2.789)
Year dummies	Yes	Yes	Yes	Yes
ln(α)	0.723*** (0.118)	2.374*** (0.162)	1.141*** (0.135)	1.225*** (0.359)
Log likelihood	-795.628	-338.205	-437.500	-127.145
Pseudo R^2	0.079	0.082	0.071	0.113
Observations	651	631	280	272



Discussion: sub-sample results

- External labor turnover
 - Positive (*TURN*) on patent applications (*PAT*) only for **high-tech sectors**.
 - People with novel ideas and networks may be particularly important in high-tech sectors, but less important in low-tech sectors, while
- Flexible labor
 - Positive (*TEMP*, *DISP*) on technological innovations (*INN*) only for **low-tech sectors**
 - Positive (*DISP*) on patent applications (*PAT*) for **low-tech sectors**.
 - Flexible labor is important for innovation only in low-tech sectors



Summary of the findings

- *External labor turnover* increases the number of patent applications (representing newness), particularly in high-tech sectors.
- *Flexible labor* increases the number of technological innovations (not necessarily representing newness) in low-tech sectors.
- But, while *flexible labor* decreases the number of patent applications in high-tech sectors, it increases in low-tech sectors.



Implications

- Encouraging external labor turnover is a significant means for boosting innovation performance, especially in high-tech sectors.
- Flexible labor is only important in low-tech sectors, but relatively unimportant for innovation in high-tech sectors.
- Therefore, from an economic policy perspective, promoting labor mobility for regular workers may contribute to achieving innovation and thus economic growth.
 - This supports the 3rd arrow of Abenomics?