



THE INDUSTRIAL EQUILIBRIUM EXCHANGE RATE

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Definitions

- A firm will be competitive in open economies when its profitability is similar to the one obtained by their competitors in domestic and foreign markets
- In order to enable the participation of domestic firms in the foreign market:
 - The profitability, calculated in local currency, of the exporters should be similar, or close, to the profitability that they would obtain for their performance in the domestic market, assuming the latter is satisfactory.
 - And this profitability has also to equalize the one obtained by their competitors in foreign trade in order to keep the competitiveness of domestic firms in the global market.



Definitions

- The variable that would enable this equalization between the profitability of the exporters in domestic and foreign markets is the exchange rate
- *The profit margin is essential to understand the concept of equilibrium exchange rate*
- The current account equilibrium exchange rate is defined as the one that ensures a satisfactory profitability for such a number of companies engaged in foreign trade which generate a volume of exports and imports resulting in a current account equilibrium
- There is a single equilibrium exchange rate, that is the current equilibrium, for an economy that is not suffering from Dutch disease process



Definitions

- But, if an economy suffers a Dutch disease process, that is, it has comparative advantages relevant in the production of primary commodities and derivatives, companies operating in these sectors have a lower production cost or face higher prices in foreign markets.
- They have a higher profit margin, and a more appreciated exchange rate (compared to the necessary in the scenario where there is no Dutch disease) will be sufficient to ensure profitability.
- As the foreign trade operations of these companies have virtually guarantees the achievement of equilibrium in the current account, the value of the exchange rate necessary to ensure such equilibrium will also be lower than in the case of absence of natural and relevant comparative advantages.



Definitions

- However, a number of other companies that do not face the same comparative advantages will not reach the same profit margin.
- They require a higher exchange rate to remain competitive in foreign or domestic markets,
- Because in this scenario these companies lose access to the demand in the market they could compete, foreign or domestic (in the latter case due to cheap imports).
- In an economy suffering from the Dutch disease, such companies are those that produce manufactured goods.



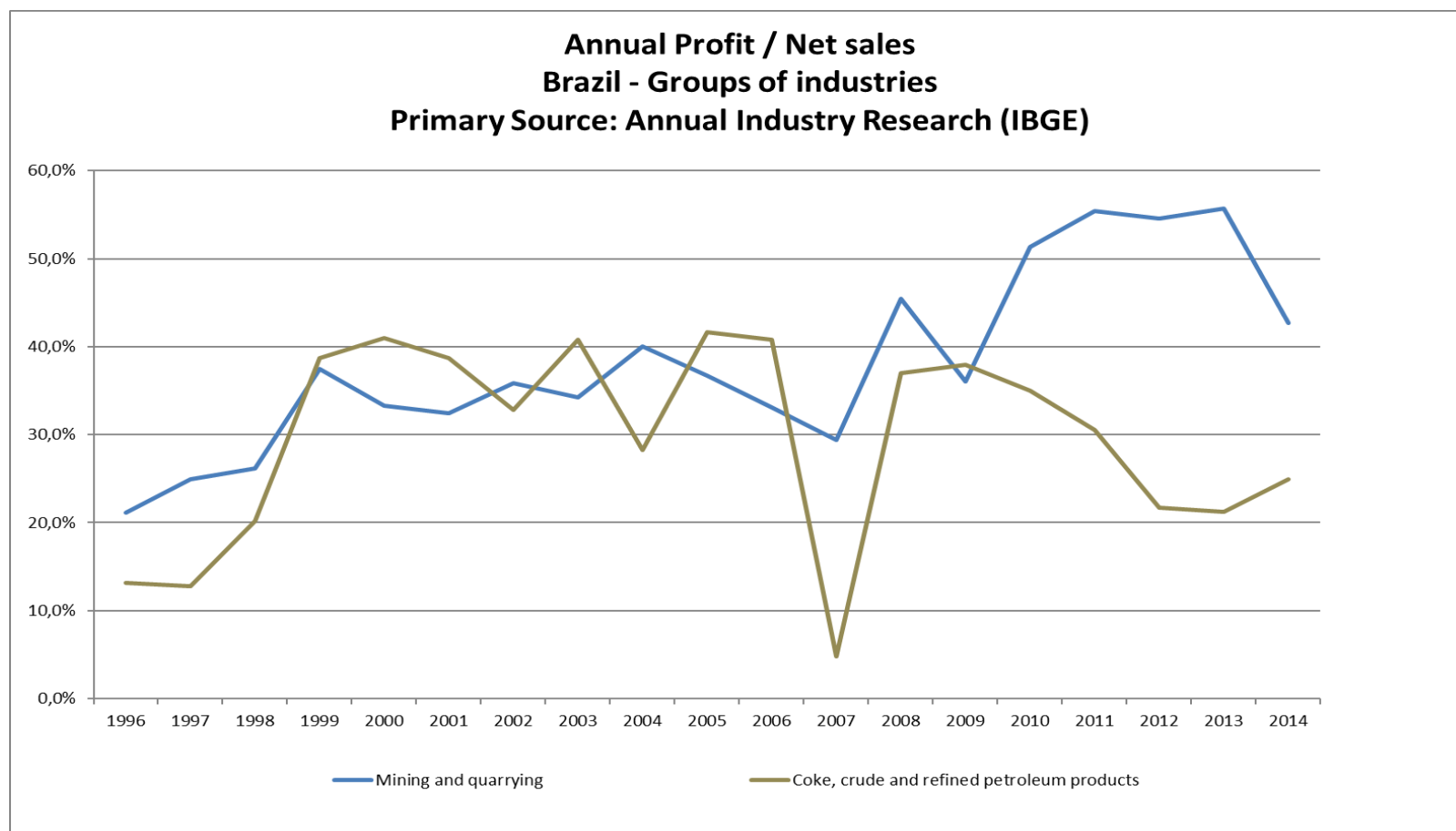
Example

	Producer of primary goods	Producer of manufacturing goods
Price in US\$	100	100
Average cost in reais	40	80
Exchange rate (R\$/US\$)	1	1
Average revenue in R\$	100	100
Profit margin	60	20

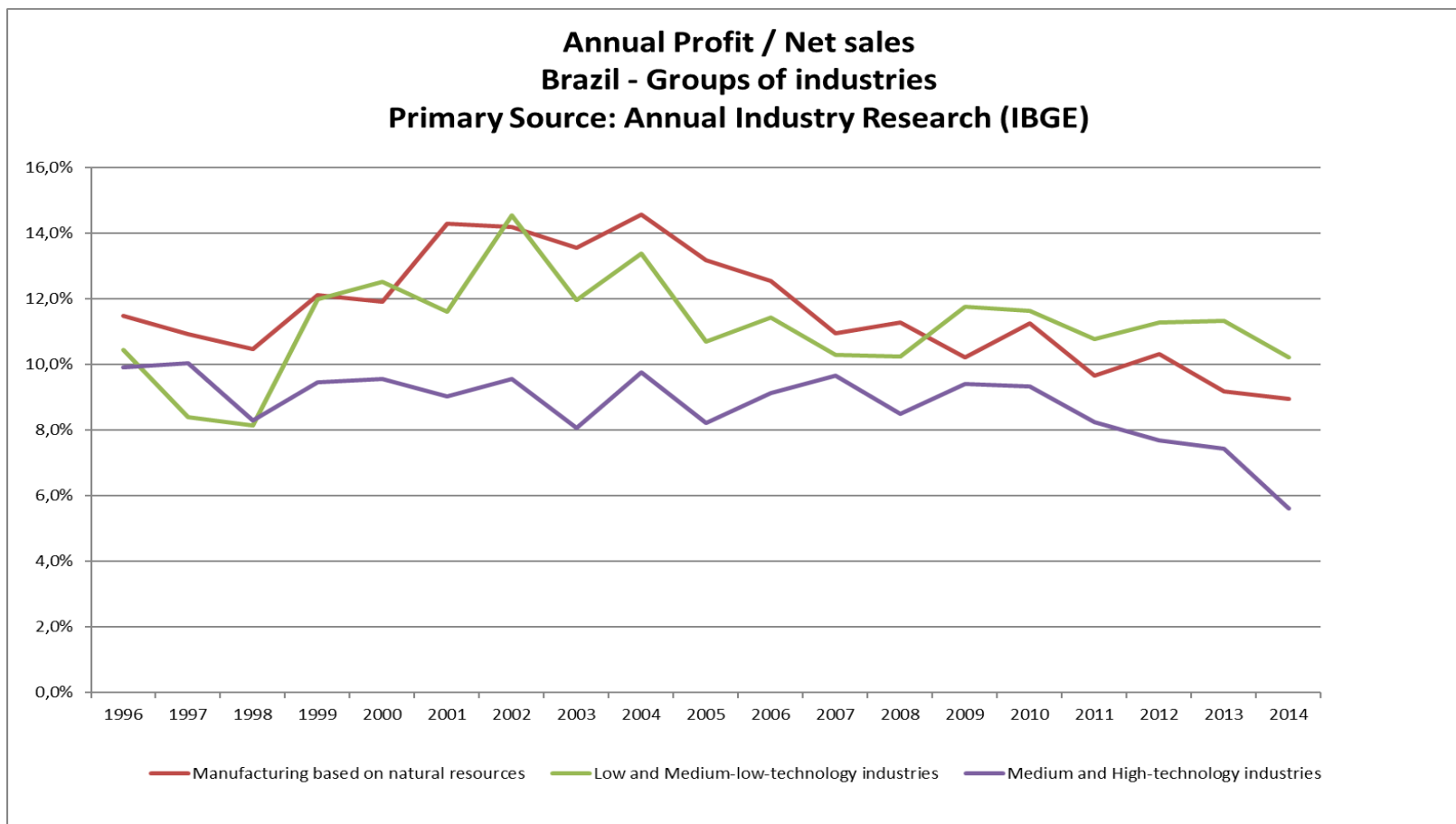
supposing an appretiation:

Exchange rate (R\$/US\$)	0,7	0,7
Average revenue in R\$	70	70
Profit margin	30	-10

In fact, profit margin of mining, quarrying and petroleum industries in Brazil are larger



And profit margin in other industries in Brazil are sticker and declining





Definitions of industries groups

1 - Mining and quarrying

2 - Manufacturing based on natural resources

Food products, beverages and tobacco

Basic metals and fabricated metal products

Other non-metallic mineral products

Biofuels

3- Medium-low-technology industries and low-technology industries

Rubber and plastics products

Wood, pulp, paper, paper products, printing and publishing

Textiles, textile products, leather and footwear

Manufacturing, n.e.c.; Recycling

4 - Medium-high-technology industries

Electrical machinery and apparatus, n.e.c.

Motor vehicles, trailers and semi-trailers

Chemicals excluding pharmaceuticals

Railroad equipment and transport equipment, n.e.c.

Machinery and equipment, n.e.c.

Building and repairing of ships and boats

4- High-technology industries

Aircraft and spacecraft

Pharmaceuticals

Office, accounting and computing machinery

Radio, TV and communications equipment

Medical, precision and optical instruments

5 - Petroleum

Crude petroleum

Coke, refined petroleum products and nuclear fuel



Definitions

- In a Dutch Disease framework, the exchange rate that manufacturing industries need to be competitive is different, higher than enough to ensure equilibrium in the current account; we call that rate as the "industrial equilibrium".
- The industrial equilibrium exchange rate is defined as the one enabling producers of manufactured goods close to the production frontier (or in the "state-of-art") to be competitive in relation to foreign firms (in foreign or domestic markets).



Definitions

- How to calculate the industrial equilibrium exchange rate?
- Remember that the definition of profit margin is essential to understand the concept of equilibrium exchange rate!
- Our discussion is based on the assumption that competitiveness requires equalization of profit margins.
- So the methodology of calculation for industrial equilibrium exchange rate is based on this assumption



What is the profit margin ?

$$P = M + C_{avg}$$

$$P = \mu P + C_{avg}$$

$$P - \mu P = C_{avg}$$

$$P(1 - \mu) = C_{avg}$$

$$P = \frac{1}{(1 - \mu)} \times C_{avg}$$

$$1 - \mu = \frac{C_{avg}}{P}$$

$$\mu = 1 - \frac{C_{avg}}{P}$$

P = price or marginal revenue

M = profit per unit

C_{avg} = average cost

μ = profit margin ($0 < \mu < 1$)



In closed economies,

$$\mu = 1 - \frac{C_{avg}}{P}$$

$$C_{avg} = \frac{W}{\lambda}$$

$$\mu = 1 - \frac{W/\lambda}{P}$$

W = wage rate

λ = average labor productivity

W/λ = unit labor cost

Profit margin will vary according to the real unit labor cost



In open economies,

Marginal revenue in domestic currency for exporters in country A is:

$$P = P_g \times E$$

Average cost is:

$$C_{avg} = \emptyset \frac{W}{\lambda} + (1 - \emptyset) P_{imp} \times E$$

And their profit margin is:

$$\mu_a = 1 - \frac{\emptyset \frac{W}{\lambda} + (1 - \emptyset) P_{imp} \times E}{P_g \times E}$$

P_g = Price of good in global market

E = nominal exchange rate

P_{imp} = Price of imported inputs in global markets

\emptyset = Share of domestic goods in production



In open economies,

$$\mu_a = 1 - \left[\emptyset \frac{\frac{W}{\lambda}}{P_g \times E} + (1 - \emptyset) \frac{P_{imp}}{P_g} \right]$$

P_g = Price of good in
global market

E = nominal exchange
rate

And the profit margin for the competitive firms
abroad is:

P_{imp} = Price of imported
inputs in global markets

$$\mu_b = 1 - \left[\emptyset_b \frac{W/\lambda_b}{P_g} + (1 - \emptyset)_b \frac{P_{imp\ b}}{P_g} \right]$$

\emptyset = Share of domestic
goods in production



In open economies,

Since competitiveness requires equalization of profit margins,

$\mu_a = \mu_b$, in order to country "a" to be competitive

$$1 - \left[\phi \frac{\frac{W}{\lambda}}{P_g \times E} + (1 - \phi) \frac{P_{imp}}{P_g} \right] = 1 - \left[\phi_b \frac{W/\lambda_b}{P_g} + (1 - \phi)_b \frac{P_{imp\ b}}{P_g} \right]$$

Rearranging the equation,

$$E = \frac{\phi W / \lambda}{\phi_b W / \lambda_b + (1 - \phi)_b P_{imp\ b} - (1 - \phi) P_{imp}}$$



In open economies,

The exchange rate that will equalize profit margins would be defined by:

- Unit labor costs in country “a” and abroad (“b”)
- Price of imported inputs used by producer in country “a”,
- Price of imported inputs used by producers abroad,
- Share of domestic goods in production in country “a” and abroad

This is a useless definition, since all this information is difficult to get from many countries and competitors



How to calculate the industrial equilibrium exchange rate ?

In order to make a simpler estimation, we consider that

$$P_{imp} = P_{imp\ b}$$

(since both competitors face the “same” global market), and

$$\emptyset = \emptyset_b$$

(that is, the share of local inputs is the same for competitors; they produce same goods with similar combination of inputs)

$$\frac{W/\lambda}{P_g \times E} = \frac{W/\lambda_b}{P_g}$$



How to calculate the industrial equilibrium exchange rate ?

$$E = \frac{W/\lambda}{W/\lambda_b}$$

The industrial equilibrium exchange rate is defined as the relation between unit labor costs in country "a" and abroad, that is, in the countries in which competitors on the global market produce (*b*)

Multiplying both terms by $\frac{1}{\frac{P_a}{P_b}}$, where P = average price level; $W/\lambda = ULC$

$$\frac{E.P_b}{P_a} = \frac{\frac{ULC_a}{P_a}}{\frac{ULC_b}{P_b}}$$

The the real exchange rate of a country will be at its satisfactory level – to maintain the competitiveness of its producers of manufactured goods on the foreign market – when it is equal to the ratio between the real unit labour costs of *a* and *b*. This is the "industrial equilibrium real exchange rate" (IEER)



How to calculate the industrial equilibrium exchange rate ?

The industrial equilibrium is an effective exchange rate between the currency of the country where exporter " a " produces and the currencies of countries in which competitors on the global market (b) produce

Step 1

- ✓ Thus, it is necessary to calculate the unit labor costs of Brazil and its major trading partners, defined as those with the largest trade flows towards our country.
- ✓ Through the analysis of Brazilian trade flows since 1995, it is clear that there are a number of countries beyond which extend the analysis does not bring more analytical benefits. In fact by adding the participation of the largest fifteen Brazilian commercial partners, we have, on average, more than 75% of the total annual trade flow, requiring more than half of that number to add another 5%.
- ✓ In order to make it easier and without informational loss analysis, calculation proposed here is restricted to the analysis of unit labor costs of the fifteen main Brazilian trade partners for manufactured goods.



How to calculate the industrial equilibrium exchange rate ?

Countries included (and corresponding 2009-2015 share in Brazilian trade flow) are:

United States	21,66%
China	18,54%
Argentina	15,34%
Germany	9,37%
Korea, Rep.	5,10%
Japan	4,73%
Mexico	4,65%
Italy	3,98%
France	3,53%
Netherlands	3,04%
United Kingdom	2,44%
Spain	2,11%
Chile	2,04%
India	1,80%
Canada	1,68%



How to calculate the industrial equilibrium exchange rate ?

Step 2

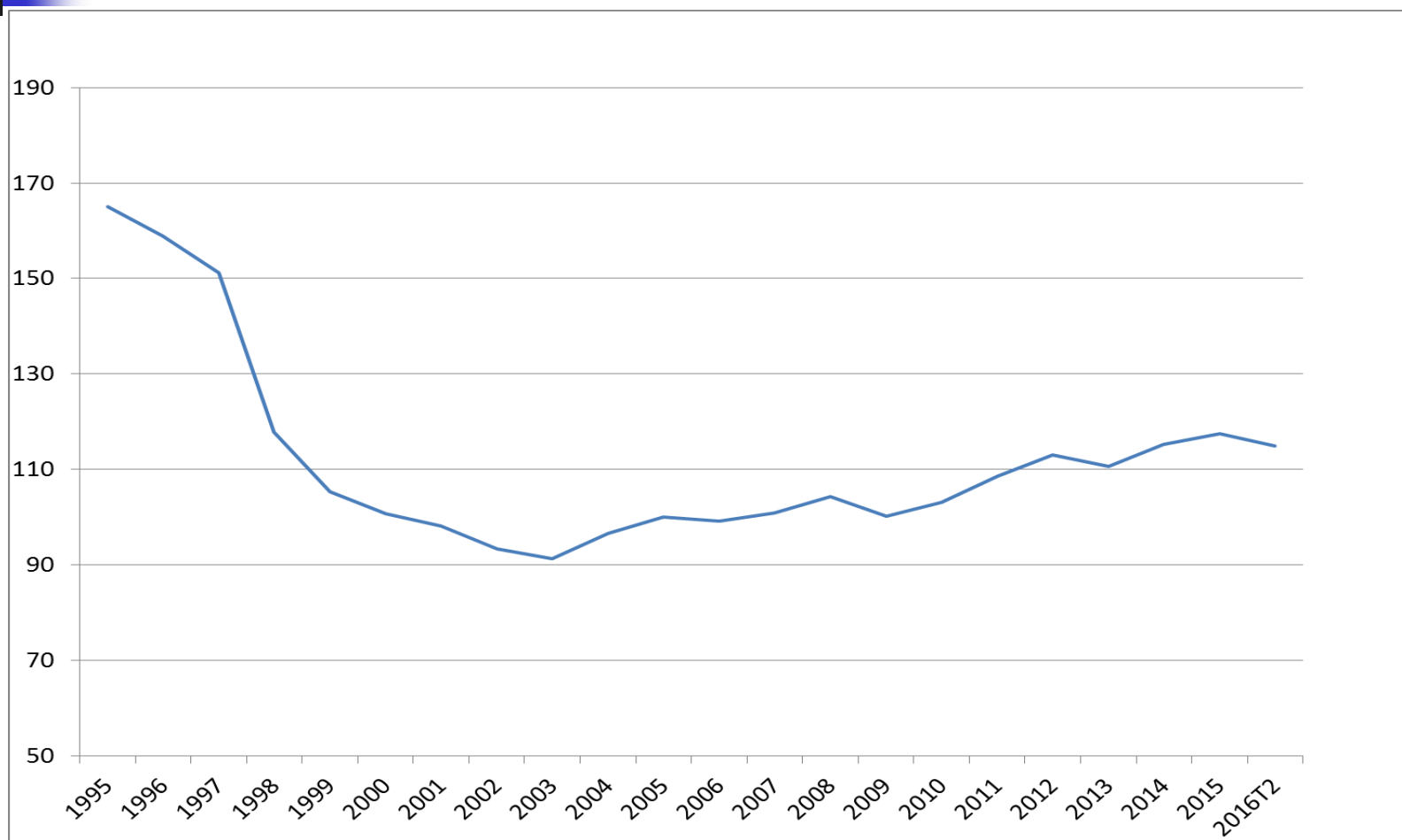
- ✓ Then we calculate unit labor costs in local currency for these countries, and perform the weighted average of their unit costs, which becomes indicative of the unit labor costs of the main partners of Brazilian trade flow and should be compared directly to the unit labor cost in Brazil.
- ✓ *IEER* is calculated as the ratio between unit labor cost in Brazil and unit labor costs of its trading partners.
- ✓ So the increase in this ratio means that unit labor costs in Brazil increased more than the average of its competitors, indicating loss of competitiveness. A higher (more devaluated) exchange rate will be necessary to recover competitiveness of Brazilian manufacturing. The same reasoning applies otherwise. This measure of this relative competitiveness is the *IEER*.
- ✓ *IEER* is a index of a real effective exchange rate based on the ratio between unit labor costs in Brazil and unit labor costs in main trading Brazilian partners (regarding trade in manufactured goods).

Index of real industrial equilibrium exchange rate

2005 = 100 – moving average in 12 months

Source: IBGE, WDI, FMI and statistical government organizations

Calculus: Center for New Developmentalism

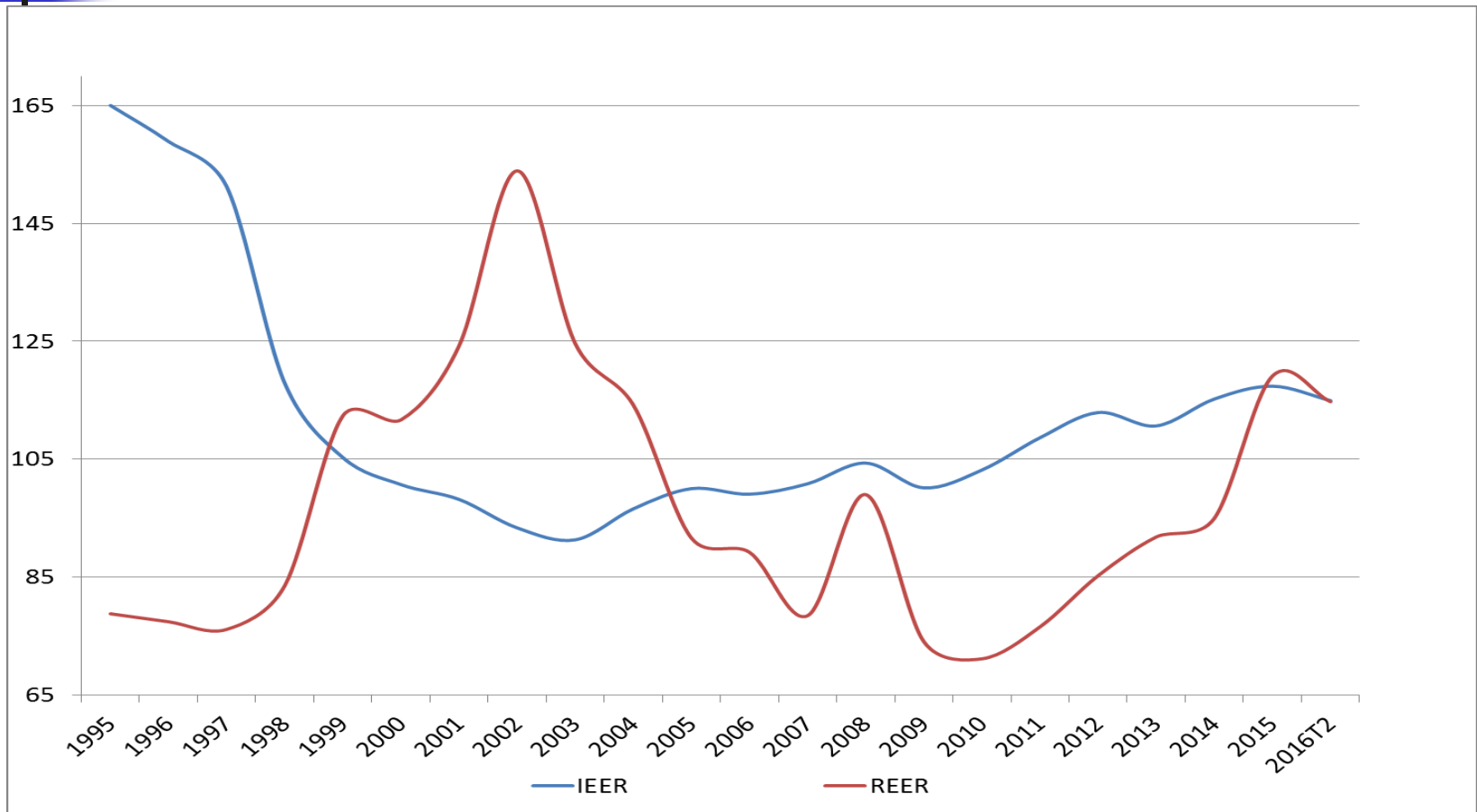


Index of real industrial equilibrium exchange rate (IEER) and real effective exchange rate (REER)

2005 = 100 – moving average in 12 months

Source: IBGE, WDI, FMI and statistical government organizations

Calculus: Center for New Developmentalism





How to calculate the industrial equilibrium exchange rate ?

But this is a index !

We need to calculate a value of the current exchange rate that corresponds to this industrial equilibrium index

Step 3

- ✓ Find a year basis
- ✓ It should be an year in which the observed real exchange rate is at the level of industrial equilibrium exchange rate
- ✓ Since the level of industrial equilibrium exchange rate is by definition more depreciated than the level of the current account equilibrium exchange rate, the country with Dutch disease should have a current account surplus that year basis.
- ✓ Given that Dutch disease in the Brazilian economy is not severe but moderate, that surplus should be small.
- ✓ Thus it was chosen the year 2005, in which the exchange rate was around the industrial balance, since the current account balance presented a slightly surplus.



How to calculate the industrial equilibrium exchange rate ?

Once the effective industrial equilibrium exchange rate index (*IEER*) is calculated and year basis is found, it is necessary to calculate a value of the current nominal exchange rate R\$/US\$ that corresponds to that level of *IEER*

Step 4

- ✓ The value of equilibrium exchange rate can be calculated from the application of the formula below, which is derived from the basic formula of a real effective exchange rate calculation.
- ✓ Given the value of other currencies in reais, we calculate the nominal exchange rate R\$/US\$ would allow the real exchange rate to stay at the level of *IEER* found for 2005.



How to calculate the industrial equilibrium exchange rate ?

- $IEER = \sum_{i=1}^n \frac{R\$}{LCU_i} \frac{CPI_i}{CPI_{BRA}} weight_i$
- $IEER = \frac{R\$}{US\$} \frac{CPI_{USA}}{CPI_{BRA}} weight_{USA} + \sum_{i=2}^n \frac{R\$}{LCU_i} \frac{CPI_i}{CPI_{BRA}} weight_i$
- $IEER = \frac{R\$}{US\$} \frac{CPI_{USA}}{CPI_{BRA}} weight_{USA} + \sum_{i=2}^n \frac{R\$}{US\$} \frac{US\$}{LCU_i} \frac{CPI_i}{CPI_{BRA}} weight_i$
- $IEER = \frac{R\$}{US\$} \frac{CPI_{USA}}{CPI_{BRA}} weight_{USA} + \frac{R\$}{US\$} \sum_{i=2}^n \frac{US\$}{LCU_i} \frac{CPI_i}{CPI_{BRA}} weight_i$
- $IEER = \frac{R\$}{US\$} \left[\frac{CPI_{USA}}{CPI_{BRA}} weight_{USA} + \frac{1}{CPI_{BRA}} \sum_{i=2}^n \frac{US\$}{LCU_i} CPI_i weight_i \right]$



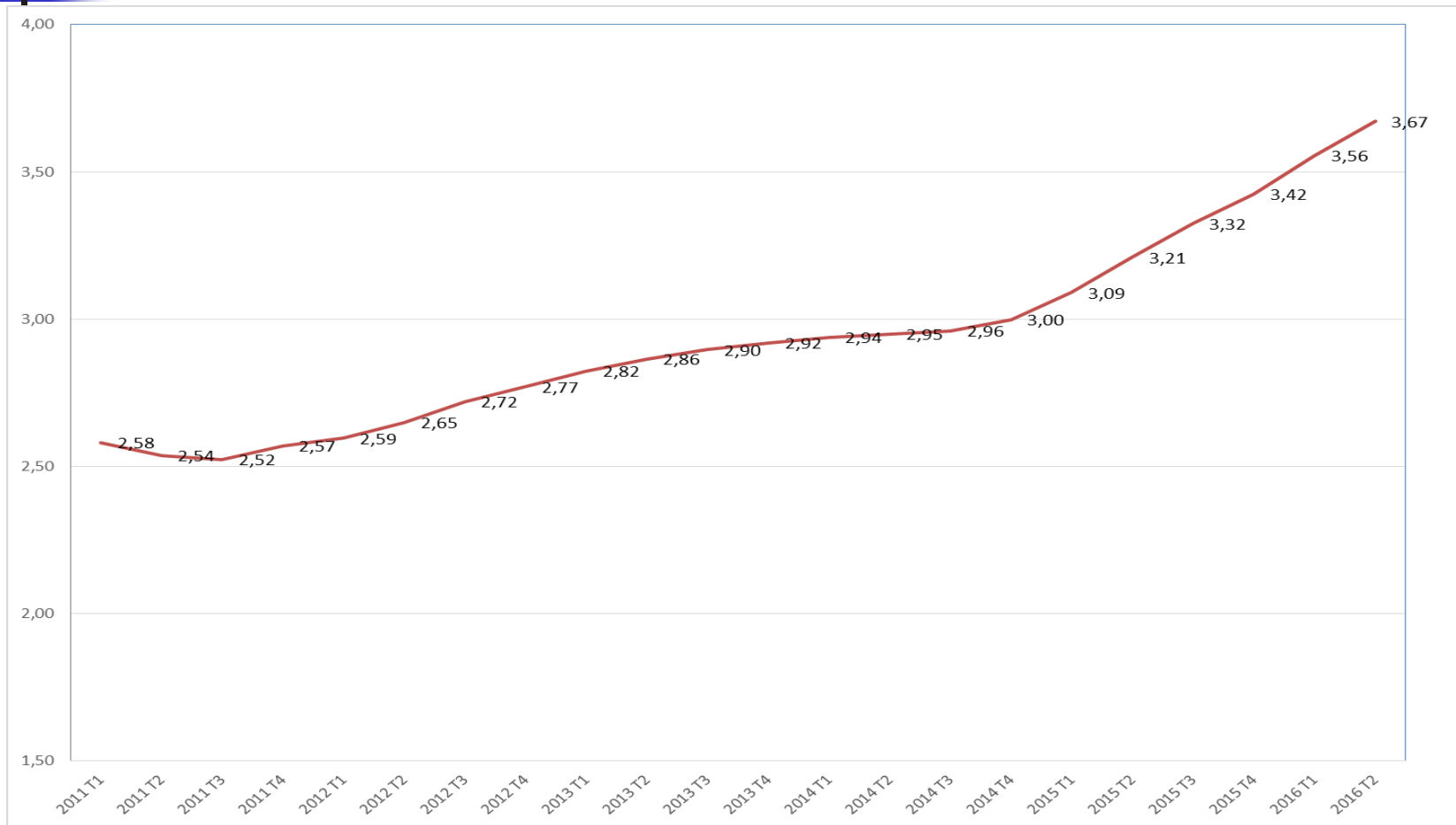
How to calculate the industrial equilibrium exchange rate ?

$$\left(\frac{R\$}{US\$} \right)^* = \frac{IEER_{2005}}{\left[\frac{CPI_{USA}}{CPI_{BRA}} weight_{USA} + \frac{1}{CPI_{BRA}} \sum_{i=2}^n \frac{US\$}{LCU_i} CPI_i weight_i \right]}$$

After this calculation, we divide this result by 100 and multiply it by the bilateral nominal exchange rate R\$/US\$ in 2005 (our year basis)

This is the necessary bilateral nominal exchange rate to return to the *IEER* in 2005

Necessary nominal bilateral exchange rate (R\$/US\$)
to return to the real industrial equilibrium exchange rate of 2005
Source: IBGE, WDI, FMI and statistical government organizations
Calculus: Center for New Developmentalism



What happened to the investment rate in recent years?

Composition of investment rate	Values at current prices (1 000 000 R\$)					
	2010	2011	2012	2013	2014	2015
Total	21,8	21,8	21,4	21,7	20,9	17,7
Investment	20,5	20,6	20,7	20,9	20,2	18,2
Construction	10,2	10,4	10,8	10,7	10,6	10,1
Housing	4,1	4,2	4,6	4,7		
Others	6,1	6,2	6,2	6,0		
Machinery and equipments	8,0	7,8	7,5	7,9	7,1	5,5
Transport equipment	3,0	2,9	2,6	2,7		
TIC Equipment	1,1	1,1	1,1	1,2		
Others	3,9	3,9	3,8	4,0		
Others	2,3	2,4	2,4	2,3	2,5	2,5
Intellectual property products	1,9	2,0	2,1	2,0		
Research and development	0,9	0,9	0,9	0,9		
Software, mineral exploration and evaluation	1,1	1,2	1,2	1,2		
Other fixed assets	0,4	0,3	0,3	0,3		
Source: IBGE, National Accounts						