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MARKET MACROSTRUCTURE: INSTITUTIONS AND ASSET PRICES

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ABSTRACT

Market macrostructure studies the broad organization of financial markets into key players and institutional features, and how this organization affects the level and dynamics of asset prices. We present a simple model to discuss when, why, and how market macrostructure matters for asset prices. We then review work on three specific examples: the rise of passive investing in the stock market, the increased role of central banks in bond markets through asset purchase programs, and the role of levered financial intermediaries in financial markets. We highlight various approaches to tackling macrostructure questions including quasi-natural experiments, equilibrium models, and the use of detailed quantity data on asset positions.

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1. Introduction

This article reviews a growing field, which we label "Market Macrostructure," that studies the broad organization of financial markets into key players or institutional features and how this organization affects the level and dynamics of asset prices. The macrostructure of financial markets shifts substantially over time. After the introduction of index funds in the 1980s, passive investing in the stock market has grown massively to over 40% today. Since the emergence of Quantitative Easing programs central banks are now dominant players in bond markets – owning around 30% of public debt outstanding across the US, Euro area, UK, and Japan. During the 2008-2010 crisis, dealer banks suffered severe losses which led to large dislocations in financial markets, some of which have persisted to today in part due to post crisis regulation of banks.[1] It is natural to think these large shifts have meaningful effects on financial markets.

The examples above highlight the rich organization of financial markets, with many different types of assets (stocks, bonds, derivatives, etc) and investor types (banks, mutual funds, pension funds, hedge funds, etc) that play different roles in each market. We argue that these highly varied examples share a lot of common themes that extend to many recent questions in finance and macrofinance. Research on market macrostructure focuses on identifying the key players or broad institutional features in asset markets and how they affect the level and dynamics of asset prices. Progress in this area has come in part from bringing in data on quantities or positions of these large players, equilibrium models with rich heterogeneity and frictions in investment, and new tools or approaches to better identify key parameters of interest. We review the key themes in this growing area, including various approaches to answering macrostructure questions, and present a basic model to understand them.

Market macrostructure questions revolve around four dimensions: (1) who are the

[1] See, e.g., Duffie (2022).

key players in a given asset market (2) what are their strategies (objective functions) and how do they trade (3) how does this shape prices in equilibrium, and (4) counterfactuals: what shocks, sources of fragility, or even broad changes in organization will impact asset markets.

We present a simple model to organize these questions featuring active financial institutions and inactive end investors or market participants. The presence of inactive end investors is important to distinguish market macrostructure models from frictionless models and makes the strategies of active institutions especially important for asset prices in equilibrium. We model passive *end* investors – e.g., households who may have implicit exposure to the underlying assets through banks, mutual funds, pension funds, insurance companies, or other institutions, but who trade with frictions that lead to inertial decisions. We think of the active investors typically as various financial institutions. We highlight how the model can be useful for counterfactuals. The main implementation challenge is in identifying who the large active investors are and what shapes their strategies or demand for assets.

We focus on three complementary approaches often taken in the macrostructure literature to approach these issues. We emphasize the strengths of each approach and how they jointly inform questions in the literature.

The first are quasi natural experiments or empirical papers broadly suggestive that this macrostructure matters. Examples include Greenwood and Vissing-Jorgensen (2018), Muir (2017), Du et al. (2018), and Shleifer (1986). For example, Du et al. (2018) use end of quarter regulatory constraints on banks to causally show how such constraints affect covered interest rate violations while Shleifer (1986) and a long literature following use index inclusion as a demand shock. Broader but less well identified examples include Greenwood and Vissing-Jorgensen (2018) who argue for an effect of the size of the pension sector on long-term yields and Muir (2017) who effectively uses a diff in diff type of approach that compares financial crises to other macroeconomic disasters to help isolate

the effect of financial sector stress on asset prices.

The second approach starts with equilibrium models of active and inactive traders and focuses on dynamics and economic mechanisms. These models typically feature a set of active key players who trade in financial markets, possibly subject to frictions or constraints, and a set of either "inelastic" (inactive) agents combined with shocks to the supply of the asset (Greenwood and Vayanos, 2014; Vayanos and Vila, 2021), or a set of noise traders that similarly shock the net supply held by active investors (Gabaix and Maggiori, 2015; Itskhoki and Mukhin, 2021). The important feature of these models is that quantities matter – shocks to the net supply held by active investors move asset prices. The empirical part of these papers typically speaks to broad patterns on asset holdings – for example noting a trend that mutual funds have become more dominant players in the corporate bond market in the last decade (Ma et al., 2022) or that financial institutions are at the center of trade in currency markets.

The third, and one of the fastest growing, of these approaches is a more bottom up approach that starts with position level asset holdings data for many investors and uses flexible but often more reduced form models of asset demand. These papers still study equilibrium outcomes but are less rich in modeling dynamics. Examples include Koijen and Yogo (2019), Gabaix and Koijen (2021), Haddad et al. (2024a), Van der Beck (2021), and Bretscher et al. (2022).

A key feature of these approaches is to bring in *quantity* or asset position level data – whether at a broad macro level or a detailed micro level. Quantity data is particularly useful in understanding both who the large players in financial markets are, as well as how they shift over time. Shifts over time can reveal both long-term trends that affect markets (e.g., dealers playing a smaller role in bond markets post financial crisis (Duffie, 2022)), as well as providing insights into the trading behavior of these players (e.g., the Fed tends to buy bonds in bad times through QE programs Haddad et al. (2024b)). While we delineate based on these approaches, we note that some papers combine various aspects of each.

Darmouni et al. (2022) and Jansen et al. (2024) are two recent examples.

It is useful to distinguish market macrostructure from other areas in asset pricing, macro, and finance. Macrostructure shares several themes with intermediary asset pricing. However, it places less emphasize on specific frictions, non-linearities, occasionally binding constraints, and crises, and considers a broader set of players and questions in asset markets. Macrostructure shares themes with market microstructure, in that it focuses on modeling and understanding markets in a detailed and realistic way, but emphasizes how the organization of markets influences low frequency (e.g., monthly quarterly or annual) behavior of asset prices. It places less weight on information asymmetry. Finally, there is overlap with heterogenous agent models in asset pricing, but macrostructure papers typically separates agents by institutional type and "activity" in a market using holdings data rather than separating by beliefs (optimists vs pessimists), risk aversion, or age (e.g., in an overlapping generations model) and other demographic features.

We organize this review by first starting with a simple model to think through these issues in Section 2. We then highlight the three complementary approach above in the context of the model. The remainder of the focuses on a few specific questions within the macrostructure literature: the rise of passive investing (Section 4), central banks and QE (Section 5), and intermediation and crises (Section 3). We emphasize that these are selective examples to highlight common themes and discuss the approaches taken in the literature. Of course, there are many more examples and questions in the macrostructure literature beyond these three specific examples – our final section (Section 6) highlights some of these.

2. Modelling Market Macrostructure

We first present a simple model to highlight the main considerations in a macrostructure setting, following Haddad and Muir (2021). Then we discuss methods the literature has

used to quantify the ingredients of this theory in a variety of contexts.

2.1 A stylized framework

We consider the market an asset in supply S with equilibrium price p. We represent all characteristics of the asset by a vector of attributes x_A. For example, it could be the mean and variance of its payoff, its covariance with various aggregate risks, or its margin requirement. To open the possibility of a role for macrostructure we allow investment to happen in two ways: the representative household can invest directly or through a financial institution.

The institution has its own characteristics x_I, for example, its size, leverage, manager, or risk-bearing capacity. Its demand for the asset depends on the characteristics of the asset x_A, its attributes x_I, and the price of the asset p, summarized by a function $D_I(p, x_A, x_I)$.

Households also have a vector of attributes x_H, that contains, for example, their wealth, risk aversion, or beliefs. Importantly, they own the financial institution. Therefore, their demand for the asset depends not only on the price, their attributes, and the attributes of the asset, but also on how much of the asset is owned by the institution D_I^* in equilibrium. This is summarized by the function $D_H(p, D_I^*, x_A, x_H)$.

The equilibrium price is determined by market clearing, plugging into the household's demand the institution's demand for the asset,

$$D_H\left(p, D_I(p, x_A, x_I), x_A, x_H\right) + D_I(p, x_A, x_I) = S. \tag{1}$$

To understand price determination, consider how the equilibrium price changes in re-

sponse to a small change in the various attributes and supply:

$$\Delta p = \underbrace{\frac{-1}{\frac{\partial D_H}{\partial p} + \left(1 + \frac{\partial D_H}{\partial D_I}\right)\frac{\partial D_I}{\partial p}}}_{\text{demand slope}} \times \left[\underbrace{\left(\frac{\partial D_H}{\partial x_A} + \left(1 + \frac{\partial D_H}{\partial D_I}\right)\frac{\partial D_I}{\partial x_A}\right)\Delta x_A - \Delta S}_{\text{asset attributes}} + \underbrace{\frac{\partial D_H}{\partial x_H}\Delta x_H + \left(1 + \frac{\partial D_H}{\partial D_I}\right)\frac{\partial D_I}{\partial x_I}\Delta x_I}_{\text{investor attributes}} \right]. \tag{2}$$

The first term is the slope of the aggregate demand curve, the second term is the shift in demand curve coming from a change in the attributes.

Absent the institution, we are in a standard representative agent framework. For example, in a standard neoclassical model changes in the risk of the asset (Δx_A) or changes in household risk aversion (Δx_H) would shape price dynamics. However, the presence of the institution opens up an additional set of questions.

The first is whether macrostructure is even relevant. For example, it could be that the household completely understands and reacts to the institution decisions, and perfectly offsets them. This corresponds to the condition $\partial D_H / \partial D_I = -1$. In such a setting, macrostructure is just a veil: ultimately the representative household determines prices as if they were alone in the market. However, as soon as we are away from such a perfect substitution, the institution matters and affects asset prices. In practice, many reasons can lead to imperfect substitutions and the answer depends on which dimension of macrostructure is at hand; for example, it could be that trading some assets require specific infrastructure or expertise (e.g. Eisfeldt et al. (2017)), or that households are not reactive due to a variety of rational or behavioral frictions (e.g. Andries and Haddad (2020) or Charles et al. (2024)).

Then, one can ask which factors create shifts in the institution's demand. For example, if the financial sector becomes distressed — a negative shock to financial health in Δx_I — they might want to liquidate assets to stabilize their balance sheets — a positive $\partial D_I / \partial x_I$ — which would then push prices down as long as aggregate demand for the asset is not perfectly elastic. Understanding the sources of shifts in institutional demand is a core concern of the macrostructure approach. For example, beyond shocks to leveraged financial intermediaries, we consider in this review how the growth of passive investing changes how many institutions, such as mutual funds, trade or how changes in policy affect how central banks intervene in asset markets. Before turning to these applications, we review tools used to flesh out the models.

2.2 Approaches for quantification

A guiding light to take these ideas to more precise theory, then to the data, is to find sharp measures of the relevant institution characteristics (x_I). For this, a natural landing point is information about the balance sheet of these institutions, that is, their portfolio holdings. Answering questions about macrostructure requires a trade-off between precisely capturing the specificities of each type of institutions, and being general enough to represent broad forces shifting markets. We describe briefly various approaches to deal with this trade-off. While we organize models in three categories, they fit more naturally on a spectrum.

Broad measures of frictions. A first approach emphasizes the broad consequences of institutional frictions for asset price dynamics. Instead of taking a strong stance on the specific source of friction among the myriad of constraints they face, it highlights how these frictions change trading, and testable consequences for the dynamics of asset prices.

Haddad and Muir (2021) present such a model to identify the effect of financial intermediary shocks in the cross-section of asset classes. They focus on two dimensions representing the general ingredients highlighted above. First, intermediaries experience variation over time in their risk-bearing capacity, materialized by changes in their risk aversion γ_I. Second, households face a quadratic cost c to invest directly in financial assets in addition to their own risk aversion γ_H. This cost varies in the cross-section of asset class: likely lowest for stocks and bonds and largest for credit derivatives or mortgage-backed securities. In the language of our broad framework, changes in risk-bearing capacity create movements in the intermediary attributes x_I, while the costs of direct investing open up a wedge between direct and intermediated investment, $|\partial D_H / \partial D_I| < 1$. These properties can readily be seen from the two demand functions for an asset with expected future price μ and volatility σ:

$$D_I = \frac{1}{\gamma_I \sigma^2}(\mu - p) \tag{3}$$

$$D_H = \frac{1}{\gamma_H \sigma^2 + c}(\mu - p) - \frac{\gamma_H \sigma^2}{\gamma_H \sigma^2 + c} D_I \tag{4}$$

In equilibrium, this setting leads to the prediction that the risk premium of assets that are more costly to invest in are more responsive to shifts in intermediary risk-bearing capacity. That is, the elasticity

$$\frac{1}{\mu - p} \frac{\partial(\mu - p)}{\partial \log(\gamma_I)} = \frac{c}{\gamma_I \sigma^2 + c} \tag{5}$$

is increasing in the cost of direct investment c.

Relatedly, Vayanos and Vila (2021) study a dynamic model assuming that households have a fixed demand for treasuries of various maturities, referring to them as preferred habitat investors. In contrast risk-averse intermediaries — which they call arbitrageurs — trade across the yield curve. They show that this in this model, the yield curve is pinned

down by a form of Euler equation for the arbitrageurs: when they hold more duration risk, the term premium increases to compensate them for those holdings. Greenwood and Vayanos (2014) use this framework to quantify the effects of shifts in Treasury supply on bond markets. Haddad and Sraer (2020) take the stand that banks are arbitrageurs in this market and documents that their interest rate exposure predicts bond returns. Greenwood et al. (2023b) review applications of this framework.

Specific frictions. Another strand of the literature follows the path of providing microfoundations capturing frictions affecting the decisions of institutions. A common theme of this approach (reviewed in He and Krishnamurthy (2018)) is the nonlinearities of these frictions, which can lead to amplifications and severe crises. The other benefit of this type of approaches is that it leads to precise predictions in terms of measuring the key state variables controlling institutions' portfolio decisions, that is, what is in Δx_I in our framework. He and Krishnamurthy (2012) and He and Krishnamurthy (2013) study equity capital constraints that results from optimal contracting. Brunnermeier and Sannikov (2014) study a model with endogenous borrowing constraints. Beyond "natural" sources of frictions, an important specificity of many financial intermediation is their regulation. Adrian and Shin (2010) study the implications of capital regulation, specifically taking the form of Value-at-Risk constraints. Du et al. (2023) focus on leverage regulation.

Naturally, there is no one-size-fit-all model that characterizing these foundations. For example, while the previous set of models apply well to leveraged regulated intermediaries, mutual funds face a different objectives and frictions. Kacperczyk et al. (2016) and Gârleanu and Pedersen (2018) model the limits to information acquisition and differing skills of mutual fund managers. Basak and Pavlova (2013) and Pavlova and Sikorskaya (2023) emphasize benchmarking concerns; Buffa et al. (2022) rationalizes them from an optimal contracting standpoint.

Measuring trading directly. A third approach consists in writing empirical models that are flexible enough to represent a variety of trading policies, and estimate them directly from holding data. Intuitively, this corresponds to fitting flexible functional forms to the demand functions $D_I(x_A, x_I, p)$. A benefit of this more agnostic approach is that it allows rich heterogeneity across institutions and assets. Koijen and Yogo (2019) estimates the demand for individual stocks for each institution. Gabaix and Koijen (2021) estimates the aggregate demand for stocks, highlighting that it is more inelastic than in standard theories. These approaches have also proved useful to characterize holdings of corporate bonds (Bretscher et al. (2022), Chaudhary et al. (2023)) or the demand for Treasuries (Jansen et al. (2024)).

This type of semi-structural approaches can also be enriched to capture richer mechanisms suggested by micro-founded theories. For example, Haddad et al. (2024a) incorporates strategic interactions between investors in such a model, allowing to measure how active investors are responding to the rise of passive investing. Darmouni et al. (2022) characterize market fragility by combining fund-flow sensitivity and estimates of individual fund demand for bonds.

3. Intermediation and Financial Crises

Financial intermediaries, such as dealer banks, investment banks, or hedge funds, are important players in financial markets and especially so in more sophisticated asset classes such as derivatives, foreign exchange, mortgages, and fixed income. A literature on intermediary asset pricing studies the market macrostructure associated with shocks to financial institutions and their affects on asset prices. This work focuses on both financial crises – where acute shocks impair the ability of financial intermediaries to bear risk in sharp ways – as well as broader trends and time-series variation in the importance of financial intermediaries – for example how post crisis regulation of the intermediary sector

has affected financial markets over the past fifteen years.

3.1 Financial crises

What happens to asset prices when a shock hits financial intermediaries, resulting in a financial crisis? Understanding financial crises and their associated mechanisms is important in its own right, but also provides a window into understanding how, why, and whether financial intermediaries matter for asset prices more generally. For a broader review of financial crises in general see Gorton (2018).

Muir (2017) finds that financial crises are associated with especially depressed asset prices relative to other bad macroeconomic periods, suggesting that the health of the financial sector influences asset prices as outlined in the model in Section 2. The comparison to other bad macroeconomic events, such as deep recessions or war related disasters, implies that large risk premia in financial crises is not driven by poor macroeconomic shocks that affect cash flows or aggregate risk aversion. Instead, the evidence points towards the impairment of financial institutions to take risk and the contraction in credit associated with crises, as important influences affecting stock prices and credit spreads. Muir (2017) takes a broad historical perspective using 140 years of data across 14 countries to document these patterns. A downside of this approach is that the data is relatively coarse, which makes it harder to separate specific mechanisms for why the health of the financial sector matters for asset prices.

A large number of papers instead focus on more granular data for a more recent period, studying for example the 2008-2010 financial crisis. These papers generally document large dislocations in financial markets during this period, especially for more sophisticated trades or assets that financial institutions specialize in. For example, Krishnamurthy (2010), Fleckenstein et al. (2014), and Pasquariello (2014). See He and Krishnamurthy (2018) for many more examples of financial market dislocations during the

2008-2010 crisis and a discussion.

He and Krishnamurthy (2013), Brunnermeier and Sannikov (2014), and Adrian and Shin (2014) model these dynamics, emphasizing the role of intermediaries and occasionally binding constraints that lead to strong non-linearities in risk premia associated with financial crisis episodes. For example, when the capital of intermediaries is low enough, further losses cause the intermediary to fire sell the asset to avoid a leverage constraint, but this selling pressure lowers prices further and results in a feedback loop that amplifies price declines. Similarly, constraints on short-term debt can cause asset sales that depress asset prices and make the debt constraints bind further.

3.2 Broader trends in financial intermediation

While the work on financial crises helps understand the role financial institutions play in asset markets, a related literature studies lower frequency variation in the importance of financial institutions.

Post 2008 financial crisis regulatory reforms

In the wake of the financial crisis of 2008, new regulations arose on banks in the form of additional capital requirements, leverage limits, and regulation on trading behavior (e.g., the "Volcker rule"). The effect of these regulations was that dealers and banks stepped back or reduced their role in many markets, leading to persistent issues of arbitrages, mispricings, or lack of liquidity in trade in these markets. This is especially pronounced in over the counter markets where a relatively small number of dealers handle most of the trade. Duffie (2022) provides a nice overview of the regulatory issues and provides many of examples of where and how this has affected asset prices.[2]

For example, Du et al. (2018) show persistent deviations in covered interest rate parity since 2008, and causally tie this to regulations on banks that depend on their positions at

[2]See also Gorton et al. (2022) and Boyarchenko et al. (2020), among others.

quarter ends. Duffie et al. (2023) shows how dealer balance sheet capacity impacts disruptions in Treasury markets and Du et al. (2023) study the Treasury positions of dealers in the post-crisis era and how this relates to the equilibrium yield curve. Bao et al. (2018) show the negative effects of the Volcker rule on dealers ability to intermediate in the bond market.

At the same time, other players have also stepped in to play a larger role. For example, mutual funds have played a much larger role in bond markets and this has lead to different forms of fragility – while dealers relied heavily on short-term debt (repo) to finance positions and are thus exposed to contractions in repo lending, mutual funds are sensitive to sudden outflows (Ma et al., 2022; Darmouni et al., 2022). This fragility was apparent in the 2020 covid crisis where mutual fund outflows appeared to play a large role Haddad et al. (2021).

Broad patterns relating growth of the intermediary sector and asset price variation

Haddad and Muir (2021) study broad time series variation in asset prices and risk premia across many asset classes where intermediaries play larger or smaller roles, in line with Equation 5. We reproduce their main finding in Figure 1 where the degree of intermediation in an asset class (captured in their model as the cost of households accessing this asset class directly) is on the x-axis and the sensitivity of the asset class Sharpe ratio to a change in intermediary risk aversion is on the y-axis. Asset classes where financial institutions dominate – e.g., mortgage backed securities, foreign exchange, or derivative markets – respond much more strongly to shocks that affect financial institutions ability to bear risk. In contrast, households or retail investors are much larger participants in the stock market, leaving a smaller role for financial intermediaries. The basic idea is that if financial institutions are hit with a shock that requires them to reduce positions in the credit default swap market, for example, households will not easily step in to absorb this net supply, leading to a large impact on prices. The evidence in Haddad and Muir (2021) thus shows that market macrostructure varies by asset class, because the key players vary

by asset class, and that this drives differential variation in asset prices.

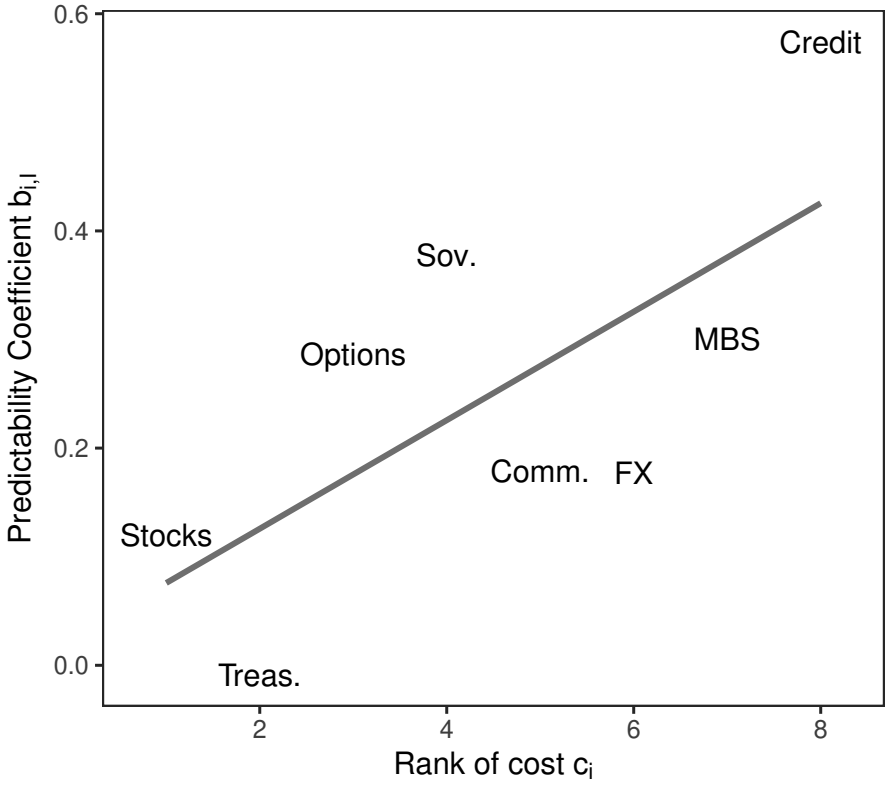

Figure 1: Predictability across asset classes: Predictive coefficients.
Reproduced from Haddad and Muir (2021).

Baron and Muir (2022) relate the expansion and contraction of intermediary balance sheets to risk premiums on stocks, bonds, and real estate using an international panel dating back to 1860. Specifically, growth in the size of the intermediary sector is associated with increased asset prices and compressed risk premia going forward. The broad historical approach suggests that the link between intermediation and asset prices is not just a recent phenomenon or one driven only by financial crises. Last, this relationship holds when controlling for macroeconomic fundamentals, resembling the result in Muir (2017) that intermediary balance sheets are not simply a proxy for other macroeconomic

risks. See also Adrian et al. (2010) who related intermediary balance sheets to risk premia and asset price variation over a shorter sample in US data.

Adrian et al. (2014), He et al. (2017), and Du et al. (2023) explore pricing the cross-section of asset returns using intermediary based factors and find strong support that intermediary balance sheets and constraints matter for the cross-section of asset returns.

Non-bank intermediaries

Much of the intermediary literature focuses on banks (at a broad level to include broker/dealers, commercial banks, or bank holding companies) as well as hedge funds. This is in part because this literature emphasizes leverage, constraints on short-term debt, banks runs and financial crises, and non-linearities associated with occasionally binding constraints. Market macrostructure takes a broader view of the important key players in a given market and how they trade. In particular, there are also many active non-bank intermediaries that are important players in financial markets as well. For example, pension funds and insurance companies are intermediaries who are especially important in several markets including fixed income markets. Mutual funds play a large role in equity markets, and an increasingly large role in fixed income markets.

Koijen and Yogo (2023) document that insurers are large holders of corporate bonds. Chodorow-Reich et al. (2021) argue that a natural reason for insurers demand for these assets is that they help insulate discount rate shocks. Koijen and Yogo (2022) and Sen (2023) each study constraints and regulatory factors that affect insurers portfolio demands. Bretscher et al. (2022) study the corporate bond market as a whole and emphasize the role of various institutional investors including insurance companies and mutual funds.

A number of recent papers study the role of non-bank financial intermediaries more broadly, and especially their evolution over time. Acharya et al. (2024), Boyarchenko and Elias (2024), Hanson et al. (2024), Buchak et al. (2018), Buchak et al. (2024), and Pozsar et al. (2010) are recent examples.

4. The Rise of Passive Investing

A large change in macrostructure has been unfolding in the stock market over the last 20 or 30 years: the rise of passive investing. Institutions participating in the stock market increasingly focus on passive as opposed to active strategies. Passive strategies can be broadly defined as following a predetermined strategy as opposed to allowing for discretionary trading. The main example — both historically and in terms of assets under management — of such a strategy is to track the market portfolio, or a broad index such as the S&P500. French (2008) documents the growth of passive strategies, and Stambaugh (2014) highlights that the change occurs both at the intensive and extensive margin: more mutual funds are passively managed and active funds pursue less active strategies. In the US, passive mutual funds and indexed exchange-traded funds (ETFs) have gone from holding a tiny fraction of the stocks to about 20% of the market. This number is just the tip of the iceberg as, for example, mutual funds are just some of the institutions trading in the market: using different methodologies, Haddad et al. (2024a) and Chinco and Sammon (2024) estimate that the passive share is of the order of 40%.

The natural macrostructure question is whether this large shift alters the dynamics of asset prices. A simple view would say that by having less active investors, the market becomes less elastic and liquid, and prices are more volatile and less informative. The classic paradox of Grossman and Stiglitz (1980) highlights that the market response can be more subtle because investors compete with each other. If markets are efficient, there are not gains from being active, and hence nobody would want to be active ... but then how can market be efficient in the first place? What this reasoning highlights is that the key to understand the effect of many investors switching to passive investing is the reaction of the remaining active investors.

Haddad et al. (2024a) approach this question by constructing a model of demand featuring strategic responses: how aggressively you trade depends on how aggressively

other traders for the same stocks trade. They show that such response is at the heart not only of theories of information acquisition but also of liquidity or other frictions to trading. If competition across traders was extremely fierce as in an idealized view of markets, these strategic reactions would perfectly offset any shift towards passive investing. Estimating the model using the cross-section of stocks and investors, they estimate that strategic reactions are substantial, but only offset about two thirds of the direct effect of having more passive investors. This implies that the rise of passive investing has made markets 20% more inelastic.

This approach to quantify the impact of passive investing focuses on using data on quantities to directly measure trading, and specifically strategic responses in trading. The literature has entertained a variety of other approaches, putting more or less structure on the problem. At one end, Ben-David et al. (2018) focuses on a local well-identified source of variation: index inclusions. They document that volatility increases substantially when the passive share increases, with numbers in line with the idea that strategic responses are imperfect.

This type of experiment can be used to examine different dimensions of the data. Motivated by the model of Grossman and Stiglitz (1980), Coles et al. (2022) focus on information. They measure that while information production appears reduced following a increase in index investing, price informativeness is unchanged. They interpret this result as revealing that there is no net effect of passive investing on equilibrium prices. In contrast, Sammon (2021) measures information using earning announcements and find that index investing appear to diminish the information in asset prices.

Finally, a third approach relies on more sophisticated theories to enrich the set of predictions and implications from this theory. For example, Lee (2020) argues that if the rise of passive investing is driven by the entry of new investors, it can foster more liquidity in markets. Bond and García (2021) highlight how welfare implications differ for different types of investors. Jiang et al. (2020) link the rise of passive investing to an

increase in importance of mega-firms.

The richness of these findings highlight the value of a multi-pronged approach to answering macrostructure questions. While at the end of the day, changes in price dynamics must come from changes in trading behavior, theory can guide studies measuring trading behavior using quantity data. Zooming in on other dimensions help obtain a complete picture of changes in the market, and refine our understanding of the mechanisms at play.

5. Central Banks in Asset Markets

Central banks are now large players in asset markets through asset purchase programs (e.g., Quantitative Easing). The average size of central bank balance sheets across the US, UK, Euro area, and Japan is around 40% of GDP as of 2022. Figure Figure 2, taken from Haddad et al. (2024b), plots the size of central bank balance sheets over time. Much of this significant expansion is due to purchases of government bonds with significant duration, though purchases have extended to mortgages and the corporate sector as well. Because the purchases are funded by issuing reserves, they affect the supply of duration (and credit risk in the case of corporate bonds) available to investors in financial markets.

In addition to a large *stock* of purchases – the Fed's balance sheet peaked at above $9 trillion – the *flows* of purchases are also often large and occur during crisis periods. For example the Fed purchased over $1 trillion in Treasury bonds in just a few week period starting in March 2020. Further, the Fed also at times signals that purchases could be even larger – in March 2020 the Fed stated purchases could be unlimited.

How does the introduction of this large new player affects bond markets? How do other players respond and how do the level and dynamics of bond prices change as a result of this significant shift in macrostructure?

One unique feature in this setting is that we do have natural experiments – asset purchase announcements by central banks – that can causally identify effects of asset

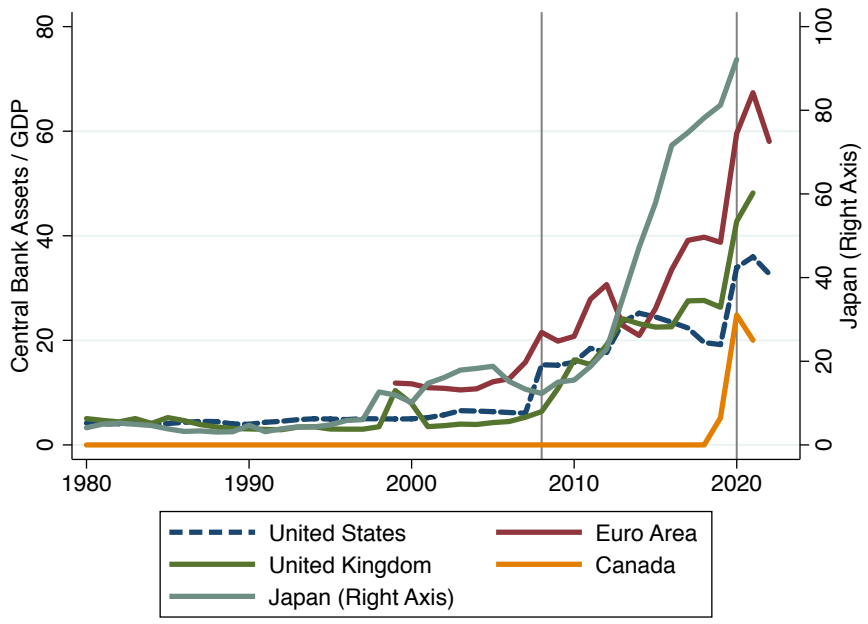

Figure 2: Central Bank Balance Sheets.
Reproduced from Haddad et al. (2024b).

purchase policies on asset prices. Unlike a private investor, the Fed typically wants to announce a policy ex-ante and provide communication to markets of their future trades. This makes identification easier: the response of asset prices in a narrow window around such announcements are due to the announced policies and expectations about the future path of asset purchases.

A large literature studies the impact of central bank asset purchase announcements on financial markets through event study approaches across many countries: Gagnon et al. (2018), Vissing-Jorgensen and Krishnamurthy (2011), and Krishnamurthy et al. (2018) are three prominent examples.[3]

The studies find large effects on targeted bond yields from these announcements. For example, the announcements by the Fed during the QE1 program produced a cumulative

[3]See also Haddad et al. (2021) and Vissing-Jorgensen (2021), among others.

decline in the 10 year Treasury yield of 100-150 basis points. These are incredibly large effects.

There is some debate on the specific channels through which these asset purchases work. The evidence suggests that a sizable fraction of the effect of QE on yields comes through the term premia channel: by affecting the net supply of duration risk that investors bear, the risk premium on duration risk is lowered and hence term premia decline.

This channel is modeled most explicitly in Vayanos and Vila (2021) and Greenwood and Vayanos (2014). These models map well to the model provided in 2: there are a set of inelastic bond investors (sometimes labeled preferred habitat investors) and a set of active bond traders. Because the inelastic investors don't adjust quantities, any changes in supply must be absorbed by the active investors who require a risk premium for holding duration risk. By purchasing (or announcing to purchase) these assets from the active investors, the central bank can lower the equilibrium term premium and thus affect long-term rates.

Importantly, central banks are not static players – they follow a trading strategy where purchases depend on the state of the economy. More specifically, central banks use asset purchases in bad economic times, for example the 2008-2009 financial crisis or the 2020 covid crisis. The introduction of this new player who buys assets in crisis times will naturally change the demand and strategies of other investors in the market. Through the mechanism outlined above, purchases by the central bank in a given period will raise bond prices in that period.

However, investors respond to this trading strategy as shown in Haddad et al. (2024b). Because long-term bond prices will now be relatively higher in crisis times through central bank purchases, bond investors will view them as safer ex-ante. An asset which appreciates more during bad economic times is safer and thus in higher demand from investors. This higher demand of long-term Treasuries will push up their prices ex-ante and thus lower unconditional yields – even in periods where the central bank is not ac-

tively buying. Put differently, investors will know they can sell long-term Treasuries for an especially high price during a crisis because the Fed is buying. This increases the safety properties of Treasuries, generates increased demand, and in equilibrium pushes up their value.

Similarly, when a central bank announces asset purchases, other investors will update not just on a fixed headline dollar amount of purchases, but they may update on the information that the central bank is willing to purchase even more than stated if economic conditions worsen. Haddad et al. (2025) use option prices to infer such expectations – intuitively if investors expect larger purchases over the next quarter conditional on worse economic outcomes, then this should have a disproportionate effect on the price of out of the money put options which pay off in downside states. Haddad et al. (2025) use this insight to construct the effect of such interventions state by state, where state refers to the future price of the asset absent any intervention by the central bank, by examining how option prices change after the announcement across a wide range of strikes. Again, this result highlight that investors view the central bank as a large new player, that they form expectations about the central banks' dynamic strategy, and that this affects their demand and the equilibrium price of this asset.

A long literature studies similar issues in conventional monetary policy – the Fed's policy for dynamically adjusting the short term interest rate has large effects on both stock and bond prices, and embeds a "put option" in that the Fed responds strongly in downturns (Cieslak and Vissing-Jorgensen, 2021).

6. Additional Examples of Macrostructure

There are of course many more market macrostructure questions pursued in the literature than the three we have highlighted. This section scratches the surface of what is out there, by listing additional examples of work that speaks to macrostructure questions and uses

macrostructure approaches.

A growing area in international finance focuses on macrostructure approaches for questions such as exchange rate determination, uncovered interest parity, and FX interventions as in Gabaix and Maggiori (2015), Itskhoki and Mukhin (2021), Greenwood et al. (2023a). Koijen and Yogo (2020) and Beltran and He (2024) use quantity and price data to jointly characterize dynamics in these markets. Related work studies the role of macrostructure in global financial cycles as in Miranda-Agrippino and Rey (2020) and Zhou (2023).

A literature on Environmental, Social, and Governance (ESG) investing explores how shifts in the demand for ESG assets affects asset prices and firm investment in equilibrium, for example see Van der Beck (2021), Berk and Van Binsbergen (2021), and Pástor et al. (2021). The large shift towards ESG funds represents a shift in macrostructure that can affect equilibrium prices of ESG related firms and ultimately feed through to real investment through the cost of capital channel. The overall impact depends crucially on how willing non-ESG driven investors are to substitute away from high ESG companies (greener firms) and towards low ESG companies (browner firms).

Scharfstein (2018) and Greenwood and Vissing-Jorgensen (2018) studies the role of pension and insurance companies and their effects on long-term bond yields. They find that countries with a large pension and insurance sector – which have demand for very long duration assets – have lower bond yields at the very long end of the yield curve. Thus, the macrostructure of financial institutions in a country can meaningfully affect the cost of long-term debt.

Duffie (2010), Greenwood and Hanson (2013), and Siriwardane et al. (2022) contain many examples of supply effects on asset prices that favor the macrostructure view of markets – a limited set of active investors can absorb net supply shocks in any given period.

Gompers and Metrick (2001) find that large institutional investors play an increasing

role in the stock market and that this increases the demand for shares of large companies, leading to a rise in their price.

Coval and Stafford (2007) study institutional price pressure caused by mutual fund capital flows. When funds face outflows, they sell existing positions, and cause downward pressure on prices when the same security is held by many funds experiencing outflows. Relatedly, Ma et al. (2022) and Darmouni et al. (2022) discuss the importance of corporate bond mutual funds and their growing importance in market share over the past 15 years. This increasing role also brought fragility seen during March of 2020 when these bond funds experienced large sudden outflows, leading to significant price declines in the corporate bond market (Haddad et al., 2021). Darmouni et al. (2022) model and quantify these dynamics.

7. Conclusion

Market macrostructure is an important growing theme in the field of finance that focuses on the broad organization of financial markets and its implication for asset prices. This theme shows up in much recent work that tackles a wide range of questions from the impact of passive investing, to the effect of central banks in asset markets, or to the effect of financial intermediation on asset prices. While we focused on examples in very distinct contexts, an important message is that a common set of tools and approaches allow us to take on macrostructure questions. The universe of these questions is of course much broader than the three specific examples we highlighted, and we can only look forward to more insights from using these methods.

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