Determinants of Labour Productivity: Comparison of Developing and Developed Countries of Asia-Pacific

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Motivation .. 1/3

"Productivity isn't everything but in the long-run it is almost everything. A country's ability to raise its standard of living depends almost entirely on its ability to raise its output per worker."

Paul Krugman, The Age of Diminishing Expectations, 1994

Motivation .. 2/3

- Emerging and developing Asia-Pacific economies showed most remarkable increase in their labour productivity and growth performance over the last three decades.

- There has been threefold increase in the share of Emerging and developing Asia-Pacific in world GDP (in PPP terms) rising from a mere 9.5% in 1980 to 32% in 2016 (*WEO, IMF, 2018*).

- These strong labour productivity gains and economic growth have even trickled down to workers in terms of more employment (*Asia-Pacific Employment and Social Outlook, ILO, 2018).*

- A number of emerging and developing economies including Asian economies introduced major liberalization reforms including liberalization of capital account in early 1980s and later thus leading to greater economic integration of these economies with the rest of the world.

Motivation .. 3/3

- Emerging and developing Asia-Pacific economies have been undergoing structural change with movement of labour away from less productive agriculture sector to more productive manufacturing and services sectors.

- Services sector especially modern services of transport and communications and financial and business services have emerged as the major economic sectors in these economies over the last two and a half decades.

Objectives of the Study

- To examine determinants of aggregate labour productivity of developing and developed Asia-Pacific economies over the period 1980-2014 and compare results across two sets of economies.

- To examine determinants of sectoral labour productivity of industry and services sectors and their components in both developing and developed economies of Asia-Pacific in two separate panels.

- To compare results across the developing and developed economies of the Asia-Pacific region.

Contribution to literature

- By examining a comprehensive model of productivity at both aggregate and sectoral level, the study contributes to the empirical literature on analysis of productivity.

- By using panel data, the study gains from more observations as compared to what one would get using time series techniques for individual countries.

- Since the study analyzes developing and developed economies of Asia-Pacific, the study further adds to the literature on developing economies and the economies of Asia-Pacific.

Productivity Measures

- **Labour Productivity**: GDP/ Labour Input
  (Labour Input: Employment/ Hours Worked)

- **Total Factor Productivity**: Output per unit of labour and capital inputs.

- While Total Factor Productivity (TFP) controls for growth of both labour and capital inputs while calculating productivity measure as opposed to labour productivity, labour productivity serves as an overall measure of welfare in the economy.

- Moreover, the data on labour productivity is more readily available especially at sectoral level for emerging and developing economies as compared to Total Factor Productivity.

Data .. 1/3

Countries covered:

- **Developing Asia-Pacific** – China, India, Indonesia, Malaysia, Pakistan, Philippines, Thailand and Bangladesh
- **Developed Asia-Pacific-** Hong Kong (SAR of China), Japan, Republic of Korea, Singapore, Taiwan (Republic of China), Australia and New Zealand

Sectors covered:

- Aggregate economy
- Industry sector and its component manufacturing
- Services sector and its components viz., Trade, hotels and restaurants (Distributive trade); Transport and Communications; Financial Intermediation, real estate and renting.

Time period covered: 1980-2014.

Data .. 2/3

Variable	Definition	Source	Notation
Labour Productivity (Aggregate)	$\frac{GDP_i}{Total\ Employment_i}$ $i\ refers\ to\ country$	GDP and Total Employment data for all fifteen countries from Penn World Tables (PWT Version 9.0)	$Prod$
Labour Productivity (sector j)	$\frac{GVA_j}{Total\ Employment_j}$ j $refers\ to\ sector$	GVA and Employment in all sectors are drawn from Asian Productivity Organisation (APO) database, 2018 except for New Zealand. Data for New Zealand is drawn from OECD database.	$Prod^j$
Capital stock(Kstock) per worker (Aggregate)	$\frac{Kstock_i}{Total\ Employment_i}$ $i\ refers\ to\ country$	Kstock and Total Employment data for all fifteen countries from Penn World Tables (PWT Version 9.0)	k
Capital stock per worker (Sector j)	$\frac{Kstock_j}{Total\ Employment_j}$ $i\ refers\ to\ sector$	Data on Kstock is constructed for each sector for all countries taking data on aggregate Kstock from PWT9.0 and shares of sectors from APO database.	k^j

Data .. 3/3

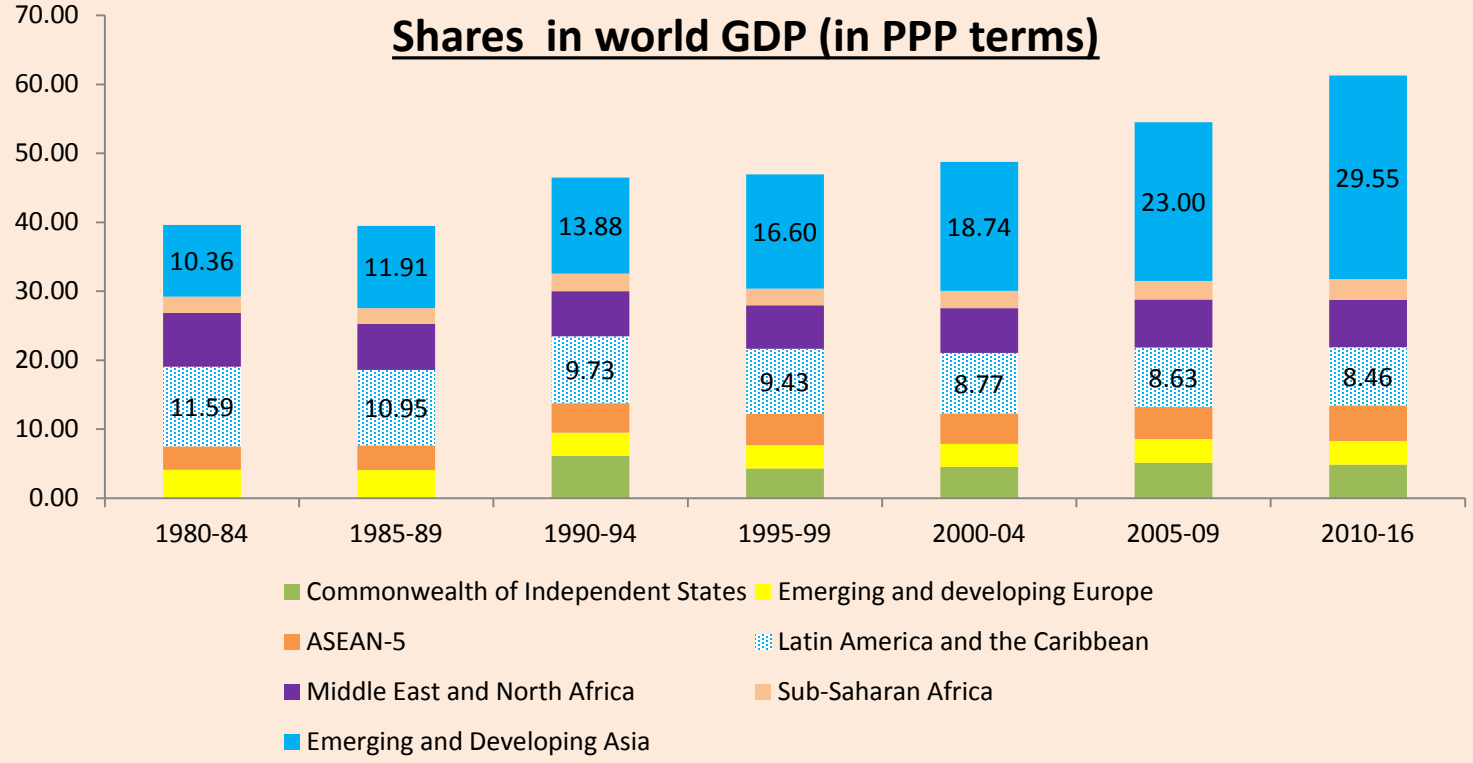
Penn World Tables (PWT9.0) –

- Internationally comparable data on various macroeconomic variables like GDP, labour input, capital stocks, total factor productivity in levels
- Covers 184 countries over the period 1950-2014
- Provides only aggregate level data
- Provides comprehensive estimates of aggregate level capital stocks

Asian Productivity Database (APO, 2017) -

- Internationally comparable data on variables like GDP, employment, hours worked, capital stocks and TFP at the aggregate level and Gross Value Added and employment for ten sectors (including three broad sectors and their components)
- Covers only 34 Asian economies.
- No data on capital stocks and total factor productivity at sectoral level

Facts & Graphs



Source: Authors' own computations from WEO,IMF, 2017.

Countries in Asia-Pacific Region

East Asia	South-East Asia	South Asia	Pacific
China (ED)	Brunei(ED)	Afghanistan (ED)	Marshall (ED)
Hong Kong(SAR of China) (D)	Cambodia(ED)	**Bangladesh (ED)**	Micronesia (ED)
Japan	**Indonesia(ED)**	Bhutan (ED)	Palou (ED)
Korea (Republic of) (D)	Laos(ED)	**India (ED)**	Timor (ED)
Mongolia (ED)	**Malaysia(ED)**	Maldives (ED)	Tuvalu (ED)
Singapore(D)	Myanmar(ED)	**Pakistan (ED)**	Papua (ED)
Taiwan (Province of China) (D)	**Philippines(ED)**	Nepal (ED)	Fiji (ED)
	Thailand(ED)	Sri Lanka (ED)	Samoa (ED)
	Vietnam(ED)		Solomon (ED)
			Vanuatu (ED)
			Tonga (ED)
			Kiribati (ED)
			Australia (D)
			New Zealand (D)

Notes: D: Developed and ED: Emerging and Developing; Boldface and color refer to countries considered in the study.
Source: World Economic Outlook, IMF, 2017.

Facts & Graphs

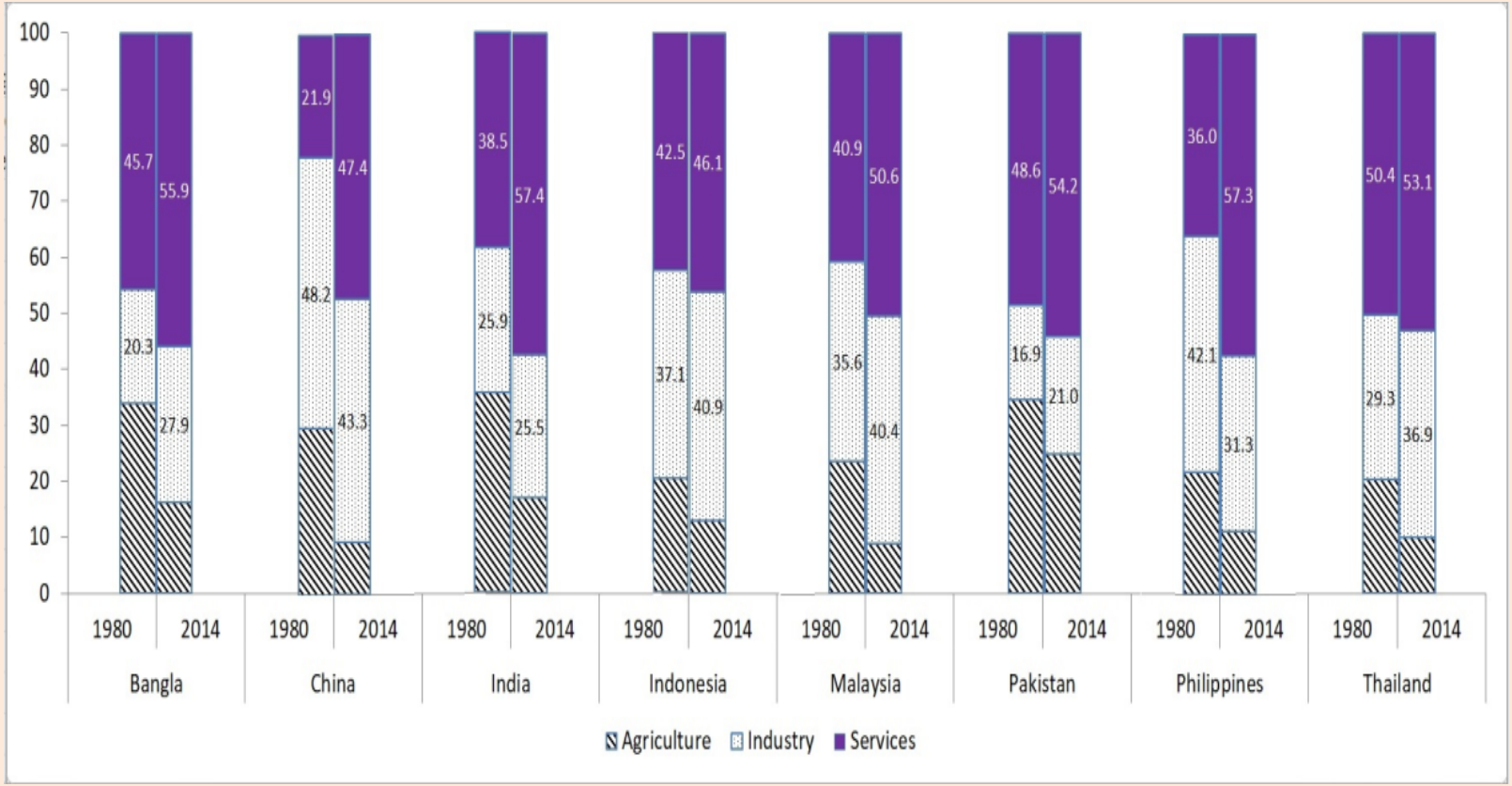
Eight largest economies in Emerging and Developing Asia :

Shares in GDP (in PPP terms) within the region

Country/Time Period	1980-84	2010-16	1980-2016
China	25.6	53.7	40.4
India	30.1	22.0	24.9
Indonesia	14.5	8.1	11.7
Thailand	5.9	3.3	5.2
Pakistan	5.8	2.7	4.4
Malaysia	3.7	2.3	3.2
Philippines	6.7	2.1	3.6
Bangladesh	3.2	1.6	2.2
Total	95.5	96.0	95.6

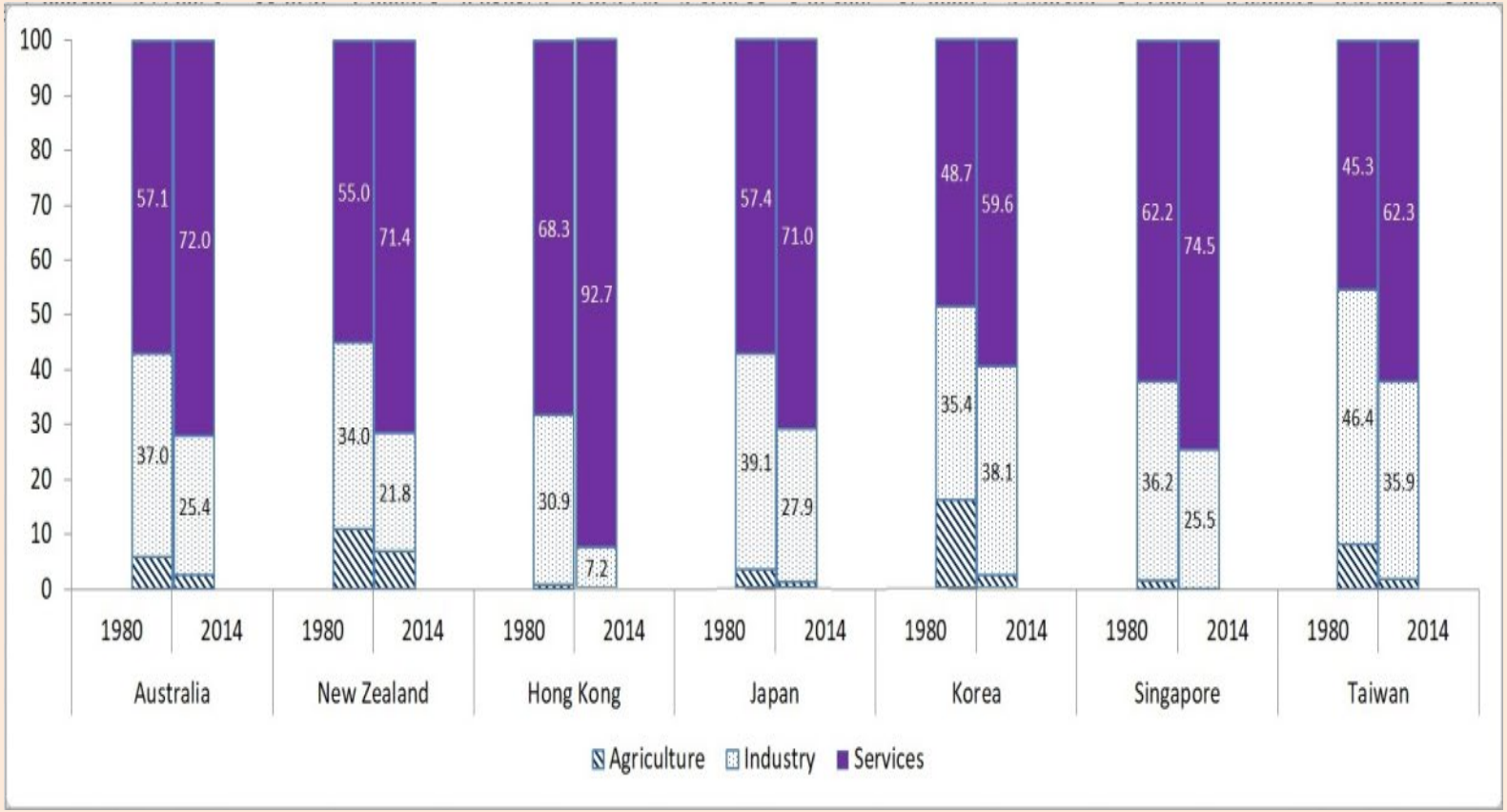
Source: Authors' own computations from WEO,IMF, 2017.

Sectoral shares of GDP: Developing Asia-Pacific



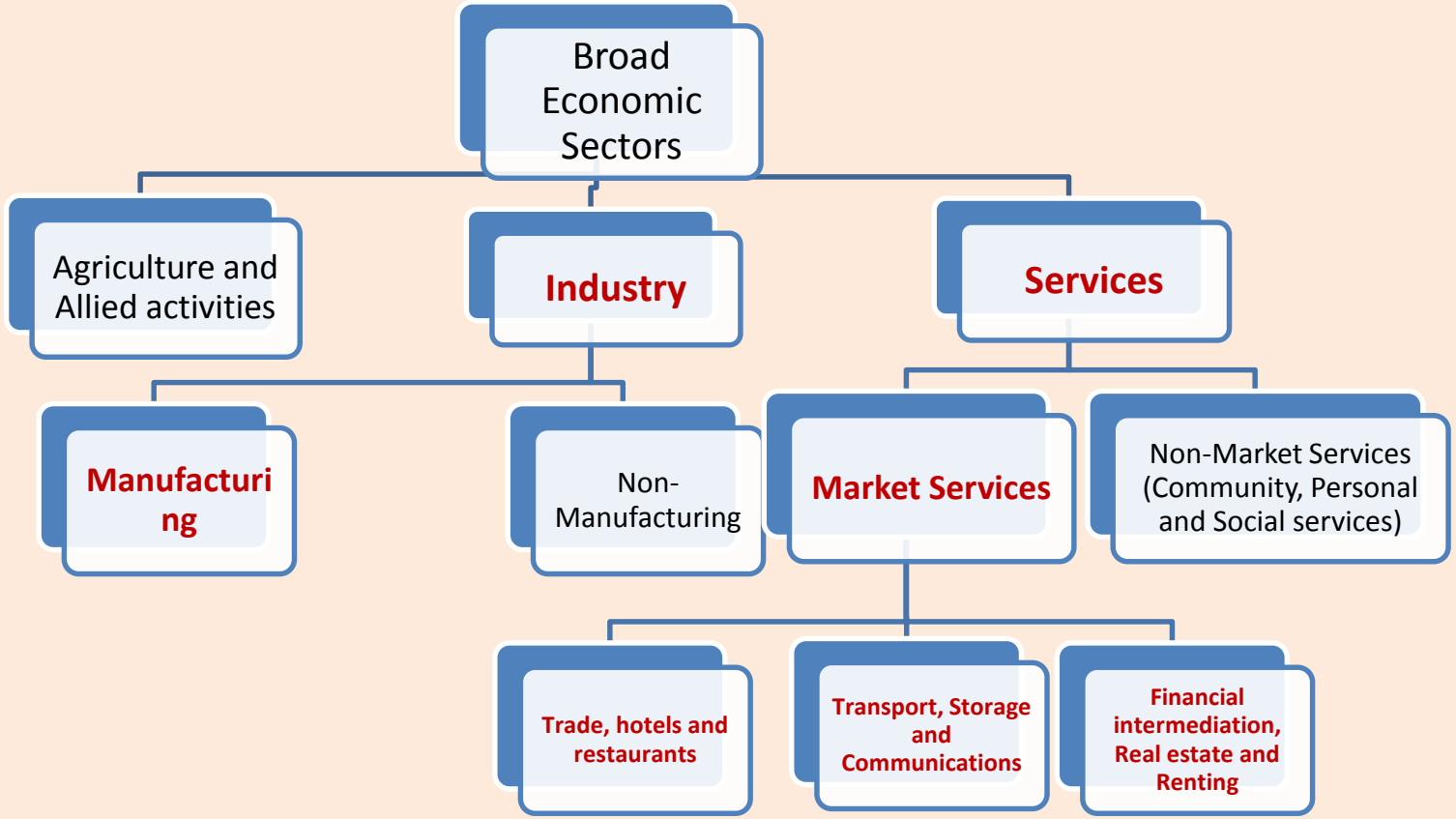
Source: Authors' computations from Asian Productivity Organisation (APO) database, 2017.

Sectoral shares of GDP: Developed Asia-Pacific



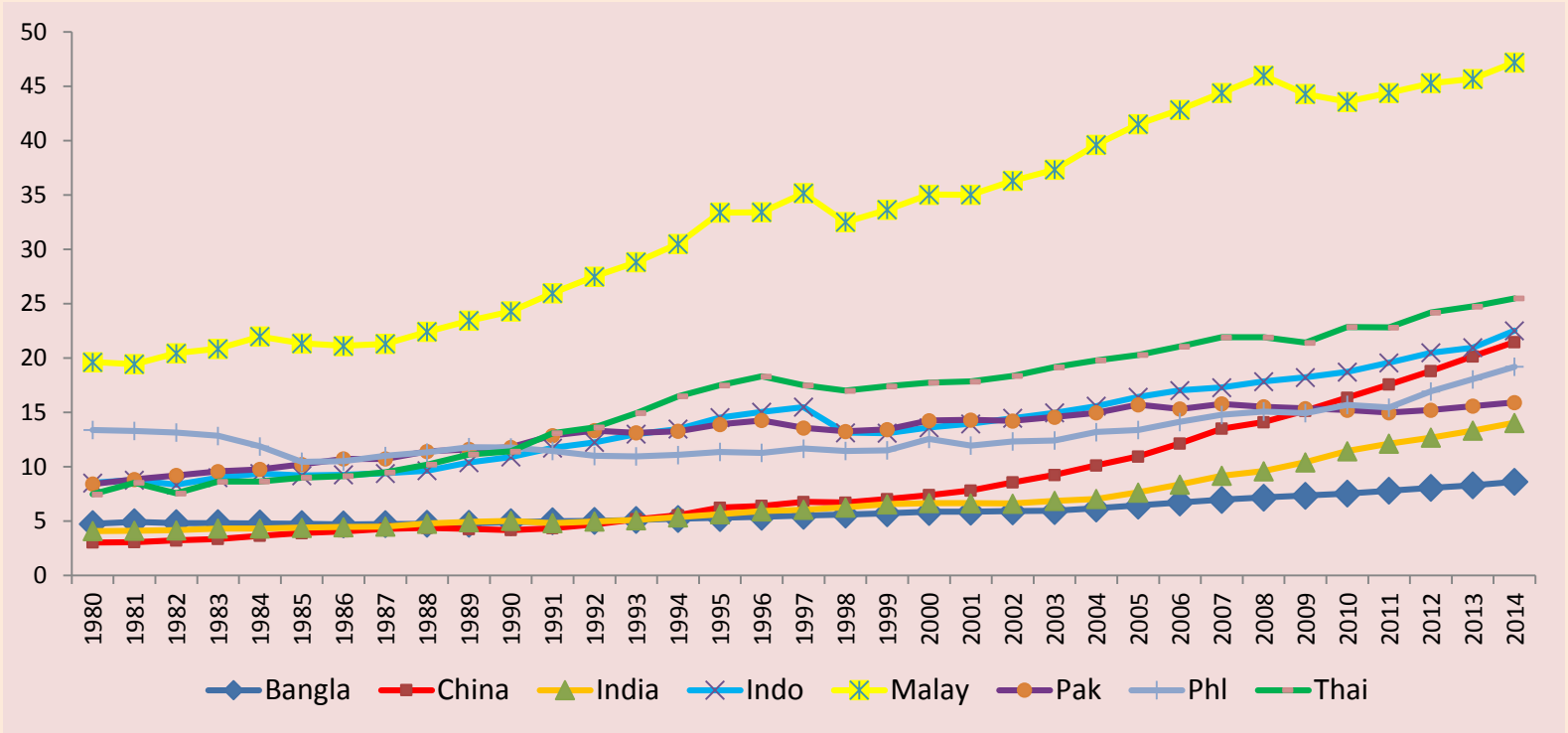
Source: Authors' computations from Asian Productivity Organisation (APO) database, 2017.

Economic sectors and their components



Note: Sectors and sub-sectors in color are the ones considered in the study.

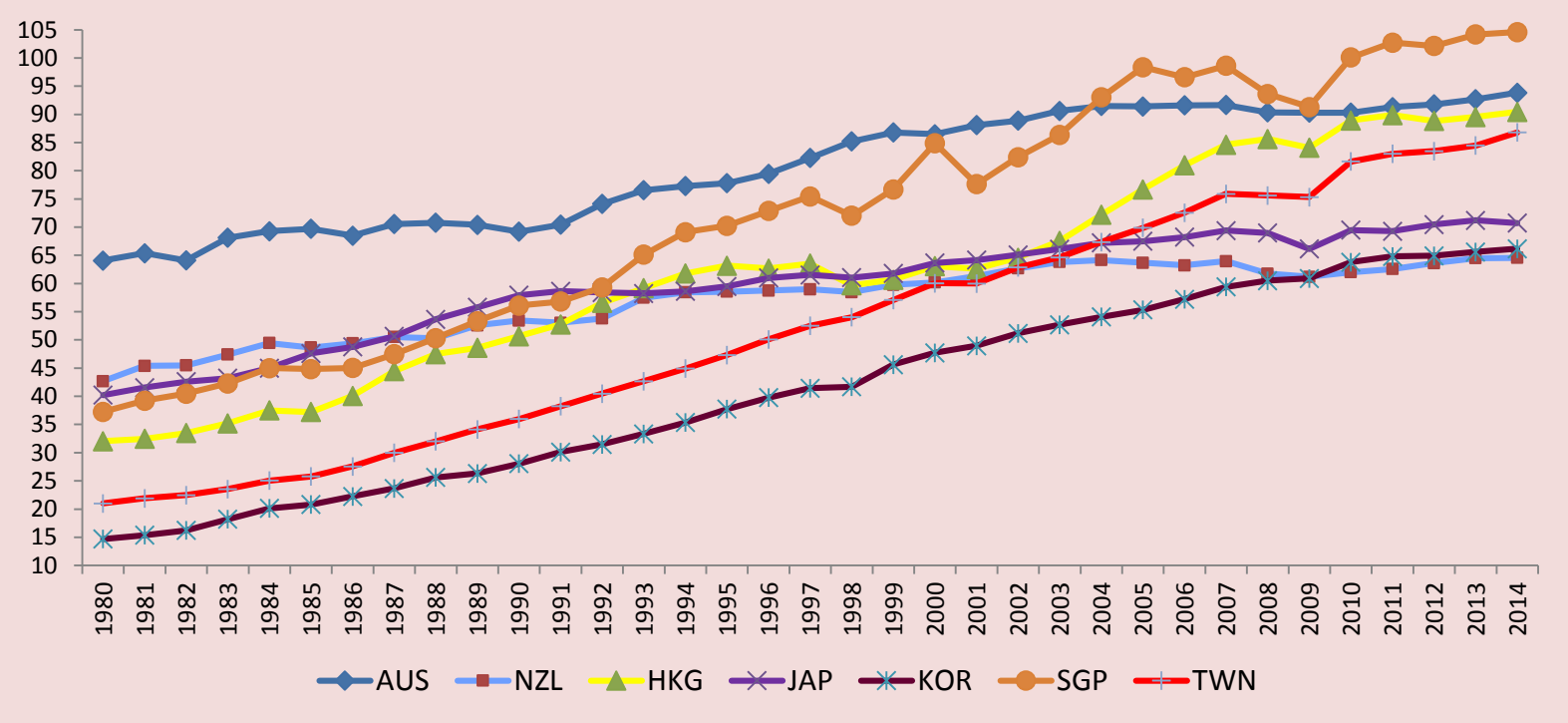
Trends in Aggregate Labour Productivity: Developing Asia-Pacific



Note: Labour Productivity Level - GDP (MN$ 2011 PPP) per thousand persons

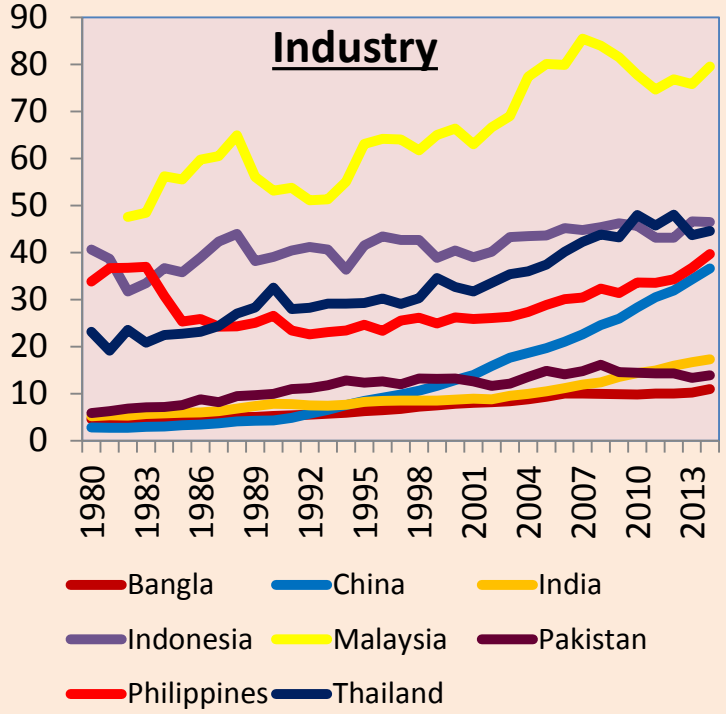
Source: Authors' own computations from PWT9.0.

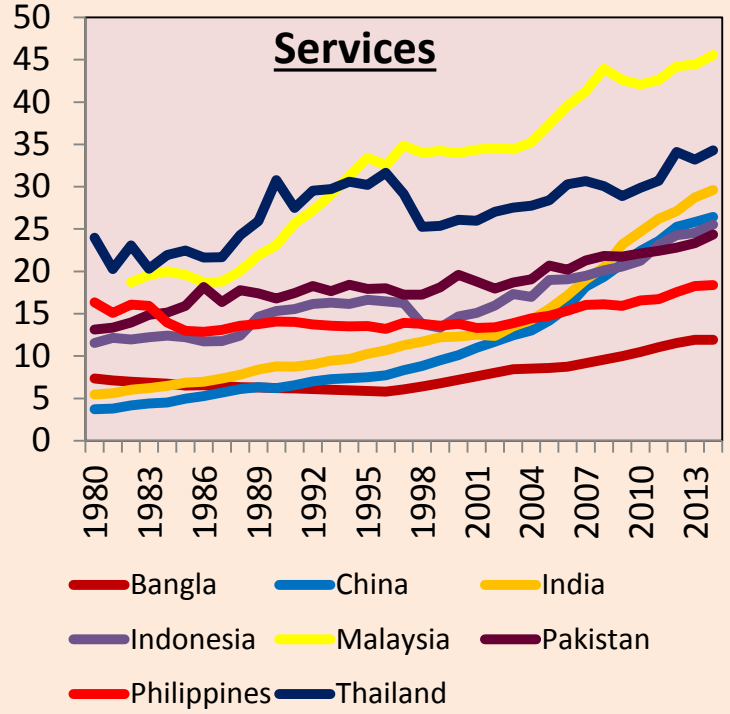
Trends in Aggregate Labour Productivity: Developed Asia-Pacific



Note: Labour Productivity Level - GDP (MN$ 2011 PPP) per thousand persons
Source: Authors' own computations from PWT9.0.

Trends in Sectoral Labour Productivity : Developing Asia-Pacific

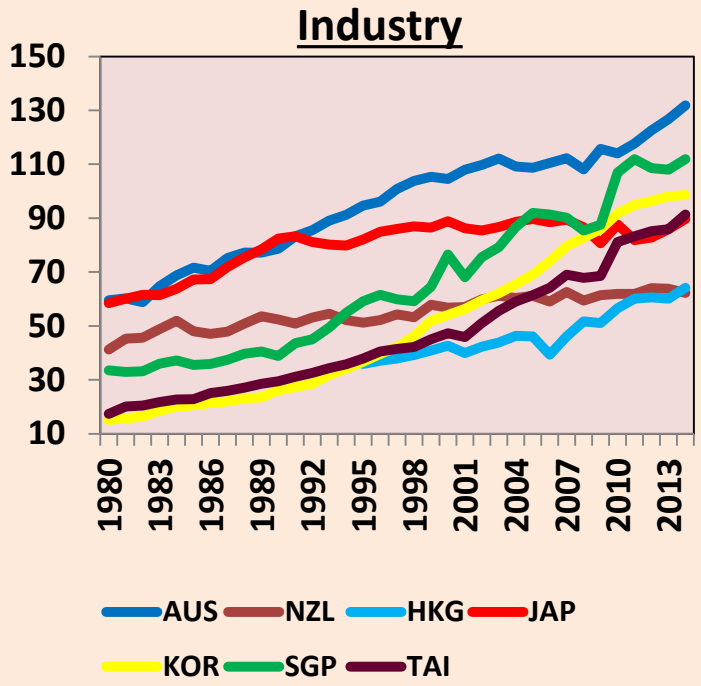


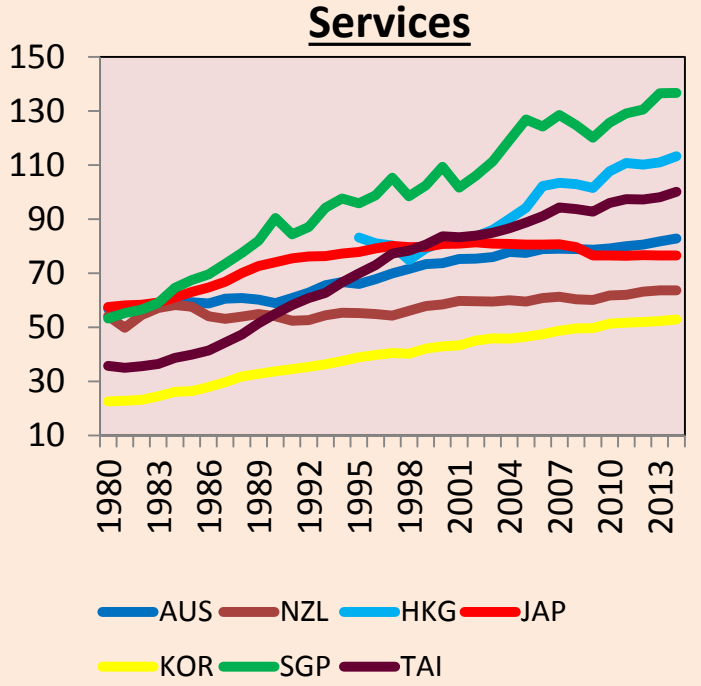


Note: Labour Productivity Level - GVA (MN$ 2011 PPP) per thousand persons

Source: Authors' own computations from APO Database, 2017.

Trends in Sectoral Labour Productivity : Developed Asia-Pacific





Note: Sectoral data for Hon Kong is available from 1995 onwards only.
Labour Productivity Level - GVA (MN$ 2011 PPP) per thousand persons
Source: Authors' own computations from APO Database, 2017.

Summary Of Trends In Labour Productivity Of Sub-sectors : Developing Asia-pacific

- While overall services sector shows steeper rise in labour productivity for all the economies as compared to industry sector, there are variations across sub-sectors of services sector.
- Further, most of the economies experienced a sharp rise in labour productivity of transport and communications component of services sector.
- While distributive trade of some economies show steep rise in its labour productivity, the financial intermediation sector doesn't show any rise in any of the economies except China.
- While financial intermediation sector doesn't show any rise, the level of labour productivity remains highest in this component of services sector

Summary Of Trends In Labour Productivity Of Sub-sectors : Developed Asia-pacific

- Both industry and services sectors show sharp rise in their labour productivity levels for most of the developed Asia-Pacific economies.
- There are variations in trends in labour productivity levels across various sub-sectors of the services sector.
- While all the economies experience sharp rise in level of labour productivity of transport and communications sector, levels in financial intermediation remain stagnant.
- Some economies experience sharp rise in labour productivity levels while others show moderate rise in the case of distributive trade services.

Model

AGGREGATE

- $Prod_{it} = \alpha + \beta k_{it} + \gamma HK_{it} + \delta Tech_{it} + \omega G_{it} + \rho \mathrm{Inst}_{it} + \sigma Share\_Agri_{it} + \varphi Finopen_{it} + \theta Tradeopen_{it}.$

SECTORAL

- $Prod^{j}{}_{it} = \alpha + \beta k^{j}{}_{it} + \gamma HK_{it} + \delta Tech_{it} + \omega G_{it} + \rho \mathrm{Inst}_{it} + \varphi Finopen_{it} + \theta Tradeopen^{j}_{it} + \lambda Prod^{m} + \varepsilon_{it}.$

All variables are taken in natural logs so that coefficients of variables on the R.H.S. measure elasticities.

Expected signs and explanations

Variable	Explanation	Expected sign
k (Capital stock per worker)	↑ in k ⇨ ↑ in capital input per unit of labour which makes labour more productive.	+
HK (Human capital)	↑ in HK ⇨ more educated and better skilled workforce that can work more productively.	+
Tech(Technological progress)	↑ $Tech$ ⇨ more innovative ways of doing things which in turn requires less labour to produce same output.	+
G (Government size)	↑ $in\ G$ in infrastructure and other productive activities may complement private business investment and thus may ↑ productivity of labour. However, inefficient government expenditure may also reduce productivity of labour by crowding out private investment.	+/-
$Inst$ (Institutional quality)	Better institutions like well-established property rights system incentivizes firms to invest more and hence lead to capital accumulation thus increasing productivity of labour.	+
$Share\_Agri$ (Share of Agriculture in GDP)	↓in $Share\_Agri$ may enhance overall productivity of an economy because of more weightage of more productive sectors of industry and services and less weightage of low productive sector of agriculture.	-
$Tradeopen$ (Trade openness)	↑ in $Tradeopen$ ⍰ ↑ productivity by either imports of better technologies from abroad or higher efficiency of exporting firms because of ↑ in competition.	+
$Finopen$ (Financial Openness)	↑ in $Finopen$ ⍰ ↑ productivity either directly due to ↑ FDI or indirectly by better developed financial markets, better macroeconomic policies, etc.	+
$Prod^m$ (Productivity of other sector)	A sector's productivity may be positively influenced by productivity of other sector because of inter-linkages between the two sectors in terms of their outputs and inputs.	+

Source: Authors' own elaborations

Econometric Methodology

- Panel unit root tests using Maddala & Wu ADF Fisher (1999) Test and Im, Pesaran and Shin (IPS,2003) tests and Pesaran's CIPS (2007) test.

- Pedroni (2004)'s panel Co integration tests.

- Estimation of long-run elasticities using Pedroni (2000, 2001)'s "Group-Mean" FMOLS.

Econometric Results: Aggregate Level

Variable\Group of Countries	Developing Asia-Pacific (Elasticities)	Developed Asia-Pacific(Elasticities)
K	.58***	.34***
HK	.01*	.06***
$Tech$	.01*	.08***
$Share\_agri$	-.17***	
G	-.03***	-.27***
$Inst.$	.42***	.074*
$Open$	.02***	.09***

Comparison of Results: Aggregate

Developing Asia-Pacific

- The elasticity of productivity with respect to capital deepening is high.
- Share of agriculture has a negative and significant impact on productivity.
- While technological progress has a positive impact on productivity, the estimated elasticity is less significant.
- Both trade and financial openness have a positive and significant impact on productivity.

Developed Asia-Pacific

- While capital deepening positively and significantly affects productivity, the elasticity is not as high as that for developing economies.
- Agriculture accounts for a negligible proportion of GDP of developed countries and hence the variable was not considered for developed economies.
- The impact of both human capital and technological progress is highly significant on productivity.
- Only trade openness has a positive and significant impact on productivity.

Econometric Results: Sectoral Level

- Developing Asia-Pacific

Summary of results across sectors:						
Dependent Variable: $Prod_j$						
$Variable \backslash Sector$	Ind	Mfg	$Agg.Serv$	$Dis.Trade$	$Trans\ \&\ Comm.$	$Fin.Intermediation$
k^j	✓	✓	✓	✓	✓	✓
HK	✓	✓	✓		✓	
$Tech$						
G	✓	✓				
$Inst.$	✓	✓	✓	✓	✓	✓
$Tradeopen^j$	✓	✓	✓		✓	✓
$Finopen$	✓	✓	✓	✓	✓	✓
$Prod^k$	✓	✓	✓	✓	✓	✓

Econometric Results: Sectoral Level

- Developed Asia-Pacific

Summary of results across sectors						
Dependent Variable: $Prod_j$						
$Variable \backslash Sector$	Ind	Mfg	$Agg.Serv$	$Dis.Trade$	$Trans \& Comm.$	$Fin.Intermediation$
k^j	✓	✓	✓	✓	✓	✓
HK	✓	✓	✓	✓	✓	✓
$Tech$	✓	✓	✓	✓	✓	✓
G	✓	✓		✓	✓	✓
$Inst.$	✓	✓	✓	✓	✓	✓
$Tradeopen^j$	✓	✓	✓	✓	✓	✓
$Prod^k$	✓	✓	✓	✓	✓	✓

Comparison of Results: Sectoral

Developing Asia-Pacific

- Government size has a positive impact on industry and its component while negative on the productivity of services sector and its components.
- Both trade openness and financial openness influence productivity of all the sectors positively and significantly throughout the period under study.
- The impact of technological progress becomes significant from mid-90s onwards on all the sectors.
- Patents stock is a significant factor affecting productivity. The other measure, R&D couldn't be incorporated due to limited availability of data.

Developed Asia-Pacific

- Government size has a negative impact on the productivity of all the sectors.
- While trade openness is significant throughout, the impact of financial openness is significant only in the sub-period, 1997-2014.
- The impact of technological progress is significant throughout the period of 1980-2014.
- Both the measures of technological progress viz. patent stock as well as R&D significantly influence productivity.

Conclusions and Policy Implications: Developing Asia-Pacific .. 1/8

- **Capital deepening** as measured by **capital stock per worker** is a significant determinant of productivity of both developing as well as developed economies, the impact is much more pronounced in the case of developing economies.
- **Policies encouraging more investment and thus capital accumulation may be advisable especially in developing and emerging economies.**

Conclusions and Policy Implications: Developing Asia-Pacific .. 2/8

- **Human capital** proxied by **tertiary school enrolment** has a positive and significant impact on productivity of not only aggregate economy but various sectors as well.

- This indicates need to **encourage more human capital by government in emerging and developing Asian economies**. In fact, some of the initiatives by these economies have already started. For instance, the e-Ushawan Programme launched by Malaysia Digital Economy Corporation in 2015.

- While human capital is important all around, sectors have their own specific requirements. For instance, the **transport and communications sector need labour skilled in higher technology than just literacy and simple education**.

- **Policies specific to sectors need to be formulated and implemented.**
  - For instance, mydigitalmaker movement launched in Malaysia in 2016 is a step in this direction.(***Economic Outlook for Southeast Asia, China and India, OECD,2018*****).**

Conclusions and Policy Implications: Developing Asia-Pacific .. 3/8

- Further, productivity of developing economies is positively and significantly influenced by **technological progress** as measured by **patent stocks** indicating that **policies encouraging innovation need to be encouraged. Reforms in Intellectual Property Rights system may further incentivise the firms to undertake more R&D efforts.**

- Results suggest that the impact of **technological progress becomes stronger in the post-1997 period**. While there was a great surge in number of patent applications in both India and China in the mid-90s and later, **other developing economies of Asia-Pacific need to emphasize policies promoting innovation and technological progress.**

- However, **greater use of technology** poses many challenges and thus **requires development of better infrastructure and laws to foster the technological and digital environment.*(Regional Economic Outlook, IMF, 2018).***

Conclusions and Policy Implications: Developing Asia-Pacific .. 4/8

- Study suggests that **structural shift of resources away from agriculture towards industry and services** as measured by **share of agriculture in GDP** may be productivity enhancing for the emerging and developing economies. This indicates low productivity level of agriculture sector as compared to non-agriculture sectors.

- This is not to suggest that agriculture sector should be discouraged but to suggest that there is a **need to have policies specific to agriculture sector that could enhance its productivity.**

Conclusions and Policy Implications: Developing Asia-Pacific .. 5/8

- The study finds that an increase in **government size** as proxied by **general government final consumption expenditure as a ratio of GDP** leads to fall in productivity of both developing and developed Asia-Pacific economies. This is not to discourage the role of government but to indicate that the **government needs to work more efficiently.**

- While an increase in government size has a positive impact on the productivity of manufacturing and industry, the impact is negative on services and its components. This may be due to restrictions and regulations on the services sector. Thus, **a less restrictive environment may be recommended for the services sector.**

Conclusions and Policy Implications: Developing Asia-Pacific .. 6/8

- A positive and significant impact of **institutional quality** as measured by Economic Freedom Index on productivity of both developing and developed economies of Asia-Pacific recommending **better developed institutions like system of property rights, less restrictive labour laws, etc.**

Conclusions and Policy Implications: Developing Asia-Pacific .. 7/8

- Greater **economic integration** of developing and developed Asia-Pacific economies with the rest of the world as measured by both trade and financial openness is found to be have a positive and significant impact on both aggregate as well productivity of sectors and their components. Thus, **better trade and financial linkages across countries may be encouraged.**

- Results suggest that **financial openness** as proxied by FDI liabilities as a ratio of GDP has a positive and significant impact on productivity at both aggregate as well as disaggregate level for developing Asia-Pacific economies. Thus, flow of capital through FDI than non-FDI mode is recommended and therefore, **policies promoting more FDI into these economies need to be encouraged**.

- Results on sectoral analysis further suggest that impact of openness becomes stronger on services and its components in the more recent period and hence less restrictive environment and **policies encouraging more foreign investment in services are highly recommended.**

Conclusions and Policy Implications: Developing Asia-Pacific .. 8/8

- **Significant spillover effects** as proxied by **productivity of other sector** are found from manufacturing sector to services and vice-versa although the effects are more pronounced from services to manufacturing. While this is not to suggest that other sectors are not important for Asian economy but that services sector has immense potential to emerge as the second engine of growth by contributing directly as well as indirectly through other sectors.

- Thus, **policies catering specifically to the services sector may be encouraged.**

- **All the factors discussed above are found important for developed economies of Asia-Pacific as well.**


THANK YOU !

Appendix

Table A1: Definitions of variables and sources of data		
Variable	**Measure/Definition**	**Source**
Prod(Aggregate Productivity)	Labour Productivity (GDP per employed persons)	PWT9.0
$Prod^j$ **(Productivity in sector j)**	**Labor Productivity in sector j(GVA in sector j divided by total employment in sector j)**	**Asian Productivity Organization(APO Sept 2017 version)**
k^j **(capital stock per worker in sector j)**	**Capital stock of each sector divided by total employment in that sector**	**Calculated by taking data from PWT9.0 and APO database(2017)**
HK(Human capital)	Gross enrolment in Tertiary education	WDI(2017)
Tech(Technological Progress)	Stock of Patent Applications (Residents)/ Stock of R&D Expenditure	Calculated using PIM taking data on patent Applications and R&D expenditure from WDI(2017)
G(Government size)	General Government Final Consumption expenditure as a ratio of GDP	WDI(2017)
Inst.(Institutional Quality)	Economic Freedom Index	Fraser Institute.
Tradeopen (Overall Trade openness)	Sum of exports and imports of goods and services as a ratio of GDP	WDI(2017)
$Tradeopen^j$ **(Trade Openness in sector j)**	**Sum of Exports and Imports of a sector divided by its GVA**	**Calculated using data on exports and imports from UNCTAD and GVA data from APO database(Sept. 2017 version)**
Finopen (Financial Openness)	Various measures of de facto Financial Openness as given in Lane and Milessi-Ferretti database (2016)	Lane and Milessi-Ferretti database (2016)