

# Why Diamond and Dybvig (1983) is a particularly flawed and dangerous paper

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## Abstract

Diamond and Dybvig's paper ("D&D") pretends to "show that bank deposit contracts can provide allocations superior to those of exchange markets, offering an explanation of how banks subject to runs can attract deposits". This broad assertion is confirmed by the press release explaining why the authors have just received the "Nobel prize": "For the economy to function, savings must be channeled to investments. However, there is a conflict here: savers want instant access to their money in case of unexpected outlays, while businesses and homeowners need to know they will not be forced to repay their loans prematurely. In their theory, Diamond and Dybvig show how banks offer an optimal solution to this problem".

We explain in this short paper how, forty years ago, unrealistic mathematical formalizations led Diamond and Dybvig to false economic results concerning the role of banks and secondary financial markets. In the strange world of D&D, there is only one generation and three periods before Doomsday. Consequently, there are no investors with a sufficiently long horizon to buy on the secondary markets the securities sold by investors who want to recover their money. In the real (modern) world, there are active secondary markets where people with different horizons can buy and sell securities issued by companies, including banks. In the real (modern) world, savers who need their money back can sell their securities to other investors without forcing companies "to repay their loans prematurely". Last but not least, in the real (modern) world, a panic-prone bank is likely to suffer from lower liquidity on its longer-term liabilities (stocks, bonds), with an overall negative welfare impact.

It should be clear that this paper without active secondary markets does not provide any fundamental understanding of how (modern) financial markets work. To come back to the original question, today panic-prone banks can attract deposits simply and only because they are protected by lenders of last resort and deposit guarantees!

There are many articles in financial economics that are math-heavy but economics-light. But D&D really stands out for its real-world consequences. Diamond and Dybvig provided the theoretical underpinning for the authorities' unfortunate tolerance relative to excessive maturity transformation and liquidity risk. In a way, they provided justifications for the various Basel regulations centered solely on solvency. The financial crisis of 2008-2009 forced the public authorities to a pragmatic reversal and they finally introduced liquidity ratios in Basel III. This key innovation brought more stability to our financial systems and was not achieved thanks to D&D, but despite D&D.

Diamond and Dybvig (1983) ("D&D") is one of the most frequently quoted papers in financial economics. Thus, it may seem natural that forty years later the authors finally receive the "Nobel prize". Yet this article is an example of financial economics at its worst. A simplistic mathematical formalization leads to erroneous conclusions that provide the theoretical foundation for inadequate financial regulations.

### **1/ A fundamentally flawed mathematical formalization.**

Let's start with the main unacceptable feature of the model used by the authors: in their world, there is no active secondary market where savers who need their money can resell their investments. Obviously, if you remove the only source of natural liquidity in a market economy, you can conclude that strange and dangerous activities can improve well-being....

Specifically, their model is a one-generation, three-period model. People invest all their money at time 0 in businesses that need two periods to produce efficiently. At time 1, part of this unique generation discovers that it needs its money. There is no one available to buy their stakes, since the other part of this unique generation is already fully invested. So they have to dismantle their businesses and they get a pretty poor return compared to the lucky ones who are able to reach  $T=2$  in the D&D universe.

D&D explained that in this strange universe, a bank can hold the businesses and provide a kind of insurance by issuing securities (called "deposits") that will pay more than previously thought to the unlucky part of the generation who needs its money at time 1 and less to lucky people who will live a little longer.

This is all quite surreal since as soon as you introduce new generations, the problem disappears. In the real world, time does not stop at  $T=2$ . Even if each generation has an investment horizon that can sometimes seem too short compared to the horizon of companies, a new generation will come and will be able to buy on the secondary markets the shares sold by the older generation. No need to interrupt the operation of the nuclear facilities built for 40 years!

It should be clear that the three-period/one-generation D&D model provides no useful economic insight. The fact that "businesses and homeowners need to know they will not be forced to repay their loans prematurely" (the Nobel press release) has no implications since in the real-world investors can get their money back by selling their claims on the secondary markets without forcing any form of repayment.

Yet, it is true that in a more realistic model with overlapping generations and functioning secondary markets, there is still a type of (small!) "market failure". Savers earn their fair share of what has been produced, depending on how long they hold their investments. This means that people who experience negative "liquidity shocks" and stay invested for a reduced duration will get less than the lucky ones. Among all the risks that are difficult to insure, the fact that your investment income depends on the duration of your investment is not the most worrying!

In theory, one could imagine that financial institutions offer some complex deposit contracts in which there would be some form of insurance given to households having to liquidate their holdings sooner than expected. Indeed, this is the central idea of D&D as they claim that "banks issuing demand deposits can improve on a competitive market by providing better risk sharing among people who need to consume at different random times". However, real deposit contracts are rather simple and do not seem to offer any kind of insurance: your return depends strictly on how long you have left your money in the bank. From an insurance point of view, deposits bring no added value. This should come as no surprise: it is difficult to see what key informational advantages financial institutions would have compared to other potential insurers to control the reality of the liquidity shocks and avoid some

opportunistic behaviors of households trying to benefit from complex contracts (i.e. withdrawing the money earlier to reinvest it elsewhere whenever it makes financial sense). Indeed, in a key article, Jacklin (1987) rightly insisted that D&D type of contracts cannot work if households are active participants in financial markets. Finally, Allen and Gale (2004) confirmed: *“in reality, we do not observe such complex contracts”*. As Tirole (2006) put it, referring to the Jacklin critique: *“Financial Markets force the yield curve back to the technological yield curve”* (page 453). Broadly speaking, the return you get on your bank deposits depends on the duration of your investment and there is no risk-sharing or subsidies in favor of households affected by specific liquidity shocks. Everyone receives their fair share of what is produced by the capital installed in the economy. Banks have many key functions, but contrary to D&D’s hopes they don’t prevent capital incomes from being redistributed between savers according to the duration and riskiness of investments.

Any useful analysis of the role of banks should introduce the role of true secondary markets that provides liquidity in conjunction with banks. They are absent of D&D. But our fundamental critique of D&D does not mean that we believe secondary markets are always efficient. It is clear that some claims on installed capital are difficult to sell in secondary markets and that banks play a useful role to make secondary markets work better and provide liquidity to savers. But they don’t do that in the way that D&D describes and that has profound implications for the regulation of financial markets.

Loans to small businesses and households are difficult to sell because they suffer from “asymmetric information”. As it is well known, asymmetric information is indeed the worst enemy of liquidity on secondary markets since when an investor wants to sell, potential buyers fear that this selling decision may be based on superior information and as a result may rationally adjust downwards their own view on the fundamental value of the offered security. As Tirole (2006) stated: «The chief determinant of whether a claim can be easily traded in a secondary market (is “liquid”) is the symmetry of information among investors about the value of the claim” (page 81). In other words, market liquidity can be greatly affected by the difficulty for potential counterparties to differentiate orders based on new information from orders triggered by other reasons (sellers facing liquidity shocks and in need of cash, or sellers who changed their mind without any new information).

Tirole (2006) explains how financial markets adjust to this key problem of asymmetric information and highlights the key role played by “bundles of assets”: *“This flight to low-information-intensity securities takes multiple forms, and debt is only one of these. Another way of limiting costly trade with speculators is to buy bundles of indices on the grounds that they are less exposed to asymmetric information ‘thanks to the law of large numbers’: stock index futures, closed-end mutual funds, real-estate investment trusts, etc..”* (page 460).

Tirole does not explicitly mention the role of banks in building these “bundles of assets”, but it is fundamental. Banks can “securitize” the small loans they make and resell these packaged loans as liquid securities. But it is important to note that banks don’t really need securitization to produce “bundle of assets” that are mechanically less sensitive to asymmetric information. The shares and bonds that they issue, representative of the diversified assets that they hold in their balance sheets, are mechanically such “bundles of assets”. In addition, a bank is subject to many disclosure rules on the overall risks it takes and it is closely monitored by many outside observers (sell-side analysts, rating agencies). So naturally, on average, the shares of banks and the bonds they issue are much more liquid in the secondary markets than the assets they hold. For example, at the height of the financial crisis of 2007-2009, certain primary assets held by banks turned out to be almost completely impossible to sell (corporate bonds, sub-prime ABS...) while there was always an active, albeit very volatile, market in banks’ shares. By diversifying their assets and providing information on the aggregate risk they are

taking, banks are mechanically huge providers of liquidity for investors. Admati and Hellwig (2013) speak of “liquidity transformation” (p158).

Thus, banks naturally play a key role in resolving the pseudo horizon conflict highlighted by this Nobel Prize. But we are talking here about “liquidity transformation” and not about “maturity transformation”. Banks do not need to issue securities that increase the risk of run. The same “liquidity transformation” is achieved when they issue the easy tradable medium- or long-term securities that have disappeared from D&D inaccurate formalization. In fact, one can argue that the exposure to runs reduces the positive role of banks, because the risk of run creates a lot of asymmetric information with some creditors much better informed than others about this risk. In other words, the high liquidity of short-term liabilities may be paid for by lower liquidity for the other securities issued by banks (stocks, bonds) with possibly a net negative impact on welfare. Indeed, this mechanism is clearly apparent in all financial crisis<sup>1</sup>.

Like most highly formalized economic papers, D&D is difficult for non-specialists to read despite the very simplistic model they use. Moreover, D&D mixed some heavy mathematical calculations with reasonable literary considerations on well-known aspects of finance. Thus, D&D is not always well understood, and many people/students believe that their main contribution was not the (false) welfare/insurance improvement brought by deposits, but their insistence on the fact that sight deposits are indeed subject to dangerous runs. Well, Bagehot (1873) wrote some definitive pages on the subject in the 19<sup>th</sup> century and in the United States, the FDIC was created in 1933 to avoid runs and “bad equilibria”. After decades of financial crisis, Diamond and Dybvig did not discover in 1983 that banks financed by sight deposits were unstable! But by being wrong about the key market failures, they have made the march towards a more efficient financial system more difficult.

## **2/ The very negative impact of D&D on the process of financial reform.**

If bank deposit contracts cannot provide allocations superior to those of exchange markets, how banks subject to runs can attract deposits? There are obviously three reasons:

- Efficient secondary markets are based on modern technologies that allow a fast processing of buy and sell orders. These communication technologies already existed when Diamond and Dybvig wrote their article (although less efficient than now). But in the distant past, for example when Bagehot was writing his key analysis, this was not the case. So, despite the limitations of their one-generation model, D&D may be broadly correct in describing one of the reasons why sight deposits have appeared in history despite many episodes of runs and financial crises.
- In this distant past when secondary markets were not very efficient, public authorities had to find a way to fight against panics. The answer was the “lender of last resort” as well explained by Bagehot. But it is impossible for a “lender of last resort” to completely avoid subsidizing short-term borrowing. The collateral requested by the lender of last resort cannot be 100% risk-free (if it were, the bank could probably use it in private markets). Thus, a generous lender of last resort, particularly if constrained by the “too-big-to-fail” rule, encourages banks to issue cheap short-term debt because some of the risks in extreme scenarios are transferred to the taxpayer.

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<sup>1</sup> See Davanne (2015) for an analogy between this general equilibrium mechanism and the famous Modigliani-Miller theorem (“M&M”, 1958). M&M has shown that in general the value of firms should not increase when they issue more debt, since earnings are higher, but more volatile. The problem is similar for the issuance of safe and liquid short-term debt: this financing mode concentrates the impact of asymmetric information on the other long-term securities (equities, bonds) and probably reduces the overall liquidity provided by secondary markets.

- In addition to the lender of last resort, public authorities also introduced some guarantee of deposits to avoid runs. Clearly, these guarantees play a key role in helping banks collect deposits.

Thus, in the current state of modern technologies, the main reason why banks subject to runs attract deposits is that they are encouraged and subsidized to do so by public authorities (thanks to the guarantee of deposits and a generous lender of last resort)! As explained by the IMF (2008) : *“The higher return generally expected from longer maturity assets, the low frequency and systemic nature of liquidity crisis combined with the limited liability of stockholders, deposit insurance, and the likelihood of central bank emergency operations, all encourage individual banks to underinsure against liquidity risk by holding insufficient liquid assets or liquidity facilities”*.

After all the financial crisis we have suffered in the last decades, a fundamental question is thus whether or not it is possible, thanks to modern technologies, to build a “run-free” financial system with a radically diminished role played by short-term modes of financing as advocated by Cochrane (2014).

It is interesting to note that after the financial crisis of 2008-2009, the public authorities moved in this direction by introducing new liquidity ratios which limit the ability of banks to finance long-term assets with short-term liabilities. They did so in a very pragmatic way, as is generally the case after financial crisis, while maintaining or even strengthening existing public incentives for maturity transformation (generous lenders of last resort and guarantees of deposits). As a result, we have built a bizarre financial system with new regulations introduced to limit the impact of powerful public incentives! This pragmatic answer was not based on a thorough analysis of how the financial sector provides “liquidity services” and as a result left a lot of risks hidden in the shadow banking sector (see Davanne (2015)).

In this chaotic process towards a “run-free” financial system, a real obstacle has been and still is the dominance of the D&D view among economists that maturity transformation improves welfare. The Nobel Prize is testament to the outsized influence they have had over the past 40 years. Numerous official reports show how embarrassed policy makers were when they decided to introduce liquidity ratios in the Basel III regulations for the first time. For example, the Liikanen report (2012) on the future of the European banking sector describes (page 74) the difficulties in calibrating one of the new liquidity ratios (the NSFR): *«the determination of the final details of the NSFR contains a balancing act between enabling banks to engage in maturity transformation vital for the real economy, while reducing the reliance on destabilizing, short-term market funding to a sufficient degree »*.

The introduction of liquidity ratios, a first and small step in the right direction, has been made despite Diamond and Dybvig (1983) flawed but incredibly successful defense of maturity transformation, and not thanks to their analysis.

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