

Discussion

Franklin Allen

Philip is clearly one of the world's leading experts on pensions and he's also an expert on crises. He is the ideal person to write this paper. It is a thought-provoking and interesting analysis of the problem.

The starting point is a discussion of financial stability. *Systemic risk* is defined as a sequence of events entailing heightened risk of a financial crisis. A *financial crisis* is defined as being a major and contagious collapse of the financial system, entailing inability to provide payment services or to allocate funds for investment. These are fairly narrow definitions. With ageing, it may well be that any resulting financial crisis will take a long time to develop. The crisis in Japan that resulted from the aftermath of the bubble in asset prices in the late 1980-'s is an example of a long-drawn-out crisis. The impact of aging may be similar, in that it develops over several years and its impacts are damaging without any discontinuous change.

The second step of the analysis is to outline the aging problem. This is well-known, but the paper does a nice job of summarizing the literature succinctly. The categorization of pension systems developed is a useful one. Philip distinguishes between three different types.

1. Pay-as-you-go.
2. Bond issuance.
3. Pre-funded pensions in private markets.

The final part of the paper develops the consequences of the aging problem and the type of pension scheme adopted for the financial system.

The main difference that I have with Philip is that I would use a different categorization of crises. I would divide the causes of crises into five different types. Only some of these (distinguished below by **) are likely to be associated with aging.

1 Financial panic

Panics are crises that are *random events* unrelated to changes in the real economy. The classical form of this view suggests that panics are the result of some kind of

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"mob psychology" or "mass" modern version, developed by bank runs are self-fulfilling first-served liabilities and cost equilibria. If everyone believes for each individual to try and liquid assets to meet all of its assets at a loss. Given the first-come first-served who withdraw initially, anticipating this, immediately. On the other hand occur, only those with immediate demands, there will be no panic

An important issue within equilibrium selection. One occurs is to assume it depends on example, if a sunspot occurs, this will be self-fulfilling. If a good equilibrium will prevail, a sophisticated way is to assume (1998). They show how introducing allows a unique equilibrium to

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2 Business cycle**

An alternative to the "sunspot" of the *business cycle*. An economic raising the possibility that bank depositors receive information will anticipate financial difficulties. This attempt will precipitate panics are not random events but Building on the empirical work crises were predicted by lead

"mob psychology" or "mass hysteria" (see, e.g., Kindleberger (1978)). The modern version, developed by Diamond and Dybvig (1983) and others, is that bank runs are self-fulfilling prophecies. Given their assumptions of first-come, first-served liabilities and costly liquidation of some assets, there are multiple equilibria. If everyone believes that a banking panic is about to occur, it is optimal for each individual to try and withdraw her funds. Since each bank has insufficient liquid assets to meet all of its commitments, it will have to liquidate some of its assets at a loss. Given the first-come, first-served nature of deposit contracts, those depositors who withdraw initially will receive more than those who wait. On the one hand, anticipating this, all depositors have an incentive to withdraw immediately. On the other hand, if no one believes a banking panic is about to occur, only those with immediate needs for liquidity will withdraw their funds. Assuming that banks have sufficient liquid assets to meet these genuine liquidity demands, there will be no panic.

An important issue within the Diamond and Dybvig framework is that of equilibrium selection. One simple way of modelling which of these equilibria occurs is to assume it depends on extraneous variables or "sunspots". For example, if a sunspot occurs, people believe the bad equilibrium will prevail, and this will be self-fulfilling. If a sunspot does not occur, people will believe that the good equilibrium will prevail, and this will also be self-fulfilling. Another, more sophisticated way is to assume informational imperfections, as in Morris and Shin (1998). They show how introducing a small degree of informational imperfection allows a unique equilibrium to be determined.

With regard to the issue of aging, there seems to be no particular reason why this should lead to more financial panics than before. This would happen if aging was expected to change the equilibrium selection mechanism, but this seems unlikely.

2 Business cycle**

An alternative to the "sunspot" view is that banking panics are a natural outgrowth of the *business cycle*. An economic downturn will reduce the value of bank assets, raising the possibility that banks will be unable to meet their commitments. If depositors receive information about an impending downturn in the cycle, they will anticipate financial difficulties in the banking sector and try to withdraw their funds. This attempt will precipitate the crisis. According to this interpretation, panics are not random events but a response to unfolding economic circumstances. Building on the empirical work of Gorton (1988) that nineteenth-century banking crises were predicted by leading economic indicators, Allen and Gale (1998)

develop a model that is consistent with the business-cycle view of the origins of banking panics¹

In contrast to Diamond and Dybvig (1983), the basic problem is not one of multiple equilibria. Rather the problem is that banks use deposit contracts that involve a fixed promise. If the returns on a bank's assets are low, the bank will be unable to satisfy its promise. Depositors will be able to deduce this. Early consumers with urgent liquidity needs and late consumers who do not require liquidity to consume will try and withdraw simultaneously. Since the bank has only limited liquid assets, it will be unable to meet everybody's demands and there will be a run.

Crises that result from banks being unable to meet their fixed promises to depositors may well result from the aging problem. The heavy requirements of a large cohort of elderly people requiring liquidity simultaneously may well increase the frequency of this type of crisis. The types of financial system that are likely to be particularly susceptible are those that are bank-based. Market-based financial systems, where there is widespread use of non-contingent contracts in the provision of pensions, may also suffer from an increased occurrence of financial crises.

3 Inconsistent government macro policies**

The third type of crisis is where the government follows financial and exchange-rate policies that are inconsistent with stability. The first-generation models of currency crises (e.g., Krugman (1979)) and the second-generation models (e.g., Obstfeld (1986; 1994) and Calvo (1988)) have these types of features. For example, in first-generation models the government may be running a deficit that is financed partially by expanding the money supply. The resulting inflation acts as a tax. This will be inconsistent with a fixed or pegged exchange rate and will trigger a currency crisis.

Generous pay-as-you-go and bond-issuance pension systems may well lead to an increase in this type of crisis. In addition to runs on the currency, anticipation of funding pension systems through an inflation tax may lead to a collapse in the government bond market, and it may not be possible to roll over short-term debt.

¹ See also Chari and Jagannathan (1988), Jacklin and Bhattacharya (1988), Hellwig (1994), and Alonso (1996).

4 Bubble collapse*

Crises often follow what appears to be a bubble. Examples include the crises in Norway, Finland and the Japanese bubble of the 1980's, and the Asian crises of 1997. All the ensuing crises based on the overvaluation of real estate and stock markets. If the ultimate providers of funds are not investment, there is a classic bubble. A return to investment in the market above its fundamental value. The expansion of credit that is provided for the expansion of the volume of credit is an agency problem and lead to a crisis.

This type of crisis is again a classic bubble. Types of financial system that are particularly susceptible to this type of crisis are those with significant market funding.

5 Contagion and f

The prevalence of financial crises in the sector is unusually susceptible to a large impact. A shock that originates in perhaps even a few institutions in the sector and then infect the larger sector. Contagion that have been suggested.

Banks are linked in several ways. These linkages can be considered in models of payment systems development. Parigi (1998) has considered the net payment system, banks at the end of the day settle their accounts. Contagion if the failure of the payment system, transactions are settled. There is no risk of contagion if the payment system is preferred. If the proportion of consumers that

4 Bubble collapse**

Crises often follow what appear to be bubbles in asset prices. Examples are the crises in Norway, Finland and Sweden in the late 1980-'s and early 1990-'s, the Japanese bubble of the 1980's and the subsequent lost decade of the 1990's and the Asian crises of 1997. Allen and Gale (2000a) provide a theory of bubbles and ensuing crises based on the existence of an agency problem. Many investors in real estate and stock markets obtain their investment funds from external sources. If the ultimate providers of funds are unable to observe the characteristics of the investment, there is a classic risk-shifting problem. Risk-shifting increases the return to investment in the assets and causes investors to bid up the asset price above its fundamental value. A crucial determinant of asset prices is the amount of credit that is provided for speculative investment. Financial liberalization, by expanding the volume of credit for speculative investments, can interact with the agency problem and lead to a bubble in asset prices.

This type of crisis is again likely to be exacerbated by the aging problem. The types of financial system that are likely to be particularly susceptible are those with significant market funding of pensions and institutional investors.

5 Contagion and financial fragility

The prevalence of financial crises has led many to conclude that the financial sector is unusually susceptible to shocks. One theory is that small shocks can have a large impact. A shock that initially affects only a particular region or sector or perhaps even a few institutions can spread by contagion to the rest of the financial sector and then infect the larger economy. There are a number of different types of contagion that have been suggested in the literature.

Banks are linked in several ways including payment systems and interbank markets. These linkages can lead to a problem of contagion. We start by considering models of payment-system contagion. Building on a locational model of payment systems developed by McAndrews and Roberds (1995), Freixas and Parigi (1998) have considered contagion in net and gross payment systems. In a net payment system, banks extend credit to each other within the day and at the end of the day settle their net position. This exposes banks to the possibility of contagion if the failure of one institution triggers a chain reaction. In a gross system, transactions are settled on a one-to-one basis with central bank money. There is no risk of contagion, but banks have to hold large reserve balances. A net payment system is preferred when the probability of banks having low returns is small, the opportunity cost of holding central bank money reserves is high, and the proportion of consumers that have to consume at another location is high. Freixas,

Parigi and Rochet (1999) use this model to examine the conditions under which gridlock occurs. They show that there can be gridlock when the depositors in one bank withdraw their funds, anticipating that other banks cannot meet their netting obligations if all their depositors have also withdrawn their funds. Rochet and Tirole (1996a) consider the role of the too-big-to-fail policy in preventing contagion.

Allen and Gale (2000b) focus on a channel of contagion that arises from the overlapping claims that different regions or sectors of the banking system have on one another through interbank markets. When one region suffers a banking crisis, the other regions suffer a loss because their claims on the troubled region fall in value. If this spillover effect is strong enough, it can cause a crisis in the adjacent regions. In extreme cases, the crisis passes from region to region and becomes a contagion. Aghion, Bolton and Dewatripont (1999) also consider a model of contagion through interbank markets. In their model, there are multiple equilibria. In one equilibrium there are self-confirming beliefs that a bank failure is an idiosyncratic event and, in the other, there are self-fulfilling beliefs that a bank failure signals a global shortage of liquidity. Lagunoff and Schreft (1998) study the spread of crises in a probabilistic model. Financial linkages are modelled by assuming that each project requires two participants, and that each participant requires two projects. When the probability that one's partner will withdraw becomes too large, all participants simultaneously withdraw, and this is interpreted as a financial crisis. Van Rijckeghem and Weber (2000) document linkages through banking centres empirically. Rochet and Tirole (1996b) use monitoring as a means of triggering correlated crises: if one bank fails, it is assumed that other banks have not been properly monitored, and a general collapse occurs.

None of these theories of contagion and financial fragility suggest that the aging problem will lead to an increase in this type of crisis. They are much more due to the structure of the payment system and the form of the interbank market. These are independent of the pensions system.

In conclusion, there does seem to be some likelihood of an interaction between the aging problem and financial stability. The types of crisis that are most likely to be triggered by the ageing problem are those due to the business cycle, where fixed promises are made and there are insufficient resources to meet them, those due to inconsistent government macro policies and those due to bubble collapse.

References

Aghion, P., P. Bolton and M. Dewatripont. 1999. *Contagious Bank Failures*. Princeton University, Working Paper.

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- Allen, F. and D. Gale. 1998. Optimal Risk Sharing. *Journal of Economic Theory*, 72, pp. 128-150.
- Allen, F. and D. Gale. 2000a. Bubbles and Crises. *Journal of Economic Perspectives*, 14, pp. 1-33.
- Allen, F. and D. Gale. 2000b. Financial Crises. *Journal of Economic Perspectives*, 14, pp. 1-33.
- Alonso, I. 1996. On Avoiding Bank Runs. *Journal of Economic Theory*, 72, pp. 141-142.
- Calvo, G. 1988. Servicing the Public Debt: A Failure of International Financial Relations. *Review of Economics and Statistics*, 70, pp. 141-142.
- Chari, V. and R. Jagannathan. 1996. Expectations Equilibrium. *Journal of Economic Theory*, 72, pp. 141-142.
- Diamond, D. and P. Dybvig. 1983. Bank Runs, Deposit Insurance, and Financial Structure. *Journal of Political Economy*, 91, pp. 401-424.
- Freixas, X. and B. Parigi. 1998. Contagion in Payment Systems. *Journal of Financial Economics*, 51, pp. 1-38.
- Freixas, X., B. Parigi and J. Rochet. 1998. Liquidity Provision by the Central Bank. *Journal of Economic Theory*, 72, pp. 141-142.
- Gorton, G. 1988. Banking Panics and Crises. *Journal of Economic Theory*, 72, pp. 141-142.
- Hellwig, M. 1994. Liquidity Provision and Bank Runs. *European Economic Review*, 38, pp. 141-142.
- Jacklin, C. and S. Bhattacharya. 1988. Bank Runs: Welfare and Policy Implications. *Journal of Economic Theory*, 72, pp. 141-142.
- Kindleberger, C. 1978. *Manias, Panics, and Crashes*. New York: Basic Books.
- Krugman, P. 1979. A Model of Balance of Payments Crises. *Journal of Banking and Finance*, 11, pp. 311-25.
- Lagunoff, R. and S. Schreft. 1998. A Model of Financial Crises. *Economic Theory*, 11, pp. 141-142.
- McAndrews, J. and W. Roberds. 1999. Financial Intermediation. *Journal of Economic Theory*, 72, pp. 141-142.
- Morris, S. and H. Shin. 1998. Unique Equilibria and Bank Runs. *American Economic Review*, 88, pp. 141-142.
- Obstfeld, M. 1986. Rational and Irrational Expectations. *Economic Review*, 76, pp. 72-81.
- Obstfeld, M. 1994. Risk-Taking, Global Capital Markets, and Risk-Sharing. *Journal of Economic Theory*, 72, pp. 141-142.

- Allen, F. and D. Gale. 1998. Optimal Financial Crises. *Journal of Finance*, 53, pp. 1245-1284.
- Allen, F. and D. Gale. 2000a. Bubbles and Crises. *Economic Journal*, 110, pp. 236-255.
- Allen, F. and D. Gale. 2000b. Financial Contagion. *Journal of Political Economy*, 108, pp. 1-33.
- Alonso, I. 1996. On Avoiding Bank Runs. *Journal of Monetary Economics*, 37, pp. 73-87.
- Calvo, G. 1988. Servicing the Public Debt: The Role of Expectations. *American Economic Review*, 78, pp. 1411-1428.
- Chari, V. and R. Jagannathan. 1988. Banking Panics, Information and Rational Expectations Equilibrium. *Journal of Finance*, 43, pp. 749-60.
- Diamond, D. and P. Dybvig. 1983. Bank Runs, Deposit Insurance and Liquidity. *Journal of Political Economy*, 91, pp. 401-419.
- Freixas, X. and B. Parigi. 1998. Contagion and Efficiency in Gross and Net Interbank Payment Systems. *Journal of Financial Intermediation*, 7, pp. 3-31.
- Freixas, X., B. Parigi and J. Rochet. 2000). Systemic Risk, Interbank Relations and Liquidity Provision by the Central Bank. *Journal of Money, Credit & Banking*, 32, pp. 611-38.
- Gorton, G. 1988. Banking Panics and Business Cycles. *Oxford Economic Papers*, 40, pp. 751-781.
- Hellwig, M. 1994. Liquidity Provision, Banking and the Allocation of Interest Rate Risk. *European Economic Review*, 38, pp. 1363-1389.
- Jacklin, C. and S. Bhattacharya. 1988. Distinguishing Panics and Information-Based Bank Runs: Welfare and Policy Implications. *Journal of Political Economy*, 96, pp. 568-592.
- Kindleberger, C. 1978. *Manias, Panics, and Crashes: A History of Financial Crises*, New York: Basic Books.
- Krugman, P. 1979. A Model of Balance of Payments Crises. *Journal of Money, Credit and Banking*, 11, pp. 311-25.
- Lagunoff, R. and S. Schreft. 1998. A Model of Financial Fragility. forthcoming. *Journal of Economic Theory*.
- McAndrews, J. and W. Roberds. 1995. Banks, Payments and Coordination. *Journal of Financial Intermediation*, 4, pp. 305-27.
- Morris, S. and H. Shin. 1998. Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks. *American Economic Review*, 88, pp. 587-597.
- Obstfeld, M. 1986. Rational and Self-Fulfilling Balance of Payments Crises. *American Economic Review*, 76, pp. 72-81.
- Obstfeld, M. 1994. Risk-Taking, Global Diversification, and Growth. *American Economic Review*, 84, pp. 10-29.

- Rochet, J. and J. Tirole. 1996a. Interbank Lending and Systemic Risk. *Journal of Money, Credit and Banking*, 28, pp. 733-762.
- Rochet, J. and J. Tirole. 1996a. Controlling Risk in Payment Systems. *Journal of Money, Credit and Banking*, 28, pp. 832-862.
- Van Rijckeghem, C. and B. Weber. 2000. *Spillovers Through Banking Centers: A Panel Data Analysis*. IMF Working Paper, WP/00/88, Washington D.C.

Discussion

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The paper by Davis on "Ageing a

Whereas anybody concerned with old-age provision based on pay-as-you-go systems should appreciate that in an ageing population pay-as-you-go systems may be increasingly unstable for the financial and economic system. A pay-as-you-go system under stress aff

A shift towards funding requires stronger supervision. Regulation should be strengthened and use international diversification to reduce country-specific shocks, in particular. Regulation and supervision must be strengthened to avoid a moral hazard on the side of f

Financial institutions as well as governments that the demographic shift requires new modes of old-age provision. It is important to monitor asset price levels and asset price pressures associated with a pay-as-you-go system and the changes in demographic s

On the implications of pay-as-you-go systems for pension societies, I am, at once, more cautious and more optimistic because pension systems are more secure. There is no issue of "solvency" for pay-as-you-go systems if the rules of these systems so as to be self-financing and convenient. This will harm the pension system at the same time it will reduce the need for a pay-as-you-go system.

At the same time, I am more cautious about pay-as-you-go systems for financial markets. Political economy suggests that expropriations of pension wealth are likely to occur in other forms of wealth as well. I am more cautious, e.g., by the introduction