

Notes on 3rd Generation Models (add banks + currency mismatch)

The so-called “third generation” currency crisis models add a banking sector that borrows from abroad—typically in a foreign currency. Hence the usual term mismatch problems banks have (they lend long term and borrow short-term) are compounded if they borrow in dollars and lend in local currency, perhaps to a nontraded sector business as in the TWM (2004) story about capital account liberalization. Chang and Velasco use two models of banks, one is the Diamond-Dybvig Model (see their 1983 paper) as in the “Canonical Model” paper (see Chang and Velasco (1998a)). In the “Liquidity Crisis” model review here banks overcome a market imperfection (indivisibility or lumpy investment) by pooling funds for big project, thereby providing a welfare enhancing service even if agents are not risk averse. Here are the key assumptions of their model:

1. Ex ante identical agents each with endowment $e > 0$ at $t = 0$.
2. Time periods: $t = 0$, make plans; $t = 1$ short term investments mature; $t = 2$ is long term investment.
3. Domestic residents can invest internationally with a zero return of $R = 1$ or they can borrow internationally up to a debt limit $d > 0$.
4. Alternatively domestic residents can invest at home in a technology which is profitable long term $R > 1$ with a penalty for early liquidation $r < 1$ in the short run ($t = 1$).

5. To earn long term + return $R > 1$, investors must pool their funds— via a bank or stock market. Each depositor then turns over to the bank their initial endowment e and their international credit line d . The bank then gives the depositor the right to withdraw e in the short run ($t = 1$) or some larger amount y in the long run ($t = 2$).
6. Banks have a reserve requirement of $b > 0$ for each depositor— consolidated for all depositors b may be viewed as the reserves of the Central Bank.

Banks maximize profits on behalf of their depositors raising overall investment and consumption in the long run so that that $y > e$ which implies (note banks are welfare enhancing):

1. They invest as little as possible in the zero return world asset— precisely b .
2. Banks borrow all they can, d per depositor, in world markets to earn the spread $R-1$ on domestic long-term investment. Long term GDI will thus be $k = e + d - b$.
3. Perfectly competitive banks earn zero profit distributing all earnings to depositors: $y = Re + (R-1)(d-b)$ after repaying foreign debt d where $y > e$ for b not too large, meaning $b < d + e$.

A Liquidity Crisis:

- The above assumes international creditors and depositors remain confident in the bank at $t = 1$. Then the bank may fail when international creditors recall loans d and depositors attempt to withdraw their initial deposits e . To meet these demands the bank can draw on its reserves b and liquidate its long term investment k but if $e + d > b + rk$ the bank fails—this is an “international Liquidity crisis.”
- A floating exchange rate or big devaluation can make things worse or even trigger a crisis. Suppose d is lent in foreign currency at s pesos per dollar (recall that e is per capita endowment). Assuming the Central Bank holds all its reserves in foreign bonds, the liquidity crisis now occurs when $e > s(b-d) + rk$. If the country is net debtor, a devaluation can make the banks illiquid since depositors know this they will rush to withdraw their assets – Calvo tells several stories of this sort in his Chronicle of a Death Foretold Paper while drawing our attention to m/b where this m is broad money (M2) per person.

II. Preventing Liquidity Crises:

There are several strategies to avoid this type of crisis, none costless. A number of these policies involve management of short term bank to bank external obligations, d :

1. **Stretch out the maturity of external debt**, d , helps reduce vulnerability to bank runs—though it does not guarantee it. That only borrow long term so that $t = 2$ for d as well as k . Banks still pool assets, but profitability is no doubt lower. This also raises the risk for lenders of d funds and to some extent shifts the potential liquidity crisis to OECD banks—who in turn should monitor their bank’s lending more closely. The result of this policy, however, may be less total bank lending d , and therefore less investment k .

2. One partial solution is a **lender of last resort**. The IMF plays that the role to some extent, but perhaps its conditionality is too strict and its funds are too limited to do this effectively. Alternatively one could form an regional lending fund to provide a lender of last resort. However, if the funds of this regional lender of last resort per person, z , simply raised per capita credit limits in the region so that $d' = d + z$ the regional facility would not solve the problem. The regional bank would have to enforce a per capita borrowing limit $d' < b + rk + z - e$ otherwise there would still be a risk of a regional liquidity crisis. One has to argue that a regional fund was better at enforcing prudential regulations than the IMF or other OECD institution (the BIS).

3. The government could also raise **reserve requirements b** , but this reduces k and could even force banks out of the intermediation business—banks no longer do what they are supposed to do. This is what happened in Argentina during 1970s and 1980s. An intermediate approach was the capital controls—a implicit tax on short term capital inflows-- Chile used from 1985-1999. The Central Bank required some fraction of short term dollar foreign loans be put on held at the CB earning zero interest—in effect raises reserve requirements net borrowing as $b' = b + vd$ where v is the set aside requirement (about 20% when Chile had capital controls). This again reduces domestic investment, as $k = e + d - b'$ where $b' > b$.

4. Another alternative is to **import banking services**. This shifts the lender of last resort function to from the host country to the home country, but the host country losses some control over its banking system (nationalism may be a factor here) and once there is a crises the home country Central bank may restrict lending to host country residents, d falls and again k falls as the countries credit line per person d shrinks.

5. Yet another approach is to finance investment with a **local equity market**. Equities provide domestic residents with liquidity, but avoid the original sin problem since they are typically denominated in local currency units, d/s where d is now equity issues per domestic agent. Now devaluation discourages liquidation of equities as the foreign currency value of equities plummet. This type of financing may be expensive, however, as investors demand big equity returns where exchange rate risk is high. There also market liquidity problems

in smaller countries, though listing stocks on a regional or OECD exchange can help overcome this problem.

5. Finally, a country can switch from short term debt and equity financing to FDI—but this effectively eliminates the role of banks by internalizing finance within a multinational or by again importing banking services. See Hausmann et.al.'s “Good Cholesterol” paper for a critique of this approach.

IIB. A second group of strategies to avoid liquidity crises is focus on reducing withdrawals of e. Deposit insurance and fixed fx rates are common policy instruments to address these issues.

1. **Improved prudential regulation of banks**, imposed as a precondition for IMF precautionary credit lines (the Clinton Plan) or imposed on OECD banks by home governments. The Halifax II accords focused on shoring up domestic prudential regulations, reforming and limiting deposit insurance for example and imposing standard Basle accord risk management and accounting standards on the banking system. This seems like a necessary step to reduce moral hazard whether or not a country borrows from abroad.
2. **A fixed exchange rate backed by ample reserves b**—can also prevent bank runs—but only if $b > d + e$ which again makes the country a net creditor ties it to a currency board type of arrangement. Argentina's convertibility plan requires and $b > e$ to discourage runs, but of course this does not prevent external debt from becoming a burden.
3. **A floating exchange rate** gives the government more flexibility and does not put the government in the business of absorbing currency risk – providing a free hedging service.

Generation III Currency Crisis Model: Chang and Velasco (1998)
Canonical Model and the Asian Liquidity Crises Finance and
Development, 1999:

Stylized facts regarding post 1994 Mexico Crises:

1. No government fiscal misbehavior (except perhaps contingent liabilities for private deposits)
2. Wide variety of macroeconomic circumstances—sometimes large CA deficit, some not – not driven by fundamentals, can be self-fulfilling (but see Edwards on CA deficits).
3. Contagious - sometimes
4. Exchange rate regime became incompatible with helping banks, but devaluation also created severe problems for banks. Loan term and/or currency mismatches.
5. Punishment larger than the crime.

Misc notes.

Agents can borrow or invest in uncertain long term technology $r < 1$ in period 1 and $R > 1$ in period 2, early liquidation causes a net loss of $1-r > 0$.

Agents can also invest internationally in a risk free asset.

With probability λ agent needs to consume early, $(1-\lambda)$ agent is patient.

Banks spread risk by pooling risks of various agents:

Banking Crises (Kaminsky and Reinhart(1996)

1. Of 26 banking crisis, 18 were preceded by financial sector liberalization
2. Financial liberalization "signaled" 71% of all crises.
3. M2 multiplier rose 20% faster than in tranquil times
4. Growth of DC to GDP was high and increasing as crises approached

Financial liberalization-- lowering reserve requirements on banks,

Greater competition in the banking sector.

Goodbye Financial Repression, Hello Financial Crash

Conclusions

1. High reserve requirements on liquid bank liabilities-- or controls on S-T liabilities for everyone.
2. Financial liberalization may raise probability of a crisis.
3. Large real costs due to early liquidation-- insolvency vs. illiquidity
4. Self fulfilling liquidity squeeze on banks-- role of international lender of last resort
5. Prudential regulations needed in this case.

Generation III Currency Crisis Model: Chang and Velasco (1998) Canonical Model and the Asian Liquidity Crises Finance and Development, 1999:

Generation III Currency Crisis Model: Chang and Velasco (1998) Canonical Model
And Asian Liquidity Crisis Papers

1. No government fiscal misbehavior (except perhaps contingent liabilities for private deposits)
2. Wide variety of macroeconomic circumstances-- some CA deficit, some not
3. Specific-- sometimes crisis sometimes not
4. Exchange rate regime became incompatible with helping banks, but devaluation also created severe problems for banks. Term and Currency mismatches.
5. Punishment larger than the crime.

Add banks to a basic Macro model of exchange rate crisis:

1. Capital flows from abroad may magnify an liquidity problem
2. Financial liberalization accentuates a maturity mismatch typical of commercial banks.
3. Prices of nontraded assets (inelastic supply) rise as financial flows are intermediated by the financial system.
4. Small shocks big distress via the financial system
5. Unsound policies lead to over-borrowing and overinvestment-- deposit guarantees and credit or investment subsidies.
6. Fx collapses when a pegged fx rate and helping banks become incompatible objectives.