Balassa Samuelson Effect
An Application of the Specific Factor Model

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Let the price level in country A be $P_A$ and the price level in country B be $P_B$.

Let the nominal exchange rate of the currency of country A in terms of 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 logic of the purchasing 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?

Real Exchange Rate based on Big Mac

- India
- Malaysia
- China
- Philippines
- Indonesia
- Mexico
- Japan
- Greece
- Estonia
- Hungary
- Chile
- Costa Rica
- Netherlands
- Spain
- Euro area
- Israel
- Uruguay
- Finland
- Switzerland

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
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 productivities of hair cut and restaurants are the same in developed countries and developing countries. However, the productivities of tradable sector such as manufacturing sector are different across countries.
Consider a three goods model where the utility function of a representative consumer is given as follows

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

- Consumers gain utility consuming from three goods.
- $c_n$ is the consumption of non-tradable goods.
- $c_x$ and $c_m$ are the consumption of tradable goods.
- $c_x$ is the consumption of goods produced in exporting sector.
- $c_m$ is imported goods. This goods is not produced in this country.
Let $A^x \times F^x(K_x, L_x)$ be the production 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-tradable sector.

$K_x$ and $K_n$ are specific capital for good $x$ sector and good $n$ sector.

$L_x$ and $L_n$ 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 $L_x + L_n = \bar{L}$

The production function of each sector exhibits the diminishing marginal product of labor.
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 country 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 completely vertical.
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

$$p_x A^x \frac{\Delta F^x(K_x, L_x)}{\Delta L^x} = w$$

$$p_n \frac{\Delta F^n(K_n, L_n)}{\Delta L^n} = w$$

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.
Holding other things constant, as $P_n$ 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-tradable will increase. This implies that the supply function of non-tradable goods is an increasing function of $p_n$. 

![Diagram showing supply and demand curves for non-tradable goods.](image-url)
- Now consider the effect of an increase of the productivity of tradable sector $A^x$.
- As $A^x$ increases, the $P_x \times A^x \times MPL_x$ 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 developing countries.
- Assume that the production functions 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 productivity. 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 available for developed countries.
Prediction of the model (2)

- From the previous slide, in a country 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
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.
## Table 1: Regression Results

<table>
<thead>
<tr>
<th>Ingredient Traded:</th>
<th>Regression in Levels</th>
<th>Change Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient Estimates$^1$</td>
<td>Implied Cost Share (%)$^2$</td>
</tr>
<tr>
<td>Beef</td>
<td>3.010 (0.645)</td>
<td>9.0</td>
</tr>
<tr>
<td>Cheese</td>
<td>2.530 (0.592)</td>
<td>9.4</td>
</tr>
<tr>
<td>Lettuce</td>
<td>1.546 (3.645)</td>
<td>0.7</td>
</tr>
<tr>
<td>Onions</td>
<td>1.156 (3.610)</td>
<td>0.5</td>
</tr>
<tr>
<td>Bread</td>
<td>13.428 (3.053)</td>
<td>12.1</td>
</tr>
</tbody>
</table>

| Nontraded:        |                      |                  |                              |
| Labor             | 9.245 (0.832)        | 45.6             | 11.823 (1.069)               |
| Rent              | 0.008 (0.003)        | 4.6              | 0.010 (0.004)                |
| Electricity       | 0.085 (0.027)        | 5.1              | 0.078 (0.039)                |

Total = 86.9%

| # of observations | 318                  | 284              |
| Adjusted R-squared| .95                  | .66              |

$^1$ 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 $i$th ingredient is computed as: $\frac{\hat{\beta}_i F_i}{\bar{F}_{Big Mac}}$, where $\bar{F}_i$ is the average price of the $i$th 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
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.
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 become 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.
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.