Entry, Trade Costs and International Business Cycles

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Goals of the Paper

- Trend in International Trade Literature to write models with Heterogeneous Firms, Entry and Exit of Establishments and Fixed Costs of Exporting. Long run analysis
- Are these important margins to consider when studying International Business Cycles?
- This paper provides a quantitative analysis of the role of 1) entry and 2) fixed costs of exporting in an international business cycle model with heterogeneous firms.
- Our work is close to Ghironi-Melitz (2005) (which lacks both capital and endogenous labor) and Alessandria and Choi (2007) (which has no entry)
• Adding these two margins is not innocuous, it has implications for the volatility of aggregate variables, in particular for Investment, Exports and Trade Balance.

• The model has a better fit of second moments than the standard BKK

• In addition, the model delivers a negative correlation between RER and Ratio of Consumption (Backus-Smith), under some assumptions about the measurement of the CPI.
Technology and Problem of the Firms

- **Final Good Sector (competitive)**

\[
\begin{align*}
\left[ \int_{\omega \in \Omega_t} y_t(\omega)^{\frac{(\theta-1)}{\theta}} dG \right]^{\frac{\theta-1}{\theta}} \frac{\rho-1}{\rho} + \left[ \int_{\omega \in \Omega^*_{x,t}} y_{x,t}^*(\omega)^{\frac{(\theta-1)}{\theta}} dG \right]^{\frac{\theta-1}{\theta}} \frac{\rho-1}{\rho} \right]^{\frac{\rho}{\rho-1}} \\

y_t(\omega) = \left( \frac{p_t(\omega)}{P_t} \right)^{-\theta} \left( \frac{P_{D,t}}{P_t} \right)^{\theta-\rho} Y_t \\
y_{x,t}^*(\omega) = \left( \frac{p_{x,t}^*(\omega)}{P_t} \right)^{-\theta} \left( \frac{P_{x,t}^*}{P_t} \right)^{\theta-\rho} Y_t
\end{align*}
\]

- **Intermediate Goods Sector (monopolistic competition)**

\[
y(\omega) = Z\omega \left[ k(\omega) \right]^\alpha \left[ l(\omega) \right]^{1-\alpha}
\]

\[
\rho(\omega) = \frac{\theta}{\theta-1} MC_p(\omega) \quad \rho_x(\omega) = Q^{-1} \frac{\theta}{\theta-1} \tau MC_p(\omega)
\]

\[
MC_p(\omega) = \left( \frac{r}{\alpha} \right)^\alpha \left( \frac{w}{1-\alpha} \right)^{1-\alpha} \left( \frac{1}{Z\omega} \right)
\]
Profits from export sales are

\[ d_x = \begin{cases} \frac{Q_t}{\theta} \left[ \rho_{x,t}(\omega) \right]^{1-\theta} \left( \frac{p_{x,t}}{p_t^*} \right)^{\theta-\rho} Y^*_t - \frac{w_t f_x}{Z_t} & \text{if firm } \omega \text{ exports} \\ 0 & \text{otherwise} \end{cases} \]

Export cutoff

\[ \omega_{x,t} = \inf \{ \omega : d_{x,t}(\omega) > 0 \} \]

Entrants pay sunk entry cost \((fe)\) in units of effective labor. Productivity is drawn from \(G(\omega)\). Exit is exogenous, and occurs with probability \(\delta\)

Free Entry Condition:

\[ \frac{fe \omega}{Z} = \tilde{\omega}_t = E_t \sum_{s=t+1}^{\infty} [\beta(1-\delta)]^{s-t} \left( \frac{U_c(C_s,l_s)}{U_c(C_t,l_t)} \right)^{-\gamma} \tilde{d}_s \]

Law of Motion of firms:

\[ N_{D,t} = (1-\delta) (N_{D,t-1} + N_{e,t-1}) \]
The Problem of the Representative Household

- Household’s in each country solve:

\[
\max E_0 \sum_{t=0}^{\infty} \beta^t \left[ \frac{\left( C_t^\mu (1 - l_t)^{1-\mu} \right)}{1 - \gamma} \right]^{1-\gamma}
\]

\[
C_t + K_{t+1} + \phi_{t+1} \tilde{\omega}_t (N_{D,t} + N_{e,t}) + B_{t+1}
= \left( 1 + r^B_t \right) B_t + \left( r^k_t + 1 - \delta_k \right) K_t + (\tilde{\alpha}_t + \tilde{\omega}_t) \varphi_t N_{D,t} + \omega_t l_t
\]

- Our benchmark results refer to the case of international bond trading
Two Approaches to Measure the Price Indices

- **Model Based Price Index:**
  \[
P_t = \left[ N_{D,t} \left( \tilde{p}_t \right)^{1-\theta} + N_{x,t} \left( \tilde{p}_{x,t} \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}
  \]

- **Cleaning it from Variety Effect:**
  \[
  \tilde{P}_t = \left[ \frac{N_{D,t}}{N_t} \left( \tilde{p}_t \right)^{1-\theta} + \frac{N_{x,t}}{N_t} \left( \tilde{p}_{x,t} \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}
  \]
  where \( N_t = N_{d,t} + N_{x,t} \)

- **The RER without variety effect is:**
  \[
  \tilde{Q} = \frac{\tilde{P}^*}{\tilde{P}} = \left[ \frac{N_{D,t}^*}{N_t^*} \left( \tilde{p}_t^* \right)^{1-\theta} + \frac{N_{x,t}^*}{N_t^*} \left( \tilde{p}_{x,t}^* \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}
  \]

- **Look also at model with fixed Expenditure Shares.**
Calibration

**Standard Parameters**

\[ \beta, \gamma, \mu, \alpha, \delta_k \]

Usual in RBC literature

\[ \rho_z, \rho_z^*, \rho_{z,z}^* \]

Stochastic process from BKK

**Microlevel Parameters**

\[ \delta = 0.025 \]
Exogenous death rate

\[ \tau = 1.3 \]
Iceberg costs

\[ \theta = \rho = 3.8 \]
Elasticity of Substitution

\[ \kappa = 3.4 \]
Shape parameter Pareto Distribution

\[ f_x/f_e = 0.235 \frac{(1-\beta(1-\delta))}{\beta(1-\delta)} \]
Match \( N_X/N_D = 21\% \)
The Role of Entry

- Degree of entry irrelevant for quantities, but important for relative prices.
- If there is no entry, aggregate quantities are too volatile, second moments resemble standard BKK.
Define entry Cost be: $\hat{f}_e = f_e + \gamma_e \left[ \exp \left( N_{D,t} - N_D \right) - 1 \right]$. 

![Graph showing the volatility of exports, trade balance, and investment and the volatility of entry, number of exporters, and cutoff.](image-url)
Changing the fraction of exporting firms:

- Quantities have little sensitivity to Share of Exporters, but important for relative prices
- If all firms export, the model with just entry, delivers the usual positive correlation consumption ratio and RER
The Volatility of the Fraction of Exporting Firms

**Volatility Exp, TB and Inv**

- **Exp**: Blue line
- **TB**: Red line
- **Inv**: Green line

**Gamma_X**: 0 to 300

**Volatility of Entry and Number of Exporters**

- **Entry**: Blue line
- **Number of Exporters**: Red line
- **Export Cutoff**: Green line

**Gamma_X**: 0 to 300

**Correlation CH/CF and RER and TOE**

- **RER**: Red line
- **TOE**: Blue line

**Gamma_X**: 0 to 300
Conclusion

- Regarding quantities, entry and the export margin combine to keep aggregate volatilities close to the data. In this result is crucial that Entry and Investment behave as substitutes for consumption smoothing. In the BKK, the usual feature introduced to reduce volatility is ad-hoc adjustments to investment.

- Entry and the export margin can help to explain the negative correlation of the Consumption Ratio and RER, under the assumption that CPI captures changes in the set of goods.

- Complementarity Result: both extensive margins have to be present for the model to deliver novel results.
## International Business Cycles: The Model vs The Data

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Benchmark</th>
<th>GM(replic)</th>
<th>BKK(replic)</th>
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<td>Gdp</td>
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<tr>
<td>Number of Exporters</td>
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<td><strong>Other Correlations</strong></td>
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<tr>
<td>Ratio Cons vs RER</td>
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<td>Ratio Cons vs TOE</td>
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<td>0.97</td>
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The Role of the Financial Structure.

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<td>Ratio Cons vs TOE</td>
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<td>Ratio Cons vs TOT</td>
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\[ \tilde{Q} = (2s_D - 1) \text{TOE} - (1 - s_D) (\omega_{x,t} - \omega^*_{x,t}) \\
+ \frac{1}{\theta - 1} \left( \frac{N_D}{N_D + N_x} - s_D \right) \left[ (N^*_{D,t} - N_{x,t}) - (N_{D,t} - N^*_{x,t}) \right] \]
The expression for the ratio of Trade Balance to GDP:

$$\frac{TB}{GDP} = \frac{EX}{GDP} \left[ 1 - \frac{N_x^*}{N_x} Q^{-\theta} (TOE)^{1-\theta} \frac{Y}{Y^*} \left( \frac{\omega_x^*}{\omega_x} \right)^{\theta-1} \right]$$

where the ratio of exports to GDP is given by:

$$\frac{EX}{GDP} = \frac{1}{\left( \frac{\omega}{\omega_x} \right)^{\theta-1} \tau^{\theta-1} Q^{-\theta} \frac{Y}{Y^*} \frac{N_d}{N_x} + 1}$$