Balassa Samuelson Effect

An Application of the Specific Factor Model

Hisahiro Naito

Division of Humanities and Social Sciences
University of Tsukuba

- Let the price level in country A be P_A and the price level in country be P_B.
- Let the nominal exchange rate of the currency of country A in terms fo the currency used in B be e.
- Then, real exchange rate is defined as

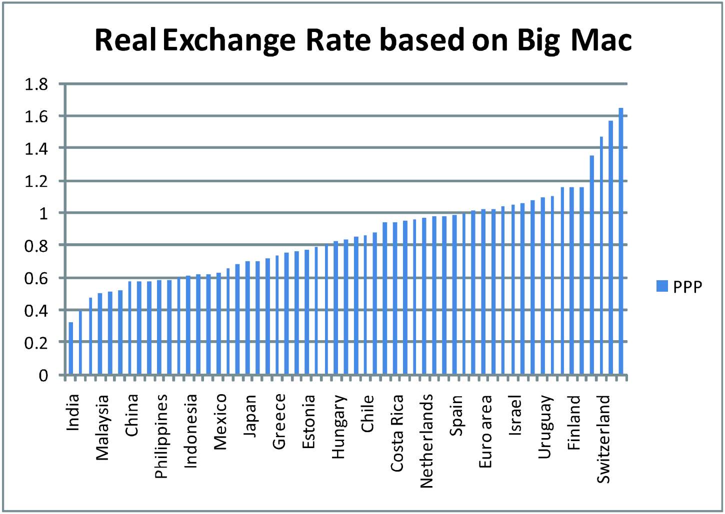
$$\frac{eP_A}{P_B}$$

- If the purchasing power parity holds, the real exchange rate is always equal to one.

The purchasing power parity

- The logic of the puchasing power parity
- If you buy a good in a cheaper place and sell it in a higher price, you can get profit.
- Without transportation cost and tariffs, everyone will get a profit and everyone will try to participate in this arbitrage
- Then, the price in a cheaper location will increase because of less supply.
- The price at the higher price location will decrease due to the increase of the supply
- The price between two areas will converge

What is the data telling?



PPP

- Why is the real exchange not equal to one?
- In other words, why doesn't PPP hold?

PPP puzzle:possible reasons:

- Presence of tariffs and non-tariff barriers
- transportation cost
- non-tradable goods

Non-tradable goods and PPP puzzle

- Balassa-Samuelson effect explains this puzzle using a specific factor model
- The model is the standard two sector specific factor model
- The one sector is tradable industry and the other industry is non-tradable sector.
- Assume that the technological level of non-tradable sector are the same across countries.
- The producitivities of hair cut and resturants are the same in developed countries and developping countries.
- However, the productivitiy of tradable sector such as manufacturing sector are different across countries.

Balassa Samuelson Model

- Cosinder a three goods model where the utiity function of a representative consumer is given as follows

$$u(c_x, c_y, c_n)$$

- Cosnumers gain utility consuming from three goods
- c_n is the consumption of non-tradable goods
- c_x and c_m are the consumtion of tradable goods.
- c_x is the consumpton of goods produced in exporting sector.
- c_m is imported goods. This goods is not produced in this country

Balassa Samuelson Model(2)

- Let $A^x \times F^x(K_{x,} L_x)$ be the productution function of good x.
- A^x is the parameter that shows the productivity of the tradable sectors.
- Let $F^n(K_n, L_n)$ be the production of non-radable sector.
- K_x and K_n are specific capital for good x sector and good n sector.
- L_x and Ln are labor used in good x sector and good n sector.
- K_x and K_n are immobile.
- L_x and L_n are mobile and $L_x + L_n = \overline{L}$
- The production function of each sector exhibits the diminishing marginal product of labor.

Balassa Samuelson Model(3)

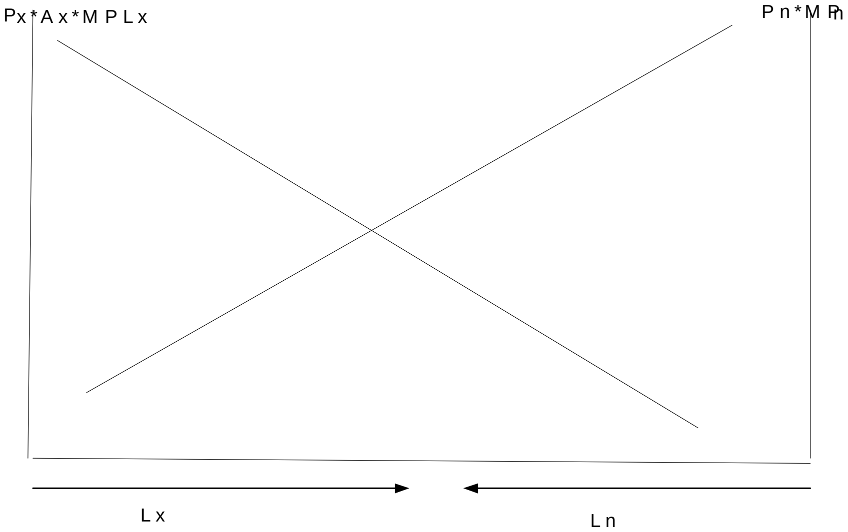
- The price of good x and good y are determined in the international market and they are given.
- The price of non-tradable good is determined within the home coutnry from the demand and supply
- The demand of the non-tradable good is downward sloping
- The wage level is also determined from the demand of labor and the supply of the labor
- We assume that the supply curve of labor is completly vertical.

Balassa Samuelson Model(4)

- For the production side of the economy, each of two sectors maximizes its profit.
- The profit maximization implies that the value of the marginal product of labor is equal to the wage level
- This implies that

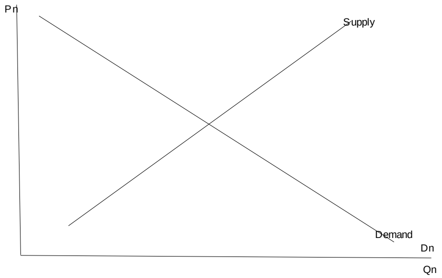
$$
\begin{aligned}
p_x A^x \frac{\Delta F^x(K_x, L_x)}{\Delta L^x} &= w \\
p_n \frac{\Delta F^n(K_n, L_n)}{\Delta L^n} &= w
\end{aligned}
$$

- Note that from the property of the diminishing marginal product of labor, as L_n increases, $\Delta F^n / \Delta L_n$ will decrease. Thus, w/p_n will go down


Px*Ax*MPLx
Pn*MPn
Lx
Ln

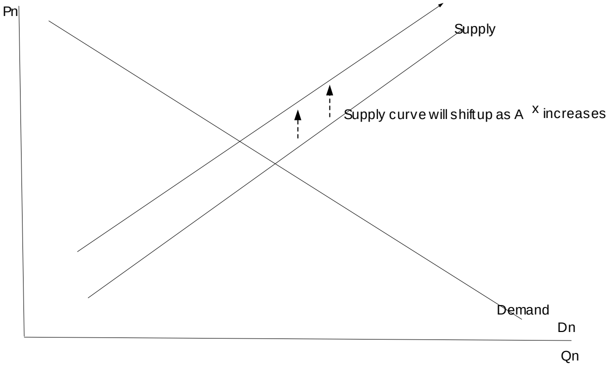
Balassa Samuelson Model(5)

- Holding other things constant, as Pn increases, the labor demand of the non-tradable sector increases and the amount of labor used in the non-tradable sector will increase.
- As a result, the supply of non-tradalbe will increase. This implies that the supply funciton of non-tradable goods is an increasing funciton of p_n



- Now consider the effect of an increase of the productivity of tradable sector A^x.
- As A^x increases, the $P_x * A^x * MPL_x$ curve will shift up.

- More labor will go to tradable sector.
- Thus, even if the price of the non-tradable goods stays the same, the supply of the non-tradable good will decrease.
- The supply curve of the non-tradable good will shift left
- The price of non-tradable good will increase.

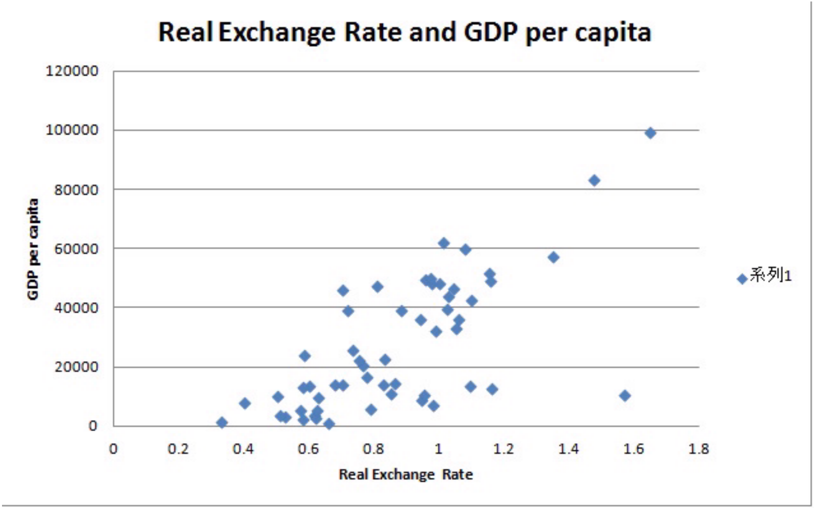


Prediction of the model

- Consider two types of countries:developed countries and developping countries
- Assume that the produciton funciton of the non-tradable sectors are the same for developed and developing countries
- This assumption implies that the number of the customers a waiter or a waitress can serve is the same between developed countries and developing countries.
- On the other hand, for tradable sector, assume that developed countries have a higher productiviy. This implies that A^x is higher for developed countries.
- This assumption makes sense since developed countries have higher capital stock and many advanced technologies are avaialble for developed countries.

Prediction of the model (2)

- From the previous slide, in a coutnry where A^x is high, the price of non-tradable sectors are high since labor are attracted to tradable sectors and the supply of non-tradable sector shrink. This will increase the price of non-tradable goods.
- The model predicts that the the price of non-tradable goods be higher in countries with higher GDP per capita
- Let's look at the data



Real Exchange Rate and GDP per capita
120000
100000
80000
60000
40000
20000
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
GDP per capita
Real Exchange Rate
系列1

- In the above graph, the price of Big mac is used to calculate the real exchange rate since the big mac is so standardized and easy to compute.
- One might ask whether the Big Mac is tradable goods or not.
- Some parts of Big mac, for example, bread and meat, are clearly tradable.
- However, the following research shows that substantial part of the cost comes from non-tradable goods and service.

Ingredient	Regression in Levels: Coefficient Estimates[1]	Regression in Levels: Implied Cost Share (%)[2]	Change Regression: Coefficient Estimates[3]
Traded:			
Beef	3.010	9.0	2.257
	(0.645)		(0.669)
Cheese	2.530	9.4	1.995
	(0.592)		(0.625)
Lettuce	1.546	0.7	6.017
	(3.645)		(3.476)
Onions	1.156	0.5	4.411
	(3.610)		(3.239)
Bread	13.428	12.1	11.256
	(3.053)		(3.200)
Nontraded:			
Labor	9.245	45.6	11.823
	(0.832)		(1.069)
Rent	0.008	4.6	0.010
	(0.003)		(0.004)
Electricity	0.085	5.1	0.078
	(0.027)		(0.039)
		Total = 86.9%	
# of observations	318		284
Adjusted R-squared	.95		.66

[1,3] Coefficient estimates and standard errors are multiplied by 100. Estimation method is random effects. Hausman test statistic for levels regression is $\chi^2(8) = 5.8$ (significance level =0.67), and the test statistic for the change regression (1st differences) is $\chi^2(8) = 3.3$ (significance level =0.91

[2] The share attributed to the ith ingredient is computed as: $\hat{\beta}_i \overline{P}_i / \overline{P}_{Big\ Mac}$, where $\overline{P}_i$ is the average price of the ith input.

The source:"A Prism into the PPP Puzzles: The Micro-foundations of Big Mac Real Exchange Rates" by David C. Parsley, Shang-Jin Wei, Economic Journal

Implication of Balassa Samuelson Model (1)

- Why the barber in Japan have a higher wage than the barber in India
- The number of customer that one barber can cut is almost the same in Japan and India
- In other words, in many non-tradable goods, the productivity of one person is the same across countries
- However, the wage rate of workers in non-tradable industry in Japan is much higher than the wage rate of the non-tradable industry in India
- The logic of the Balassa Samuelson model explain this fact very well

Implication of Balassa Samuelson Model (2)

- The logic of Balassa Samuelson Model goes as follows:
- Higher productivity in tradable sector
- Tradable sector can pay higher wage due to higher profitability
- More workers are attracted to tradable sector
- Initially, no workers work in non-tradable sector
- Supply of non-tradable goods will becomes so small
- In the market of non-tradable goods, the price of the non-tradable good will increase
- Increase of the non-tradable good implies that the wage rate in the non-tradable sector increases.
- The increase of the price of non-tradable good and the wage rate in non-tradable sector will continue until the wage rate in the non-tradable sector and the tradable sector becomes the same

Implication of Balassa Samuelson Model (3)

- The above mechanism explains why the wage rate of a barber in Japan is higher than the wage rate of a barber in India.
- The mechanism has three components
- First, people want to and need to consume some non-tradable goods
- Second, labor are mobile between tradable and non-tradable sectors
- Third, the productivity of the tradable sector is higher in Japan than in India.
- Higher productivity of tradable industry will put upward wage pressure on workers in non-tradable industry