

# **Exchange rates and trade**

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ADBI-JIIA International Symposium on current global trade  
governance: toward the next agenda, Plaza Hall, Tokyo, Japan  
November 10<sup>th</sup>, 2015



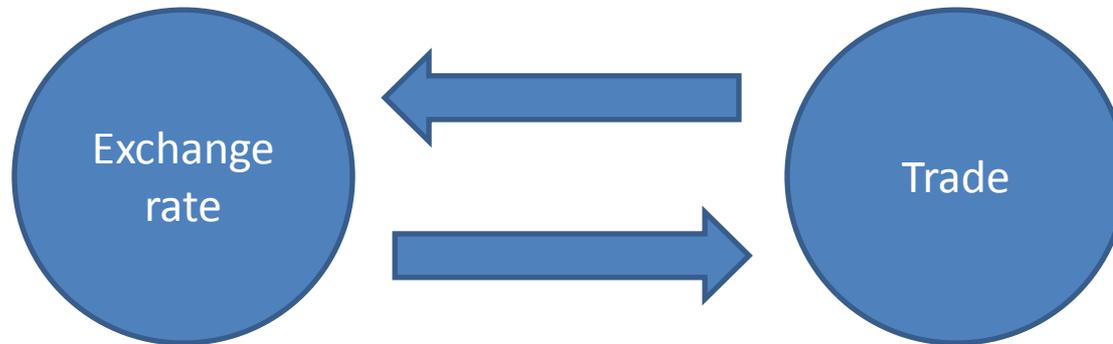
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# 1. Trade and exchange rates: An endogenous relationship

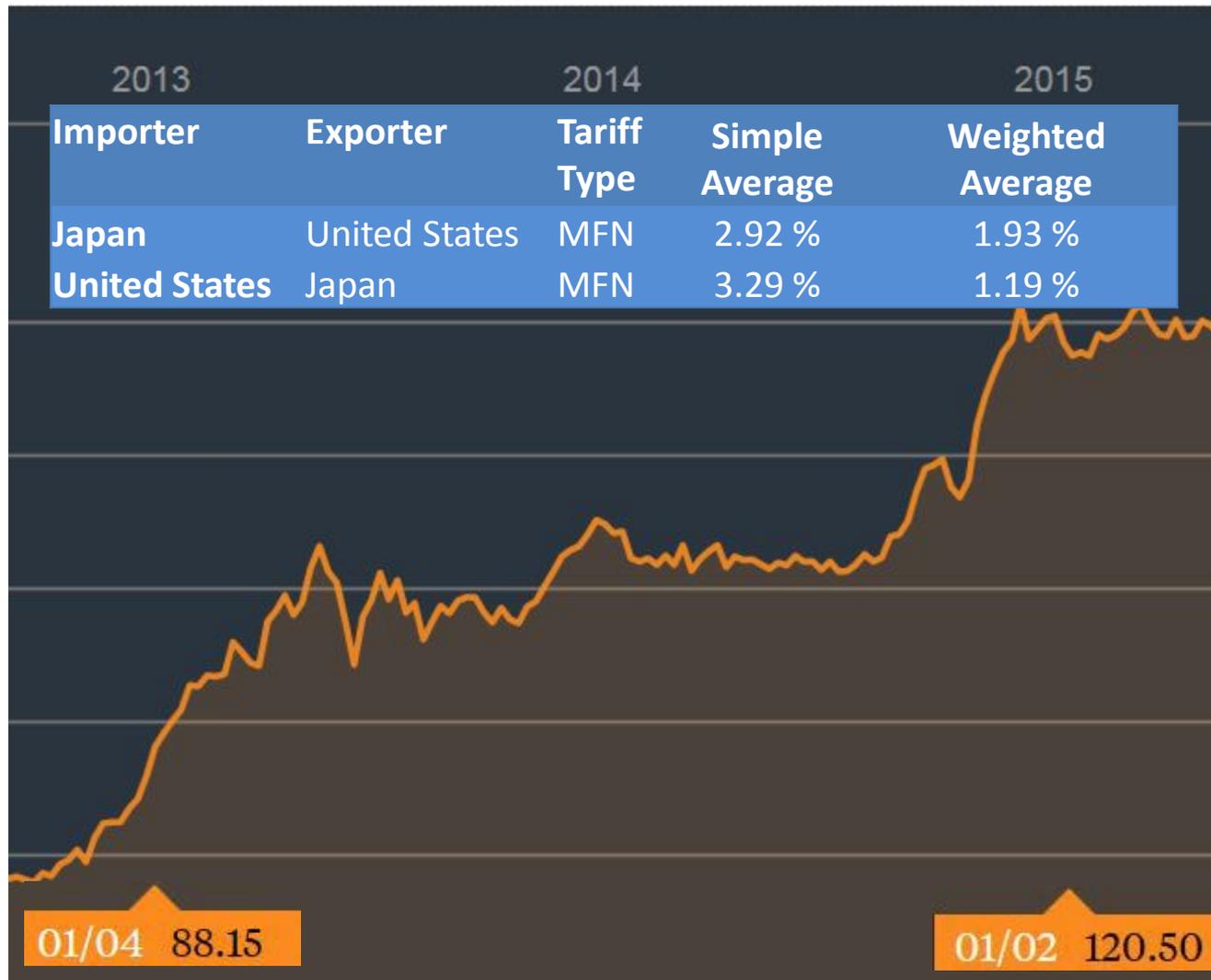
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1. Trade rules limit governments ability to use traditional trade policy measure, which creates the temptation to use **currency depreciation** as substitute for trade measure.
2. A currency devaluation is equivalent to a uniform ad valorem export subsidy on all export goods and an import tariff on all imported goods.
3. Early TPP negotiations assumed exchange rates to be exogenous.

# Example

## Yen – US Dollar vs. Japan-US Tariffs (2014)



Source: Bloomberg, UNTRAINS (2015)

# 1. Trade and exchange rates: An endogenous relationship

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## Exogeneity test of exchange rate in Trade equation:

- Davidson and MacKinnon (1993) suggested an augmented regression test (Durbin-Wu-Hausman test). (See Ravankar and Yoshino (1990, RES, **Weak exogeneity test**)

## Structural Equations

$$\text{Current Account/GDP} = \alpha + \beta(\text{Terms of Trade}) + \delta(\text{FDI/GDP}) + u_{CA}$$

$$\begin{aligned} \text{Exchange rate} = & a + b(\text{financial account/GDP}) + c(\text{financial uncertainty}) \\ & + d(\text{expected currency appreciation}) + e(\text{interest differential}) + u_{EX} \end{aligned}$$

## Reduced Form Equation

$$\text{Exchange rate} = \text{all exogenous variables} + U_e$$

→ Exogeneity Test  $E(U_e, U_{CA}) = 0$  or Not

$$\rightarrow \text{Current Account/GDP} = \alpha + \beta(\text{Terms of Trade}) + \delta(\text{FDI/GDP}) + h \times U_e + U_{CA}$$

It can be easily formed by including the residuals of each endogenous right hand side variable, as a function of all exogenous variables, in a regression of the original model.

## 2.1 Basic econometric exercise shows that the exchange rate is endogenously determined by the current account balance

- We used quarterly data from 2000Q1 to 2015Q1, for 9 out of 12 economies in TPP free trade pact (AU, CA, JP, MY, US, VN, SG, NZ) and Asian countries (HK, IN, ID, KR, PH, TH, and PRC) and (EU).

### Simultaneous equation:

#### Equation 1:

$$\text{Log(Exchange Rate}_{it}) = 3.30 + 0.08(\text{financial account/GDP}_{it}) - 0.02\text{log(global financial uncertainty}_{it}) + 0.01\text{log(expected currency appreciation}_{it}) + 0.01(\text{interest differential}_{it})$$

(9.27)\*\*\* (1.10)
(-1.81)\*
(3.91)\*\*\*\*
(2.37)\*\*\*

#### Equation 2:

$$\text{Current account/GDP}_{it} = 0.04 + 0.06\text{log(term of trade}_{it}) + 0.0(\text{FDI/GDP}_{it}) + 0.05(\text{residual from Exchange Rate Regression}_{it})$$

(10.3)\*\*\*
(3.44)\*\*\*
(-1.34)
(2.56)\*\*\*\*

*If the coefficient in front of the residual from FX regression is statistically different from zero, then OLS is not consistent. The test implies endogeneity of the foreign exchange rate equation.*

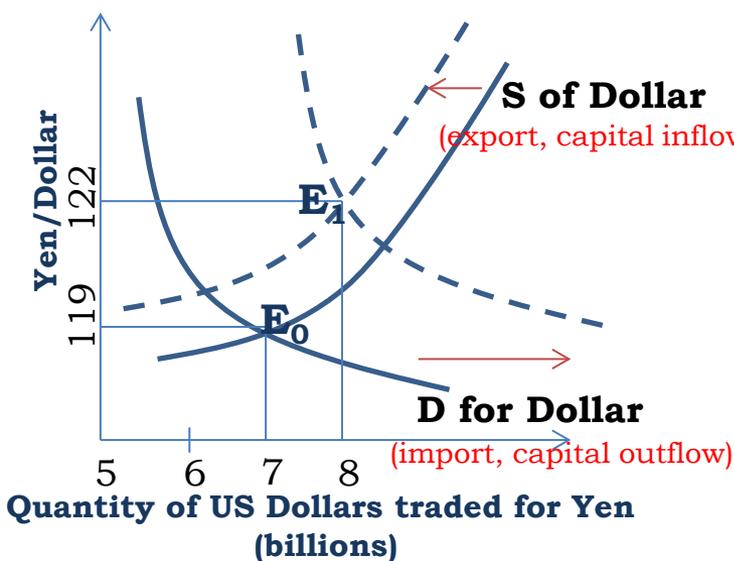
Note: t value in the parenthesis, fixed effect regression with overall r-square=0.36, number of observation = 563

Note: Using augmented regression test (Durbin-Wu-Hausman test) suggested by Davidson and MacKinnon (1993). It can be easily formed by including the residuals of each endogenous right hand side variable, as a function of all exogenous variables, in a regression of the original model.

## 2.2 Equilibrium in foreign exchange market

### Purchasing power parity (PPP):

- Over the long term, exchange rates must have some relationship to the **buying power of the currency in terms of goods that are internationally traded**.
- If at a certain exchange rate it was much cheaper to buy internationally traded goods (oil, steel, cars, etc.)—in one country than in another country, businesses would start buying in the cheap country, selling in other countries, and earns profits.



- In the end, arbitrage process will force prices and exchange rates to align so that the price of internationally traded goods is similar in all countries.
- The exchange rate that equalizes the prices of internationally traded goods across countries is called the **purchasing power parity (PPP) exchange rate**
- In PPP, exchange rate changes are induced by changes in relative price levels between two currencies
- **Future work:** Behavioral equilibrium exchange rate, which
  1. Consider influence of capital flows on the exchange rate, such as relative interest return, net foreign asset position, FDI, foreign debt, shocks, etc.
  2. Consider factor determining current account in detail, such as relative term of trade, fiscal stance, productivity, etc.

# How to determine over- and undervaluation?

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## Calculation of currency overvaluation index:

**1. The real exchange rate (RER)** is defined as:

$$\ln(RER_{it}) = \ln(XRAT_{it}/PPP_{it}) \quad (3)$$

Where  $RER_{it}$  is the real exchange rate,  $XRAT_{it}$  is the nominal exchange rate and  $PPP_{it}$  is purchasing power parity conversion factors. All are expressed as national currency per unit of USD, and are averaged over 5 years.

**2. Balassa-Samuelson adjusted RER** is defined by the regression of:

$$\ln(RER_{hatit}) = 5.124 - 0.353 \ln(RGDPCH_{it}) - 0.002(time\_effectit) \quad (4)$$

(19.29)\*\*\*      (-9.24)\*\*\*      (-0.72)

Balassa-Samuelson effects means non-tradable goods are cheaper in poorer countries). We regress RER on GDP per capita (RGDPCH) here. This implies that when income rises by 10 percent, the real exchange rate falls by around 3.5 percent.

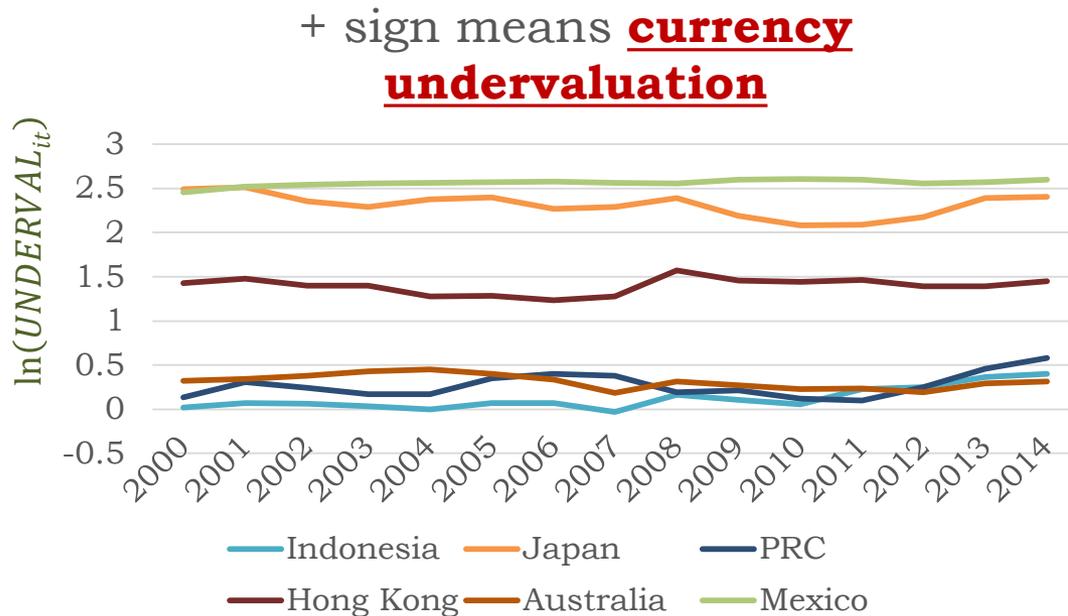
**3. Index of undervaluation** is defined as:

$$\ln(UNDerval_{it}) = \ln(RER_{it}) - \ln(RER_{hatit}) \quad (5)$$

Where  $\ln(UNDerval_{it}) > 0$  implies currency undervaluation, ( $< 0$  is currency overvaluation)

Note: We followed the methodology of Rodrik (2008) which based on price comparison using the long run equilibrium concept, instead of definition that relates to external balance . BASED ON TRADE.

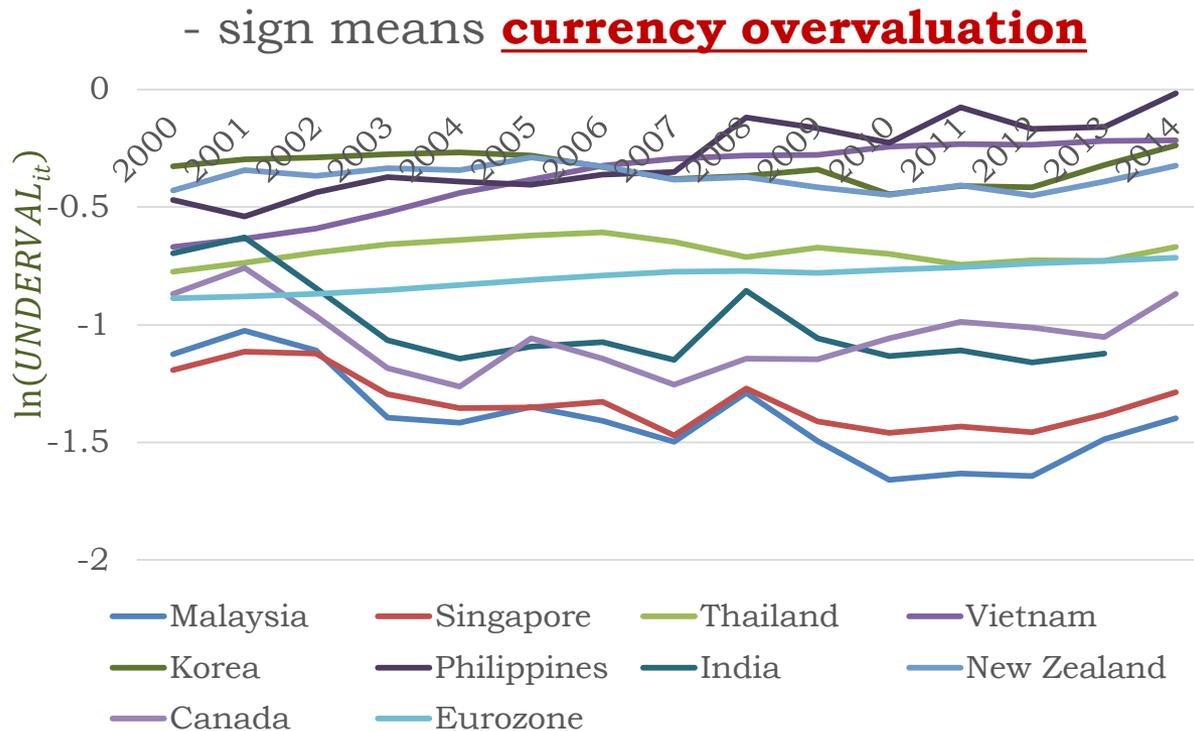
# Which economies have undervalued currencies?



$\ln(UNDerval_{it}) > 0$  indicates **currency undervaluation** (led by Mexico, Japan and Hong Kong). The exchange rate is set such that goods produced at home are relatively cheap in dollar terms.

Note: the index of currency overvaluation is a measure of domestic price level adjusted for the Balassa-Samuelson effect. This index has the advantage of comparable across countries as well as over time. This is the calculation of the equilibrium exchange rate using the long run concept. We followed the methodology of Rodrik (2008)

# Which economies have overvalued currencies?



$\ln(UNDerval_{it}) < 0$   
**indicates currency overvaluation** (led by Malaysia, Singapore India and Canada).

Note: the index of currency overvaluation is a measure of domestic price level adjusted for the Balassa-Samuelson effect. This index has the advantage of comparable across countries as well as over time. This is the calculation of the equilibrium exchange rate using the long run concept. We followed the methodology of Rodrik (2008)

# 3.1. Gravity Estimation

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- Research question: Does undervaluation promote exports?
- Main variables:
  - Dependent variable: Yearly bilateral trade flows
  - Independent variable: Distance, GDP, nominal exchange rate/USD, undervaluation measure
- 17 economies included: **Australia**; **Canada**; Eurozone; Hong Kong, China; India; Indonesia; **Japan**; Republic of Korea; **Malaysia**; **Mexico**; **New Zealand**; Philippines; **Singapore**; Thailand; PRC; **Viet Nam**; **USA**
- Years covered: 2000-2014
- Nbr. of obs.: 4080 (17\*16\*15) bilateral relations
- Basic gravity equation (Anderson and van Wincoop, 2003):
$$\log(\text{trade})_{ijt} = a_0 + a_1 \ln(\text{GDP})_{it} + a_2 \ln(\text{GDP})_{jt} + a_3 \ln(\text{tradedcosts})_{ijt} + a_4 \ln(\text{undervaluation})_{ijt} + a_5 (\text{Exporter multilateral resistance})_{it} + a_6 \ln(\text{Importer multilateral resistance})_{jt} + \varepsilon_{ijt}$$

## 3.2. Undervaluation provides an advantage for exporters...

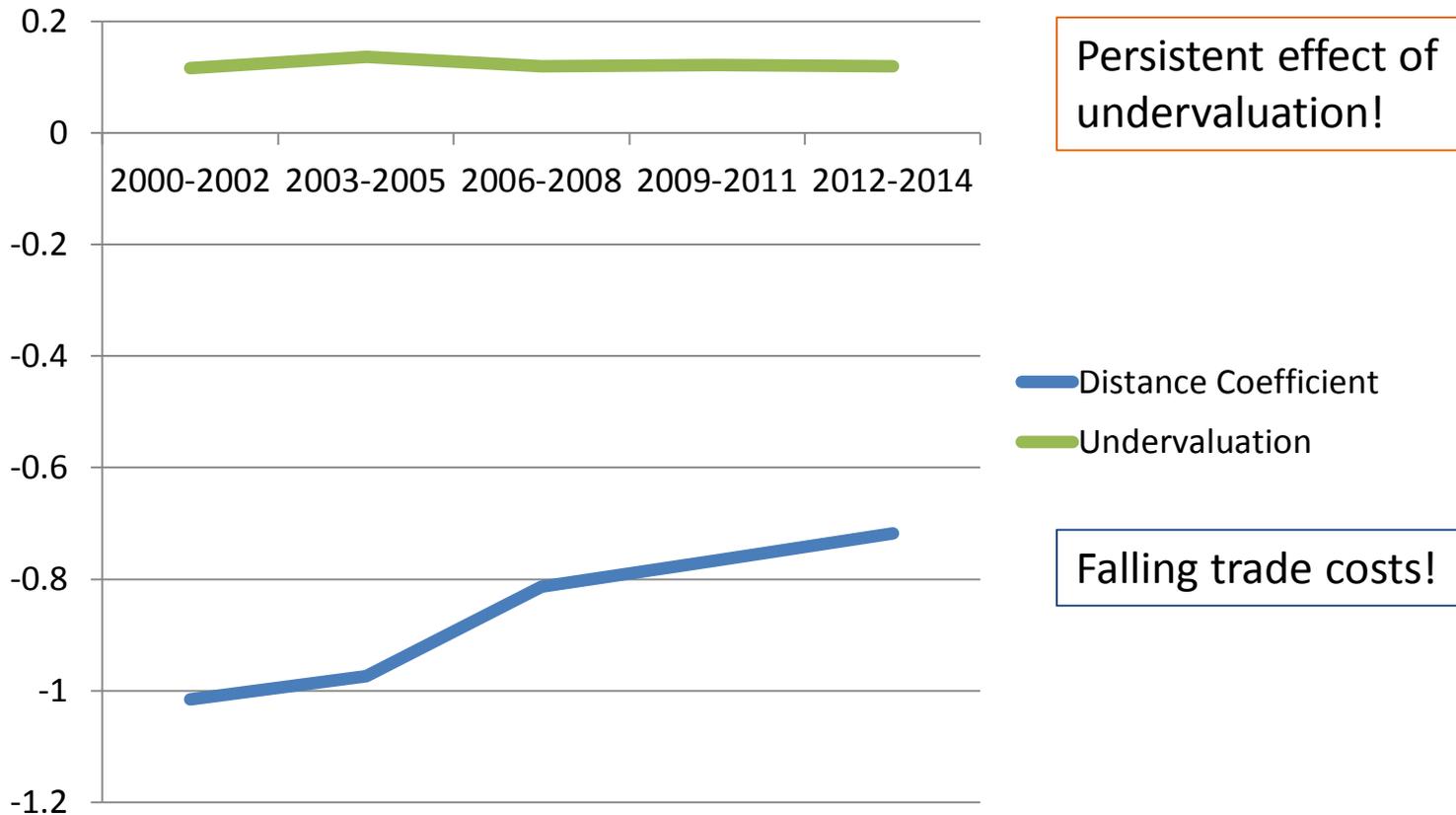
Gravity equation results for exports 2000-2014:

	(1) All Trade	(2) TPP	(3) All Trade	(4) TPP	(5) All Trade	(6) TPP	(7) All Trade	(8) TPP
Log (Distance)	-0.836*** (0.0272)	-1.270*** (0.0646)	-0.838*** (0.0266)	-1.270*** (0.0644)	-0.706*** (0.0189)	-1.161*** (0.0526)		
Log (GDP Exporter)	0.304*** (0.00712)	0.608*** (0.0240)	0.307*** (0.00755)	0.664*** (0.0254)				
Log (GDP Importer)	0.296*** (0.00786)	0.743*** (0.0250)	0.294*** (0.00742)	0.686*** (0.0243)				
Log (GDP per capita Exporter)	0.177*** (0.0163)	0.0998** (0.0486)	0.218*** (0.0171)	0.103** (0.0462)				
Log (GDP per capita Importer)	0.248*** (0.0166)	0.00898 (0.0497)	0.208*** (0.0167)	0.00595 (0.0503)				
Log (Exchange Rate to USD Exp.)	0.00312 (0.00780)	-0.000417 (0.0161)	0.0203** (0.00796)	0.0195 (0.0155)				
Log (Exchange Rate to USD Imp.)	<b>-0.0348***</b> (0.00801)	<b>-0.0703***</b> (0.0172)	<b>-0.0526***</b> (0.00806)	<b>-0.0902***</b> (0.0194)				
Undervaluation			<b>0.123***</b> (0.0113)	<b>0.101***</b> (0.0194)	<b>0.0765*</b> (0.0451)	<b>0.171**</b> (0.0728)	<b>3.253***</b> (0.530)	<b>4.139***</b> (0.911)
Observations	4,044	1,064	4,014	1,064	4,044	1,080	4,044	1,080
R-squared	0.634	0.829	0.646	0.835	0.917	0.940	Not reported	Not reported
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
ImpYearFE & ExpYearFE	NO	NO	NO	NO	YES	YES	YES	YES
Country-pair FE	NO	NO	NO	NO	NO	NO	YES	YES

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Several bilateral variables are not reported, such as common language, shared border or RTA.

### 3.3. Undervaluation continues to matter for trade...



Note: Coefficients estimated for three consecutive years using specification:

$$\log(\text{trade})_{ijt} = a_0 + a_1 \ln(\text{GDP})_{it} + a_2 \ln(\text{GDP})_{jt} + a_3 \ln(\text{tradedcosts})_{ijt} + a_4 \ln(\text{undervaluation})_{ijt} + a_5 (\text{Exporter multilateral resistance})_{it} + a_6 \ln(\text{Importer multilateral resistance})_{jt} + \varepsilon_{ijt}$$

## 4. JOINT DECLARATION OF THE MACROECONOMIC POLICY AUTHORITIES OF TPP COUNTRIES

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In their joint declaration the TPP countries commit:

1. to foster an exchange rate system that reflects economic fundamentals and to refrain from competitive devaluation.
2. to release publicly a range of macroeconomic information and data to support dialogue and improve transparency.
3. to set up regular dialogue on macroeconomic and exchange rate policy issues, with the aim of sharing information and understanding the impact of policies on other countries.

First time that unfair currency practices are addressed in free-trade agreement.

# 4.1. Joint Declaration of the Macroeconomic Policy Authorities of Trans-Pacific Partnership Countries

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## Preamble

Macroeconomic policy authorities of the TPP Members:

... “recognize the importance of orienting our fiscal and monetary policies toward meeting **domestic** objectives, with due regard for the **effects** of our policies on other TPP countries.”

.... “recognize that **allowing real exchange rates to adjust** in line with economic fundamentals facilitates smooth macroeconomic adjustment, helps to avoid prolonged external imbalances, and promotes strong, sustainable, and balanced global growth.”

**Pledge not officially part of TPP.**

# Joint Declaration of the Macroeconomic Policy Authorities of Trans-Pacific Partnership Countries

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## **I. Exchange Rate Policies**

“Each Authority confirms that its country is bound under the Articles of Agreement of the International Monetary Fund (IMF) to avoid manipulating exchange rates or the international monetary system in order to prevent effective balance of payments adjustment or to gain an unfair competitive advantage.

Each Authority is to take policy actions to foster an exchange rate system that reflects underlying economic fundamentals, and avoid persistent exchange rate misalignments.

Each Authority will refrain from competitive devaluation and will not target its country’s exchange rate for competitive purposes.”

TPP members will not be subject to any trade sanction.

## 4.2. Joint Declaration of the Macroeconomic Policy Authorities of Trans-Pacific Partnership Countries

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### **II. Transparency and Reporting**

Each Authority will disclose publicly:

- (a) Each country's IMF Article IV Staff Report, including exchange rate assessment;
- (b) Foreign-exchange reserves data including forward positions (monthly);
- (c) Intervention in spot and forward foreign exchange markets (at least quarterly);
- (d) Balance of payments portfolio capital flows (quarterly);
- (e) "Broad" money stock (quarterly);
- (f) Exports and imports (quarterly);
- (g) Confirmation that it is participating in the IMF Currency Composition of Official Foreign Exchange Reserves ("COFER") database.

**Similar transparency commitments compared to those by IMF.**

## 4.3. Joint Declaration of the Macroeconomic Policy Authorities of Trans-Pacific Partnership Countries

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### **III. Macroeconomic Policy Consultations**

1. *Multilateral dialogue* . To establish a Group of TPP Macroeconomic Officials (the “Group”) to meet at least annually.
2. The Group will consider the macroeconomic and exchange rate policies of each TPP country, especially the effects of such policies on other TPP countries; issues or challenges with respect to transparency or reporting; and the policy responses which address imbalances.
3. The Group is to prepare and publish reports, communiqués, or other documents regarding the meeting and any conclusions that reflect the collective views of the Group

## 5. Conclusion

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1. When TPP negotiated, exchange rate assumed to be exogenous. Paper shows that exchange rate is endogenously determined.
2. CA and FX equations have to be estimated simultaneously.
3. Gravity equation results confirms that exchange rate plays role in trade, especially among TPP members.
4. Joint Declaration important step to address exchange rate issue.
5. However, joint declaration is separate document and «misbehavior» cannot lead to trade sanctions.

**THANK YOU VERY MUCH**

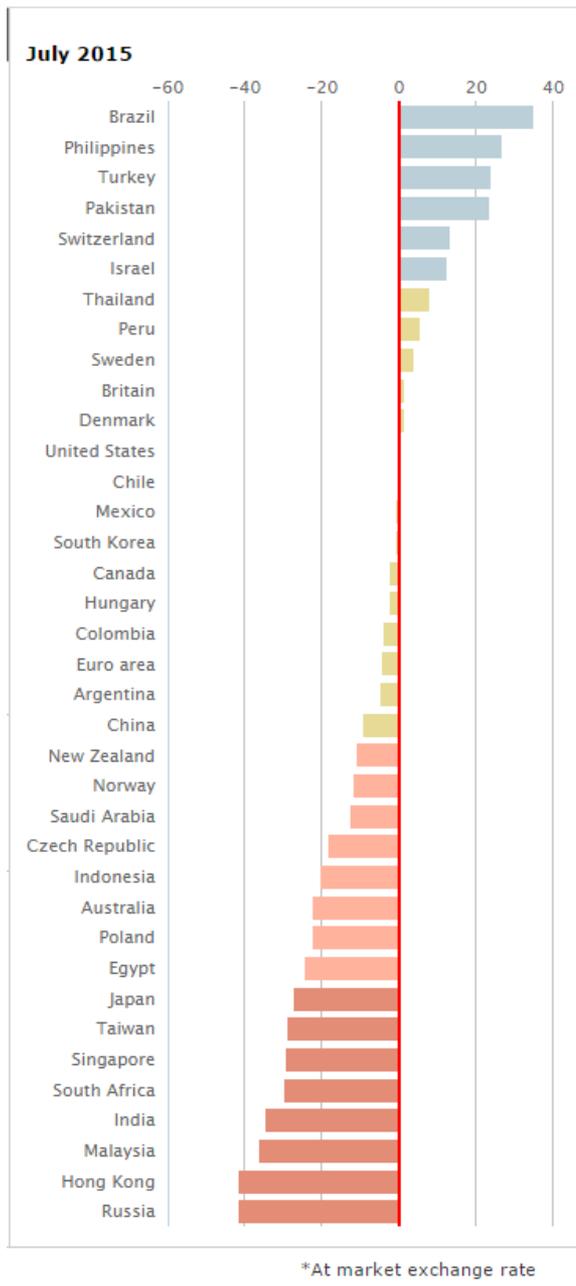
**FOR YOUR ATTENTION**

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## Big Mac index shows consistent results:



- THE Big Mac index was invented by *The Economist* in 1986 as a lighthearted guide to whether currencies are at their “correct” level.
- It is based on the theory of purchasing-power parity (PPP), the notion that in the long run exchange rates should move towards the rate that would equalise the prices of an identical basket of goods and services (in this case, a burger) in any two countries.
- For example, the average price of a Big Mac in America in July 2015 was \$4.79; in China it was only \$2.74 at market exchange rates. So the "raw" Big Mac index says that the yuan was undervalued by 43% at that time.
- Burgernomics was never intended as a precise gauge of currency misalignment, merely a tool to make exchange-rate theory more digestible.
- This adjusted index addresses the criticism that you would expect average burger prices to be cheaper in poor countries than in rich ones because labour costs are lower.
- PPP signals where exchange rates should be heading in the long run, as a country like China gets richer, but it says little about today's equilibrium rate.
- The relationship between prices and GDP per person may be a better guide to the current fair value of a currency.
- The adjusted index uses the “line of best fit” between Big Mac prices and GDP per person for 48 countries (plus the euro area).

Source: The economist