

What Lies Behind Investment Banking, Shadow Banking, and High-Frequency Trading? A Risky, Dangerous, Secretive, or Reputable Business?

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Abstract

Investment banking, shadow banking, and high-frequency trading are among those manifestations of modern finance that evoke fascination and mistrust in equal measure. Drawing on the academic literature and on current data from international institutions (Financial Stability Board, ESMA, SEC, LSEG), this paper examines what these lines of business actually are, how they function, who conducts them, and whose interests they serve.

The analysis shows that all of the activities examined constitute legal, economically well-founded, and in large part regulated businesses whose questionable reputation stems chiefly from opacity, conflicts of interest, and isolated excesses. Investment banking is a highly concentrated business of a few large banks, with worldwide fee income of \$60.5 billion in the first half of 2025 alone. Shadow banking, as recorded by the Financial Stability Board, comprises assets of \$256.8 trillion and thus already 51 per cent of the global financial system. In high-frequency trading, roughly 55 per cent of US and up to 43 per cent of European equity trading volume is attributable to strategies whose reaction times are measured in millionths of a second; the costs associated with latency arbitrage amount to roughly five billion dollars per year worldwide (Aquilina, Budish, and O'Neill, 2022).

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For investors, a differentiated assessment follows: none of the businesses examined is disreputable per se, and none is free of risk. Those who understand how they work, who the participants are, and where the profits originate can weigh opportunities and dangers realistically — and may, in selected cases, participate in these markets themselves, whether through listed trading firms or through regulated credit funds.

Keywords: Investment Banking · Shadow Banking · High-Frequency Trading · Interbank Market · Market Microstructure · Financial Stability.

JEL codes: G14, G15, G21, G23, G24, G28.

Non-Technical Summary

Few corners of the financial world are as burdened with preconceptions as investment banking, so-called shadow banking, and high-frequency trading. The very terms suggest secrecy, power, and risk — and indeed, each has its firm place in the history of financial crises. At the same time, they perform functions without which modern economies could not operate: bringing companies to the stock market, advising on mergers, financing credit outside bank balance sheets, and continuously quoting buying and selling prices on the exchanges.²

This paper answers the question posed in its title on the basis of the academic literature and current figures. Investment banking is the business of a small number of large houses: the five leading banks account for close to one third of worldwide fee income, which amounted to \$60.5 billion in the first half of 2025. The business demands exceptional qualifications from its employees and rewards them with exceptional bonuses — most recently an average of \$246,900 per employee on Wall Street. Opacity arises above all where transactions are settled not on exchanges but bilaterally.

Shadow banking, in turn, is no dark parallel world but the umbrella term for credit intermediation outside the classical banking system: money market funds, credit funds, hedge funds, securitisation vehicles, and similar structures. According to the data of the Financial Stability Board, this sector now manages \$256.8 trillion — more than half of the world's financial assets — and is growing twice as fast as the banks. It makes the system more diverse, but it shifts risks to places where neither deposit insurance nor central bank support applies directly.

High-frequency trading, finally, is the technological culmination of exchange trading: computer programs buy and sell within millionths of a second. They supply a substantial share of market liquidity, but they also earn money by detecting slower orders and getting ahead of them. Research puts the cost of this race for speed at roughly five billion dollars per year worldwide — a small but avoidable “tax” on every transaction. Exchanges support the business because they earn revenue from technology, data feeds, and server space.

The practical conclusion for investors is this: all of the businesses examined are more reputable than their reputation suggests, and riskier than their practitioners like to admit. Anyone who invests — whether in the shares of investment banks and trading houses, in credit funds, or simply through the stock exchange — should understand the profit sources of these actors, for they determine whether the investor earns from them or they from the investor.

² On the history of the term: the phrase “shadow banking system” was coined by the PIMCO economist Paul McCulley at the end of August 2007 at the central bankers' conference in Jackson Hole; his written text appeared in September 2007 (McCulley, 2007).

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1 Introduction

Few terms in finance carry as heavy a load of attributions as investment banking, shadow banking, and high-frequency trading. Since the financial crisis of 2007 to 2009, investment banking has stood, in many eyes, for excess; shadow banking carries darkness in its very name; and high-frequency trading was introduced to a mass audience as a rigged game by Michael Lewis's bestseller “Flash Boys” (Lewis, 2014). Yet all of these activities rest on economic functions as old as banking itself: bringing together capital and its uses, assuming and passing on risks, and providing liquidity and prices.

The discrepancy between public perception and economic function is the point of departure for this paper. It asks what actually lies behind these lines of business: How do they work, who conducts them, at what magnitudes do they take place, what qualifications do they demand, who profits from them — and are they, in the end, risky, dangerous, secretive, or simply reputable businesses with a bad press? The intent is expressly that of an illuminating survey for investors: light is to be brought into relationships that reporting often renders abridged or distorted.

The academic literature offers a broad foundation for this purpose. For investment banking, Morrison and Wilhelm (2007) have examined the institutional and historical development; Liaw (2012) and Fleuriet (2008) describe the business lines from a practical vantage point. Shadow banking was studied systematically after the financial crisis, in particular by Pozsar, Adrian, Ashcraft, and Boesky (2013), Gorton and Metrick (2010, 2012), Acharya, Schnabl, and Suarez (2013), and Claessens and Ratnovski (2014); the Financial Stability Board (FSB) has published annual monitoring exercises since 2011. On high-frequency trading, empirical studies from the leading journals are available in Hendershott, Jones, and Menkveld (2011), Menkveld (2013), Brogaard, Hendershott, and Riordan (2014), Budish, Cramton, and Shim (2015), Kirilenko, Kyle, Samadi, and Tuzun (2017), and Aquilina, Budish, and O'Neill (2022).³

In terms of method, the paper is a literature-based survey with descriptive data analysis. The most recent available publications are used throughout: the FSB's Global Monitoring Report on Nonbank Financial Intermediation (data as of end-2024, published December 2025), the fee statistics of LSEG Data & Analytics for the first half of 2025, the compensation data of the New York State Comptroller (March 2026), and the market share studies of ESMA (2014) and the Congressional Research Service (2016). All judgements are developed from these sources and identified as such.

The paper is structured as follows. Section 1 (the present section) serves as the introduction, frames the research question, and surveys the prior literature. Section 2 examines investment banking, including the classical interbank business, the demands

³ A comprehensive treatment of the microstructure of modern markets is given by Harris (2002) and O'Hara (2015); the technological history of ultrafast trading is described by MacKenzie (2021).

placed on employees, compensation practice, and the question of which banks conduct this business. Section 3 is devoted to shadow banking, its characteristics, actors, and magnitudes. Section 4 analyses high-frequency trading, from its origins through latency, co-location, and trading strategies to the questions of whether investors can profit from it and whether it is viable in its present form. Section 5 answers the question posed in the title and formulates recommendations for investors.

2 Investment Banking

2.1 Concept, Delimitation, and Historical Development

Investment banking denotes the capital-market-related business of banks: the management of securities issues, advice on corporate acquisitions and disposals, trading in securities, foreign exchange, and derivatives for the bank's own account and for clients, and associated services such as research and the coverage of institutional customers (Morrison and Wilhelm, 2007; Liaw, 2012). It differs fundamentally from classical commercial banking, which rests on taking deposits and granting loans, in its revenue sources, its risk profile, and its clientele: revenues arise predominantly from commissions, fees, and trading results rather than from net interest income, and the customers are corporations, sovereigns, and institutional investors rather than the general public.

The historical development of the business is closely interwoven with its regulation. In the United States, the Glass-Steagall Act of 1933, a response to the banking crises of the Great Depression, forced the separation of deposit banking from the securities business; the independent Wall Street investment houses emerged from that separation (Morrison and Wilhelm, 2007). Only the Gramm-Leach-Bliley Act of 1999 lifted the separation again and made today's universal banking groups possible. In continental Europe, by contrast, universal banking was always the rule: German and Austrian banks conducted issuance and trading business under one roof with the deposit business from the outset (Hartmann-Wendels, Pfingsten, and Weber, 2019).⁴

The financial crisis of 2007 to 2009 became the caesura of the business model. Of the five large independent investment banks of Wall Street, none survived in its previous form: Bear Stearns was sold to JPMorgan Chase in an emergency takeover in March 2008, Lehman Brothers filed for bankruptcy on 15 September 2008, Merrill Lynch took refuge in an acquisition by Bank of America, and Goldman Sachs and Morgan Stanley converted themselves into bank holding companies with access to central bank liquidity (FCIC, 2011). Investment banking did not disappear as a result — it migrated into regulated banking groups and was subjected to stricter capital and liquidity requirements.

⁴ The Glass-Steagall Act (Banking Act of 1933) separated commercial banking from investment banking; its gradual erosion from the 1980s onwards is described in the Financial Crisis Inquiry Report (FCIC, 2011).

2.2 Business Lines and Sources of Revenue

The range of services in investment banking can be ordered by its sources of revenue. Table 1 provides an overview of the principal business lines, the services rendered, and the manner of remuneration. In the issuance business (equity and debt capital markets), the banks undertake the structuring, pricing, and placement of share and bond issues and, in underwriting an issue, temporarily carry the placement risk on their own balance sheet. In M&A advisory, they accompany purchases, sales, and mergers of companies in return for success fees. In sales and trading, they continuously quote bid and ask prices to their clients in equities, bonds, foreign exchange, and derivatives, and earn the bid-ask spread.

Table 1: Business lines of investment banking

Business line	Service	Source of revenue
Issuance business (ECM)	Initial public offerings, capital increases, placements	Underwriting and placement commissions
Issuance business (DCM)	Bond issues of corporations and sovereigns	Underwriting and placement commissions
M&A advisory	Mergers, acquisitions, defence advice, valuations	Success and advisory fees
Sales & trading	Trading in equities, bonds, foreign exchange, derivatives	Bid-ask spread, trading result
Syndicated lending	Structuring and syndication of large loans	Arrangement and commitment fees
Prime brokerage	Clearing, financing, and securities lending for hedge funds	Interest, lending, and settlement charges
Research	Analyses of companies, markets, and economies	Indirect (order flow, commissions)

Sources: Morrison and Wilhelm (2007); Liaw (2012); Fleuriet (2008); own presentation.

The magnitude of the business is considerable, and so is its concentration. According to LSEG Data & Analytics, worldwide investment banking fees amounted to \$60.5 billion in the first half of 2025, of which \$31.9 billion accrued in the Americas and \$11.9 billion in the Asia-Pacific region (LSEG, 2025). The market leader was JPMorgan with fee income of \$4.6 billion and a market share of 7.7 per cent, followed by Goldman Sachs with 6.5 per cent and by BofA Securities, Morgan Stanley, and Citi; the five leading houses together thus account for close to one third of the world market. Table 2 summarises the regional distribution.⁵

Table 2: Worldwide investment banking fees in the first half of 2025 by region

Region	Fees (USD billion)	Share (per cent)
Americas	31.9	52.7
Asia-Pacific	11.9	19.7
Europe, Middle East, Africa	16.7	27.6

⁵ LSEG (formerly Refinitiv and Thomson Reuters) compiles the fees from issuance, advisory, and lending business under a uniform attribution scheme; the half-year figures for 2025 were 1 per cent below the prior year.

World total	60.5	100.0
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Sources: LSEG (2025); own calculations.

Notes: The figure for Europe, the Middle East, and Africa is derived as a residual from the reported totals.

The cyclicity of these revenues is striking. Issuance and advisory business live on the receptiveness of the capital markets: in boom years, initial public offerings, capital increases, and takeovers crowd into the market and fee income reaches record levels — most recently in the exceptional year 2021 — whereas in years of rising interest rates and falling prices, entire market windows remain closed for months. Trading revenues, by contrast, follow volatility and act partly in the opposite direction: turbulent markets that paralyze the issuance business invigorate trading. This combination of two counter-cyclical revenue sources explains why the large houses rarely face existential distress despite all cyclicity — and why their quarterly results are nevertheless notoriously hard to predict.

2.3 The Classical Interbank Business

To be distinguished from client-related investment banking is the classical interbank business: trading among the banks themselves. In the interbank market, institutions balance their liquidity positions by lending one another unsecured funds at maturities from overnight up to twelve months, by entering into secured transactions in the form of repurchase agreements (repos), and by trading foreign exchange and interest rate derivatives (Hartmann-Wendels, Pfingsten, and Weber, 2019). This business is no side show but the foundation of every bank's liquidity management: whoever holds surpluses at the end of the day places them with other institutions or with the central bank; whoever runs deficits borrows.

The volumes of the interbank business begin where retail business ends. The threshold of the wholesale market is commonly taken to be the one-million mark: the euro short-term rate €STR computed by the European Central Bank, for instance, rests exclusively on unsecured money market transactions with an individual volume of at least €1 million, as reported daily by the banks subject to statistical reporting. Customary trades lie well above this level — in overnight money and in the repo business, individual transactions in the tens to hundreds of millions are the rule, and central bank operations and large repo transactions reach into the billions. For private investors, this market is thus effectively inaccessible; it is open only to banks and large institutional names.⁶

The interbank business in the broader sense also includes foreign exchange trading, the largest financial market in the world: according to the triennial survey of the Bank for International Settlements, daily turnover most recently reached \$7.5 trillion, overwhelmingly between banks and other financial intermediaries (BIS, 2022). Trading

⁶ The €STR (euro short-term rate) replaced EONIA as the reference rate for unsecured overnight money in October 2019; it captures transactions of €1 million or more from the banks' money market statistical reporting (MMSR) to the ECB.

takes place around the clock and almost entirely over the counter; market leadership has for years rested with a small number of large banks and — remarkably enough — increasingly with non-bank electronic trading houses, to which Section 4 is devoted. From the interbank business also spring the reference rates on which loans, bonds, and derivatives in the hundreds of trillions depend — a quiet but central contribution of this market to the financial architecture.⁷

The financial crisis transformed this business as well. When mistrust among banks rose abruptly in August 2007, the unsecured interbank market largely dried up — a process that Gorton and Metrick (2012) described for the repo market as a veritable run (“run on repo”). Since then, the business has shifted structurally: away from unsecured money trading, towards secured transactions through central counterparties and towards holding liquidity with the central banks. The classical interbank business has thereby become safer, but also thinner; the reference rates were converted from survey-based fixings (LIBOR, EONIA) to transaction-based rates (€STR, SOFR).

2.4 Staff Requirements and Compensation

Investment banking places demands on its employees that go well beyond the usual standard of the financial industry. Recruitment is drawn overwhelmingly from a small number of leading universities; required are excellent degrees in economics, mathematics, physics, or computer science, together with professional credentials such as the Chartered Financial Analyst (CFA), the Certified European Financial Analyst (CEFA), the Certified International Investment Analyst (CIIA), or the Financial Risk Manager (FRM) designation. In trading and product development, quantitatively trained specialists (“quants”) have dominated since the 1990s, developing valuation models for derivatives and increasingly programming them as well; in M&A advisory, expertise in corporate and takeover law is added. Characteristic is a steep hierarchy from analyst through associate to managing director, with a pronounced up-or-out selection.⁸

The counterpart of these demands is a compensation practice without equal in any other industry, and one that shapes the public perception of investment banking decisively. According to the New York State Comptroller (2026), the Wall Street bonus pool for 2025 reached a record high of \$49.2 billion; the average bonus per employee rose by 6 per cent to \$246,900. The industry's average compensation including bonuses stood at \$505,677 in 2024 — nearly five times the average of the rest of New York's private sector. These

⁷ The susceptibility of survey-based reference rates to manipulation became evident in the LIBOR scandal: in June 2012, Barclays was the first institution to accept penalties of roughly \$450 million; other houses followed.

⁸ The workload is substantial: an internal survey of first-year analysts at Goldman Sachs that became public in the spring of 2021 reported average working weeks of roughly 95 hours.

payments were carried by industry profits of more than \$65 billion, an increase of 30 per cent over the prior year.⁹

Economically, the bonuses can be read as the employees' participation in the revenues they generate — the business is people-intensive, and client relationships and the skill of the staff are the true factor of production (Morrison and Wilhelm, 2007). At the same time, asymmetric bonus schemes create distorted incentives: those who share in profits but not in losses have an incentive towards excessive risk-taking. Rajan (2005) pointed to this incentive problem well before the financial crisis; regulation has responded with clawback clauses, multi-year deferral periods, and — in the European Union — a cap on variable compensation relative to fixed salary.

2.5 Opacity and Conflicts of Interest

The charge of secrecy strikes investment banking in a precise sense: substantial parts of the business take place not on transparent exchanges but bilaterally, over the counter — trading in interest rate and credit derivatives, foreign exchange transactions, private placements of debt, large blocks of shares. Prices and volumes there are known only to the parties involved, and the banks' informational advantages over their clients are considerable (Harris, 2002). To this are added exchange-like but anonymous trading venues (dark pools), in which orders are not visible before execution. Opacity here is no accident but in part deliberate: large orders are to be executed without moving the market against them.

Regulation has answered this opacity with a steadily growing catalogue of duties. In Europe, MiFID II has since 2018 required pre- and post-trade transparency for instruments traded over the counter as well, has capped the volume of anonymous trading in dark pools, and obliges banks to demonstrate best execution of client orders; in the United States, derivatives trading was largely shifted onto central counterparties and reporting systems after the financial crisis. Complete transparency has not been achieved thereby — nor would it be sensible for block transactions — but the distance between what the bank knows and what the supervisor can see has narrowed considerably.

Weightier than the opacity are the built-in conflicts of interest. The same bank that brings a company to the stock exchange publishes buy recommendations through its research; the same bank that advises a client on a takeover may finance the bidder; the same bank that executes client orders trades for its own account. The industry counters this with organisational separations (“Chinese walls”) and disclosure duties, but history shows that these precautions can fail: in the Global Research Analyst Settlement of 2003,

⁹ Office of the New York State Comptroller, press release of 26 March 2026. The survey covers securities industry employment in New York City (most recently 198,200 persons).

ten leading houses paid \$1.4 billion because their equity research had systematically served the issuance business.¹⁰

For the question posed in the title, it should be recorded that investment banking is not a secretive business in the sense of illegality — it is among the most densely regulated trades of all, supervised by securities and banking authorities and subject to extensive reporting, disclosure, and conduct obligations. But it is a business whose revenue sources are difficult for outsiders to penetrate and in which the bank structurally knows more than its client. The recurring scandals — from the research affair through the manipulation of reference rates to misconduct in foreign exchange trading — are, against this background, less an expression of criminal energy across an entire industry than an expression of the temptations that informational advantages bring with them.

2.6 Who Conducts Investment Banking?

Investment banking in its full breadth is conducted by only a few institutions worldwide. The barriers to entry are substantial: the issuance business demands global placement power with institutional investors, underwriting demands a large and resilient balance sheet, trading demands an expensive technology and risk infrastructure, and all business lines demand reputation — perhaps the scarcest commodity of the industry. The market is accordingly concentrated on the so-called bulge bracket houses: JPMorgan, Goldman Sachs, Morgan Stanley, BofA Securities, and Citi from the United States, joined by Barclays, UBS, and Deutsche Bank from Europe. Mid-sized banks generally confine themselves to individual niches of their home market.¹¹

Alongside the large banks, a second species has become established: independent advisory houses (boutiques) such as Lazard, Rothschild & Co, Evercore, and Houlihan Lokey. They forgo balance sheet business and trading and concentrate on M&A and restructuring advice — a business that requires no equity capital, only talent, and is therefore open to smaller providers as well. The question of minimum size thus receives a twofold answer: capital markets business involving the assumption of placement risk is reserved to the large names, whereas pure advisory work becomes economically viable from mid-sized transactions of a few tens of millions of euros, while the large houses typically accept mandates only from three-digit million amounts upward.

From the client's perspective, these proportions translate into effective access thresholds. An initial public offering is taken on by the international syndicates only from issue volumes that permit broad institutional placement; an M&A mandate at a major

¹⁰ In the settlement concluded in April 2003 with the SEC, the New York Attorney General, and other supervisors, the institutions additionally committed themselves to the organisational separation of research from investment banking.

¹¹ The term “bulge bracket” derives from the typography of issue prospectuses: the lead underwriters were named on the cover page in larger type — in the protruding bracket.

house presupposes fee volumes that arise only from transaction values in the high tens of millions; and in trading, institutional clients receive terms and coverage from which smaller names are excluded. Investment banking is in this respect a wholesale business in the strict sense: it begins where the volume carries the high fixed costs of a transaction — prospectus, due diligence, roadshow, syndicate — and that is regularly the case only beyond institutional orders of magnitude.

Austrian and most German institutions appear on this world market only selectively — in the domestic bond and private placement business, in mid-market takeovers, or as members of international underwriting syndicates. The true large-scale business, from the management of billion-dollar initial public offerings to defence advice in hostile takeover battles, plays out between London, New York, and, increasingly, the Asian financial centres. An investor who wishes to “invest in investment banking” therefore in effect invests in the shares of a handful of globally active houses — with their pronounced revenue cyclicity, as Section 2.7 shows.

2.7 An Assessment from the Investor's Perspective

From the investor's perspective, investment banking is two things: a service provider whose services one uses — mostly indirectly, through funds and new issues — and a potential investment. In the first role, the following holds: the interests of the bank and those of the investor are not congruent. Issues are sold when markets are receptive, not when they are cheap; research, notwithstanding all regulation, is not a neutral adviser; structured products contain margins that the buyer seldom fully penetrates. An informed investor therefore treats the industry's recommendations as what they are: sales documents with informational value.

In the second role — as an investment — the business displays pronounced cyclicity: issuance and M&A revenues follow the capital market climate, trading revenues follow volatility, and in crisis years record profits can quickly turn into losses. The returns on equity of the large houses fluctuate accordingly, and the valuations of their shares reflect this uncertainty in comparatively low earnings multiples. Whoever acquires shares of investment banks thus buys a levered claim on capital markets activity — a legitimate but volatile addition to a portfolio, whose risk resembles that of a cyclical industrial stock rather than that of a classical commercial bank.

3 Shadow Banking

3.1 The Term and Its Origins

The term shadow banking is younger than the phenomenon it names. It was coined at the end of August 2007 by the PIMCO economist Paul McCulley at the central bankers' conference of Jackson Hole — as a collective label for “the whole alphabet soup of levered up non-bank investment conduits, vehicles, and structures” that conduct credit business without being banks (McCulley, 2007). The Financial Stability Board, which has examined the sector on behalf of the G20 since 2011, defines it more soberly: shadow banking is credit intermediation involving entities and activities fully or partially outside the regular banking system (FSB, 2011). What is meant, then, is not criminal backrooms but legally unobjectionable funds, special purpose entities, and financing arrangements — “shadow” denotes the location outside the spotlight of banking regulation, not unlawfulness.¹²

Shadow banking arose from two impulses. The first is economic: savers seek money-like, interest-bearing assets beyond the savings account, firms seek financing beyond the bank loan, and specialised intermediaries can often bring the two together more cheaply than universal banks. The second is regulatory: the more strictly capital and liquidity rules raise the cost of banking, the more attractive it becomes to shift credit business into vehicles not subject to those rules. Acharya, Schnabl, and Suarez (2013) showed, using the securitisation vehicles of the pre-crisis years, that a substantial share of these constructions served less the transfer of risk than the circumvention of capital requirements — the risks remained with the banks through guarantees, while the capital to back them was saved.

Historically, the pattern is older than its name. The American money market funds of the 1970s already arose as an evasive manoeuvre: because the interest rate regulation of the day (Regulation Q) prescribed ceilings on deposit rates, funds offered savers an unregulated, higher-yielding alternative — and within a few years grew into a mainstay of corporate financing (Pozsar, Adrian, Ashcraft, and Boesky, 2013). The same pattern repeated itself with the securitisation vehicles of the 1980s and 1990s and repeats itself today with the credit funds: every tightening of bank regulation creates the demand for its circumvention, and every circumvention creates, after the next crisis, new regulation.

Before the financial crisis, American shadow banking had reached a size that at times exceeded the classical banking system. Pozsar, Adrian, Ashcraft, and Boesky (2013) characterised its structure in a study that has since become classic: mortgages were originated by non-banks, pooled in special purpose entities, transformed into tradable securities, refinanced through short-term paper (asset-backed commercial paper) and repurchase agreements, and ultimately held by money market funds that promised their

¹² Owing to the term's judgmental connotation, the FSB has since 2018 used the neutral designation “non-bank financial intermediation” (NBFI); public debate has retained the older term.

investors daily availability. Each stage of this chain performed a banking function of its own — credit origination, maturity transformation, a promise of liquidity — but no stage was a bank, and none had access to deposit insurance or central bank credit.

3.2 Characteristics and Functioning

What makes a shadow bank in the economic sense can be identified by four characteristics that define banks and that are replicated here without a banking licence. First, maturity transformation: funds raised at short term finance long-term assets. Second, liquidity transformation: assets that are hard to sell are combined with a promise of redemption at any time. Third, leverage: equity is multiplied by borrowed funds. Fourth, credit risk transfer: default risks are assumed, passed on, or repackaged (FSB, 2011; Claessens and Ratnovski, 2014). The combination is decisive: an unlevered equity fund transforms neither maturities nor liquidity in a bank-like manner; a money market fund that issues daily redeemable units and holds commercial paper does exactly that.

The vulnerability of these constructions follows from the same logic as the vulnerability of banks: whoever makes short-term repayment promises while holding long-term or illiquid assets is exposed to the risk of a run — except that shadow banks possess neither the deposit insurance nor the assured central bank access that make such a run unlikely at banks (Diamond and Dybvig, 1983). The financial crisis supplied the evidence in series: in September 2008, the oldest American money market fund, the Reserve Primary Fund, fell below the unit value of one dollar, whereupon several hundred billion dollars were withdrawn from comparable funds within days; the market for asset-backed commercial paper and the repo market experienced the same withdrawal dynamic (Gorton and Metrick, 2012).¹³

Adrian and Shin (2009) pointed out early that this fragility is not a marginal feature but a property of the system: the leverage of market-based intermediaries acts procyclically — rising asset prices permit higher indebtedness, which drives prices further, and in the downswing the spiral reverses. Shadow banking thus amplifies the upswings and downswings of the financial system, and its close interconnection with the banks — through credit lines, guarantees, securities lending, and the prime brokerage business — ensures that losses can ultimately arrive back in the regulated system after all.

3.3 Actors and Magnitudes

¹³ The Reserve Primary Fund held debt of the insolvent Lehman Brothers; the “breaking of the buck” on 16 September 2008 is regarded as the trigger of the run on American money market funds, which was halted only by a government guarantee.

Who, then, are the shadow banks? The answer is less spectacular than the term suggests. The principal actors include money market funds, which manage money-like assets for corporations and private investors; open-end investment funds holding credit instruments, whose daily redemption terms rest on partly illiquid portfolios; hedge funds, which work with borrowed money and derivatives; credit funds (private credit), which extend corporate loans outside the banking sector; securitisation and finance companies; money market and securities financing transactions such as repos; and, finally, the payment and financing subsidiaries of large corporations. Large asset managers and insurers also touch the sector insofar as they assume bank-like functions (Pozsar, Adrian, Ashcraft, and Boesky, 2013; FSB, 2025).

The magnitudes are documented by the FSB's annual Global Monitoring Report, whose latest edition reflects data as of end-2024. According to it, non-bank financial intermediation worldwide reached assets of \$256.8 trillion — 51 per cent of total global financial assets — and grew at 9.4 per cent, twice the pace of the banking sector at 4.7 per cent. The subset of “other financial intermediaries,” which includes money market funds, hedge funds, investment funds, and securitisation vehicles, expanded by 11 per cent to \$169.4 trillion. The narrower measure of those entities whose activity carries bank-like stability risks was put by the FSB at \$76.3 trillion. Table 3 summarises the figures.¹⁴

Table 3: Shadow banking in figures (data as of end-2024)

Measure	Value	Change over prior year
Non-bank financial intermediation (NBF), total	USD 256.8 tn	+9.4 %
Share of global financial assets	51 %	—
Other financial intermediaries (incl. money market, investment, and hedge funds)	USD 169.4 tn	+11.0 %
Narrow measure (bank-like risks)	USD 76.3 tn	—
Banking sector (memo): growth	—	+4.7 %

Sources: FSB (2025), Global Monitoring Report on Nonbank Financial Intermediation; own presentation.

Behind these sums stand familiar names. The large money market funds are managed by houses such as Fidelity, Vanguard, BlackRock, and JPMorgan Asset Management; the credit fund business is dominated by alternative managers such as Apollo, Ares, Blackstone, and KKR, whose credit arms now rival mid-sized banks; among hedge funds, multi-strategy houses such as Citadel, Millennium, and Bridgewater stand for volumes in the hundreds of billions. The market for private corporate credit has multiplied within a decade and is estimated by the International Monetary Fund at roughly two trillion dollars (IMF, 2024). The geographical distribution is noteworthy: the sector is concentrated in the United States, the euro area, and a few financial centres such as the Cayman Islands, Luxembourg, and Ireland, where fund vehicles have their legal seat.

¹⁴ Under the FSB methodology, the narrow measure comprises only entities with maturity or liquidity transformation, leverage, or imperfect credit risk transfer — that is, with a bank-like risk profile.

A special position is occupied by index funds and exchange-traded funds (ETFs). They count statistically towards non-bank financial intermediation and have carried much of its growth, but — where unlevered — they conduct no bank-like maturity transformation. What supervisors do debate is their liquidity architecture: ETFs on corporate bonds, for instance, promise intraday tradability in a market whose underlying securities are barely tradable in periods of stress. In March 2020, large bond ETFs at times traded at marked discounts to their net asset value; the market stress of those weeks, which the FSB (2020) has reviewed, now counts as the sector's most important test since 2008 — a test passed, in the end, only thanks to massive central bank intervention.¹⁵

3.4 Who Benefits from Shadow Banking?

The beneficiaries of shadow banking are, first of all, the same as those served by any functioning financial system: savers and investors obtain additional forms of investment with their own risk-return profile — from the money market fund as a cash substitute to the credit fund with its illiquidity premium. Companies, especially mid-sized and more highly leveraged ones, gain financing routes beyond the bank loan; after banks withdrew from parts of the corporate lending business under stricter capital rules, credit funds filled the gap. The economy as a whole benefits from the spreading of credit risks across more shoulders and from the competitive pressure on the banks (Claessens and Ratnovski, 2014; FSB, 2025).

Alongside these stand beneficiaries in the narrower sense. For asset managers, the business is attractive because it generates management and performance fees on rapidly growing assets without incurring the capital costs of a bank. For the banks themselves, the sector is customer, counterparty, and relief at once: they finance credit funds and hedge funds through credit lines and prime brokerage, sell risks to them, and earn on the settlement. It is precisely this double role, however, that grounds the supervisory concern that risks which appear to have left the banking system return by detours — the losses of several banks in the collapse of the family office Archegos in 2021 demonstrated this mechanism exemplarily.¹⁶

Whom does shadow banking not serve? The uninformed investor who expects bank-like safety where there is none. Units in money market and credit funds are not deposits: they are covered by no deposit insurance, their redemption can be suspended or restricted in periods of stress (notice periods, redemption gates, exit discounts), and their value can fall. Experience shows, moreover, that the sector's yield advantages are in part simply

¹⁵ In the “dash for cash” of March 2020, investors withdrew sums in the hundreds of billions from money market and bond funds within a month; central banks stabilised the markets through purchase programmes and liquidity facilities (FSB, 2020).

¹⁶ In the collapse of Archegos Capital Management in March 2021, the prime brokers involved lost more than \$10 billion in total, of which Credit Suisse alone accounted for roughly \$5.5 billion.

payment for illiquidity and credit risk — for risks, that is, which reveal themselves only in the downturn. A rational investor collects these premiums deliberately and in measured doses, rather than mistaking them for a promise of safety.

3.5 Regulation and Transparency

Since the financial crisis, shadow banking has been the subject of an extensive regulatory program, outlined early by Gorton and Metrick (2010), which proceeds along two paths. The first is the direct regulation of the vehicles: money market funds in the United States as in the European Union are now subject to dedicated regulations with liquidity buffers, valuation rules, and crisis instruments; managers of alternative funds in the EU have required authorisation, reporting, and risk management under the AIFM Directive; securitisations are bound to risk retention and transparency requirements. The second path is observation: the annual FSB monitoring on which the figures in Table 3 rest has made the sector systematically measurable in the first place.¹⁷

Fully illuminated the sector is not. The supervisors themselves name the remaining gaps: data gaps on leverage and interconnectedness, valuation uncertainty in private credit portfolios, liquidity mismatches of open-end funds, and the question of how, in a crisis, liquidity is to reach a sector that has no central bank access. Episodes such as the run on money market funds in March 2020, which again ended only through central bank intervention, show that the fundamental vulnerability persists (FSB, 2020). For the question posed in the title, this means that shadow banking today is far less secretive than before 2008 — but it remains the part of the financial system in which risks can grow unnoticed most easily.

3.6 An Assessment from the Investor's Perspective

For investors, shadow banking is less a danger than a reality they have long lived with: whoever holds a money market fund, a bond fund with corporate bonds, an exchange-traded index fund, or a stake in a credit fund is part of the sector. The practical consequence is not avoidance but diligence along a few test questions: What assets does the vehicle hold, and how liquid are they relative to the redemption terms? How high is the leverage? Who bears the credit risks, and how are illiquid positions valued? Which instruments — notice periods, redemption gates, exit discounts — can the manager deploy in periods of stress, and what do they mean for the investor's own liquidity needs?

Properly deployed, the sector can enrich a portfolio: credit funds offer access to an asset class formerly reserved to the banks and compensate the commitment of capital with

¹⁷ In the EU, the sector is governed in particular by the Money Market Funds Regulation (EU) 2017/1131 and the AIFM Directive 2011/61/EU; the Securitisation Regulation (EU) 2017/2402 requires, among other things, an originator risk retention of 5 per cent.

a yield premium; money market funds are a serviceable instrument of cash management, provided their residual risks are understood. Wrongly deployed — as a supposedly safe substitute for deposits or as a yield-maximising full investment — the investor repeats on his own account precisely the error that shook the system in 2008: the confusion of promises of liquidity with liquidity. The recommendation is therefore to collect illiquidity and credit premiums deliberately and within limits, and to hold the portfolio's liquidity reserve outside such vehicles.

4 High-Frequency Trading

4.1 Origins and Technological Foundations

High-frequency trading is the product of some three decades of electronification of exchange trading. Electronic order books took the place of floor trading — in Germany, for instance, with the introduction of Xetra in 1997 — and programs that generate, modify, and cancel orders according to predefined rules took the place of human traders. Regulatory decisions accelerated this development: in the United States, the decimalisation of price increments (2001) and Regulation NMS (2005) forced the trading venues into competition on speed and price, while in Europe MiFID (2007) opened the exchanges to competition from alternative trading systems. In the fragmented, fully electronic markets that thus emerged, speed became a competitive factor in its own right (Gomber, Arndt, Lutat, and Uhle, 2011; MacKenzie, 2021).

The prehistory reaches back further than is commonly assumed. As early as 1971, NASDAQ began as an electronic quotation system; in the 1990s, the so-called SOES traders used an automatic execution facility of NASDAQ intended for small orders to exploit the sluggish quotes of the established market makers — and from this milieu emerged the first purely electronic trading networks such as Island, whose technology and personnel later formed the core of the high-frequency industry (MacKenzie, 2021). What began as a revolt against the privileges of the floor and telephone traders became, within two decades, privileged infrastructure itself — an irony that is instructive for judging today's debates.

High-frequency trading denotes a subset of algorithmic trading: extremely fast proprietary trading with very short holding periods, very high order and cancellation rates, and positions that are generally flat at the close of trading (SEC, 2010; Gomber, Arndt, Lutat, and Uhle, 2011, whose study was commissioned by Deutsche Börse Group). A high-frequency trader manages no client money and holds no overnight positions of any consequence; its capital turnover is enormous, its profit per individual trade minute. The business model consists in exploiting minimal price differences and minimal time advantages millions of times over — which succeeds only if technology, data access, and location are directed uncompromisingly at speed.

How far this race has been driven is shown by the history of the data links. For the route between the futures exchanges in Chicago and the equity markets in New Jersey, a private operator laid, around 2010, a fibre optic line as straight as possible, which brought the round-trip signal time down to roughly 13 milliseconds; a few years later, microwave relay routes undercut this figure at just over 8 milliseconds, because signals propagate faster through air than through glass (MacKenzie, 2021). Inside the data centres, calculations today proceed in nanoseconds; specialised circuits (FPGAs) respond to market data events without a conventional computer program intervening.¹⁸

4.2 Latency, Co-location, and the Role of the Exchanges

Latency denotes the span of time between a market event and one's own reaction to it — from the arrival of the market data through the decision to the arrival of one's own order in the order book. In modern equity trading it is measured in microseconds, that is, in millionths of a second: Aquilina, Budish, and O'Neill (2022) observe reaction times on the London Stock Exchange whose modal value lies between 5 and 10 microseconds. For comparison, a human blink lasts roughly 300 milliseconds — time enough for tens of thousands of machine reactions. What decides the competition is not absolute but relative speed: it suffices to be one microsecond faster than the second fastest.

The exchanges are not bystanders in this race — they are its outfitters. For a fee, they rent server space in their own data centres (co-location), so that all participants who can afford it are connected to the exchange systems with identical cable lengths; they sell direct data feeds that deliver the market picture faster and at finer resolution than the consolidated public streams; and they design their fee schedules so that liquidity providers receive rebates or payments. Why so? Because trading venues compete for order flow and liquidity attracts liquidity: high-frequency traders supply a substantial share of the quotations, and technology revenues from co-location and market data have become a mainstay of the exchange operators' earnings (O'Hara, 2015; Budish, Cramton, and Shim, 2015).¹⁹

This double role of the exchanges is economically delicate: they sell speed to those who derive advantages from it over the remaining market participants. Budish, Cramton, and Shim (2015) showed that the cause lies in the market design itself — in continuous trading, which ranks orders strictly by time of arrival and thereby rewards even the smallest time advantages. As long as this design persists, the arms race over microseconds is individually rational for the participants but largely unproductive for the economy as a whole: the

¹⁸ The fibre optic line of Spread Networks became known to a broad public through Michael Lewis's "Flash Boys" (2014); according to Lewis, shortening the Chicago-New Jersey transmission time cost roughly \$300 million.

¹⁹ Under so-called maker-taker schedules, the liquidity-providing (passive) order receives a rebate or payment, while the liquidity-taking (aggressive) order bears the full fee.

outlays on towers, cables, and specialised equipment create no information; they merely redistribute who reacts first to information already in existence.

A dimension of inequality of its own resides in the market data themselves. In the United States there exist two speeds of truth: the consolidated public data stream, from which quotation services and private investors obtain their prices, and the direct feeds of the individual exchanges, which deliver the same information measurably earlier and at finer resolution. Whoever sees only the public stream sees — on the scale of the machines — the past; Lewis (2014) made this the core of his indictment. The exchanges point out, correctly, that the direct feeds are open to every paying participant; only, the price is set such that “every” in practice means “every professional trading firm.” Here too: not secret, but exclusive.

4.3 Trading Strategies: From Market Making to Overtaking Orders

The most widespread strategy of high-frequency trading is electronic market making: the simultaneous quoting of bid and ask prices in order to earn the spread between them. Menkveld (2013) accompanied a large high-frequency market maker at its market entry and showed that its inventories oscillate around zero within minutes — the business lives on turnover, not on directional bets. In addition, high-frequency traders pursue arbitrage across trading venues, indices, exchange-traded funds, and futures: if the price of the same asset diverges in two places, the machine buys at the cheaper and sells at the dearer one. Both strategies are economically unobjectionable; they keep prices consistent and spreads tight.

More contested are strategies that rest on detecting and overtaking the orders of others. In order anticipation, the algorithm attempts to infer, from observable market activity — partial executions, order sizes, patterns across several venues — the existence of a large buy or sell order, in order to position itself ahead of it and capture the price movement it triggers (SEC, 2010). Hirschey (2021) demonstrates empirically that aggressive purchases by high-frequency traders systematically precede the purchases of the remaining market participants. The legal classification matters: contrary to what the term “front running” suggests, this is not the — prohibited — abuse of confidential client order information, but inference from public data; objectionable or not, in this form it is not illegal.²⁰

The overtaking of orders proper, finally, is the subject of latency arbitrage: when the price changes on a reference market — say, in the S&P 500 futures contract — the still unchanged quotations on other venues are, for a few microseconds, stale. Whoever processes the news first buys up those stale quotes before their originators can withdraw them; the slower market maker loses. Aquilina, Budish, and O'Neill (2022) examined these races for

²⁰ Prohibited, by contrast, are manipulative techniques such as spoofing (the entry of orders not meant to be executed, to influence prices); prominence attached to the case of the London trader Navinder Sarao, whose spoofing in the E-mini future was prosecuted in connection with the flash crash of 2010.

the first time in full, using the message logs of the London Stock Exchange: in FTSE 100 stocks, a race occurs on average about once per stock per minute, roughly 20 per cent of trading volume takes place in such races, and the losing quotations bear an implicit charge of about half a basis point of turnover — extrapolated, roughly five billion dollars per year in the world's equity markets.

4.4 Market Shares and Actors

How large is high-frequency trading? For the United States, the Congressional Research Service puts its share of equity trading volume at roughly 55 per cent; for Europe, the same source cites about 40 per cent (CRS, 2016). For Europe, the securities regulator ESMA (2014) has provided a methodologically strict measurement: depending on the approach — classification of entire firms or classification by the lifetime of orders — between 24 and 43 per cent of trading turnover and up to three quarters of all orders are attributable to high-frequency trading. For the German market, the Deutsche Bundesbank (2016) arrives at similar magnitudes and emphasises the elevated order activity in volatile market phases. Table 4 summarises the ranges.²¹

Table 4: Share of high-frequency trading in equity trading

Market	Share of turnover	Share of orders
United States	approx. 55 %	n/a
European Union (direct approach)	24 %	58 %
European Union (lifetime-of-orders approach)	43 %	76 %

Sources: CRS (2016); ESMA (2014); own presentation.

Notes: The figures for the European Union refer to the ESMA sample of May 2013; the figure for the United States is the estimate cited by the Congressional Research Service.

The actors in this business are — unlike in investment banking — predominantly not banks but specialised proprietary trading houses, frequently founded by mathematicians and computer scientists and owner-managed to this day. Table 5 names the most important houses. Their workforces are small — a few hundred to a few thousand employees — but their market weight is not: Citadel Securities, by its own account, handles a substantial share of all American retail equity order flow, and the races for latency advantages are dominated by a handful of firms — Aquilina, Budish, and O'Neill (2022) attribute more than 80 per cent of all races to the six fastest participants.

²¹ The ranges are explained by the method of measurement: ESMA's direct approach counts only unambiguous high-frequency trading houses, while the lifetime-of-orders approach also captures the high-frequency business of the investment banks.

Table 5: Leading high-frequency and electronic trading houses

Firm	Headquarters	Ownership
Citadel Securities	Miami	private
Virtu Financial	New York	listed (Nasdaq)
Jump Trading	Chicago	private
Tower Research Capital	New York	private
Hudson River Trading	New York	private
DRW	Chicago	private
Optiver	Amsterdam	private
IMC Trading	Amsterdam	private
Flow Traders	Amsterdam	listed (Euronext)
XTX Markets	London	private

Sources: Company disclosures; own presentation.

The German-speaking world, too, is a stage for this business, though less as home to the traders than as home to the infrastructure: Deutsche Börse, with the cash market Xetra and the derivatives exchange Eurex, ranks among the technologically leading venues in Europe and markets co-location and direct data feeds to international trading houses; the Frankfurt data centre that houses its trading system is one of the nodes of the European microwave routes between Frankfurt and London. The Deutsche Bundesbank (2016) has examined activity on these markets and shown, among other things, that high-frequency traders supply liquidity in calm phases but demand liquidity disproportionately in highly volatile ones — in line with the international evidence.

How profitable the business is in capable hands was shown by the offering prospectus of Virtu Financial: for the years 2009 through 2013, the firm reported exactly one single losing day in 1,238 trading days (Virtu Financial, 2014). Baron, Brogaard, Hagströmer, and Kirilenko (2019) confirm the pattern academically: the profits of high-frequency trading are persistent, concentrated on few firms, and rest essentially on relative speed — whoever is faster earns at the expense of the slower. At the same time, aggregate profits are smaller than the public imagination suggests: this is a business of narrow margins on enormous turnover, whose earnings fluctuate with market volatility.²²

4.5 Effects on Market Quality

Empirical research draws a more differentiated picture than the public debate suggests. Hendershott, Jones, and Menkveld (2011) show, using the electronification of the New York Stock Exchange, that algorithmic trading improves liquidity and narrows bid-ask spreads; Hasbrouck and Saar (2013) reach the same conclusion for low-latency trading. Brogaard, Hendershott, and Riordan (2014) demonstrate that high-frequency traders predominantly trade in the direction of permanent price changes and thus accelerate price discovery. The literature review of the American securities regulator likewise concludes

²² After the merger with its competitor KCG in 2017, Virtu remained, alongside Flow Traders, one of only two large listed houses in the industry.

that the majority of studies attest to a liquidity-improving effect of high-frequency trading (SEC, 2014). The bid-ask spreads of the major equity markets are tighter today than ever — to the particular benefit of the small orders of private investors.

Against this stand the shadows. The flash crash of 6 May 2010, in which the American equity market fell by several per cent within minutes and recovered as quickly, displayed the fragility of highly automated markets: Kirilenko, Kyle, Samadi, and Tuzun (2017) show that high-frequency traders did not trigger the collapse but amplified the downward movement as they passed their inventories to one another in rapid succession, and that their supply of liquidity shrank precisely when it was needed most. Liquidity that is abundant in calm times and withdraws in the storm is worth less than it appears — this caveat accompanies the positive results of the literature to this day (O'Hara, 2015).²³

The overall balance of the research can thus be summarised as follows: high-frequency trading has lowered the measurable trading costs of small orders and accelerated price discovery; it has at the same time created a new fragility of markets, established a redistribution embedded in the market design at the expense of slower participants, and directed considerable resources into a race for speed that is unproductive for the economy as a whole (Budish, Cramton, and Shim, 2015; Aquilina, Budish, and O'Neill, 2022). It is, in other words, neither the benefactor its industry portrays nor the pickpocket its critics portray — but both at once, in empirically quantifiable proportions.

4.6 Can Investors Profit from High-Frequency Trading?

The question of participation arises along two routes. The first is ownership of the trading houses themselves. Listed, and thus accessible to anyone, are Virtu Financial and Flow Traders; the remaining leading houses are private and at best indirectly accessible through occasional minority stakes held by institutional investors. Whoever acquires such shares should understand the earnings dynamics: the industry's profits rise with volatility and trading volume and fall in quiet markets. In a portfolio, such stocks therefore act like insurance against turbulent phases — at the price of potentially lagging the broad market in friendly, quiet periods. They are no standing recommendation, but for the informed investor a defensible addition.

The year 2020 demonstrated this effect vividly: in the extremely volatile weeks of spring, trading volumes and bid-ask spreads multiplied and the listed houses reported record results, while broad equity portfolios were deep in the red. In the quiet years before and after, the reverse held: tight spreads, low volatility, meagre trading revenues — and correspondingly disappointing share price performance. Whoever holds such stocks holds, at bottom, a position on future market turbulence; that can be sensible as deliberate

²³ According to the joint report of the SEC and CFTC, the flash crash was set off by a large automated selling program in the E-mini S&P 500 future; the steepest decline unfolded in roughly four and a half minutes, the recovery was complete after a good half hour, and the Dow lost 998.5 points at its intraday low.

insurance, but it replaces neither bonds nor cash and belongs, in size, at the margin of the portfolio.

The second route — placing one's own orders — leads to a clear answer: in the race for speed itself, the private investor cannot take part. Co-location, direct data feeds, and specialised equipment cost millions per year and pay off only at institutional turnover; whoever trades “fast” with retail technology is, on the scale of this market, always the slowest. The private investor does, however, benefit indirectly: his small orders are executed at historically tight spreads, and he can protect himself by simple rules — limit orders instead of market orders, restraint in the first and last minutes of trading and in turbulent phases when machine liquidity thins out. The attempt, by contrast, to exploit short-term price patterns at the pace of a hobby trader is structurally futile.²⁴

4.7 Is High-Frequency Trading Viable?

In favour of the viability of the business speak, first, the market data: high-frequency trading has been the dominant liquidity provider of Western equity markets for a decade and a half, and nothing suggests that human market makers will return. What has changed is the economics of the business: the excess profits of the pioneer years were competed away, the costs of the arms race are rising, and the industry has responded with mergers. Earnings are settling at the level of a mature, capital-intensive infrastructure trade — highly profitable for the fastest, adequate for a few, closed to newcomers without substantial capital (Baron, Brogaard, Hagströmer, and Kirilenko, 2019).

Changes nonetheless stand on the horizon — regulatory and market-driven alike. Germany, with its High-Frequency Trading Act of 2013, was the first country to introduce a licensing requirement, labelling duties for algorithmic orders, and ceilings on the ratio of orders to executions; MiFID II extended these principles to all of Europe in 2018 and added requirements for system testing and market making agreements. In the United States, IEX in 2016 became a registered exchange whose built-in delay of 350 microseconds deliberately devalues latency arbitrage. Furthest-reaching in academic terms is the proposal of Budish, Cramton, and Shim (2015) to replace continuous trading with very frequent auctions — at intervals of a tenth of a second, say: it would transform the competition in speed into a competition in price and withdraw the foundation from the arms race.²⁵

At the same time, the terrain of competition is shifting on the market side. Since the physical limits of signal transmission have largely been reached, the advantage is migrating from the line to the logic: specialised circuits shorten reaction times inside the data centres,

²⁴ In the European Union, payment by brokers for routing client orders to particular execution venues (payment for order flow) is prohibited under the 2024 revision of MiFIR; transitional arrangements for existing models ran until mid-2026.

²⁵ The 350-microsecond delay (“speed bump”) of the Investors Exchange (IEX) was approved by the SEC in June 2016 as part of the exchange's registration.

and machine learning improves the prediction of short-term order flow — so that the race over microseconds is gradually turning into a race over predictive quality. For supervisors, a new task arises from this: learning systems that react to one another can generate feedback effects that no single operator intended — the flash crash experience in potentiated form. The literature on market microstructure has its next great programme of work before it here (O'Hara, 2015).

That any of these reforms will displace continuous trading at the principal markets in the foreseeable future is nevertheless improbable: too strong are the forces directed at preserving the existing state of affairs, and too strong the revenue interests of the exchanges, which earn from the race for speed (Budish, Cramton, and Shim, 2015). Realistic is a coexistence: continuous trading with high-frequency liquidity as the rule, complemented by protective mechanisms such as volatility interruptions, minimum tick sizes, and occasional delay models, together with growing auction shares at the close. High-frequency trading will survive, then — but as a regulated, thin-margin trade, not as the gold field of its early years.

5 Conclusion and Recommendation

Risky, dangerous, secretive, or reputable? The answer of this paper differs for each of the businesses examined — and in no case is it monosyllabic. Investment banking is a reputable, densely regulated, and economically necessary trade whose risks lie less in its products than in its incentives: informational advantages, conflicts of interest, and asymmetric compensation recurrently invite excesses that regulation and reputation contain only imperfectly. Secretive it is not — but discreet, and this discretion is part of its business model.

Shadow banking, in turn, is neither a shadow economy nor shadow boxing: it is regulated and semi-regulated credit intermediation outside the banks, which makes the financial system more diverse and at the same time harder to survey. At \$256.8 trillion and 51 per cent of global financial assets, it has long ceased to be the shadow of the banking system and has become its equal twin (FSB, 2025). It becomes dangerous where bank-like promises are made without bank-like safeguards — a lesson taught anew at regular intervals, from 2008 through March 2020 to Archegos. Reputability and risk do not exclude each other here; they inhabit the same vehicles.

High-frequency trading, finally, is a legal, largely useful, and in particular respects questionable trade: it has lowered investors' trading costs and accelerated price discovery, but it has also created a redistribution embedded in the market design at the expense of the slower, whose magnitude research puts at roughly five billion dollars per year (Aquilina, Budish, and O'Neill, 2022). It is not secretive — its methods have been studied academically like hardly another financial trade — but it is demanding: only those who

engage with market microstructure can understand it, and precisely this gradient of understanding feeds its questionable reputation.

For investors, the results can be gathered into a few recommendations. First: use the services of these businesses without adopting their sales interests — research, new issues, and structured products are offers, not advice. Second: treat bank-like returns without bank-like protection as what they are — payment for illiquidity and credit risks, to be collected deliberately and within limits, while the portfolio's liquidity reserve belongs outside such vehicles. Third: trade on the exchange with limit orders, avoid turbulent minutes, and leave the race for speed to those who can win it; whoever wishes to earn from it does so, if at all, through the shares of the listed trading houses — in full knowledge of their dependence on volatility.

The limits of this paper lie in its character as a survey grounded in the literature and in published data: it rests on publications whose recording methods differ across sources and over time, and it can reflect ongoing regulatory developments — from the implementation of the European ban on payment for order flow to the FSB's work on the liquidity of open-end funds — only up to the current state of the literature. Future research will have to clarify, in particular, how artificial intelligence affects the strategies of high-frequency trading and the lending of non-banks — and whether the migration of credit business into the non-bank sector will dampen or feed the next crisis.

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