ECON 6356
International Finance and Macroeconomics

Lecture 3: The Terms of Trade and the Deviations from the Purchasing Power Parity

Camilo Granados
University of Texas at Dallas
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ER = Nominal Exchange Rate
(Price of the foreign currency units,
in terms of home currency units)

Introduction

From this point onward we want to start considering specific goods produced in different locations and the possibility that not all goods are traded.

LOP/LOOP

Thus, we need to establish some definitions: The Law of One Price (LOP), the Parity of Purchasing Power (PPP), the Real Exchange Rate (RER), and the Terms of Trade (TOT).

PPP RER

We will see how these are related and how different assumption lead to potential violations to the PPP.

Definitions

Consider two locations, *home (h)* and *foreign (f)*. Furthermore let:

- P_H: price of home produced good (in home currency)
- P_F: price of foreign produced good (in home currency)
- P_H^*: price of home produced good in foreign currency
- P_F^*: price of foreign produced good in foreign currency
- ε: nominal exchange rate (in home currency units; home currency units paid for a single unit of foreign currency)

Law of One Price: The price of an **identical good** should be the same when expressed in a **common currency**

Example: dollar price of a cup of coffee in US vs. price, also in dollars in the UK

$$LOP: \quad P_{H,t} = \varepsilon_t \times P^*_{H,t}$$

or in log-linear terms:

$$LOP: \quad \mathsf{P}_{\mathsf{H,t}} = \epsilon_t + \mathsf{P}^*_{\mathsf{H,t}}$$

Where non-italic letters refer to the log-linear version of the original variable (log of variable minus log of steady state), and ϵ_t is the log-linear version of the nominal exchange rate.

The idea is that if prices were not equal there would be arbitrage opportunities (in trading goods)

For this to hold we need assumptions implying trading markets are frictionless.

Purchasing Power Parity

Generalization of LOP concept to a **basket** (bundle) of goods.

If LOP holds for all goods, **and baskets are similar between countries**, it's only natural to think that the price of the baskets will equalize too.

More interesting (than LOP) as we measure inflation in terms of baskets

In levels: $P_t = \varepsilon_t \times P_t^*$

In log-linear terms:

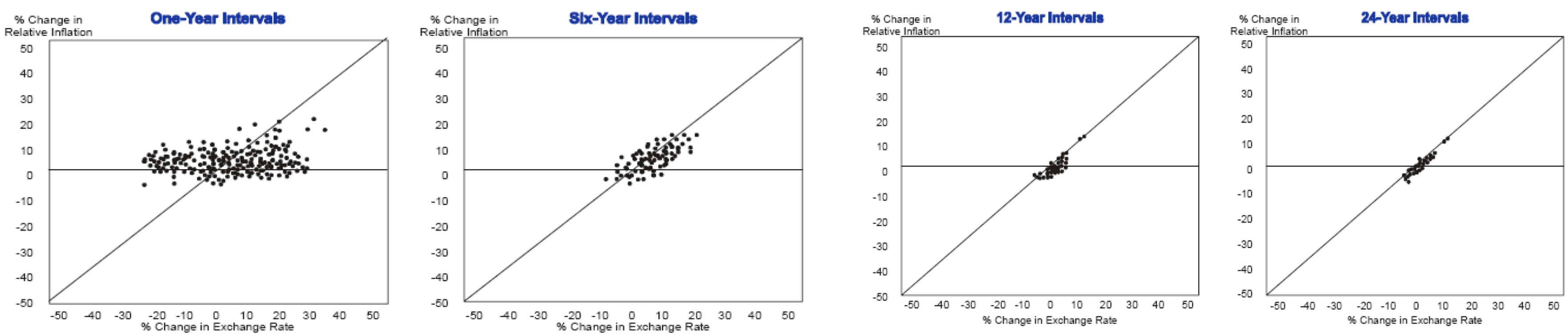
$$PPP : \quad \mathsf{P}_\mathsf{t} = \epsilon_t + \mathsf{P}_\mathsf{t}^*$$

If LOP holds for all goods in the basket, PPP holds.

if LOP does not hold for some goods, PPP may still hold as it is an average of individual prices

Purchasing Power Parity (cont.)

PPP holds relatively well in the long-run (when prices are likely to adjust) but it's not a good approximation in the short-run.



Source: Taylor and Feenstra (2016)

Implications (set the equation in differences –or inflation terms): In the Long-Run inflation differentials determine the exchange rates (depreciation).

But in the short-run we see <u>deviations from the PPP</u>.

Sources of PPP Deviations and the RER

Here we cover some details on the sources of PPP deviations and the implications for the Real Exchange Rate (RER) dynamics.

RER: relative price of consumption across countries.

How many units of home consumption it takes to buy one unit of foreign consumption.

$$RER = \frac{\varepsilon_t P_t^*}{P_t} \xrightarrow{\text{units}} \frac{\frac{\cancel{\text{home curr}}}{\cancel{\text{foreign curr}}} \times \frac{\cancel{\text{foreign curr}}}{\text{foreign Goods}}}{\frac{\cancel{\text{home curr}}}{\text{home goods}}} = \frac{\text{home goods}}{\text{foreign goods}}$$

Recall its definition (in log-linear terms):

$$Q_t = e_t + P_t^* - P_t$$

where e_t is the nominal ER (units of home currency per unit of foreign), $P_t(P_t)$ is the home (foreign) consumer price index.

If PPP holds we have that: $Q_t = 0$ (i.e., $\varepsilon P^* = P$)

Real exchange rate depreciation: $Q_t \uparrow$

Sources of PPP Deviations and the RER (cont.)

There are several sources of deviations of PPP:

1. Deviations from the LOP: frictions in trade costs, Pricing to Market (PTM), Local Currency Pricing (LCP)

2. Home Bias in preferences

3. Non-traded goods

Deviations from the Law of One Price

Frictions in trade costs

Suppose an environment with 2 countries, each producing a type of good (2 goods, 2 countries). Assume households use an Armington aggregator to combine each (home and foreign) good into their consumption basket.

Let the weights or shares be: a: home good, $(1-a)$: foreign good.

Assume an identical consumption basket. The prices level in each location are (in log-linear terms):

$$\mathsf{P}_t = a\mathsf{P}_{H,t} + (1-a)\mathsf{P}_{F,t},$$
$$\mathsf{P}^*_t = a\mathsf{P}^*_{H,t} + (1-a)\mathsf{P}^*_{F,t},$$

with $\mathsf{P}_{H,t}(\mathsf{P}_{F,t})$: home currency price of home (foreign) good, $\mathsf{P}^*_{F,t}(\mathsf{P}^*_{H,t})$: foreign currency price of foreign (home) good.

If LOP holds:

$$\mathsf{P}_{F,t} = \mathsf{e}_t + \mathsf{P}^*_{F,t},$$
$$\mathsf{P}_{H,t} = \mathsf{e}_t + \mathsf{P}^*_{H,t},$$

We can substitute these expressions in the equations above and get:

$\mathsf{P}_t = \mathsf{P}^*_t + \mathsf{e}_t \quad \Rightarrow \; \mathsf{Q}_t = 0$ (i.e., PPP holds)

Now, suppose LOP does not hold: there is a friction in international trade, e.g., a tariff τ_t s.t.:

$$\begin{aligned} \mathsf{P}_{F,t} &= \boxed{\tau_t} + \mathsf{e}_t + \mathsf{P}^*_{F,t}, \\ \mathsf{P}_{H,t} &= \boxed{\tau_t} + \mathsf{e}_t + \mathsf{P}^*_{H,t}, \end{aligned}$$

Substituting:

$$\mathsf{P}_t = \mathsf{e}_t + \mathsf{P}^*_t + \tau_t \quad \text{(PPP will not hold)}$$

Then:

$$\underline{\mathsf{Q}_t = -\tau_t}$$

Thus, the fluctuations in the trade costs will translate into the RER fluctuations.

Not only this is a violation of PPP, but it is also not a good theory of the RER fluctuations: empirically, trade costs do not move much over the business cycle.

Pricing-to-Market (PTM)

Alternative theory of LOP deviations. PTM: firms charge different prices at different markets.

In earlier literature PTM occurs as a result of price discrimination.

Local Currency Pricing (LCP)

Similarly, we can have that firms set prices in the currency of the consumers.

LCP implies deviations from LOP *if* prices are sticky:

Assume that home (foreign) firms can segment markets and set the price $\mathsf{P}_{H,t}(\mathsf{P}_{F,t})$ for the home market and $\mathsf{P}^*_{H,t}(\mathsf{P}^*_{F,t})$ for the foreign one.

Assume these prices are set 1 period in advance (1 period stickiness): prices in t were set in $t-1$ (and will adjust to t shocks in $t+1$).

Then, any ER movement (e) will translate into deviations of PPP and movements of the RER.

With 1 period stickiness P_t, P_t^* won't move in t, then $\mathsf{P}_t = \mathsf{P}^*_t = 0$.

Then, there is no pass-through of the exchange rate into the prices.

Thus, in t: $\mathsf{Q}_t = \mathsf{e}_t$ (in t the RER tracks the ER)
This is a relatively better theory of the RER fluctuations.

Home Bias in Preferences

Individuals may prefer to consume local goods and that creates a deviation from the PPP.

Assume again that individuals aggregate home and foreign final goods into a consumption basket.

But let's assume a change in weights: $a \in (0, 1)$ for domestic good (own good), and $(1-a) \in (0, 1)$ for foreign good.

$a = 1/2$ implies no Home Bias (same consumption baskets)

$a > 1/2$: Home Bias in preferences (higher consumption of local good)

Basket prices now are:

$$\mathrm{P_t} = a\mathrm{P}_{H,t} + (1-a)\mathrm{P}_{F,t},$$

$$\mathrm{P}_t^* = a\mathrm{P}_{F,t}^* + (1-a)\mathrm{P}_{H,t}^*,$$

Before:
$\mathrm{P}_t = a\mathrm{P}_{H,t} + (1-a)\mathrm{P}_{F,t}$,
$\mathrm{P}_t^* = a\mathrm{P}_{H,t}^* + (1-a)\mathrm{P}_{F,t}^*$

Assume trade is frictionless and prices are flexible (or are set in currency of producers). Then: LOP holds,

$$\mathrm{P}_{F,t} = \mathrm{e}_t + \mathrm{P}_{F,t}^*,$$

$$\mathrm{P}_{H,t} = \mathrm{e}_t + \mathrm{P}_{H,t}^*,$$

Define the terms of trade (relative price of exports):

$$\mathsf{TOT}_t = \mathsf{P}_{H,t} - \mathsf{e}_t - \mathsf{P}^*_{F,t}$$ (TOT improvement/appreciation: $\uparrow \mathsf{TOT}_t$)

We can use simple algebra to link the RER and the TOT:

$$\begin{aligned}
\mathsf{Q}_t &= \mathsf{e}_t + \mathsf{P}^*_t - \mathsf{P}_t \\
&= \mathsf{e}_t + a\mathsf{P}^*_{F,t} + (1-a)\mathsf{P}^*_{H,t} - a\mathsf{P}_{H,t} - (1-a)\mathsf{P}_{F,t} \\
&= \mathsf{e}_t + a\mathsf{P}^*_{F,t} + (1-a)(\mathsf{P}_{H,t} - \mathsf{e}_t) - a\mathsf{P}_{H,t} - (1-a)(\mathsf{e}_t + \mathsf{P}^*_{F,t}) \\
&= (1-2a)(-\mathsf{e}_t) + (1-2a)\mathsf{P}_{H,t} + (1-2a)(-\mathsf{P}^*_{F,t}) \\
&= (1-2a)[\mathsf{P}_{H,t} - \mathsf{e}_t - \mathsf{P}^*_{F,t}] \\
&\boxed{= -(2a-1)\mathsf{TOT}_t}
\end{aligned}$$

$\Rightarrow$ RER is negatively proportional to TOT

If $a = 1/2$ (No HB), $\mathsf{Q}_t = 0$ and PPP holds; if $a > 1/2$ (HB): $\uparrow \mathsf{TOT}_t \Rightarrow \downarrow \mathsf{Q}_t$

Intuition:

TOT $\uparrow \longrightarrow$ home good is more expensive relative to foreign.

With households spending more disproportionately on their own good: $P_t \uparrow$, $\mathsf{P}^*_t \downarrow$

Thus: $\mathsf{Q}_t \downarrow$

Non-Traded Goods

Now, assume that there is a non-traded good (in each location).

Similar to before, the households aggregate consumption using an Armington aggregate with weights: b for the traded, $(1-b)$ for the non-traded good.

To simplify, consider each type of good is an homogeneous good (e.g., just traded good worldwide).

The prices are: (in log-linear terms around a symmetric steady state)

$$\mathsf{P}_t = b\mathsf{P}_{T,t} + (1-b)\mathsf{P}_{NT,t}, \tag{1}$$

$$\mathsf{P}_t^* = b\mathsf{P}_{T,t}^* + (1-b)\mathsf{P}_{NT,t}^*, \tag{2}$$

where $\mathsf{P}_{T,t}(\mathsf{P}^*_{T,t})$ is the home (foreign) currency price of the home (foreign) basket of traded goods, and $\mathsf{P}_{NT,t}(\mathsf{P}^*_{\mathsf{NT,t}})$ is the home (foreign) currency price of the home (foreign) non-trade basket.

Then,

$$\mathsf{Q}_t = \mathsf{Q}_{T,t} + (1-b)\overbrace{[\mathsf{P}_{T,t} - \mathsf{P}_{NT,t} - (\mathsf{P}^*_{T,t} - \mathsf{P}^*_{NT,t})]}^{\text{Diff in Relative prices b/w countries}},$$

with, $\mathsf{Q}_{T,t} = \mathsf{e}_t + \mathsf{P}^*_{T,t} - \mathsf{P}_{T,t}$ (RER for traded goods)

Each country's terms in the square brackets expression is the relative price of traded goods (with respect to non-traded).

RER$=$RER traded$+$Difference in relative prices' deviations

If PPP holds for traded goods: $\mathsf{Q}_T = 0$

If PPP does not hold for T goods: (e.g., because of HB, or due to deviations of LOP) $\mathsf{Q}_T \uparrow \rightarrow \mathsf{Q} \uparrow$

Q_t also moves if $\mathsf{P}_T - \mathsf{P}_{NT}$ moves: $(\mathsf{P}_T - \mathsf{P}_{NT}) \downarrow \Rightarrow \mathsf{Q} \downarrow$
(intuition here: if price of non-traded goods increases at home, then $\mathsf{P}_t \uparrow$ relative to P^*_t, e_t)

Engel (1999): Relative importance of Q-traded vs. Relative T/NT prices.

- Most of RER (Q) variation comes from $\triangle \mathsf{Q}_T$
- Variation in Q_T is driven by deviations of LOP

Engel's results are based on a LCP + Sticky prices setup which led to adopt LCP as underlying theory of PPP deviations (e.g., Chari, Kehoe, McGrattan, 2002, and Benigno, 2004).

Relation with Risk Sharing

A key result of international models (with no frictions and complete markets) is the fact that relative differences in consumption are either constant or intermediated by RER fluctuations.

This is known as **risk sharing** and is a powerful concept: due to financial and trade globalization, consumption differences are nil relative to potentially large income differences between economies.

The idea behind this is that expenditure switching and external borrowing increases a country's abilities to weather income fluctuations and smooth consumption.

You've probably seen this result in other courses (e.g., Micro) expressed as a constant or stable ratio of marginal utility between agents:

With complete markets: ratio of $MU_c \propto$ RER

Relation with Risk Sharing (cont.)

For example, with CRRA preferences and in log-linear terms: $\gamma(\mathsf{C}_t - \mathsf{C}_t^*) = \mathsf{Q}_t$

Intuition: Home consumption rising above foreign associated with home's consumer price index falling relative to foreign (for any nominal ER).

With PPP deviations (due to):

- LCP + sticky prices: $\gamma(\mathsf{C}_t - \mathsf{C}_t^*) = \mathsf{e}_t$ (in the period in which prices are fixed)
- HB in preferences: $\gamma(\mathsf{C}_t - \mathsf{C}_t^*) = -(2a-1)\mathsf{TOT_t}$
- Non-traded goods: $\gamma(\mathsf{C}_t - \mathsf{C}_t^*) = \mathsf{Q}_{T,t} + (1-b)\mathsf{P}_{T,t} - \mathsf{P}_{NT,t} - (\mathsf{P}_{T,t}^* - \mathsf{P}_{NT,t}^*)$

Problem here: Risk-sharing (condition) is not supported by evidence.