Job Turnover and Trade:
A General Equilibrium Analysis.

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Introduction

Does trade increase job instability?

- Policy pundits argue yes (Blinder, Rodrik…).
- But the empirical evidence is mixed.
- And the theoretical literature provides little guidance:
  - Trade literature “ignores” job turnover,
  - Turnover literature “ignores” trade.

- Our goal is to quantify the link between trade and job turnover.
We revisit this issue in a G.E. model of job turnover and trade:

- We build a G.E. model of plant-level employment and export dynamics to quantify the effect of trade openness on turnover. The model is related to both the Melitz model of trade and to the Hopenhayn model of industry dynamics.
- We reproduce the basic employment and export dynamics from the data.
- And we quantify what happens to job turnover when we remove trade barriers.
For the U.S., there is a small rise in $JT^{SS}$ from a big increase in trade (5% to 25%)

- $JT^{SS}$ rises 0.2 points (i.e., more rapid reallocation of workers).
- But, there is a big welfare effect on steady-state consumption.

The impact is small because trade has offsetting effects on $JT$:

- New plants start smaller (less JT),
- Plants stay exporters longer (less JT),
- New exporters sell more (more JT).

In transition, $JT_t$ spikes in the short-run,

- the short-run increase in turnover is 10 times larger than the long-run one.
Model: Melitz meets Hopenhayn and Rogerson.

Calibration.

Turnover and trade: steady state and transitions.

Evidence: Canadian data.
Empirical literature


Model: basic structure

- Two symmetric countries \( \{H, F\} \) - infinite horizon.

- In each country, a competitive (non-traded) final good sector uses tradable and non-tradable intermediates as inputs.

- Heterogeneous productive units, producing unique varieties.

- Export costs.
Model: basic structure

- Intermediate producers (prod. $z$) as monopolistic competitors,
- stochastic processes given by $\phi(z'|z)$, $\phi_E(z')$ and $n_d(z)$.
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There is a distribution of intermediate producers over:
- country ($H$, $F$),
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- country ($H, F$),
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Model: basic structure

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  - stochastic processes given by \( \phi(z'|z) \), \( \phi_E(z') \) and \( n_d(z) \).

- There is a distribution of intermediate producers over:
  - country \( (H, F) \),
  - sector \( (T, NT) \),
  - productivity \( (z) \),
  - export status \( (m = 0 \text{ for non-exporters, } m = 1 \text{ for exporters}) \).
There are several export costs:

- fixed sunk cost $f_0$ of entering export market (units of labor),
- period cost $f_1$ of staying in the export market (units of labor),
- tariff rate $\tau$ and iceberg costs $\xi$. 

Start exporting if $EV_{exp} > sunk\ cost$, Leave export market if $V_{exp} < period\ cost$. 

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\]

- Tariff rate $\tau$ and iceberg costs $\varsigma$. 
Main abstractions

- Symmetric countries: no reallocation due to comparative advantage.

- Abstract away from business cycle fluctuations (Alessandria and Choi, 2007: export participation is pro-cyclical).

- Iceberg costs are exogenous and identical across firms.
Consumer problem

\[
\begin{align*}
\max & \sum_{t=0}^{\infty} \beta^t U(C_t), \\
\text{s.t.} & \quad c_t + k_t - (1 - \delta) k_{t-1} + Q_t \frac{b_t}{P_t} = W_t l_t + R_t k_{t-1} + \frac{b_{t-1}}{P_t} + \Pi_t + T_t. \\
\end{align*}
\]

- \( P_t \): price of final good; \( (W_t, R_t) \): real factor prices; \( Q_t \): price of bonds.
- \( \Pi_t \): home country profits; \( T_t \): lump-sum transfer from home government.
- The foreign problem is similar.
Consumer problem

\[
\max \sum_{t=0}^{\infty} \beta^{t} U(C_t),
\]

s.t. \(c_t + k_t - (1 - \delta) k_{t-1} + Q_t \frac{b_t}{P_t} = W_t l_t + R_t k_{t-1} + \frac{b_{t-1}}{P_t} + \Pi_t + T_t.\)

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The FOC’s are

\[
Q_t = \beta \frac{U_{C,t+1}}{U_{C,t}} \frac{P_t}{P_{t+1}},
\]

\[
q_t \equiv \frac{e_t P_t^*}{P_t} = \frac{U_{C,t}^*}{U_{C,t}}.
\]
Final good:

\[ D = D_T^\gamma \cdot D_N^{1-\gamma} \]
Technologies

- **Final good:**
  \[ D = D_T^\gamma \cdot D_N^{1-\gamma}. \]

- ** Tradable good:**
  \[ D_T = \left[ \sum_m \int z y_H(z, m) \frac{\theta-1}{\theta} \psi_T(z, m) dz + \int z y_F(z, 1) \frac{\theta-1}{\theta} \psi_T^*(z, 1) dz \right]^{\frac{\theta}{\theta-1}} \]
Technologies

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- **Non-tradable good:**
  \[ D_N = \left[ \int_z y_N(z) \frac{\theta-1}{\theta} \psi_N(z) dz \right]^{\frac{\theta}{\theta-1}}. \]
Final good sector

- **Final good firms**

\[
\max \Pi_F = D - \sum_{m \in \{0,1\}} \int_z \left[ \frac{P_H(z,m)}{P} \right] y^d_H(z,m) \psi_T(z,m) \, dz
\]

\[
- \int_z \left[ \frac{(1+\tau)P_F(z,1)}{P} \right] y^d_F(z,1) \psi^*_T(z,1) \, dz
\]

\[
- \int_z \left[ \frac{P_N(z)}{P} \right] y^d_N(z) \psi_N(z) \, dz,
\]
Final good sector

**Final good firms**

\[
\max \Pi_F = D - \sum_{m \in \{0,1\}} \int_z \left[ \frac{P_H(z,m)}{P} \right] y_H^d(z,m) \psi_T(z,m) \, dz \\
- \int_z \left[ \frac{(1+\tau)P_F(z,1)}{P} \right] y_F^d(z,1) \psi_T^*(z,1) \, dz \\
- \int_z \left[ \frac{P_N(z)}{P} \right] y_N^d(z) \psi_N(z) \, dz,
\]

subject to

\[
\begin{cases}
D \text{ aggregate of } D_N, D_T, \\
D_T \text{ aggregate of all } y_H^d(z,m) \text{ and all } y_F^d(z,1), \\
D_N \text{ aggregate of all } y_N^d(z).
\end{cases}
\]
Non-tradable producers

- The non-tradable producer chooses $P_{N,t}(z)$, $k_{N,t}(z)$ and $l_{N,t}(z)$ to maximize

$$V_{N,t}(z) = \max \pi_{N,t}(z) + n_s(z) Q_t \int_{z'} V_{N,t+1}(z') \phi(z'|z) \, dz',$$
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s.t. \[
\begin{align*}
\pi_{N,t}(z) &= \frac{P_{N,t}(z)}{P_t} y_{N,t}(z) - W_t l_{N,t}(z) - R_t k_{N,t}(z), \\
y_{N,t}(z) &= e^z \cdot k_{N,t}(z)^{\alpha} \cdot l_{N,t}(z)^{1-\alpha}, \\
y_{N,t}(z) &= y^d_{N,t}(z). (FG\text{-prob.})
\end{align*}
\]
Tradable producers

The tradable producer chooses $P_{H,t}(z, m)$, $P_{H,t}^*(z, 1)$, $k_{T,t}(z, m)$, $l_{T,t}(z, m)$, $x_t(z, m)$ [materials] and next period’s export status $m'$ to maximize

$$V_{T,t}(z, m) = \max \pi_{T,t}(z, m) - m' W_t [f_1 m + (1 - m) f_0]$$

$$+ n_s(z) Q_t \int_{z'} V_{T,t+1}(z', m') \phi(z'|z) dz',$$

where $\Pi_{T,t}(z, m)$ = foreign sales + domestic sales - payments to labor and capital - payments to other TP.
Tradable producers

The tradable producer chooses $P_{H,t}(z, m)$, $P^*_{H,t}(z, 1)$, $k_{T,t}(z, m)$, $l_{T,t}(z, m)$, $x_t(z, m)$ [materials] and next period's export status $m'$ to maximize

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where

$$\Pi_{T,t}(z, m) = \text{foreign sales} + \text{domestic sales}$$

- payments to labor and capital
- payments to other TP,
Tradable producers

subject to

\[
\begin{align*}
\text{production with inputs } & k_{T,t}(z,m), l_{T,t}(z,m), x_t(z,m), \\
x_t(z,m) \text{ aggregate of tradable intermediates}, \\
\text{supply dom. mkt} = \text{demand by dom. FGP} + \text{dom. TP}, \\
\text{supply foreign mkt} = \text{demand by foreign FGP} + \text{foreign TP}, \\
\text{total supply} = \text{dom. supply} + (1 + \xi) \times \text{foreign supply}.
\end{align*}
\]
**Value of exporting at $t+1$:**

\[
V_{T,t}^1 (z, m) = \max \left\{ \Pi_{T,t} (z, m) - W_t \left[ f_1 m + (1 - m) f_0 \right] + n_s (z) Q_t \int V_{T,t+1} (z', 1) \phi (z'|z) \, dz' \right\}
\]
Exporting decision

- **Value of exporting at t+1:**
  \[ V_{T,t}^1 (z, m) = \max \sum_{T,t} (z, m) - W_t [f_1 m + (1 - m) f_0] \]
  \[ + n_s (z) Q_t \int V_{T,t+1} (z', 1) \phi (z' | z) dz', \]

- **Value of not exporting at t+1:**
  \[ V_{T,t}^0 (z, m) = \max \sum_{T,t} (z, m) + n_s (z) Q_t \int V_{T,t+1} (z', 0) \phi (z' | z) dz'. \]
Exporting decision

- **Value of exporting at \( t+1 \):**
  \[
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  V_{T,t}^0 (z, m) = \max \Pi_{T,t} (z, m) + n_s (z) Q_t \int V_{T,t+1} (z', 0) \phi (z'|z) dz'.
  \]

- Thus, the value is \( V_{T,t}(z, m) = \max \{ V_{T,t}^0 (z, m), V_{T,t}^1 (z, m) \} \).
The value is increasing in $z$, given $m$. There are two thresholds that determine when non-exporters start exporting ($z_0$), and when exporters stop exporting ($z_1$), i.e.

\[
\begin{align*}
V^0_{T,t}(z_0,t,0) &= V^1_{T,t}(z_0,t,0), \\
V^0_{T,t}(z_1,t,1) &= V^1_{T,t}(z_1,t,1).
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\]
Exporting decision

- The value is increasing in \( z \), given \( m \). There are two thresholds that determine when non-exporters start exporting \((z_0)\), and when exporters stop exporting \((z_1)\), i.e.

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\end{align*}
\]

- We have that \( z_{1,t} < z_{0,t} \) (hysteresis in exporter status).
- The starter rate for non-exporters decreases with \( z_0 \) and the stopper rate for exporters increases with \( z_1 \).
Establishment distributions

![Graph showing establishment distributions with productivity on the x-axis and fraction of establishments on the y-axis. The graph includes two lines: one labeled 'All establishments' and another labeled 'Starter threshold'. The 'Starter threshold' line is marked by a vertical dashed line at productivity level 0.5.]
Establishment distributions

![Graph showing establishment distributions with productivity (z) on the x-axis and the fraction of establishments (%) and death probability (%) on the y-axis. The graph compares all establishments, non-exporters, and exporters. The stopper threshold and starter threshold are indicated.]
Establishment distributions

The diagram illustrates the distribution of establishments across different productivity levels. The x-axis represents productivity (z), while the y-axis shows the fraction of establishments (%). The graph compares the productivity distributions of all establishments, non-exporters, and exporters, with distinct peaks indicating their respective modes.

Key features:
- **Productivity (z)**: The scale ranges from -2 to 2, highlighting the productivity spectrum.
- **Fraction of establishments (%)**: This axis quantifies the percentage of establishments falling into each productivity bin.
- **Death probability (%)**: Represents the likelihood of establishment failure.
- **Stopper threshold** and **Starter threshold**: Indicate critical productivity levels for entry and exit.

The graph also includes labels for birth and death probability, along with lines marking the distinction between non-exporters and exporters.
Entry into the market

- Firms pay $f_E \cdot W_t$ and start the next period with no workers.

- At $t + 1$, firms draw $z$ from $\phi_E(z)$ and produce

  Tradable entry:
  $$V_{T,t}^E = -W_t f_E + Q_t \int_{z'} V_{T,t+1}(z',0) \phi_E(z') \, dz' = 0,$$

  Non-tradable entry:
  $$V_{N,t}^E = -W_t f_E + Q_t \int_{z'} V_{N,t+1}(z') \phi_E(z') \, dz' = 0.$$
Calibration (macro)

- $\theta$ to match producer markup of 25%, also consistent with US trade-weighted import elasticity.
- Tariff rate of 8% mid-point of tariff and non-tariff barriers in industrialized countries.
- Transportation cost $\zeta$ set to match exporters’ export to sales ratio of 13%.
- Tradable share $\gamma$ set to match manufacturers’ nominal value added relative to industry GDP.
- Labor share in production technology to match labor share of income.
- Share of materials into production determines ratio of gross output to value added in manufacturing.
- Entry cost $f_E$ so total mass of establishments normalized to 2.
Calibration (establishment dynamics)

The underlying stochastic process is given by: \( z' = \rho z + \varepsilon \); for entrants, \( z' = -\mu_E + \varepsilon_E \). The death rate is

\[
nd(z) = \max\{0, \min\{\lambda e^{-\lambda e^z} + n_{d0}, 1\}\},
\]
decreasing in \( z \).
Calibration (establishment dynamics)

- The underlying stochastic process is given by: \( z' = \rho z + \varepsilon \); for entrants, \( z' = -\mu_E + \varepsilon_E \). The death rate is
  \[
  n_d(z) = \max\{0, \min\{\lambda e^{-\lambda e^z} + n_{d0}, 1\}\},
  \]
  decreasing in \( z \).

- The parameters of the stochastic processes \((\rho, \sigma, \mu_E, \lambda, n_{d0})\) and the export cost parameters \((f_0, f_1)\) are set to match:
  - exporter rate [22.3%],
  - exporter output premium [5.6%],
  - stopper rate [17%],
  - entrants labor share [1.5%],
  - Shutdown establishments’ labor share [2.3%],
  - five-year exit rate of entrants [37%],
  - Estab. employment and size distributions (to pin \( \sigma, \varepsilon \) down).
## Calibration - Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>$\theta$</td>
<td>Elasticity of Substitution</td>
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<tr>
<td>$\rho$</td>
<td>Persistence of idiosyncratic shock</td>
<td>0.69</td>
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<td>$\sigma^2_\epsilon$</td>
<td>Variance of idiosyncratic shock</td>
<td>0.332</td>
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<td>$\lambda$</td>
<td>Exit shock</td>
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<td>$n_{d0}$</td>
<td>Constant exit rate</td>
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<td>$\mu_E$</td>
<td>Productivity disadvantage young firms</td>
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<td>$f_E$</td>
<td>Entry Cost</td>
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<tr>
<td>$f_0$</td>
<td>Startup export cost</td>
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<tr>
<td>$f_1$</td>
<td>Continuation cost</td>
<td>0.028</td>
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### Calibration - Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Period</td>
<td>year</td>
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<tr>
<td>Elasticity of Demand</td>
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<tr>
<td>Discount factor</td>
<td>β</td>
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<td>Capital Depreciation</td>
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<td></td>
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<tr>
<td>Capital Share</td>
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<tr>
<td>Tradables share</td>
<td>γ</td>
</tr>
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<td></td>
<td>0.21</td>
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<tr>
<td>Materials Share</td>
<td>α_x</td>
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<tr>
<td></td>
<td>0.70</td>
</tr>
</tbody>
</table>

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Calibration

Calibration tight on:

- establishment distributions,
- exporter persistence.

Calibration substantially overstates JT (55% vs. 10%):

- results robust in lower turnover calibration though.
Experiments

- We study the steady state relation between job turnover and trade, by varying trade costs $\zeta$.

- We examine the transition dynamics to a large unanticipated cut in trade costs.
Steady state turnover

- Contributions from entrants fall, as new plants start smaller.
- More job turnover from continuing firms.
- The net effect is small.
Impact on entrants:

- Trade barriers affect the level of competition plants face at home. Reducing tariffs reduces domestic sales as foreign competitors come in.

- Also big domestic plants demand more labor and push wages up.

- This has a negative effect on entry by small firms.
Impact on incumbents:

- Shocks move firms across employment levels and export status:
  - Both the decisions of (i) whether to export, and (ii) how much to export affect JT,

- Reducing tariffs decrease $z_0$ and $z_1$ - more entry, less exit into and out of exporting. Plants stay in the export market longer.

- Reducing tariffs increases foreign sales and employment changes associated with a switch.
Non-linear relation between trade and turnover

More trade (lower barriers):

- Export intensity rises $\implies$ Changes in export status associated with greater adjustment in plant-level employment,
Non-linear relation between trade and turnover

More trade (lower barriers):

- Export intensity rises $\rightarrow$ Changes in export status associated with greater adjustment in plant-level employment,

- More non-exporters start and fewer exporters stop,
  - Share of plants exporting ($N_X/N$) rises.
Non-linear relation between trade and turnover

More trade (lower barriers):

- Export intensity rises —> Changes in export status associated with greater adjustment in plant-level employment,

- More non-exporters start and fewer exporters stop,
  - Share of plants exporting \((N_X / N)\) rises.

- So changes in exporting may increase/decrease.

\[
\Delta \text{status} = \frac{N_X}{N} \Delta \Pr(\text{stop}) + \left(1 - \frac{N_X}{N}\right) \Delta \Pr(\text{start})
\]
Non-linear relation between trade and turnover

Exports/GDP

Percent

Intensity
Pr(Starter)
Pr(Stopper)
Participation

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Job Turnover and Trade

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Consider an unanticipated cut in tariffs from 8 percent to zero.

- Long run impact on:
  - Job turnover up 0.1 percentage point,
  - Exports/Nominal GDP rises from 4.9 percent to 10.9 percent.
- Substantially more job turnover initially.
Graph showing the dynamics of export share of GDP over time. The x-axis represents time, ranging from 0 to 10, and the y-axis represents the exports share of nominal GDP, ranging from 0% to 12%. The graph shows an upward trend in the export share from 0% at time 0 to a steady state around 10% by time 6. The trend plateaus around time 6 and remains stable thereafter.
A look at Canadian data

- We can check whether the main mechanisms highlighted and results find support in the data:
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  2. Two opposing effects on the turnover of incumbents (reduced switching / greater adjustment after switch),
A look at Canadian data

We can check whether the main mechanisms highlighted and results find support in the data:

1. Effect on entry,
2. Two opposing effects on the turnover of incumbents (reduced switching / greater adjustment after switch),
3. Total turnover when trade opens up.
A look at Canadian data

We look at the Annual Survey of Manufacturers (1973-1999):

- Population of establishments in Canada,
- Industry, age, size, shipments, inventories, employment,
- Some years, export data is reported: exports/sales, destination.
A look at Canadian data

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  - Population of establishments in Canada,
  - Industry, age, size, shipments, inventories, employment,
  - Some years, export data is reported: exports/sales, destination.

- We look at low-frequency turnover:
  - Availability of data,
  - High-frequency job turnover swamps low-frequency turnover due to export status changes.
The relative contribution of startups to job creation has decreased over time:

<table>
<thead>
<tr>
<th></th>
<th>Trade share</th>
<th>%JC by incumbents</th>
<th>%JC by entrants</th>
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<tbody>
<tr>
<td>1984-1990</td>
<td>26.5%</td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>1993-1999</td>
<td>36.6%</td>
<td>88%</td>
<td>12%</td>
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Canadian data: reduced entry.

- The relative contribution of startups to job creation has decreased over time:

<table>
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<tbody>
<tr>
<td>1984-1990</td>
<td>26.5%</td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>1993-1999</td>
<td>36.6%</td>
<td>88%</td>
<td>12%</td>
</tr>
</tbody>
</table>

- Entry rates have decreased post-FTA relative to pre-FTA (for all class sizes).
Canadian data: gains/decreases from switches.

- Bernard and Jensen (1999) argue that regressing plant-level employment growth rates on export status is misleading because of switching behavior. We follow their suggestion and regress

\[
\Delta N_i^p = \alpha_i^p + \beta_{1}^p \cdot \text{start}_{i,0} + \beta_{2}^p \cdot \text{both}_{i,0} + \beta_{3}^p \cdot \text{stop}_{i,0} + \theta X_{i,0} + \varepsilon,
\]

where the period \( p \in \{84/90, 93/99\} \).

- The coefficients give the growth rate differentials for new exporters, continuing exporters and stoppers, relative to continuing non-exporters.
### Canadian data: gains/decreases from switches.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>start</td>
<td>+0.71%</td>
<td>+1.94%</td>
</tr>
<tr>
<td>both</td>
<td>-0.62%</td>
<td>+1.28%</td>
</tr>
<tr>
<td>stop</td>
<td>-1.99%</td>
<td>-0.26%</td>
</tr>
<tr>
<td><strong>growth diff.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NE / NN</td>
<td>+0.71%</td>
<td>+1.94%</td>
</tr>
<tr>
<td>EN / EE</td>
<td>-1.37%</td>
<td>-1.54%</td>
</tr>
</tbody>
</table>
Canadian data: aggregate turnover.

- Gross job reallocation (GJR) is relatively constant over time:

<table>
<thead>
<tr>
<th></th>
<th>84-90</th>
<th>93-99</th>
</tr>
</thead>
<tbody>
<tr>
<td>GJR</td>
<td>30.5%</td>
<td>30.1%</td>
</tr>
</tbody>
</table>
Conclusion

1. We built a model of employment and export dynamics to look at the relation between job turnover and trade.

2. We found that the long-run effect of increased trade integration on job turnover is small:
   - Startups are smaller,
   - There are offsetting effects on job turnover:
     - Plants change export status less often,
     - But changes lead to more hiring/firing.

3. Cuts in trade cost lead to a short-run spike in job turnover.
Future research

- As of yet, the model overpredicts job turnover. A less volatile model would miss on establishment and exporter distributions.
  - Another source of heterogeneity may be needed. Coming closer to JT may require adjustment costs and shocks to fixed costs.

- Trade integration and the turnover of various types of plants:
  - exporters,
  - firms in the tradable sector.

- Large job losses and trade?