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

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

Abstract
This paper contributes to the literature by computing the contribution of labor reallocation to productivity growth for the United States and Canada, using several different decomposition specifications, and applying a consistent approach to data from both countries. We compute the Baily, Hulten & Campbell (1992), Griliches & Regev (1995), Foster, Haltiwanger & Krizan (2001), and Baldwin & Gu (2006) decompositions, for both three-year and five-year time frames. We focus on the manufacturing sector for both countries, and assess the robustness of the conclusions to alternate specifications that the data from one or the other country allow us to do.

Keywords
productivity decomposition, Canada, United States, LBD, T2LEAP

Comments
Suggested Citation

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

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 Disclaimer

- Vilhuber’s research was supported by NSF Grant SES-0820349, SES-1042181, and SES-1042181.
- Part of the research was done while one of the researchers was a Special Sworn Status researcher of the U.S. Census Bureau at the Center for Economic Studies. Research results and conclusions expressed are those of the authors and do not necessarily reflect the views of the Census Bureau.
- 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.
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).
Cross-national analysis

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- This paper is with US and Canadian administrative data (combined in the US with firm survey data: ASM).
Cross-national analysis

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- “Multi-site, multi-author” replication approach
Cross-national analysis

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- start with same code, sit in front of respective secure terminals
Cross-national analysis

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- “Multi-site, multi-author” replication approach
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- ... then see what happens....
Replication issues

Slew of issues

- lack of common variable names
Replication issues

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- lack of common variable names
- code divergence/creep
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- different merge/match issues
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- lack of common variable names
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- different variable definitions - obvious and subtle - that affect the outcomes
Replication issues

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- access issues
A large literature attempts to quantify how factor reallocation contributes to productivity growth.
Background

- A large literature attempts to quantify how factor reallocation contributes to productivity growth.
- Some numbers:
A large literature attempts to quantify how factor reallocation contributes to productivity growth.

Some numbers:

- Quarterly job reallocation rates are about 12% in the US (Abowd and Vilhuber 2011)
- Worker reallocation rates are about 2-3 times larger (Abowd and Vilhuber 2011)
- Labor productivity growth is an important contributor (Foster, Haltiwanger, and Krizan 2001, US data)
- Or is it higher: 70% (Lentz and Mortensen 2008, Danish data)
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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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Our approach

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
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
- ... 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

\[ \Delta P_{t,t-k} = \sum_{j \in J_t} \theta_{jt} p_{jt} - \sum_{j \in J_{t-k}} \theta_{jt-k} p_{jt-k} \] (2)
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)
BHC decomposition (Baily, Hulten, and Campbell 1992)

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

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

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= Within
BHC decomposition

BHC decomposition (Baily, Hulten, and Campbell 1992)

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

\[
= \text{Within} + \text{Between} \tag{3}
\]
BHC decomposition

- BHC decomposition (Baily, Hulten, and Campbell 1992)

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\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}
\]

\(=\) **Within** + **Between** + **Cross**
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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\]

\[= \text{Within} + \text{Between} + \text{Cross} + \text{Entry} \tag{3}\]
BHC decomposition

BHC decomposition (Baily, Hulten, and Campbell 1992)

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\[ + \sum_{i \in C_t} \Delta \theta_{it} p_{it-1} + \sum_{i \in C_t} \Delta \theta_{it} \Delta p_{it} \]
\[ + \sum_{i \in E_t} \theta_{it} p_{it} - \sum_{i \in X_t} \theta_{it-1} p_{it-1} \]  \hspace{1cm} (3)
\[ = \text{Within} + \text{Between} + \text{Cross} + \text{Entry} - \text{Exit} \]
BHC decomposition

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\]

= Within + Between + Cross + Entry − Exit

- where \( J_t = \{C_t, E_t\} \) and \( J_{t-k} = \{C_t, X_t\} \)
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 (\bar{p}_j - \bar{P}_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)
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GR decomposition (Griliches and Regev 1995)

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

= Within
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\[ = \text{Within} + \text{Between} + \text{Entry} + \text{Exit} \]

- within-firm productivity growth is weighted by the average market shares between period \( t \) and \( t - k \)
GR decomposition

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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

Bérubé, Dostie, Vilhuber

Reallocation
GR decomposition

- GR decomposition (Griliches and Regev 1995)

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\]

\[= \text{Within} + \text{Between} + \text{Entry} + \text{Exit}\]

- 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
- productivity differences for entrants/exiters are weighted by the contemporaneous market share of the firm
FHK decomposition

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

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

\[ + \sum_{j \in C} \Delta \theta_j \Delta p_j + \sum_{j \in E} \theta_{jt} (p_{jt} - P_{jt-k}) \]

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FHK decomposition

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

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

\[ - \sum_{j \in X} \theta_{jt-k} \left( p_{jt-k} - P_{Jt-k} \right) \]

- contribution of firm’s \( p_i, i = t, t - k \) now relative to economy/sector-wide \( P_{t-k} \)
If new entering firms are taking market share away from both exiting and existing firms, then

\[
\Delta P_{t,t-k} = \sum_{j \in C} \tilde{\theta}_j \Delta p_j + \sum_{j \in C} \Delta \theta_j (\bar{p}_j - P_D) \\
+ \sum_{j \in X} \theta_{jt-k} (P_N - p_{jt-k}) + (S_N - S_X) (P_N - P_D)
\]
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between-effect: relative to the average for firms with declining market share, \( P_D \).
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.
Baldwin-Gu decomposition

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contribution to productivity growth of new entrants that recoup market shares from declining firms.
Baldwin-Gu decomposition

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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 \( p_{jt-k} \rightarrow \) 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
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
  - Corporate Tax Statistical Universe File (T2SUF): covers all companies filing income tax, provides financial information
    - excludes unincorporated businesses, non-employers
  - 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
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- 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)
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- CM: sampled in Business Register, includes ASM establishments in CM years
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- 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
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: 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)
LBD

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

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
Overview of LBD data

LBD Provenance

Business Register (SSEL)

- Some exclusions
- New establishments
- Sample frame

Economic Census (quinquennial)

- Possible linkage
- Possible linkage

Longitudinal Business Database (LBD)

- Jermin and Miranda (2002)

County Business Patterns (CBP)

Business Dynamics Statistics (BDS)

Annual Survey of Manufactures (ASM)

Synthetic LBD (SynLBD)
ASM-CM-LBD schema
Methodology for US

Matching methodology using LBD

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

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Matching methodology using LBD

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- Match to records in ASM/CM as feasible
- Create panel weight to match birth/death rates in LBD (here: by ten size-classes)
Data definitions

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

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- Employment not measured the same way (average employment in year imputed in Canada, point-in-time employment in the US) (could be adjusted in the US)
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

BDV

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FHK

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- Within
- Between
- Cross
- Net entry

Graphs by src

Bérubé, Dostie, Vilhuber

Reallocation
Comparing to Baldwin and Gu (multiple)

to come
US and Canada: FHK

Bérubé, Dostie, Vilhuber

Reallocation
US and Canada: BHC

Bérubé, Dostie, Vilhuber

Reallocation
US and Canada: GR

Graphs by year range

Bérubé, Dostie, Vilhuber

Reallocation
US and Canada: BG

Graphs by yearrange

Bérubé, Dostie, Vilhuber

Reallocation
Variations and robustness checks

- Variations in $k$ (3 years, 5 years, 1 year?) [easy in Canada, not in US] (already noted in Foster, Haltiwanger, and Krizan (2001))
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- Robustness to firm birth/death adjustments
  - Missing data [currently very simple (simplistic) impute]
  - Importance of measuring at firm level [only way in Canada, only in EC years in US]
Much stronger role for within-reallocation, little role for entrants/exiters in Canada, in all periods.
Preliminary conclusions and speculation

▶ Much stronger role for within-reallocation, little role for entrants/exiters in Canada, in all periods
  ▶ ... due to measurement at firm vs. establishment level?
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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

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