Revitalizing Indonesia's manufacturing: the productivity conundrum

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FKP – SMERU – 12 October 2016

Abstract

In light to continuing importance of the manufacturing sector, but declining dynamism, this paper investigates trends in productivity at firm levels. It finds that labour productivity has been either stagnant or falling in labour intensive manufacturing. The paper uses firm level cross-sectional and time series data and employs GMM techniques to estimates determinants of productivity. It finds that real wage is the most important variable that influences firm level productivity, followed by capital intensity. Contrary to the common perception, foreign ownership and export-orientation are not found to have statistically significant influence on firm level productivity. This finding is consistent for firms of all sizes – large, medium, small and micro. This implies that Indonesia can use wages policy, as Singapore did during the late 1970s-mid 1980s, to upgrade its manufacturing to higher value added activities.

- Keyword: manufacturing, productivity, firm-size, real wage, GMM
- JEL classification: E24; J24; J38; O14; O53

Objective

To understand manufacturing's productivity stagnation; what matters for it?

How do we do ?

- Firm level data of manufacturing establishments, disaggregated by firm size and factor intensity.
- According employment size, firms are categorized **into large, medium, small and micro**.
  - the long standing Large and Medium Manufacturing Survey (*Survei Industri Besar dan Sedang*) and
  - the newly introduced Micro and Small Manufacturing Survey (*Survei Industri Mikro dan Kecil*).
- Three categories of factor intensity (ISIC 2 manufacturing sub-sector): **LABOUR intensive, RESOURCE intensive and CAPITAL intensive**.

Tadjoeddin, Auwalin &Chowdhury (2016)

Outline

I. **Background**

II. **Transformation of manufacturing**

III. **Productivity trends in manufacturing**

IV. **Productivity and firms characteristics – an econometric investigation**

V. **Concluding remarks**

(I)
Background

Problem with manufacturing

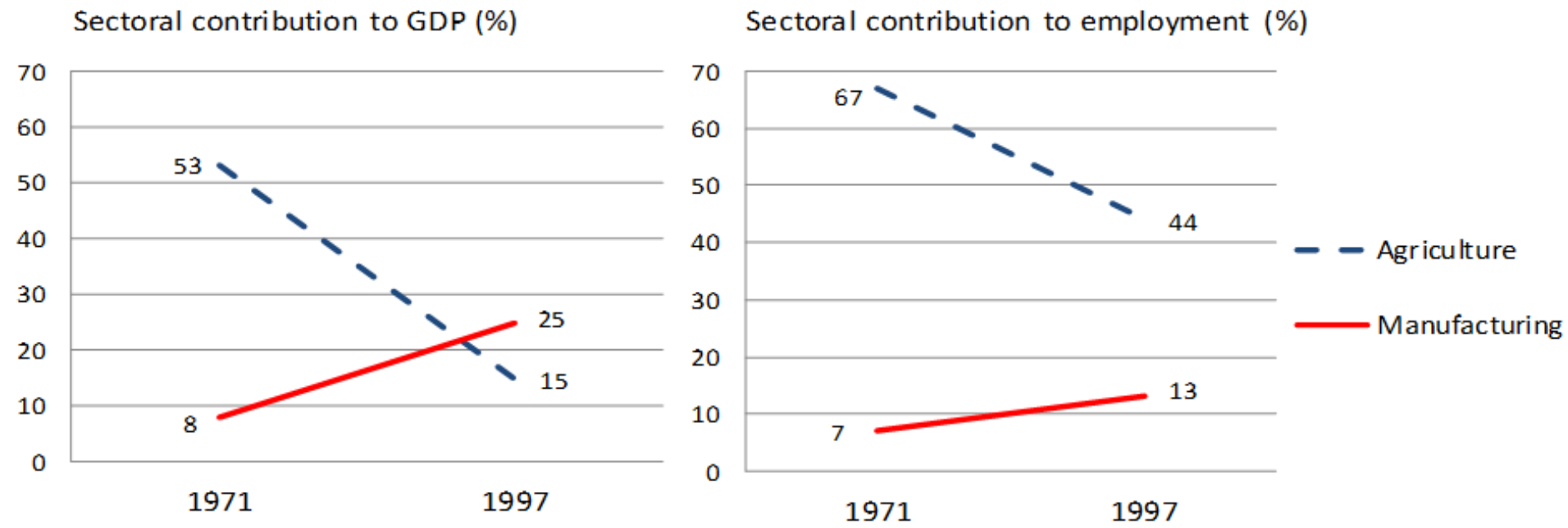
- Manufacturing – loosing dynamism
  - 1970-1997: 9% avg. growth (6.5% overall)
  - 2003-2015: 4.9% avg. growth (5.6% overall)

- Premature de-industrialization in post-crisis Indonesia
  - This structural change occurred at a low level of per capita income and before industrialization reached maturity

Tadjoeddin, Auwalin &Chowdhury (2016)

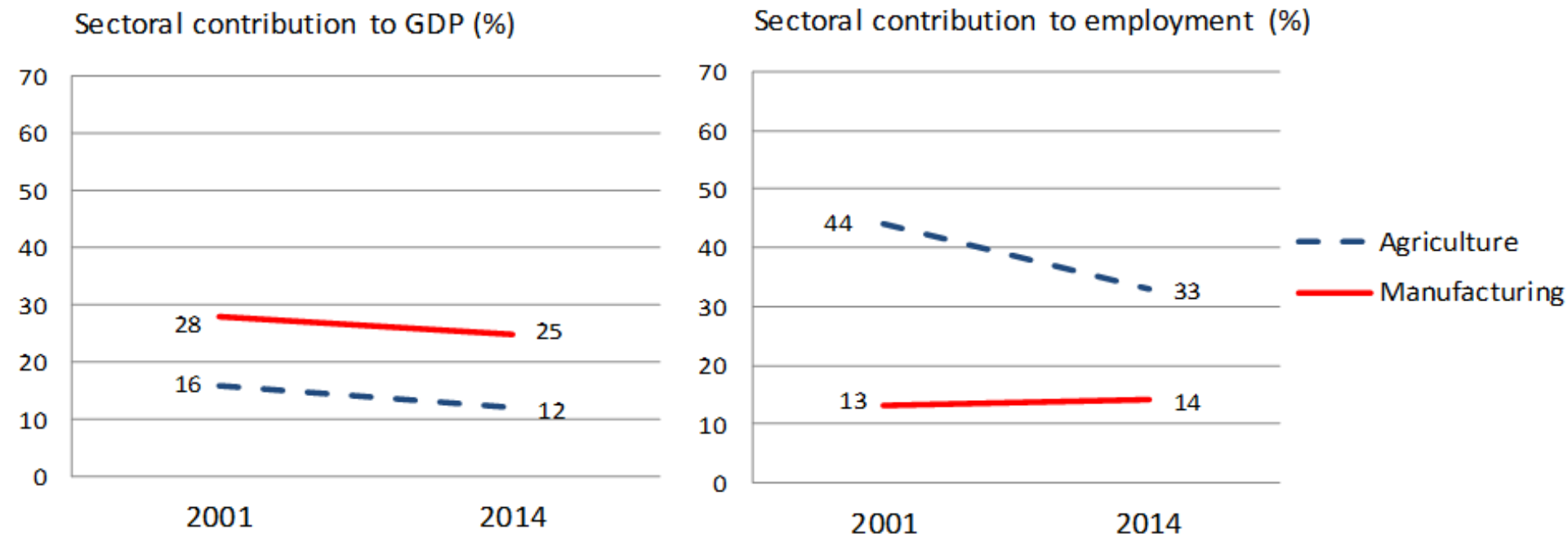
Structural transformation and “de-industrialization” of the Indonesian economy

Structural transformation, 1971 and 1997



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De-industrialization, 2001 and 2014



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‘premature’ de-industrialization

- The Indonesian economy passed the peak of manufacturing industry’s contribution to the overall GDP at around 28%: Quite low
- In advanced economies, the peak was achieved in the 1960s and the figures were much higher, around 36% in Japan, 32% in European Union and 30% in industrial countries
- More importantly, at the peak of the industrialization in the advanced economies, the employment share of the manufacturing sector was more or less comparable to the sector’s share of GDP
- Positive and negative de-industrialization

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+ de-industrialization

'… the normal result of sustained economic growth in a fully employed, and already highly developed, economy. It occurs because productivity growth in the manufacturing sector is so rapid that, despite increasing output, employment in this sector is reduced, either absolutely or as a share of total employment. However, this does not lead to unemployment, because new jobs are created in the service sector on a scale sufficient to absorb any workers displaced from manufacturing. Paradoxically, this kind of de-industrialization is a symptom of economic success.' (Rowthorn and Wells, 1987, p. 5)

…failure of manufacturing sector in absorbing the surplus labour in the agricultural sector…

Table 2.1: Sectoral GDP, employment and productivity, 2001 and 2014

	2001		2014		Productivity growth	Change in emp. share
	% Emp	% GDP	% Emp	% GDP	(% annual)	(% point)
Agriculture	43.8	15.5	34.0	12.1	4.6	-9.8
Mining	1.0	11.7	1.3	6.7	-1.8	0.2
Manufacturing	13.3	27.7	13.3	25.5	3.7	0.0
Electricity	0.2	0.6	0.3	0.8	1.6	0.1
Construction	4.2	5.6	6.4	6.7	2.1	2.1
Trade	19.2	16.2	21.7	18.0	4.5	2.4
Transportation	4.9	4.9	4.5	10.9	22.6	-0.4
Finance	1.2	8.6	2.6	9.9	-1.0	1.4
Services	12.1	9.3	16.1	9.4	1.7	4.0
Total	100	100	100	100	4.6	0.0

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Despite the recent trend of apparent de-industrialization, the manufacturing sector remains the **most important sector** in the Indonesian economy.

During 2001-2014, among the 9 economic sectors,

- the manufacturing sector recorded the highest contribution (25.5%) to the overall GDP, and
- the main engine of growth with the largest contributor (23%) to the overall GDP growth.

❑ **But**, jobless growth and depressed.

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What happen in the manufacturing sector?

1) manufacturing sector's contribution to regular waged-employment has significantly declined, while the contribution to the overall employment remained unchanged
2) Increased casualization (from 3.1% to 5.1% between 2001-14)
3) the real wages of regular employees in the manufacturing sector was under relative depression vis-à-vis other sectors.

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the problem…

Table 2.2: Regular waged emp.: sectoral share and wage index, 2001-2014

	Total employment share (%)		Regular waged employment share (%)		Wage index of regular-waged emp. (Indonesia = 100)	
	2001	2014	2001	2014	2001	2014
Agriculture	43.8	34.0	10.6	7.9	60	66
Mining	1.0	1.3	1.5	1.9	146	177
Manufacturing	*13.3*	*13.3*	*28.6*	*23.8*	*88*	*89*
Electricity	0.2	0.3	0.4	0.6	147	134
Construction	4.2	6.4	7.3	6.8	87	95
Trade	19.2	21.7	11.4	15.5	83	80
Transportation	4.9	4.5	5.6	5.4	115	120
Finance	1.2	2.6	3.8	5.9	161	143
Services	12.1	16.1	30.8	32.2	122	111
Total	100	100	100	100	100	100

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Re-industrialization ?

- The argument for reversing the trend of negative de-industrialization, or **a case for re-industrialization**, has been widely advocated on the ground that the manufacturing sector in Indonesia has not matured yet.
- The problems lie with the facts that the Indonesian manufacturing industry seems to have **failed to move to a higher level and diversify into more sophisticated manufacturing activities** beyond the traditional resource-based and labour intensive industries.

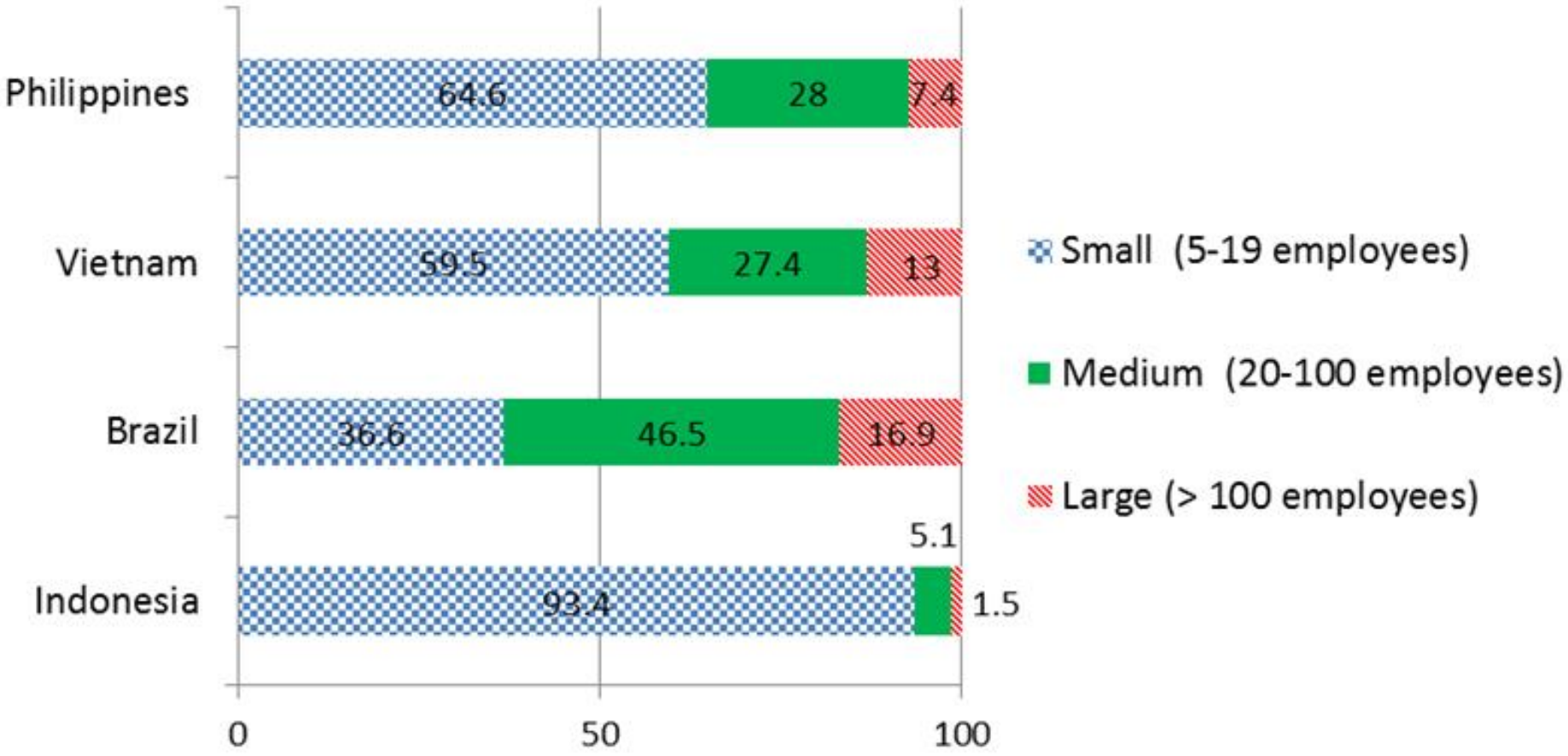
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(II)
Transformation of manufacturing

Figure 3: Distribution of manufacturing firms by size, 2008

(World Bank, Enterprise Survey 2008, quoted from World Bank (2012a:8))

severe imbalance & **missing middle**



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Large-medium firms did not expand

Table 3: Employment and value added shares of LM and SM firms

	Manufacturing Employment share (%)		Manufacturing Value added share (%)	
	2001	2011	2001	2011
Large-medium	36	32	56	56
Small-micro	64	68	44	44
Total	100	100	100	100

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Manufacturing sector has not transformed much in recent years, still dominated by labour-intensive sectors such as food, textile, wood and paper contributing over 46 per cent to manufacturing value added (MVA) in 2014, roughly the same as in 2010.

Table 5: Manufacturing value added by sub-sectors (%)

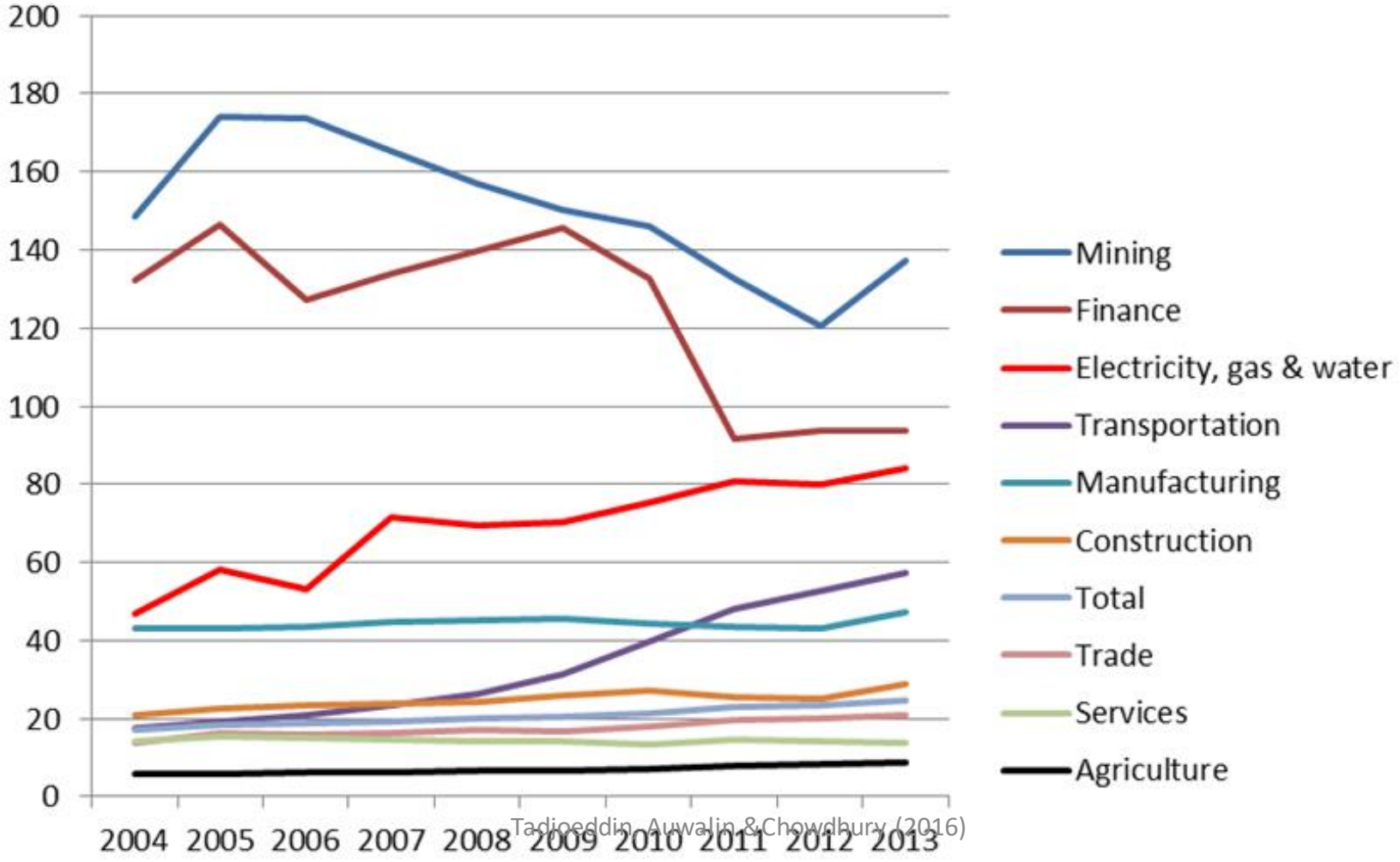
	2000	2010	2014
31. Food	33.8	29.1	29.8
32. Textile	13.7	9.5	9.1
33. Wood	6.1	3.5	3.1
34. Paper	6.0	5.0	4.2
35. Chemical	13.0	13.2	12.4
36. Non-metallic mineral	3.1	3.0	2.8
37. Basic metal	2.8	1.4	1.5
38. Fabricated metal	20.7	34.5	36.5
39. Other manufacturing	0.8	0.7	0.6
All manufacturing (non-oil	100	100	100

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(III)
Productivity trends in manufacturing

Figure 4. **Labour productivity** (IDR Mil, 2000 cp, GDP def)

Labour productivity of the manufacturing sector is roughly twice of labour productivity in the overall economy, but stagnant. Interestingly, the only sectors that experienced rising productivity are the non-tradable ones (electricity, transport & construction).



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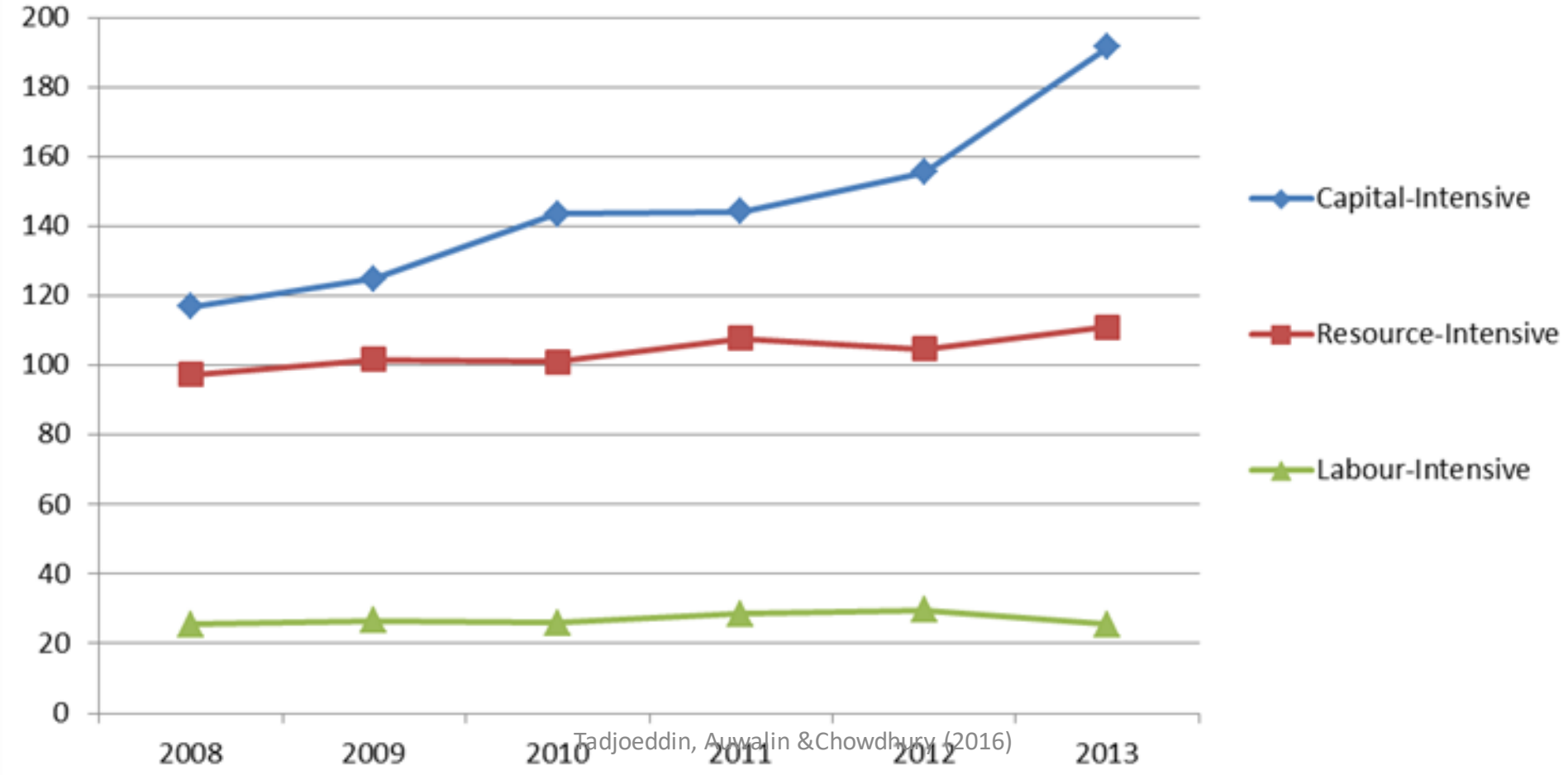
Aswicahyono, Hill & Narjoko's (2010) classification

ISIC 2	
	Labour Intensive
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except funiture
31	Manufacture of furniture
32	Other manufacturing
33	Maintenance and repair of machinery and equipment
	Resource Intensive
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical medicine
22	Manufacture of rubber and plastics products
	Capital Intensive
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machine
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment

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Productivity in Large-Medium firms (manufacturing)

(IDR million, 2000 constant price, GDP deflator)



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What about micro-small firms?

- Informality: significant portions of their employment are unpaid workers. Largely categorized as self-employed involving family members in running their micro firms.
- irregularities in the 2011 data
- Nevertheless, a quick comparison between 2010 and 2014 data: a broad trend of increasing levels of productivity in micro and small firms across the three categories of factor intensity.

Small & Micro firms

Productivity: **SMALL** firms					
	2010	2011	2012	2013	2014
Labour intensive	13.4	2.2	6.9	10.0	15.5
Resource intensive	9.2	1.8	9.1	10.2	11.6
Capital intensive	12.0	1.8	7.2	11.1	14.6
Productivity: **MICRO** firms					
	2010	2011	2012	2013	2014
Labour intensive	4.2	1	3.5	4	5.9
Resource intensive	6.1	0.8	3.5	3.9	4.9
Capital intensive	5.8	1.5	5.6	5.6	8.3

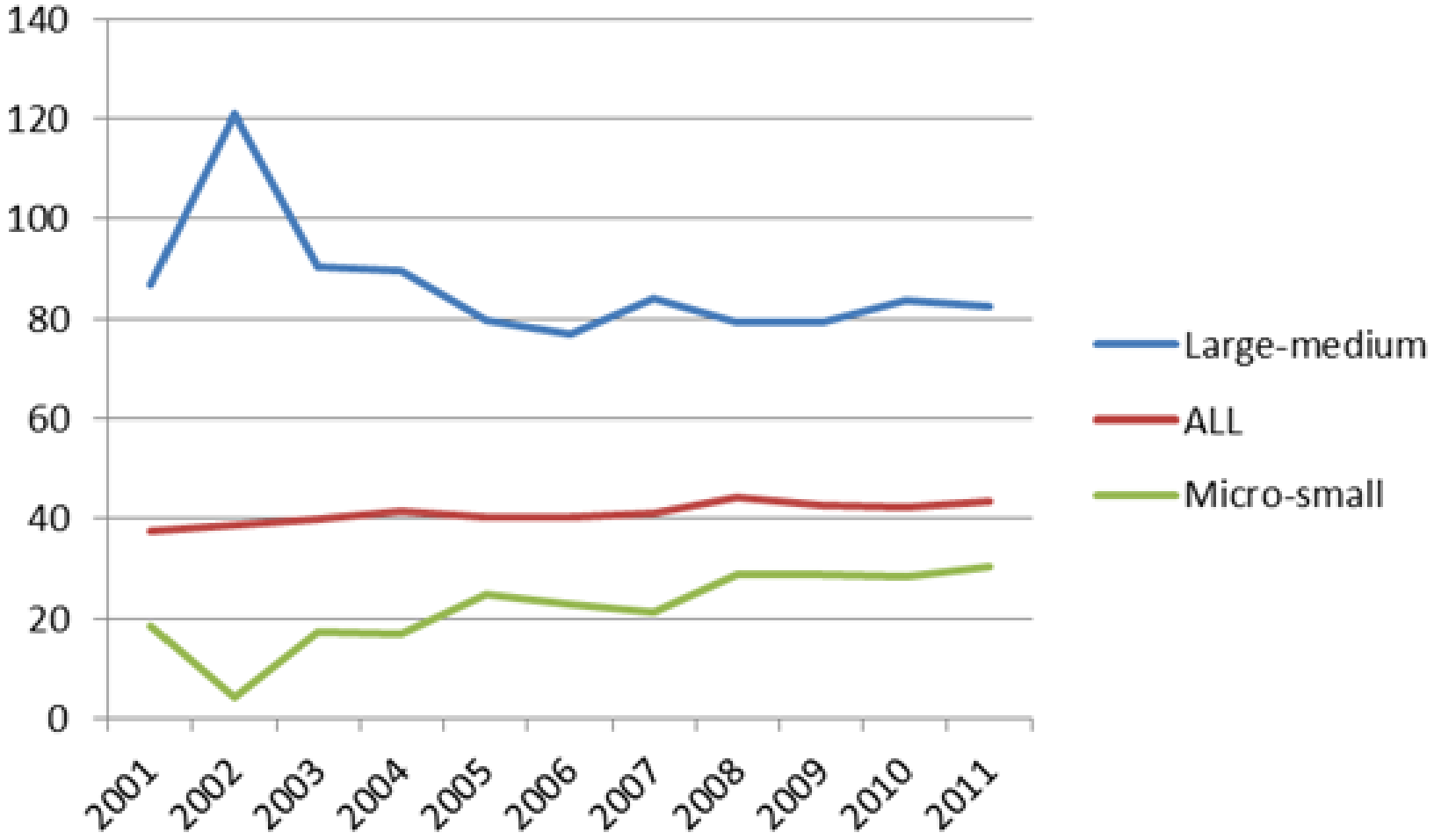
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So…

- The above diagnostic of firm level data indicate that the stagnating productivity in the overall manufacturing sector is due to stagnating and/ or falling productivity of **labour intensive** large-medium firms.

Labour productivity
(sub-sector: Food, Beverages and Tobacco industries)

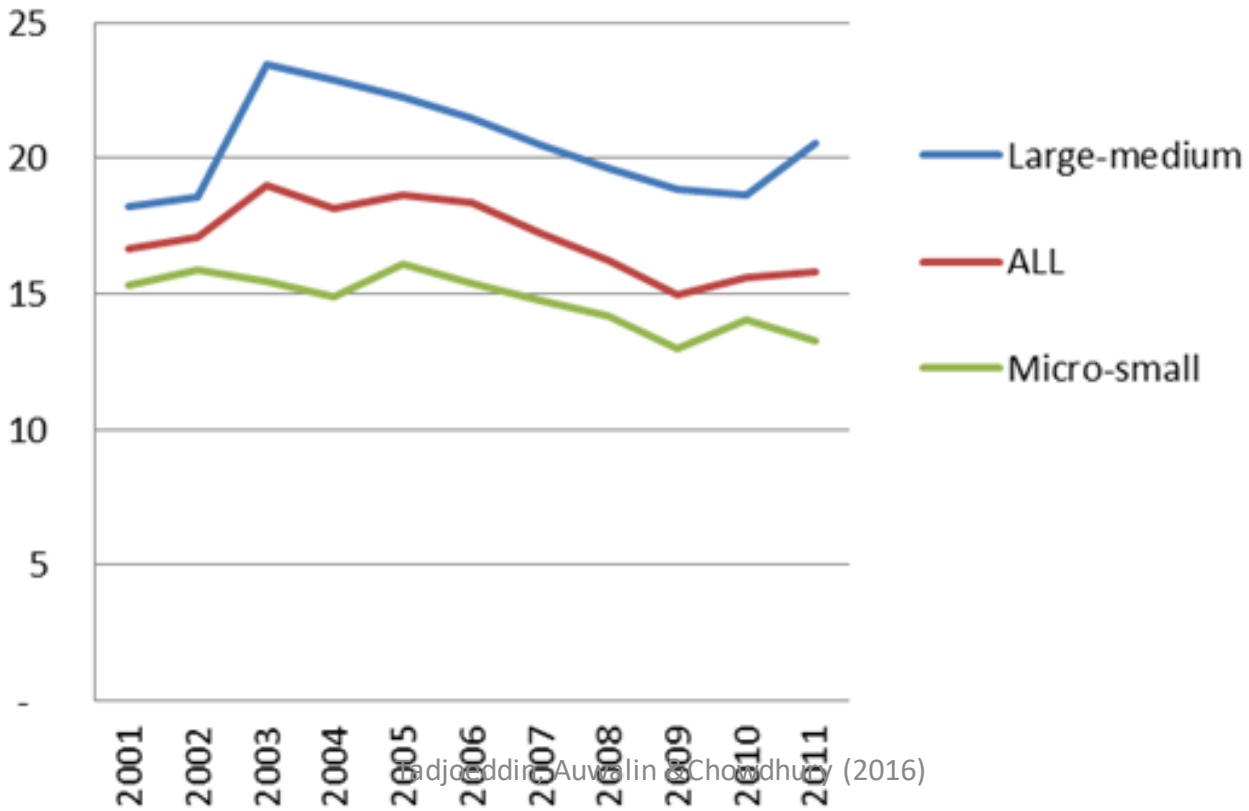
IDR million/year/worker, 2000 constant prices



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Labour productivity
(sub-sector: Textile, Leather Products and Footwear Industries)

IDR million/year/worker, 2000 constant prices



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(IV)
Productivity and firms characteristics – an econometric investigation

a) Large & medium firms

b) Micro & small firms

Data sources & methods

- Firm level observations
- Survei industri besar-sedang (2008-2013)
  - balance panel dataset
  - difference GMM with year fixed effects
- Survei industri mikro-kecil (2010-2014)
  - OLS & Heckman
  - pseudo panel

Productivity function for LARGE & MEDIUM firms:

Productivity = f {wage, capital, export, foreign)

- It is hypothesized, following the efficiency wage theory, that productivity is driven by wage.
  - Firms faced with the asymmetry of information regarding workers' efforts, pay higher than the market clearing wage.
  - Workers, in return, feel more loyal and devoted to the company.
  - With a higher wage, they may also fear losing the job if caught shirking and may not get another with a similarly higher pay.
  - So they are likely to work harder.
  - Therefore, although the firm pays more, they get more productivity from their workers.

- We also assume that capital-intensity, export-orientation and foreign ownership would have positive impacts on productivity.
  - To remain competitive in the international market, export-oriented firms must improve their productivity. Due to access to better technology and management practices, foreign firms are likely to have higher productivity.

Productivity function for Large and Medium firms:

Productivity = f {wage, capital, export, foreign)

$$\ln PROD_{it} = \alpha_0 + \alpha_1 \ln PROD_{it-1} + \alpha_2 \ln RW_{it} + \alpha_3 \ln CAP_{it} + \alpha_4 EXPORT_{it} + \alpha_5 FOREIGN_{it} + \varepsilon_{it}$$

Difference GMM with year fixed effects

	Real wage (Elasticity)		Capital intensity (Elasticity)		Export orientation	Foreign investment	Year fixed effects	Obs.
All firms	0.122	***	0.078	***	0.00004	0.0002	Yes	6818
Firm Size								
Medium	0.109	***	0.052	**	0.001	-0.001	Yes	2825
Large	0.131	***	0.093	***	-0.0003	0.001	Yes	3993
Factor intensity								
Labour	0.089	***	0.050	***	-0.0003	0.001	Yes	3312
Resource	0.124	***	0.114	***	0.0003	-0.001	Yes	2286
Capital	0.230	***	0.066	*	0.0001	0.002	Yes	1220

Tadjoeddin, Auwalin &Chowdhury (2016)

Productivity function for LARGE & MEDIUM firms:

Key RESULTS

- real wage exerts more influence than any other variables on productivity across the board – for both in large and medium firms as well as in labour-, capital- and resource-intensive firms.
- Contrary to the general perception, neither export-orientation nor foreign ownership is found to play a significant role.
- As expected: capital intensity has positive and statistically significant effect on productivity.
  - NOTE: the effect of capital intensity on labour productivity in large firms is nearly twice as that of medium firms.

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Productivity function for MICRO & SMALL firms:

Prod = f {wage, own capital, age, cooperative, licence)

$$\ln PROD_{it} = \phi_0 + \phi_1 \ln PROD_{it-1} + \phi_2 \ln RW_{it} + \phi_3 \ln OWNCAP_{it} + \phi_4 AGE_{it} + \alpha_5 COOP_{it} + \phi_6 LIC_{it} + \varepsilon_{it}$$

- We model productivity function for micro and small firm with a different set of firms characteristics, which include:
  - **a)** **capital ownership**, measured as percentage of business capital originated from own internal source,
  - **b)** **firm age**, measured by how many years the firm has been in operation,
  - **c)** **cooperative** membership, indicating whether a firm is a member of any cooperative association,
  - **d)** **business licence** type, indicating whether a firm has any type of business license.
- These small and micro firm characteristics are different from those for large and medium firms and these differences are simply dictated by the differences in the design of manufacturing surveys for large-medium and micro-small firms.

Productivity function for MICRO & SMALL firms:

$$\ln PROD_{it} = \phi_0 + \phi_1 \ln PROD_{it-1} + \phi_2 \ln RW_{it} + \phi_3 \ln OWNCAP_{it} + \phi_4 AGE_{it} + \alpha_5 COOP_{it} + \phi_6 LIC_{it} + \varepsilon_{it}$$

Prod = f {wage, own capital, age, cooperative, licence)

1) Cross section (OLS & Heckman)
   - **Heckman** for checking selection bias due to large proportion of workers are unpaid (key informality characteristic)
2) Pseudo panel (difference GMM)
   - Grouping based on age cohorts of firms

❖In both cases: wage is a significant predictor of productivity

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OLS & Heckman

	ALL (Micro + small)		MICRO FIRMS ONLY		SMALL FIRMS ONLY	
	-1	-2	-3	-4	-5	-6
	OLS	Heckman	OLS	Heckman	OLS	Heckman
	Robust	Robust	Robust	Robust	Robust	Robust
Ln real wage	0.663***	0.657***	0.645***	0.753***	0.687***	0.663***
Own capital	-0.0003	-0.0003	-0.0024**	-0.0019*	0.0014*	0.0014***
Cooperative	-0.110**	-0.111***	-0.0952	-0.0732	-0.104*	-0.109**
Firm age	-0.00253	-0.00255	-0.00486	-0.00434*	0.00137	0.00126
Firm age (squared)	0.00003	0.00003	0.00007	0.0001	-0.00004	-0.00004*
Business license	0.101	0.109	0.0674*	-0.0714	0.138	0.164
Rho		0.0358		-0.658		0.132
Sigma		1.141		1.239		1.136
Lambda		0.0409		-0.815		0.15
P-Value for LR test		0.468		0.00237		0.0113
Test age & age-sq	0.3486	0	0.1724	0	0.2786	0
Obs	40678	48940	24400	29617	16278	19323
R-sq	0.21		0.219		0.206	
Year dummies	YES	YES	YES	YES	YES	YES

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Pseudo panel

Determinants of productivity (psedo panel, difference GMM)						
	ALL		Micro		Small	
Ln real wage	0.9096	***	0.9279	***	1.0689	***
	0.0615		0.1061		0.0833	
Firm age	0.1993	*	-0.0053		-0.0931	
	0.1077		0.0823		0.1403	
Firm age (squared)	-0.0009		-0.0004		0.0022	
	0.0006		0.0005		0.0021	
Own capital	0.0010		-0.0026		-0.0047	
	0.0025		0.0028		0.0035	
no of obs.	224		186		94	
no of groups	84		69		38	

Tadjoeddin, Auwalin &Chowdhury (2016)

Concluding remarks

- The finding that real wage plays the most critical role in influencing productivity across the whole spectrum of manufacturing has significant policy implications.
- This raises the question, would a flexible labour market with a minimum interference from the government with instruments, such as minimum wage legislations or requiring better working conditions, be able to achieve the objective of industrial upgrading?
- The general perception is that such legislations are adversely affecting the manufacturing sector, especially in creating employment.
  - Here the policy makers face a dilemma between **labour intensity** and **productivity**.
  - Raising labour intensity for improving the employment rate can reduce labour productivity as they are inversely related.
  - In a dynamic setting an ideal situation **is high wage-high productivity driving the economy.**

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