Monetary & Economic Policy Department
BANK INDONESIA

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Benefiting from the Implementation of AEC 2015

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Outline

1. Background
2. Research Questions
3. Empirical Methodology
4. Discussion on Results
5. Conclusions and Recommendations
6. Appendices

Background

ASEAN ECONOMIC COMMUNITY 2015 - 2025

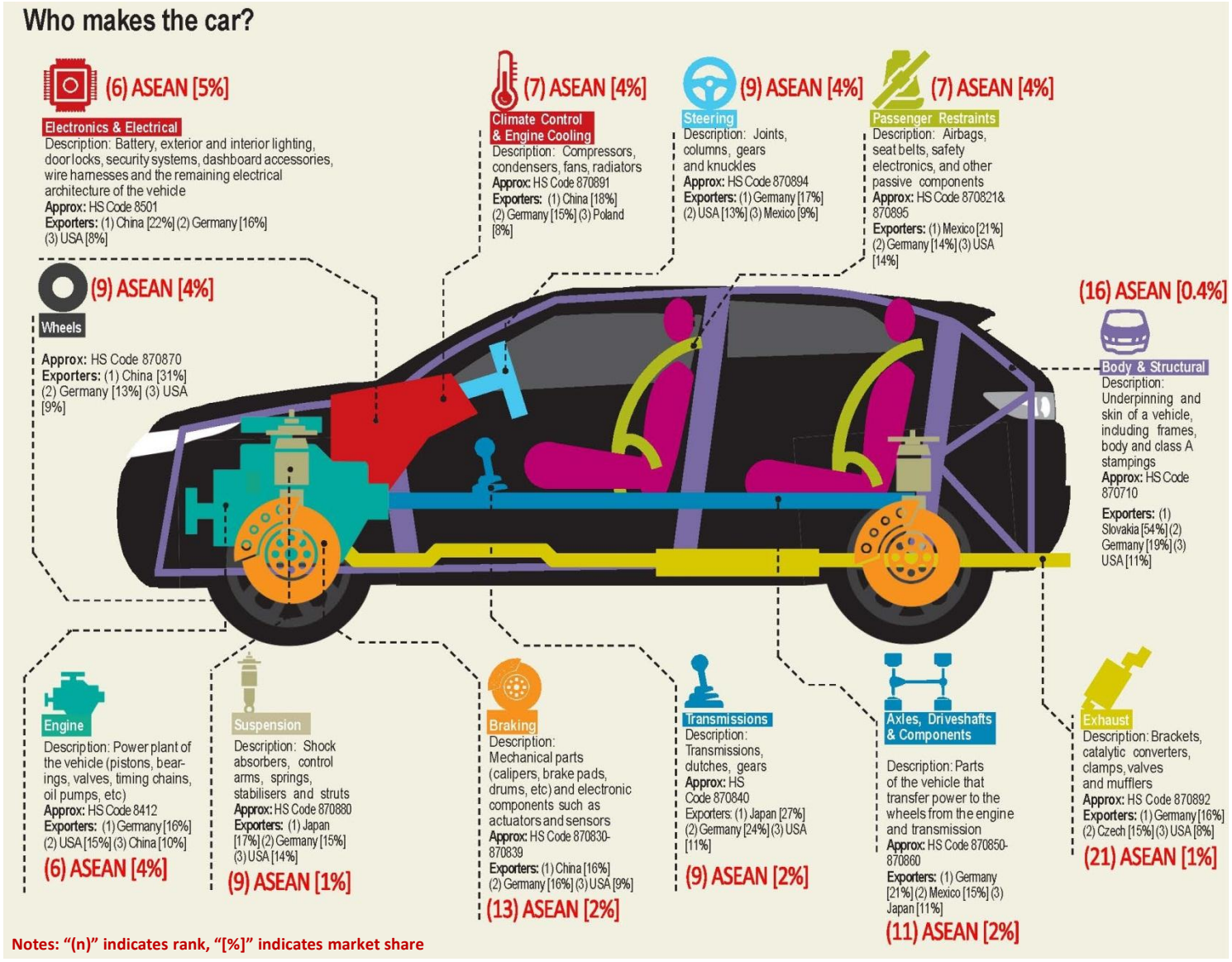
The implementation of AEC in stages from 2015 onwards until 2025 provides ASEAN member countries with the opportunity for economic advancement. **This paper focuses on Pillar 1 & 4 of the AEC Blueprint**.

AEC Blueprint

4 pillars, 17 core elements, 176 priority actions

Pillar 1 Single Market & Production Base	**Pillar 2** Competitive Economic Region	**Pillar 3** Equitable Economic Development	**Pillar 4** Integration into the Global Economy
• Free flow of goods • Free flow of services • Free flow of investment • Free flow of capital • Free flow of skilled labour • Priority integration sectors • Food, agriculture and forestry	• Competition policy • Consumer protection • Intellectual property rights • Infrastructure development • Taxation • E-commerce	• SME development • Initiative for ASEAN integration	• Coherent approach towards external economic relations • **Enhanced participation in global supply networks**
5 + 2 core elements	**6 core elements**	**2 core elements**	**2 core elements**

Global production network has been increasingly fragmented



Global trade has seen the increase in **Trade in Value Added** (TiVA), whereby components at different stages are being produced in multiple locations and traded across border multiple times between multiple countries.

Such production sharing is driven by offshoring of production and distribution activities by multi-nationals along the global value chains (GVC), in search of most efficient locations for completing specific/ specialized tasks.

Source: adopted with adjustments for illustrative purposes from investorchronicle.co.uk, using data from UN Comtrade HS classification year 2014 (http://www.investorschronicle.co.uk/r/FT%20Publications/IC/Assets/PDF/CarPDF.pdf) .

Enhancement of the GVC performance provides opportunities

Improved GVC participation

- Producers (including ASEAN companies) can specialize on tasks that can be completed most efficiently in different production locations within ASEAN
- These depend on the availability of specialized skill-set at reasonable price and the capability to compete on CQDC (cost, quality, delivery & compliance).
- The latter in turn depends on the ability of ASEAN member countries to create an enabling environment for private enterprises to create values at low cost.

Reaping the benefits

- A greater participation in GVC will contribute to economic development through direct GDP, employment, and opportunities for industrial upgrading
- As a single & competitive production base, promoting ASEAN integration to the larger Global Production Network (GPN) entails enhanced access to a wider & larger global market
- More domestic value added will potentially be generated as the potential business linkages rises between local firms and foreign affiliates

Analytically, TiVA is a re-statement of the Ricardian framework

David Ricardo wrote in chapter seven of his seminal 1817 work The Principles of Political Economy & Taxation: *Under a system of perfectly free commerce, each country naturally devotes its capital and labour to such employments as are most beneficial to each. This pursuit of individual advantage is admirably connected with the universal good of the whole. By stimulating industry, by regarding ingenuity, and by using most efficaciously the peculiar powers bestowed by nature, it distributes labour most effectively and most economically: while, by increasing the general mass of productions, it diffuses general benefit, and binds together by one common tie of interest and intercourse, the universal society of nations throughout the civilized world. It is this principle which determines that wine shall be made in France and Portugal, that corn shall be grown in America and Poland, and that hardware and other goods shall be manufactured in England.*

BUT, due to globalization (space & time compression) it is no longer wine for corn anymore:**

- **Unbundling between production and consumption, perpetuated by reduced transportation cost (Space compression).**
- **Unbundling of the value chains, propagated by reduced communication cost (Time compression).**

Nations tend to specialize on components and/or tasks they produce / do best (most efficiently), hence TiVA could also be seen as Trade in Tasks.

**** See also Grossman, G.M. and Rossi-Hansberg,E. (2006): The Rise of Offshoring: It is not Wine for Cloth Anymore, Kansas City Fed Symposium**

Research Questions

Topics addressed in this paper

- State of internal economic integration in ASEAN
  - How far is ASEAN from an integrated economic zone?
- Competitiveness of ASEAN members in the GVC and Lessons Learned
  - Who are well positioned in the GVC?
  - What are the key requirements for competitiveness?
- Conclusions and recommendations

Some Key Results:

- **State of internal economic integration in ASEAN**
  - ✓ ASEAN resembles an integrated economic zone, yet within the past two decades, the level of integration has increased only slightly.
  - ✓ Greater capital and human capital mobility would improve the equalization of factor income across ASEAN's members.

- **Competitiveness of ASEAN members in the GVC**
  - ✓ ASEAN's "import productivity", that is the ability to generate large scale export after sourcing their inputs from external producers, has been disappointingly low.
  - ✓ Strategic global collaboration for enhanced access to large markets, supported by supportive enabling environment for higher value creation at low cost is key to gaining competitiveness within the GVC.

- **Key Strategic Recommendation → Reforming ASEAN's Manufacturing Sector**
  - ASEAN as the next global factory.
  - A location of choice for export oriented manufacturing
  - A strategic focus on **assembly** & **design**:
    - ✓ Assembly of export oriented labor intensive products.
    - ✓ Assembly of globally standardized consumer durables.

Empirical Methodology

1. Measuring internal integration in an economic zone

APPENDIX 1 for details

In a Fully Integrated Economic Equilibrium (FIE), output and factor share (capital & human capital) will follow a Zipf's law (see Bowen, Munandar & Vianne (2010)).

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- It is then predicted that factors of production will move in search of locations that will provide the highest return.
- Hence, given equal access to technology, the wedges between the actual shares of both output and of factors of production from their respective theoretical shares, will narrow over time.

In this paper, the framework proposed by Bowen, Munandar, and Vianne (2010) is employed to establish whether ASEAN resembles a FIE or not. The Kullback-Leibler Divergence (KLD) indicator is then used to evaluate the progress of internal integration of ASEAN towards FIE equilibrium.

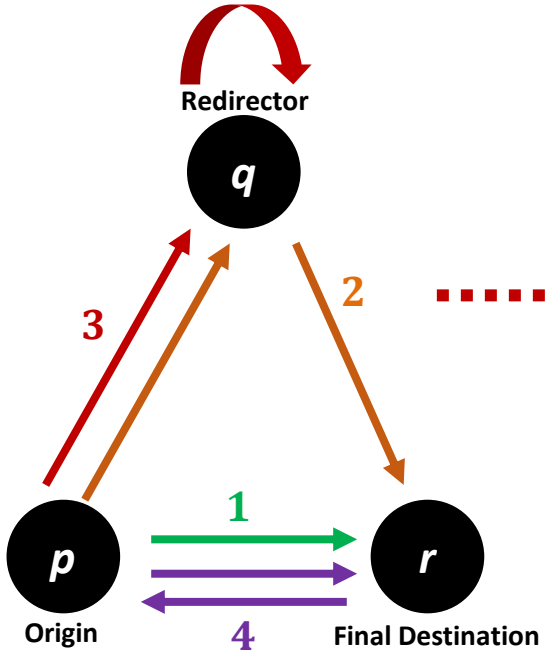
See:

- Bowen, H, et al (2010). "*On the Extent of Economic Integration: A Comparison of EU Countries and US States*," Tinbergen Institute Discussion Papers 10-009/2, Tinbergen Institute, revised 04 July 2011.
- Bowen, H, et al (2011). "*How Integrated is the World Economy?*", Review of World Economics (Weltwirtschaftliches Archiv) Springer, vol. 146(3), pages 389-414, September.
- Gabaix (1999), "*Zipf's Law for Cities: An Explanation*". Quarterly Journal of Economics, 114(4), 739–767.

2. Measuring competitiveness within the GVC

In this paper, the multi-regional yet bilateral input output is reconstructed into a triangular trading scheme ala Lejour et al (2012) to obtain indicators of internal & external competitiveness…

There are 4 types of trade activities among nations, but cannot be made explicit due to the bilateral nature of multi-regional I/O data….



Reconstruction of the multiregional I/O data into a triangular trading scheme allows for explicit expressions on the four types of activities…

Methodology: Triangular Trading Scheme

1 Initial Condition: Bilateral IO

$$\begin{bmatrix} s_{11} & s_{12} & s_{13} & \cdots & s_{1n} \\ s_{21} & s_{22} & s_{23} & \cdots & s_{2n} \\ s_{31} & s_{32} & s_{33} & \cdots & s_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ s_{n1} & s_{n2} & s_{n3} & \cdots & s_{nn} \end{bmatrix} \begin{bmatrix} f_{11} & f_{12} & f_{13} & \cdots & f_{1n} \\ f_{21} & f_{22} & f_{23} & \cdots & f_{2n} \\ f_{31} & f_{32} & f_{33} & \cdots & f_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ f_{n1} & f_{n2} & f_{n3} & \cdots & f_{nn} \end{bmatrix}$$

$$[w_1 \quad w_2 \quad w_3 \quad \cdots \quad w_n]$$

$$[y_1 \quad y_2 \quad y_3 \quad \cdots \quad y_n]$$

2 Technology Matrix, Value Added, Final Demand Extraction

$$a_{ij} = {}^{s_{ij}}/_{y_j} \qquad v_{ij} = {}^{w_{ij}}/_{y_j}$$

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix} \quad \hat{V} = \begin{bmatrix} v_1 & 0 & 0 & \cdots & 0 \\ 0 & v_2 & 0 & \cdots & 0 \\ 0 & 0 & v_3 & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \cdots & v_n \end{bmatrix} \quad \hat{F} = \begin{bmatrix} f_{1i} & 0 & 0 & \cdots & 0 \\ 0 & f_{2i} & 0 & \cdots & 0 \\ 0 & 0 & f_{3i} & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \cdots & f_{ni} \end{bmatrix}$$

3 Leontief inverse and Trilateral Scheme

$$B = (I - A)^{-1}$$

$$\hat{V} * B * \hat{F}$$

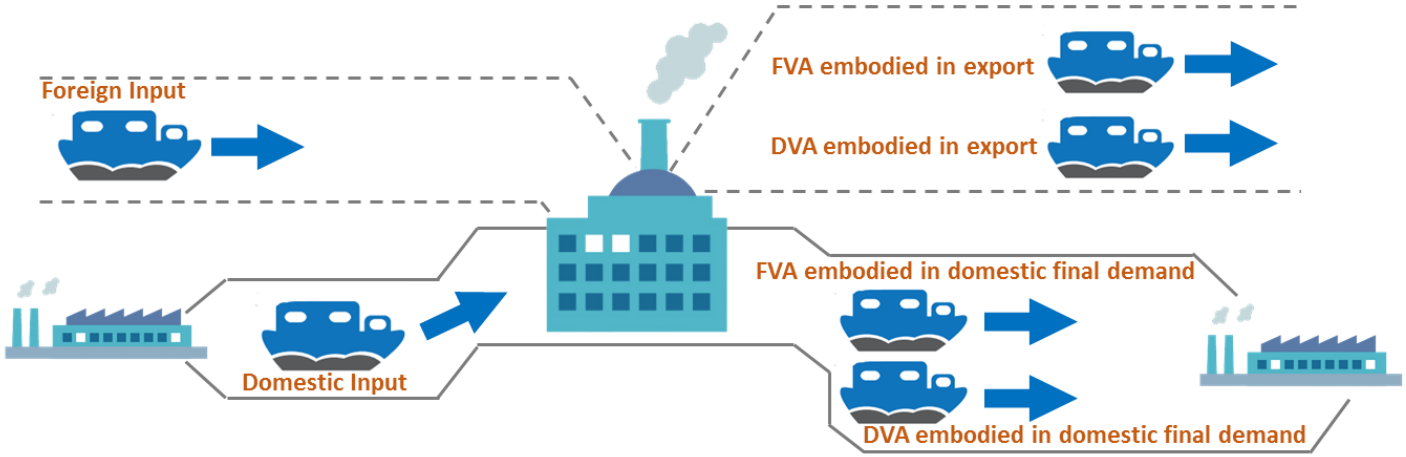
$$F_i = \begin{bmatrix} f_{11i} & f_{12i} & f_{13i} & \cdots & f_{1ni} \\ f_{21i} & f_{22i} & f_{23i} & \cdots & f_{2ni} \\ f_{31i} & f_{32i} & f_{33i} & \cdots & f_{3ni} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ f_{n1i} & f_{n2i} & f_{n3i} & \cdots & f_{nni} \end{bmatrix}$$

See:

- Lejour, Arjan; Hugo Rojas-Romagosa; and Paul Veenendaal. 2012. "Identifying Hubs and Spokes in Global Supply Chains Using Redirected Trade in Value Added." *ECB Working Paper Series* no. 1670. Frankfurt: European Central Bank
- Johnson, Robert C., and Guillermo Noguera. 2011. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86, no. 1: 224-236.

2. Measuring competitiveness within the GVC (…cont.)

Using the reconstructed Asian I/O table, foreign and domestic VA embodied in bilateral export value can be used to construct indicators of external & internal competitiveness as a hub (redirector):



Internal competitiveness as a hub (redirector)

$$IntComp_i = \frac{FVAEXP_i}{FVAEXP_i + FVADOM_i}$$

External competitiveness as a hub (redirector)

$$ExtComp_i = \frac{FVAEXP_i}{\sum_{j=1}^{N} FVA\,EXP_j}$$

i : country index, i =1,…, N
$FVAEXP$: FVA embodied in gross export (external demand)
$FVADOM$: FVA embodied in domestic final demand
$DVAEXP$: DVA embodied in gross export (external demand)
$DVADOM$: DVA embodied in domestic final demand

3. Updating the Asian I/O database

APPENDIX 2 for details

IDE-JETRO publishes Asian I/O only for 2005. We update the I/O to 2009 and 2013 so as to enable the triangular trade analysis to be expanded into post 2007/2008 Global Financial Crisis (GFC).

1. Collecting trade in goods data from UN COMTRADE, CEIC, IFS and UNCTAD for 2005-2013

2. Building AIO for 2009 & 2013 : Intermediate Demand Block, Import Block, Final demand Block, and Export Block

3. Readjusting Hongkong trade by counting re-exports by country of origin, destination, and also by type of goods and destination

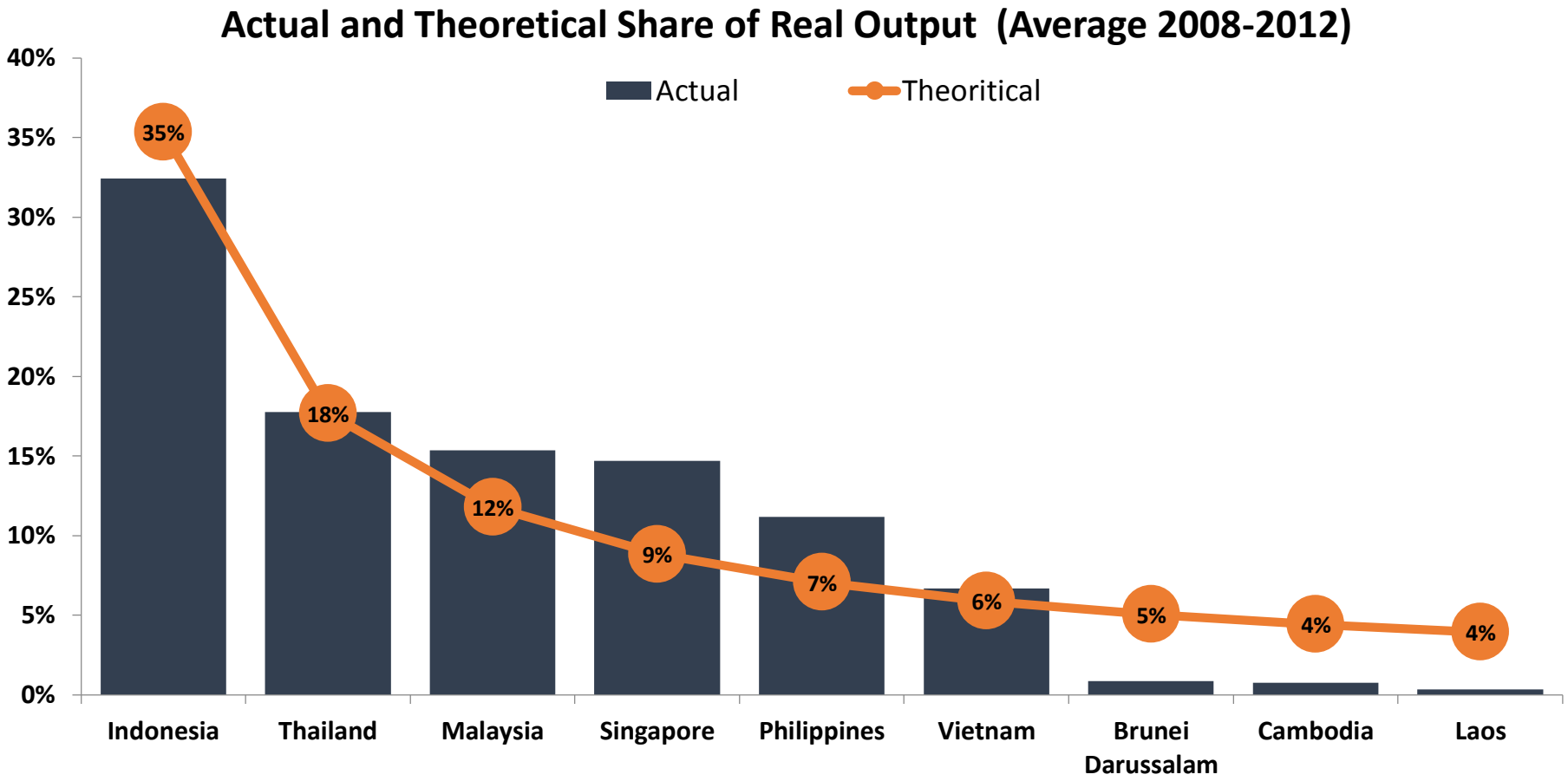
4. Estimating Total Intermediate Input, Total Intermediate Output, Statistical Discrepancy And Total Input/output.

Discussion on Results

1. Is ASEAN a fully integrated economic zone?

1. Is ASEAN a fully integrated economic zone?

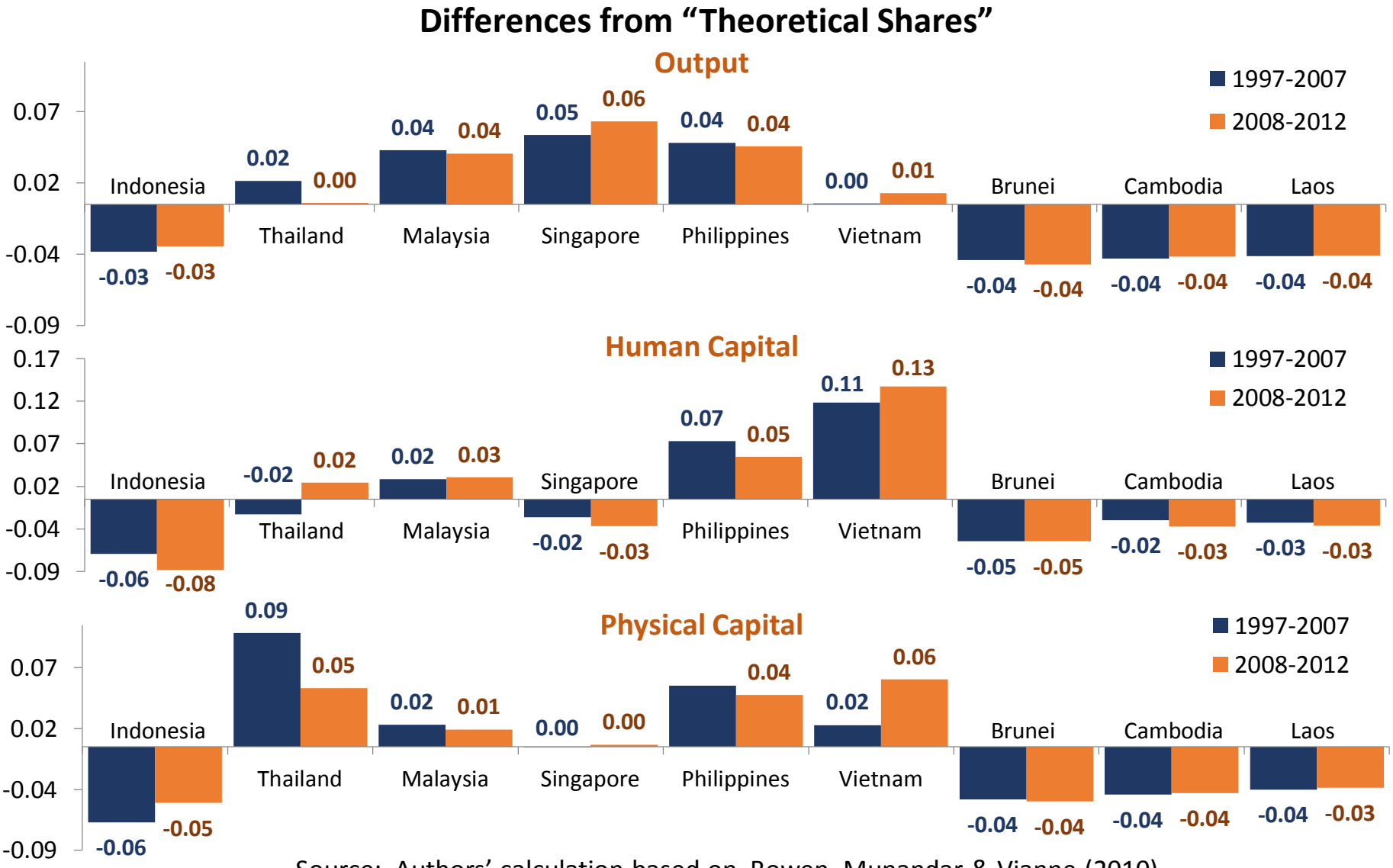
- **ASEAN resembles a fully integrated zone. Theoretical shares of output and of factors of production conform with the Zipf's law.**
- **Some countries fall below their theoretical share of output, hence a greater integration will bring a higher growth for these countries, but all will benefit in the long run since an increase of output in one country will be followed by others**



Source: Authors' calculation based on Bowen, Munandar & Vianne (2010)

1. Is ASEAN a fully integrated economic zone?

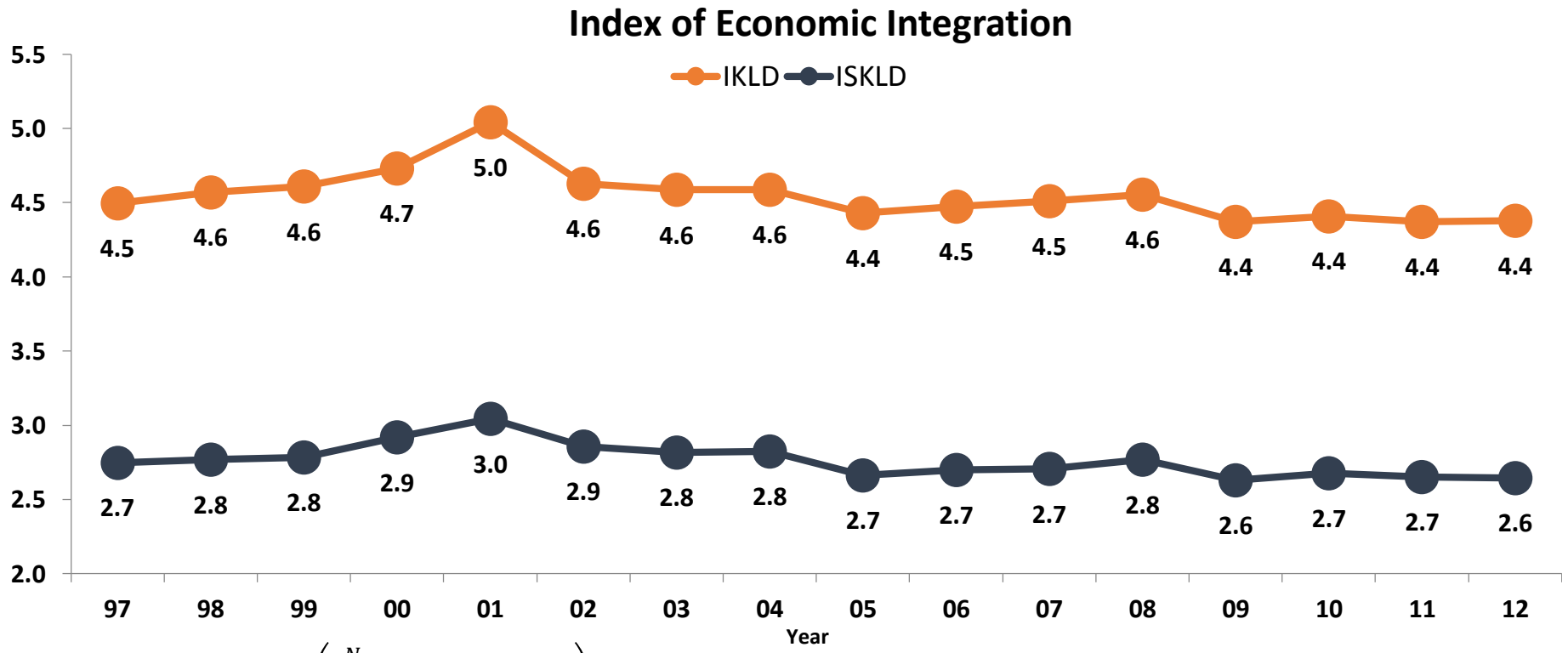
Under the assumption of equal access to technology and no barriers to factor mobility, the gap of theoritical and actual output, and factor shares will dissappear.



Source: Authors' calculation based on Bowen, Munandar & Vianne (2010)

1, Is ASEAN a fully integrated economic zone?

Index of economic integration shows that progress to Fully Integrated Economic Zone has been quite slow in the past two decades and marked by some set-backs due to economic crises (Asian & Lehman Bros).



$$KLD(\bar{S}:S_t) = \frac{1}{3}\sum_{j=Y,K,H}\left(\sum_{n=1}^{N}(\bar{S}_{nj})\ln\left(\frac{\bar{S}_{nj}}{S_{njt}}\right)\right)$$

$$IKLD(\bar{S}:S_t) = \frac{1}{KLD(\bar{S}:S_t)}$$

$$SKLD(\bar{S}:S_t) = \frac{1}{3}\sum_{j=Y,K,H}\left(\sum_{n=1}^{N}(\bar{S}_{nj} - S_{njt})\ln\left(\frac{\bar{S}_{nj}}{S_{njt}}\right)\right)$$

$$ISKLD(\bar{S}:S_t) = \frac{1}{SKLD(\bar{S}:S_t)}$$

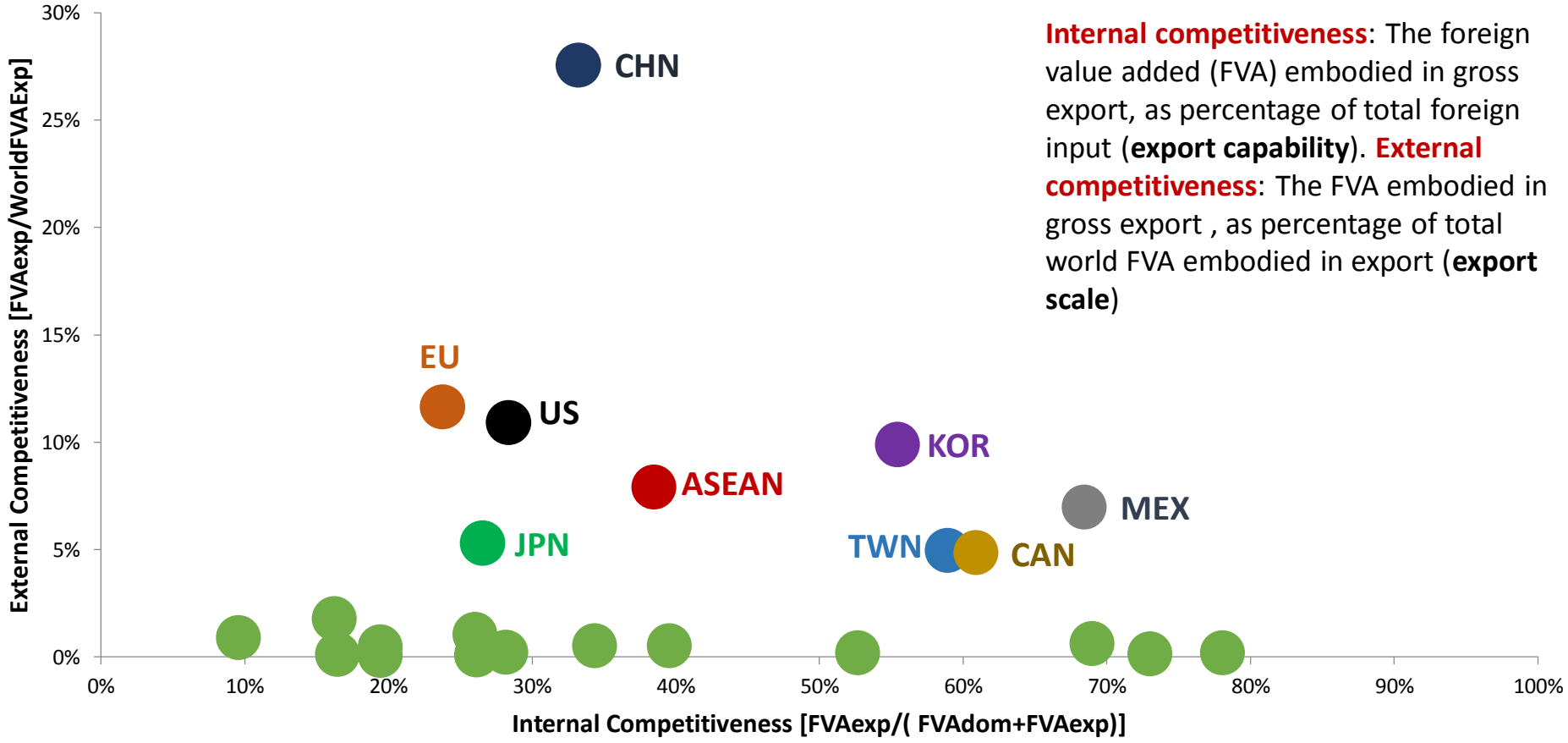
Values of KLD range between zero and infinity. It is equal to 0 under complete integration . ISKLD is the inverse. Bowen's calculation for EU and US States are 20 and 15, respectively.

Discussion on Results

2. Who are well positioned in the GVC?

2. Who are well positioned in GVC?

China stands out among 24 countries/ group economies (EU and ASEAN are aggregated) as the one that have developed both internal and external competitiveness. The internal competitiveness gauge suggests that countries like Mexico, Canada, Taiwan, and Korea have strong export capability after utilizing foreign value added, while the external competitiveness gauge shows the scale of such capability is dominated by China. Joint analysis on the two gauges suggests that China has the strongest "**import productivity**", that is the ability to generate large scale export after sourcing their inputs from external producers. Meanwhile, with a slight difference in internal competitiveness, ASEAN's export scale is far below China and other economies like EU, US and Korea.

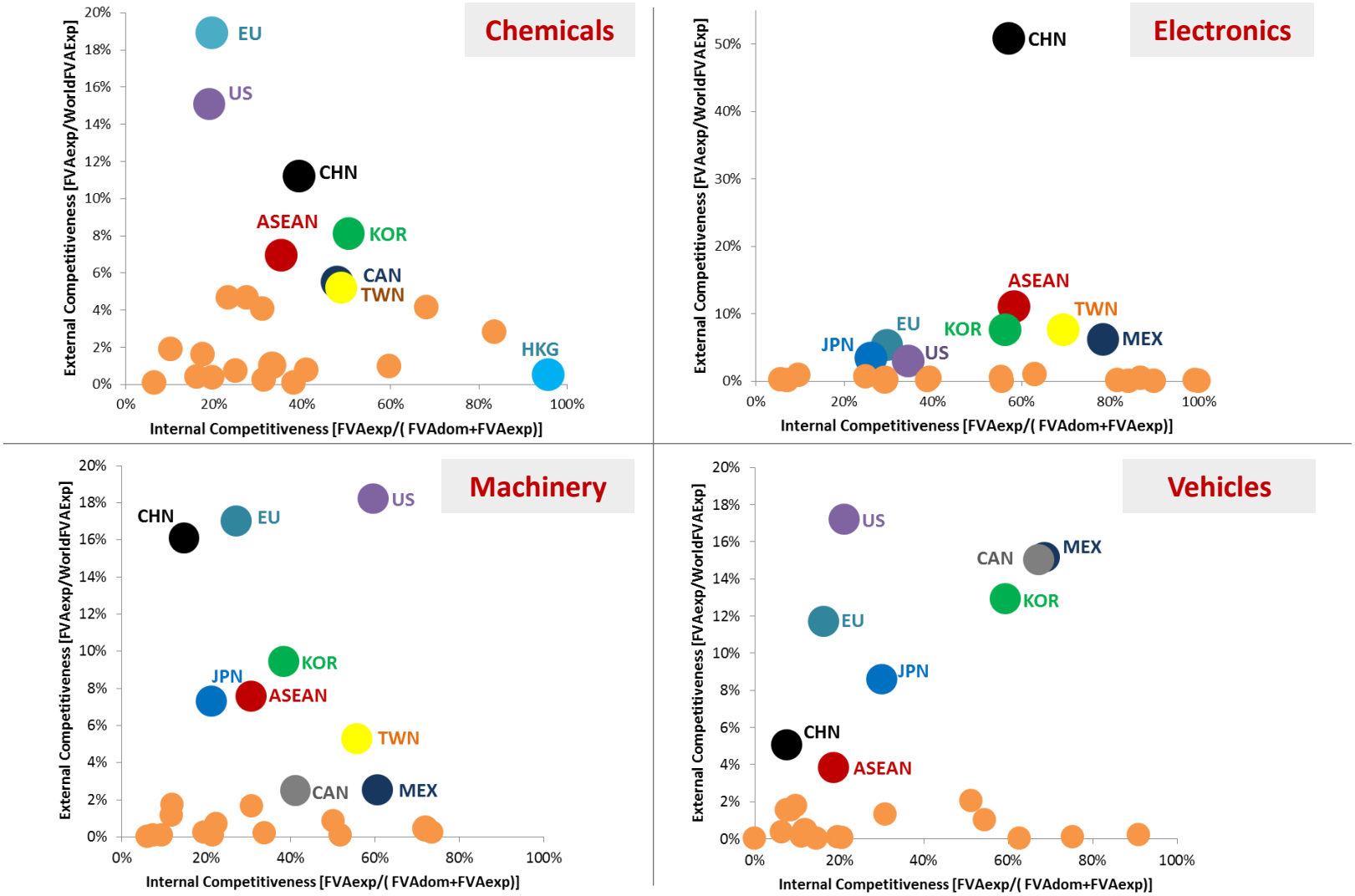


Internal competitiveness: The foreign value added (FVA) embodied in gross export, as percentage of total foreign input (**export capability**). **External competitiveness**: The FVA embodied in gross export , as percentage of total world FVA embodied in export (**export scale**)

Source: Authors' calculation for the Aggregate Medium-High Tech sectors, Tiva based on OECD ICIO Table 2011.

2. Who are well positioned in the GVC?

Domestic market size seems to have no role in explaining "Import productivity". The case of China suggests that, despite large domestic market, "import productivity" can be as strong as (even stronger than) those with smaller domestic market size.



Source: Authors' calculation, Tiva based on OECD ICIO Table 2011.

Discussion on Results

3. Key Requirements for competitiveness in the GVC?

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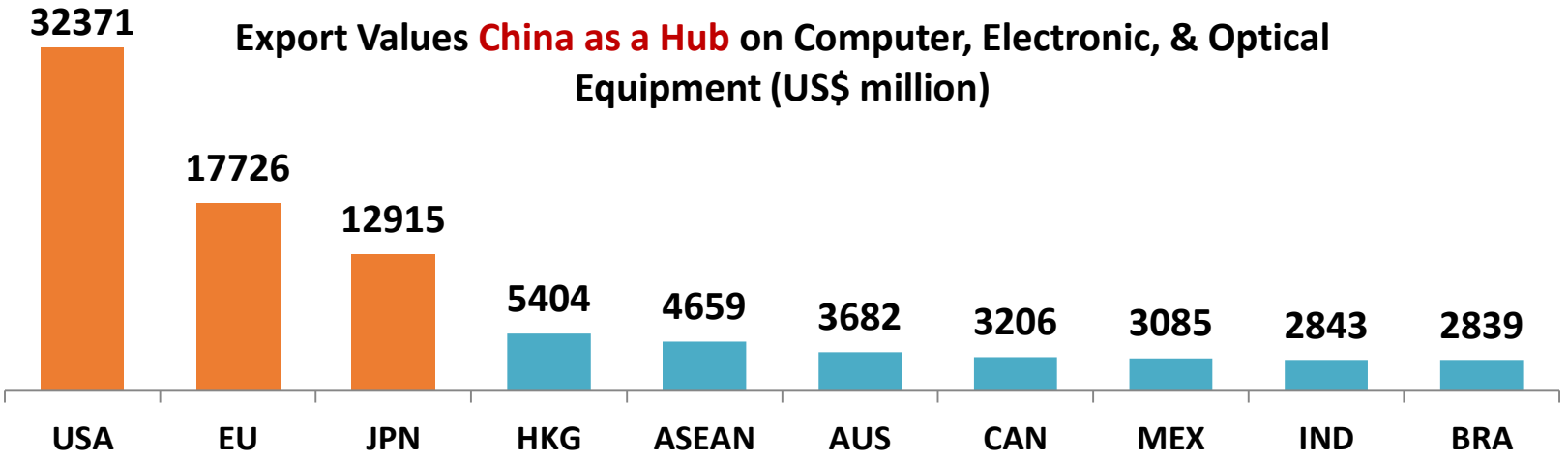
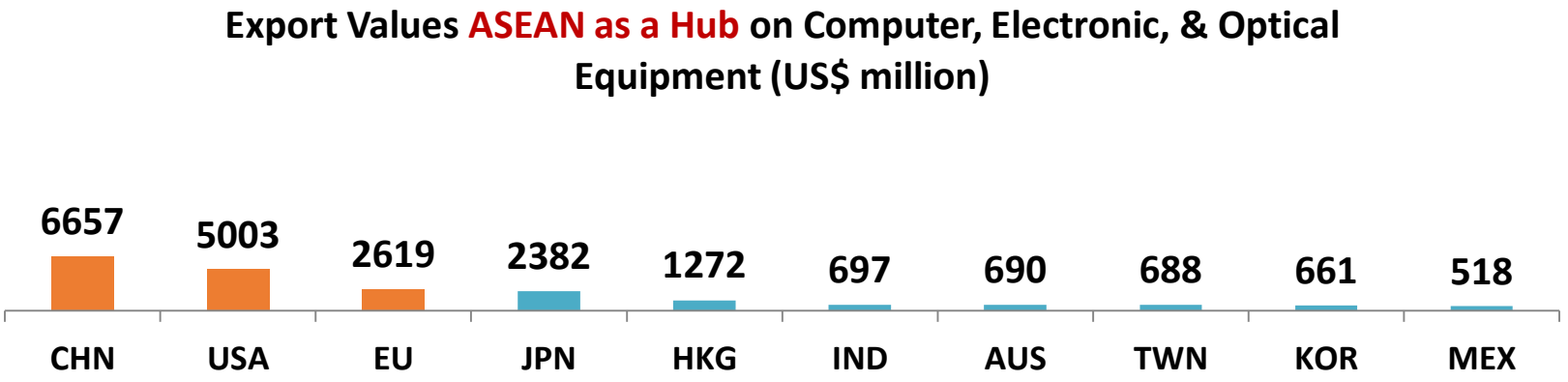
Market Access (Sector Case Study → Computer, Electronic, & Optical Equipment)

Access to large export markets is one of the key factors in ensuring "import productivity" within the GVC in most competitive ASEAN members. Such access allow for economies of scale (the bigger the market the lower your per unit cost). This suggests that ASEAN as a zone must not lose sight of **the importance of extra-ASEAN trade agreements**, in addition to intra-ASEAN.



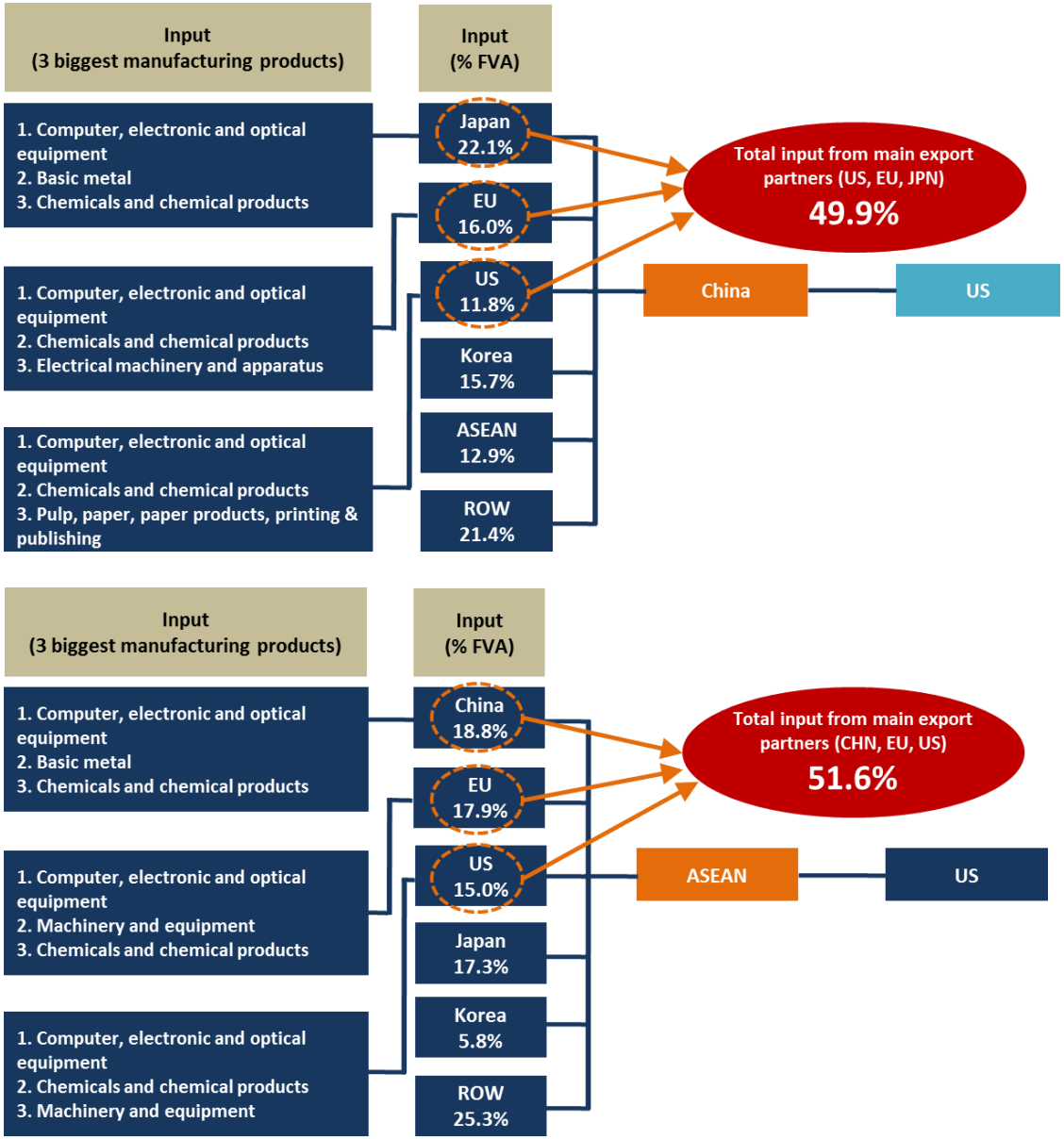


Source: Authors' calculation, Tiva based on OECD ICIO Table 2011.

Sector Case Study → Computer, Electronic, & Optical Equipment

Input Sourcing & Redirector in a Triangular Trading Scheme: China vs ASEAN

- China's biggest Electronics export destination are US, EU, & Japan and ASEAN's biggest export destination is China.
- Input sourcing inferred by the triangular trade I/O shows that around 50% of imports as a global hub are originating from its biggest export market (high volume of intra industry trade), which suggests:
  - **Chinese Electronics industry is closely linked to the highly innovative electronics industry in the US, Japan, and EU as a part of production sharing network (TiVA). China has an important role as a redirector in the production network to developed countries.**
  - The labor force gets the benefits through knowledge and technology spill-over and descent jobs, which builds the foundation for industrial upgrading overtime.
  - **ASEAN is trapped in low value added labor intensive electronics segment.**

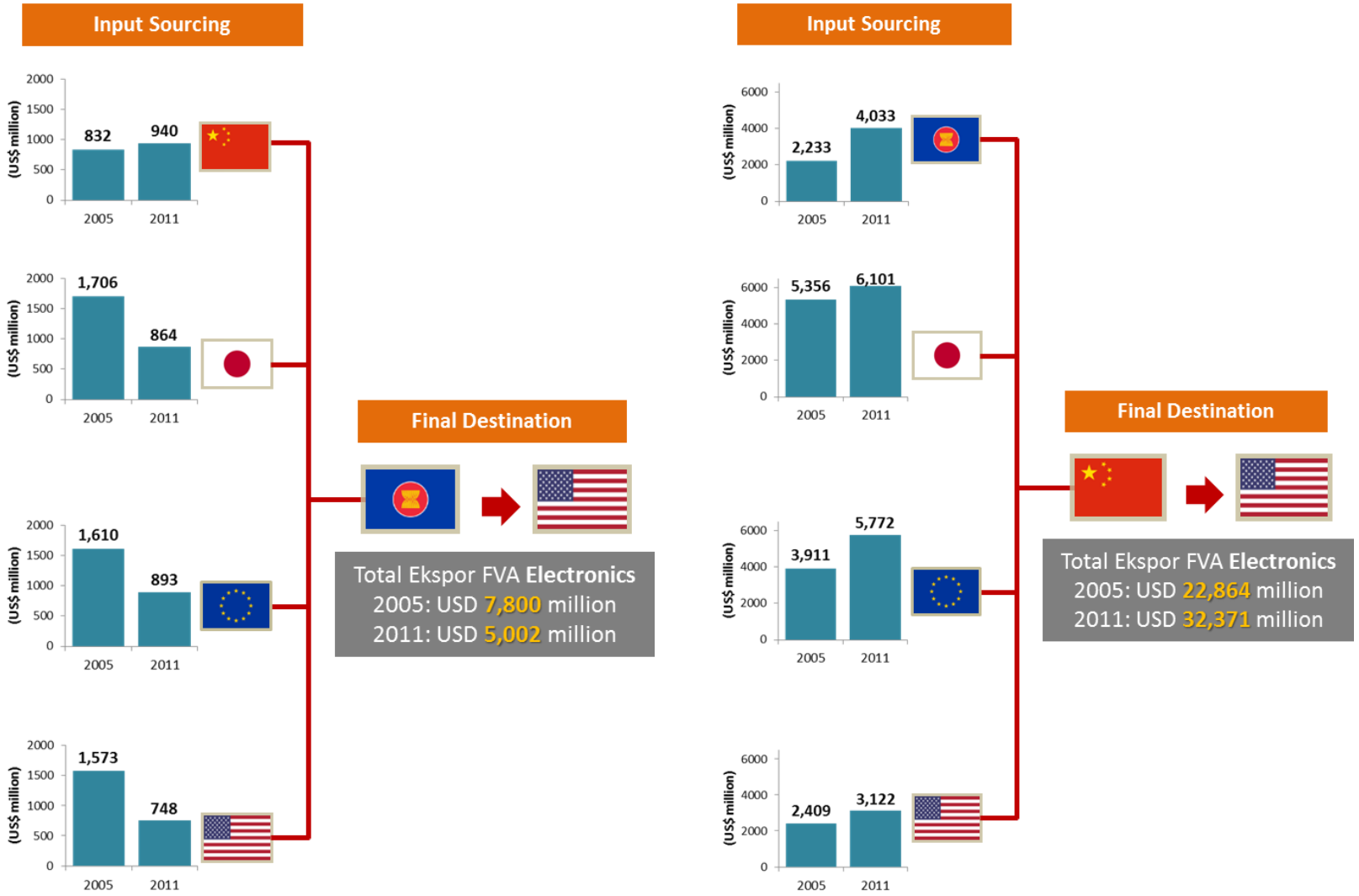


Source: Authors' calculation, Tiva based on OECD ICIO Table 2011.

Sector Case Study → Computer, Electronic, & Optical Equipment

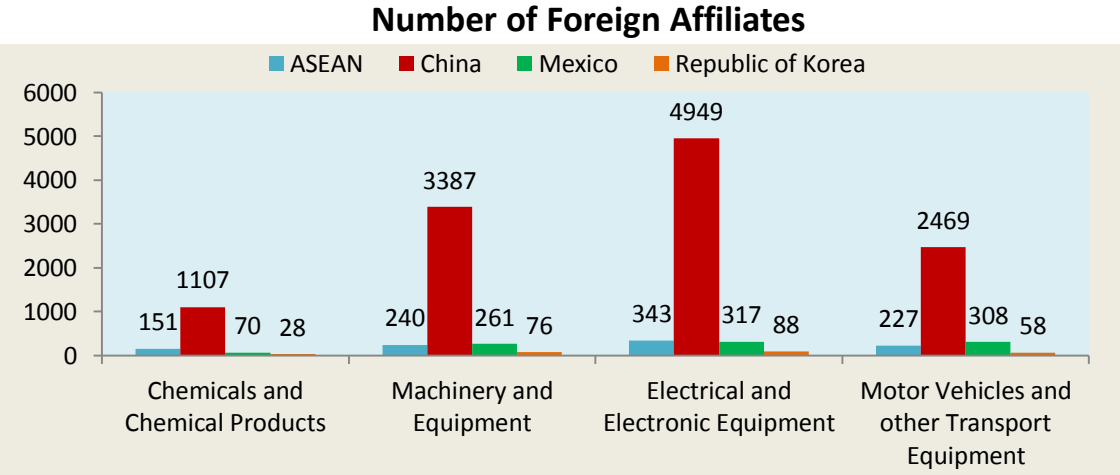
Input Sourcing & Redirector in a Triangular Trading Scheme: China vs ASEAN

ASEAN's collaboration with developed countries are decreasing. China's main input sourcing is predominantly from the developed countries (Japan and EU)



Source: Authors' calculation, Tiva based on OECD ICIO Table 2011.

Boosting the Export Oriented Investment



- **China is the location of choice by multinational companies (global producers) in medium-high tech sectors**
- **Producing globally standardized products of high VA.**

Based on 2011 data the reported export value generated by MNCs is high in China, suggesting "high import (TiVA) productivity". On the contrary, ASEAN member countries need to boost more exports oriented investment and employment opportunities.

Country/ Economic Group	Foreign Affiliates	FDI (US $million)	Export (US $million)	Exports/FDI	Employment
ASEAN	15,865	111,200	1,440,184	12.95	6,004,303
China	32,034	116,011	2,072,469	17.86	8,023,426
Mexico	12,907	21,504	362,826	16.87	3,898,434
Korea	2,398	13,670	650,400	47.58	332,819

Source: Authors' calculation based on ITC database (2011)

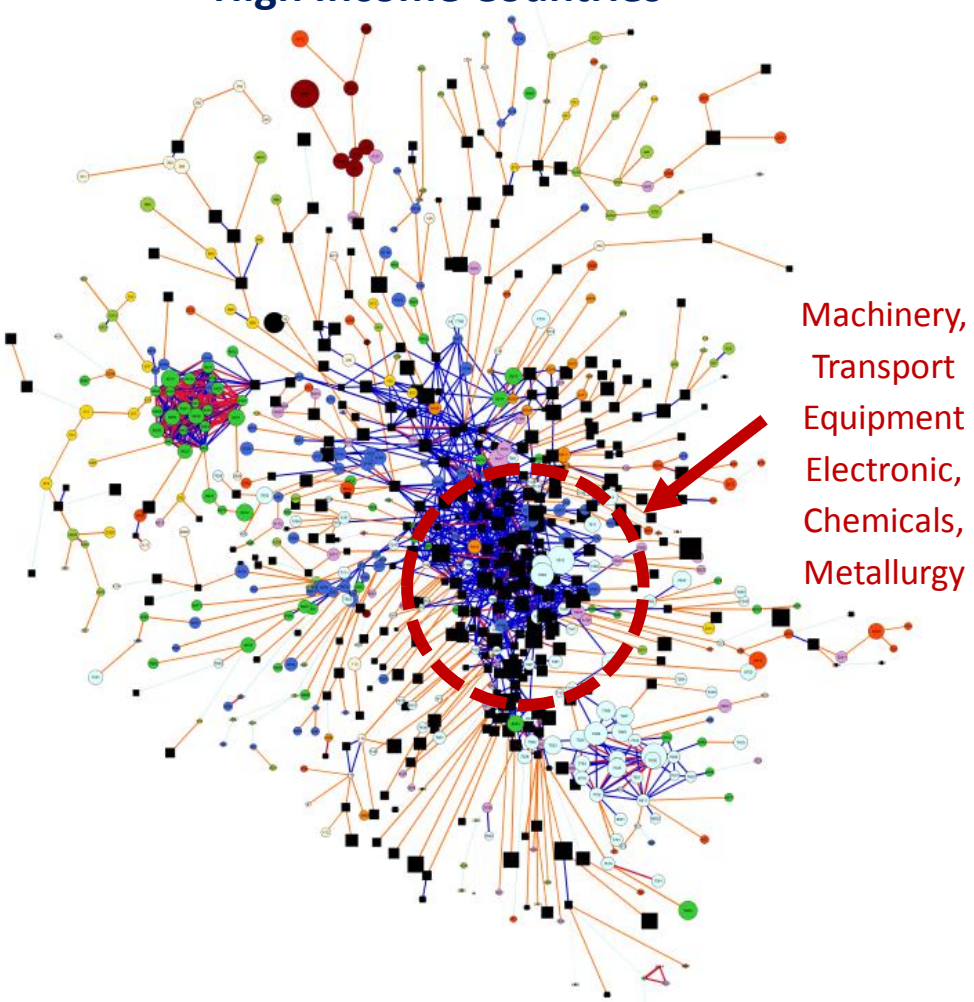
Sector Case Study: (1) Electronic Computing Equipment

Correct choice of competitive industry to promote in support of transition to a higher income group

Each color on the network represents a specific sector (see Appendix 4 for details), where the black squares are the sectors on which the country has Revealed Comparative Advantage (RCA)>1. The notion of product space as proposed by Hidalgo et al (2007) suggests that transition from less developed to developed country should be conditioned by promoting capital and skill intensive sectors, and gradually moving away from cheap labor & natural resource rent.

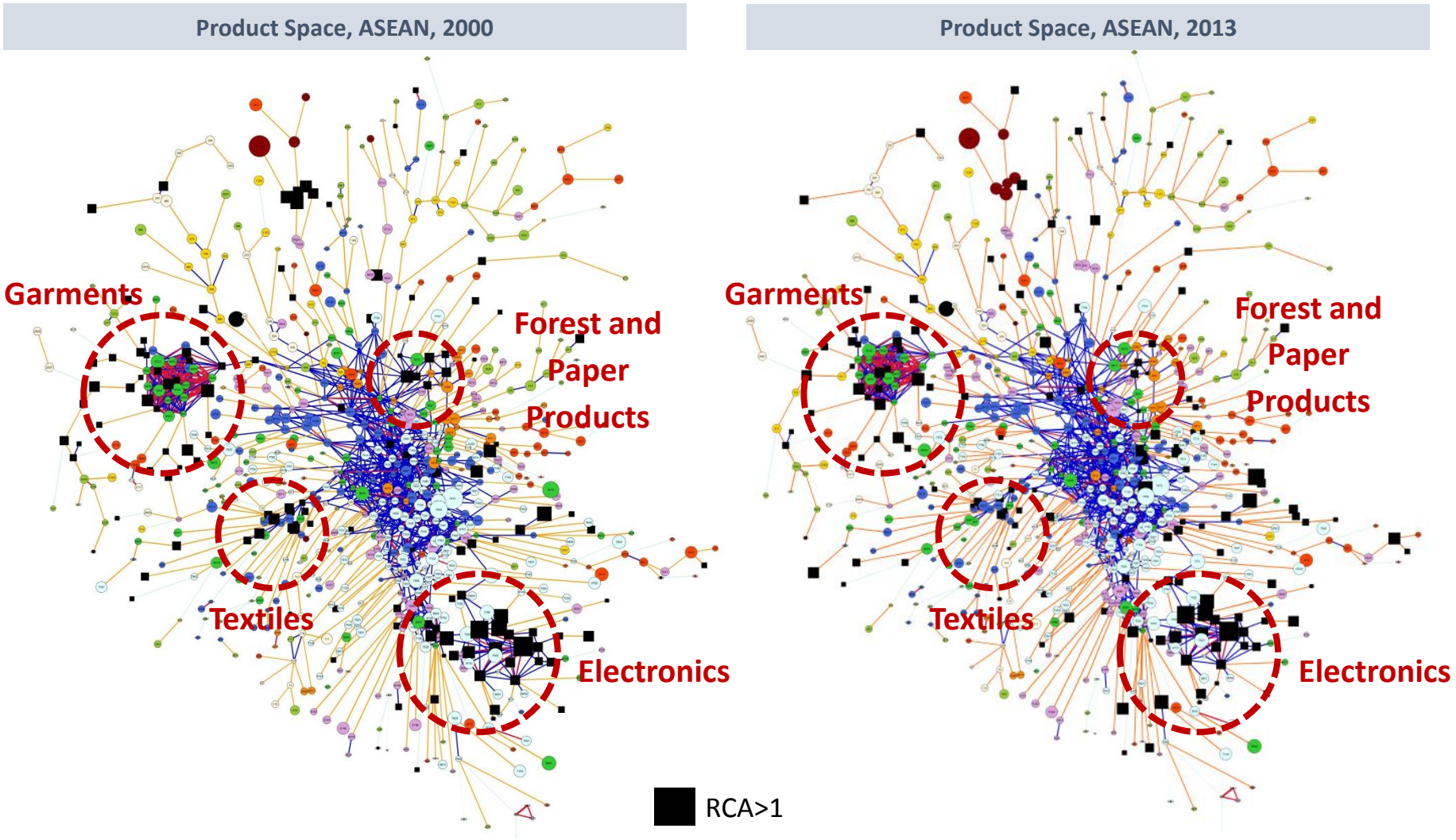
Our calculation of the product space map for upper middle and high income country shows the importance of promoting capital & skill intensive export industries as a part of the overall growth strategy, i.e. metallurgy, simple machinery, chemical, transport equipment, electrical equipment and electronics.

Product Space Map (2013)
"High Income Countries"



The notion of Product Space follows Hidalgo et al (2007). Source of data: WITS World Bank – 4 digit SITC, country classification is from World Bank Country Income Classification. Product space mapping is implemented using Product Space Explorer (http://www.chidalgo.com/productspace/data.htm), and : Cytoscape (www.cytoscape.org,

Product Space: ASEAN, 2000 & 2013



Slow progress of transition to skill intensive export industries

Source:
Authors' calculation

Discussion on Results

4. Lessons Learned

4. Lessons Learned

- ✓ **Access to large markets (large developed markets) is important** to ensure product differentiation and increasing return (economy of scale).

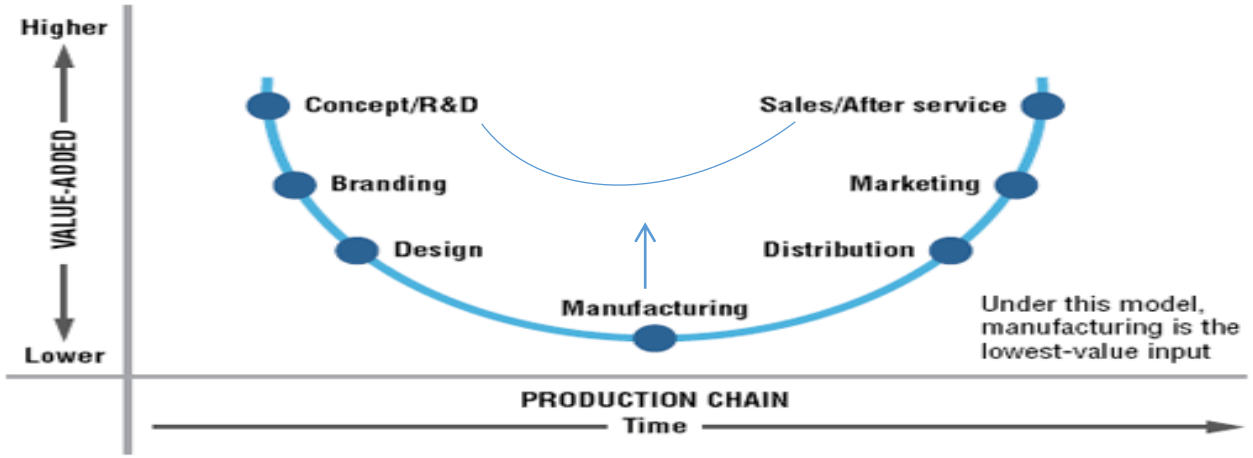
- ✓ **What you import and its sources matter** !
  - Competitive producers use inputs imported from export destinations (large developed markets), which suggests the use of high value import.
  - Access to large markets requires competitiveness in cost, quality, delivery, and compliance, hence goods exported to large developed markets tend to be of high value, which in turn require high value inputs.

- ✓ **Global collaboration helps in boosting export competitiveness**
  - The link between high value export to large developed markets and high value inputs sourced from developed market reveals the role of production sharing activities (TiVA) driven by MNCs along the global production network.
  - Hence, import productivity is determined by the ability to become a location of choice for export oriented production sharing.

- ✓ **The choice of competitive industry to promote conditions economic development.**

Policy Recommendations

What Next for ASEAN?



Investment Policy

Labor Market Policy

Competition Policy

STRATEGIC FOCUS:
Reforming ASEAN's Manufacturing Sector

- ASEAN as the next **Global Factory.**
- A location of choice for **export oriented high value manufacturing,**
- **Moving to R&D , design, and downstream services**

Infrastructure

Trade Policy

Education & Innovation Policy

APENDICES

Appendix 1: Integrated Economic Equilibrium

A. Theoretical Predictions

Under the assumption of perfect factor mobility (physical and human capital), and equal acces to technology, three theoretical predictions under fully Integrated Economy Area (IEA) can be proposed:

1. Each economy's shares of total IEA output, physical capital and human capital will be identical
2. Distribution of output and productive factors across IEA members would exhibit Zipf's law
3. Since the number of IEA members is fixed, then theoretical shares of each IEA member's productive factors can be computed

B. Equality of Output and Factor Shares

Output (Y_t) is assumed to be determined by physical capital (K_t) and human capital (H_t) under Constant Elasticity of Substitution (CES) production function:

$$Y_t = \gamma\{\delta {K_t}^{-\rho} + (1-\delta){H_t}^{-\rho}\}^{-1/\rho}$$

Assuming perfect mobility of physical and human capital between two countries, we expect each production factor to flow from low-return to high return country until the marginal productivity is equalized, then we obtain:

$$\frac{H_t}{H_t + H_t^*} = \frac{Y_t}{Y_t + Y_t^*} = \frac{K_t}{K_t + K_t^*}$$

if the countries are N:

$$\frac{H_{it}}{\sum_{k=1}^{N} H_{kt}} = \frac{Y_{it}}{\sum_{k=1}^{N} Y_{kt}} = \frac{K_{it}}{\sum_{k=1}^{N} K_{kt}}$$

interpreted as the shares of output, physical, and human capital are equal for each IEA member.

Appendix 1: Integrated Economic Equilibrium

B. Equality of Output and Factor Shares

$$\frac{H_{it}}{\sum_{k=1}^{N} H_{kt}} = \frac{Y_{it}}{\sum_{k=1}^{N} Y_{kt}} = \frac{K_{it}}{\sum_{k=1}^{N} K_{kt}}$$

The implications of this equality are:

1. If physical capital of one country i is increasing because of the reallocation among IEA members (the total capital unchanged)

$$\frac{K_{it} \uparrow}{\sum_{k=1}^{N} K_{kt}} \rightarrow$$

The human capital shares will be equal following these two alternatives:

a. If the total human capital of IEA members is fixed, the human capital will be increasing from the reallocation of human capital from other country(s)

$$\frac{H_{it} \uparrow}{\sum_{k=1}^{N} H_{kt}} \rightarrow$$

b. If the human capital of country i is accumulated on its own, then the total of IEA members will increase too.

$$\frac{H_{it} \uparrow}{\sum_{k=1}^{N} H_{kt} \uparrow}$$

2. If physical capital of one country i is increasing because of a Foreign Direct Investment (FDI), then total physical capital of IEA members will increase too, and the shares of human capital will change following the two alternatives as stated above.
3. If human capital of one country i is increasing by a factor α to be αH_{it} while the other remains unchanged, then the share of human capital will increase by a factorα too.

$$\frac{H_{it} \uparrow}{\sum_{k=1}^{N} H_{kt}} \rightarrow > \frac{H_{it}}{\sum_{k=1}^{N} H_{kt}}$$
$$(S'_{iHt}) > (S_{iHt})$$

4. If human capital of each IEA members is increasing by a factor α to be αH_{kt}, then the shares of human capital will be fixed.

Appendix 1: Integrated Economic Equilibrium

C. Distribution of Output and Productive Factors (Zipf's law)

Zipf's law establishes specific relationship among IEA members, that is, the share of output and productive factors will follow their rank, where the size of rank 1st will be twice of rank 2nd, three times of rank 3rd, and so on. We apply the results of Gabaix (1999) to assume that the IEA member shares will evolve as geometric Brownian motion:

$$\frac{dS_{njt}}{S_{njt}} = \mu dt + \sigma dB_t$$

where $S_{njt} > \min(S_{njt})$, μ and σ is the average and standard deviation of distribution share, $\min(S_{njt})$ is the lower bound, and B_t is wiener process.

Appendix 1: Integrated Economic Equilibrium

D. Calculation for Zipf's Law Theoritical Share

Accepting the long-run distribution of output and factor shares will exhibit Zipf's law, the theoritical shares of output and factor shares will be equal to:

$$S_{1jt} = \frac{1}{1+\delta_{2jt}+\delta_{3jt}+\cdots+\delta_{Njt}}$$

$$S_{2jt} = \frac{\delta_{2jt}}{1+\delta_{2jt}+\delta_{3jt}+\cdots+\delta_{Njt}}$$

$$S_{3jt} = \frac{\delta_{3jt}}{1+\delta_{2jt}+\delta_{3jt}+\cdots+\delta_{Njt}}$$

$$S_{Njt} = \frac{\delta_{Nt}}{1+\delta_{2jt}+\delta_{3jt}+\cdots+\delta_{Njt}},$$

Where δ_{ijt} is equal to the inverse rank, that is $\delta_{ijt} = 1$ for country listed on 1st rank, $\delta_{ijt} = \frac{1}{2}$ for country listed on 2nd rank, $\delta_{ijt} = \frac{1}{3}$ for 3rd rank.
We apply this rule for all j variables (output, physical, and human capital).

Appendix 1: Integrated Economic Equilibrium

E. Calculation for Integration Progress

We use the Kullback-Leibler Divergence (KLD) to measure the difference between two probability distributions (Bowen et al., 2010; Kullback and Leibler, 1951). By analogy, KLD can be applied in our context to measure the distance between actual and theoretical share distributions. KLD and symmetric KLD (SKLD) are defined:

$$KLD(\bar{S}: S_t) = \frac{1}{3} \sum_{j=Y,K,H} \left(\sum_{n=1}^{N} (\bar{S}_{nj}) \ln \left(\frac{\bar{S}_{nj}}{S_{njt}} \right) \right) \qquad SKLD(\bar{S}: S_t) = \frac{1}{3} \sum_{j=Y,K,H} \left(\sum_{n=1}^{N} (\bar{S}_{nj} - S_{njt}) \ln \left(\frac{\bar{S}_{nj}}{S_{njt}} \right) \right)$$

where S_{njt} = observed proportion at the time t ; $\bar{S}_{nj}$ = independent of time the theoretical part. Values of KLD range between zero and infinity. It is equal to zero (which is interpreted as the full integration).

Furthermore, to measure the index of internal integration:

$$IKLD(\bar{S}: S_t) = \frac{1}{KLD(\bar{S}: S_t)} \qquad ISKLD(\bar{S}: S_t) = \frac{1}{SKLD(\bar{S}: S_t)}$$

Appendix 1. Integrated Economic

F. Data Source

Our data set comprises yearly data on the output, stocks of human and physical capital for the 9 ASEAN countries in 1997 to 2012, based on the variables selection

Table 1. Data Used for Constructing Capital Stock, Human Capital Stocks, and Real Output

No	Variable	Explanation	Data Source
1	Output (Y)	GDP (constant 2005 US$)	World Development Indicator
2	Human Capital (H)	Number of persons with occupation: proffesionals, technical and related workers	Labor Force Survey,
3	Physical Capital (K)	Capital stock at current PPPs (in mil. 2005US$)	Penn World Table, version 8.0

[1] Key Statistics of Thailand, Labor Force Survey in Philippines, LAO, Singapore, Malaysia, Indonesia, Vietnam, Brunei, Cambodia.

Appendix 1: Integrated Economic Equilibrium

G. Results: Correlation Between Output, Human and Physical Capital

Based on the methodology developed by Bowen, Munandar, and Viaene (2010; 2011), the estimation is done by calculating the difference between the actual share of Y, K, and H with theoritical share.

The estimates are as follows.
First, we tested the relationship of equal shares. Calculation of Spearman's rank correlation showed a positif and significant relationship between output and production factors (human capital and physical capital).

Table 2. Spearman Rank Correlations Between Output (Y) and Human Capital (H), and Physical Capital (K)

	y & h			y & k			k & h		
	Rho	tstat	Prob	Rho	tstat	Prob	Rho	tstat	Prob
1997-2012	0.78	3.33	0.01	0.98	14.31	0.00	0.77	3.16	0.02
2001-2012	0.77	3.16	0.02	0.95	8.05	0.00	0.85	4.27	0.00

Notes: y = output share; h = human capital share; * n = 9

Appendix 1: Integrated Economic Equilibrium

G. Results: Correlation Between Output, Human and Physical Capital

Second, the relationship between output and factor shares is tested using Seemingly Unrelated Share Regression (SUR) model.

Table 3. *Seemingly Unrelated Regression* Estimates of Output and Factor Share Equations

		1997-2012			2001-2012		
		Intercept	Slope	Adj R2	Intercept	Slope	Adj R2
n=9	y on h	0.851	0.851 ***	0.627	-0.470	0.832 ***	0.653
	y on k	0.938	0.938 ***	0.961	-0.175	0.935 ***	0.958
	h on k	1.078	1.078 ***	0.748	0.295	1.104 ***	0.777

y = output share; h = human capital share; k=capital share, n = 9

Finally we estimate the relationship between output and factor using OLS model, which shows a significant relationship

Table 4. OLS Estimates of Parameters with Respect to The Share of Output, Physical Capital and Human Capital.

		1997-2012			2001-2012		
		Intercept	Slope	Adj R2	Intercept	Slope	Adj R2
n=9	Y	-0.211	1.959 ***	0.701	-0.228	1.940 ***	0.698
	H	-0.588	1.698 ***	0.435	1.170	1.729 ***	0.437
	K	-0.250	1.947 ***	0.684	0.796	1.922 ***	0.674

y = output share; h = human capital share; k=capital share, n = 9

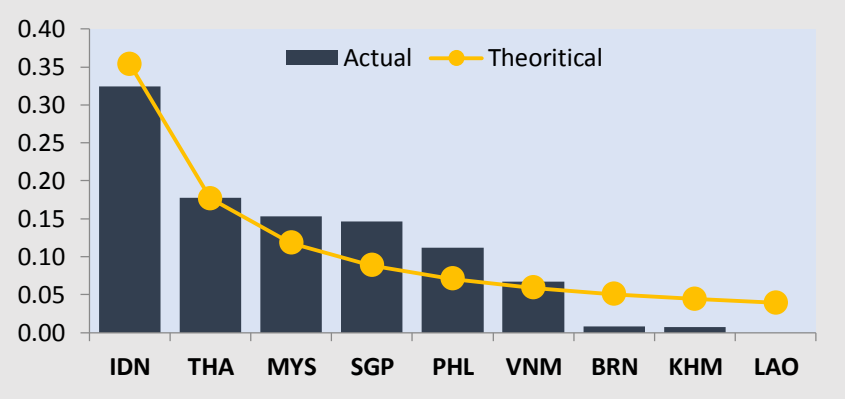
Appendix 1: Integrated Economic Equilibrium

G. Results: Difference between Zipf's Theoretical and Actual Share

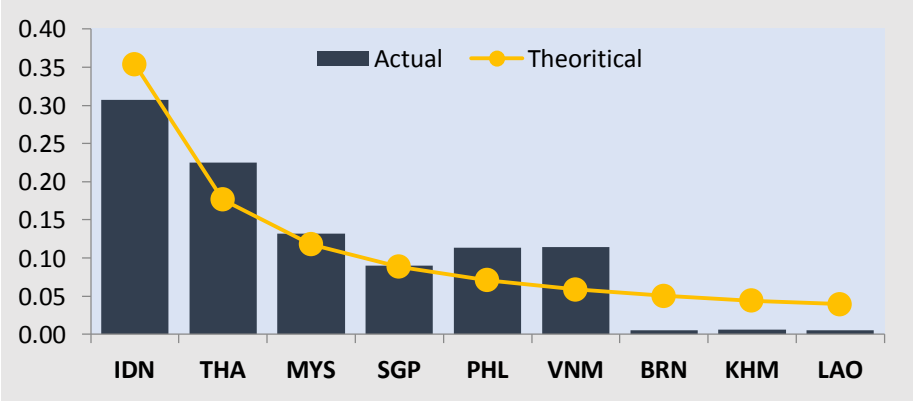
To Answer the question : "Is ASEAN a fully integrated economic zone?"

- ASEAN resembles a fully integrated zone.
- Theoretical shares of output and production factors conform the Zipf's law.

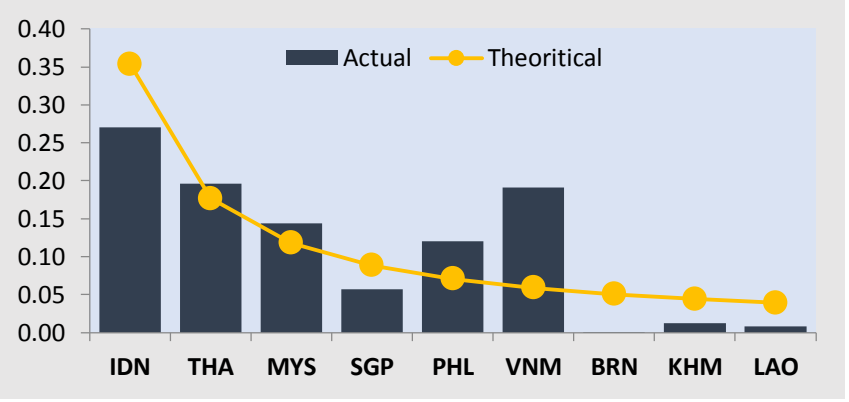
Graph. Actual and Theoretical Share Real Ouput 2008-2012



Graph. Actual and Theoretical Share Capital Stock 2008-2012



Graph. Actual and Theoretical Share Human Capital 2008-2012



Appendix 2. Updating the IDE-JETRO Asian IO

- The starting point of the updating procedure is the 2005 AIO table. In general, the 2013 value of a specific cell in the AIO table is calculated by multiplying the 2005 value of the cell by its nominal growth rate in 2013.
- Intermediate demand block
  - *Value added*. The value added is the summation *value added* manufacturing and *value added* non-manufacturing.
  - *Total Input.* The Total Input is the sum total intermediate input and value added. Total input is equal to Total Output.
  - *Imported inputs*. Imported inputs used the trade data from national account, UNCOMTRADE and also UNCTAD that provide information on imports not only by direction, but also by type of goods.
  - *Freight and insurance* dan *import duties.* The freights and insurance and import duties are chosen to be the same as the import growth rate from the National Accounts.
  - *Total consumption and investments.* The consumption and investments are taken from the National Accounts statistics. Consumption is defined as the sum of private and government consumption, while investments equal gross capital formation.

Appendix 2. Updating the IDE-JETRO Asian IO

- Export block.
  - *Exports to Hong Kong, EU15 and RoW.* The data is a combination of the National Accounts' export growth rates and the COMTRADE export growth rates by country of destination (HK, EU15, RoW)
  - *Statistical discrepancy.* Statistical Discrepancies is the difference between the total output of the summation Final Demand and Export.
- Total Intermediate Input/output
  - Intermediate input is sum of the column side of each products, Int. Freight & Insurance, Import and the Duties & imp. sales tax.
- Total Intermediate Output
  - Total Intermediate Output is sum of the line side of each products in each countries.
- Adjusting for Hong Kong's entrepot trade
  - The Hong Kong trade statistics provides information on re-exports by country of origin, destination, and also by type of good and destination.

Appendix 2. Updating the IDE-JETRO Asian IO

Data Source.

Variable	Source
Value Added: Manufacturing & Non Manufacturing	CEIC
Export and Import Goods: HS6 Digits, Consumption goods, Intermediate goods, Capital goods	UN COMTRADE, UNCTAD, CEIC
Consumption	CEIC
Gross Fixed Capital	CEIC
Change in Stocks	CEIC
Hongkong - Re-export By Country destination, Products	CEIC

Appendix 2. Updating the IDE-JETRO Asian IO

Formula.

1. Intermediate demand block.

$$A_{t+1}^{ij} = A_t^{ij} * (int\ M_{t+1}^{*ij} / int\ M_t^{*ij})$$

2. Freight and Insurance int demand block.

$$BA_{t+1}^{j} = BA_t^{j} * ((int\ M_{t+1}^{*j} / int\ M_t^{*j})$$

3. Import int demand block.

$$A_{t+1}^{ij} = A_t^{ij} * ((int\ M_{t+1}^{*ij} / int\ M_t^{*ij})$$

4. Duties and Import Commodity Taxes

$$DA_{t+1}^{j} = DA_{jt} * ((int\ M_{t+1}^{*j} / int\ M_t^{*j})$$

5. Value Added

$$V_{t+1}^{j} = V_t^{j} * ((V_{t+1}^{*j} / V_t^{*j})$$

6. Total Intermediate Input / Output

ET_{in}= Intermediate demand block + Freight and Insurance + Import + Duties and Import Commodity Taxes.

ET_{out}= sum intermediate demand block (line base)

6. Total Input / Total Output.

$$XX_{in} = ET + Value\ Added$$

$$XX_{out} = XX_{in}$$

7. Final Demand Block.

$$cF_{t+1}^{ij} = cF_t^{ij} * (cM_{t+1}^{*ij} / cM_t^{*ij})$$

$$iF_{t+1}^{ij} = iF_t^{ij} * (capM_{t+1}^{*ij} / capM_t^{*ij})$$

8. Freight and Insurance Fin demand.

$$cBF_{t+1}^{j} = cBF_t^{j} * ((consM_{t+1}^{*j} / consM_t^{*j})$$

9. Import Fin demand.

$$cF_{t+1}^{ij} = cF_t^{ij} * (consM_{t+1}^{*ij} / consM_t^{*ij})$$

$$iF_{t+1}^{ij} = iF_t^{ij} * (capM_{t+1}^{*ij} / capM_t^{*ij})$$

10. Duties and Import Fin Demand.

$$cDF_{t+1}^{ij} = cDF_t^{ij} * (consM_{t+1}^{*ij} / consM_t^{*ij})$$

$$iDF_{t+1}^{ij} = iDF_t^{ij} * (capM_{t+1}^{*ij} / capM_t^{*ij})$$

Appendix 2. Updating the IDE-JETRO Asian IO

Formula.

11. Value added Fin Demand.

$$C^{j}_{t+1} = C^{j}_{t} * (C^{*j}_{t+1} / C^{*j}_{t})$$

$$I^{j}_{t+1} = I^{j}_{t} * (I^{*j}_{t+1} / I^{*j}_{t})$$

12. Export Block.

$$L^{ij}_{t+1} = L^{ij}_{t} * (EX^{*ij}_{t+1} / EX^{*ij}_{t})$$

13. Statiscal Discrepancy.

$QX = Total\ output\ (XXout)$- total intemediate output (ET_{out})– final demand - export

Note:

X^{*j}_{t} = Gross production of country j (National Accounts data) or industrial gross output

V^{*j}_{t} = GDP of country j (National Accounts)

C^{*j}_{t} = total consumption of country j (National Accounts)

I^{*j}_{t} = capital accumulation of country j (National Accounts)

EX^{*ij}_{t} = exports of country j to country i (COMTRADE+National Accounts)

$intM^{*j}_{t}$ = intermediate goods imports of country j (COMTRADE+National Accounts)

$intM^{*ij}_{t}$ = intermediate goods imports of country j from country i (COMTRADE+National Accounts)

$consM^{*j}_{t}$ = consumption goods imports of country j (COMTRADE+National Accounts)

$consM^{*ij}_{t}$ = consumption goods imports of country j from country i (COMTRADE+National Accounts)

$capM^{*j}_{t}$ = capital goods imports of country j (COMTRADE+National Accounts)

$capM^{*ij}_{t}$ = capital goods imports of country j from country i (COMTRADE+National Accounts)

Appendix 2. Updating the IDE-JETRO Asian IO

Dynamics of ASEAN Internal and External Competitiveness on Specific Medium-High Tech Industries (Using IDE-JETRO 2005 on Own Updated 2009 &2013)

Sector	Internal Competitiveness			External Competitiveness		
	2005	2009	2013	2005	2009	2013
Chemical Products	18%	13%	11%	29%	26%	23%
Industrial Machinery	46%	43%	43%	13%	10%	9%
Computers, electronic & electrical equipment	76%	71%	67%	32%	28%	28%
Transport Equipment	13%	10%	8%	19%	15%	14%

Appendix 3: GVC Competitiveness

Top 10 Hub Exporters in Aggregate Medium-High Tech Industries (Values in US$ Million)

No	Negara	Total FVA	FVA for Domestic	FVA for Export	%DOM	%Ekspor	Skala
1	China	466,611	311,624	154,987	67%	33%	28%
2	EU	275,645	210,147	65,499	76%	24%	12%
3	United States	216,337	154,980	61,358	72%	28%	11%
4	Korea	100,379	44,751	55,629	45%	55%	10%
5	ASEAN	115,622	71,138	44,484	62%	38%	8%
6	Mexico	57,371	18,110	39,261	32%	68%	7%
7	Japan	112,305	82,483	29,822	73%	27%	5%
8	Taiwan	47,338	19,449	27,888	41%	59%	5%
9	Canada	44,987	17,595	27,392	39%	61%	5%
10	India	61,348	51,370	9,979	84%	16%	2%
World				562,407			

Source: Authors' calculation, Tiva based on OECD ICIO Table 2011.

Appendix 4: Properties of Product Space Network