A comparison of the contribution of labor reallocation to aggregate productivity growth: Canada and the United States

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Other data used in this paper are confidential data housed at a Statistics Canada Research Data Center, accessed through the Ottawa Head Office by arrangement with Industry Canada.

All results presented in this paper have been screened to insure that no confidential data are revealed.

Research results and conclusions expressed are those of the authors and do not necessarily reflect the views of the Census Bureau, Statistics Canada, or Industry Canada.
This is work in progress, and results are very preliminary!
Outline

Introduction to the paper

Methodology

Data

Results

Conclusion
Cross-national analysis

- We started several years ago with Canadian survey (WES), French and US administrative data (CAED2009).
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Cross-national analysis

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- ... then see what happens....
Replication issues

Slew of issues

- lack of common variable names
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- access issues
A large literature attempts to quantify how factor reallocation contributes to productivity growth.
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- 50% of labor productivity growth is dependent on labor reallocation (Foster, Haltiwanger, and Krizan 2001, US data)
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Labor productivity growth is an important contributor
- 50% of labor productivity growth is dependent on labor reallocation (Foster, Haltiwanger, and Krizan 2001, US data)
- ... or is it higher: 70% (Lentz and Mortensen 2008, Danish data)
Here: evidence on the evolution of labor productivity decomposition ...

- ... for two countries: Canada and the United States...
Our approach

Here: evidence on the evolution of labor productivity decomposition ...

▶ ... for two countries: Canada and the United States...
▶ ... using several different labor productivity decomposition methodologies, applied homogeneously to both datasets
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► ... caveats at the end
Aggregate productivity

\[ P_t = \sum_{j \in J} \theta_{jt} p_{jt} \] (1)

\( \theta_{jt} \) represents the firm’s market share (share of labor or share of sales), and \( p_{jt} \) is the individual firm’s productivity.
Productivity growth

\[
\Delta P_{t,t-k} = \sum_{j \in J_t} \theta_{jt} p_{jt} - \sum_{j \in J_{t-k}} \theta_{jt-k} p_{jt-k}
\]
BHC decomposition

BHC decomposition (Baily, Hulten, and Campbell 1992)

\[
\Delta P_t = \sum_{i \in C_t} \theta_{it-1} \Delta p_{it} + \sum_{i \in C_t} \Delta \theta_{it} p_{it-1} + \sum_{i \in C_t} \Delta \theta_{it} \Delta p_{it} + \sum_{i \in E_t} \theta_{it} p_{it} - \sum_{i \in X_t} \theta_{it-1} p_{it-1}
\] (3)
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\]
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\[ + \sum_{i \in E_t} \theta_{it} p_{it} - \sum_{i \in X_t} \theta_{it-1} p_{it-1} \]  \hspace{1cm} (3)

\[ = \text{Within} \]
BHC decomposition (Baily, Hulten, and Campbell 1992)

\[ \Delta P_t = \sum_{i \in C_t} \theta_{it-1} \Delta p_{it} \]

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\]

\[= \text{Within} + \text{Between} + \text{Cross} \] 

where \( J_{t} = \{ C_{t}, E_{t} \} \) and \( J_{t-k} = \{ C_{t}, X_{t} \} \)
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- where \( J_t = \{C_t, E_t\} \) and \( J_{t-k} = \{C_t, X_t\} \)
FHK decomposition

► FHK version (Foster, Haltiwanger, and Krizan 2001)

\[
\Delta P_{t,t-k} = \sum_{j \in C} \theta_{jt-k} \Delta p_j + \sum_{j \in C} \Delta \theta_j \left( p_{jt-k} - P_{jt-k} \right) \\
+ \sum_{j \in C} \Delta \theta_j \Delta p_j + \sum_{j \in E} \theta_{jt} \left( p_{jt} - P_{jt-k} \right) \\
- \sum_{j \in X} \theta_{jt-k} \left( p_{jt-k} - P_{jt-k} \right)
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- \sum_{j \in X} \theta_{jt-k} (p_{jt-k} - P_{Jt-k})
\]

- contribution of firm’s \( p_i, i = t, t - k \) now relative to economy/sector-wide \( P_{t-k} \)
GR decomposition

GR decomposition (Griliches and Regev 1995)

\[ \Delta P_{t,t-k} = \sum_{j \in C} \bar{\theta}_j \Delta p_j + \sum_{j \in C} \Delta \theta_j \left( \bar{p}_j - \bar{P}_J \right) + \sum_{j \in E} \theta_{jt} \left( p_{jt} - \bar{P}_J \right) - \sum_{j \in X} \theta_{jt-k} \left( p_{jt-k} - \bar{P}_J \right) \]
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$$\Delta P_{t, t-k} = \sum_{j \in C} \bar{\theta}_j \Delta p_j$$

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$$+ \sum_{j \in E} \theta_{jt} (p_{jt} - \bar{P}_J) - \sum_{j \in X} \theta_{jt-k} (p_{jt-k} - \bar{P}_J)$$

$$= \text{Within}$$
GR decomposition

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= \text{Within} + \text{Between}
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- within-firm productivity growth is weighted by the average market shares between period \( t \) and \( t - k \)
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\[ \Delta P_{t,t-k} = \sum_{j \in C} \bar{\theta}_j \Delta p_j + \sum_{j \in C} \Delta \theta_j (\bar{\rho}_j - \bar{\rho}_J) + \sum_{j \in E} \theta_{jt} (p_{jt} - \bar{P}_J) - \sum_{j \in X} \theta_{jt-k} (p_{jt-k} - \bar{P}_J) = \text{Within} + \text{Between} + \text{Entry} + \text{Exit} \]

- within-firm productivity growth is weighted by the average market shares between period \( t \) and \( t - k \)
- between effect weighted by the difference between firm’s average productivity vs. average productivity of all firms
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- within-firm productivity growth is weighted by the average market shares between period \( t \) and \( t - k \)
- between effect weighted by the difference between firm’s average productivity vs. average productivity of all firms
- productivity differences for entrants/exiters are weighted by the contemporaneous market share of the firm
Baldwin-Gu decomposition

- If new entering firms are taking market share away from both exiting and existing firms, then

\[
\Delta P_{t,t-k} = \sum_{j \in C} \bar{\theta}_j \Delta p_j + \sum_{j \in C} \Delta \theta_j (\bar{p}_j - P_D) + \sum_{j \in X} \theta_{jt-k} (P_N - p_{jt-k}) + (S_N - S_X) (P_N - P_D)
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- between-effect: relative to the average for firms with declining market share, \( P_D \).
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- productivity of new entrants \( P_N \) measured relative to the productivity of exiting firms \( p_{jt-k} \) \( \rightarrow \) new entrants displacing exiting firms.
If new entering firms are taking market share away from both exiting and existing firms, then

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- between-effect: relative to the average for firms with declining market share, \( P_D \).
- productivity of new entrants \( P_N \) measured relative to the productivity of exiting firms \( p_{jt-k} \) → new entrants displacing exiting firms.
- contribution to productivity growth of new entrants that recoup market shares from declining firms.
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productivity of new entrants \(P_N\) measured relative to the productivity of exiting firms \(p_{jt-k} \rightarrow\) new entrants displacing exiting firms.

contribution to productivity growth of new entrants that recoup market shares from declining firms.

\(S_N\) market share of \(j \in E\), \(S_X\) market share of \(j \in X\)
Data
T2/Longitudinal Employment Analysis Project (LEAP)

- two main sources of administrative data:
Canadian data - T2/LEAP

T2/Longitudinal Employment Analysis Project (LEAP)

- two main sources of administrative data:
  - the Longitudinal Employment Analysis Program (LEAP), containing information on the employment of firms with (paid) employees
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  - Corporate Tax Statistical Universe File (T2SUF): covers all companies filing income tax, provides financial information
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- employment variable not directly measured: computed by Statistics Canada as ratio of labor expenditures to the typical worker’s average annual remuneration, adjusted for industry, province, and firm size (Average Labor Unit, ALU, Baldwin and Gu (2011))
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- employment variable not directly measured: computed by Statistics Canada as ratio of labor expenditures to the typical worker’s average annual remuneration, adjusted for industry, province, and firm size (Average Labor Unit, ALU, Baldwin and Gu (2011))
- No value-added: productivity measured as sales (receipts) per worker
ASM+CM

US data

ASM+CM

- CM: quinquennial census of firms (years in 2 and 7)
US data

ASM+CM

- CM: quinquennial census of firms (years in 2 and 7)
- CM: sampled in Business Register, includes ASM establishments in CM years
**ASM+CM**

- **Available:** 1973-2009 (1987-2009 used)
- **CM:** quinquennial census of firms (years in 2 and 7)
- **CM:** sampled in Business Register, includes ASM establishments in CM years
- **ASM:** Certainty sample for large firms, size-stratification for smaller firms
ASM+CM

- CM: quinquennial census of firms (years in 2 and 7)
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- ASM: Certainty sample for large firms, size-stratification for smaller firms
- ASM: about 50,000 establishments per year
US data

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- ASM: Certainty sample for large firms, size-stratification for smaller firms
- ASM: about 50,000 establishments per year
- ASM: panel for 5 years, sampled in CM, refreshed based on expansion of the frame through tax records
- ASM/CM: information on employment, wages, sales, value-added
US data

LBD

- longitudinal research file (Miranda and Jarmin 2002)
US data

LBD

- longitudinal research file (Miranda and Jarmin 2002)
- corrects linkages in Business Register
LBD

- longitudinal research file (Miranda and Jarmin 2002)
- corrects linkages in Business Register
- contains link id to ASM, CM, employment
ASM-CM schema
ASM-CM schema
ASM-CM schema
T2LEAP schema
T2LEAP schema
Overview of LBD data

LBD Provenance

- Business Register (SSEL)
  - Some exclusions
  - Enumeration frame
  - New establishments
  - Sample frame
  - Possible linkage

- Economic Census (quinquennial)

- Longitudinal Business Database (LBD)
  - Possible linkage

- County Business Patterns (CBP)

- Annual Survey of Manufactures (ASM)

- Synthetic LBD (SynLBD)

- Business Dynamics Statistics (BDS)

Bérubé, Dostie, Vilhuber

Reallocation
ASM-CM-LBD schema

Bérubé, Dostie, Vilhuber

Reallocation
Methodology for US

Matching methodology using LBD

▶ Define births/deaths/continuers in LBD
Matching methodology using LBD

- Define births/deaths/continuers in LBD
- Match to records in ASM/CM as feasible
Matching methodology using LBD

- Define births/deaths/continuers in LBD
- Match to records in ASM/CM as feasible
- Create panel weight to match birth/death rates in LBD (here: by ten size-classes)
Imputations

- We impute missing sales based on data for surrounding years for the same firm.
- When employment is missing, we assume the plant is inactive (dead)

Adjustments

- Productivity = (real value of) sales/worker
- Trim top and bottom 2% of productivity by removing from the panel.
Comparing

Common characteristics

- Long time series
Comparing

Common characteristics

- Long time series
- Data accessible in restricted access environments
Comparing

Common characteristics

- Long time series
- Data accessible in restricted access environments
- Results need to pass disclosure review
Comparing

Differences

- Canada is administrative data, US is administrative linked to survey sample data
Comparing

Differences

- Canada is administrative data, US is administrative linked to survey sample data
- Canada is firm-based (no establishments), US is establishment-based
Comparing

Differences

- Canada is administrative data, US is administrative linked to survey sample data
- Canada is firm-based (no establishments), US is establishment-based
- Canada is all industries, US Economic Censuses/Annual Surveys are by-sector (no unified dataset)
Comparing

Differences

▶ Canada is administrative data, US is administrative linked to survey sample data
▶ Canada is firm-based (no establishments), US is establishment-based
▶ Canada is all industries, US Economic Censuses/Annual Surveys are by-sector (no unified dataset)
▶ Entity adjustment: flow adjustment in Canada, name/location linkage in US
Comparing Differences

- Canada is administrative data, US is administrative linked to survey sample data
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Results
Enormous literature
The literature is enormous. Many studies provide some summary of previous studies.

- Within-plant contribution between 0.79-1.2 (Foster, Haltiwanger, and Krizan 2001)
Comparing to FHK2001

fhk decompositions 1987-1992

<table>
<thead>
<tr>
<th>BDV</th>
<th>FHK</th>
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<tr>
<td>Within</td>
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<td>Cross</td>
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Graphs by src

Berube, Dostie, Vilhuber

Reallocation
Comparing to Baldwin and Gu (multiple)

to come
US and Canada: FHK

fhk decompositions


Graphs by yearrange

Within  Between  Cross  Entrants

Reallocation
US and Canada: BHC

Graphs by yearrange

bhc decompositions


BHC decompositions


Within  Between  Cross  Entrants  Exiters

Graphs by yearrange

Bérubé, Dostie, Vilhuber

Reallocation
US and Canada: GR

Graphs by year range

Bérubé, Dostie, Vilhuber

Reallocation
US and Canada: BG

Graphs by year range

Bérubé, Dostie, Vilhuber

Reallocation
Variations and robustness checks

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  - Importance of measuring at firm level [only way in Canada, only in EC years in US]
Introduction Methodology Data Results Conclusion

Preliminary conclusions and speculation

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Preliminary conclusions and speculation

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  - ... due to measurement at firm vs. establishment level?
  - ... due to fundamentals?
- Decreasing role of cross effect (all), between effect (GR,BG) in Canada?
- In the US, positive net effect of entry/exit, but secular increase in role of entrants/decrease in role of exiters?
Thank you.


References

The end