Empirical exercise 1

In this exercise you will analyze the correlation between the real exchange rate with future changes in the nominal exchange rate at horizons between 1 and 5 years. You are provided with a dataset containing the NER of two countries (China and Canada) against the US dollar, and the CPI for each country. Quarterly data between years 1994 and 2008.

1. Using this data, construct a series for the RER of each country $i = Can, Chi$ against the US:

$$RER_{i,t} = \frac{NER_{i,t}P_{i,t}}{P_{US,t}}$$

   where $NER_{i,t}$ is dollars per currency i, and $P_{i,t}$ is the CPI in country i.

2. Construct the growth rate of country i's NER for 5 different horizons, $h = 1, 2, .., 5$ years: $\frac{NER_{i,t+h}}{NER_{i,t}}$ for each t between $1993q1$ and $2008q4 - h$.

3. Estimate separately for Canada and China the following regression for each of the 5 horizons:

$$\log\left(\frac{NER_{i,t+h}}{NER_{i,t}}\right) = \alpha_{i,h}^{NER} + \beta_{i,h}^{NER}\log\left(RER_{i,t}\right) + \varepsilon_{i,t}^{NER}$$

4. What do your estimates of $\beta_{i,h}^{NER}$ imply about the adjustment of the RER to shocks in the short vs long run? Do these changes in the RER take place through changes in the nominal exchange rates or through changes in prices?

5. Do you find a different adjustment pattern in China and in Canada? If so, provide an explanation to your finding.

Empirical exercise 2

In this exercise, you will predict the impact on inflation of a depreciation of the home currency. The exchange rate depreciates by e% over a given period. The rate of pass-through from exchange rates to import prices at the border (these are prices of imported goods at the dock, exclusive of local distribution costs) is equal to $0 \leq \beta^b \leq 1$. For example, if $\beta^b = 0.5$, a 10% depreciation of the home currency increases import prices at the border by $\beta^b \times 10\% = 5\%$. Similarly, the rate of pass-through from exchange rates to the price of locally produced goods and services is $0 \leq \beta^l \leq 1$. In the consumption basket that makes the consumer price index (CPI), the share of tradeable goods is s^T and the share of non-tradeable goods and services is $1 - s^T$. Within the set of tradeable goods at the consumer level, the share of imports is s^M and the share of local goods (distribution costs and locally produced goods) is $1 - s^M$. Putting all of these pieces together, the overall percentage change in the CPI is given by

$$\begin{aligned} cpi &= \beta^b \times s^T \times s^M \times e + \beta^l \times \left(s^T \times \left(1 - s^M\right) + 1 - s^T\right) \times e \\ &= \left[\beta^b \times s^T \times s^M + \beta^l \times \left(1 - s^T \times s^M\right)\right] \times e \end{aligned}$$

Note that the overall import content in the consumption bundle is given by $s^T \times s^M$.

Consider the following countries with tradeable shares an import in tradable shares, obtained from the paper "Large devaluations and the real exchange rate", http://www.econ.ucla.edu/arielb/LargeDevaluationsJPE.pdf

Table 1: Share of tradeable and imported good shares by country

	Argentina	Brazil	Korea	Mexico	Thailand
Share of tradables in CPI	53.0%	59.3%	48.0%	53.5%	43.3%
Share of imported goods in tradable consumer goods	19.8%	15.0%	42.9%	20.3%	47.8%

1. Suppose that each of these countries experiences a 50% depreciation of its currency, $e = 50$. Calculate for each country the predicted rate of CPI inflation under the following assumptions on pass-through:

   - high import-price pass-through, $\beta^b = 1$, and high local-price pass-through, $\beta^l = 1$
   - high import-price pass-through, $\beta^b = 1$, and low local-price pass-through, $\beta^l = 0.1$
   - low import-price pass-through, $\beta^b = 0.5$, and low local-price pass-through, $\beta^l = 0.1$

2. Now suppose that in each country, the overall import content $s^T \times s^M$ in the consumption bundle is 10% higher for high income households than for low income households. For simplicity, assume that the import content in consumption for high income groups is equal to the one given in Table 1 above, and the that import content in consumption of low income groups is equal to the one given in Table 1 plus 10 percentage points. Calculate for each scenario considered in question 1 the difference in inflation between high and low income groups. Based on these examples, what are the implications of a exchange rate depreciation on real income inequality?

Answer one of the following questions (or if you want you can also answer the two exercises)

Theoretical exercise 1

1. Suppose a monopolist with marginal cost C_{in} faces the following demand function:

$$Q_{in} = A_{in} \left(\frac{P_{in}}{P_n} \right)^{-\varepsilon} Q_n \quad \text{, where} \quad \varepsilon > 1 \tag{1}$$

   (a) Solving the profit maximization problem of this producer, find an expression for the optimal price P_{in} as a function of the marginal cost C_{in} and the elasticity ε.

   (b) Suppose that $\varepsilon = 4$. The dollar marginal cost C_{in} is equal to $C_{in} = W_i E_{in}$, where W_i is the nominal Euro wage in Germany, and E_{in} denotes the dollar per Euro exchange rate. Suppose that the Euro wage is fixed at $W_i = 20$ (20 Euros) and the Euro appreciates from $E_{in} = 1$ to 1.2. Calculate:

      i. The dollar marginal cost C_{in}

      ii. The dollar price P_{in}, before and after the Euro appreciation.

   (c) Calculate the exchange-rate pass-through, calculated in two alternative ways:

      i. Change in dollar price divided by change in dollar marginal cost

      ii. *Percentage* change in dollar price divided by *percentage* change in dollar marginal cost.

2. Now suppose that the retail and wholesale sector bundle the imported good with distribution services to bring it to the final consumer. Assume that the retail sector is competitive and combines the good and distribution services at fixed proportions. Specifically, the demand (1) now depends on the P^r_{in} (rather than on the producer price P_{in}) and that the retail price is related to the producer price by

$$P^r_{in} = P_{in} + \eta_{in} P^d_n \tag{2}$$

   where η_{in} denotes the fixed distribution cost per good and P^d_n denotes the price of distribution services. When setting the price P_{in}, the monopolist takes P^d_n as given.

   (a) Repeat (1a) under the assumptions stated above on demand and the distribution sector.

   (b) Assume that $\eta_{in} P^d_n = 15$, $Q_n = P_n = A_{in} = 1$. Under the demand assumptions of this part of the question, compare profits obtained by the firm under the pricing rule in (2a) with profits the firm would obtain if it had instead followed the pricing rule in (1a). Explain your answer.

   (c) Repeat (1b) under the demand assumptions of this part of the question.

   (d) Repeat (1c) under the demand assumptions of this part of the question.

   (e) Compare the percentage pass-through rate obtained in (2d). with that obtained in (1c). Provide intuition for the different pass-through rates in the two questions.

Theoretical exercise 2

Consider the oligopoly model studied by Atkeson and Burstein (AER 2008) that we discussed in class. The elasticity of substitution across sectors is $\eta = 1$. The elasticity of substitution across two differentiated products (each produced by a single firm) in a sector is $\theta > 1$. Firms within each sector compete in prices (Bertrand competition): they choose price to maximize profits taking all other prices as given.

Taking as given prices of other firms in its sector, the elasticity of demand for good $i = 1, 2$ selling in country n is:

$$\varepsilon_{in} = s_{in} + \theta (1 - s_{in}),$$

where $s_{in} = (P_{in}/P_n)^{1-\theta}$ is expenditure share of product i in that sector, and the sectoral price is $P_n = \left(P_{1n}^{1-\theta} + P_{2n}^{1-\theta}\right)^{\frac{1}{1-\theta}}$. The profit maximixing price of product i is

$$P_{in} = \frac{\varepsilon_{in}}{\varepsilon_{in} - 1} C_{in} \tag{3}$$

where ε_{in} is a function of s_{in}, and s_{in} is a function of prices. In the equilibrium of the sector, prices P_{in} are the solution to the system of equations

$$P_{in} = \frac{s_{in} + \theta (1 - s_{in})}{s_{in} + \theta (1 - s_{in}) - 1} C_{in}$$

and

$$s_{in} = \frac{P_{in}^{1-\theta}}{P_{1n}^{1-\theta} + P_{2n}^{1-\theta}}.$$

Assume that $\theta = 5$.

1. Suppose that $C_{1n} = 1.5$ and $C_{2m} = 1.5$. Solve for the equilibrium level of P_{1n} and P_{2n}.

2. Suppose that $C_{1n} = 1$ and $C_{2n} = 2$. Solve for the equilibrium level of P_{1n} and P_{2n}, markups P_{in}/C_{in}, and market shares s_{1n} and s_{2n}. Compare (and discuss) the equilibrium level of markups and market shares between the two firms.

3. Suppose that C_{1n} rises from 1 to 1.2, while $C_{2n} = 2$. Solve for P_{1n} and P_{2n} and markups in the new equilibrium. Calculate and discuss the rate of cost pass-through of each firm.