Firms and Workers: Industry Instability and Employee Transitions

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Figure 1: Aboriginal Sweetgrass Bistro

About 20 employees out of work!

Figure 2: Aveos Fleet Performance Inc.

2400 employees out of work!

Contribution & Novelty

- How does industry firm instability affect worker turnover and wages in the firms that continue?
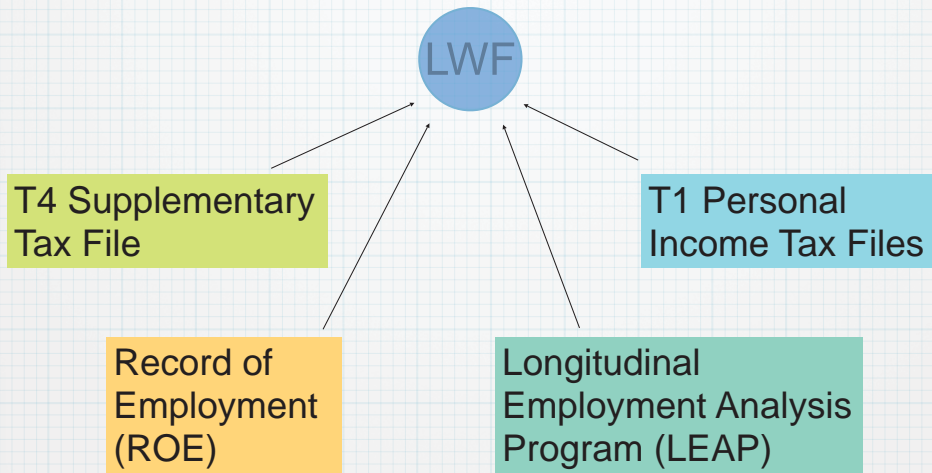- Important to control for selection/unobserved heterogeneity.

Data at Statistics Canada allows us to:

- Incorporate longitudinal data (1992-2008).
- Detailed info about reasons for separations
  i.e. Distinguish between permanent and temporary separations.
- Larger set of demographic and economic variables.
- Wage profiles of switchers.

Related Literature

1. Occupation-specificity,
   Kamburov and Manovskii (REStud, 2009)
2. Firm characteristics,
   Abowd, Kramarz and Margolis (ECTA, 1999)
   Haltiwanger, Jarmin and Miranda (NBER, 2010)
3. Industry Instability,
   Quintin and Stevens (2005)and industry exit rates.
   Dinlersoz, Hyatt and Nguyen (2012)

Longitudinal Worker File

LWF

T4 Supplementary Tax File

T1 Personal Income Tax Files

Record of Employment (ROE)

Longitudinal Employment Analysis Program (LEAP)

T4 Supplementary Tax File

- A random sample of all individuals who received a T4 supplementary tax form and filed a tax return (T4 $\equiv$ W-2).
- A T4 supplementary tax form is issued by employers for any earnings that either exceed a certain threshold or trigger income tax, Canada Public Pension (CPP) or unemployment insurance (EI) premiums.
- Recently added variables: net self-employment income, Registered Retirement Savings Plans (RRSP) income and contributions, union dues, death identifier, etc.

Record of Employment (ROE)

Includes employer provided information on separations and their reasons:

- Shortage of work,
- Labour dispute,
- School,
- Injury/illness,
- Quit,
- Pregnancy.

- Retirement,
- Work-sharing program,
- Apprenticeship,
- End of fishing season,
- Parental leave,
- Other.

Allows us to calculate a permanent separation (PS)

T1 Personal Income Tax Files

Demographic variables such as

- age,
- gender,
- family status and
- area of residence.

Longitudinal Employment Analysis Program

- LEAP is a firm-worker matched dataset.
- Covers companies (not establishments) with at least $1 in payroll.
- Includes information about the payroll of the firm for which an employee works.
- Firm's employment is derived from its payroll.
- LEAP makes it possible to track employees who move from one firm to another.

$$\text{Worker (T4, T1, ROE)} + \text{LEAP} \rightarrow \text{LWF}.$$

LWF Sample

- 10% random sample of Canadian tax-filers.
- Period: 1992 - 2008.
- 10 provinces (the territories are excluded).
- 4-digit NAICS codes are converted into 2-digit codes.
- Shutdown[t]=1 if firm_size[t]>0 and firm_size[t+1]=0, also use payroll.
- The firm can have a positive firm size/payroll in the future.
- **Why not 'exits'?**
    - More difficult to identify.
    - Shutdowns are more relevant because the focus is on separations.
- Annual shutdown rates (SR) are from LEAP (based on all firms in the industry in a given year).

Table 1: Industrial Composition

Industry	Age	Gender	Tenure	w_t	SR	PS	Firms	Workers
Agriculture	41.7	0.41	5.8	21.5	0.132	0.073	8.6	13.5
Forestry	41.1	0.20	5.5	30.8	0.138	0.124	4.5	9.5
Oil	41.2	0.29	6.9	107.1	0.125	0.015	0.4	3.6
Mining	43.9	0.10	9.9	66.0	0.115	0.026	0.4	6.2
Oil & Mining Services	39.0	0.14	4.6	59.4	0.121	0.076	1.3	6.1
Utilities	43.4	0.26	10.5	69.3	0.161	0.015	0.4	11.3
Construction	41.0	0.15	5.3	39.6	0.136	0.114	30.5	65.0
Food	41.3	0.39	7.0	38.4	0.099	0.035	2.9	27.0
Textiles	41.7	0.42	7.1	34.1	0.111	0.039	0.8	3.8
Clothing	43.0	0.76	6.3	23.0	0.160	0.055	1.8	8.1
Wood	41.1	0.15	7.7	46.7	0.118	0.036	1.9	13.7
Paper	43.2	0.18	9.7	58.1	0.087	0.017	0.4	10.2
Printing	41.0	0.41	6.7	41.2	0.102	0.031	2.1	7.7
Chemical	41.2	0.36	6.8	56.9	0.100	0.020	0.9	8.2
Plastics	40.1	0.32	7.0	43.5	0.089	0.026	1.3	12.3
Non-metallics	42.3	0.16	7.8	47.1	0.091	0.041	0.9	5.9
Primary Metals	44.0	0.11	11.4	63.0	0.095	0.015	0.3	8.7
Fabricated Metals	41.1	0.18	6.7	44.7	0.074	0.046	4.0	15.4

Note: Age and tenure are in years. Gender is the proportion of workers that are female. Earnings (w_t), firms and workers are in thousands. SR and PS are the shutdown rate and permanent layoff proportions.

Descriptive Statistics   **12/24**

Table 1: Industrial Composition

Industry	Age	Gender	Tenure	w_t	SR	PS	Firms	Workers
Machinery	40.6	0.18	6.7	51.5	0.081	0.034	2.4	12.7
Computer	39.8	0.35	6.7	60.7	0.111	0.032	1.0	8.4
Electrical	41.7	0.31	7.0	49.0	0.093	0.041	0.6	4.9
Transport	41.6	0.20	9.0	57.1	0.094	0.018	1.1	23.8
Furniture	40.4	0.24	6.2	33.6	0.106	0.040	2.0	8.0
Misc.	40.5	0.42	6.2	36.4	0.096	0.041	1.9	5.6
Wholesale	40.9	0.35	6.3	47.1	0.110	0.032	19.7	66.0
Retail	40.4	0.56	6.0	30.0	0.126	0.022	35.6	117.4
Air Transport	**42.0**	**0.28**	**8.8**	**52.9**	**0.146**	**0.021**	2.4	20.4
Truck Transport	41.6	0.16	5.1	37.8	0.144	0.037	6.7	16.4
Transit	44.9	0.33	7.9	34.5	0.125	0.026	1.5	9.6
Warehousing	40.7	0.27	6.1	41.4	0.097	0.033	0.4	2.5
Publishing	40.1	0.49	6.3	51.1	0.136	0.020	1.7	12.2
Movies	37.8	0.40	4.3	40.7	0.159	0.092	0.9	3.0
Telecommunications	40.0	0.45	8.9	58.1	0.147	0.009	0.6	17.5
FIRE	41.1	0.61	7.2	51.8	0.118	0.017	16.3	81.7
Professional	39.6	0.49	5.0	50.9	0.131	0.035	23.0	58.5
Admin	39.7	0.48	3.8	28.3	0.133	0.049	12.4	55.5
Arts	39.5	0.50	4.9	29.4	0.123	0.059	4.9	14.9
Hospitality	**38.8**	**0.62**	**4.2**	**18.8**	**0.152**	**0.035**	25.7	61.1
Other	41.4	0.56	5.3	30.4	0.137	0.031	27.4	53.1

Note: Age and tenure are in years. Gender is the proportion of workers that are female. Earnings (w_t), firms and workers are in thousands. SR and PS are the shutdown rate and permanent layoff proportions.

Table 2: Firm Size Composition

Firm Size	Gender	Tenure	w_t	SR	PS	Firms	Workers
XS (0,5]	0.47	4.8	25.7	0.130	0.050	110.5	126.1
S (5,20]	0.43	5.2	32.1	0.128	0.054	83.9	136.3
M (20,100]	0.39	5.3	38.0	0.125	0.049	47.8	177.0
L (100+)	0.41	7.2	48.9	0.121	0.025	9.3	450.0

Note: Tenure is in years. Gender is the proportion of workers that are female. Earnings (w_t), firms and workers are in thousands. SR and PS are the shutdown rate and permanent layoff proportions.

Bivariate Probit with Selection

$$\mathrm{PS}^*_{ikjt}|(\mathrm{FS}_{jkt} = 1) = \alpha^{PS} + \beta^{PS} SR_{jt} + \gamma^{PS} X^{PS}_{it} + I_j + YR_t + u_{ikjt}. \quad (1$$
$$\mathrm{FS}^*_{kjt} = \alpha^S + \beta^S SR_{jt} + \gamma^S X^S_{kjt} + I_j + YR_t + \lambda RER_{jt} + v_{kjt}$$

where PS_{ikjt} is permanent separation of worker i from firm k in industry j at time t and FS_{kjt} is the survival of firm k from industry j at time t.

- SR_{jt} is the annual shutdown rate in industry j in period t,
- X^{PS}_{it} is a set of worker-specific variables,
- X^S_{kjt} is a set of matched firm-specific variables,
- I_{jt} are industry dummy variables,
- YR_t are a time dummy variables and
- u_{ikjt} and v_{kjt} are $NID(\mu, \Sigma)$.

Identification

1. **Functional forms:** Joint normality of the error terms.
2. **Exclusion Restriction:** Industry Real Exchange Rates affect Firm Survival but not Separation contemporaneously.
   Campa and Goldberg (REStat, 2001)

$$RER_{jt} = P_{jt}^{US} / P_{jt}^{CDN} \times e_t$$

   - P_{jt}^{US} is the US industry gross output price index,
   - P_{jt}^{CDN} is the Canada industry gross output price index and
   - e_t is the nominal bilateral exchange rate between Canadian and US in year t.

3. Firm Specific Variables (Size of a Firm)

Table 3: Probability of Permanent Separation: Males

Firm Size	XS	S	M	L
No Selection				
Marginal Effect SR	-0.035	0.117	0.160	0.088
With Selection				
Marginal Effect SR	0.213	0.155	0.158	0.042
ρ	-.593	-.609	-.634	.934
logL	-404470.2	-342554	-385405.8	-492905.4
Censored	78093	32210	26559	18265
Observations	858091	1046930	1466118	3827287

Note: No selection is the probit model for just probability of permanent separation while the selection model accounts for censoring due to firm shutdown.

Table 4: Probability of Permanent Separation: Females

Firm Size	XS	S	M	L
No Selection				
Marginal Effect SR	-0.349	-0.187	-0.093	-0.019
With Selection				
Marginal Effect SR	0.023	0.111	0.120	0.078
ρ	-.421	-.374	-.844	-.997
logL	-362475.4	-236286.8	-225164.8	-311194.5
Censored	80695	27230	18551	12860
Observations	793191	806926	980194	2621838

Note: No selection is the probit model for just probability of permanent separation while the selection model accounts for censoring due to firm shutdown.

Wage Growth with Selection

$$\Delta \ln w_{ikjt}^{*}|(\mathrm{FS}_{kjt} = 1) = \alpha^{W} + \beta^{W} SR_{jt} + \gamma^{W} X_{it}^{W} + I_{j} + YR_{t} + \epsilon_{ikjt}. \quad (2)$$

$$\mathrm{FS}_{kjt}^{*} = \alpha^{S} + \beta^{S} SR_{jt} + \gamma^{S} X_{kjt}^{S} + I_{j} + YR_{t} + \lambda RER_{jt} + v_{kjt},$$

where $\Delta \ln w_{ikjt}$ is wage growth of worker i from firm k in industry j at time t and FS_{kjt} is firm survival of firm k, in industry j at time t.

- SR_{jt} is the annual shutdown rate in industry j in period t,
- X_{it}^{W} is a set of worker-specific variables,
- X_{kjt}^{S} is a set of matched firm-specific variables,
- I_{jt} are industry dummy variables,
- YR_{t} are a time dummy variables and
- ϵ_{ikjt} and v_{kjt} are $NID(\mu, \Sigma)$.

Table 5: Earnings Regression with Selection: Males

	XS	S	M	L
SR	3.2667	.8308	1.2821	-1.2512
Age 35-50	.0033	-.0825	-.0893	-.0791
Age 50+	.0720	-.1645	-.2100	-.2302
Married	.1338	.1066	.0909	.0234
Tenure	-.0685	-.1195	-.1197	-.1331
Tenure^2	.0057	.0075	.0069	.0046
Union	-.2212	.0104	.0608	.0785
Atlantic	-.4951	-.2496	-.1157	.0163
Quebec	-.3119	-.1701	-.0904	.0123
Prairies	.1080	-.0730	-.0495	.0596
BC	-.1399	-.1940	-.1379	-.0231
ρ	-.825	-.754	-.664	.0201
logL	-87503.88	-94198.06	-107002.1	-122182.4
Censored	81173	31108	25087	17137
Observations	104286	64666	68134	72377

Empirical Strategy   **20/24**

Table 6: Earnings Regression with Selection: Females

	XS	S	M	L
SR	2.8959	5.1051	2.2607	.9558
Age 35-50	-.0869	-.1294	-.1606	-.1507
Age 50+	.0418	-.1814	-.3273	-.3527
Married	.2969	.2249	.1897	.0973
Tenure	-.1299	-.1626	-.1661	-.1479
Tenure^2	.0093	.0102	.0096	.0052
Union	.2466	.1661	.2702	.1216
Atlantic	-.5814	-.4504	-.3081	-.0076
Quebec	-.3684	-.2271	-.1342	.1157
Prairies	.1690	-.0633	-.0354	-.0081
BC	-.2199	-.2537	-.3454	-.0718
ρ	-.893	-.856	-.813	-.774
logL	-51984.8	-48149.53	-47926.22	-60751.66
Censored	83011	26867	17860	12232
Observations	94426	40928	33674	35877

Empirical Strategy

Table 7: Worker-Firm Size Transitions

Size	XS	S	M	L	Total
XS	8.6	5.8	.	.	14.4
S	6.0	7.8	7.1	.	20.8
M	.	.	10.9	11.4	22.3
L	.	.	10.5	25.2	35.6
	14.6	13.6	28.4	36.6	93.1

Note: Percentage of switchers and possible transitions. Probabilities of less than one percent are suppressed.

Earnings Regression for Switchers

$$
\begin{aligned}
\Delta \ln w_{ikjt}^{*}|(\mathrm{FS}_{kjt}=1) &= \alpha^{W} + \beta^{W} SR_{jt} + \sum_{m=XS:XS}^{L:L} \psi_{m} SW_{m} \times SR_{jt} \ (3) \\
&+ \gamma^{W} X_{it}^{W} + I_{j} + YR_{t} + \epsilon_{ikjt}. \\
\mathrm{FS}_{kjt}^{*} &= \alpha^{S} + \beta^{S} SR_{jt} + \sum_{m=XS:XS}^{L:L} \psi_{m}^{S} SW_{m} \times SR_{jt} \\
&+ \gamma^{S} X_{kjt}^{S} + I_{j} + YR_{t} + \lambda RER_{jt} + v_{kjt},
\end{aligned}
$$

where $\sum_{m=XS:XS}^{L:L} \psi_{m} SW_{m} \times SR_{jt}$ is the interaction of the shutdown rate and for those switchers i at time t for transitions m.

Figure 3: Marginal Effect Shutdown Rate on Wage Growth

Legend: ■ Male ■ Female