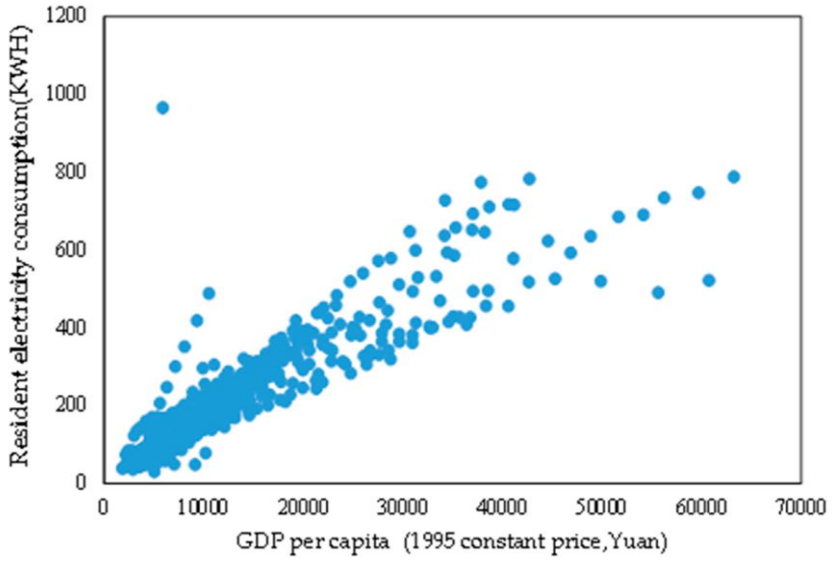
Southern China as a part of the Southeastern Asia

FUKUYO, YAMAGUCHI UNIV.

China is rich in geographical and socioeconomic diversity

… We thus should not take it in as a whole.

Provincial residential electricity consumption per capital in 2012 (kWh).



GDP per capita and Residential Electricity Consumption per capita; 30 provinces in mainland China during 1995 - 2012

Source: Yanan Liu et al. The Relationship between Residential Electricity Consumption and Income: A Piecewise Linear Model with Panel Data, Energies 2016, 9, 831; doi:10.3390/en9100831

Jumping scale in China and Southeast Asia

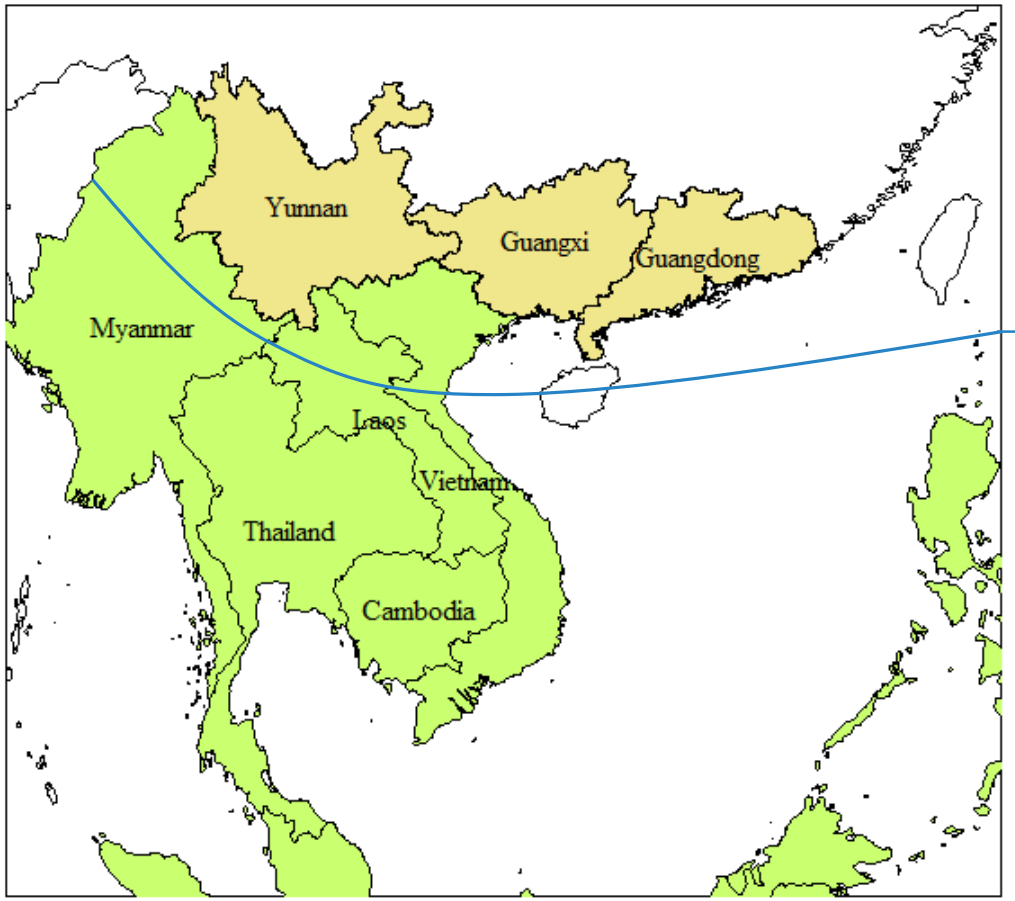
"Cartographic convenience reinforces a hierarchical spatial awareness" (Willem van Schendel, 2002)

- We often use conventional geographical segmentation
- For instance, energy consumption in Guangxi Zhuang Autonomous Region is usually compared to those in the other Chinese provinces and not to the neighboring countries such as Vietnam, Lao PDR, etc.
- However, there are climatological, socio-cultural, and ethnological continuities between Southern Chinese Provinces and Southeastern Asian countries

"We need academic versions of the strategy of 'jumping scales', which allows us ''to circumvent or dismantle historically entrenched forms of territorial organization and their associated scalar morphologies" (Willem van Schendel, 2002)

Willem van Schendel: Geographies of knowing, geographies of ignorance: jumping scale in Southeast Asia, Environmental and Planning D: Society and Space 2002, vol. 20, pp. 647 – 668

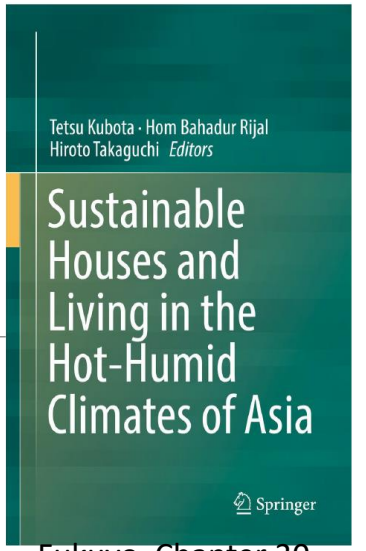
Southern Chinese provinces and ASEAN countries



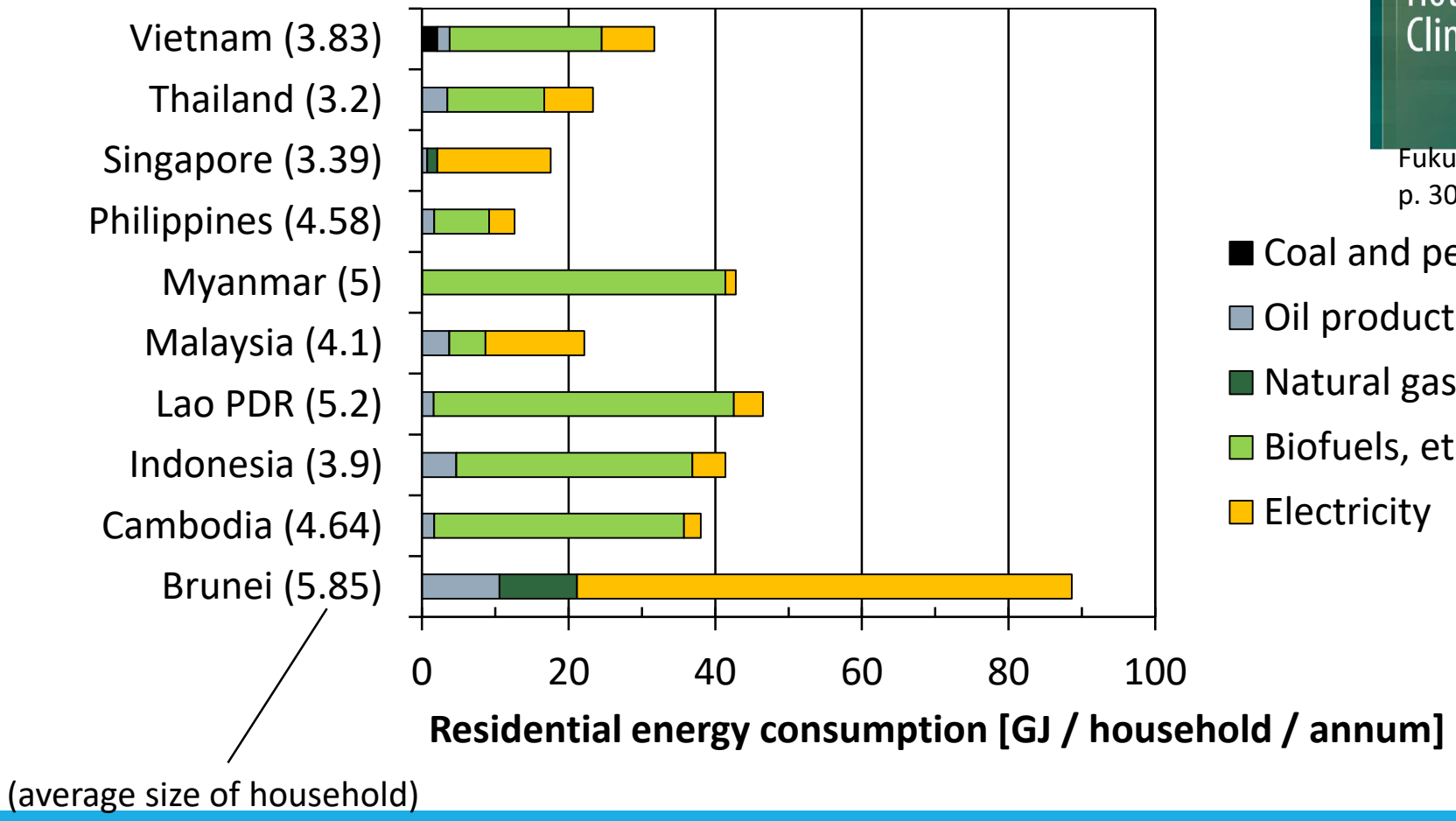
Subtropical-Dry Winter

Tropics

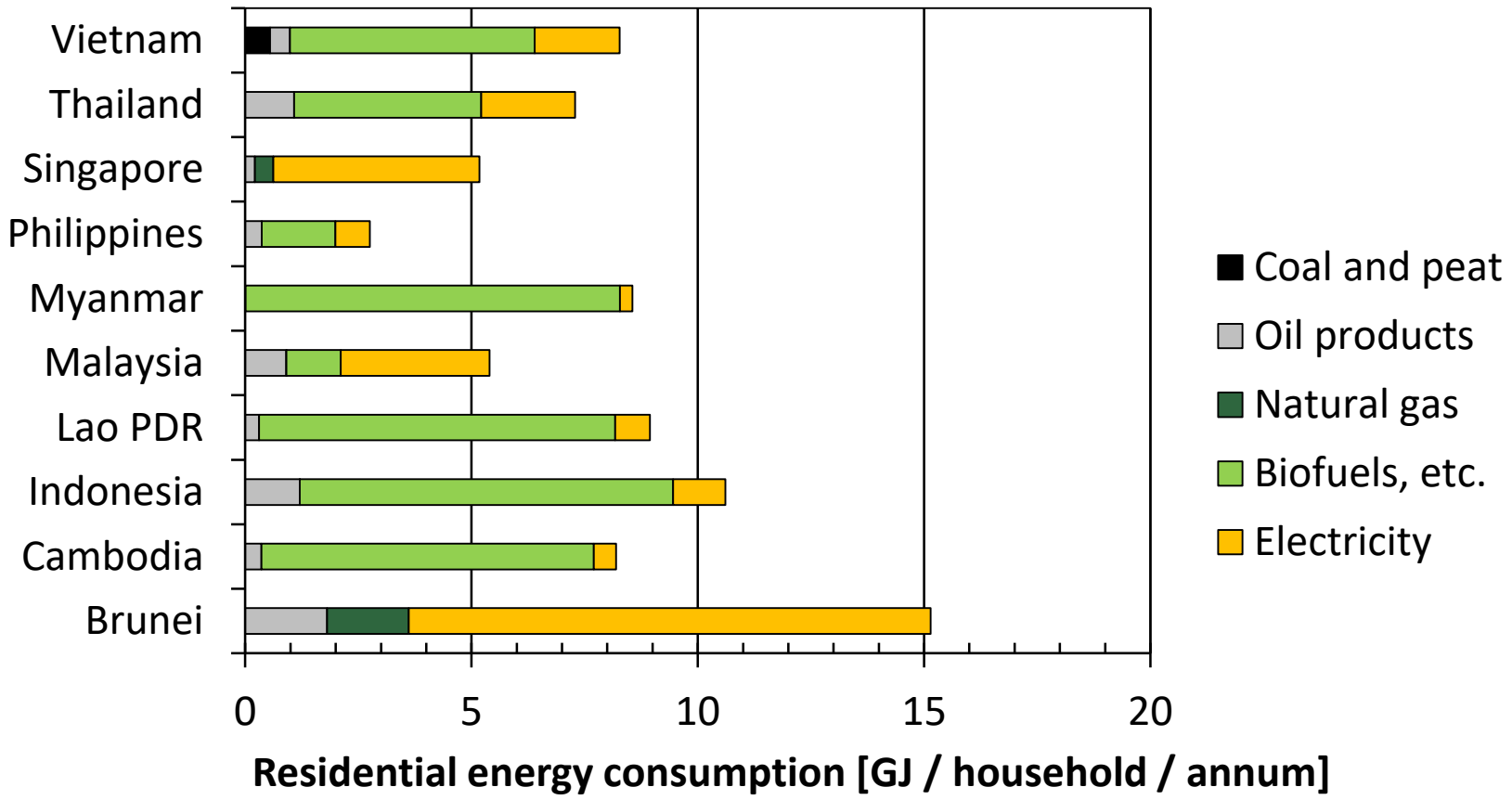
Residential energy consumption per household, 2014



Fukuyo, Chapter 30, p. 307

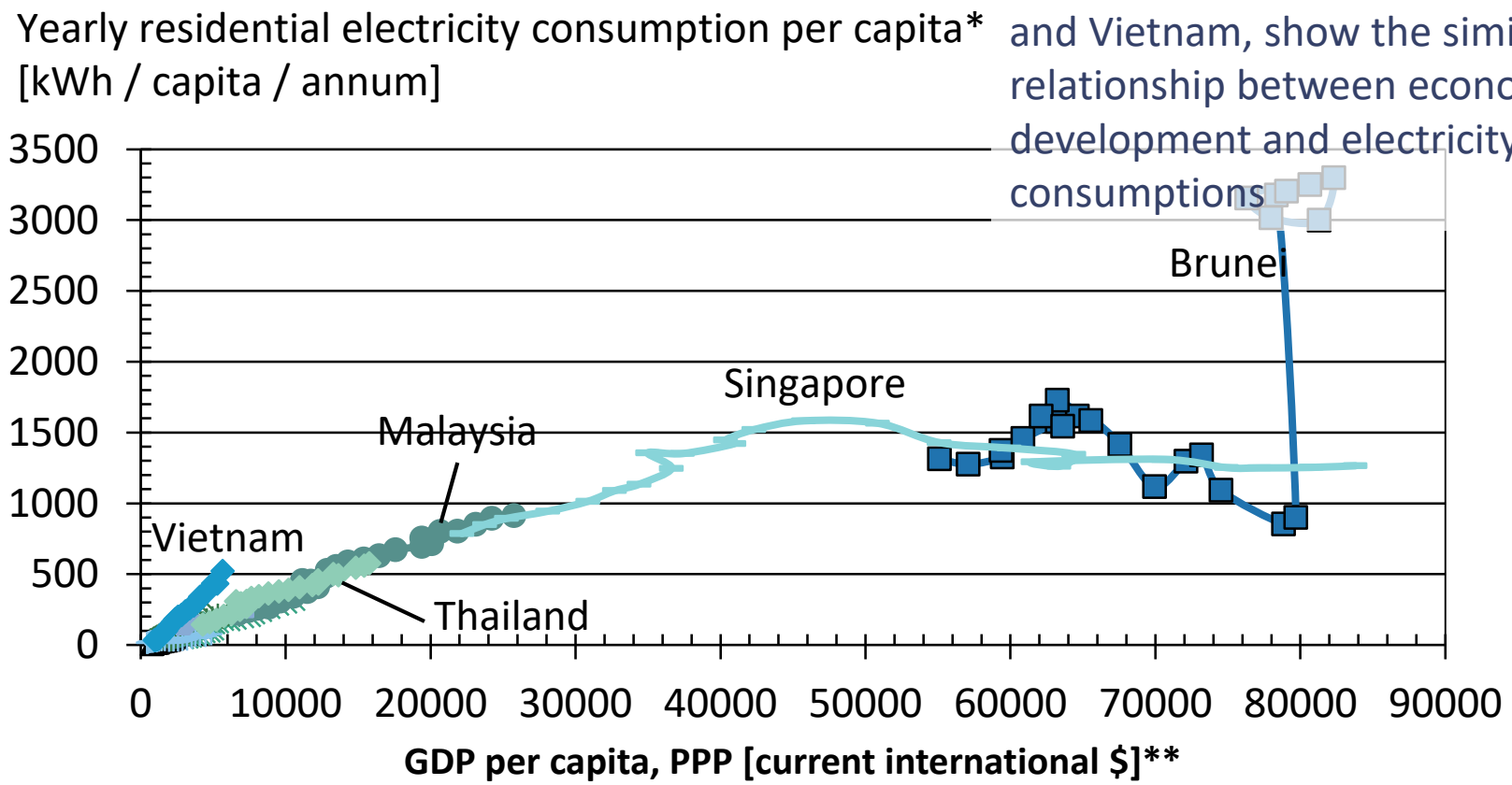


Residential energy consumption per capita, 2014



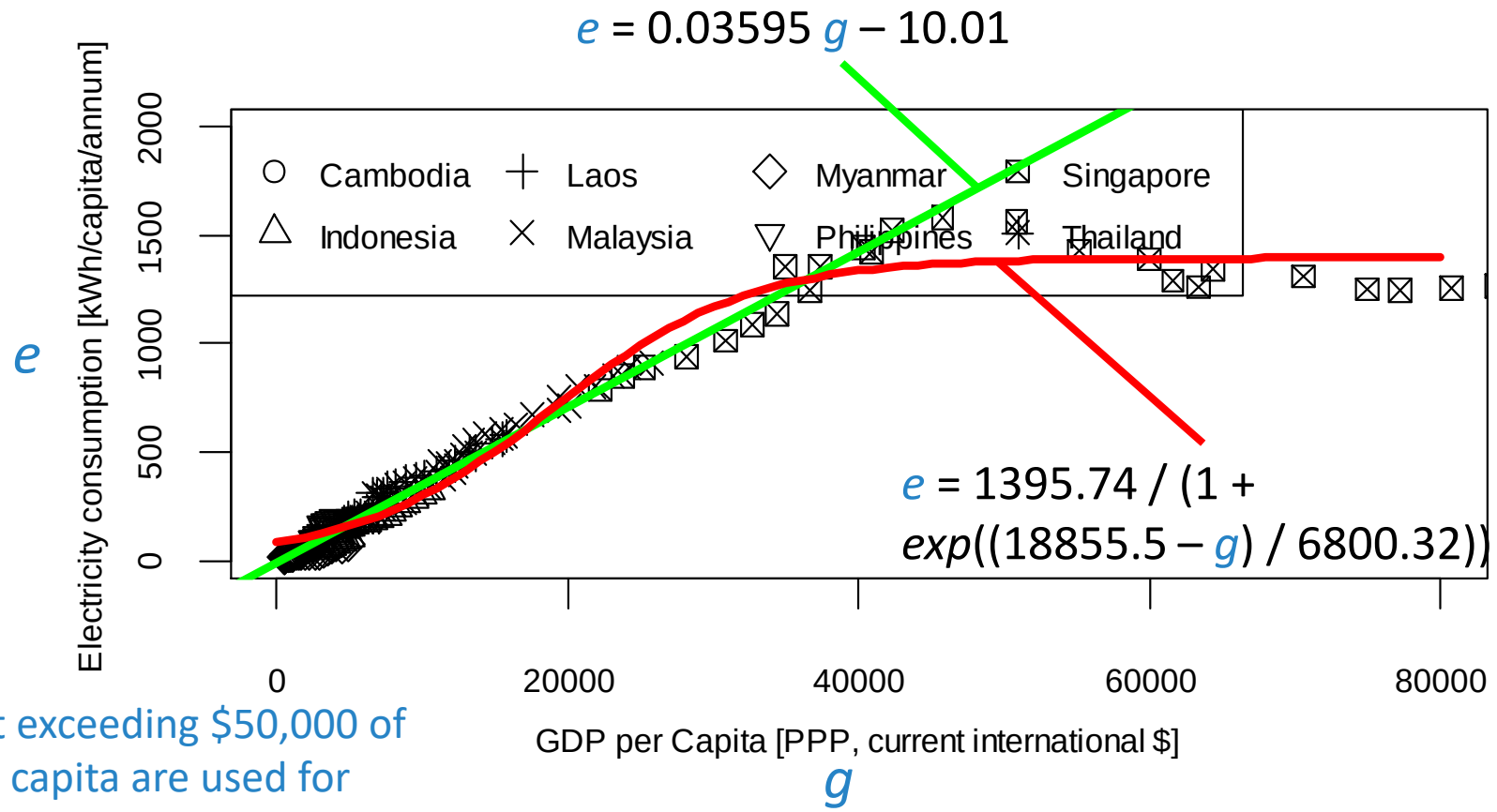
Economic development and electricity consumption in the ASEAN countries

The ASEAN countries, except Brunei and Vietnam, show the similar relationship between economic development and electricity consumptions



Source: *IEA, EDL; **World Bank

Linear and Logistic Regressions for the data of the ASEAN selected countries

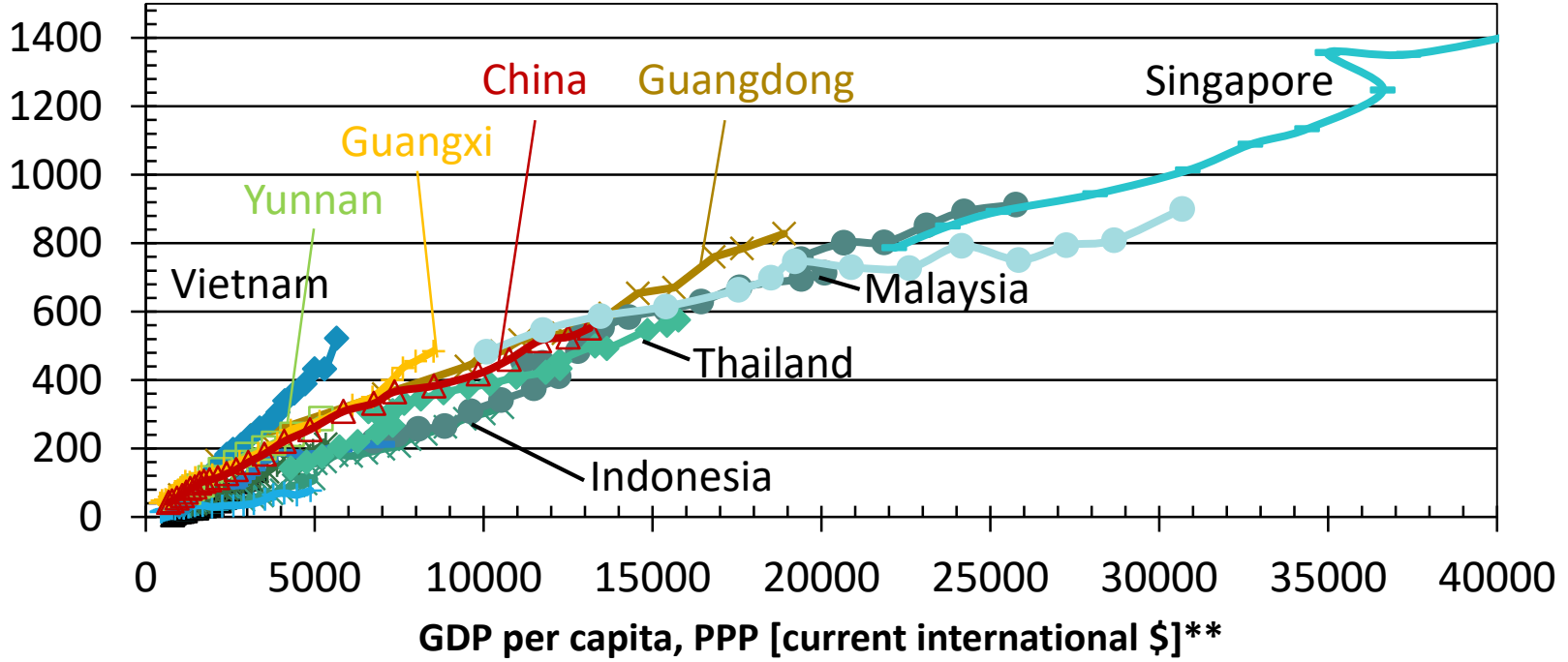


Data not exceeding $50,000 of GDP per capita are used for regression analyses

Economic development and electricity consumption: Adding Southern Chinese provinces

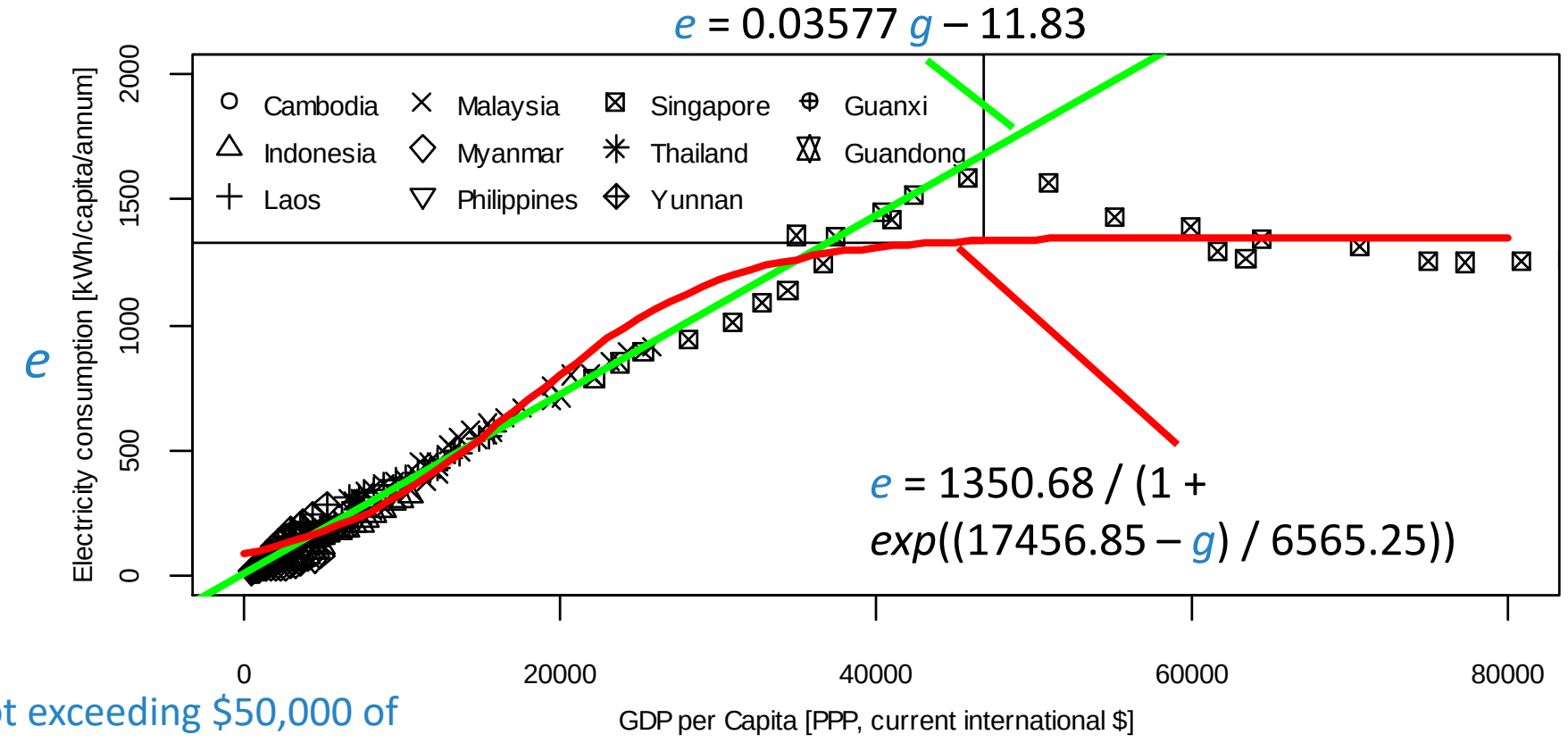
Yearly residential electricity consumption per capita*
[kWh / capita / annum]

The Southern Chinese provinces seem to trace the same pattern of the ASEAN countries



Source: *IEA, EDL; **World Bank

Linear and Logistic Regressions for the data of the ASEAN countries and Southern Chinese Provinces



Data not exceeding $50,000 of GDP per capita are used for regression analyses

Comparison between regression results

	ASEAN selected countries	**ASEAN selected countries + Southern China provinces**
Linear Regression	$e = 0.03595\ g - 10.01$	$e = 0.03577\ g - 11.83$
Logistic Regression	$e = 1395.74 / (1 + exp((18855.5 - g) / 6800.32))$	$e = 1350.68 / (1 + exp((17456.85 - g) / 6565.25))$

Where,
g: GDP per capita [$ / capita /annum]
e: electricity consumption [kWh / capita / annum]

- There are little differences between the regression results.
- Trends of the electricity consumption in the Southern Chinese provinces are similar to those in the ASEAN selected countries.
- The regression results show that a 1,000 dollar increase in GDP per capita results in a 30 ~ 40 kWh increase in electricity consumption per capita

Correlation and causality

The correlation between the economic development and residential electricity consumption is obvious.

How about the causality between them?

The energy economists named the causal relationship between the economic development and energy consumption "energy-growth nexus"

They use the augmented Cobb-Douglas production functions to represent the energy-growth nexus and employ the unit root test, co-integration tests, Granger causality test, etc.:

- Kraft and Kraft studied the relationship between energy consumption and gross national product (GNP) in the USA during 1947 – 1974 [*]
- Saboori and Sulaiman studied the relationship between the real GDP, CO2, and Energy consumption in Indonesia, Malaysia, Philippines, Singapore, and Thailand during 1971 – 2008 [*]

[*] Kraft J, Kraft A. On the relationship between energy and GNP. J Energy Development 1978; 3: 401–403.
[**] Saboori B, Sulaiman J. CO2 emissions, energy consumption and economic growth in Association of South East Asian Nations (ASEAN) countries: a cointegration approach. Energy 2013; 55: 813–22.

How about the “energy-growth nexus” in the residential sector?

Energy economists have focused on the “energy-growth nexus” of the selected county as a whole, i.e., focused on the GDP and the total energy/electricity consumption of all sectors.

They have not focused on the “energy-growth nexus” in the residential sector.

Now we conduct the Granger causality test for the residential sector of the ASEAN and Southern Chinese provinces.

Part of the results of the Granger causality test

Country/Province	Results	Country/Province	Results
Cambodia	-	Philippines	-
Indonesia	g -> e (** p < 0.01)	Singapore	-
Laos	g -> e (. p < 0.1)	Thailand	g -> e (** p < 0.01)
Malaysia	-	Guangdong	e -> g (* p < 0.05)
Myanmar	g -> e (. p < 0.1)	Guangxi	g -> e (** p < 0.01)

In short,
In Indonesia, Thailand, and Guangxi, the economic development obviously “granger-causes” the residential electricity consumption;
In Laos and Myanmar, the economic development slightly “granger-causes” the residential electricity consumption;
In Guangdong, the reverse causal relationship are found.

Conclusion

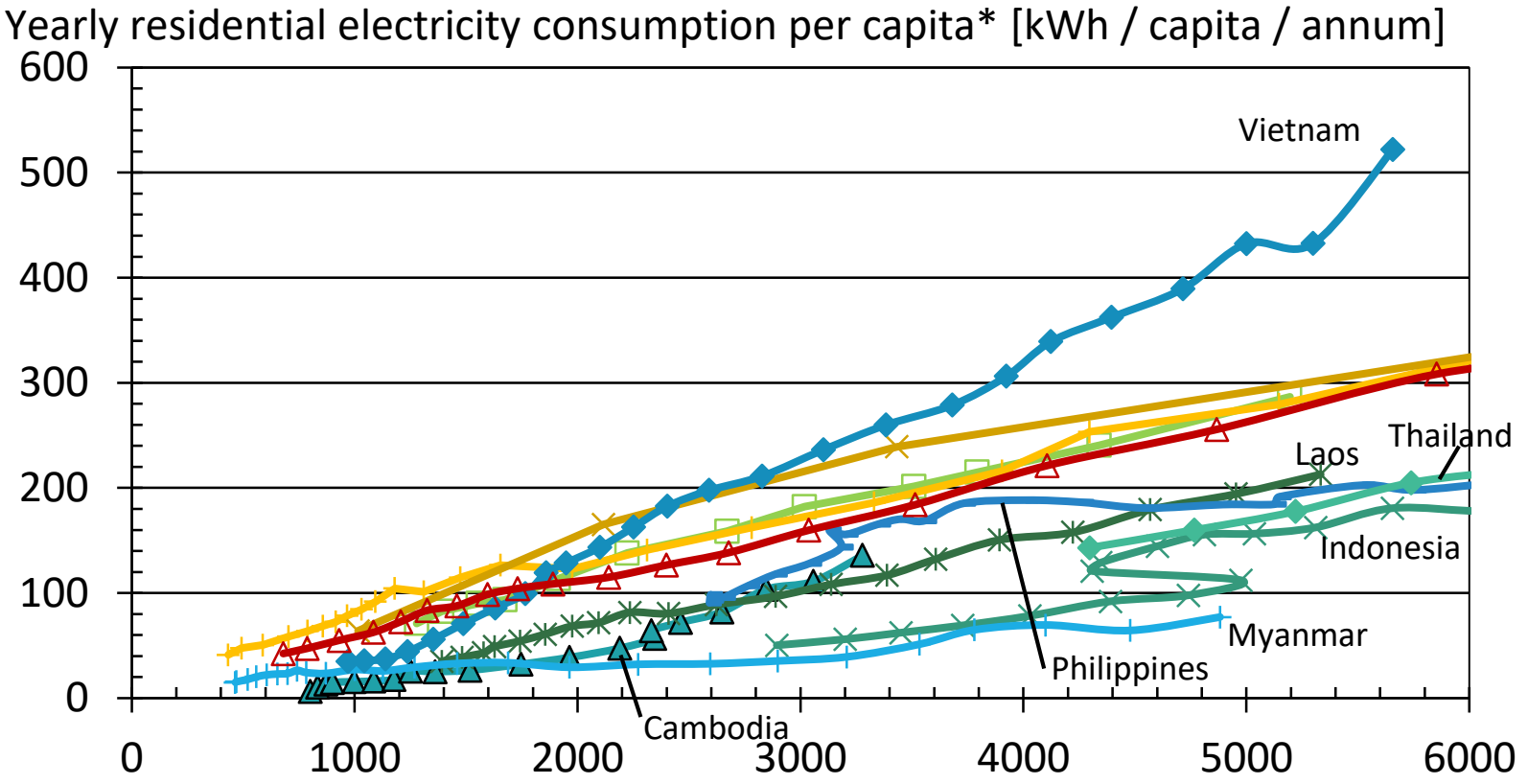
There are climatological, socio-cultural, and ethnological continuities between Southern Chinese Provinces and Southeastern Asian countries.

As to the relationship between the GDP per capita and the per capita residential electricity consumption, the Southern Chinese provinces (Guangxi, Guangdong, etc.) seem to trace the same pattern of the ASEAN countries.

Although the causality between them should be carefully examined, the linear regression results show that a 1,000 dollar increase in GDP per capita results in a 30 ~ 40 kWh increase in electricity consumption per capita per annum.

Additional Information

Economic development and electricity consumption: Zooming in



Source: *IEA, EDL; **World Bank