The Endogeneity of the Exchange Rate as a Determinant of FDI:
A Model of Money, Entry, and Multinational Firms

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Introduction

• This is a very interesting paper.

• It contributes to a growing literature that combines recent developments in research on international trade and investment with modern international macroeconomics (Bergin and Glick, various works; Corsetti, Martin, and Pesenti, 2003; Ghironi and Melitz, 2004, among others).
• FDI has become a key channel for resource flows across countries

• How do exchange rate (ER) fluctuations affect FDI?

  - In particular, what is the effect of ER volatility?

• Existing empirical studies report mixed evidence.

  - Goldberg and Kolstad (1995): ER volatility increases FDI
    (consistent with FDI being a substitute for exports).

  - Campa (1993): ER volatility deters FDI (the more so the larger
    sunk entry costs into foreign market).
• Most empirical studies are based on partial equilibrium theories of FDI that take the ER as exogenous.

• This paper develops a microfounded, general equilibrium model of FDI and the ER.

• The model combines a version of Helpman, Melitz, and Yeaple (2004)/Melitz (2003) with Devereux and Engel’s (2001) model of internationalized production with sticky prices.

• Katheryn adds firm heterogeneity and entry subject to sunk entry costs to the Devereux-Engel setup.
• The model makes it possible to analyze the effect of ER volatility on FDI when both the ER and FDI depend on the same set of fundamentals.

• Key result: ER volatility matters for FDI, but the effect depends on the source of volatility:
  
  - Volatility that originates in the host country encourages FDI.
  
  - Volatility that originates in the native country discourages FDI.

• Hence, the paper provides a structural explanation for ambiguous empirical evidence (and guidance for future empirical work).

• Very nice!
The Endogeneity of the Exchange Rate as a Determinant of FDI

• FDI is endogenous to the ER.

• It is plausible to think that, in general equilibrium, the ER should be endogenous to FDI.
  
  - That sounds realistic to me.

• It is not a feature of this model: The ER does not depend on FDI (or its determinants) in any way.

• Why?
Monetary Policy and Exchange Rate Determination

- The model assumes exogenous money supply (lognormal $M^s$ growth at home and abroad).

- (Relative) money demand, risk-sharing through the market for contingent bonds, and the exogenous $M^s$ ratio are the centerpieces of ER determination.

\[ S_t = \frac{M_t (1 - \beta \theta)}{M^*_t (1 - \beta \theta^*)}. \]

- Once we know the exogenous $M^s$, we know the ER.
• Recent literature has deemphasized the role of exogenous $M^s$ and money demand in ER determination.

• Empirical evidence: Exogenous monetary shocks play little role relative to systematic response of monetary policy to economic conditions.

• At least since Taylor (1993), it is commonplace to think of monetary policy in terms of endogenous response of the interest rate to the conditions of the economy.

• That has implications for exchange rate determination.
A Simple Log-linear Example

• Assume UIP: \( i_{t+1} - i_{t+1}^* = E_t S_{t+1} - S_t \)

• Assume PPP: \( P_t = S_t + P_t^* \implies \pi_t = \Delta S_t + \pi_t^* \)

• Assume central banks set interest rates to react to inflation and GDP:

\[
\begin{align*}
  i_{t+1} &= \alpha_1 \pi_t + \alpha_2 y_t + \xi_t, \\
  i_{t+1}^* &= \alpha_1 \pi_t^* + \alpha_2 y_t^* + \xi_t^*,
\end{align*}
\]

where \( \xi \) is the exogenous component of monetary policy (if we want to have it).
• Policy implies: \( i_{t+1}^D = \alpha_1 \pi_t^D + \alpha_2 y_t^D + \xi_t^D \).

• But \( \pi_t^D = \Delta S_t \) (PPP) and \( i_{t+1}^D = E_t S_{t+1} - S_t \) (UIP).

• Hence, \( E_t S_{t+1} - S_t = \alpha_1 (S_t - S_{t-1}) + \alpha_2 y_t^D + \xi_t^D \).

• Two implications:

  - No role for money (easy to see if \( \alpha_2 = 0 \) but true in more general cases).

  - If \( \alpha_2 > 0 \), the ER depends on the GDP differential and, in turn, on variables that affect it (for instance, net foreign assets).
• PPP does not hold with FDI.

\[ E_t S_{t+1} - S_t = \alpha_1 \pi_t^D + \alpha_2 y_t^D + \xi_t^D. \] (*)

• Inflation and GDP differentials will depend on ER and (plausibly) FDI in ways that depend on details of the model.

• But, in general, equation (*) will imply that ER is affected by FDI.
• When monetary policy responds endogenously to the conditions of the economy, FDI and ER are endogenous with respect to each other and jointly determined in equilibrium.

• ER volatility will affect FDI, but FDI flows (and their determinants) will matter for the ER.

• It would be very important to investigate the results under a more realistic specification of monetary policy.

• Especially true for a theory that aims to provide guidance for empirical work and in which monetary policy is a key determinant of FDI.
A Model of Entry and Multinational Firms

• When I approached work with Marc, I thought of entry as a mechanism for propagation of economic fluctuations over time (among other roles).

• I still think that.

• The number of firms that produce \(N\) can be thought of as the capital stock of the economy in our model.
• Potential entrants must pay a one-time sunk entry cost to enter the economy during period $t$.

• They do that before observing their firm-specific productivity (and subject to other sources of uncertainty).

• They start producing in period $t + 1$.

• The free-entry condition equates the value of the firm (expected PDV of profits from $t + 1$ to $\infty$) to the sunk entry cost.

• $N$ moves over time as an endogenous state variable.
• There is no endogenous state variable in Katheryn’s model.

• There is a predetermined range of possible varieties to which consumers have access:

\[
C_t = \left[ \int_0^1 c_H(i,t) \frac{\mu-1}{\mu} \, di + \int_1^2 c_F(i,t) \frac{\mu-1}{\mu} \, di \right] \frac{\mu}{\mu-1}
\]

Home owns potential entrants between 0 and 1; foreign owns potential entrants between 1 and 2.
• At the end of period \( t - 1 \), each potential entrant finds out its firm-specific productivity in period \( t \).

• The firm then decides whether or not to pay fixed costs to produce at home and abroad during period \( t \) based on expectations of economic conditions at home and abroad in that period.

  - Fixed cost is sunk relative to ER uncertainty (not relative to productivity).

• \( n_{H,t} \) home firms and \( n_{F,t} \) foreign firms choose to produce in the home country during period \( t \).
• This sequence of events is repeated every period (firm-specific productivity is i.i.d.).

• In each period $t$, the home consumer has access to varieties in the ranges $[0, n_{H,t}]$ produced by home-owned firms and $(1, 1 + n_{F,t}]$ produced by foreign-owned firms.
• It helps me to think of this structure of production and access to varieties as an “accordion.”

• When all potential entrants produce, the home consumer has access to varieties in the ranges [0, 1] and (1, 2]. This is the maximum amplitude of the accordion.

• In each period $t$, the accordion is extended to a position that varies depending on how close $n_{H,t}$ is to 0 or 1 and $n_{F,t}$ is to 1 or 2.

• There is no persistence in entry decisions at home or abroad: $n_{H,t}$ and $n_{F,t}$ are not state variables.
• The equilibrium is such that $n_{H,t}$ and $n_{F,t}$ are actually constant.

- The accordion settles at the same amplitude in each period.

• But i.i.d. productivity implies that the identity of the firms that are producing in each period changes relative to the previous period.

- In each period, different buttons are being pushed on the accordion.
• I find it a bit hard to reconcile that with entry and FDI as the creation of new productive facilities or a commitment that involves a potentially long-lasting investment position.

- OECD (1999) definition of FDI: “FDI reflects the objective of obtaining a *lasting interest* by a resident entity in one economy (“direct investor”) in an entity resident in an economy other than that of the investor (“direct investment enterprise”). The lasting interest implies the existence of a *long-term relationship* between the direct investor and the enterprise…” (Emphasis added.)
• It seems to me that Katheryn’s model could be reinterpreted as follows:

- Some time in the past (phase 1), firms invested in the creation of productive facilities at home and abroad, defining the maximum possible amplitude of the accordion.

- They did that subject to uncertainty on their firm-specific productivity and by sinking resources in a one-time fashion.

- Firms can then decide in each period whether or not to actually turn on these plants subject to period-by-period fixed costs (phase 2, Katheryn’s model).
• In this interpretation, I think of phase 1 as the entry and FDI phase, where long-lasting investments are made.

• In a model of phases 1 and 2, one would want to endogenize the maximum amplitude of the accordion, which would become the endogenous state variable that is now missing.

• An alternative is to just slow down the movement of the accordion by using one-time sunk entry costs.
• In my paper with Marc,

\[ C_t = \left[ \int_{\omega \in \Omega} c_t(\omega) \frac{\mu}{\mu-1} \, d\omega \right]^{\frac{\mu}{\mu-1}}, \]

where the continuum \( \Omega \) defines the maximum amplitude of our accordion.

• In period \( t \), only goods in \( \Omega_t \subset \Omega \) are actually available – those supplied by \( N_t \) home producing firms and those supplied by \( N^*_{X,t} \) foreign exporters (a subset of \( N^*_t \) firms producing in the foreign country).
• Suppose we change our model:

* No trade. Foreign firms can set up production facilities at home (using the same technology they use in their native country) subject to one-time sunk costs of the type we now have only for domestic entry.

* A foreign firm contemplating entry into home during period $t$ compares the expected PDV of profits from sales in the home market from $t + 1$ on to the sunk entry cost.

* In each period, there are $N_{E,t}^H$ home entrants in the home economy and $N_{E,t}^F$ foreign entrants into home.
* Assuming the same exogenous death shock as in my paper with Marc, the total number of firms producing at home during period $t$ is:

$$N_t = (1 - \delta) \left( N_{t-1} + N_{E,t-1}^H + N_{E,t-1}^F \right)$$

* FDI into home during period $t$ would then be measured by $N_{E,t}^F$ (or by $N_{E,t}^F$ times the value of foreign firms into home during period $t$).

* Entry (at home or abroad) is a persistent decision and the number of producing firms in each country is an endogenous state variable, propagating fluctuations over time.
* In a world of sticky prices (or wages), it would then be possible to investigate how ER fluctuations affect FDI and how the effects are transmitted across countries and over time.

* This would be a channel for long-lasting real effects of nominal exchange rate movements (Baldwin and Krugman, 1989).

* This may be complicated to do.

* But it is certainly worth trying.
Conclusions

• I like accordion music! I learned a lot from this very insightful paper.

• I see it as the starting point of an exciting research agenda and I look forward to reading more of Katheryn’s work in the future.