



UNSW Business School

Centre for Applied Economic Research

Measuring Firm-Level Capital and Productivity Using Australian Integrated Microdata

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Sixth World KLEMS Conference

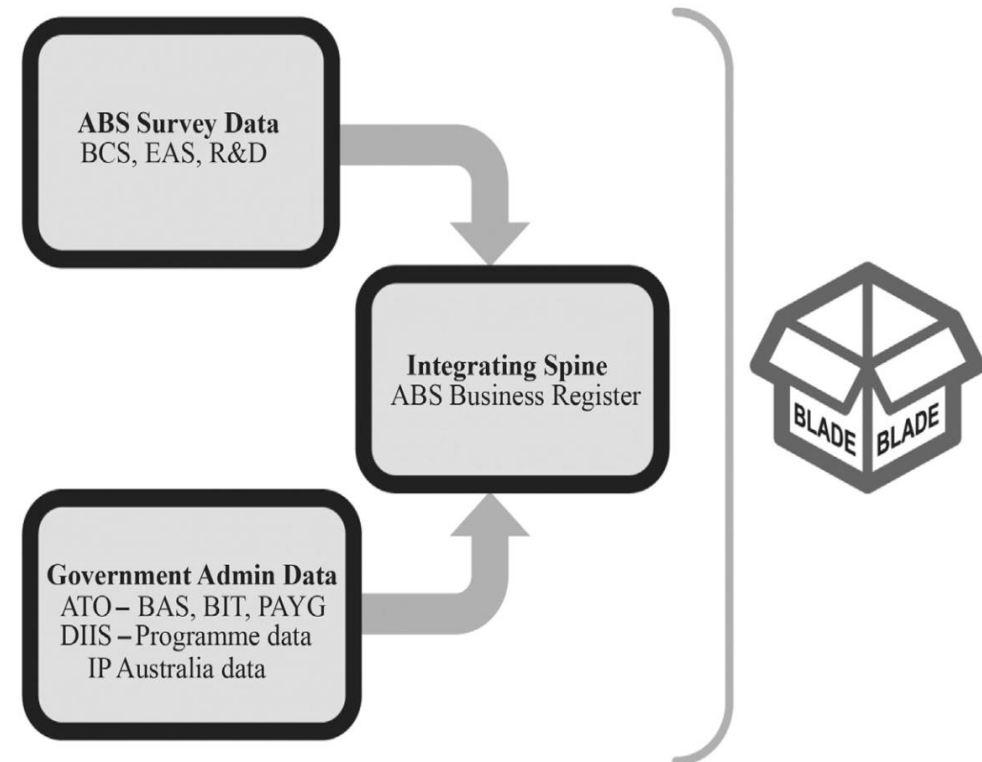
9, 10, 16, 17 March 2021

BLADE: Business Longitudinal Analysis Data Environment

- Combines tax and survey data
- Tax data are for the universe of Australian firms since (fiscal year) 2001-2002.
- BAS: Business Activity Statements. Related to reporting for Goods and Services Tax (GST)
- BIT: Business Income Tax

See: Hansell and Rafi (2018): “Firm-Level Analysis Using the ABS’ Business Longitudinal Analysis Data Environment,” *Australian Economic Review* 51, 132-138.

Figure 1 Overview of BLADE



Note: BCS denotes Business Characteristics Survey; EAS denotes Economic Activity Survey; and R&D denotes Research and Development.

MFP Calculation using BLADE

- **Collaboration with the ABS (MAVS) (Franklin Soriano, Kay Cao), supported by Treasury and the Economic Data Analysis Network.**
- **Carmit Schwartz has been a partner in this work.**
- **Measurement of capital and Multifactor Productivity using firm level data.**
- **Most studies have so far used labour productivity.**
- **Many challenging problems need to be addressed before the data can be effectively used to answer policy relevant questions.**

MFP Calculation using BLADE

- 1. Weed out "firms" with all zeros and missing values, GST adjustments, calculation of value etc., and merging with auxiliary data.**
- 2. Check the labour data. Can have several problematic cases.**
 - (NB: 26 potentially problematic cases were considered, with 5 being found in the data)
- 3. Check if there are ANZSIC code conflicts with the assigned division.**
- 4. Deal with labour problems, calculate capital input, delete outliers and construct MFP estimates.**
- 5. Plot growth and level series from BLADE data and compare with the official ABS industry MFP data cube estimates (not constructed using BLADE).**

Some Challenges

1. **ANZSIC and Division code mismatches.**
2. **Asset disposals in Gross Output, and hence Value Added**
3. **Negative Value Added and the construction of MFP**
4. **Missing labour data**
5. **Capital measurement**

ANZSIC Code and Division Mismatches

- In BLADE S15, the ABS backcast ANZSIC codes when a firm changes industries.
- It (effectively) forward cast Division codes.

ANZSIC Code and Division Mismatches

- **Made up example: A firm with ANZSIC 3020 should be in Division E Construction. If it started in Division A and shifted to E in 2016, then:**

Year	2002	2003	...	2015	2016
<u>Actual</u>					
ANZSIC	0529	0529	0529	0529	3020
Division	A	A	A	A	E
<u>BLADE S15</u>					
ANZSIC	3020	3020	3020	3020	3020
Division	A	A	A	A	A
<u>BLADE S1617</u>					
ANZSIC	3020	3020	3020	3020	3020
Division	E	E	E	E	E

ANZSIC Code and Division Mismatches

- Hence from BLADE S15, we knew that there was a change but don't know when the change happened.
- Potentially very problematic, especially for frontier analysis, analysis of firm exit and entry.
- Only solution was to delete firms with a mismatch of ANZSIC and Division codes
- In the S1617 version of BLADE, the ABS applied the same backcasting to both ANZIC and Division codes.
- Hence, it was impossible to identify the firms that were misallocated to Divisions.

ANZSIC Code and Division Mismatches

The ABS provided a solution in December 2019!

- **The ABS produced a 'point-in-time' ANZSIC file that can be merged to the existing BLADE Frame.**
- **This reflects the actual ANZSIC of the unit in each year of the BLADE time series.**

Asset Disposals

- The usual output measure is Total Sales from BAS data (TURNOVER).
- This includes revenues from all sources including asset disposals. (Same for profit from BIT data.)
- One-off large sales of assets may get caught by outlier detection methods, but not a pattern of continuous sales leading up to e.g. a global financial crisis.
- BLADE S15 provided information on “Termination value of intangible depreciating assets”, but not “Termination value of other depreciating assets”
- Output and capital should be adjusted for asset sales, but this was not possible without information on the disposal of (tangible) assets.
- **The ABS has subsequently added information on asset disposals, as the information was available, just not given to researchers.**

Negative Value Added

- **VA= (GO – Intermediates) can be negative. Firms can make losses in any period, and these can be persistent (e.g. Uber).**
- **Deflating, get real VA as negative. A negative real output is an input. Not sensible in the context of a firm producing output (e.g. Uber rides) but making losses.**
- **A common solution is to set negative VA to zero. Not ideal.**
- **Suggests the following:**
 - **VA based MFP only makes sense at some level of aggregation so that aggregate VA is positive.**
 - **Gross Output based MFP (i.e. KLEMS) is the only sensible measure at the firm level.**

Missing Labour Data

wages=total wage bill; fte=full time equivalent; go=gross output; ==. means missing; ==0 means equal to zero

1. Work out average wage rate at the 4 digit ANZSIC level.
2. Some averages are zero, as there are no firms that have positive wages recorded in their ANZSIC code. For these firms, use the division average wage. [Very few cases.]
3. For fte==., wages==0 and go>0 (Case 13):
Replace average wage rate (0) with division average wage rate
Replace fte=1, wages=(division av. Wage)*1
4. For fte==., wages==. and go>0 (Case 14):
Replace average wage rate (missing) with division average wage rate
Replace fte=1, wages=(division av. Wage)*1

Missing Labour Data

5. For $fte == .$, wages positive, use a regression approach (Case 15):
Regress $\ln(fte)$ on $\ln(\text{realwages})$ and time dummies. Replace the missing fte observations with the predicted values.
6. For fte positive, $wages == 0$ (Case 25):
Replace $wages = (\text{division av. wage}) * fte$
7. For fte positive, $wages == .$ (Case 26):
Replace $wages = (\text{division av. wage}) * fte$

Capital

NB: BIT data has only (historical) book value for some firms. OECD approach a mix of methods, meaning that relative levels and growth rate differences may be determined by the method used.

1. Starting value:

(average investment)/(depreciation rate + investment growth rate).

1. Then Perpetual Inventory Method to get k_stock_real

2. User Cost = $capital_def * (intrate - infla + (infla) * delta)$;

Capital_def=capital deflator from ABS, intrate=interest rate from RBA, infla=cpi rate, delta=Division depreciation rate from the ABS

3. User Cost Value = $uc * (k_stock_real)$

4. Payments to factors of production (payts) = wages + User Cost Value

5. Labour share = wages/payts, Capital share = 1-Labour share

MFP

1. Calculate (value added) MFP growth using a Törnqvist index for inputs.
2. **Division aggregates** by weighting using $\text{payts_share} = \text{payts} / \text{div_payts}$. That is, the firm's share in total Division payments to labour and capital. **Weighted geometric mean with two-period arithmetic average share weights.**
3. **Outliers:** try the three OECD methods (3sd, Tukey, percentiles). Only using output growth and input growth. Also try the IMF method of doing a split by employment numbers (headcount), then outlier deletion on each employment size class. Two variants of this method are tried.

On-going Work

Work agenda includes:

- 1. Take into account asset disposals now data are available**
- 2. Comparisons of different aggregation methods and levels, and resulting policy insights regarding growth areas of the economy, e.g.:**
 - By ownership type
 - By industry (ANZSIC codes and divisions)
- 3. Gross output versus value added**
- 4. Capital construction using BIT data (given changes to BAS reporting)**
- 5. Impact on policy implications from using alternative imputation methods**
- 6. Examine impact of issue with the ABS treatment of GST now it has been resolved**

On-going Work

Note on Goods and Services Tax (GST) Issue:

- **ABS noted problem in BLADE Technical Advisory Group meeting in Dec 2019**
- **Reported resolution and impact in March 2020 meeting**
- **Affected 53.9% of firms, lowering their Total Sales data by 9%**
- **Will affect all analyses that used Total Sales in value added calculation prior to this correction**

ABS also introduced other enhancements at the same time, e.g. treatment of extreme values, meaning that only 35.2% of Total Sales records remained unchanged

On-going Work

New project in collaboration with the ABS:

**“Productivity of Australian Firms in Global Market Pre- and Post-Covid-19”
(Fox, Li, Diewert, Soriano, with the participation of many other ABS staff)**

To significantly advance understanding of the determinants of firm performance and to guide industrial and trade policy, this project develops new methods for integrating and analysing data sets of all Australian firms. In collaboration with the Australian Bureau of Statistics (ABS), it uses newly available confidential data to **examine the role of trade and digital intensity in firm productivity and survival**. This information can be utilised to inform policies which assist the recovery of firms from the current pandemic conditions. In doing so it **assists the ABS with developing a Graph-Linked Information Discovery Environment**, which can lead to significant cost savings in data integration and analysis across a broad range of data products.