The Domestic and International Effects of Financial Deregulation

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1 Motivation

- 1980s and late 1990s: Real appreciation of the U.S. dollar and U.S. current account deficits.

- After the early 1980s: Reduction of macroeconomic volatility around the world.

- Late 1970s through early 1990s: U.S. bank deregulation, i.e. removal of bank geographical expansion restrictions within and across states.

- The mid 1990s: Asymmetries in bank competitiveness between Europe and the U.S.

- We develop a model of the domestic and international effects of financial deregulation to study the contribution to these phenomena of the U.S. banking deregulation started in 1977 and finalized in 1994.
2 Model Preview

• Our model builds on Ghironi and Melitz (2005), Bilbiie, Ghironi, and Melitz (2005), and Stebunovs (2006) by incorporating
  
  – endogenous producer entry subject to sunk costs,

  – deviations from PPP,

  – and a role for financial intermediation.

• Investment takes the form of the creation of new production lines (firms).

• Sunk costs and a time-to-build lag induce the number of firms to respond slowly to shocks, consistent with the notion that the number of producers is fixed in the short run.

• New entrants must obtain funds from financial intermediaries (banks) to cover entry costs.

• Banks with market power erect a financial barrier to entry to protect the profitability of existing borrowers, reducing average entry relative to the competitive benchmark.

• We take bank concentration as exogenous to the business cycle, and we interpret financial deregulation as an exogenous decrease in bank monopoly power.
3 Results

- The economy that deregulates experiences increased producer entry, real exchange rate appreciation, and current account deficit.

Intuition

- Bank deregulation makes the domestic economy a relatively more attractive environment for potential entrants in the presence of trade costs.

- This expansion in producer entry following banking deregulation is consistent with the findings of the empirical finance literature:
  - Cetorelli and Strahan (2006) and Black and Strahan (2002) document the association of the U.S. banking deregulation with a decrease in bank monopoly power, an increase in the number of non-financial establishments, and a decrease in their average size — all facts that our model reproduces.

- Entry in the economy that deregulates pushes relative labor costs upward, inducing real appreciation when the economy features a non-traded sector or home bias in preferences.

- When economies are allowed to borrow and lend internationally, financial deregulation induces the home economy to borrow to finance increased firm entry.
4 Results, Continued

- In addition, less bank monopoly power results in less volatile business creation, reduced markup countercyclicality, and weaker substitution effects in labor supply in response to productivity shocks.

Intuition

- Banks have less incentive to let firms enter the economy after a favorable productivity shock when fluctuations happen around a steady state with a large number of firms, since incumbent firms are already operating on a relatively smaller share of the market.

- Financial deregulation thus contributes to a moderation of firm-level and aggregate output volatility.

  - Banking deregulation $\Rightarrow$ reduced firm-level volatility is consistent with evidence in Correa and Suarez (2007).

- In turn, trade and financial ties between the two countries allow the foreign economy to enjoy lower volatility as well.

- Interpreting the economy that deregulates as the U.S., the predictions of our model are thus consistent with features of the empirical evidence following the U.S. banking deregulation started at the end of the 1970s.
5 Relation to the Literature


- Caballero, Fahri, and Gourinchas (2007 – CFG): Growth differentials and heterogeneity in capacity to generate financial assets $\Rightarrow$ external imbalances.


- As in CFG and MQR, borrowing arises as a consequence of capital mobility between asymmetric financial systems:
  - In CFG: asymmetric ability to generate financial assets; in MQR: asymmetric financial contract enforcement; here: asymmetric degree of banking competition.

- In FP, imbalance follows moderation; in our model imbalance is a feature of the transition to moderation.
6 The Benchmark Model: The Setup

- Financial autarky; two countries: home and foreign.

- Each country populated by a unit mass of atomistic households, a discrete number of banks, and a continuum of firms.

- In each country, there are several exogenously given locations with a discrete number of banks and a local continuum of firms in each of them.

- Monopolistically competitive firms must borrow from banks to finance sunk entry costs, and they have no collateral to pledge except a stream of future profits.

- Each firm then produces a firm-specific consumption good for sale in the domestic and export markets.

- Firm entry reduces the stream of future profits of both incumbents and entrants and thus the amount pledgeable for entry loan repayments.
7 The Benchmark Model: Bank Behavior

• Before deregulation, firms are restricted to borrow from local banks.

• These use their monopoly power on loans to extract all the future profits from the entrants they finance.

• Each bank holds a portfolio of firms and decides on the number of loans to be issued (that is, on the number of entrants).

• Each bank trades the increase in revenue from expanding its firm portfolio (portfolio expansion effect) against the decrease in revenue from all firms in its portfolio due to reduced market share (profit destruction effect).

• The profit destruction effect induces credit rationing at the extensive margin:
  
  – Less prospective entrants receive funding than with perfectly competitive financial markets.

• Each bank supplies one-period deposits to domestic households in a perfectly competitive deposit market.

• The bank then uses the deposits to fund firm entry.

• Thus, the cost that each bank faces is the deposit interest rate.
Bank deregulation lifts the restriction on borrowing from banks at a different location. The number of banks to which a borrower has access increases, reducing bank monopoly power.

For expositional simplicity, we present the model economy normalizing the number of banking locations to one.

We denote the number of banks represented at this location with $H \geq 1$.

If the number of locations were $M > 1$, following deregulation, the product $HM$ would replace $H$ below.

Before deregulation, prospective entrants can borrow only from the $H$ banks represented at their location; after deregulation, they can borrow from $HM$ banks.

Having normalized the number of locations to one, this is isomorphic to an increase in the number $H$ of banks represented at this location.
9 The Benchmark Model: Households

• The representative home household supplies $L$ units of labor inelastically in each period at the nominal wage rate $W_t$, denominated in units of home currency.

• The household maximizes

$$E_t \sum_{s=t}^{\infty} \beta^{s-t} \frac{(C_s)^{1-\gamma}}{1-\gamma}, \quad \beta \in (0, 1), \, \gamma > 0.$$  

• At time $t$, the household consumes the basket of goods

$$C_t = \left( \frac{C_{T,t}}{\alpha} \right)^{\alpha} \left( \frac{C_{N,t}}{1-\alpha} \right)^{1-\alpha}, \quad \alpha \in (0, 1).$$

- I will focus on the model with non-traded goods.

• The consumption-based price index is then

$$P_t = (P_{T,t})^\alpha (P_{N,t})^{1-\alpha}.$$
10 The Benchmark Model: Households, Continued

- The basket of tradable goods is

\[
C_{T,t} = \left( \int_{\omega \in \Omega} c_t(\omega)^{(\theta-1)/\theta} d\omega \right)^{\theta/(\theta-1)}, \quad \theta > 1.
\]

- At any given time \( t \), only a subset of goods \( \Omega_t \subset \Omega \) is actually available for consumption.

- Let \( p_t(\omega) \) denote the home currency price of tradable good \( \omega \in \Omega_t \). \( \Rightarrow \)

\[
P_{T,t} = \left( \int_{\omega \in \Omega_t} p_t(\omega)^{1-\theta} d\omega \right)^{1/(1-\theta)}.
\]

- The modeling of foreign households is similar.

  – Note: The set of tradable goods available for consumption in the foreign economy during period \( t \) is identical to that available in the home economy.

- Households in each country hold shares in a mutual fund of domestic banks and one-period deposits supplied by these banks.

- Intertemporal optimization yields standard Euler equations for holdings of shares and deposits.
11 Firms: Tradable Goods Producers

• There is a continuum of firms in each country, each producing a different tradable variety $\omega \in \Omega$.

• Aggregate labor productivity is indexed by $Z_t$, which represents the effectiveness of one unit of labor.

• Production requires only one factor, labor: The output of firm $\omega$ is $y_t(\omega) = Z_t l_t(\omega)$.

• Home and foreign tradable producers serve both their domestic and export markets.

• Exporting is costly, and it involves a melting-iceberg trade cost $\tau > 1$. 
12 Firms: Non-Tradable Good Producers

- There is a constant mass of firms in each country producing the homogeneous non-tradable good.

- These firms are perfectly competitive and possess the same technology as the firms producing tradable goods.

- Labor is perfectly mobile across sectors in each country.
13 Banks and Firm Entry

- In every period there is an unbounded number of prospective entrants.

- Prior to entry, firms face a sunk entry cost of one effective labor unit, or $\frac{w_t}{Z_t}$ units of the consumption basket.

- Since there are no fixed production costs, all firms produce in every period, until they are hit with an exogenous exit shock, which occurs with probability $\delta \in (0,1)$ in every period.

- Unspecified financial frictions force entrants to borrow the amount necessary to cover the sunk entry cost from a local bank in the firm’s domestic market.

- Since the bank has all the bargaining power, it sets the entry loan repayment to extract all the firm profit in each period.
There is a constant number $H$ of forward looking banks in the home country, which compete in Cournot fashion over the number of loans issued.

Bank $h$ has $N_t(h)$ producing firms in its portfolio and decides simultaneously with other banks on the number of entrants to fund ($N_{E,t}(h)$), taking into account post entry firm profit maximization.

Entrants at time $t$ only start producing at time $t + 1$ (time-to-build lag).

The exogenous exit shock occurs at the very end of the time period (after production and entry).

⇒ the number of firms in bank $h$’s portfolio during period $t$ is

$$N_t(h) = (1 - \delta) (N_{t-1}(h) + N_{E,t-1}(h)),$$

and the number of producing home firms in period $t$, is

$$N_t = (1 - \delta) (N_{t-1} + N_{E,t-1}),$$

where $N_t \equiv \sum_{h \in H} N_t(h)$ and $N_{E,t} \equiv \sum_{h \in H} N_{E,t}(h)$. 
15 Bank Monopoly Power and the Financing of Producer Entry

- F.o.c. w.r.t. $N_{t+1}(h)$ and symmetry of bank behavior ⇒

$$q_t = \beta E_t \left\{ \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} \left[ \left( 1 - \frac{1}{H} \right) d_{t+1} + (1 - \delta)q_{t+1} \right] \right\}, \quad (1)$$

where $q_t$ is the (shadow) value to the bank of an additional firm producing at $t + 1$.

- Balancing portfolio expansion and profit destruction.

- The parameter $H$ plays the same role in the banking market that $\theta$ plays in the goods market.

- At one extreme, $H = 1$ or absolute bank monopoly, equation (1) implies that there is no entry as the value of funding an entrant is zero:

  - Portfolio expansion is fully offset by profit destruction.

- Bank market power decreases as $H$ increases.

- At the other extreme, $H = \infty$, equation (1) simplifies to the competitive asset pricing equation.
16  Bank Monopoly Power and the Financing of Producer Entry, Continued

• Equation (1) ⇒:

\[ q_t = \left(1 - \frac{1}{H}\right) E_t \sum_{s=t}^{\infty} \beta^{s-t} (1 - \delta)^{s-(t+1)} \left(\frac{C_s}{C_t}\right)^{-\gamma} d_s = \left(1 - \frac{1}{H}\right) q_t^A, \]

where \( q_t^A = E_t \sum_{s=t+1}^{\infty} \beta^{s-t} (1 - \delta)^{s-(t+1)} (C_s/C_t)^{-\gamma} d_s. \)

- \( q_t^A \) = valuation of an additional firm at \( t+1 \) generated by perfectly competitive finance.

• As in Hayashi (1982), monopoly power induces a discrepancy between average \( q \) and marginal \( q \):

  - Monopoly power results in a proportional mark-down \( (H - 1)/H \) of the value of firms to the bank relative to the competitive valuation.

• As in Hayashi’s analysis of capital accumulation, the discrepancy disappears as the economy approaches the competitive benchmark \( H \rightarrow \infty \).

  - Monopoly power causes \( q_t < q_t^A \) because additional firm creation conflicts with a monopolist’s incentive to reduce supply relative in order to generate higher profit.
17 Entry Condition

• F.o.c. w.r.t $N_{E,t}(h)$ and symmetry $\Rightarrow$ firm entry condition: $q_t =$ expected, discounted entry cost (deposit principal and interest):

$$q_t = \frac{\beta}{1 - \delta} (1 + r_{t+1}) \frac{w_t}{Z_t} E_t \left( \frac{C_{t+1}}{C_t} \right)^{-\gamma} = \frac{1}{1 - \delta} \frac{w_t}{Z_t},$$

where the second equality follows from the household’s Euler equation for deposits.
18 Aggregate Accounting and Balanced Trade

- Aggregating the budget constraint across home households and imposing equilibrium \((x_{t+1} = x_t = 1 \text{ and } B_{t+1} = (w_t/Z_t)N_{E,t})\) yields:

\[ C_t + B_{t+1} = d_tN_t + w_tL. \]

- \(B_{t+1}\) is the value of home investment in new firms. \(\Rightarrow\) equality of spending (consumption plus investment) and income (labor plus dividend).

- To close the model, observe that financial autarky implies balanced trade: The value of home exports must equal the value of foreign exports:

\[ Q_tN_t \left(\rho_{X,t}\right)^{1-\theta} C^*_t = N^*_t \left(\rho^*_{X,t}\right)^{1-\theta} C_t. \]
19 The Real Exchange Rate

- Given the welfare-based real exchange rate $Q_t = \varepsilon_t P_t^*/P_t$, the data-consistent counterpart is $\tilde{Q}_t = \varepsilon_t \tilde{P}_t^*/\tilde{P}_t$.

- The average price index $\tilde{P}_t$ removes the pure variety effect from $P_t$: $\tilde{P}_t = (N_t + N_t^*)^{-\alpha/(1-\theta)} P_t$.

- In the model with non-traded goods,
  \[
  \tilde{Q}_t = \frac{\varepsilon_t P_t^* (N_t + N_t^*)^{-\alpha/(1-\theta)}}{P_t (N_t + N_t^*)^{-\alpha/(1-\theta)}} = \frac{\varepsilon_t P_t^*}{P_t} = Q_t.
  \]

- Using the price index equations,
  \[
  Q_t = (TOL_t)^{1-\alpha} \left[ \frac{N_t^* (TOL_t)^{1-\theta} + \tau^{1-\theta}}{1 + \frac{N_t^*}{N_t} (\tau^* TOL_t)^{1-\theta}} \right]^{\frac{\alpha}{1-\theta}},
  \]
  where the terms of labor $TOL_t \equiv \varepsilon_t (W_t^*/Z_t^*)/(W_t/Z_t)$ measure the relative cost of effective labor across countries.

- A decrease in $TOL_t$ indicates an appreciation of home effective labor relative to foreign.
• In log-linear terms, around a symmetric steady state,

\[ Q_t = \left(1 - \alpha \frac{2\tau^{1-\theta}}{1 + \tau^{1-\theta}}\right) \text{TOL}_t + \frac{\alpha \left(1 - \tau^{1-\theta}\right)}{(\theta - 1)(1 + \tau^{1-\theta})} (N_t - N_t^*) \, . \]

- \( \text{TOL}_t \downarrow \Rightarrow Q_t \downarrow \), and \((N_t - N_t^*) \uparrow \Rightarrow Q_t \uparrow \).

- \( \text{TOL}_t \) has a significantly larger effect on \( Q_t \) than \((N_t - N_t^*)\).

- If there is no trade cost, \( Q_t = (1 - \alpha) \text{TOL}_t \).

• If there are no non-tradables \((\alpha = 1)\),

\[ Q_t = \frac{1 - \tau^{1-\theta}}{1 + \tau^{1-\theta}} \text{TOL}_t + \frac{1 - \tau^{1-\theta}}{(\theta - 1)(1 + \tau^{1-\theta})} (N_t - N_t^*) \, . \]

- In this case, if there is no trade cost, \( Q_t = 0 \) (PPP).
The Real Exchange Rate, Continued

• With only tradable goods, but home bias in consumption,

\[
Q_t = \left[ \frac{\alpha N_t + (1 - \alpha) N_t^*}{\alpha N_t^* + (1 - \alpha) N_t} \right]^{1 \theta} \tilde{Q}_t,
\]

where \( \alpha \) now denotes the weight of domestic goods in consumption.

• In this case, \( Q_t \) and \( \tilde{Q}_t \) need not move in the same direction.

• \( TOL_t \) remains the main determinant of \( \tilde{Q}_t \).

• Suppose \( \tilde{Q}_t \downarrow \) (because \( TOL_t \downarrow \)) and \( Q_t \uparrow \) (because \( N_t \uparrow \) more than \( N_t^* \)):

  – Average prices are higher in the home country, but home agents are better off spending a given nominal amount at home because they have access to a larger number of goods toward which their preferences are biased.
Bank Deregulation and the Real Exchange Rate: Intuition

- Suppose the initial steady state is such that home and foreign are completely symmetric, and home implements banking deregulation ($H \uparrow$).

- Less bank market power induces home banks to finance more entrants.

- In general equilibrium, this is mirrored by the desire of a disproportionate number of prospective entrants to locate themselves in the more attractive business environment.

- This pushes up labor costs at home ($TOL_t \downarrow$).

  - Home effective labor must appreciate for some entrants to find it optimal to locate themselves in the foreign country and keep home labor employed in the long run (otherwise, firm death would completely eliminate foreign firms).

- $\Rightarrow \tilde{Q}_t$ appreciates.

- An economy with permanently more competitive banking (relative to its trading partners) has a permanently appreciated real exchange rate.
### Calibration and Impulse Responses

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<th>Value</th>
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<td>Discount factor $\beta$</td>
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<td>Elasticity of substitution $\theta$</td>
<td>3.8 (Bernard et al, 2003)</td>
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<tr>
<td>Risk aversion $\gamma$</td>
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<td>Probability of exit $\delta$</td>
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<td>Trade cost $\tau$</td>
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<tr>
<td>Steady-state productivity $Z$</td>
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<tr>
<td>Labor supply $L$</td>
<td>1(w.l.o.g.)</td>
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### Model with Non-traded Goods

<table>
<thead>
<tr>
<th>Parameter</th>
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<tr>
<td>Share of tradable goods $\alpha$</td>
<td>0.39 (to match U.S. import share)</td>
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### Model with Home Bias

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<td>Weight of home goods $\alpha$</td>
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- We set the initial $H$ to generate a 10% bank markup: ex post bank markup: $\mu_{B,t} \equiv d_t N_t / (q_t N_{t+1}) - r_t$.

- To determine the size of a permanent deregulation shock, we calculate the change in $H$ that induces a 30% long-run increase in the number of firms in the home country.

Figure 1. Banking Deregulation under Financial Autarky
When we allow for international deposits, bank deregulation is followed by external borrowing, as home households borrow to finance increased entry in the more attractive business environment.

We then extend the model to incorporate elastic labor supply and endogenous (countercyclical) markups in the pricing of tradable goods (by assuming a discrete number of producers).

Deregulation yields less volatile fluctuations in response to productivity shocks.
Figure 2. Banking Deregulation with International Deposits
25 Financial Deregulation and Business Cycle Moderation

Intuition

- Compare the responses around pre- and post-deregulation steady states.

- Post deregulation, average market share per firm is smaller than pre deregulation.

- When productivity improves, financing additional entry reduces profits per firm both by further reducing market share and by generating lower markups.

- Hence, banks have an incentive to finance relatively less entry (after a favorable productivity shock) around the post-deregulation steady state.

- This dampens markup fluctuations (and volatility) relative to fluctuations around the pre-deregulation steady state.
Figure 4. Business Cycles, Pre- and Post Banking Deregulation
Following Backus, Kehoe, and Kydland (1992):

\[
\begin{bmatrix}
Z_t \\
Z_t^*
\end{bmatrix} = \begin{bmatrix}
.906 & .088 \\
.088 & .906
\end{bmatrix} \begin{bmatrix}
Z_{t-1} \\
Z_{t-1}^*
\end{bmatrix} + \begin{bmatrix}
\xi_t^Z \\
\xi_t^{Z^*}
\end{bmatrix}.
\]

• Standard deviation of innovations = 1 percent; correlation to = .258 (.19 percent covariance).
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<td>0.8978</td>
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Conclusions

- This paper provides an analysis of the domestic and international consequences of banking deregulation.

- We showed that deregulation can lead to real appreciation, external borrowing, and business cycle moderation (domestically and abroad).

- The model thus explains the potential contributions of U.S. banking deregulation started in 1977 and finalized in 1994 to features of U.S. and international dynamics since the 1980s.
Figure 3. Banking Deregulation with International Deposits, Elastic Labor, and Endogenous Firm Markups