Essays in Law and Finance



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To my parents,

John and Rosalie,

for their endless love and support.

"And once the storm is over you won't remember how you made it through, how you managed to survive. You won't even be sure, in fact, whether the storm is really over. But one thing is certain. When you come out of the storm you won't be the same person who walked in. That's what this storm's all about."

Kafka on the Shore, Haruki Murakami

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Abstract

This dissertation consists of three essays in law and finance, with applications in private markets and real estate. In the first chapter, I examine the direct impacts of concentrated ownership by private market funds. Using the hotel industry as a laboratory, I show that private funds and REITs use the opacity of their ownership structures to purchase seemingly competing hotels within the same market. I show that increased concentration of ownership by private markets funds following acquisitions that cause exogenous shocks to ownership concentration results in decreased customer satisfaction (especially perceptions of value and service) according to reviews from TripAdvisor.com. In the second chapter, I explore the spillover impacts of concentrated ownership by private equity funds on other owners and the communities in which they operate. Using mergers of private-equity backed firms to isolate quasi-exogenous variation in concentration of ownership at the neighborhood level, I find that shocks to institutional ownership indeed cause higher prices and rents — but, contrary to popular opinion — increase rather than decrease neighborhood diversity. Institutional investors extract value from neighborhoods by challenging tax assessors' valuations and thus reduce their tax bill by an estimated $4.1b nationwide. In the final chapter, I examine the circumstances in which covenant-lite lending may be advantageous to members of a syndicated facility. Covenant-lite loans limit the circumstances in which lenders can withdraw or renegotiate credit agreements, and thus insulate lenders from inefficient liquidation arising from shocks to other syndicate members. I find covenant-lite lending is preferred where monitoring is imperfect and the probability that the other lender will suffer a repayment preference shock is higher. Collectively, these papers critically examine how the rise of institutional investors, especially through private funds, has impacted competition and contracting within markets.

Contents

1 Introduction

2 Literature Review **2**

2.0.1 What is Private Equity? 3

2.0.2 Impact of private equity on portfolio companies 4

2.0.3 The impact of private equity on industries 7

2.0.4 Competitive pressures of direct ownership versus franchising . . . 8

2.0.5 Benefits of agglomeration 10

2.0.6 Debt covenants and incentives to monitor 10

2.0.7 Debt in LBOs and Financial Stability 12

2.0.8 Impact of institutional investment on retail investors and herding 14

2.0.9 Toehold Stakes and Global Games 16

3 REITs and Local Market Competition **18**

3.1 Introduction 18

3.2 Institutional Details 22

3.2.1 Hotel Brands and Ownership 22

3.2.2 Hotel Ratings 24

3.3 Data 25

3.3.1 Sample selection 25

3.3.2 Identification of ultimate owner 25

3.3.3 Additional Data . . . 28
3.3.4 Hotel Concentration Indices . . . 29
3.3.5 Identifying transactions . . . 30
3.3.6 Blackstone's history with Hilton . . . 31
3.4 The Impact of Private Equity Entry on Local Competition . . . 31
3.4.1 Empirical Strategy . . . 31
3.4.2 Identification . . . 34
3.5 Conclusion . . . 38

4 Keeping Up with the Blackstones **52**
4.1 Introduction . . . 52
4.2 Institutional Details and Literature Review . . . 58
4.3 Theoretical Framework . . . 62
4.3.1 A Two-House Model . . . 62
4.4 Data and Investor Classification . . . 65
4.4.1 Description of Datasets . . . 66
4.4.2 Descriptive Statistics . . . 70
4.4.3 Identify SFR Investors . . . 71
4.4.4 Mergers in the SFR Market . . . 73
4.5 Empirical Framework . . . 73
4.5.1 Impact of mergers on local prices . . . 76
4.5.2 Impact of mergers on house improvements . . . 78
4.5.3 Tax Assessor Appeals by Investor Type . . . 84
4.5.4 Neighborhood Composition . . . 88
4.6 Conclusion . . . 91

Appendices **113**
A Proofs and Derivations . . . 113
A.1 Demand Functions with Differentiated/Undifferentiated Houses . 113

A.2 Optimal Price and Quality with Competition . . . 114
A.3 Merged Landlords . . . 116
A.4 Three house model: Owner Occupier . . . 117
B Ownership Matching . . . 119
C Census Matching . . . 122
D Screening for SFR mergers within CapitalIQ . . . 123
E Institutional Investors and Arbitrage . . . 124
F Extra Figures . . . 126
G Extra tables . . . 127

5 Heterogeneous Creditors and Cov-Lite Loans 156
5.1 Introduction . . . 156
5.2 Institutional Details and Literature Review . . . 158
5.3 Model Development . . . 161
5.3.1 Model Foundations . . . 161
5.3.2 Informational assumptions and choice of covenants . . . 162
5.3.3 Single lender contracts: choice of covenants, and monitoring . . . 164
5.4 Multiple Lender Contracts, Choice of Covenants, and Monitoring . . . 169
5.4.1 Public signal and intermediate signal perfectly correlated . . . 171
5.4.2 Public signal and intermediate signal independent . . . 176
5.4.3 Trade in loan shares . . . 178
5.5 Conclusion and further directions of analysis . . . 180

Appendices 182
A Proofs and Derivations . . . 182
B Perfectly correlated intermediate and public signals . . . 199
B.1 Single Lender . . . 199

6 Conclusion 204

List of Figures

3.1 Stylized control/branding in the hotel industry 40

3.2 Changes in Reviews of All Hotels Around Private Equity Entry 41

3.3 Changes in Reviews of Private Equity Hotels Around Entry 42

4.1 Difference in rent between overlapped and non-overlapped properties around mergers 94

4.2 Difference in house prices between overlapped and non-overlapped properties around mergers 95

4.3 Difference in permits by investor type between overlapped and non-overlapped properties around mergers 96

4.4 Difference in mean value for home improvements loans by investor type between overlapped and non-overlapped properties around mergers . . . 97

4.5 Difference in mortgage applications by race/ethnicity between overlapped and non-overlapped properties around mergers 98

4.6 Difference in mortgage originations by race/ethnicity between overlapped and non-overlapped properties around mergers 99

F.1 Model Outputs for Duopoly Case with No Excess Demand 126

5.3.1 Time line of events: At date zero, financing is negotiated, including choice of covenants, and lenders choose whether to monitor. At date one, if a covenant is violated, the lenders must either agree to waive the covenant or to liquidate the loan. One of the lenders may also experience a repayment preference shock. The lenders may trade their loan shares. At date two, the outcome of the project and any outstanding cash flows are realised. . 161

5.4.1 Borrower's preferred contract (lowest face value D) for different probabilities of repayment preference shocks and precision of information 174

List of Tables

3.1 Brand ownership of upscale US Hotels 43
3.2 10 Largest Chains in Sample 44
3.3 20 Largest Owners in sample 45
3.4 Upscale hotel transactions > 1b 46
3.5 Summary Statistics: Reviews 47
3.6 Correlation between HHI and reviews 48
3.7 Change in ratings around the Apple Six acquisition 49
3.8 Value Ratings in Apple Six Regions 50
3.9 Other Ratings in Apple Six Regions 50
3.10 Value Ratings in Blackstone Hotels 51
3.11 Other Ratings in Blackstone Hotels 51

4.1 Summary of mergers in analysis 100
4.2 Summary statistics 101
4.3 Summary Statistics: Prices and Improvements 102
4.4 Change in neighbourhood prices around mergers 103
4.5 Tax Assessor Valuations around Mergers 104
4.6 Home Improvements Loans by Owner Type 105
4.7 Permitting Activity by Owner Type 106
4.8 Tax Assessor Appeals by Investor Type 107
4.9 Probability of Appeals by Investor Type 107

4.10 Success of Appeals by Investor Type . . . 108
4.11 Reduction in Assessed Value of Successful Appeals by Investor Type . . . 109
4.12 Difference between Assessed Value and Sale Price by Investor Type . . . 110
4.13 Mortgage applications by race/ethnicity around mergers . . . 111
4.14 Mortgage originations by race/ethnicity around mergers . . . 112
A1 Tax Assessor Valuations around Mergers . . . 128
A2 Change in property-level valuations around mergers . . . 129
A3 All Applications for Loans for Home Improvements (with controls) . . . 130
A4 Owner Occupier Applications for Loans for Home Improvements (with controls) . . . 131
A5 Investor Applications for Loans for Home Improvements (with controls) . 132
A6 Mean Value of All Loans Originations for Home Improvements (with controls) 133
A7 Owner Occupier Loan Originations for Home Improvements (with controls) 134
A8 Mean Value of Loan Originations for Home Improvements by Investors (with controls) . . . 135
A9 Investor Home Loan Applications (with controls) . . . 136
A10 Investor Home Loan Approvals (with controls) . . . 137
A11 Owner Occupier Permit Activity Around Mergers . . . 138
A12 Small Investor Permit Activity Around Mergers . . . 139
A13 Large Investor Permit Activity Around Mergers . . . 140
A14 SFR Investor Permit Activity Around Mergers . . . 141
A15 Mortgage applications by race/ethnicity around mergers: 2010-2021 . . . 142
A16 Mortgage originations by race/ethnicity around mergers: 2010-2021 . . . 143
A17 Black/African American Mortgage Applications (with controls) . . . 144
A18 White Mortgage Applications (with controls) . . . 145
A19 Latino/Hispanic Mortgage Applications (with controls) . . . 146
A20 Asian Mortgage Applications (with controls) . . . 147
A21 Mixed Race/Ethnicity Mortgage Applications (with controls) . . . 148

A22 Non-White Mortgage Applications (with controls) 149
A23 Black/African American Mortgage Originations (with controls) 150
A24 White Mortgage Originations (with controls) 151
A25 Latino/Hispanic Mortgage Originations (with controls) 152
A26 Asian Mortgage Originations (with controls) 153
A27 Mixed Race/Ethnicity Mortgage Originations (with controls) 154
A28 Non-White Mortgage Originations (with controls) 155

Chapter 1

Introduction

The growth of private markets is arguably the most significant development in financial markets in the new millennium. More capital has been raised by private markets than public markets in every year of the past decade.[1] Private capital vehicles have been raised to provide financing for leveraged buyout acquisitions, to offer lending at all levels of seniority, and to fund real estate acquisitions. Increasing capital inflows into private funds has resulted in an increased proportion of equity and debt being supplied through vehicles that are non-transparent to investors, markets, policy makers, and the public. Hence, the increasing prevalence of private funds raises questions about whether and how policymakers should respond to a large portion of the economy being beyond regulatory reach.

Regulation may be particularly necessary given the unique investment structure of private market funds. Most funds require on day one that investors commit capital for investments that may not produce returns for many years, with capital often remaining locked in for a decade or more. Contract terms are agreed at the time of the initial investment, and are rarely renegotiated. Furthermore, individual investors may be able to negotiate more favorable fund terms than other investors through side letters. Yet, unlike other

[1] Morgan Stanley, Public to Private Equity in the United States: A Long-Term Look, 4 August 2020. Available online here.

investments, it is extremely difficult for investors to withdraw their capital should circumstances change or issues arise.[2]. In addition to management fees, fund managers often charge underlying portfolio investments fees to compensate for management services and transaction costs. Such fund structures give rise to potential conflicts of interest in how assets are allocated, fees are charged, and concessions are granted to investors.

Regulators have been slow to respond to the growth of such private funds, with most jurisdictions requiring at most that a fund register with the local financial services regulator. In 2022, the United States' Securities and Exchange Commission (SEC) introduced a proposal to increase transparency of private funds. Under the proposed rules, private fund advisers would be required to provide detailed quarterly reporting to investors including fund fees, expenses, compensation, and performance. It would also limit the ability of funds to offer preferential treatment to some individual investors, unless the arrangement is disclosed to existing and future investors.

Although these proposed regulations would increase transparency for fund investors, they do not increase transparency of fund ownership to regulators or the public. Private equity (real estate) fund managers typically purchase controlling interests in portfolio companies (properties) and actively manage these investments by either direct management or selecting and monitoring management and controlling the board. Direct control of fund assets coupled with the opacity of ownership structures enables private funds to may enable fund managers to acquire and manage otherwise competing assets. Fund ownership of multiple assets within the same industry or geography may give the fund sufficient market power to behave anti-competitively. Market power may enable price increases that could affect the behaviour of other owners and have spillovers on local communities.

This dissertation addresses three questions relating to the law and finance of private

[2]Fund investors can typically only exit a fund through default (where they lose any right to all capital previously invested in the fund) or sale of their fund stake. The latter requires the fund manager's permission and, even if granted, it is not trivial to find a buyer. Total assets under management in the private equity secondary market is only 5.5% of the primary market in March 2022 (Preqin Global Report 2023: Private Equity)

markets and real estate investments. In the first chapter, I examine the direct impacts of concentrated ownership by private market funds. In the second chapter, I explore the spillover impacts of concentrated ownership by private equity funds on other owners and the communities in which they operate. In this final chapter, I examine the circumstances in which covenant-lite lending may be advantageous to members of a syndicated facility.

The first paper examines whether private funds use the opacity of their ownership structures to behave anti-competitively. Using the hotel industry as a laboratory, I show that private funds and REITs purchase seemingly competing hotels within the same market. This results in increased concentration of ownership that impacts local competition. I use the Blackstone's acquisition of the Apple Six portfolio as an exogenous shock to local concentration of ownership. Utilising reviews from TripAdvisor.com, I show that increased concentration of ownership by private markets funds results in decreased perceptions of value and service from hotel customers.

The second paper explores the impact of institutional investment on local housing markets. Policy makers worry that institutional investment in residential real estate drives up house prices and crowds out minority residents. Using mergers of private-equity backed firms to isolate quasi-exogenous variation in concentration of ownership at the neighborhood level, I find that shocks to institutional ownership indeed cause higher prices and rents — but, contrary to popular opinion — increase rather than decrease neighborhood diversity. The reason for increased diversity is that some minorities benefit from the relaxation of borrowing constraints as a result of higher house prices and take out mortgages for home improvement, increasing the attractiveness of their homes; other minorities move in because more rental properties become available as institutional ownership crowds out predominantly white individual home ownership. Institutional investors benefit from increased market values of their houses in increasingly attractive neighborhoods, but also extract value by challenging tax assessors' valuations and thus reduce their tax bill by an estimated $4.1b nationwide. This is a hitherto unknown source of rent extraction by

institutional investors. I conclude that policy makers are right to be worried about some aspects of institutional investment in residential real estate, but they are mostly worried about the wrong thing.

The third paper considers how contractual provisions in the syndicated lending market have changed to accommodate the recent dominance of institutional investors in this market. I propose a theoretical framework in which lenders may suffer repayment preference shocks that encourage early and costly termination of a loan contract. Cov-lite loans limit the circumstances in which lenders can withdraw or renegotiate credit agreements, and thus insulate lenders from inefficient liquidation arising from shocks to other syndicate members. I find cov-lite lending is preferred where monitoring is imperfect and the probability that the other lender will suffer a repayment preference shock is higher. However, if the lenders are able to costlessly trade their loan shares, maintenance covenants reduce the cost of lending (the face value of debt) relative to cov-lite contracts.

Collectively, these papers critically examine how the rise of institutional investors, especially through private funds, has impacted competition and contracting within markets.

Chapter 2

Literature Review

Since its inception in United States in the early 1980s, private capital has grown to be a large global asset class, with private equity (including venture) holding more than $4.7t in assets under management at the end of 2020. [1] The leveraged loan market has experienced similar growth over more recent years, reaching $3t in August 2021. [2] This growth in leveraged loans has been accompanied by a weakening of traditional monitoring covenants, with 91% of leveraged loans issued as covenant lite in 2021. [3] Private capital markets have attracted academic research, both for their unique features with which to test finance theory, and the challenge of paucity (and opacity) of data. This thesis will aim to contribute to this burgeoning academic literature.

[1] Estimates according to the Preqin Private Equity and Venture Capital Report 2021, available at https://www.preqin.com/insights/global-reports/2021-preqin-global-private-equity-and-venture-capital-report

[2] According to S& P Global and LCD Data. Report available here: https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/after-risk-on-run-us-leveraged-finance-market-tops-3-trillion-in-size-65456285

[3] According to S & P Global report available here: https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/covenant-lite-deals-exceed-90-of-leveraged-loan-issuance-setting-new-high-66935148

2.0.1 What is Private Equity?

Private equity is any equity provided to a company that is not publicly-listed. Private equity firms raise capital from investors (limited partners, or LPs) through private equity funds. Private equity funds are typically "closed-end" vehicles in which the LPs agree to provide a certain amount of capital on call over the fund's investment period. The private equity firm, as the fund's general partner (GP), manages the fund and chooses which companies to invest in (so-called portfolio companies).

The agreement between the private equity firm and the limited partners is set out in a limited partnership agreement (LPA). These agreements typically give the GP broad discretion over how capital is invested and the timing and form of divestment. However, the LPA may specify the geographies, industries, etc that the GP may invest in. For example, a fund may specialise in a particular industry, such as real estate or healthcare. When a private equity firm uses significant leverage to purchase a portfolio company, the transaction is referred to as a leveraged buyout (LBO). If existing management of the portfolio company is involved in the transaction, it is referred to as a management buyout (MBO).

Private equity firms are compensated through management fees, portfolio company fees, and carried interest. Management fees are typically calculated as a percentage of the capital committed [4] to subsidize the cost of managing the fund. Portfolio company fees may include fees for monitoring a company in the fund's portfolio, transaction fees associated with the acquisition of a portfolio company, or directors fees. Some (or all) of these fees may be rebated to the fund.[5] Carried interest is awarded to the GP as a percentage of the profits of the fund, typically 20% once a minimum hurdle rate (often

[4] Management fees are usually calculated as a percentage of capital committed during the investment period and as a percentage of net invested capital thereafter. Metrick and Yasuda (2010) provide an overview of typical fund fee terms.

[5] Phalippou et al. (2018) provide some descriptive statistics on the occurrence of portfolio company fees and some empirical estimates of the magnitude of these fees. They estimate that at best 70% of these additional fees are rebated. In their sample of 592 companies, fees amount to $20 billion, which represents over 6% of the total equity invested by GPs.

8%) has been returned to limited partners.

Private equity as an investment model has long been argued to better align the interests of the firm's owners (the GP and LPs) with the firm's management (controlled by the GP). Jensen (1989) argues that the pay-for-performance compensation resolves the owner-manager conflict of public corporations. The carried interest portion of fees means that GPs are highly incentivised to actively manage the underlying portfolio companies with the goal of maximising the financial return upon divestment.[6]

2.0.2 Impact of private equity on portfolio companies

Historically private equity returns have outperformed public markets net of fees (Harris et al. (2014)) but less is known about how these returns are achieved.[7] Proponents of the industry have argued that GPs improve the operations of their portfolio companies, which creates economic value. This economic value translates into higher sale prices for firms and greater returns at a fund level. Kaplan and Stromberg (2009) divide these portfolio company changes into three categories: financial, governance and operational engineering.

Financial engineering may mitigate the owner-manager agency problem. Higher leverage constrains the available cash flow, which limits the ability of management to use cash for empire-building projects (Jensen (1989)) or for management perquisites (Edgerton (2012)). Due to the tax-deductibility of debt, reduced taxes from higher leverage can increase firm value (Kaplan (1989a)). Private equity firms improve managerial incentives by granting management stock or options to provide a large equity upside, and may require management to directly participate in the deal, exposing management to downside

[6]Note that Metrick and Yasuda (2010) find that 69% of the expected revenue to private equity firms in their sample comes from management fees, a fixed-fee component. This suggests that GPs may have incentives to hold onto investments in order to earn fee revenue when the expected return from sale is low.

[7]Earlier work using different data finds underperformance of private equity relative to public markets, for example Phalippou and Gottschalg (2009) and Kaplan and Schoar (2005)

risk.[8] Higher equity ownership coupled with the illiquidity of private stock means that management have little incentive for short-termism.

Governance engineering refers to the changes a private equity firm may make to the engagement between the board and the portfolio company's management. Acharya et al. (2009) conduct a survey of 48 GPs about the governance changes they implement following a buyout. They find that private equity boards are smaller and have greater engagement with management, especially in the first 100 days following a transaction when business plans are made. They report a lower implied tenure for management of private equity backed companies (2 years) compared to publicly listed companies (4.7 years) but do not distinguish at what stage of the transaction change in management occurs. Cornelli and Karakas (2015) find that CEO turnover is very high in the period of transition from public to private, but that post-transition turnover is lower than pre-buyout levels.[9] The authors interpret this as a willingness of private equity firms to assess CEOs over longer horizons, which discourages excessive focus on short-term results. Bloom et al. (2015) find that private equity firms are better managed than government, family and other privately owned firms, but they find no improvement in management over public firms.[10] Cotter and Peck (2001) find that using debt with tighter terms does not increase firm's performance where there is active monitoring by the private equity firm. They conclude that active monitoring is a substitute for tighter debt terms.

Operational engineering refers to changes the private equity firm makes to a portfolio company's strategy or operations based on industry-specific knowledge and operating expertise. Early studies in the US and Europe found that private equity ownership

[8] Kaplan (1989b) estimates that management equity ownership percentage increases by a factor of four (from 5.88% to 22.63%) following a public-to-private buyout. Using a more recent set of buyouts from 1996-2004, Kaplan and Stromberg (2009) find the median management team receives 16% of the equity upside through stock and options.

[9] CEO turnover falls from 14.5% pre-buyout to 9.2% post-buyout in their sample. The post-buyout turnover of portfolio companies is also lower than that of matched public firms in the post-buyout period (matched public firms have a turnover of 14.4% which is not statistically different from the turnover of the same public firms in the pre-LBO period).

[10] The authors measure management improvement according to an evaluation score that considers performance monitoring, setting targets and performance incentives.

improves the operating performance and productivity of portfolio companies. Kaplan (1989b) reports large increases in operating income ratios and market value for 48 LBOs completed between 1980 and 1986. [11] Lichtenberg and Siegel (1990) find that the total factor productivity of manufacturing plants that underwent an LBO in their sample increased to 8.3% above the industry mean in the three years following the buyout. [12] Similarly, Harris et al. (2005) find the total factor productivity of UK manufacturing firms in their sample increases after an MBO. But more recent studies find only slight improvements in firm operating performance following an LBO. Guo et al. (2011) find median operating performance of private equity backed firms is often not different from benchmark firms matched by industry and pre-LBO characteristics.[13]

More recent work has found private equity investment may positively impact growth (Boucly et al. (2011)), innovation (Lerner et al. (2011)) and management practices (Bloom et al. (2015)) within portfolio companies. In contrast to public perception, there is little evidence that private equity firms engage in short-termism with their portfolio companies (Harford and Kolasinski (2014))

Private equity ownership may also impact the way portfolio companies invest. Recent studies suggest that private equity backed companies time investments more effectively, and do not invest less in long-term projects than public firms. Using a sample of chemical producers, Bergström et al. (2016) finds that private equity backed producers time capacity increases better than publicly traded firms. Looking at the impact of private equity on long-term investments, Lerner et al. (2011) find that firms produce patents that are more cited (i.e. economically meaningful) following an LBO.

[11] Smith (1990) finds similar results in a study of 58 MBOs between 1977-1986. She attributes the change in operating returns to adjustments in working capital rather than layoffs or changes in other key expenditures. Bergström et al. (2007) find similar improvement in financial operating statistics (namely, EBITDA margin, sales growth and return on invested capital) under private equity ownership of Swedish firms in their 1998-2006 sample.

[12] The authors note that this effect is only observed in the latter half of their sample, from 1983-1986. There is no statistically significant effect for buyouts in 1981 -1982.

[13] The authors find greater gains in firms where the CEO is replaced and where leverage is higher, consistent with theories of debt as a disciplining device.

Academic research on the impact of private equity on consumers and employees is mixed. Bernstein and Sheen (2016) show that restaurants implement better operational practices and commit fewer health violations following a private equity buyout. These improvements are concentrated in directly owned stores where private equity has the greatest influence, rather than franchise locations. This suggests that the private equity owner is driving these improvements rather than picking restaurants that are already improving.Prior studies have shown that private equity ownership reduces workplace injuries (Cohn et al. (2021)), and increases product offerings across geographies (Fracassi et al. (2020)). Yet other research has found private equity buyouts increase price (Chevalier (1995)) and lower product quality (Matsa (2011)) in supermarkets, increase tuition in higher education providers (Eaton et al. (2019)), increase mortality in nursing homes (Gupta et al. (2021)), lower local governance content and reduce editorial staff in newspapers (Ewens et al. (2021)), and decrease employee satisfaction across a range of industries (Lambert et al. (2021)). Gandhi et al. (2021) find that private equity backed companies compete more aggressively in competitive markets and exploit their market power in less competitive ones. This paper further examines the competitive consequences of private equity on consumers. In particular, it asks how private equity investment impacts the behaviour of competitors, and the consequences for consumers.

2.0.3 The impact of private equity on industries

Private equity firms may influence not only firms under their direct control, but also competitors within the same industry or supply chain. In a 26 country, 20 industry study, Bernstein et al. (2017) find greater productivity and employment growth in industries where private equity funds have invested in the previous five years. [14]

Similarly, Aldatmaz and Brown (2017) find increases in labor productivity, employment, firm profitability and capital expenditures in publicly-listed companies following a private

[14]Note that level of private equity investment does not lead to significant differences between industry outcomes in this study. That is, it is the existence of the investment, rather than the magnitude, that drives the industry outcomes.

equity investment in the same country and industry. These effects are stronger when the local competition is higher suggesting that changes in private-equity backed firms to make them more efficient adds competitive pressure to rivals. This increased competition drives efficiency spillovers to public-firms within the same country-industry.

Economists have long considered strategies where a competitor may trade off short-term profits for long-term market share. [15] Yet little is known about the optimal strategies of short-term focussed competitors and how incumbents should respond to their entry. Theoretical work suggests that firms may optimally compete less aggressively by delegating pricing decisions to a short-term focussed managers (Miettinen and Stenbacka (2018)). Empirical work finds that the relative strength of competitors affects their response to a private equity entrant: less-levered rivals may"prey" on LBO targets by reducing prices, while more-levered competitors raise their prices along with private equity portfolio companies (Chevalier (1995), Fracassi et al. (2020)).

2.0.4 Competitive pressures of direct ownership versus franchising

Crucial to any competition analysis is knowledge of who owns the business. Franchising obscures ownership as it creates a dual structure where some chain outlets are owned and controlled by the parent (directly owned), while others are legally independent businesses that take the brand of the chain. In a franchise agreement, the franchisee takes the branding, appearance, rewards program, booking systems etc, of the chain, in exchange for paying a fee to the franchisor (parent company). Franchise fees typically include a flat fee for use of the brand as well as a percentage of gross profits of the franchised location.[16] Thus, even though franchised locations are managed independently, fee arrangements

[15] Predatory pricing - the strategy of pricing aggressively in order to eliminate competitors - may be profitable for a firm operating in multiple markets to deter others from entry (Milgrom and Roberts (1982)). Bolton et al. (1999) and Edlin (2012) provide an overview of the theoretical, empirical and legal analysis of predatory pricing.

[16] Indirect fees include contractual requirements to pay for use of services provided exclusively by the parent company (for example, IT charges for booking infrastructure at franchised location)

ensure the parent company retains a direct interest in the financial performance of the franchised location.

Customers cannot distinguish between directly owned and franchised outlets, so both types should face similar consumer demand shocks (Mathewson and Winter (1985)). But the inability of consumers to differentiate between directly owned and franchised outlets may generate different incentives. Directly owned locations may exert more effort to protect the brand's reputation than franchised locations, which are only concerned about a customer's bad experience to the extent it discourages repeat business at their own franchise (Caves and Murphy (1976)). Consistent with this behaviour, Jin and Leslie (2009) find that franchisees had lower hygiene scores than directly owned locations prior to the introduction of hygiene grade cards.[17]

Franchised businesses may also face different competitive pressures than those owned by the parent-company. Using a sample of hotels in Texas, Vroom and Gimeno (2007) find that directly owned hotels increase price as ownership concentration increases whereas franchise-operated hotels did not. However, this study did not take account of possible common-ownership in the franchise market nor any quality differences that may exist between franchised and non-franchised locations.

Kidwell et al. (2007) find that franchisees may free-ride on the franchisor's brand by lowering product quality or services. However, the authors find greater interaction between the franchisor and franchisee and increased competition in the franchisee's market segment mitigate this effect. Bernstein and Sheen (2016)'s work does not support the hypothesis that directly owned locations are in general of higher quality than franchised locations. They find that directly owned locations have fewer health violations than franchised outlets after a private equity buyout, but the opposite is true prior. This suggests that type of parent company is relevant to the service provided.

[17]Hygiene grade cards provided independent verification of the hygiene at a specific location so a franchisee would naturally face the same incentives as a directly owned outlet to provide a positive signal to consumers about hygiene standards at their location.

2.0.5 Benefits of agglomeration

Competition is not the only channel through which spillovers from one business may influence another. Ellison and Glaeser (1997) hypothesise that benefits from co-location may accrue due to spillovers (increased demand, improved information sharing), natural advantages of the location, or both.[18] Applied to the hotel industry, Baum and Haveman (1997) find that new hotels in New York tend to locate near hotels that are of a similar price (i.e. in the same market) but different in size. Chung and Kalnins (2001) find that a hotel in a market with a higher fraction of chain hotels and a higher fraction of large hotels will have higher revenues per room, other factors held constant. From this, the authors conclude that agglomeration heightens demand, especially in rural markets.

2.0.6 Debt covenants and incentives to monitor

There is a large literature that studies the optimal design of debt contracts with incomplete contracting. It argues that contracts can be designed to align the incentives of borrowers and lenders by optimally allocating control rights and cash flows contingent on the borrower's performance.[19]. Covenants are one of the principal means that rights are assigned within a debt agreement, and may be relaxed or renegotiated as the lender learns about the borrower or project (Berlin and Mester (1992), Gârleanu and Zwiebel (2008)).

Financial covenants can be split into two broad categories: maintenance covenants and incurrence covenants. Maintenance covenants specify the interval or threshold that certain financial metrics must satisfy for the duration of the contract, e.g. debt to EBIT ratio. Lenders check periodically whether these covenants are satisfied. If the borrower violates one of these covenants, it constitutes technical default, which enables lenders to take certain actions to protect their interests (e.g. lenders may choose to accelerate loan

[18] In a subsequent cross-industry, they find only 20% of location decisions can be explained by natural advantages (Ellison and Glaeser (1999))

[19] Notable examples include Aghion and Bolton (1992), Nachman and Noe (2015)Anderson and Sundaresan (2015)

payments). Lenders may also use the threat of accelerated loan payments to renegotiate the loan on more favourable terms. [20] Incurrence covenants require the borrower to comply with specified metrics only on the occurence of an *active* event, e.g. a debt issuance that may reduce the firm's ability to service its existing debt. A cov-lite loan is characterised by having only incurrence covenants. Such loans first became a significant feature of in the years proceding the GFC, and they now account for over 90% of the leveraged loan market.

Recent literature has explored the potential rationales for the existence and prevalence of cov-lite loans. Becker and Ivashina (2016) attribute the prevalence of cov-lite loans to rising creditor coordination costs. They argue that wider syndication and the diverse incentives of institutional lenders imply that optimal contracts likely involve weaker covenants (i.e. are more like a public bond). They find that loans that have dispersed institutional ownership are much more likely to be cov-lite. Billett et al. (2016) provide an alternative explanation based on relationship lending. They posit that banks have greater incentives than non-bank investors to maintain a lending relationship in order to accrue relationship rents. They provide theoretical and empirical evidence of a hockey stick relationship between the proportion of bank involvement in a syndicate and covenant tightness: as the proportion of bank involvement declines, covenants tighten, until the relationship reverses once a low threshold is reached. Unlike Becker and Ivashina (2016), in Billett et al. (2016) the number of institutions involved in a syndication is not relevant as different institutions of the same type are assumed to always agree on a strategy. Davydenko et al. (2020) argue the preference for cov-lite is related to the leverage of the underlying firm rather than characteristics of lenders. They construct a structural model that shows that financial covenants have no value to creditors of highly leveraged firms because enforcement would result in a lower expected payoff than allowing continued operation under

[20] Roberts (2015) shows that more the typical loan is renegotiated five times (or on average every nine months). He finds pricing, loan amount, maturity, and covenants may be modified at each renegotiation and hence change significantly over the life of a loan. Roberts and Sufi (2009) find breach of covenants have persistent negative impacts on a firm's debt issuance, and borrowers rarely switch lenders following a violation despite less favourable terms.

the shareholders' control.

Berlin et al. (2020) argue that evaluations of covenant protections should include all loans issued at the same time. In particular, they find that many term loans classified as 'cov-lite' are issued with a revolving credit facility contemporaneously. Revolving credit facilities overwhelming have maintenance covenants which are monitored by the bank providing the revolving facility. Hence, these contracts are collectively subject to 'split control rights' where the bank has exclusive monitoring and renegotiation rights which reduces the inefficiencies of contract renegotiation described in Becker and Ivashina (2016).

The decision of optimal covenant structure is inherently linked to a lender's incentive to monitor. Covenants create incentives for a lender to monitor, but the presence of other claimants reduces the value of monitoring to each individual lender (Rajan and Winton (1995)). Winton and Yerramilli (2021) find that banks' incentives to monitor syndicated loans may be enhanced by reputational concerns, but these incentives fall during periods of high loan demand (e.g. credit booms). Consistent with the mechanism proposed in this paper, borrowers themselves may prefer multiple bank lending (or syndication) as a means of mitigating their exposure to the lender's loan repayment preferences. Detragiache et al. (2000) posit that internal problems may prevent a lender from continuing to finance a project. In such cases, it may be difficult for the borrower to refinance with another lender due to adverse selection, so multiple bank lending reduces the risk to the borrower of early liquidation.

2.0.7 Debt in LBOs and Financial Stability

One of the primary determinants of leverage in buyouts is the availability and price of credit. Axelson et al. (2013) find that higher leverage is associated with higher prices paid for portfolio companies and lower fund returns, implying that private equity overpays for investments when credit is cheaper. Similarly, Kaplan and Stein (1993) find that high

availability of credit in the late eighties fueled higher buyout prices and greater leverage. This encouraged bankers to lower their stakes in deals and accelerate required principal repayments, while management and other interested parties extracted more money out of deals upfront. Private equity firms shifted investments into riskier industries that subsequently experienced greater defaults. Firms' use of junk bond debt (but not leverage itself) correlates with various measures of financial distress in their sample.

Commentators and media have persistently criticised private equity for making their portfolio companies more vulnerable to bankruptcy.[21] By taking on excess leverage, portfolio companies become more vulnerable to economic downturns insofar as they can no longer make the interest payments on their debt burden. There are two competing theories for whether such financial distress should affect a firm's operating performance. The first argues that there are no real effects of financial distress as creditors can efficiently restructure their claims to firm to maximise value (Haugen and Senbet (1978)). But if there are inefficiencies and transaction costs in financial reorganisation, operating distortions may occur (Gertner and Scharfstein (1991)).

Research indicates that financial distress in private equity backed firms is unlikely to lead to economic loss. Kaplan (1994)'s analysis of the LBO of Federated Department Stores estimates its bankruptcy costs to be very low and concludes the transaction increased firm value even accounting for costs of bankruptcy and distress (Kaplan (1989c) and Kaplan (1994)). Andrade and Kaplan (1998) study the impact of financial distress on 31 leveraged buyouts and find there is no loss of value (in fact, firm value increases slightly) from pre-transaction to distress resolution. They estimate the costs of financial distress to be between 10-20% of firm value for firms whose financial distress is accompanied by a negative economic shock, and close to zero for those whose distress is purely financial.

[21] Sebastien Canderle articulated the critique to its fullest in The Debt Trap: "It is immoral to incentivize senior corporate executives to cut costs and headcount for short-term gains, notwithstanding the long-term damage it does to the over-indebted investee company - why is it okay to lever up perfectly viable, cash-rich enterprises in the hope of making extraordinary gains but not to suffer any consequences when these businesses get hurt or destroyed in the process?"

Private equity backing may also allow for more efficient resolution in the event of financial distress. In a study of 2151 firms, Hotchkiss et al. (2014) find that private equity backed firms are no more likely to default than other firms, controlling for leverage. Private equity backed firms seem to restructure more efficiently[22] and more often remain as independent going-concerns.

Private equity involvement may also provide portfolio companies greater access to resources during a financial crisis. Bernstein et al. (2017) consider the impact of the recent global financial crisis on a sample of private equity portfolio companies and matched non-private equity companies. They find that private equity backed companies decreased investment less and issued more debt at a lower cost than matched companies during the crisis. Consistent with the hypothesis that private equity provides portfolio companies with greater access to resources, investment increased more for firms whose private equity sponsor had greater resources at the start of the crisis.

2.0.8 Impact of institutional investment on retail investors and herding

Institutional investors are broadly considered sophisticated investment managers who play a role in moderating conflicts of interests (Ljungqvist et al. (2007), Evans and Fahlenbrach (2012)), increasing price efficiency (Boehmer and Kelley (2009) and Bai et al. (2016)) and aiding the incorporation of future corporate news into prices (Campbell et al. (2009) and Hendershott et al. (2015)). However, if institutions hold the same positions and deleverage contemporaneously, they could exacerbate stock market crashes (Stein (2009), Dennis and Strickland (2002)).[23]

[22] More firms restructure out of court, and those that do go to court have faster proceedings.

[23] Empirical studies find evidence of herding, forced deleveraging or fire sales among institutional investors: Dennis and Strickland (2002) find that institutional investors herd on days with large market moves; Ben-David et al. (2012) show that hedge funds experienced forced deleveraging during the GFC of 2007-2009; Glosser et al. (2021) find that institutional investors engaged in "fire sales" of their equity holdings in the early stages of the Covid-19 crisis in the first quarter of 2021. However, there is some evidence that institutional investors may help stabilise prices in turbulent times (e.g. following the 9/11 terrorist attacks (Chen et al. (2019))).

Yet few papers have addressed the impact institutional investors have on retail investors, and how retail investors interact with and learn from institutional investors. A recent study provides an initial insight into these relationships. In the context of insider trading, Boehmer et al. (2021) find that retail investors identify and learn from opportunistic insider purchasers.

Examining the role of institutional investors in the housing market, recent work shows the impact mortgage credit and higher institutional ownership have on home ownership and rental prices. Lambie-Hanson et al. (2019) find that regions that have higher institutional investment have lower home-ownership rates. (Gete and Reher (2018) show that the contraction in mortgage credit supply following the GFC depressed home-ownership rates and increased rental prices. At the same time, reallocation of credit to improvement projects has improved the quality of rental housing since the GFC (Reher (2021)). Moreover, novice investors' exposure to speculative investing activity within their own neighbourhood encouraged them to become property investors (Bayer et al. (2021)).

Early studies suggest that retail investors are generally uninformed, and may make systematic mistakes when selecting equity investments (Barber and Odean (2000) and Barber and Odean (2008) 2008) and "dumb money" papers in mutual fund space). Factors driving these poor decisions include sentiment, herding, limited attention, low financial literacy, etc. However, recent studies suggest that retail trade may be less uninformed than previously found: Boehmer et al. (2021) show that retail investors' trading may predict future stock returns.

Information-based herding models show that investors may rationally disregard their own own signal in an information cascade. [24] Once an investor enters a cascade, her action and the actions of all subsequent investors are uninformative to others and create a negative externality. [25] Avery and Zemsky (1998) show that herding does not occur where the

[24] See Banerjee (1992), Bikhchandani et al. (1992), and Welch (1992)

[25] The actions of an investor do not change the payoffs of other investors but they do influence the beliefs of other investors.

price adjusts to reflect all available information, but can arise when investors have private information. [26] Extant literature has also found evidence of herding at both the individual and institutional level: Welch (2000) finds evidence of herding among securities analysts, especially in bull markets[27]; Barber et al. (2008) find that individual investors herd, and that their trade imbalances predict returns; and institutional investors seem to herd in the same securities (Sias (2004)), industries (Choi and Sias (2009)), and international markets (Choe et al. (1999)), and that this herding may help stabilise prices (Choi and Skiba (2015)).

2.0.9 Toehold Stakes and Global Games

Methodologically, the model presented in paper 3 incorporates features of both the toehold literature for takeover bids and the global games literature for formation of beliefs and coordination of investment. In the toehold literature, a potential acquirer has the opportunity to make improvements to a firm through takeover, but free-riding atomistic shareholders will not accept a bid that is less than the post-takeover value of the firm. Hence, profitable takeovers must either enable the bidder to dilute untendered shares (Grossman and Hart (1980)) or the bidder must be able to acquire an initial toehold (fraction) of the target's shares prior to takeover. In the latter case, the acquirer does not profit from the additional shares but gains on the shares they acquired prior to the tender offer (Shleifer and Vishny (1986) and Hirshleifer and Titman (1990)). The model presented in this paper is similar to these in that there is a large investor who has the ability to implement improvements to the houses in the neighbourhood, and atomistic homeowners who may free-ride off these improvements. Unlike the takeover literature, the large investor is not required to obtain a minimum of 50% of the houses in the neighbourhood, but it will not invest if it cannot break-even.

[26] For example, herding may occur where the accuracy of each investor's signal is not known, so investors may mimic the behaviour of an initial group of investors on the erroneous assumption that they have better information.

[27] Another literature suggests that analysts may 'anti-herd' by providing contrarian forecasts that overshoot the consensus in the direction of their private information (Bernhardt et al. (2006))

The unique departure of this model is in the structure of information. Unlike in the aforementioned models, each home owner receives a private signal of the value of the improvement to the neighbourhood drawn from a known distribution. Home owners will not accept an offer that is beneath their own signal of the true value of improvements. This structure is similar to the global games literature (Carlsson and van Damme (1993), Morris and Shin (1998), Morris and Shin (2003)). The model presented herein is closest to Corsetti et al. (2004) in that it considers the role of asymmetric information: the equilibrium will depend on whether the large investor is relatively better or worse informed than the small investors. Hence, the noise structure will allow me to draw non-trivial conclusions about the economic importance of information for investment.

Chapter 3

REITs and Local Market Competition

3.1 Introduction

Investment in private markets has more than doubled over the past ten years, with global assets under management reaching 11. 7 trillion as of June 2022 (McKinsey & Company (2023)). In the United States, as many as 11.7 million people are employed by more than 16,000 private equity backed companies (EY (2021)). Despite its ubiquity, private equity retains a reputation in the media for being "a giant money monster" that "prioritis[es] short-term gains over creating long-term value" (Stewart (2020)). This negative public perception has prompted legislators to propose the Stop Wall Street Looting Act aimed at "rip[ping] up the predatory playbook that private equity firms are using" (United States Senate Committee on Banking and Affairs (2021)).

The growth of the private markets has coincided with increased fund specialisation. Since 2013, the share of capital raised by specialist funds that focus on a single industry has risen from 20% to 31% (Bain & Company (2022)). Fund specialization may result in a single

fund being invested in multiple competitors within a given industry or geography.[1] Such concentration of ownership could enable anti-competitive behaviour, especially if opacity of fund ownership keeps regulators unaware of increased concentration of ownership. Even if regulators are aware of such ownership, they are normally concerned with competition at a national level rather than individual markets. Hence, private funds could create concentrated portfolios of businesses in non-tradeable sectors in small geographic regions. This paper examines the competitive consequences of increased concentration of private fund ownership. It asks how private fund owners and regional competitors respond to increased concentration of ownership, and whether this changing competitive pressure has an impact on consumers.

I find that increased concentration of ownership by private funds correlates with decreased consumer satisfaction. To examine the causal impact of increased concentration of private fund ownership on consumer satisfaction, I use a national fund merger that created quasi-exogenous variation in concentration of fund ownership at a local level. I find that an increased concentration of ownership has no impact on customer experience. Yet overall customer experience and customer perceptions of value decline at competitors following the entrance of a private equity owner into the market. This occurs despite there being no change in the number of competitors in the market, and controlling for local market conditions.

I perform this analysis using the upscale segment of the hotel industry as a laboratory. Study of the hotel industry has the advantage that consumer satisfaction (measured through consumer reviews) and ownership data is available for individual hotels through time. Competition between hotels is clearly defined by geographic location and services offered. These features enable me to relate consumer satisfaction to concentration of private fund ownership in defined locations through time. Thus, I am able to reduce the

[1] Although fund specialization creates more opportunities for concentrated ownership, private equity funds have long used "buy and build" strategies where they acquire and consolidate multiple smaller competitors within an industry.

amount of confounding variation. Further, I use a series of private fund acquisitions of a large portfolio of geographically disperse hotels to study the effect of exogenous changes in ownership in different regions to address concerns regarding endogeneity.

I measure customer satisfaction at each hotel using reviews from TripAdvisor, an online travel advice platform. TripAdvisor users rate their experience with a score out of five along seven categories: overall, value, service, cleanliness, sleep quality, rooms, and location. Some of these characteristics are strongly affected by managerial decisions (for example, service and cleanliness) while others are largely unaffected by ownership status (location). Moreover, evaluations of value provides a direct measure of a customer's perception of price-to-quality at a hotel.

I use a differences-in-differences approach to estimate the impact of a private equity entrant into a market controlling for underlying market concentration. I use Blackstone's (a private equity firm) acquisition of the Apple Six REIT's portfolio of hotels in 2013 as an exogenous change of ownership event. Crucially, Apple Six REIT's portfolio was formed in the mid-2000s, so hotel locations and characteristics were determined prior to Blackstone's acquisition decision. Therefore, it is reasonable to treat the loss of a non-Blackstone owned hotel as exogenous to a local competitor's business decisions.Due to the geographic dispersion in the Apple Six portfolio, local hotel markets were differentially affected by the acquisition. Some areas experienced a large increase in Blackstone-owned competitors, while others were not affected. Thus, the "treatment" is whether a hotel exhibits an increase in private equity ownership of its competitors following Blackstone's acquisition. These changes provide for pre- and post-acquisition comparisons across affected and unaffected markets for identifying the effect of increased private equity ownership on consumer satisfaction conditioned on hotel-level fixed effects and city-time fixed effects.

This analysis provides new insight into how private equity ownership can impact local market competition. In particular, it reveals how the entrance of a competitor with a

reputation for short-termism (like a private equity firm) may encourage other firms to behave the same way - reducing customer satisfaction and perceptions of value - even without any anti-consumer conduct from the entrant.

Economists have long considered strategies where a competitor may trade off short-term profits for long-term market share. [2] Yet little is known about the optimal strategies of short-term focussed competitors and how incumbents should respond to their entry. Theoretical work suggests that firms may optimally compete less aggressively by delegating pricing decisions to a short-term focussed managers (Miettinen and Stenbacka (2018)). Empirical work finds that the relative strength of competitors affects their response to a private equity entrant: less-levered rivals may"prey" on LBO targets by reducing prices, while more-levered competitors raise their prices along with private equity portfolio companies (Chevalier (1995), Fracassi et al. (2020)). Recent work by Gandhi et al. (2021) finds that private equity backed companies compete more aggressively in competitive markets and exploit their market power in less competitive ones.

Contrary to the public consensus, academic research on the impact of private equity ownership on stakeholders is mixed. Prior studies have shown that private equity ownership reduces health violations (Bernstein and Sheen (2016)) and workplace injuries (Cohn et al. (2021)), and increases product offerings across geographies (Fracassi et al. (2020)). Yet other research has found private equity buyouts increase price (Chevalier (1995)) and lower product quality (Matsa (2011)) in supermarkets, increase tuition in higher education providers (Eaton et al. (2019)), increase mortality in nursing homes (Gupta et al. (2021)), lower local governance content and reduce editorial staff in newspapers (Ewens et al. (2021)), and decrease employee satisfaction across a range of industries (Lambert et al. (2021)).

Evidence of the impact of private equity investment on portfolio company operating

[2]Predatory pricing - the strategy of pricing aggressively in order to eliminate competitors - may be profitable for a firm operating in multiple markets to deter others from entry (Milgrom and Roberts (1982)). Bolton et al. (1999) and Edlin (2012) provide an overview of the theoretical, empirical and legal analysis of predatory pricing.

performance is more positive. Private equity ownership has been shown to improve financial operating performance[3] (Kaplan (1989b), Bergström et al. (2007)), total factor productivity (Lichtenberg and Siegel (1990), Harris et al. (2005), Davis et al. (2014)), growth (Boucly et al. (2011)), innovation (Lerner et al. (2011)) and management practices (Bloom et al. (2015)) within portfolio companies. In contrast to public perception, there is little evidence that private equity firms engage in short-termism with their portfolio companies (Harford and Kolasinski (2014))

The paper proceeds as follows. In Section 2, I provide institutional background regarding the hotel industry and the consumer ratings websites. Section 3 describes my data sources and the process I use to construct concentration indices and to match ownership data to an ultimate parent. In Section 4, I examine the impact of private equity investment on local market competition, focussing on the behaviour of competitors in response to a private equity entrant. Section 5 concludes.

3.2 Institutional Details

3.2.1 Hotel Brands and Ownership

Hotel ownership and management is complex. Most hotels in the US are branded, e.g. Hilton Garden Inn or Residence Inn by Marriott. Branding offers consumer recognition and centralized support and advice from the brand owner (a hotel chain, e.g. Hilton or Marriott). A chain may own several brands. For example, Hilton Worldwide owns four brands in the upscale segment (Homewood Suites, Hilton Garden Inn, DoubleTree, and Tapestry). As shown in Table 3.1, more than half of the hotel rooms are (nearly) equally split across only two brands: Hilton and Marriott. The next five brands cover another quarter of hotel rooms.

[3] An important paper queries this result. Guo et al. (2011) find that the median operating performance of private equity backed firms is close to other firms operating in the same industry and with similar pre-LBO characteristics.

The right to operate a branded hotel is provided through either direct ownership by the chain or through a franchise agreement. Only 12.7% of branded hotels in my sample are owned directly by the hotel chain. The remainder are owned and operated by third party entities through franchise agreements. Franchise agreements impose detailed requirements on individual hotels relating to hotel appearance, amenities provided, service and maintenance standards, etc. Such agreements may also require the hotel to offer loyalty benefits to customers of the chain and provide support on pricing decisions. The dominant use of franchising in the hotel industry means that a hotel owner's identity is often obscured by the brand. Section 3 provides an overview of how I identify the ultimate owner of each hotel in the sample.

Not all hotels offer the same amenities and services at various price points, and thus compete in differentiated markets. Different consumer types are sticky in their preferences on the price-quality spectrum of hotel offerings (e.g. a business traveller is unlikely to stay in a holiday park regardless of their perception of price-quality trade off). Hence, not all hotels within a geographic region compete with each other. One means of identifying the hotels within a region that are likely to compete is through assigning each hotel to a class based on its price and amenities. Smith Travel Research (STR) – a large hospitality research firm – performs this classification.[4] According to STR, the largest class in the United States is the "upscale class' with 6532 hotels across 41 chains plus 1524 unbranded hotels (as of 2017).[5]

Table 3.3 lists the twenty largest owners of hotels in the upscale class. Marriott is the largest single owner of hotels in this segment, with approximately 5% of the hotels in the sample under direct control by Marriott. Hilton does not appear on the list because Blackstone had significant control over it throughout the sample.[6] Aside from

[4]Hotels supply STR with pricing and occupancy information which STR aggregates and sells it back to the industry for benchmarking purposes. The STR Census covers around 98% of the hotels in the US (Povel et al. (2016)). STR primarily base their classification on the room rates. For more information, visit STR's website

[5]These hotels usually have between 2.5 to 3.5 stars. Above this segment is upper-upscale class and luxury class.

[6]Although Hilton was relisted via IPO in 2013, Blackstone remained a significant shareholder and did

hotel chains, the largest owners are private equity firms (Blackstone, Starwood Capital Group), large investment institutions (Goldman Sachs), and real estate investment trusts (Apple REIT, RLJ Lodging Trust, Chatham Lodging Trust). For instance, the second largest single owner is Apple REITs, a group of related real estate investment trusts that collectively own 4% of all the hotel rooms in this segment. The significant share of ownership by private funds and REITs makes the upscale segment an ideal laboratory to test the competitive impacts of concentrated private fund ownership.

3.2.2 Hotel Ratings

Over the past twenty years, online consumer reviews have become a source of information for consumers and marketing tool for firms. Consumer reviews have been shown to influence sales and profitability (Chevalier and Mayzlin (2006), Chintagunta et al. (2010)) and to contain information relevant to prediction of stock returns (Huang (2018)), Green et al. (2019)). In this paper, I use hotel reviews as a measure of consumer satisfaction.

The largest website for travel reviews is Tripadvisor.com. Since 2000, it has amassed over 730 million user reviews across 1.3 million hotel listings, and accounts for 25% of all hotel reviews. I scrape all available reviews for each hotel in the sample from Tripadvisor.com. Each review includes an overall rating on a scale of 1-5 and may contain an additional rating of six categories: sleep quality; room quality; service; cleanliness; value; and location. [7]

Hotels can respond to changing competitive pressure in their local market by adjusting price or quality (or both). Each type of rating provides information about a different aspect of a hotel's response to changing competitive pressures. If a concentrated owner wishes to take advantage of their market power within a region, they may increase increase prices without improving services. This would be expected to result in a decrease in

not fully exit Hilton until 2018.

[7]Reviews also contain text. A future version of this paper will use textual analysis to search the text for specific changes that may have affected the review quality. For example, recent renovations or changes in hotel services (e.g. addition or absence of free breakfast).

customer's perceptions of value (and overall satisfaction). Hence, 'overall' and 'value' ratings should reflect a hotel's price response to competition as these ratings reflect a customer's perception of the services offered given the price paid. Alternatively, a concentrated owner may choose to reduce the amenities offered at some hotels in order to maximise the differentiation between its offerings in a given geographic market. This would be expected to increase (decrease) customers' perceptions of service at hotels where the concentrated owner wants to increase (decrease) the hotel's 'class'.[8] It follows that 'service' and 'cleanliness' ratings should indicate a customer's perception of the services offered and an improvement (deterioration) in ratings could reflect increases (cutbacks) in services./amenities offered.

3.3 Data

3.3.1 Sample selection

I start with the universe of upscale hotels in the United States. I remove 424 hotels from this sample classified as being a resort, a golf resort, a ski resort, a spa, or a casino. I exclude these types of hotels as they do not compete directly with the other hotels in my sample. For example, a person travelling to Los Angeles on business would be unlikely to stay at a Disney resort regardless of the price. Prices and reviews may also be distorted by the additional facilities that are not relevant to the core hotel business.

3.3.2 Identification of ultimate owner

Ultimate owner from franchise document

Hotels may be independent or may be associated with a hotel brand. To identify the ultimate owner of a hotel with a brand, it is first necessary to identify those hotels that

[8]This competitive response may be less obvious in the data because all hotels are within the same 'class' according to STR. However, even within the upscale class, there are differences between brands (for example, long stay versus regular hotels) that a concentrated owner may try to accentuate.

are owned/controlled by the hotel chain and those that are franchised to third parties. Since 1972, the Federal Trade Commission has required every brand in the US to disclose an up-to-date list of all the hotels it franchises in its Franchise Disclosure Document (FDD).[9] The Minnesota Department of Commerce made FDDs in use within its state publicly available in 2010.[10] Hence, any brand with at least one franchise in the state of Minnesota needs to disclose the list of all the hotels it brands (but does not own) in the US at the end of each calendar year. All of the brands listed in Table 3.1 have FDDs in the Minnesota database. Using these franchise agreements, I identify 5576 unique hotel owners. The remaining brands that are not present in Minnesota are relatively small and cover 4.3% of rooms in the upscale class in 2018. Iassume that hotels in this set are branded and owned by the same entity.

Matching LLC to ultimate owner

Hotel owner names as reported in an FDD are often limited liability companies whose names are uninformative as to the ultimate owner. Hence, it is necessary method to match the LLC name to an ultimate owner using information provided in state corporate registries. [11].

Most state legislatures require companies that transact business in their jurisdiction to register their company. Registration requires the LLC to submit a set of identifying information that may include its head office address, address for service, agent name, agent title, agent address, etc. [12]. Not all information provided is informative. Some companies use registered agents which provide an address for document filing and service

[9]Franchise disclosure documents contain the key contractual provisions that govern the relationship between a franchisor and franchisee. Part of these disclosures is the contact information of current franchisees so that prospective franchise owners can seek additional information on franchise arrangements.

[10]Several state departments require that any firm wishing to operate a franchise within their jurisdiction submit the FDD for approval annually. Minnesota is one of the only states to make this information public. It provides historical FDDs since 2010. See Minnesota Commerce Department's website

[11]FDDs report the identify of each franchise holder and their contact details *at the franchise location*. Hence, FDDs provide information on which hotels are franchised to which LLC, but they do not provide any details (beyond state of operation) to identify the ultimate owner of the listed owner of the LLC

[12]For example, the Ohio Secretary of State requires the LLC to disclose the location of the principal office, a mailing address in Ohio, an agent name and agent mailing address

of process that is unrelated to ultimate parent. [13] Such service agents obscure ultimate ownership as they may be used for any number of LLCs.

I use the OpenCorporates database to search each state's corporate registry for LLCs listed in an FDD as operating a hotel within that state. OpenCorporates collates company registration information form state and national corporations registries for over 220 million companies. STR provides the ultimate owner in the year 2017, which enables me to cross check 1721 controlling companies. By matching the principal office address or agent name and address to a corporate parent, I identify the ultimate owner of 2553 companies in my sample. I identify the ultimate owner of a further 944 LLCs using ownership information provided by STR. A further 41 follow from matching via shared parent in Opencorporates, bringing the matches to 3538.

Naming conventions are helpful in identifying corporate group in some cases. For example, Apple REIT companies are named with the fund name (and location), e.g. Apple Eight Services Birmingham Inc or Apple Nine Services Austin Northwest Inc. Where I can identify at least 10 companies in the dataset that follow the same naming pattern, I assign all companies that follow the convention to the relevant corporate parent. Details of this matching process are provided in the Appendix. A further 46 companies are identified this way. I assume the remaining companies are independent.

I assume that each unbranded hotel is controlled by a a separate entity. I follow industry convention and refer to such hotels as independent. It may be that the same owner controls multiple seemingly independent hotels within the same geographic region. This would cause the calculated concentration indices to be lower than otherwise, but this should not affect the findings of this paper provided as the behaviour is not systematic.

As data acquisition is costly, I restrict my attention to the upscale market segment and assume that there is no competition across segments.[14]

[13] The address of one registered agent in Delaware was subject of a New York Times article after it was found to be the paper address of over 285,000 corporations, see the article here

[14] It seems reasonable to assume that consumers wanting to stay at a DoubleTree in Newark, New

3.3.3 Additional Data

The STR database also provides information about the census tract, county, and state in which the hotel is located, each hotel's organizational form (company-managed, franchised, or independent), a description of the hotel's location (urban, small town, suburban, etc.), and other property characteristics including the number of rooms, the quality segment, and the year that the hotel opened. I do not have a time-series of these characteristics, so I assume that they are fixed throughout the sample. Hence, I assume that room count has not changed from 2010 to 2017. 3.1 shows that the ranking of the brands by number of rooms is similar across this time period, which supports this assumption. [15]

Finally, the STR database provides a history of the previous three chain affiliations for each hotel in our sample.[16] For 88 hotels in the sample there is a discordance between the chain history of the hotel and the franchise ownership history. This often occurs where I have obtained the franchise ownership history for a hotel that belonged to a chain that STR does not classify as an upscale hotel (for example, Wyndham Garden, which was not separated from Wyndham in franchise agreements). In all such cases, we assume that STR's information is more accurate than the franchise agreements as it is at the monthly rather than yearly frequency. Table 3.2 shows the number of chains through time in the total dataset[17]. There are eight hotels in the total dataset for which the chain ownership history from STR is insufficient to cover the entire period (i.e. there are more than three chain changes between 2010-2017). In these cases, the majority of which have

Jersey are unlikely to consider staying at a Motel 6 (the next segment below) in the same city even though the price of the former was 54% higher in November 2018.

[15] In a future iteration of this paper, I hope to incorporate information on the average daily rate and occupancy rate of a sub-set of hotels in the sample. I have been in negotiation with STR to obtain this data, but I have no yet obtained this data to be incorporated into the thesis.

[16] Recall that the ownership of a hotel is often different from the chain. Hence, a hotel owner may choose to change the chain affiliation of their hotel at any time. If this occurs, the change in affiliation for a hotel at that address will be recorded in the STR database. For this reason, it is far more relevant to identify each hotel by situs than by name (.e.g the hotel at 189 Oxford Street rather than the 'Courtyard Oxford Street').

[17] This includes all hotels not just those hotels for which I have reviews. I impose a requirement that there be a minimum of five hotels in a chain in each year in our sample.

chain history until as early as 2011, I assume that the hotels are closed for the period for which I do not have a chain affiliation.

3.3.4 Hotel Concentration Indices

I define a hotel's competitor set by competitors within a certain radius of the hotel, by the census tract of the hotel, and by MSA. For each hotel I use latitude/longitude coordinates to find all hotels within a certain radius. Figure 3.1 presents a stylized representation of competition, branding and ownership within an area. The focal hotel is Hilton Orange and it has three competitors in a 10 kms radius. This means that when Marriott Orange is a focal hotel, Hilton Orange will be part of its competitors but Starwood Orange may not be (e.g. if Marriott is 10 kms north of Hilton Orange and Starwood Orange is 10 kms south).

For each hotel in the sample, I calculate an Herfindahl-Hirschman Index (HHI index) with market share defined by room count. Formally:

$$HHI = \sum_{i=1}^{N} s_i^2 \tag{3.1}$$

where s is the share of the total number of hotel rooms within a geographic region under the control of owner i, and N is the total number of hotels in that geographic area.

I compute three sets of concentration indices:

- Room-weighted brand concentration (visible concentration): $HHI = \sum_{i=1}^{N} b_i^2$ where b is the share of rooms of brand i. To illustrate, in figure 3.1 there are four hotels, but two have the same brand, so concentration of brands is 38%.
- Room-weighted control concentration (opaque concentration): $HHI = \sum_{i=1}^{N} c_i^2$ where c in the share of rooms of owner i. In figure 3.1, there are two controlling entities, hence, control concentration is 63%.

- Room-weighted control-brand concentration (soft-power concentration): $HHI = \sum_{i=1}^{N}(s_i)^2$ where s is share of the sum of branded and controlled rooms. In figure 3.1, Blackstone is a brander twice and a controller three times, so control and branding concentration is 47%.

To further illustrate our formulas, if Marriott and Starwood merge with Starwood Capital not being a majority shareholder in the new entity, then control concentration is not changed, but the other two concentration measures increase. The C& B concentration increases by 50% to 70%.

3.3.5 Identifying transactions

In order to identify the impact of changes in concentration of ownership on consumer welfare, I use a set of acquisitions of hotel portfolios that created discrete jumps in the concentration of ownership within specified geographic regions. I compile this set of acquisitions using Capital IQ.

I start with a list of all mergers, acquisitions and private placements that took place between 1 January 2010 and 31 December 2017 where the target was classified as being in the hotels and motels industry or as a hotel and resort REIT, with its primary geographic location in the United States. This list includes 2753 transactions. There are 22 transactions above $1b, a threshold I consider indicative of a transaction capable of generating the change in concentration required across diverse markets to provide identification. I exclude 14 transactions from this list where the underlying hotels/assets are in a different market segment to the hotels in my sample (primarily resort destinations, for example, Universal Studios Orlando). The remaining 8 transactions are listed in 3.4

I distinguish two control channels: Branding and Ownership. A given hotel may be branded Hilton, but be owned by another entity (e.g. a REIT, a private equity firm, a publicly-listed company). Each channel implies a different level of control and regulatory oversight. I exploit these differences to identify whether a feature of private equity

ownership (perhaps opacity) affects the way companies in their portfolio compete.

3.3.6 Blackstone's history with Hilton

From the list of acquisitions, I focus primarily on Blackstone's acquisition of Apple Six REIT's portfolio in 2013. This acquisition meant that Blackstone owned franchises of Marriott in the same locations as Hilton hotels (which it controlled at the time).

Blackstone arranged for a partial exit from Hilton via IPO in December 2013. However, Blackstone continued to hold a controlling stake of Hilton well past mandatory lockup periods following IPO. Blackstone continued to control a majority stake of Hilton until May 2015 (55.3%), and had divested its stake to 45.9% by December 2015. However, Blackstone negotiated on exit of its majority stake that while it retained a certain percentage it would still be able to significantly control the board of Hilton. For this reason, I treat Hilton as a Blackstone-controlled entity throughout the sample. Blackstone finally sold its final stake in Hilton in May 2018.

3.4 The Impact of Private Equity Entry on Local Competition

3.4.1 Empirical Strategy

I start by examining the correlation between concentration of ownership and consumer satisfaction using the following specification:

$$r_{h,j,t} = \beta HHI_{j,t} + \alpha_t + v_h + \epsilon_{h,t} \tag{3.2}$$

where $r_{h,j,t}$ is a review of hotel h in region j at during time period t. I estimate this equation using both annual and quarterly time intervals. $HHI_{j,t}$ is the measured of concentration of ownership in region j at date t. Hence, β is the impact of concentration

of ownership on consumer ratings. I consider three different types of concentration of owner: room-weighted ultimate owner concentration at the MSA level; room-weighted chain concentration at the MSA level; and the difference between ultimate owner and chain concentration. α_t and v_h are time and hotel fixed effects respectively. These hotel and time fixed effects absorb the majority of the hotel invariant factors (e.g. hotel characteristics) and time invariant factors (e.g. national economic conditions) respectively. Therefore, this specification is a within-hotel and within-year (quarter) estimation. Standard errors are double-clustered at the hotel and year-quarter levels.

Table 3.6 shows the results from the estimation in equation (3.2) using all types of reviews. I find that customer satisfaction increases across all measures with owner concentration. This positive correlation is observed for chain concentration (for all but value ratings). Interestingly, there is a negative correlation between the difference between owner and chain concentration and customer satisfaction. This suggests that where the true concentration of ownership in a region is higher than it appears to the public, there is a decrease in customer satisfaction. This suggests that in areas of high concentration where branding can be used to obscure the true concentration, hotels may provide lower service.

In order to examine the impact of private equity ownership on consumer satisfaction, I conduct the following regression:

$$r_{h,j,t} = \beta PE_{j,t} + \gamma HHI_{j,t} + \alpha_t + v_{h,t} + \epsilon_{h,t} \tag{3.3}$$

where $r_{h,j,t}$ is a review of hotel h in region j at during time period t. I estimate this equation using both annual and quarterly time intervals. $PE_{j,t}$ is a dummy variable that is equal to one if the hotel was in a region j that experienced an increase in PE-owned hotels after the Apple Six acquisition and t is after the acquisition date, and is zero otherwise. Hence, β is the impact of being in the same region as a hotel that

changed to PE-ownership after the acquisition. α_t and v_h are time and hotel fixed effects respectively. These hotel and time fixed effects absorb the majority of the hotel invariant factors (e.g. hotel characteristics) and time invariant factors (e.g. national economic conditions) respectively. Therefore, this specification is a within-hotel and within-year (quarter) estimation. Standard errors are double-clustered at the hotel and year-quarter levels.

Table 3.8 shows the results from the estimation in equation (3.3) using value reviews. The decrease in customer evaluations of value in regions that experienced an increase in PE ownership is small but significant. Importantly, this result is robust to alternative measures of concentration of ownership. It is notable that effective concentration (measured by franchise ownership) and the difference between effective and apparent (actual versus observed) ownership are both large and significant, whereas apparent concentration (branding) has little correlation with customer satisfaction. However, Specification (3) shows that apparent concentration is large and significant where there is a difference between actual and observed concentration. This implies that branding matters only when it obscures the true level of concentration of ownership in a region.

Table 3.9 shows the results from the estimation in equation (3.3) using (1) overall ratings, (2) service ratings, (3) cleanliness ratings, (4) rooms ratings, and (5) location ratings. None of these types of ratings show any change following the acquisition of a local hotel by a PE-competitor. This suggests that the observed decline in customer perception of value in Apple Six regions is likely associated with an increase in price rather than a decline in quality.[18] It is notable that effective HHI is also not significant for any type of review other than overall ratings. This implies that hotels do not respond to competition by adjusting quality, but rather through adjusting price (which would only be incorporated in value and overall ratings).

I re-run (3.3) using only those hotels that changed to Blackstone ownership in the Apple

[18]If we assume that value is a measure of a customer's perception of the price/quality trade off.

Six transaction. That is,

$$r_{h,j,t} = \beta PE_{h,t} + \gamma HHI_{j,t} + \alpha_t + v_h + \epsilon_{h,t} \tag{3.4}$$

where $PE_{h,t}$ is a dummy variable that is equal to one if the hotel changed to Blackstone ownership in the Apple Six transaction and t is after the acquisition date, and is zero otherwise.

Table 3.10 shows the results from the estimation in equation (3.4) on value reviews. Notably, PE-ownership has no significant correlation with customer perceptions of value., despite the observed correlation between increased regional PE-ownership and decreased customer satisfaction in the estimation of (3.3). This implies that hotels in regions that experienced an increase in PE ownership responded as if competition had softened, even though there was no significant change of behaviour at the PE-owned hotels.

Table 3.11 shows the results from the estimation in equation (3.4) on (1) overall ratings, (2) service ratings, (3) cleanliness ratings, (4) rooms ratings, and (5) location ratings. Consistent with the regional findings, there is no significant correlation between Blackstone-ownership and customer experience. This finding supports the conclusion that Blackstone did not significantly improve the quality of the hotels following the acquisition. This suggests that the Blackstone did not raise both price and quality in such a way that customer perceptions of value did not change. Rather, it suggests that Blackstone managed the hotels in a manner broadly consistent with the previous owner, and that the observed decrease in regional value ratings was due to expected rather than actual softening of competition.

3.4.2 Identification

Private equity owners may be better at picking hotel locations, leading to potential reverse causality. Equally there may be unobserved factors that drive the decision of a

private equity fund to invest in an area, which could result in omitted variable bias in these results. Private equity owners may manage hotels significantly better than other owners, in which case value increases may reflect improved quality even if it coincides with increase prices. It is for this reason different categories evaluated within reviews - especially the customer evaluation of value - is useful to disentangle the different aspects of the customer experience.

I conduct a difference-in-difference approach similar to Hastings (2004). I use the acquisition of Apple Six REIT's portfolio by Blackstone in 2013 as an exogenous consolidation event. Due to the geographic dispersion in the Apple Six portfolio, local hotel markets were differentially affected by the acquisition. Some areas experienced a large increase in Blackstone-owned competitors, while others were not affected. Thus, the "treatment" is whether a hotel exhibits an increase in private equity ownership of its competitors following Blackstone's acquisition. These changes provide for pre- and post-acquisition comparisons across affected and unaffected markets for identifying the effect of increased concentration on prices, conditioned on hotel-level fixed effects and city-time fixed effects.

Apple Six REIT's portfolio was formed in the mid-2000s so hotel locations and characteristics were determined prior to Blackstone's acquisition decision. Therefore, it is reasonable to treat the loss of a non-Blackstone owned hotel as exogenous to a local competitor's pricing decision.

I initially test the following difference-in-difference equation:

$$r_{h,j,t} = \beta_k PE_j + \alpha_t + \upsilon_h + \epsilon_{h,l,t} \tag{3.5}$$

where $r_{h,j,t}$ is a review of hotel h in region j at during time period t. I estimate this equation using both annual and quarterly time intervals. PE_j takes three possible values. In the first specification it is a dummy variable that is equal to one if the hotel was in a region j where the share of private equity owned hotels increased due to the Apple

Six acquisition, and is zero otherwise. In the second and third specifications I scale the treatment by the degree of change in concentration of ownership as a result of the acquisition. Specifically, the second treatment is equal to the change in owner HHI from 2012 to 2013 in regions affected by the Apple Six transaction, and the third treatment is equal to the change in chain HHI from 2012 to 2013 in Apple Six regions. Hence, β_k is the impact of being in the same region as private equity hotel before and after the acquisition. α_t and v_h are time and hotel fixed effects respectively. Standard errors are double-clustered at the hotel and year-quarter levels.

Table 3.7 shows the results from the estimation in equation (3.5) using all types of reviews. I find that customer satisfaction decreases across all types of reviews in areas that experienced a change of ownership as a result of the Apple Six transaction. I find results are mixed once I adjust for the change in owner HHI or the change in chain HHI as a result of this acquisition. This analysis reveals one of the deficiencies with the current analysis: there was no material change in traditional measures of concentration as a result of this acquisition. This is because the hotels transacted in the Apple Six acquisition were in regions in which Hilton only had hotels franchised to third parties. Hence, traditional HHI indices do not register a change in concentration as they do not account for the influence of chain-control on third party franchises. This remains an area for future analysis.

To examine the possible influence of pre-trends, I examine the results of the following difference-in-difference equation:

$$r_{h,j,t} = \sum_{k=-n_{pre}}^{n_{post}} \beta_k PE_j + \alpha_t + v_h + \epsilon_{h,l,t} \tag{3.6}$$

where $r_{h,j,t}$ is a review of hotel h in region j at during time period t. I estimate this equation using both annual and quarterly time intervals. PE_j is a dummy variable that is equal to one if the hotel was in a region j where the share of private equity owned

hotels increased due to the Apple Six acquisition, and is zero otherwise. Hence, β_k is the impact of being in the same region as private equity hotel before and after the acquisition. α_t and v_h are time and hotel fixed effects respectively. I inspect β_k in the pre-acquisition period to assess whether there is a difference in pre-trends for target and control facilities.

Figure 3.2 plots β_k from (3.6) for overall, value, service and cleanliness reviews. These represent the estimated impact of having a PE-backed competitor for each of the three years before and four years after acquisition. There is no evidence of a treatment effect prior to the acquisition, yet there is a negative effect following the acquisition, especially for overall and value reviews. This absence of a pre-trend coupled with the emergence of a treatment effect after the acquisition suggests that the changes in reviews can be plausibly attributed to the change in competitor ownership. The change in value reviews without a commensurate change in service or cleanliness reviews implies that the price component of value (rather than the quality) changed following the acquisition. For these estimates to be biased by selection into treatment, PE firms would have to identify regions for investment where competitors were reducing consumer satisfaction. The treated regions were pre-determined at the time of the formation of the Apple Six REIT in the early 2000s, so it is implausible that these regions were selected into treatment based on hotel trends at the time of acquisition.

I run a similar regression to examine whether the post-entry effects are observed in private equity owned hotels:

$$r_{h,j,t} = \sum_{k=-n_{pre}}^{n_{post}} \beta_k PE_h + \alpha_t + v_h + \epsilon_{h,l,t} \tag{3.7}$$

In this regression, PE_h takes the value of one if the hotel was a Blackstone-owned hotel after the Apple Six transaction, and zero otherwise. Figure 3.3 plots from β_k (3.7) for overall and value ratings at Blackstone-owned hotels. Notably, there is no evidence of a pre-trend nor evidence of a treatment effect post-acquisition. This implies that the change

in reviews observed in 3.2 was not driven by changes within the Blackstone-owned hotels. It is plausible that Blackstone-backed hotels increased prices and services in a way that resulted in no change to consumer perceptions of value, and this encouraged competitors to raise their prices without increasing their services (hence reducing customer perceptions of value). However, panel (c) and (d) of 3.3 suggest there was no change in customer perceptions of service or cleanliness following the acquisition, implying that there was no significant change to these characteristics. Rather, the results suggest that the mere entry of a private equity owner altered the behaviour of its competitors.

3.5 Conclusion

The growth of private equity has increased concerns about how private equity ownership effects stakeholders such as consumers. Existing academic studies reveal the mixed impacts of private equity acquisitions on consumers. I find a new channel through which private equity ownership may impact consumers. In particular, I find that competitors compete less aggressively following the entry of a private equity firm into the local market. This result is not driven by observed changes in the behaviour of businesses under private equity ownership. Rather, competitors appear to respond to public perceptions of private equity firms as "short termist" by behaving in a short-termist manner themselves (by reducing the quality of the consumer experience).

This finding has important policy implications. Current competition policy concerns itself exclusively with the market share of participants and fails to consider the endogenous response of the market to a entrant's reputation. This is despite extensive theoretical and empirical work that suggests that an entrant's reputation - be it for predation or short-termism - affects the behaviour of other market participants. A natural extension of this research is to study whether there is heterogeneity in the market response to private equity entry: does size, type, or industry specialisation of the private equity entrant affect participant behaviour?

This study belongs to a broader research agenda exploring how the entry of a large investor into a market affects the behaviour of smaller investors. Potential areas for future research include how large investor entry affects the investment decisions of smaller investors.

Figure 3.1: Stylized control/branding in the hotel industry

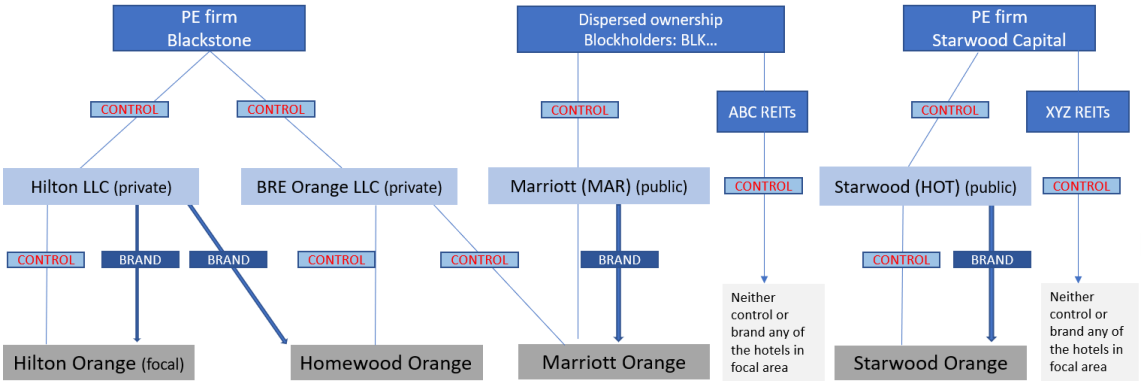


Figure 3.2: Changes in Reviews of All Hotels Around Private Equity Entry

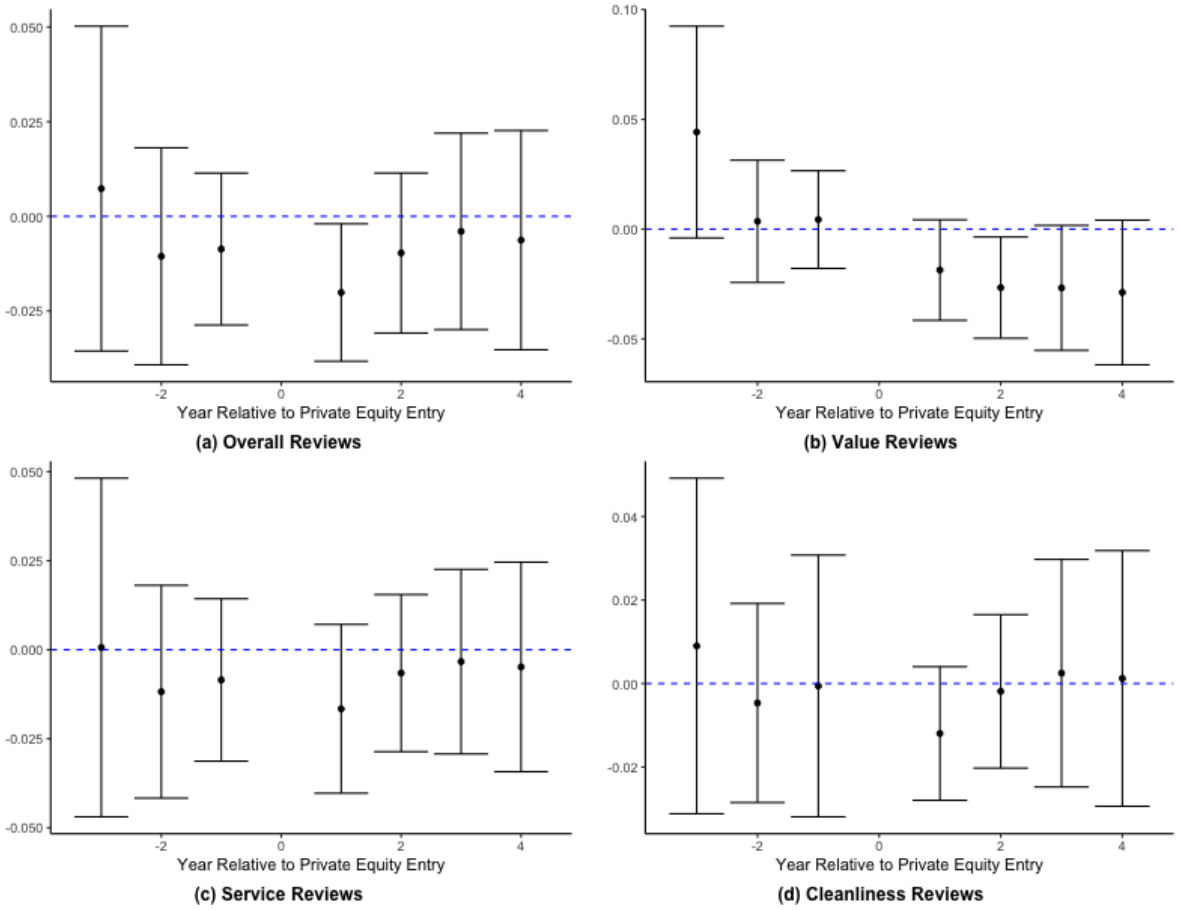


Figure 3.3: Changes in Reviews of Private Equity Hotels Around Entry

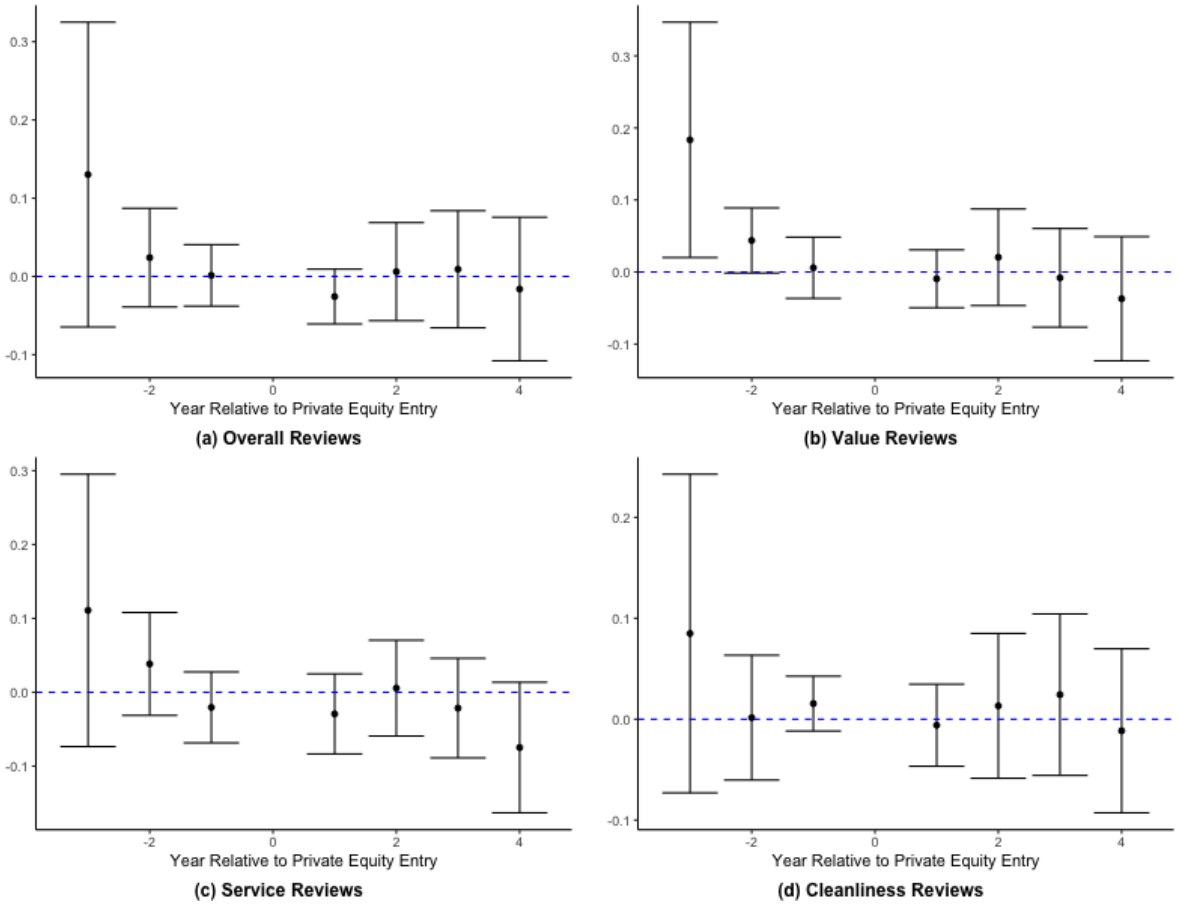


Table 3.1: Brand ownership of upscale US Hotels

Hotel Group		2017		
Brand	Chain	Rooms (000s)	% of total	Hotels
Marriott	Courtyard	134	15.0	964
	Residence Inn	89	10.0	729
	Springhill Suites	45	5.0	386
	AC Hotels by Marriott	5	1.0	31
Hilton	Hilton Garden Inn	88	10.0	638
	DoubleTree	83	9.0	337
	Homewood Suites	49	5.0	431
Hyatt	Hyatt Place	35	4.0	261
	Hyatt House	11	1.0	78
IHG	Crowne Plaza	35	4.0	126
	Staybridge Suites	24	3.0	227
	EVEN Hotels	1	0.0	8
Radisson	Radisson	20	2.0	91
Starwood	Four Points by Sheraton	17	2.0	110
	aloft Hotel	14	2.0	94
	element	3	0.0	25
Choice	Ascend Collection	12	1.0	156
	Cambria hotel & suites	4	0.0	36
Other brands in Minnesota		12	1.0	44
Other brands not in Minnesota		69	8.0	230
Total Branded		757	83.0	5002
Independent	Independent	153	17.0	1524

This table summarises the chain association and branding of all 'upscale' hotels (as defined by STR) in the United States as at end of 2017. The size of each brand as measured by rooms and total number of hotels is provided in the third and fifth columns. The fourth column gives each brand's relative share of the market by rooms under management.

Table 3.2: 10 Largest Chains in Sample

Chain	Total Count	2010 Count	2017 Count
Marriott	14598	1650	2110
Independent	11903	1468	1524
Hilton	9344	981	1410
Intercontinental Hotel Group	2661	323	361
Hyatt	2064	198	339
Starwood	1335	130	229
Choice Hotels	920	57	192
Radisson Hotel Group	776	122	91
Wyndham Hotel Group	454	48	51
Best Western Premier	126	2	27

This table summarises the size of the ten largest hotel chains in the 'upscale' segment as measured by number of rooms under management (column 2), number of hotels in the chain in 2010 (column 3), and number of hotels in the chain in 2017 (column 4).

Table 3.3: 20 Largest Owners in sample

Owner	Type	Total Count	2010 Count	2017 Count
Independent	Independent	11883	1461	1523
Marriott	Hotel Chain	3329	431	393
Apple REIT Companies	REIT	1244	161	149
Goldman Sachs	Investor	817	150	10
Blackstone	PE	786	40	120
RLJ Lodging Trust	REIT	653	82	74
Hyatt	Hotel Chain	584	112	51
Chatham Lodging Trust	REIT	551	51	80
Starwood Capital Group	PE	437	3	103
TMI Hospitality	Management Co	358	45	39
Summit Hotel Properties	REIT	296	24	44
Hospitality Investors Trust	REIT	264	1	78
MCR Development	Investor	240	9	36
Ashford Hospitality Trust	REIT	225	25	28
Noble Investment	Investor	191	10	25
Intercontinental Hotel Group	Hotel Chain	182	44	8
CSM Lodging, LLC	Investor	179	24	21
Disney Hotels	Hotel Chain	165	19	21
Hersha Hospitality Management, LP	Management Co	162	17	13
Aston Hotel	Hotel Chain	154	19	20

This table summarises the size and type of the twenty largest hotel owners in the 'upscale' segment as measured by number of rooms under management (column 3), number of hotels owned in 2010 (column 4), and number of hotels owned in 2017 (column 5). Each owner is classified as a hotel chain, PE (private equity owner), a REIT (real estate investment trust), investor or management company. There is considerable overlap between the final three classifications, with many management companies also owning and developing hotels, which are sometimes placed in REIT structures. Each business has been classified according to its primary business according to its website. Note that 'Independent' refers to independent owners that each own one hotel in the sample.

Table 3.4: Upscale hotel transactions > 1b

Closed Date	Target	TEV	Buyers	Sellers
23/09/2016	Starwood	15,819	Marriott (DO)	Public (DO)
27/02/2015	Equity Inns Lodging	1,808	ARC (REIT)	Goldman Sachs (PE)
01/09/2016	Apple Ten (REIT)	1,278	Apple Hospitality (REIT)	MPF (Private)
30/01/2015	TMI (Private)	1,200	Starwood Capital (PE)	-
31/12/2011	Innkeepers USA (REIT)	1,140	Five Mile Capital (PE)	Apollo (PE)
17/11/2014	Portfolio of 52 Hotels	1,071	NorthStar (Private)	-
14/05/2013	BRE Select Hotels Corp	1,070	Blackstone (PE)	Apple (REIT)
27/10/2011	64 Hotels	1,020	Cerberus (PE)	-

Note that MPF = MacKenzie Patterson Fuller. This table summarises transactions in the 'upscale' hotel segment that had a total enterprise value (TEV) greater than one billion dollars. The first column presents the date on which each transaction closed; the second column provides a description of the target (name or portfolio description); the third column states the total enterprise value (TEV) of the transaction; the fourth gives the buyer name; and the fifth column gives the seller name. I classify each buyer or seller as a type in brackets where DO refers to a direct owner, REIT to a real estate investment trust, PE a private equity owner, and private a private owner.All transaction information is from CapitalIQ, and in some cases the seller information is missing from the transaction record within this database.

Table 3.5: Summary Statistics: Reviews

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Overall Ratings	1,571,178	4.16	1.08	1.00	4.00	5.00	5.00
Value Ratings	1,043,219	4.14	1.08	1.00	4.00	5.00	5.00
Service Ratings	1,288,003	4.35	1.05	1.00	4.00	5.00	5.00
Cleanliness Ratings	1,044,707	4.40	0.96	1.00	4.00	5.00	5.00
Rooms Ratings	1,020,025	4.27	1.01	1.00	4.00	5.00	5.00
Location Ratings	1,024,293	4.44	0.83	1.00	4.00	5.00	5.00
Owner MSA HHI	1,340,575	0.08	0.11	0.01	0.03	0.09	1.00
Chain MSA HHI	1,340,550	0.25	0.11	0.04	0.19	0.30	1.00
Δ Owner and Chain HHI	1,340,550	-0.17	0.09	-0.75	-0.24	-0.12	0.50

This table presents summary statistics for the reviews and HHI indices used in this study. The first column provides the variable name; the second column is the observation count; the third-eighth column provide summary statistics including the mean, standard deviation, minimum, lower quartile, upper quartile and maximum of each variable. The HHI indices are given at the MSA level. There are two types of HHI provided. The Owner HHI is the HHI calculated using each ultimate owner's rooms under management in a particular MSA, whereas the Chain HHI is the HHI calculated from each chain's rooms under management (i.e. the control as is appears to the public). I provide summary statistics for the difference between the owner and chain HHI in the final row.

Table 3.6: Correlation between HHI and reviews

Dependent Variable	Review Rating		
Treatment Variable:	Owner HHI	Chain HHI	Δ (Owner HHI - Chain HHI)
(1) Overall	0.147***	0.0391*	-0.0274
	(2.727)	(1.827)	(-1.022)
(2) Value	0.230***	0.0696	-0.0613
	(3.502)	(1.246)	(-1.260)
(3) Service	0.256***	0.0966***	-0.106***
	(4.839)	(5.792)	(-3.179)
(4) Cleanliness	0.203**	0.0986***	-0.131***
	(2.296)	(7.368)	(-4.111)
(5) Rooms	0.300**	0.0830***	-0.0783*
	(4.601)	(4.605)	(-1.727)
(6) Sleep Quality	0.269***	0.110***	-0.0867***
	(5.521)	(6.589)	(-1.558)
(7) Location	0.256***	0.104***	-0.0561
	(3.169)	(2.916)	(-1.364)
Hotel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1,606,048	1,606,048	1,606,048

This table presents estimates from a regression of hotel reviews on three measures of concentration of ownership. The sample includes all individual reviews for the hotels in the sample. The time period is from 2009-2018. The dependent variable for each regression is the rating that each consumer assigned to the hotel in a given category. In column 1, HHI is the room-weighted HHI at the MSA-level based on the ultimate owner of each hotel. In column 2, HHI is the room-weighted HHI at the MSA-level based on the chain of each hotel. In column 3, HHI is the difference between the room-weighted HHI at the MSA-level based on the ultimate owner of each hotel and the room-weighted HHI for the chain. I include hotel and year fixed effects in each regression. I report t-statistics using standard errors clustered by hotel t in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 3.7: Change in ratings around the Apple Six acquisition

Dependent Variable	Review Rating		
Treatment Variable:	Blackstone MSA	Δ Owner HHI	Δ Chain HHI
(1) Overall	-0.0240***	-0.105	-0.751***
	(-5.298)	(-0.671)	(-4.377)
(2) Value	-0.0473***	-0.366**	-0.177
	(-8.963)	(-2.039)	(-0.901)
(3) Service	-0.0160***	0.315*	-0.259***
	(-3.345)	(1.925)	(-1.444)
(4) Cleanliness	-0.0100**	0.134	-0.635***
	(-2.155)	(0.840)	(-3.654)
(5) Rooms	-0.0181***	0.172	-0.599***
	(-3.663)	(1.015)	(-3.253)
(6) Sleep Quality	-0.0200***	-0.0320	-0.755***
	(-3.572)	(-0.163)	(-3.549)
(7) Location	-0.00438	0.0740	-0.0553
	(-1.064)	(0.516)	(-0.357)
Hotel FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1,606,048	1,606,048	1,606,048

This table presents estimates of difference-in-difference regressions of hotel reviews by type around the acquisition of the Apple Six REIT portfolio by Blackstone. The sample includes all individual reviews for the hotels in the sample. The time period is from 2009-2018. The dependent variable for each regression is the rating that each consumer assigned to the hotel in a given category. I consider three levels of treatment. In column 1, it is a binary treatment that identified a hotel that was in an MSA in which a hotel transacted during the Apple Six acquisition. In column 2, the treatment is the change in owner HHI in an MSA where a hotel was transacted during the Apple Six acquisition. In column 3, the treatment is the change in chain HHI in an MSA where a hotel was transacted during the Apple Six acquisition. I include hotel and year fixed effects in each regression. I report t-statistics using standard errors clustered by hotel t in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 3.8: Value Ratings in Apple Six Regions

	Dependent variable:		
	Value Rating		
	(1)	(2)	(3)
Effective HHI	-0.245***		
	(0.062)		
Apparent HHI		-0.023	-0.217***
		(0.069)	(0.071)
Difference between Effective and Apparent			-0.296***
			(0.078)
PE Region	-0.033***	-0.035***	-0.033***
	(0.011)	(0.011)	(0.011)
Hotel FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Observations	895,285	895,277	895,277
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 3.9: Other Ratings in Apple Six Regions

	Dependent variable:				
	Overall	Service	Cleanliness	Rooms	Location
	(1)	(2)	(3)	(4)	(5)
Effective HHI	-0.138**	-0.104	-0.085	-0.110	-0.078
	(0.065)	(0.065)	(0.065)	(0.067)	(0.048)
Blackstone	-0.007	-0.008	-0.003	-0.005	-0.0001
	(0.012)	(0.011)	(0.012)	(0.012)	(0.008)
Hotel FE	Y	Y	Y	Y	Y
Year-Quarter FE	Y	Y	Y	Y	Y
Observations	1,340,575	1,104,233	896,535	875,642	879,510
R^2	0.090	0.062	0.082	0.100	0.088
Adjusted R^2	0.088	0.059	0.078	0.096	0.085
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 3.10: Value Ratings in Blackstone Hotels

	Dependent variable:		
	Value Rating		
	(1)	(2)	(3)
Effective HHI	-0.262***		
	(0.062)		
Apparent HHI		-0.033	-0.235***
		(0.070)	(0.072)
Difference between Effective and Apparent			-0.310***
			(0.077)
Blackstone	-0.026	-0.027	-0.026
	(0.027)	(0.027)	(0.027)
Hotel FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Observations	895,285	895,277	895,277
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 3.11: Other Ratings in Blackstone Hotels

	Dependent variable:				
	Overall	Service	Cleanliness	Rooms	Location
	(1)	(2)	(3)	(4)	(5)
Effective HHI	-0.142**	-0.108	-0.087	-0.112*	-0.078
	(0.065)	(0.064)	(0.065)	(0.066)	(0.048)
Blackstone	0.007	-0.017	0.002	0.0005	0.023
	(0.034)	(0.034)	(0.029)	(0.022)	(0.020)
Hotel FE	Y	Y	Y	Y	Y
Year-Quarter FE	Y	Y	Y	Y	Y
Observations	1,340,575	1,104,233	896,535	875,642	879,510
R^2	0.090	0.062	0.082	0.100	0.088
Adjusted R^2	0.088	0.059	0.078	0.096	0.085
Note:					*p<0.1; **p<0.05; ***p<0.01

Chapter 4

Keeping Up with the Blackstones

4.1 Introduction

> *Invitation Homes has virtually no ability to impact broader rent trends in its communities... What's more, the notion that a company that represents less than 0.1 percent of the single-family homes in America is having a significant impact on this market is not based in fact.*
>
> Blackstone, November 2019

Concentrated ownership is often viewed as dangerous, because it may generate market power that facilitates exploitation; conversely, it may increase welfare by generating efficiencies. Research into this trade-off informs the regulation of take-overs and of monopolistic enterprises. On the one hand, horizontal mergers may concentrate ownership and allow inefficient price increases that increase corporate profits at the expense of consumer surplus (Farrell and Shapiro (1990), Brueckner and Spiller (1991), Ashenfelter and Hosken (2010)). On the other hand, concentrated owners may operate at a sufficiently large scale to achieve productivity gains that benefit consumers (Daughety (1990), Sapienza (2002)).

In recent years, questions relating to ownership concentration have become salient in the residential property market. Since the Great Recession, private-equity backed institutional investors have acquired over 300,000 single-family homes across the United States and have converted them to rental properties.[1] In doing so, they have created geographically concentrated residential property investment portfolios. The above Blackstone quotation therefore gives a potentially misleading impression: within the neighborhoods where they invest, private equity firms own significantly more than 0.1% of the single-family homes. The emergence of institutional ownership created a significant change in the ownership structure of neighborhoods where it has occurred. In June 2022, the US Congress Financial Services Committee expressed concern that this change might have raised rents and house prices, while also decreasing minority home ownership.[2]

In this paper, I use a unique dataset of private equity investment in the residential housing market in Atlanta, GA, to investigate the effects of concentrated ownership. I examine four mergers that resulted in substantial, and quasi-exogenous, variation in ownership concentration of single-family housing in Atlanta. I argue that the mergers were plausibly exogenous to local economic conditions in Atlanta. I use a difference-in-differences approach to study the effect that the mergers had upon rent, house prices, housing quality, and neighbourhood demographics. My analysis uncovers a new benefit of ownership concentration: when they decide how much to spend on improvements to their property portfolios, concentrated owners internalize more of the communal benefits that their investment brings to their neighborhoods. Consequently, concentrated owners may spend more on home improvements. I find that rents increase by 3.5% increase and house prices by 6.0% in the three years following a merger. And, because those price increases relax

[1] American Homes 4 Rent in their S-11 in 2013 noted that 'According to JBREC, for every 1.0% decline in the homeownership rate, the occupants of approximately 1.1 million homes become prospective tenants. '

[2] The Committee aimed to know the role of institutional investors in raising rents and house prices, decreasing minority home ownership, "displacing residents of colour and leading to the gentrification of these communities." from the opening remarks of Rep. Al Green, Chair of the Sub-Committee for Oversight and Investigations of the House Committee on Financial Services in the Hearing 'Where Have All the Houses Gone? Private Equity, Single Family Rentals and America's Neighborhoods'.

credit constraints for owner occupiers, I find that they apply for more home-improvement loans and permits. Contrary to the concerns expressed by Congress, neighbourhoods in which there is concentrated private equity ownership exhibit greater racial and socio-economic diversity. I also find that institutional owners use their economies of scale to more successfully appeal tax assessor valuations. These appeals reduce institutional investors' tax bills by an estimated $4.1b nationwide.

In order to conduct my analysis, I hand-collate the ownership history and annual tax valuations of all single-family properties in six counties in Atlanta, GA, via Freedom of Information Act (FOIA) requests. This tax data provides a detailed history of each property including an assessment of the condition/quality of the property, as well as disaggregated house and land valuations. I merge this ownership history with institutional ownership data collected from SEC filings and OpenCorporates. To further examine the impact of institutional ownership on housing quality, I combine this property ownership dataset with detailed home permit records obtained from the City of Atlanta. I merge this individual property-level dataset with neighborhood-level data including house price and rent indices obtained from Zillow and neighborhood characteristics obtained from the Census Bureau's American Community Survey. I examine changes at the neighborhood-level in terms of borrowing for home improvements and neighborhood demographics using mortgage applications and originations obtained from the Consumer Financial Protection Bureau's Home Mortgage Disclosure Act (HMDA) database. Finally, I identify the mergers used for this analysis using CapitalIQ.

I use merger data in order to identify a causal connection between observed changes in ownership concentration and neighborhood outcomes. Mergers and acquisitions of geographically dispersed portfolios have long been recognized as a means of isolating the differential local impact of changes in ownership concentration (Hastings (2004)). Similar to the approach in Gurun et al. (2022), I use national mergers between institutional investors that occur for reasons that are plausibly unrelated to local portfolio composition.

Ownership concentration that changes in a given residential neighborhood as a result of such a merger is arguably exogenous to the underlying economic conditions of that neighborhood. The main challenge to this identification assumption is that the decision to merge may be endogenous: that is, acquirers may select targets whose portfolios they expect to perform well in the future. If acquirers do create value in this way, then the target's property portfolio should exhibit outperformance regardless of any change in ownership concentration that occurs as a result of the merger. I test for this possibility by showing that this outperformance does not occur in neighborhoods in which only the target owns property pre-merger. This suggests that my results are driven by changing competitive dynamics and not by target portfolio selection. I also consider an announced (but failed) merger as a placebo to my analysis. An alternative potential criticism of this empirical strategy is post-merger neighbourhood outperformance may be driven not by changing competitive pressures but, rather, by the aquirer's ability to select neighbourhoods that will experience greater price appreciation or quality improvements. I control for this potential selection effect, by comparing neighborhoods where the acquirer gained properties in the merger with those where the acquirer already owned properties but the target did not.

I directionally confirm existing findings that institutional ownership correlates with higher prices (Lambie-Hanson et al. (2019),Mills et al. (2019) and Gurun et al. (2022)). I find a 3.5% increase in rents and a 6.0% increase in house prices in the three years following a merger in neighborhoods with greater overlap between the acquirer's and target's portfolios relative to neighbourhoods where the acquirer already owned houses, but the target did not. This result holds after controlling for time-varying characteristics at the county-level and fixed neighborhood characteristics.

Next, I examine the impact of mergers on housing quality. Higher house and rental prices relax households' borrowing constraints which induces greater spending on home improvements by owner occupiers and investors that own less than ten properties (here-

after 'small' investors). In the four years following a merger, applications for home improvement loans by owner occupiers are 54% higher in value in neighborhoods in which there was a change in concentration as a result of an institutional merger. This adds a new channel to the finding in Cloyne et al. (2019) that households increase borrowing in response to house price increases. To further investigate household improvements following mergers, I examine the building permits obtained by different types of property owners following mergers. I find that owner occupiers and small investors apply for more permits for home improvement following an institutional merger in their neighborhood. Specifically, 78% more permits are issued to owner occupiers and 47% more permits to small investors in neighborhoods that experience an increase in institutional ownership post-merger.

Property valuations for tax purposes provide no evidence that institutional investors make more home improvements to properties in areas in which they have an increased market share as a result of a merger. In fact, I find that acquirer-owned properties experience 2.5% lower tax assessor valuations post-merger than properties in the same neighborhood, controlling for neighborhood-year fixed effects. I rationalize this finding through forensic examination of tax appeals. Institutional owners may take advantage of economies of scale in a region by employing in-house legal services and property assessors that enable the institutional investor to more efficiently appeal tax assessments. Consistent with this hypothesis, I find institutional investors appeal property valuations with a frequency of 16.8% (over 18 times the rate at which owner occupiers appeal). Institutional investors are more successful in their appeals than owner-occupiers and there is no difference in the financial benefit of successful appeals. That is, the reduction in valuation obtained on successful appeal is no different between owner types once I control for the size of the appeal.[3] I use realized sales to investigate whether these appeals create a misalign-

[3]Institutional investors experience lower reductions in valuations in absolute terms. This is unsurprising given the frequency with which they appeal (i.e. there is less time for the tax assessor valuation to become substantially misaligned from the owner's valuation). However, once I control for the difference between the taxpayer's valuation and the tax assessor's valuation (i.e. the "size" of the appeal), there is no difference in the size of the reduction in valuation (i.e. the degree of success of the appeal).

ment between taxable valuation and market price. I find the difference between property valuation and sale price is over four times higher for institutional investors than owner occupiers, even controlling for neighborhood-year characteristics and the number of previous appeals on the property valuation. This finding suggests that institutional investors may use tax appeals to decrease the valuations of properties in their portfolios, and hence reduce the local tax paid on those properties. These appeals are economically significant. Assuming a property tax rate of 1% and the median difference between tax and realized (sale) valuation, institutional investors are saving $4.1b in tax payments across all institutional-owned properties in the United States. This hitherto unknown source of rent extraction by institutional investors.

Higher rent prices creates a greater supply of rental housing which generates greater racial and socio-economic diversity in neighborhoods. High house prices do not reduce diversity of home loan applications or approvals. Loan application rates from Black/African American and Latino/Hispanic applicants are 17.9% and 23.4% higher, respectively, in neighborhoods that experienced a large increase in concentration of ownership as a result of an institutional merger. Mortgage origination rates in these neighborhoods are similarly 15.4% and 20.8% higher for Black/African American and Latino/Hispanic borrowers. Rather, it is White non-Hispanic and Mixed Race applicants who reduce their demand for housing in neighborhoods that experience an increase in institutional investor concentration of ownership. White and Mixed Race application rates are 6.7% and 20.8% lower, respectively, in neighborhoods that experience a large increase in concentration of institutional investor ownership. These findings are robust to the inclusion of a number of controls for housing supply, changes in rental supply, house prices, etc. These results are suggestive that increased supply of rental housing following institutional mergers correlates with greater neighborhood diversity.

This paper contributes to a growing literature on the impact of institutional investors on single-family housing markets. Smith and Liu (2020) find that institutional investors

were able to acquire properties at a significant discount to other purchasers, and Ganduri et al. (2022) find that institutional investors stabilized prices in distressed neighborhoods during the Great Recession. Recent work has found that regions with higher institutional ownership have lower home ownership rates and higher house and rental prices (Lambie-Hanson et al. (2019) and Mills et al. (2019)). Gurun et al. (2022) uses a subset of the mergers examined in this paper to show that increased concentration of institutional ownership increases prices and rents, and reduces neighborhood crime.

The paper proceeds as follows. Section Two provides further institutional details and a literature review. Section Three presents the theoretical framework and develops the key empirical predictions of the model. Section Four describes the data and classifications used in the empirical analysis. Section Five contains the empirical analysis. Section Six concludes.

4.2 Institutional Details and Literature Review

Institutional ownership of single family rental properties has grown 3% annually since 2010. Institutional purchases are not confined to distressed acquisitions in the post-Great Recession period. In fact, institutional investors added 27% to their housing stock between 2018-2021, with the third quarter of 2021 having the largest ever year-on-year increase in purchases.[4] Before the financial crisis, there were approximately 10 million single family rental homes across the United States that were predominantly owned by small 'mom and pop' investors, each of whom owned 10 homes or less. As late as 2011, no single investor in the United States owned more than 1,000 homes (Christophers (2021)). Institutional investors entered the market in 2012 and began purchasing homes across the United States. The vast majority of these homes were acquired in single asset purchases.[5] By mid-2021, the largest institutional investors owned over 280,000 homes

[4]See the disclosures made to the House Financial Services.

[5]Invitation Home's S-11 statement notes that they 'have largely avoided bulk portfolio acquisitions... Our acquisition teams have acquired 94% of our [homes] in single-asset acquisitions. Similarly, both

across the United States, with some estimating the that institutional investors owned upwards of 700,000 properties, about 5% of the overall market of 14m rental homes in the United States.[6]

Institutional investors tend to cluster their purchases in areas in which they can obtain economies of scale. As early as 2016, Invitation Homes acknowledged that more than 95% of their revenue would come from markets in which they owned at least 2000 properties.[7] Similarly, Colony Starwood noted that they had approximately 2,800 homes in each of their largest markets, and that they would continue to expand their holdings in these markets and would only expand into other areas where they could acquire 'the critical mass of homes that management believes is necessary to maximize operational efficiency.'[8] Hence, while SFR ownership represents a small percentage of overall housing ownership, it is highly concentrated in several geographic regions that experienced high levels of foreclosures during the Great Recession. Furthermore, the existing fragmentation in the SFR market enabled institutional investors to gain significant market power without owning a significant market share.[9]

Colony American and American Homes 4 Rent acknowledge that their primary acquisition channels are MLS listings, our strategic relationships in our core markets, home builders, foreclosure auctions and short sales. However, both acknowledge that they 'may opportunistically identify and pursue bulk portfolios of homes from other SFR companies, government sponsored enterprises, private investors, banks, mortgage servicers and other financial institutions. ' Colony Starwood 10-K Bulk acquisitions have become more common through purchase of assets from other SFR providers or mergers. Nevertheless, across the five major SFR providers, only 21.9% of their homes were acquired through bulk sales (according to disclosures made to the House Committee on Financial Services available.

[6]More information from HousingWire Wall Street SFR firms accused of stripping equity from neighborhoods

[7]Invitation Homes' S-11 statement says 'More than 95% of our revenue for the three months ended September 30, 2016 was earned in markets where we have at least 2,000 homes, driving significant operational efficiency. '

[8]Colony Starwood's 2016 10-K report states 'SFR portfolio had an average of approximately 2,800 homes in each of our 10 largest markets. Management...expects to further expand our depth in markets currently represented in our SFR portfolio and... [other markets] where we will be able to establish the requisite critical mass of homes that management believes is necessary to maximize operational efficiency.'

[9]Institutional SFR owners point to market fragmentation as an attractive characteristic that has been key to their business success: American Homes 4 Rent notes in its S-11 that 'Historically, the single-family home rental market has been extremely fragmented, comprised primarily of private and individual property investors in local markets. Until recently, there have been no large-scale, national market owners/operators... [with] an unprecedented opportunity to acquire a large number of homes at attractive prices.'

One means for institutional investors to amass a larger market share in housing markets is through mergers or acquisitions of existing portfolios. I use four such mergers to examine the impact of increased concentration of institutional ownership on neighborhood characteristics. Economic theory provides us with two predictions of the impact of horizontal mergers on local markets. First, mergers reduce competition and may enable firms to raise prices (Farrell and Shapiro (1990), Brueckner and Spiller (1991)). Second, mergers may increase efficiencies through economies of scale and productivity improvements (Daughety (1990), Sapienza (2002)). In the single family rental market, mergers could increase efficiency through synergies (for example, consolidation of overlapped functions, e.g. property management divisions) and productivity gains (e.g. technology used for property valuations and estimates of required improvements). Indeed, institutional investors cite complementarities with their existing portfolio and economies of scale as the key drivers for each of the mergers used in this analysis.[10]

Institutional investors state that their presence may improve the neighborhoods in which they operate. For example, Invitation Homes states 'the investments we make, and the high standard to which we renovate our homes, improve our local communities both by offering residents choice and access to a superior quality of living and by driving local employment.'[11] In this paper, I examine three different channels through which increased concentration of institutional ownership may impact gentrification of local communities. First, institutional investors may make more improvements to houses in neighborhoods in which they own a higher market share, especially if mergers create increased bargaining power with local tradespeople (e.g. builders). Such construction works or visible home improvements may have a spillover impact on the home improvement decisions of other homeowners in the neighborhood. Second, if a merger results in higher rent and house

[10]For example, Tricon American note in relation to the acquisition of Silver Bay Realty Trust that the 'combination of two geographically complementary SFR portfolios is expected to unlock substantial operating benefits and efficiencies... in particular given the geographic overlap in the Sun Belt' and will achieve synergies 'through two primary channels: (i) property-level efficiencies arising from enhanced operating scale in each market... and (ii) general and administrative expense synergies through the elimination of corporate-level redundancies.'

[11]S-11 statement

prices, there may be a wealth effect for other homeowners in the neighborhood which encourages greater expenditure on home improvements.[12] Finally, institutional investors may indirectly improve neighborhoods through consistent payment of taxes that support local councils to make improvements.[13]

As noted above, this paper is most closely connected to the literature on the role of institutional investors in the single family housing market. This research sits within the broader literature on how private equity investment impacts the industries in which it invests. Research has found private equity buyouts increase price (Chevalier (1995)) and lower product quality (Matsa (2011)) in supermarkets, increase tuition in higher education providers (Eaton et al. (2019)), increase mortality in nursing homes (Gupta et al. (2021)), lower local governance content and reduce editorial staff in newspapers (Ewens et al. (2021)). Gandhi et al. (2021) find that private equity backed companies compete more aggressively in competitive markets and exploit their market power in less competitive ones. Furthermore, this paper relates to studies on the ESG impact of private equity investments. Private equity ownership reduces health violations (Bernstein and Sheen (2016)) and workplace injuries (Cohn et al. (2021)), increases product offerings across geographies (Fracassi et al. (2020)), but decreases employee satisfaction across a range of industries (Lambert et al. (2021) and Gornall et al. (2021)).

Finally, my study contributes to a growing literature on the causes and impacts of gentrification on communities. Gentrification increases local house prices, which benefits existing owners, and can promote creation of local businesses (Glaeser et al. (2018)). However, gentrification may also displace low-income renters, resulting in less economically diverse neighborhoods (Couture et al. (2019) and Berkes and Gaetani (2022)). Diamond and McQuade (2019) finds that provision of tax credits to finance low-income housing in low-

[12]For example, Carroll et al. (2011) and Case et al. (2005). Note other work has indicated a small and insignificant impact of house prices on consumption (Calomiris et al. (2009)).

[13]Invitation Homes notes in the Social Responsibility section of its website that one of its contributions to the communities in which it invests is 'the company paid approximately $306 million in state and local taxes; money that was invested back into local schools, roads, and social services.'

income neighborhoods results in increased house prices and attracts racially and income diverse populations. Hwang and Lin (2016) summarizes many factors that have been proposed as contributing to gentrification, but note that little is known about what initially triggers gentrification. To my knowledge, my paper is the first to examine whether institutional investment in residential property impacts housing quality and neighborhood demographic composition.

4.3 Theoretical Framework

4.3.1 A Two-House Model

I develop a Bertrand-style model of rent and quality competition in which home improvements increase neighborhood quality. Consider a neighborhood in which there are two identical houses, 1 and 2. Each house is rented for a price $r_i \in [0, \infty)$ with $i \in \{1, 2\}$, and the quality of each house, s_i, may be improved for a cost $c_i = s_i^2/2$. The quality of houses within a neighborhood determines the overall neighborhood quality, n. Assume that neighborhood quality is given by:

$$n = \alpha(s_1 + s_2) \tag{4.1}$$

with $\alpha \in (0, 1)$. Renters have identical (indirect) utility functions in which their utility is increasing in both the quality of the house they rent and the overall neighborhood quality[14]:

$$U = \theta(s_i + n) - r \tag{4.2}$$

where $\theta \in (\underline{\theta}, \bar{\theta})$ is a parameter that expresses each renter's preference for quality. I assume that taste for quality is uniformly distributed in the economy according with unit

[14]Potential renters obtain zero utility if they do not rent at all.

density. The higher the quality of rental housing and surrounding neighborhood, the higher utility U enjoyed by the renter for any given price r. Hence, renters with a higher θ will be willing to pay more for higher quality housing.

If only one quality, s, is offered at a rental price r, the demand for rental housing is the number of consumers with the taste parameter θ such that $\theta(1+2\alpha)s \geq r$. Hence, demand is $D(r) = N[\bar{\theta} - (r/(1+2\alpha)s)]$ where N is the total number of potential renters.

If there is more than one quality of rental housing offered, the potential renters choose among these qualities as well as choosing whether to rent at all. Denoting the high quality house by index 1 and the low quality house by index 2, the demand schedules for each landlord are as follows. The demand for the high quality house is:

$$D_1(r_1, r_2, s_1, s_2) = \begin{cases} \bar{\theta} - \frac{r_1}{s_1+\alpha(s_1+s_2)} & \text{if } r_1 < \frac{s_1+\alpha(s_1+s_2)}{s_2+\alpha(s_1+s_2)} r_2 \\ \bar{\theta} - \frac{r_1-r_2}{s_1-s_2} & \text{if } \frac{s_1+\alpha(s_1+s_2)}{s_2+\alpha(s_1+s_2)} r_2 \leq r_1 \leq r_2 + \bar{\theta}(s_1-s_2) \\ 0 & \text{if } r_1 > r_2 + \bar{\theta}(s_1-s_2) \end{cases} \tag{4.3}$$

and demand for the low quality house is given by

$$D_2(r_1, r_2, s_1, s_2) = \begin{cases} \bar{\theta} - \frac{r_2}{s_2+\alpha(s_1+s_2)} & \text{if } r_2 < r_1 - \bar{\theta}(s_1-s_2) \\ \frac{r_1-r_2}{s_1-s_2} - \frac{r_2}{s_2+\alpha(s_1+s_2)} & \text{if } r_1 - \bar{\theta}(s_1-s_2) \leq r_2 \leq r_1 \frac{s_2+\alpha(s_1+s_2)}{s_1+\alpha(s_1+s_2)} \\ 0 & \text{if } r_2 > r_1 \frac{s_2+\alpha(s_1+s_2)}{s_1+\alpha(s_1+s_2)} \end{cases} \tag{4.4}$$

Suppose that the two houses are owned by two different investors, A and B. To facilitate analysis, let the game be conducted in two stages. In the first stage, the landlords simultaneously decide whether or not to make improvements to their house. In the second stage of the game, each investor sets their rental price. At this stage, the costs of any quality improvements are already sunk. I obtain a sub-game perfect Nash equilibrium of

the game using backwards induction. I show the best response functions for each landlord in Appendix A.

I find the equilibrium prices are rents are higher for both quality profits than in the case where there is no positive externalities from home improvements for the other renter in the neighborhood. Although quality for the high quality house is increasing in the degree of spillover from home improvements to neighborhood quality, the quality of the low quality house is decreasing in the degree of this spillover. Hence, where there are positive externalities from home improvements to neighborhood quality, there is more diversity in the quality of housing offered. Profits for both the high quality and low quality landlord are increasing in the degree of spillover from home improvements. However, the competition between landlords ensures that they are not able to extract all surplus from renters. Instead, the utility of the high and low quality house renters is increasing in neighborhood spillovers, even with higher rent and lower quality being offered to the renter of the low quality house (i.e. the benefits from neighborhood improvement more than compensate the renter for the marginal reduction in own-house quality). Figure F.1 charts these key results for different degrees of spillover from home improvements to neighborhood quality.

Next I consider the impact of a merger between the two landlords. I show the merged landlord chooses to offer one quality of housing at a quality that is only slightly less than the high quality house in the competitive case. Hence, the neighborhood quality (measured as the sum of the quality of individual houses) is significantly higher following a merger. Increased concentration of ownership allows the merged landlord to fully internalize the benefit of neighborhood improvements, so they offer higher quality housing at higher prices.

Finally, I consider the inclusion of an owner occupier in the neighborhood. I find that increased rent prices relax the borrowing constraint for the owner occupier, allowing her to make more improvements to her house. These improvements have a positive externality

on neighborhood quality that enables the landlord to free ride off of the improvements made by the owner occupier. I provide full derivation of these results in Appendix A.

My model generates the following empirical predictions about the effect of institutional mergers on neighborhoods:

> **Hypothesis 1** Following an institutional merger, rent and house prices will increase in neighborhoods where both the acquirer and target owned properties.
>
> **Hypothesis 2** Quality of rental housing will be higher following an institutional merger in neighborhoods in which both the acquirer and target owned properties.
>
> **Hypothesis 3** Owner occupiers will make more home improvements to their properties in neighborhoods in which both the target and acquirer owned properties following an institutional merger.

4.4 Data and Investor Classification

My core analysis relies on the complete ownership, transaction, and valuation history for all residential properties in six counties of Atlanta, GA from 2010-2021. These counties include DeKalb and Fulton counties (that absorb the City of Atlanta) and the surrounding counties: Gwinnett, Cobb, Paulding, and Douglas. These counties collectively hold 3.9 million inhabitants. My data is compiled from FOIA requests made to Tax Assessor Office records supplemented with City of Atlanta permitting records and ownership records from OpenCorporates. In addition, I rely on multiple auxiliary datasets to control for economic and real estate trends within neighbourhoods and assess the robustness of my core findings. I provide a brief overview of the different data sources below.

In order to proceed clearly, I introduce some terminology to clarify the rest of the paper. I define "property" as an individual housing unit that includes a "dwelling" defined as any structural features and the land on which the dwelling is situated. Following Reher (2021), I define "quality" as a structural feature of the dwelling. I use the term "improvement"

to refer generally to an increase in quality, encompassing both large structural changes to the dwelling (e.g. addition of another room) as well as smaller improvements (e.g. replacement of driveway).

4.4.1 Description of Datasets

I use and combine the following datasets in my paper:

County Tax Assessor Records

This dataset contains all property-level information on ownership and appraisal values from 2010-2021. Tax Assessors are required to keep records of the ownership status of all properties including owner name and owner address. In addition, tax assessors provide annual valuations for tax purposes including total assessed value, total appraised value, land appraisal and improvements appraisal. This information is supplemented with basic property characteristics including location, neighbourhood, lot area and shape. Some counties include historical sale prices and an assessment of the quality of the unit in this data.

I supplement my primary analysis with details of tax appeals. [15] This data specifies the property against which an appeal was lodged, the date of the appeal, and the grounds for the appeal. The data may also include the taxpayer's asserted property value, whether the tax payer provided evidence to justify their valuation, the board of assessors' assessed property value, and the property valuation following resolution of the appeal.

OpenCorporates

OpenCorporates maintains a database of over 200 million companies globally. The database contains information on the company's registered address (as recorded in the

[15] Two counties (Paulding and Douglas) provided me with the universe of tax assessor data. This includes over 70 different databases, some with over 150 variables, across hundreds of thousands of observations annually. These databases include information on all taxable items within the county, including commercial land and improvements, taxable accessories, aircraft, boats, fireplaces, etc. Details of the information available in the Tax Assessor records are available in the WinGAP Technical Workshop summary.

state or national company register), jurisdiction, its incorporation date, the company's agent and its address, and any directors or officers. It also links companies within its directory by corporate group, listing relevant parent or subsidiary companies. This is the primary database I use to match a private limited liability company (LLC) to its corporate parent.

Permit Data

The City of Atlanta maintains an online portal containing all permits applied for from 2010-present. Each permit is sorted into a category based on the nature of the works to be completed. The relevant categories for my study are:residential addition; residential alteration; residential conversion; residential miscellaneous non-structural; residential miscellaneous structural; residential pool; residential repair. [16] Each permit application contains the date of application, the address of the building, the name of the applicant [17], the status of the application, and a description of the works involved. Hence, each permit can be described by the category of works (as above) or by the description of the works.[18] Hence, the nature of the works is able to be coded using both the existing categories and textual analysis of the work described. City of Atlanta permit data is combined with permit data provided by Paulding County and Douglas County Tax Assessor offices.

Zillow

Zillow produces comprehensive indices of house prices and rental rates by zipcode. To measure rents, I use the Zillow Observed Rent Index (ZORI). This index measures the monthly rent for each zipcode in the units of nominal dollars per month. The ZORI imputes changes in rent over time by calculating the price difference for the same unit

[16] Future versions of this paper may include Residential Demolition and Residential New permits but at this stage my study is primarily concerned with short term changes to existing structures rather than new development.

[17] The application will often be a commercial owner or the contractor completing the works. For example, "Kuhlemann Alterations".

[18] A typical residential alteration may be described as "a new covered porch, new exterior bath and new terrace" whereas a typical residential non-structural permit may be for a "new fence in front yard" or "replacing driveway, walkway, and patio in same footing 17000 sq ft.".

listed over time, then aggregating those differences across all properties repeatedly listed on Zillow. This allows the index to control for changes in the quality of the available rental stock through time, so it is not bias by the current composition (unlike pure repeat-listing indices). This index is available from 2014-present.

To measure house prices, I use the Zillow Home Value Index (ZHVI). This index is built from monthly estimates of property-level valuations calculated by Zillow ('Zestimates'). Importantly for this study, the ZHVI corrects for appreciation from home improvements, so changes in the quality of the housing stock are not reflected in the appreciation rate of the neighbourhood. This index is available for the full length of my sample 2010-present.

Home Mortgage Disclosure Act (HMDA)

The HMDA requires the collection and publication of data on the vast majority of home mortgage applications and loan approvals in the United States. This includes first mortgages as well as refinances. The data include each application's status,loan amount, the purpose of borrowing, the occupancy type, as well as key demographic information about the borrower (income, race, and ethnicity).

I filter the HMDA data to retain applications that satisfy the following conditions: property type = 1 (1 -4 family home) and loan type = 1 (conventional loans). I additionally require that the applications have a non-empty census tract number, and that they were not flagged for data quality issues (edit status = "NA"). I examine all applications that satisfy the stated criteria as well the subset of those loans that are identified as originated (action taken = 1). I further split the sample into applications for the purpose of home purchase (loan type =1) and those for the purpose of home improvements (loan type =2). For some specifications, I use occupancy type to distinguish between investors and owner occupiers. [19]

[19]It is important to note the limitations of this data. Occupancy status is prone to misreporting. Elul et al. (2019) and Fisher and Lambie-Hanson (2012) find that residential real estate investors often misrepresent their status as owner-occupiers to obtain a lower mortgage rate. For this reason, analysis of investor loans should be viewed as representing the minimum response of investors to treatment.

I assign a race and ethnicity to each application by the following process. If there is one applicant listed on the application, the application is classified according to the race/ethnicity of that individual. If the individual identifies as being of more than one race/ethnic background, I identify the application as 'mixed race'/'mixed ethnic heritage'. If there is more than one person listed on the application, the application is classified according to the race/ethnicity of both parties (if both parties identify as being of the same race) or mixed race/ethnic heritage (if the parties identify as being of different races or are mixed race). I also generate a broad category of all applications that are not classified as being non-Latino/Hispanic white.

I obtain census-tract level population and median family income from the Federal Financial Institutions Examination Council's census data. This data also contains the total number of 1-4 family units, and the number of owner-occupied units that act as controls in some regression specifications.

American Community Survey Data

I obtain age, unemployment level, education level, race, median income, labor-force participation rates, and insurance/social security details from the American Community Survey (ACS) 5-Year Estimates provided by the US Census Bureau. ACS Census data is available at varying frequency depending on the granularity of the geographic region, with data from smaller geographic areas averaged over time to create more robust estimates. ACS 5-Year estimates represent averages obtained from fives years of data (e.g. 2016-2020) and are available at the census tract level. Census tracts are the smallest geographic unit available in the ACS and are defined to be between 1,200-8,000 inhabitants with an optimal size of 4,000. Hence, these tracts represent small communities/neighborhoods with the boundaries typically following visible and identifiable geographic features. Although ACS 5-Year estimates cannot be used to provide a single year 'snapshot' of neighborhood composition, they can be used to track demographic changes through time.

4.4.2 Descriptive Statistics

Data Construction

I start with the annual Tax Assessor records from 2010-2021. I generate a time series of ownership and valuation by matching properties on Parcel ID number. I drop any records for which there is no Parcel ID and any records for which there is no numbered address.

I classify all properties in which the owner's address matches the property address as being owner-occupied. This may bias the estimate of owner-occupation upwards, as some small property investors may choose to have tax accounts delivered to the rental property, or may choose to use the property address as the owner contact address in order to maintain the perception that the property is owner-occupied for mortgage rate purposes (Elul et al. (2019)). However, it is unlikely to falsely capture large investors that can easily conceal their ownership through a registered agent, if it is desired. To further validate these results, I cross-check my descriptive statistics against ownership estimates from the US Census Bureau. I find that my measure of owner-occupancy is within 5% of the Census-reported level.

For those properties that are not owner-occupied, it is necessary to identify an ultimate owner. First, I identify all owner-contact addresses that are associated with more than 100 properties in the sample. I manually search to match each of these addresses with an ultimate owner, which generates a database of 396 ultimate owners and contact address pairs. This process also generates a list of " false friends": registered agents, lawyers, tax specialists, etc, whose addresses appear multiple times belonging to different LLCs but are not informative as to the ultimate owner.

Second, I utilise OpenCorporates to identify each LLC's registered address, agent name, agent's address, parent company, and parent's address. I use this additional contact information to match additional LLCs to their parent in the ownership database. This process is described in detail in Appendix B.

Finally, I assume all properties that have the same owner contact address have the same owner, provided as the owner does not appear in my list of false friends. I verify the robustness of this process by ensuring that no address matches to more 100 properties without having been previously identified in my sample.

I further classify investors according to their total number of unique properties owned over the 12 years of my sample: micro investors are those with only one investment property; small investors are those with between 2-10 investment properties; medium investors are those with between 11-50 properties; large investors are those with over 51 properties.

Tax Assessor records contain the universe of all properties in an area. I focus on the impact of institutional investment on single family rental market. Hence, I include only properties categorised as residential lots ("R3" according to the Tax Digest Consolidated Summary). I exclude commercial, agricultural, industrial, utilities, conservation, and other properties zoned for specific land-use from my analysis. For counties where I have not been provided with sales data, I need to identify whether a transaction took place via imputation. I specify that a transaction has taken place if the owner name is not a substring of the previous owner name.[20]

4.4.3 Identify SFR Investors

Institutional involvement in the SFR market only began within the last 10 years. Other large investors in the residential real estate market act as either property developers or asset flippers that aimed to build/improve a property within a minimal period of time to maximise capital appreciation at sale. Firms involved in this style of real estate investing are typically geographically localized.[21] SFR investors are unique among large investors in that they acquire properties primarily to offer as rental homes.[22] As a result, SFR

[20]I require that the owner name not be a substring of the previous owner name in order to avoid erroneously classifying divorces (where one partner's name is dropped from the owner name) as changes in ownership.

[21]Indeed, no one investor owned more than 1000 properties across the United States prior to 2013.

[22]SFR investors are securitize the properties they invest in using the revenues from the rental income and the underlying properties themselves as collateral. Specifically, SFR securities are typically collat-

investors have a longer investment horizon, with their holding period resembling that of very small "mom and pop" investors that own a single rental property (see figure **??**).

Previous approaches used by researchers to identify property investors are of limited use for identifying SFR investors.[23] I propose a hybrid approach to identify SFR investors in this paper. First, I compile a list of SFR providers from mortgage securitization issuances and news reports.[24] For US-listed SFR providers, I identify subsidiary names from SEC 10-K Exhibit 21.1. [25] I record subsidiaries by parent-year to capture any changes in ownership due to mergers.[26] However, this approach is only effective for identifying subsidiaries of US-listed SFR providers. To identify the subsidiaries of unlisted SFR providers, I use the database of large investors I compiled using OpenCorporates to identify the ultimate parent. To ensure that I have not missed any entities, I cross-check the addresses identified as belonging to SFR entities in the Florida Divisions of Corporations website. [27] Public data is prone to typos and spelling irregularities so I use the compiled list of addresses to identify any SFR subsidiaries that were erroneously

eralized by a single loan that is secured by first-priority mortgages on the underlying properties.The securities are is tranched and pay interest to a schedule using the cash generated from the SFR rental properties. Since Invitation Homes' first issuance in 2013, $69.6b in single-borrower issuances has been raised across 113 transactions from 16 sponsors backed by 355,000 SFR properties, according to KBRA's report SFR Securitizations: A Decade in the Making.

[23]For example, one approach use HMDA data to identify investors, but only captures those investors that rely on local credit markets for borrowing (SFR investors typically borrow via securitization) and is prone to misreporting (Elul et al. (2019) and Fisher and Lambie-Hanson (2012)). Ownership tenure may also be used as a proxy for investor activity, with those who own a house for a short time assumed to be investors (e.g. Bayer et al. (2021) and Giacoletti and Westrupp (2017)). But this fails to capture buy-to-let SFR investors that have a significantly longer holding period (see figure **??**). Finally, Lambie-Hanson et al. (2019)use naming heuristics to identify investor type (e.g. classify names that include "LLC", "Corporation", "Partnership"). This approach is effective for identifying institutional investors, but also captures many corporate owners that are not SFR providers (e.g. builders, property developers, banks, etc).

[24]Many SFR providers borrow via securizations of their mortgage portfolios. This is a unique feature of the SFR business model and allows a clear classification of these firms. However, I supplement these issuances with news reports so as to not exclude entities that are in the business of providing SFR services but do not borrow via securitization in the United States.

[25]For example, Invitation Homes' list of subsidiaries is available here

[26]It is rare for subsidiary names to change with ownership. For example, Invitation Homes reports 'SWAY 2014-1 Borrower LLC' as a subsidiary even though this entity has been absorbed in two large mergers since its creation under Starwood Waypoint.

[27]Florida is unique in enabling search by address rather than solely by corporate name. Hence, it is possible to find all Florida listed subsidiaries associated with a corporate headquarters. Florida has experienced high levels of SFR investment post-GFC so many of the same subsidiaries are active in both Georgia and Florida.

classified due to minor discrepancies in their name. Details of this process are in Appendix B.

4.4.4 Mergers in the SFR Market

I use CapitalIQ to identify the largest mergers of institutional investors in the single family rental market. I provide details of the screening process in Appendix D. Table 4.1 summarizes the four mergers that I use for my analysis. All mergers were completed between 2015-2017, which enables me to obtain data for (a minimum of) three years before and after the mergers to analyze. All but one of the SFR investors were publicly traded at the time of the mergers, so I am able to obtain detailed information on the geographic distribution of each portfolio from annual reports. Although Colony American Homes was private at the time of its merger, the combined firm, Colony Starwood, provides a detailed overview of their portfolio pre- and post- acquisition.[28]

4.5 Empirical Framework

I use the four largest SFR mergers to identify the impact of changes in institutional market share on gentrification. These mergers created discrete jumps in the concentration of institutional ownership within neighbourhoods depending on the degree of overlap between the acquirer and target's Atlanta portfolio. I define a neighborhood as a census tract for all specifications except those that examine house prices and rent for which data is only available at the zip code level. For comparability with previous work, I use three levels of treatment. First, I (Δ Properties) > 0 is a binary variable that equals one if the acquirer gained at least one additional property in the neighborhood as a result of a merger. Second, I define a 'large' treatment variable, I (Δ Properties) ≥ 10, that equals 1 if the acquirer gained 10 (20) or more properties in a census tract (zip) during a merger. Finally, Δ Properties Count is a continuous variable that equals the number of

[28]Details of Colony Starwood's portfolio pre- and post- merger are available in Colony Starwood's 10K.

properties the acquirer gained in a neighborhood as a result of a merger. The level of the 'large' treatment effect is equivalent to the upper quartile of the number of overlapped properties in a neighborhood.[29]

The degree of overlap between the acquirer and target's portfolio is plausibly independent of local economic conditions, yet it influences the market power of the acquiring landlord. Increasing the market power of a landlord could causally affect local conditions by enabling the landlord to charge higher rent, which would increase house prices (i.e. higher rent mechanically increases the value of houses within a discounted cash flow or discounted dividend valuation framework). Equally, increasing the market share of a landlord could also incentivize the landlord to make greater improvements to their properties if they anticipate that improvements could increase the quality of the neighborhood (with resulting increases in rents and house prices). Construction/improvement works may encourage other homeowners/landlords within the neighborhood to make further investments in their properties (Kuhn et al. (2011)).

I compare property prices and investment within neighborhoods in which both the acquirer and target owned properties to those neighbourhoods where the acquirer already owned at least one property but the target did not. Hence, I can identify the impact of increased concentration of institutional ownership independent from local market conditions that would otherwise influence selection (i.e. institutional investors may be good at picking neighbourhoods where prices or quality are likely to rise). Furthermore, by focussing on mergers that include a national portfolio of institutional properties, I can minimise the possibility that the portfolio was acquired in order to increase ownership within specific neighbourhoods in Atlanta. I only use as controls those neighborhoods that did not experience a merger at any time during the sample period. Hence, there is no risk that a neighborhood that was treated in one merger would be used as a control

[29]I rely on census tracts and zips to define neighborhoods, so I use a different definition of large treatment to that of **?**. However, the treatments are qualitatively similar, so to the extent that I observe price and rent impacts that are similar to **?**, the other results in my paper may also generalize to the larger sample in theirs. This should allay some concerns about the external validity on this study.

for another.

Treatment effects estimated from this DiD specification could be confounded by selection for two reasons. First it could be that the acquirer chooses to acquire the target's portfolio because of market overlap (synergies) between the two portfolios. Indeed, all acquirers state the cost efficiencies of market overlap as one of the benefits of the acquisition.[30] It follows that the acquisition decision may be endogenous to the degree of overlap between the acquirer and the target's portfolios. Although portfolio complementarity may influence the portfolio acquisition decision, the degree of overlap within individual neighborhood in the Atlanta Metro region is unlikely to influence the acquisition decision in the context of a national portfolio (in fact, institutional investors regulatory filings and press releases refer to overlapped "markets" as cities rather than tracts or zips within cities). Even if census tracts (zips) were selected for the degree of overlap, the proposed DiD estimator would still capture the impact of mergers on local prices, but the estimated average treatment would likely be larger than the effect of landlord concentration absent a merger.

Treatment effects could also be confounded due to selection bias because an institutional portfolio is more likely to become the target of an acquisition where there is misalignment between the acquirer's and the market's perception of target portfolio value. If the acquirer's acquisition decision depends on its perception of the growth prospects of the markets within target's portfolio, the acquirer may have already purchased property in

[30]For example, the 10 August 2017 press release to announce Invitation Home's merger with Colony Starwood stated "The two companies have very similar portfolios of homes focused on overlapping, strategically selected, high-growth markets...The combined portfolio would also have an average of 4,800 homes per market, allowing it to leverage economies of scale and improve operating efficiency, while also enhancing customer service. " Similarly, an investor presentation released at the time of Starwood Waypoint's acquisition of Colony American highlights the "focused strategy of concentrated market density in attractive, high-growth markets to drive operational efficiency, economies of scale and attractive returns." The presentation goes on an increase of 175 bp in portfolio renewal rent increases in the combined company (Exhibit 99.2 of Form DEFA14A filed 21 September 2015). Finally, American Homes 4 Rent notes that "[g]iven the geographic overlap of American Homes 4 Rent and American Residential Properties portfolios, operational synergies are expected to be achieved by reducing duplicate expenses for internet charges, supervisory property management personnel, management information systems and other back-office functions." (Exhibit 99.1 of 3 December 2015 Form 425 filing)

these markets. Hence, the degree of overlap may be endogenous the acquirer's perception of growth prospects in those markets. If the acquirer is better at picking winners than the market, then a finding that prices rise in areas of high overlap could be simply be market prices catching up with the acquirer's assessment of market outlook. I conduct further tests to evaluate the risk of selection bias in the Appendix.

4.5.1 Impact of mergers on local prices

For each institutional merger, I estimate the following difference-in-difference model for neighbourhood house prices and rental prices:

$$ln(\text{Rent}_{z,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_z + \beta_3 \text{Post}_{,t} \text{ x } \text{Treat}_z + \gamma_{c,t} + \zeta_z + \epsilon_{n,t} \quad (4.5)$$

$$ln(\text{HousePrice}_{z,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_z + \beta_3 \text{Post}_t \text{ x } \text{Treat}_z + \gamma_{c,t} + \zeta_z + \epsilon_{z,t} \quad (4.6)$$

$ln(\text{HousePrice}_{z,t})$ is the Zillow house price index following a merger in zip z, in period t. Similarly, $ln(\text{Rent}_{z,t})$ is the Zillow rent index following a merger in zip z, in period t. Post_t is a binary variable that takes the value of 1 for neighbourhood-year observations following a merger. Treat_z indicates treatment for zip z. I include county x year fixed effects, $\gamma_{c,t}$, to control for time-varying characteristics at the county level. Hence, county-level conditions, such as local economic performance and demographics, would not confound the estimated treatment of institutional landlord mergers on local prices. I also include zip fixed effects, ζ_z, to account for fixed (or slow moving) unobservable neighborhood characteristics that may impact local prices (such as geographic characteristics and climate conditions). Thus, after controlling for these fixed effects, the DiD estimates capture the differences in local prices post-merger across zips within a county.

Table 4.4 presents the DiD estimates for equations 4.5 and 4.6. The estimates show that the DiD estimator is significantly positive for rent prices, and is significantly positive for

house prices where there is a large overlap in properties at the merger. This is consistent with landlords raising rent in regions of reduced competition as a result of mergers., and house prices adjusting in neighbourhoods where there is a large consolidation as a result of the merger. Note that Treat and Post are not perfectly absorbed by the fixed effects because their definitions relate to mergers that affect different zips at different times. The adjusted R^2 is 96.7% for regressions on rental prices and 97.5% for regressions on house prices (across all specifications). This suggests that the fixed effects have absorbed most of the variation in rent and house prices, and that there is little scope for an omitted variable in these regressions. Based on the estimates in Table 4.4, I find that rent prices are 3.5% higher following the merger in overlapped zip codes than other zip codes. House prices are 6.0% higher in zips where the acquirer gained more than 20 properties. These findings are directionally consistent with the previous findings in (Lambie-Hanson et al. (2019),Mills et al. (2019) and Gurun et al. (2022)).

Figure 4.1 presents the rent difference between zips where the acquirer gained 20 or more properties after the merger and zips where the acquirer owned at least one property prior to the merger. This figure shows no evidence of parallel trends as there is no trend in rent prices between treated and untreated zips in the years preceding the merger transactions. The prolonged consistency in rents between treated and non-treated zips prior to the merger supports the conclusion that the observed increase in rent is driven by the merger rather than other confounding factors. Figure 4.2 similarly presents the house price difference between zips where the acquirer gained 20 or more properties and those zips where the acquirer owned at least one property prior to the merger but the target did not. The figure shows very little evidence of a trend in house prices prior to mergers, and a strong increase in house prices subsequent to the merger.

Both figures indicate a lag of approximately one year before prices in overlapped zips diverge from non-overlapped zips. This lag can be explained by delays in contract negotiations. Although price indices reflect the current advertised price of properties, acquirers

typically have to wait until the end of current leases to renegotiate prices with existing tenants. On observing higher prices from merged landlords, other landlords would then need to wait for an opportunity to renegotiate with their tenants. House prices could then adjust to reflect increased returns to renting.

4.5.2 Impact of mergers on house improvements

Prices are only informative about one component of neighborhood welfare. It is possible that the observed price increases for houses and rents are accompanied by improved quality of housing. In fact, institutional investors state that they make improvements to the houses they own, with Invitation Homes estimating it makes improvements of $25,000 on average to each home in its portfolio. According to the model presented in this paper, institutional investors are likely to make the most improvements to properties in areas where they have the highest concentration of ownership because improvements within a concentrated area are more likely to improve neighbourhood quality (with associated increases in rent and house prices).

To test if institutional investors make more improvements to houses within neighbourhoods in which they own a larger share of houses, I estimate the following difference-in-difference model for property-level valuations following each merger:

$$\begin{aligned} ln(\text{Valuation}_{i,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x Treat}_n + \beta_4 \text{Merged Landlord}_{i,t} \\ + \beta_5 \text{Post}_t \text{ x Merged Landlord}_{i,t} + \beta_6 \text{Treat}_n \text{ x Merged Landlord}_{i,t} \\ + \beta_7 \text{Post}_t \text{ x Treat}_n \text{ x Merged Landlord}_{i,t} + \gamma_{n,t} + \epsilon_{n,t} \end{aligned} \quad (4.7)$$

$ln(\text{Valuation}_{i,n,t})$ is the County Tax Assessor's valuation of property i in neighbourhood n in period t. Treatment and timing variables are defined similarly to in the price regressions. Post_t is a binary variable that takes the value of 1 for neighbourhood-year

observations following a merger. Treat_n indicates treatment for neighbourhood n in a merger. In these regressions, I use census tracts (which are significantly more granular than zips) to define treated neighborhoods. To evaluate the impact of ownership by a merged firm, I introduce the binary variable $\text{Merged Landlord}_{i,t}$ that is equal to 1 if property i is owned by either the acquirer or the target at period t. I include neighbourhood x year fixed effects, $\gamma_{n,t}$, to control for time-varying characteristics at the neighbourhood level. Hence, neighbourhood-level conditions, such as local economic performance and demographics, would not confound the estimated treatment of institutional landlord mergers on local home valuations. After controlling for these fixed effects, the DiD estimates captures the impact of ownership by a merged landlord on property valuations post-merger within each neighbourhood.

Table 4.5 shows the results of this regression. I find no evidence that valuations for properties owned by merged landlords are significantly higher in regions in which the landlord increased its market share as a result of a merger. Rather, in some specifications, the tax valuations of properties owned by the merged landlord fall in neighborhoods in which the merged landlord increased its share of ownership as a result of the merger. This may suggest that the loss of competitive pressure as a result of mergers overrides any benefit from economies of scale such that institutional investors do not make improvements to properties in neighborhoods where they have a higher market share post-merger. However, further analysis in Panel C of 4.5 shows that there is no change in the tax assessors' assessment of the condition (quality) of properties owned by the merged landlords around mergers. These seemingly contradictory findings could be a consequence of tax valuations not incorporating the value of any improvements made to properties. This would occur if the tax assessor valuations were successfully appealed to minimize the merged landlord's tax obligations. I examine this explanation for reduced valuations in section 4.5.3.

To further isolate the changes in property improvements post merger, I divide merged landlords' properties in acquirer-owned properties and target-owned properties in the

following regression:

$$ln(\text{Valuation}_{i,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x } \text{Treat}_n + \beta_4 \text{Acquirer}_{i,t} + \beta_5 \text{Post}_t \text{ x } \text{Acquirer}_{i,t} + \beta_6 \text{Treat}_n \text{ x } \text{Acquirer}_{i,t} + \beta_7 \text{Post}_t \text{ x } \text{Treat}_n \text{ x } \text{Acquirer}_{i,t} + \beta_8 \text{Target}_{i,t} + \beta_9 \text{Post}_t \text{ x } \text{Target}_{i,t} + \beta_10 \text{Treat}_n \text{ x } \text{Target}_{i,t} + \beta_11 \text{Post}_t \text{ x } \text{Treat}_n \text{ x } \text{Target}_{i,t} + \gamma_t + \epsilon_{n,t} \quad (4.8)$$

Table ?? in the Appendix presents the results from this regression. It shows that the valuation of acquirer-backed properties significantly decreases following the merger. If we believe tax valuations are informative, this result is consistent with the finding that there is no evidence that acquirer's make more improvements to properties in neighborhoods in which they have a higher concentration of ownership.

Permitting Activity

Since tax assessors valuations are prone to appeals, they may not be sensitive to changes in housing quality. Therefore, to better understand changes in the quality of housing in a neighborhood following an institutional merger, I examine applications for home improvement permits. Permits are required for any home improvements that make structural modifications to a property. Such changes could include the addition of a pool, another bedroom, a resurfaced driveway or roof, or a new fence. However, permits are not required for cosmetic changes even if significant (e.g. entire kitchen or bathroom refits or painting the entire house), so this analysis represents a low estimate of the quality changes that take place in a neighborhood following an institutional merger.

To estimate the impact of increased concentration of institutional ownership on housing

quality, I run the following regressions:

$$ln(1+\text{Permits}_{g,n,t}) = \alpha+\beta_1\text{Post}_t+\beta_2\text{Treat}_n+\beta_3\text{Post}_t \text{ x } \text{Treat}_n+\gamma_{c,t}+\zeta_n+\text{C}_{n,t}+\epsilon_{n,t} \quad (4.9)$$

$ln(1+Permits_{g,n,t})$ is the natural logarithm of 1 plus the count of permits issued to group g around mergers in neighborhood (census tract) n, in period t. Post_t is a binary variable that takes the value of 1 for year observations following a merger. Treat_n indicates treatment for neighborhood n. I include county x year fixed effects, $\gamma_{c,t}$, and neighborhood fixed effects, ζ_n, in all specifications. I also include time-varying neighborhood controls $\text{C}_{n,t}$ including number of one-to-four family homes (to account for changes in home supply), lag house prices, total number of mortgage applications (originations), population, and lagged investor approvals (to control for changes in rental supply). I cluster standard errors at the neighborhood (census tract) level.

Table 4.7 summarizes the results of these regressions. Further tables showing the full set of regression results including all controls are available in the Appendix G. I find that owner occupiers apply for 79% more permits and small investors apply for 47% more permits in neighborhoods that experienced an increase in concentration of institutional ownership following a merger. There is no change in the permitting activity of either larger investors or institutional SFR investors.

For owner occupiers, the increase in permitting is consistent with a wealth effect where rising house prices following the merger enable households to borrow more to make improvements to their homes. For small investors ('mom and pop' landlords) this is suggestive of a change in competitive pressures in the neighborhood. As the model proposed in this paper implies, it is beneficial for landlords to offer different quality properties in order to minimize competitive pressures. The finding that small investors increase their permitting activity when SFR investors do not implies that small investors may aim to

offer 'high quality' rental properties within the neighborhood. This suggests that it is smaller landlords that are changing the quality composition of rental property which may limit the supply of affordable rentals to existing/future tenants.

Loans for Home Improvements

One of the shortcomings of permits is that they are only required for specific structural changes to a property. For example, installation of a pool, a deck, or addition of a new room, would require a permit, but cosmetic changes (including to household fixtures) would not.[31] For this reason, permit data represents a low estimate of all improvements that may be taking place in a neighborhood at a given time. I supplement the analysis of permits with an analysis of loans for home improvements. [32] I disaggregate improvement data by borrower type (owner occupier or self-reported investor) to explore differences in home improvements between owner types. [33]

$$ln(1 + \text{Value Applications}_{g,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x Treat}_n + \gamma_{c,t} + \zeta_n + \text{C}_{n,t} + \epsilon_{n,t} \tag{4.10}$$

$$ln(1 + \text{Value Originations}_{g,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x Treat}_n + \gamma_{c,t} + \zeta_z + \text{C}_{n,t} + \epsilon_{n,t} \tag{4.11}$$

$ln(1 + \text{Value Applications}_{g,n,t})$ is the natural logarithm of 1 plus the mean value of applications by owner type g around a merger in neighborhood (census tract) n in period t. Similarly, $ln(1 + \text{Value Originations}_{g,n,t})$ is the natural logarithm of 1 plus the mean value of loan originations by group g around a merger in neighborhood n in period t. As

[31] For example, a extensively renovated kitchen with all new appliances and cabinetry would not require a permit unless structural changes were made.

[32] HMDA data splits loan applications by loan purpose so I am able to consider loans for home improvements separately to loans for other purposes (purchase or refinancing).

[33] SFR investors borrow via securitization so investors in this context are small investors who do borrow in local credit markets.

before, Post_t is a binary variable that takes the value of 1 for year observations following a merger and Treat_n indicates treatment for neighborhood n in a merger. I include county x year fixed effects ($\gamma_{c,t}$) and neighborhood fixed effects (ζ_n) in all specifications. I also include time-varying neighborhood controls $\text{C}_{n,t}$ including number of one-to-four family homes (to account for changes in home supply), lag house prices, median income, and lagged investor approvals (to control for changes in rental supply) in some specifications. I cluster standard errors at the neighborhood (census tract) level.

Table 4.6 presents summary results from these regressions. Further tables showing the full set of regression results including all controls are available in the Appendix G. I find that the value of all home improvements loans (both applications and approvals) increases following an institutional merger. When I disaggregate by owner type, I find that this effect is due to owner occupiers rather than investors. Owner occupiers increase the value of their applications by between 20-37% in the four years following an institutional merger in the neighborhood. Increased loans for home improvements could be a result of a relaxation of the borrowing constraint for owner occupiers who are able to obtain higher credit to make improvements to their houses, potentially due to house prices increases following the merger. This finding is consistent with the previous literature that has found higher house prices correlate with increased borrowing as a result of collateral effects (Cloyne et al. (2019)).

However, there is no significant change in the value of loans applied for or approved by investors. This is suggestive that small investors do not borrow to make improvements to their properties in order to compete more effectively with institutional owners.

Hence, both the permitting and home loan data suggests that it is owner occupiers rather than investors that make improvements to housing quality following institutional mergers. To the extent that visible home improvements induce home improvements by one's neighbors (Kuhn et al. (2011)) it appears that it is owner occupiers that influence changes in housing quality rather than housing investors.

4.5.3 Tax Assessor Appeals by Investor Type

Local taxes are charged on the basis of tax assessor house valuations. Hence, one reason we may observe lower home valuations in institutional-owned properties is if institutional investors appeal valuations more than other owner types in order to minimise their tax obligations. I test this hypothesis by running the following regression:

$$Appeal_{i,t} = \alpha + Type_{i,t} + \zeta_{n,t} + \gamma_t + \epsilon_{i,t} \tag{4.12}$$

where $Appeal_{i,t}$ is the incidence of an appeal by property i in year t. $Type_{i,t}$ is the type of owner, which is delineated into the familiar categories: owner-occupier, tiny investor (1 investment property), small investor (between 1 and 10 investment properties), medium investor (between 10-50 investment properties), large investor (more than 50 properties), and institutional investor. In some specifications I include neighbourhood (tract) x time fixed effects, $\zeta_{n,t}$.[34] Standard errors are clustered at the property level.

Table 4.8 presents the results of these regressions. I find that institutional ownership is highly correlated with appeals. Indeed, the probability of an institutional investor appealing a valuation is 16.8%, which is higher than any other investor type. This finding is robust to the inclusion of tract x year fixed effects that control for changes in underlying neighbourhood quality and different tax assessors. I find that the probability of an appeal is increasing in the logarithm of the tax assessor's valuation of the property, so appeals tend to be launched where the value of the underlying property is higher.

I find all investor types are more likely than owner-occupiers to appeal their property's valuation. I present these probabilities from the baseline regression in (1) in Table 4.9. I find that the probability of an appeal is increasing in investor size, even once underlying characteristics of the neighborhood and property values are controlled for. This suggests

[34]For robustness, I also use county (rather than tract) fixed effects. These account for differences between tax assessors and are fully absorbed at the more discrete neighbourhood level. There is qualitatively no difference in the analysis.

that larger investors may be more active in trying to minimise their tax obligations. This also implies that there may be economies of scale in efficiently mounting tax appeals.

A high appeal frequency does not imply that these appeals were aimed at reducing the taxable value of the property. Hence, in the subsequent analysis I restrict the data to appeals on the basis of valuation. [35] I choose to focus on appeals on the basis of valuation for two reasons. First, I am interested in studying how institutional investment impacts the communities in which it occurs. One of the channels through which institutional investors purport to add value to communities is through the payment of local taxes.[36] Hence, appeals against taxable valuations are directly relevant to the community impact of these investors. Second, the data does not specify whether an appeal is "successful" or not. The data only reports the final valuation settled upon during the appeals process. Hence, only appeals on the grounds of valuation can be classified unambiguously as successful or not using this output.[37]

In Table 4.10, I present the results from the following regression:

$$Success_{i,t} = \alpha + Type_{i,t} + \zeta_{n,t} + \epsilon_{i,t} \tag{4.13}$$

where $Success_{i,t}$ is a binary variable that equals 1 if the final valuation of property i in year t is less than the board of assessors' valuation for that property in that year. $Type_{i,t}$ is the type of owner, which is delineated into the familiar categories: owner-occupier, tiny investor (1 investment property), small investor (between 1 and 10 investment properties), medium investor (between 10-50 investment properties), large investor (more than 50 properties), and institutional investor. In some specifications I include neighbourhood

[35] Other grounds for appeal include the uniformity of the property, the taxability of the property, the denial of a tax exemption to the property, a taxpayer breach of a covenant on the property, and the denial of a covenant to the property.

[36] For example, Invitation Homes refers to the local taxes it paid as an example of its positive impact on the communities in which it operates.

[37] Although a successful appeal on the basis of one of the other grounds may result in a reduced valuation, it is not clear that this was the primary objective of the appeal and hence we cannot classify such appeals as successful or otherwise purely on the basis of the final valuation.

(tract) x year fixed effects, $\zeta_{n,t}$. Standard errors are clustered at the property level.

I find that all investor types except tiny investors (those with only one investment property) have a higher probability of a successful appeal than owner occupiers. This result is even stronger once I consider the inclusion of evidence in the appeal and the valuation of the underlying property. Institutional investors have a similar probability of success to small investors, and a lower probability than medium and large investors. This result is consistent with the different investment strategies across investor types. Medium and large investors hold their properties for a much shorter period than smaller (or institutional) investors. This is consistent with a "buy to sell" investment strategy that may see these investors may develop (or make improvements to) properties with the intention of selling them immediately following completion of the works.[38] Properties that have been developed or undergone significant change are more difficult to assign a market value to due to a limited transaction history of properties of a similar age or with similar characteristics. This could explain the relative success of appeals from these investor types over other owner types.

Table 4.11 quantifies the reduction in taxable valuation of successful appeals by investor type. It presents the results from the following regression:

$$AppealSize_{i,t} = \alpha + Type_{i,t} + \zeta_{n,t} + \epsilon_{i,t} \tag{4.14}$$

where $AppealSize_{i,t}$ is either unscaled or scaled. In the unscaled regression, $AppealSize_{i,t}$ is defined as (1 plus) the logarithm of the difference between the board of assessors' valuation and the final valuation resolved upon as a result of the appeal. The scaled regression defines $AppealSize_{i,t}$ as the difference between the board of assessors valuation and the final valuation divided by the difference between the board of assessors' valuation and the valuation asserted by the taxpayer. Hence, the scaled regression measures the

[38] A low holding period would also be consistent with house flipping.

degree of success of the appeal, i.e. the proportion of the difference between the taxpayer's assert value and the board of assessor's value that the taxpayer recovered as a result of the appeal. $Type_{i,t}$ is the type of owner, which is delineated into the familiar categories: owner-occupier, tiny investor (1 investment property), small investor (between 1 and 10 investment properties), medium investor (between 10-50 investment properties), large investor (more than 50 properties), and institutional investor. In some specifications I include neighbourhood (tract) x year fixed effects, $\zeta_{n,t}$. Standard errors are clustered at the property level.

In the unscaled regression, I find that smaller investors experience significantly larger reductions in property valuations as a result of successful appeals than owner occupiers. Conversely, larger investors and institutional owners experience significantly smaller reductions in valuations than owner occupiers as a result of successful appeals. This could be due to the frequency of appeals: smaller investors appeal less frequently so may obtain larger reductions (if we assume that valuations become additively misaligned over time).

It could be that tax assessors impose unfairly high valuations on institutional owners' properties in order to extract greater tax revenue from them. If that were the case, tax appeals could reflect institutional investors aiming to argue their valuations down to a "fair" level. To evaluate the economic significance of these appeals, I compare the sale price of properties to the tax valuation in the following regression:

$$\text{Valuation Difference}_{i,t} = \alpha + Type_{i,t} + \zeta_{n,t} + C_{i,t} + \epsilon_{i,t} \tag{4.15}$$

where Valuation $\text{Difference}_{i,t}$ is equal to the sale price of property i in period t minus the tax valuation of property i in period $t-1$. $\text{Type}_{i,t}$ indicates the owner type (as detailed in the above specifications). I include neighborhood x year fixed effects ($\zeta_{n,t}$) and controls $C_{i,t}$ for the number of previous appeals in the regressions. I cluster errors at the property level.

Table 4.12 presents the results of these regressions. I find a large and significant difference between the valuation difference for institutional investors and owner occupiers. In particular, the valuation difference for institutional investors is over four times higher than that of owner occupiers. Assuming a tax rate of 1% and the median house price of institutional investors in the sample, this implies tax savings of $747 per house per year. Across 280,000 institutional properties in the United States, this represents tax savings of over $209m per annum or $4.1b when capitalised with a 5% discount rate.

4.5.4 Neighborhood Composition

Finally, I explore the impact of increased institutional ownership on neighborhood composition using using HMDA data. HMDA data can be split into two samples: (1) applications for loans and (2) loan originations. Loan applications indicate preferences/demand for a particular neighborhood whereas loan originations indicate realized movement into a neighborhood. Hence, loan applications and originations are separately informative as to perceived desirability and observed changes within neighborhoods. For each institutional merger, I estimate the following difference-in-difference model for mortgage applications and originations:

$$ln(\text{Applications}_{g,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x } \text{Treat}_n + \gamma_{c,t} + \zeta_n + \text{C}_{n,t} + \epsilon_{n,t} \tag{4.16}$$

$$ln(\text{Originations}_{g,n,t}) = \alpha + \beta_1 \text{Post}_t + \beta_2 \text{Treat}_n + \beta_3 \text{Post}_t \text{ x } \text{Treat}_n + \gamma_{c,t} + \zeta_n + \text{C}_{n,t} + \epsilon_{n,t} \tag{4.17}$$

$ln(\text{Applications}_{g,n,t})$ is the natural logarithm of the count of applications by group g around a merger in neighborhood (census tract) n in period t. Similarly, $ln(\text{Originations}_{g,n,t})$ is the natural logarithm of the count of loan originations by group g around a merger in neighborhood n in period t. Post_t is a binary variable that takes the value of 1 for

year observations following a merger and Treat_n indicates treatment for neighborhood n in a merger. I include county x year fixed effects, $\gamma_{c,t}$, and neighborhood fixed effects, ζ_n, in all specifications. I also include time-varying neighborhood controls $\text{C}_{n,t}$ including number of one-to-four family homes (to account for changes in home supply), lag house prices, total number of mortgage applications (originations), population, and lagged investor approvals (to control for changes in rental supply). I cluster standard errors at the neighborhood (census tract) level.

Table 4.13 presents a summary of the regressions for loan applications by racial/ethnic group. Similarly, Table 4.14 presents a summary of the regressions for loan originations by racial/ethnic group within a neighborhood. Both applications and approvals indicate that neighborhoods are becoming more diverse following institutional mergers. Loan applications (originations) by Black/African Americans are higher by 2.84 (1.35) in neighborhoods in which there was a large increase in concentration following a merger. This corresponds to an application (origination) rate that is 17.9%(15.4%) higher on average relative to neighborhoods that did not experience a large increase in concentration after an institutional merger. Applications (originations) by Latino/Hispanic people are higher by 1.51 (0.86) which corresponds to an application (origination) rate 23.4% (20.8%) higher in neighborhoods that experienced a large increase in concentration as a result of an institutional merger. These findings are robust to the inclusion of a number of controls for housing supply, changes in rental supply, house prices, etc. A careful examination of pre-trends contained in Figure 4.5 and Figure 4.6 reveals that there is a pre-trend in applications in the three years prior to the merger. Three years prior to the merger, loan applications/originations are lower in merged neighborhoods for most non-white groups. This can be explained by the timing of the mergers with respect to the Great Recession (three years prior to merger is 2013 for two of the mergers). Institutional investors had only just entered the market and were predominantly buying in high foreclosure neighborhoods. Hence, the finding that there was depressed demand in neighborhoods that would later go on have overlap between institutional portfolios is not surprising: this

was precisely what made these neighborhoods so attractive for institutional investment. What is crucial for this study is that increased institutional investment has not dampened demand by minorities. In fact, these trends have continued in the post-merger period.

This increase in demand for properties in merged neighborhoods from Black and Latino/Hispanic applicants corresponds with a decline in demand from white and mixed race applicants. Applications (originations) by non-Hispanic/Latino white people are lower by 2.6 (2.1) in neighborhoods that experienced a large increase in concentration of institutional ownership following a merger. This corresponds to an application (origination) rate that is 6.7% (8.0%) lower in neighborhoods that experienced a large increase in concentration of institutional ownership following a merger. Similarly, mixed race/ethnicity applications (originations) are lower by 0.42 (0.37) in neighborhoods that experienced a large increase in concentration of institutional ownership as a result of a merger. This corresponds to an application (origination) rate that is 21% (28%) lower than in neighborhoods that did not experience an increase in concentration of institutional ownership.

One possible explanation for the increased desirability among people of colour for neighborhoods in which there is a higher concentration of institutional ownership is that institutional investment increases the supply of rental housing.[39] In Atlanta, 52% of households that rent are Black/African American (whereas the total share of Black households in Atlanta is only 37.5% so Blacks are disproportionately represented among renters).[40] For this reason, an increase in rental housing may enable an increase in the number of Black households in a neighborhood. Increased diversity within a neighborhood may make neighborhoods relatively more attractive for POC to purchase housing all else equal. Coefficients from regressions incorporating the lag of investor mortgage originations (as a proxy for rental property growth) are indicative of this. Black/African American applications have a positive and significant correlation with increased investor purchases whereas

[39] I observe this in my data and this is also consistent with the finding of Lambie-Hanson et al. (2019) that owner occupancy falls in neighborhoods that have higher investor activity.

[40] This data is available from the Atlanta Regional Council.

white applicants have a negative and significant relationship with such purchases.

4.6 Conclusion

This paper examines the impact of increased concentration of institutional ownership of residential housing on neighborhoods. I use a series of national mergers to examine three channels through which institutional ownership may affect communities. First, I directionally confirm previous findings that increased concentration of institutional ownership is associated with higher house and rental prices. I find house prices increase by 6.0% and rental prices by 3.5% in the three years following an institutional merger in neighborhoods that experience a large change in concentration of institutional ownership as a result of a merger.

Higher house and rental prices relax households' borrowing constraint that induces greater spending on home improvements by owner occupiers and small investors. I find that owner occupiers and small investors apply for more permits for home improvement and higher value loans for home improvement in the years following an institutional merger in their neighborhood. In the four years following a merger, owner occupiers are issued with 78% more permits and apply for home improvement loans that are 54% higher in value in neighborhoods in which there was a change in concentration of ownership as a result of an institutional merger. Investors that own less than 10 properties ('small' investors) have a similar increase in permitting activity with 47% more permits issued to small investors in neighborhoods that experience an increase in concentration of institutional ownership.

There is no evidence that institutional investors make more home improvements to properties in areas in which they have an increased market share as a result of a merger. In fact, property valuations for houses owned by the merged landlord are lower in areas in which they gain a larger market share following a merger. I rationalize this finding through forensic examination of tax appeals. I find institutional investors appeal property

valuations with a frequency of 16.8% (over 18 times the rate at which owner occupiers appeal). Tax appeals by institutional investors are more successful at reducing the property valuation than appeals by owner occupiers. Once I control for the difference between the tax assessor and owner valuations, there is no difference in the size of the reduction in property valuation obtained as a result of a successful appeal across owner types. These appeals are economically significant. Assuming a property tax rate of 1% and the median difference between tax and realized (sale) valuation, institutional investors are saving $4.1b through tax appeals. This finding suggests that tax minimization may be another source of value-add pursued by private equity backed companies.

Increased institutional ownership correlates with greater racial and socio-economic diversity in neighborhoods. High house prices following institutional mergers do not reduce diversity of home loan applications or approvals. Rather, I find that home loan applications and approvals for people of color increase in neighborhoods in which there is a greater concentration of institutional ownership following a merger. One potential reason for this is that higher rent prices following a merger may create a greater supply of rental housing. In Atlanta, a large share of rental housing is used by people of color, so a greater supply of rental housing may encourage greater neighborhood diversity. Increased diversity may be a factor that makes a neighborhood more attractive when purchasing a home, especially for minority communities.

To conclude, this paper finds that increased concentration of institutional ownership has nuanced effect on communities. Although it is correlated with increased prices, it seems to generate greater improvements to housing quality, both in rental and owner-occupied homes. Crucially, I find no evidence that increased concentration of ownership results in less diverse neighborhoods. One caveat to this analysis is that Atlanta is one of the areas in the country that has seen the highest levels of institutional ownership, so there are questions as to whether we would observe the same effects in areas where institutional ownership is lower or more dispersed. Further work will examine a national sample to

test the external validity of these findings.

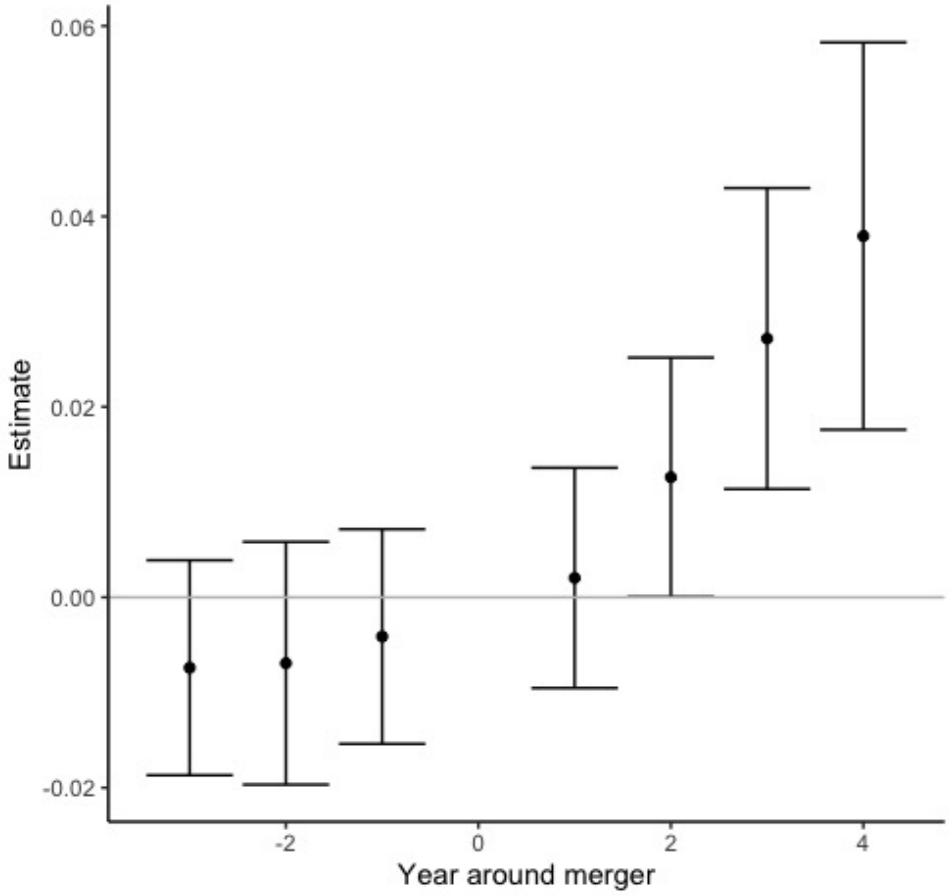


Figure 4.1: Difference in rent between overlapped and non-overlapped properties around mergers

This figure presents the coefficients from a regression of the Zillow Rent Index on the interaction between treatment and the year in relation to the merger. A zip is treated if the acquirer gained 20 properties or more in zip z as a result of the merger. Control zips include all zips in which the acquirer owned at least one property prior to the merger. I include county x year and zip fixed effects in the regression, and cluster standard errors at the zip level. The horizontal axis shows three years prior to the merger until four years after the merger. The vertical access represents the difference between treated and control zips in terms of the natural logarithm of the Zillow Rent Index. Each estimate is presented with 95% error bands.

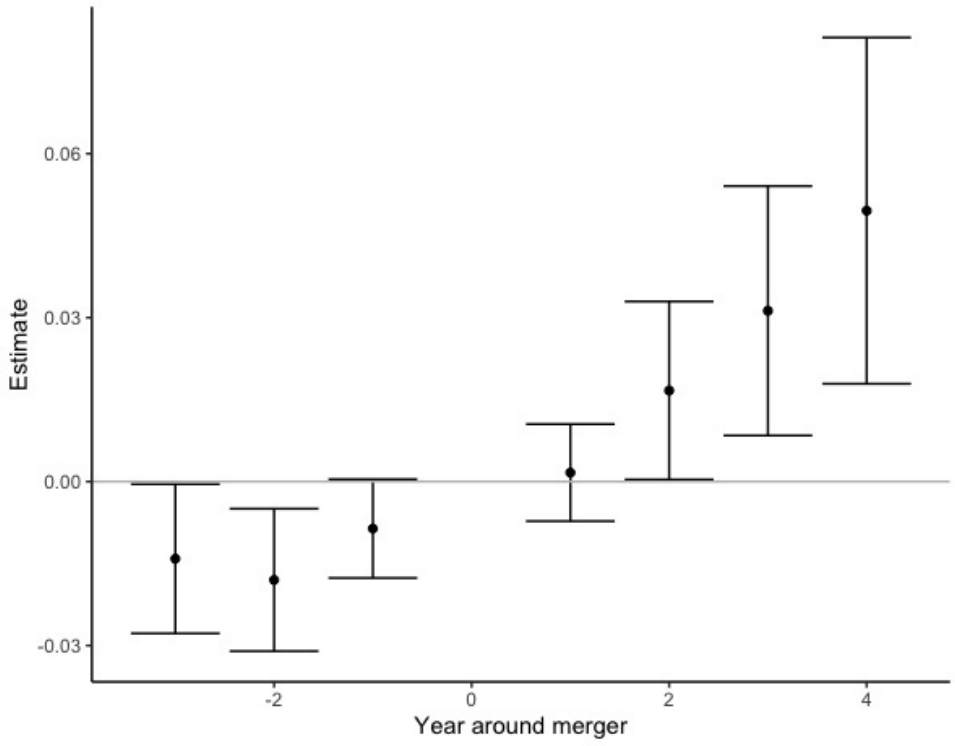
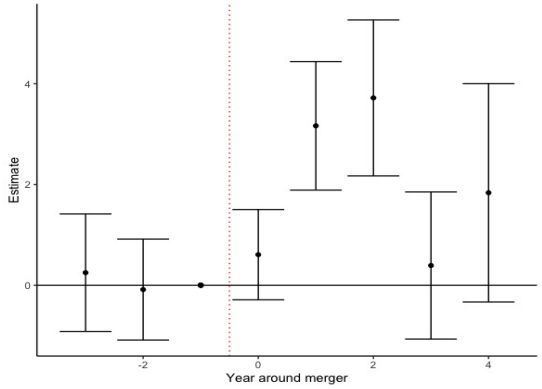
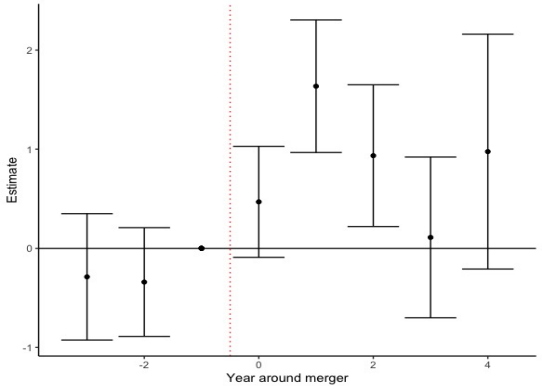


Figure 4.2: Difference in house prices between overlapped and non-overlapped properties around
mergers

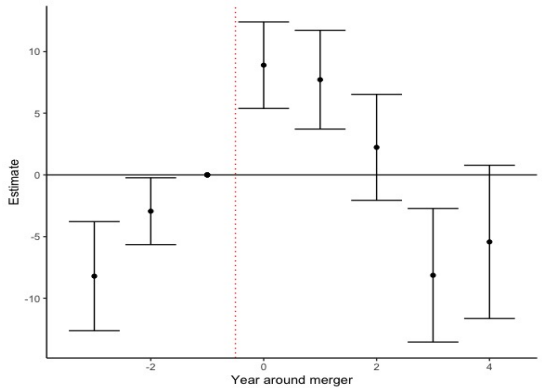
This figure presents the coefficients from a regression of the Zillow House Price Index on the interaction between treatment and the year in relation to the merger. A zip is treated if the acquirer gained 20 properties or more in zip z as a result of the merger. Control zips include all zips in which the acquirer owned at least one property prior to the merger. I include county x year and zip fixed effects in the regression, and cluster standard errors at the zip level. The horizontal axis shows three years prior to the merger until four years after the merger. The vertical access represents the difference between treated and control zips in terms of the natural logarithm of the Zillow House Price Index. Each estimate is presented with 95% error bands.



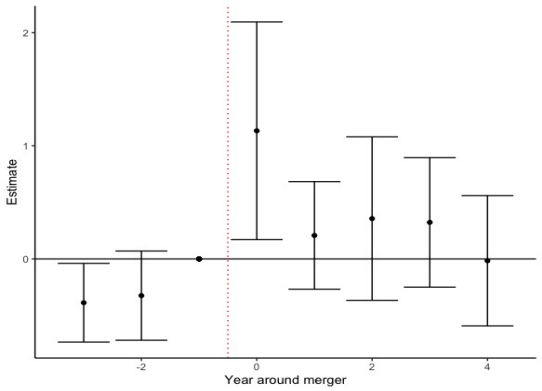
(a) Permits Issued to Owner Occupiers



(b) Permits Issued to Small Investors



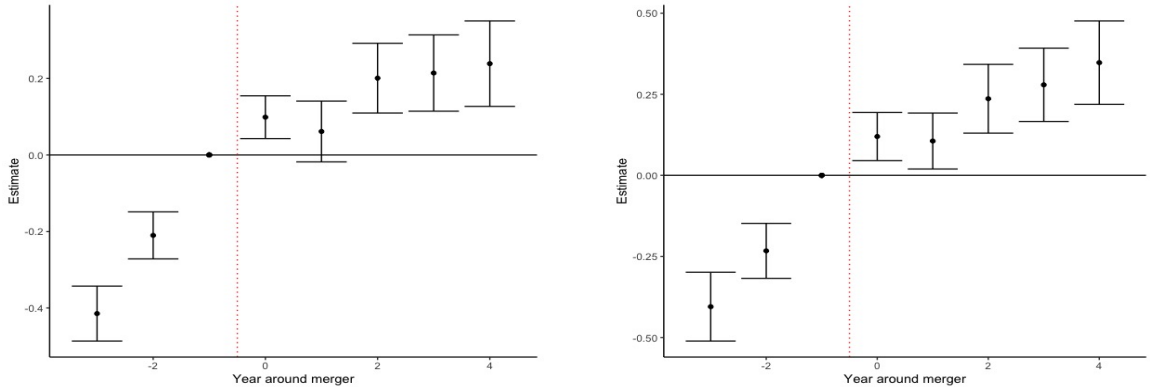
(c) Permits Issued to Large Investors



(d) Permits Issued to SFR Investors

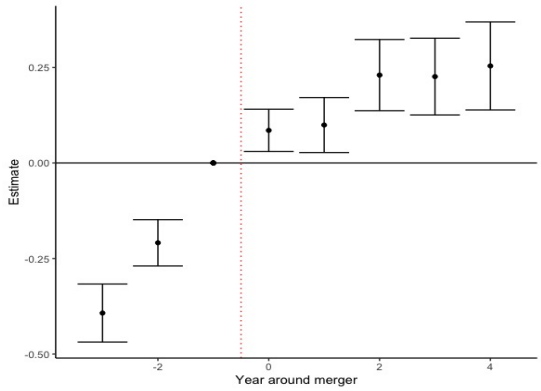
Figure 4.3: Difference in permits by investor type between overlapped and non-overlapped properties around mergers

This figure presents the coefficients from a regression of permit issuances by investor type on the interaction between treatment and the year in relation to the merger. A census tract is treated if the acquirer gained at least one property in tract t as a result of the merger. Control tracts include all tracts in which the acquirer owned at least one property prior to the merger. I include county x year and tract fixed effects in the regression, and cluster standard errors at the tract level. I include controls as specified in equation 4.9. The horizontal axis shows three years prior to the merger until four years after the merger. The vertical access represents the difference between treated and control tracts in terms of the natural logarithm of mortgage applications. Each estimate is presented with 95% error bands.

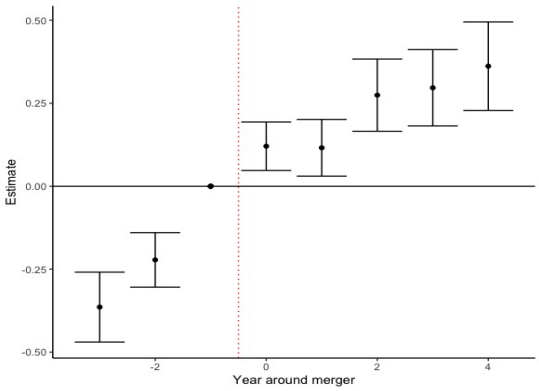


(a) All Applications

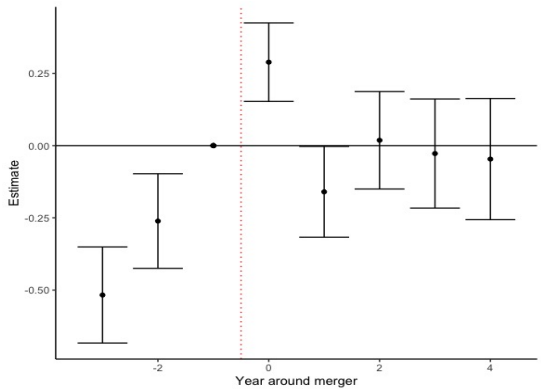
(b) All Loans



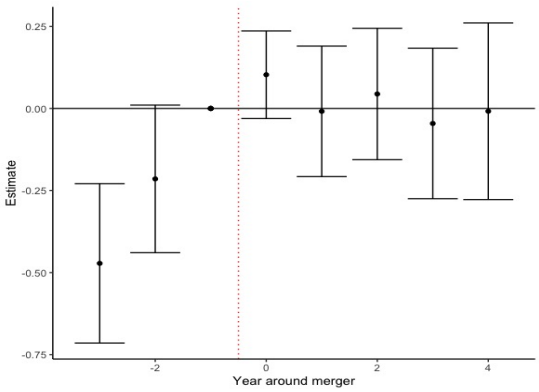
(c) Owner Occupier Applications



(d) Owner Occupier Loans



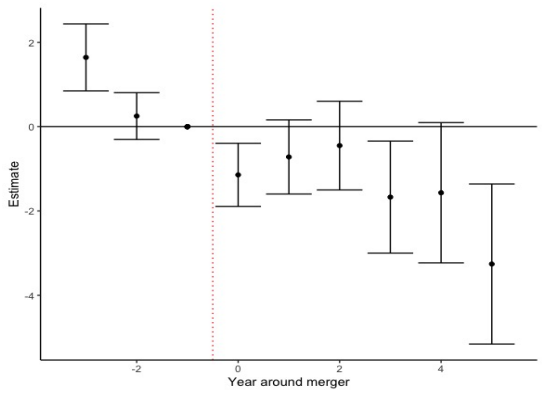
(e) Investor Applications



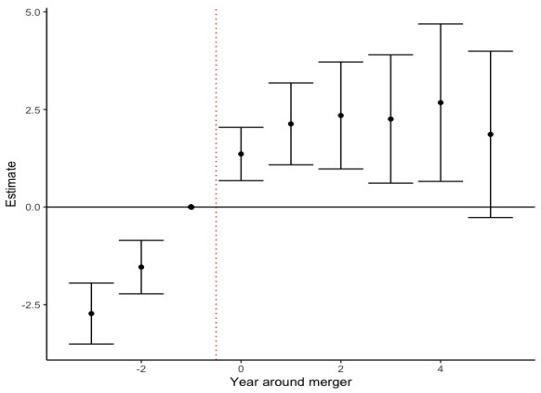
(f) Investor Loans

Figure 4.4: Difference in mean value for home improvements loans by investor type between overlapped and non-overlapped properties around mergers

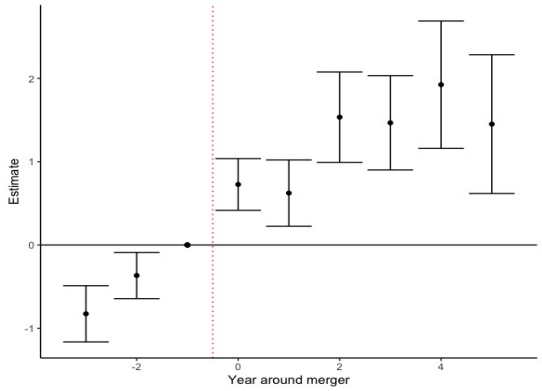
This figure presents the coefficients from a regression of the mean value of home improvements loan applications and approvals by investor type on the interaction between treatment and the year in relation to the merger. A census tract is treated if the acquirer gained 20 properties or more in tract t as a result of the merger. Control tracts include all tracts in which the acquirer owned at least one property prior to the merger. I include county x year and tract fixed effects in the regression, and cluster standard errors at the tract level. I include controls as specified in equation X. The horizontal axis shows three years prior to the merger until five years after the merger. The vertical access represents the difference between treated and control tracts in terms of the natural logarithm of mortgage applications. Each estimate is presented with 95% error bands.



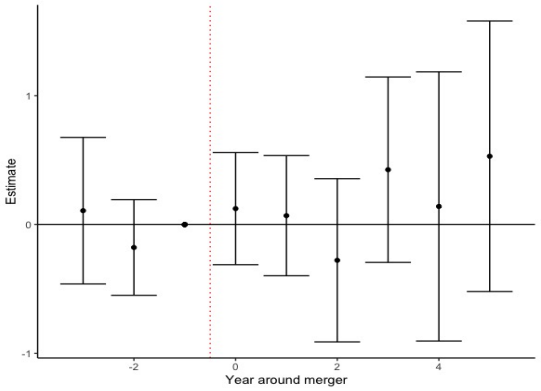
(a) White applications



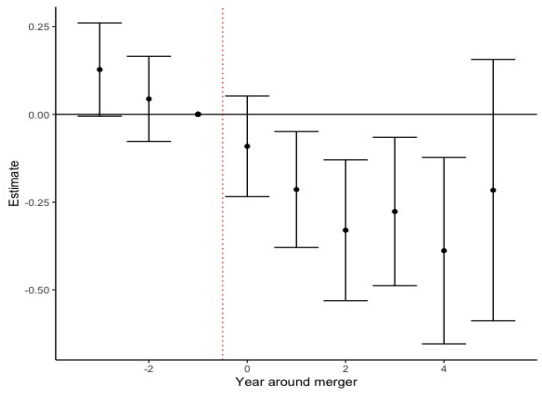
(b) Black/African American applications



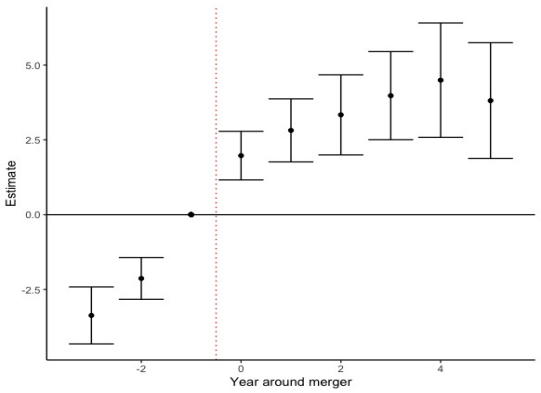
(c) Latino/Hispanic applications



(d) Asian applications



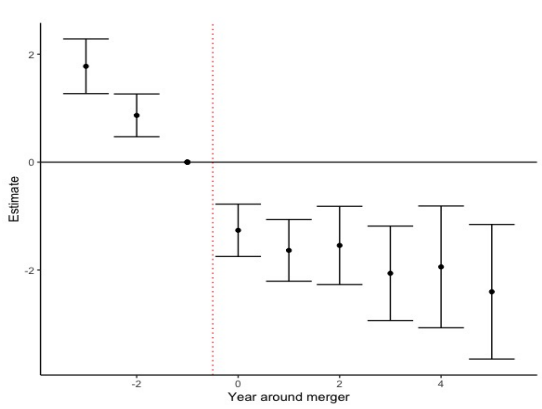
(e) Mixed-race/ethnicity applications



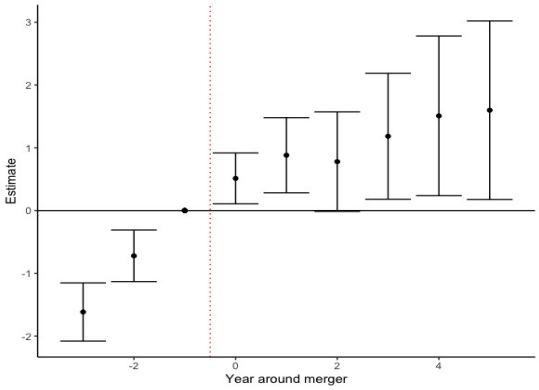
(f) Non-white applications

Figure 4.5: Difference in mortgage applications by race/ethnicity between overlapped and non-overlapped properties around mergers

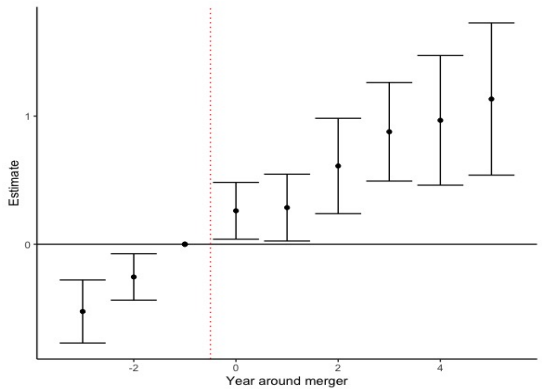
This figure presents the coefficients from a regression of mortgage applications by race on the interaction between treatment and the year in relation to the merger. A census tract is treated if the acquirer gained at least one property in tract t as a result of the merger. Control tracts include all tracts in which the acquirer owned at least one property prior to the merger. I include county x year and tract fixed effects as well as controls detailed in 4.16 in the regression, and cluster standard errors at the tract level. The horizontal axis shows three years prior to the merger until five years after the merger. The vertical access represents the difference between treated and control tracts in terms of the natural logarithm of mortgage applications. Each estimate is presented with 95% error bands.



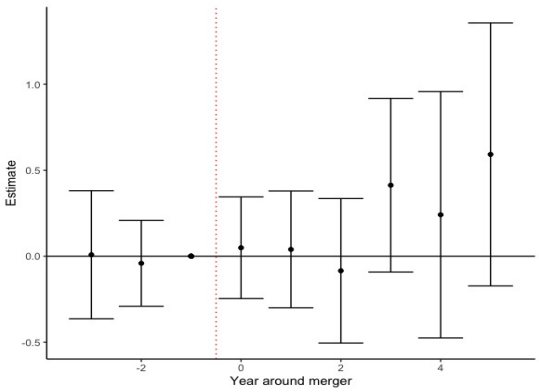
(a) White mortgage originations



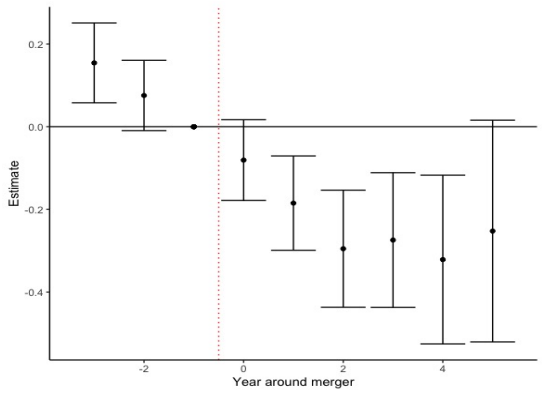
(b) Black/African American mortgage originations



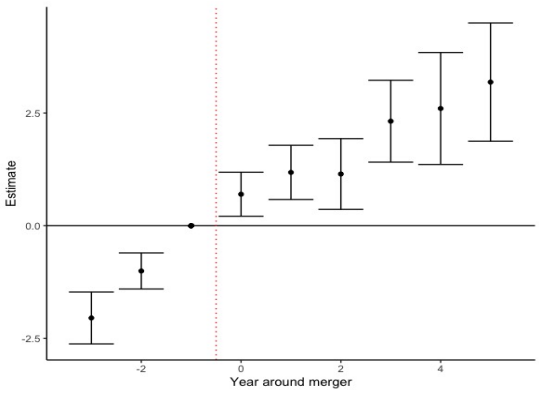
(c) Latino/Hispanic mortgage originations



(d) Asian mortgage originations



(e) Mixed-race/ethnicity mortgage originations



(f) Non-white mortgage originations

Figure 4.6: Difference in mortgage originations by race/ethnicity between overlapped and non-overlapped properties around mergers

This figure presents the coefficients from a regression of mortgage originations by race on the interaction between treatment and the year in relation to the merger. A census tract is treated if the acquirer gained at least one property in tract t as a result of the merger. Control tracts include all tracts in which the acquirer owned at least one property prior to the merger. I include county x year and tract fixed effects in the regression, and cluster standard errors at the tract level. The horizontal axis shows three years prior to the merger until five years after the merger. The vertical access represents the difference between treated and control tracts in terms of the natural logarithm of mortgage applications. Each estimate is presented with 95% error bands.

Table 4.1: Summary of mergers in analysis

Acquirer			Target			Transaction Details		
Name	*Properties in ATL*	*% Portfolio in ATL*	*Name*	*Properties in Atlanta*	*% Portfolio in Atlanta*	*Announced Date*	*Completion Date*	*Transaction Value (US$m)*
IH	7,517	20.6%	CSH	5,540	17.8%	10 Aug 2017	16 Nov 2017	8,604
SW	2,475	19.2%	CA	3,206	18.0%	21 Sep 2015	5 Jan 2016	7,700
TAH	1,062	13.7%	SBRT	2,949	32.6%	27 Feb 2017	9 May 2017	1,503
AH4R	2,802	7.2%	ARP	1,062	11.9%	3 Dec 2015	29 Feb 2016	1,429

This table presents details of the horizontal mergers of institutional SFR investors used in the analysis in the paper. The following abbreviations are used: IH = Invitation Homes; CSH = Colony Starwood Homes; SW = Starwood Waypoint; CA = Colony American; TAH = Tricon American Homes; SBRT = Silver Bay Realty Trust; AH4R = American Homes 4 Rent; ARP = American Residential Properties. The number (percentage) of properties in Atlanta are those reported in each company's annual report in the year prior to the merger. Note that Colony American was private before its acquisition by Starwood Waypoint so its financial statements are not public. However, the December 2015 10-K for Starwood Waypoint provides pre- and post-merger portfolio composition from which it is straightforward to calculate Colony American's exposure to Atlanta. Transaction size and transaction annoucement/closed dates come from CapitalIQ. Where this information is missing from CapitalIQ (e.g. in the merger of Colony American and Starwood Waypoint) this information is found in press releases contained in SEC filings relating to the merger.

Table 4.2: Summary statistics

(a) Zip level statistics

Statistic:	N	Mean	P1	Median	P99	SD
Properties (per merger):	169	56.630	0.000	2.000	700.08	143.927
Δ Properties (per merger):	169	28.26	0.000	0.000	360.760	77. 977

(b) Census tract level statistics

Statistic:	N	Mean	P1	Median	P99	SD
Properties (per merger):	981	9.294	0.000	1.667	70.600	17. 521
Δ Properties (per merger):	981	4.650	0.000	0.667	37.400	10.622

(c) Market Share

Statistic:	N	Mean	P1	Median	P99	SD
Zip level:						
Large treatment (pre-merger):	50	0.034	0.005	0.022	0.139	0.034
Large Treatment (post-merger):	50	0.071	0.009	0.050	0.272	0.064
Small treatment (pre-merger):	67	0.013	0.000	0.006	0.089	0.029
Small treatment (post-merger):	67	0.020	0.001	0.011	0.152	0.035
No treatment:	35	0.007	0.001	0.005	0.027	0.007
Census tract level:						
Large treatment (pre-merger):	200	0.066	0.010	0.050	0.210	0.048
Large Treatment (post-merger):	200	0.136	0.030	0.109	0.445	0.089
Small treatment (pre-merger):	448	0.023	0.001	0.016	0.149	0.027
Small treatment (post-merger):	448	0.047	0.005	0.035	0.247	0.047
No treatment:	298	0.026	0.001	0.012	0.312	0.066

This table presents summary statistics for the data used in this paper. Panel A and B present details on the number of properties and change in properties as a result of mergers in zip and census tracts. $Properties(permerger)$ is the average number of properties owned by the merged firms in each zip or census tract. $\Delta Properties(permerger)$ is the number of properties gained by the acquiring firm after each merger in the zip or census tract. Panel C presents the acquirers' market share in overlapped zips and census tracts before and after the merger. Market share is measured by the ratio of the number of properties owned by the merged firm to the number of investor owned properties in a zip or census tract. A neighbourhood is defined as having a"large treatment" if the acquirer gains 20 (10) or more properties in the zip (census tract) as a result of the merger. A neighbourhood is defined as "small treatment" if the acquirer gained at least one but less than 20 (10) properties in that zip (census tract) as a result of the merger.

Table 4.3: Summary Statistics: Prices and Improvements

(a) Rent Prices

Period:	Pre merger			Post merger		
Statistic:	N	Mean	SD	N	Mean	SD
American Homes 4 Rent	1307	1203	112	2092	1381	137
American Residential Properties	736	1214	123	1771	1350	154
Colony American	1797	1153	124	3742	1272	174
Invitation Homes	4944	1233	131	7438	1440	156
Starwood Waypoint	1393	1156	111	3285	1299	169
All	10177	1203	129	18328	1365	175
$I(\Delta Properties) \geq 1$	9914	1205	128	17896	1367	175
$I(\Delta Properties) \geq 20$	8838	1209	124	16473	1368	176
$I(\Delta Properties) = 0$	223	1137	127	290	1332	127

(b) House Prices

Period:	Pre merger			Post merger		
Statistic:	N	Mean	SD	N	Mean	SD
American Homes 4 Rent	63	183223	47086	63	222304	52073
American Residential Properties	565	184612	49286	2002	208513	60067
Colony American	1901	167173	56258	4256	190424	61156
Invitation Homes	5253	185358	56273	8460	232618	57951
Starwood Waypoint	1208	169640	58380	3562	199215	57365
All	10224	179807	54479	20831	214706	60598
$I(\Delta Properties) \geq 1$	86	179719	52425	86	214223	58328
$I(\Delta Properties) \geq 20$	52	176133	42885	52	210251	50966
$I(\Delta Properties) = 0$	30	177974	82342	30	226354	87622

This table presents estimates of difference-in-difference regressions of local rent and house prices around the three mergers of institutional investors. The sample includes the property valuations of properties in merged neighbourhoods, as well as properties in neighbourhoods where at least one acquiring firm owned a property prior to the acquisition. The dependent variable in (a) is the natural logarithm of the Zillow Zip Rental Index of each zip and in (b) is the natural logarithm of the Zillow House Price Index in each zip. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and zip fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.4: Change in neighbourhood prices around mergers

(a) Rent Prices

Dependent variable:	ln(Rent)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
PostxTreat	0.037**	0.034***	0.0001**
	(2.176)	(3.091)	(2.233)
Post	−0.034**	−0.022***	−0.009*
	(-2.267)	(-2.750)	(-1.824)
Treat		−0.022***	−0.00003**
		(-3.143)	(-2.214)
CountyxYear FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Adjusted R^2	0.967	0.967	0.967
Observations	13,979	13,979	13,979

(b) House Prices

Dependent variable:	ln(HousePrice)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
PostxTreat	0.071	0.058***	0.0001***
	(1.164)	(2.636)	(2.692)
Post	−0.063	−0.035**	−0.017*
	(-1.125)	(-2.059)	(-1.889)
Treat		−0.038***	−0.0001**
		(-2.714)	(-2.550)
CountyxYear FE	Yes	Yes	Yes
Zip FE	Yes	Yes	Yes
Adjusted R^2	0.975	0.975	0.975
Observations	14,108	14,108	14,108

This table presents estimates of difference-in-difference regressions of local rent and house prices around the three mergers of institutional investors. The sample includes the property valuations of properties in merged neighbourhoods, as well as properties in neighbourhoods where at least one acquiring firm owned a property prior to the acquisition. The dependent variable in (a) is the natural logarithm of the Zillow Zip Rental Index of each zip and in (b) is the natural logarithm of the Zillow House Price Index in each zip. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and zip fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.5: Tax Assessor Valuations around Mergers

(a) Total Valuations for Properties around Mergers

		Dependent variable: ln(Total Valuation)		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Merged Landlord	Merged x Post x Treat	-0.044***	-0.016	0.001
		(-2.687)	(-0.924)	(0.809)
	Adjusted R^2	0.392	0.392	0.392
(2) Institutional Investor	SFR x Post x Treat	-0.004	0.055**	0.004***
		(-0.224)	(2.094)	(4.098)
	Adjusted R^2	0.393	0.393	0.393
All regressions	Tract x Year FE	Yes	Yes	Yes

(b) Tax Assessor Improvements Valuations around Mergers

		Dependent variable: ln(Improvements Valuation)		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Merged Landlord	Merged x Post x Treat	-0.288***	0.030	0.001
		(-6.383)	(0.327)	(0.369)
	Adjusted R^2	0.275	0.275	0.275
(2) Institutional Investor	SFR x Post x Treat	-0.141	0.254*	0.020***
		(-1.216)	(1.713)	(3.755)
	Adjusted R^2	0.275	0.275	0.275
All regressions	Tract x Year FE	Yes	Yes	Yes

(c) Tax Assessor Home Condition Assessment around Mergers

		Dependent variable: Condition/Quality Grade		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Merged Landlord	Merged x Post x Treat	0.005	-0.046	-0.001
		(0.066)	(-1.109)	(-1.425)
	Adjusted R^2	0.642	0.642	0.642
(2) Institutional Investor	SFR x Post x Treat	0.127***	0.067***	0.0005*
		(5.293)	(4.325)	(1.901)
	Adjusted R^2	0.642	0.642	0.642
All regressions	Tract x Year FE	Yes	Yes	Yes

This table presents estimates of difference-in-difference regressions of property valuations for institutional investor owned properties around the four mergers of institutional investors. The sample includes all properties in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes three years before each merger until four years after. The dependent variable for Panel A is the natural logarithm of the total tax assessor valuation, for Panel B is the natural logarithm of the tax assessor valuation of improvements (including house), and for Panel C is the tax assessor assessment of property condition/quality. I include results for (1) the merged landlord and (2) all institutional investors separately. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include tract x year fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.6: Home Improvements Loans by Owner Type

(a) Mean Value of Applications for Home Improvements Loans

Dependent Variable				
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) All	Post x Treat	0.292***	0.172***	0.007**
		(3.863)	(2.692)	(2.242)
	Adjusted R^2	0.899	0.899	0.899
(2) Owner Occupier	Post x Treat	0.312***	0.181***	0.008**
		(4.127)	(2.797)	(2.526)
	Adjusted R^2	0.898	0.898	0.898
(3) Investor	Post x Treat	0.102	-0.065	-0.008
		(0.737)	(-0.453)	(-1.313)
	Adjusted R^2	0.869	0.869	0.869
All regressions:	CountyxYear FE	Yes	Yes	Yes
	Tract FE	Yes	Yes	Yes
	Controls	Yes	Yes	Yes
	Observations	6,512	6,512	6,512

(b) Mean Value of Home Improvements Loans Originations

Dependent Variable				
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties> 20)	Δ Properties Count
(1) All	Post x Treat	0.400***	0.251***	0.010**
		(4.583)	(2.881)	(2.145)
	Adjusted R^2	0.886	0.885	0.885
(2) Owner Occupier	Post x Treat	0.430***	0.300***	0.013***
		(4.868)	(3.364)	(2.845)
	Adjusted R^2	0.883	0.883	0.883
(3) Investor	Post x Treat	-0.212	-0.443	-0.038***
		(-0.860)	(-1.362)	(-2.817)
	Adjusted R^2	0.869	0.869	0.870
All regressions	CountyxYear FE	Yes	Yes	Yes
	Tract FE	Yes	Yes	Yes
	Controls	Yes	Yes	Yes
	Observations	6,512	6,512	6,512

This table presents estimates of difference-in-difference regressions of home improvement loans by owner type around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes from three years before the merger until four years after. The dependent variable for each regression is (a) the natural logarithm of 1 + the mean value of home improvement applications in each tract or (b) the natural logarithm of 1 + the mean value of loan originations for home improvements in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression as well as control variables per equation X. I report t-statistics using standard errors clustered by census tract in parenthesis. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 4.7: Permitting Activity by Owner Type

Dependent Variable		$\ln(1 + \text{Permits}_{i,t})$		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Owner Occupier	Post x Treat	0.584***	0.277	0.033***
		(3.089)	(1.661)	(2.671)
	Adjusted R^2	0.433	0.424	0.429
(2) Small Investor	Post x Treat	0.388**	0.256*	0.023**
		(2.589)	(1.888)	(2.224)
	Adjusted R^2	0.362	0.359	0.361
(3) Large Investor	Post x Treat	0.062	0.042	-0.007
		(0.234)	(0.166)	(-0.358)
	Adjusted R^2	0.520	0.521	0.521
(4) SFR	Post x Treat	0.065	0.043	0.001
		(1.324)	(0.606)	(0.187)
	Adjusted R^2	0.081	0.081	0.081
All regressions	CountyxYear FE	Yes	Yes	Yes
	Tract FE	Yes	Yes	Yes
	Controls	Yes	Yes	Yes
	Observations	965	965	965

This table presents estimates of difference-in-difference regressions of permit activity by owner type around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes from three years before the merger until four years after. The dependent variable for each regression is the natural logarithm of 1 + the permits issued to each type of investor in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression as well as control variables per equation X. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.8: Tax Assessor Appeals by Investor Type

Dependent variable:	$Appeals_{i,t}$		
	(1)	(2)	(3)
Intercept	-4.671***	-3.215***	-10.322***
	(0.013)	(0.731)	(0.772)
SFR	3.070***	3.335***	3.388***
	(0.020)	(0.022)	(0.023)
Tiny Investor	0.572***	0.515***	0.573***
	(0.025)	(0.026)	(0.029)
Small Investor	1.098***	1.017***	1.159***
	(0.025)	(0.027)	(0.031)
Medium Investor	2.115***	2.006***	2.417***
	(0.025)	(0.027)	(0.032)
Large Investor	2.427***	2.343***	2.862***
	(0.018)	(0.020)	(0.25)
log(Tax Assessor Valuation$_{i,t}$)			0.282***
			(0.008)
Tract-Year FE:	N	Y	Y
Observations	971,282	913,720	865,075

This table presents estimates of a logistic regression of appeals by investor type. The sample includes all property appeals in two counties (Paulding and Douglas) between 2012-2021. The dependent variable is the incidence of an appeal in property i during year t. SFR indicates the owner of property i is an SFR company. Other investor types include: tiny investor (owns 1 investment property); small investor (owns between 2-10 investment properties); medium investor (owns between 10-50 investment properties); large investor (owns over 50 investment properties). The reference level is an owner-occupier. In (3) I include the logarithm of the tax assessor valuation for property i in year t. I include tract x year fixed effects in some specifications. I report standard errors clustered by property in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.9: Probability of Appeals by Investor Type

Investor Type:	Owner Occupier	Tiny Investor	Small Investor	Medium Investor	Large Investor	SFR Investor
	0.009	0.016	0.027	0.072	0.096	0.168

This table presents estimates of probability of appeals by investor type from the regression in Table 4.8 column (1).

Table 4.10: Success of Appeals by Investor Type

Dependent variable:	Successful Appeal$_{i,t}$			
	(1)	(2)	(3)	(4)
Intercept	0.121***	0.170***	0.167***	1.244***
	(0.025)	(0.039)	(0.039)	(0.174)
SFR	-0.242***	0.106**	0.237***	0.220***
	(0.046)	(0.050)	(0.052)	(0.052)
Tiny Investor	0.113***	0.050	0.068	0.065
	(0.044)	(0.046)	(0.046)	(0.046)
Small Investor	0.309***	0.252***	0.252***	0.200***
	(0.043)	(0.045)	(0.045)	(0.046)
Medium Investor	0.714***	0.649***	0.621***	0.490***
	(0.048)	(0.049)	(0.051)	(0.55)
Large Investor	1.149***	0.985***	0.990***	0.804***
	(0.036)	(0.038)	(0.038)	(0.049)
Evidence$_{i,t}$			1.658***	1.626***
			(0.067)	(0.062)
log(Tax Assessor Valuation$_{i,t}$)				-0.088***
				(0.014)
County FE:	N	Y	Y	Y
Year FE:	N	Y	Y	Y
Observations	971,282	913,720	865,075	

This table presents estimates of a logistic regression of appeals by investor type. The sample includes all property appeals in two counties (Paulding and Douglas) between 2012-2021. The dependent variable is the incidence of an appeal in property i during year t. SFR indicates the owner of property i is an SFR company. Other investor types include: tiny investor (owns 1 investment property); small investor (owns between 2-10 investment properties); medium investor (owns between 10-50 investment properties); large investor (owns over 50 investment properties). The reference level is an owner-occupier. In (3) I include the logarithm of the tax assessor valuation for property i in year t. I include tract x year fixed effects in some specifications. I report standard errors clustered by property in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.11: Reduction in Assessed Value of Successful Appeals by Investor Type

Dependent variable:	Reduction in Value due to Appeal$_{i,t}$	
	(Unscaled)	(Scaled)
SFR	-0.585***	-0.281
	(-12.763)	(-0.387)
Tiny Investor	0.618***	-0.516
	(4.026)	(-0.279)
Small Investor	0.300***	-0.217
	(3.713)	(-0.172)
Medium Investor	-0.237***	-0.059
	(-4.002)	(-0.125)
Large Investor	-0.473***	-0.113
	(-12.320)	(-0.140)
Evidence$_{i,t}$	0.153	-0.509
	(4.431)	(-0.466)
Tract FE:	Y	Y
Year FE:	Y	Y
Observations	17,024	2,189
R^2	11.32%	5.59%

This table presents estimates of the reduction in taxable home value as a result of a successful appeal by investor type. The sample includes all successful property appeals in two counties (Paulding and Douglas) between 2010-2021. The unscaled dependent variable is the logarithm of the difference between the tax assessors' property valuation and the final valuation resolved upon during the appeal. The scaled dependent variable is the difference between the tax assessors' property valuation and the final valuation divided by the difference between the tax assessors' valuation and the valuation asserted by the taxpayer. In other words, the scaled dependent variable measures the degree of success of the appeal (i.e. the reduction in the final value scaled by the distance between the tax assessor's and the taxpayer's initial valuations). SFR indicates the owner of property i is an SFR company. Other investor types include: tiny investor (owns 1 investment property); small investor (owns between 2-10 investment properties); medium investor (owns between 10-50 investment properties); large investor (owns over 50 investment properties). The reference level is an owner-occupier. I also include a dummy variable, Evidence$_{i,t}$, that equals 1 if the taxpayer presented evidence with their appeal. I include tract x year fixed effects in all specifications. I cluster standard errors by property and report t-statistics in parenthesis.. *p<0.1; **p<0.05; ***p<0.01

Table 4.12: Difference between Assessed Value and Sale Price by Investor Type

Dependent variable:	log(Δ Assessed Value and Sale Price$_{i,t}$)		
	(1)	(2)	(3)
SFR	4.487***	4.413***	4.121***
	(5.886)	(5.621)	(4.782)
Tiny Investor	0.149	0.125	-0.085
	(0.119)	(0.102)	(-0.065)
Small Investor	0.878	0.841	0.357
	(0.787)	(0.745)	(0.303)
Medium Investor	3.074***	3.051***	2.493**
	(3.177)	(3.105)	(2.439)
Large Investor	4.430***	4.406***	3.602***
	(3.839)	(3.747)	(2.929)
I(Previous Appeal > 0)		8.395***	
		(13.330)	
# Previous Appeals			0.915***
			(4.881)
Tract FE:	Y	Y	Y
Year FE:	Y	Y	Y
Observations:	3,753	3,753	3,753
R^2	63.78%	63.82%	65.52%

This table presents estimates of the difference between assessed value and sale price by investor type. The sample includes all sales in two counties (Paulding and Douglas) between 2010-2021. The dependent variable is the logarithm of the difference between the property valuation and sale price. SFR indicates the owner of property i is an SFR company. Other investor types include: tiny investor (owns 1 investment property); small investor (owns between 2-10 investment properties); medium investor (owns between 10-50 investment properties); large investor (owns over 50 investment properties). The reference level is an owner-occupier. In (2) I include a dummy variable, I(Previous Appeal > 0), that is equal to 1 if the property has had one or more appeals against its valuation. In (3) I include the number of appeals the property has had against its valuation in the sample period. I include tract x year fixed effects in all specifications. I cluster standard errors by property and report t-statistics in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.13: Mortgage applications by race/ethnicity around mergers

Dependent Variable		Applications$_{g,i,t}$		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Black	Post x Treat	2.541***	2.839**	0.221***
		(2.696)	(2.141)	(3.248)
	Adjusted R^2	0.781	0.780	0.783
(2) White	Post x Treat	-0.814	-2.607***	-0.149***
		(-0.964)	(-3.189)	(-4.029)
	Adjusted R^2	0.958	0.958	0.958
(3)Latino/Hispanic	Post x Treat	1.295***	1.514***	0.070**
		(3.648)	(2.820)	(2.429)
	Adjusted R^2	0.658	0.658	0.658
(4) Asian	Post x Treat	-0.543	0.583	0.008
		(-1.269)	(0.976)	(0.380)
	Adjusted R^2	0.815	0.815	0.815
(5) Native American	Post x Treat	-0.035	-0.006	-0.001
		(-1.012)	(-0.148)	(-0.475)
	Adjusted R^2	0.132	0.131	0.131
(6) Mixed Race	Post x Treat	-0.370***	-0.420***	-0.023***
		(-2.895)	(-3.387)	(-3.930)
	Adjusted R^2	0.516	0.515	0.516
(7) Non-White	Post x Treat	3.102***	4.790***	0.290***
		(3.620)	(4.426)	(5.597)
	Adjusted R^2	0.868	0.869	0.870
All regressions	CountyxYear FE	Yes	Yes	Yes
All regressions	Tract FE	Yes	Yes	Yes
All regressions	Observations	3,740	3,740	3,740

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes three years before each merger until four years after. The dependent variable for each regression is the application count in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year, tract fixed effects and a series of controls detailed in equation 4.16 in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table 4.14: Mortgage originations by race/ethnicity around mergers

Dependent Variable		Originations$_{g,i,t}$		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Black	Post x Treat	1.037*	1.353*	0.114***
		(1.751)	(1.781)	(2.910)
	Adjusted R^2	0.745	0.745	0.748
(2) White	Post x Treat	-0.963*	-2.111***	-0.122***
		(-1.764)	(-3.979)	(-4.895)
	Adjusted R^2	0.965	0.965	0.965
(3)Latino/Hispanic	Post x Treat	0.691***	0.858**	0.039**
		(2.822)	(2.341)	(2.159)
	Adjusted R^2	0.654	0.654	0.654
(4) Asian	Post x Treat	-0.109	0.612	0.020
		(-0.386)	(1.459)	(1.174)
	Adjusted R^2	0.804	0.804	0.804
(5) Native American	Post x Treat	-0.018	-0.031	-0.001
		(-0.845)	(-1.243)	(-1.075)
	Adjusted R^2	0.101	0.101	0.101
(6) Mixed Race	Post x Treat	-0.299***	-0.368***	-0.019***
		(-3.166)	(-4.156)	(-4.989)
	Adjusted R^2	0.520	0.519	0.520
(7) Non-White	Post x Treat	1.498***	2.669***	0.165***
		(2.797)	(4.562)	(6.321)
	Adjusted R^2	0.871	0.872	0.873
All regressions	CountyxYear FE	Yes	Yes	Yes
All regressions	Tract FE	Yes	Yes	Yes
All regressions	Observations	3,740	3,740	3,740

This table presents estimates of difference-in-difference regressions of mortgage originations by race/ethnicity around the four mergers of institutional investors. The sample includes the originations in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period is from three years before each merger until four years after. The dependent variable for each regression is the origination count for each race/ethnicity group in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year, tract fixed effects, and a variety of controls detailed in 4.17 in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Appendix

A Proofs and Derivations

A.1 Demand Functions with Differentiated/Undifferentiated Houses

Consider the demand if the low-quality property is not dominated.[41] Renters with a taste parameter exceeding $(r_2 - r_1)/(s_2 - s_1)$ rent the high quality property, those with a taste parameter between $r_1/(s_2 + \alpha(s_1 + s_2))$ and $(r_2 - r_1)/(s_2 - s_1)$ rent the low quality property, and the others do not rent at all. Hence, the demand for the high quality property is:

$$D_1(r_1, r_2) = \begin{cases} \bar{\theta} - \frac{r_1}{s_1 + \alpha(s_1+s_2)} & \text{if } r_1 < \frac{s_1+\alpha(s_1+s_2)}{s_2+\alpha(s_1+s_2)} r_2 \\ \bar{\theta} - \frac{r_1 - r_2}{s_1 - s_2} & \text{if } \frac{s_1+\alpha(s_1+s_2)}{s_2+\alpha(s_1+s_2)} r_2 \leq r_1 \leq r_2 + \bar{\theta}(s_1 - s_2) \\ 0 & \text{if } r_1 > r_2 + \bar{\theta}(s_1 - s_2) \end{cases} \tag{4.18}$$

[41] The low quality house will be dominated if the quality per dollar for the high quality property is higher such that $(s_2 + \alpha(s_1 + s_2))/r_2 \geq (s_1 + \alpha(s_1 + s_2))/r_1$. In that case all renters prefer the high quality property to the low quality property (if they rent at all), so demand for the high quality property is given as $D(r_2) = N[1 - F(r_2/(s_2 + \alpha(s_1 + s_2)))]$ and demand for the low quality property is zero.

and demand for the low quality house is given by

$$D_2(r_1, r_2) = \begin{cases} \bar{\theta} - \frac{r_2}{s_2+\alpha(s_1+s_2)} & \text{if } r_2 < r_1 - \bar{\theta}(s_1 - s_2) \\ \frac{r_1-r_2}{s_1-s_2} - \frac{r_2}{s_2+\alpha(s_1+s_2)} & \text{if } r_1 - \bar{\theta}(s_1 - s_2) \leq r_2 \leq r_1 \frac{s_2+\alpha(s_1+s_2)}{s_1+\alpha(s_1+s_2)} \\ 0 & \text{if } r_2 > r_1 \frac{s_2+\alpha(s_1+s_2)}{s_1+\alpha(s_1+s_2)} \end{cases} \tag{4.19}$$

A.2 Optimal Price and Quality with Competition

I first derive the equilibrium in the price setting game, taking the quality of each house as fixed. Each renter's quality preference is private information but the distribution of these quality preferences is known prior to the landlord's pricing decision. Without excess demand (or capacity-constraint) the Bertrand paradox for undifferentiated goods applies: rent will be set at a level equal to the cost of providing the unit. Hence, both investors are better off if one investor makes improvements to their house, so they compete in a differentiated houses game. Profits are given as $\Pi_1(r_1, r_2) = r_1 D_1(r_1, r_2)$ and $\Pi_2(r_1, r_2) = r_2 D_2(r_1, r_2)$. Hence, the best response function for the high quality landlord is:

$$\psi_1(r_2) = \begin{cases} \frac{\bar{\theta}(s_1-s_2)+r_2}{2} & \text{if } r_2 \leq \frac{\bar{\theta}s_2(s_1-s_2)}{2s_1-s_2} \\ r_2 \frac{s_1+\alpha(s_1+s_2)}{s_2+\alpha(s_1+s_2)} & \text{if } \frac{\bar{\theta}s_2(s_1-s_2)}{2s_1-s_2} < r_2 \leq \frac{\bar{\theta}(s_2+\alpha(s_1+s_2))}{2} \\ \frac{\bar{\theta}(s_1+\alpha(s_1+s_2))}{2} & \text{if } r_2 > \frac{\bar{\theta}(s_2+\alpha(s_1+s_2))}{2} \end{cases} \tag{4.20}$$

And the best response function for the low quality landlord is given by:

$$\psi_2(r_1) = \begin{cases} \frac{r_1(s_2+\alpha(s_1+s_2))}{2(s_1+\alpha(s_1+s_2))} & \text{if } r_1 \leq \frac{2\bar{\theta}(s_1+\alpha(s_1+s_2))(s_1-s_2)}{2s_1-s_2+\alpha(s_1+s_2)} \\ r_1 - \theta(s_1 - s_2) & \text{if } \frac{2\bar{\theta}(s_1+\alpha(s_1+s_2))(s_1-s_2)}{2s_1-s_2+\alpha(s_1+s_2)} < r_1 \leq \bar{\theta}[s_1 - \frac{s_2+\alpha(s_1+s_2)}{2}] \\ \frac{\bar{\theta}(s_2+\alpha(s_1+s_2))}{2} & \text{if } r_1 > \bar{\theta}[s_1 - \frac{s_2+\alpha(s_1+s_2)}{2}] \end{cases} \tag{4.21}$$

These best response functions intersect where the high quality landlord charges rent of $r_1^* = \frac{2(s_1+\alpha(s_1+s_2))\bar{\theta}(s_1-s_2)}{4s_1-s_2+3\alpha(s_1+s_2)}$ and the low quality landlord charges rent of $r_2^* = \frac{(s_2+\alpha(s_1+s_2))\bar{\theta}(s_1-s_2)}{4s_1-s_2+3\alpha(s_1+s_2)}$. This is the unique pure strategy price equilibrium. Note that these rents are strictly higher than what each landlord would charge where there is no utility spillover from the other property. [42]

Given these prices, the quantity demanded of the high quality property is $D_1^* = \frac{\bar{\theta}(2s_1+3\alpha(s_1+s_2))}{4s_1-s_2+3\alpha(s_1+s_2)}$ and the equilibrium payoff to the high quality landlord is $\Pi_1^*(s_1,s_2) = \frac{\bar{\theta}^2(s_1-s_2)(4s_1+6\alpha(s_1+s_2))(s_1+\alpha(s_1+s_2))}{(4s_1-s_2+3\alpha(s_1+s_2))^2}$. Similarly, the quantity demanded of the low quality property is $D_2^* = \frac{\bar{\theta}(s_1+\alpha(s_1+s_2))}{4s_1-s_2+3\alpha(s_1+s_2)}$, and the equilibrium payoff to the low quality landlord is $\Pi_2^*(s_1,s_2) = \frac{\bar{\theta}^2(s_1-s_2)(s_1s_2+\alpha(1+\alpha)(s_1+s_2)^2)}{(4s_1-s_2+3\alpha(s_1+s_2))^2}$. [43]

In the first stage, each landlord decides whether to make improvements to their house given these profit functions. If demand is met by the existing rental stock, the high quality firm chooses quality to maximise its profits less the cost of improvement, $\pi_1 = \Pi_1(s_1,s_2) - c_1$. The first order condition of this problem is:

$$\frac{\partial \pi_i}{\partial s_i} = \frac{2\bar{\theta}^2(2s_1(4s_i^2-3s_is_j+2s_j^2)+9\alpha^3(s_1+s_2)^3+3\alpha^2(9s_1^3+12s_1^2s_2+7s_1s_2^2+4s_2^3))}{(4s_1-s_j+3\alpha(s_1+s_2))^3} + \frac{2\bar{\theta}^2\alpha(26s_1^3+3s_1^2s_2+8s_1s_2^2+5s_2^3)}{(4s_1-s_j+3\alpha(s_1+s_2))^3} - s_1 = 0 \quad (4.22)$$

Equally, the low quality firm will maximise its profits less the cost of improvement, $\pi_2 = \Pi_2(s_1,s_2) - c_2$. The first order condition of this problem is:

[42] Compare this to the differentiated goods equilibrium where there is no spillover from shared improvements. In that case $r_1^* = \frac{2s_1\bar{\theta}(s_1-s_2)}{4s_1-s_2}$ and the low quality landlord charges rent of $r_2^* = \frac{s_2\bar{\theta}(s_1-s_2)}{4s_1-s_2}$. These rents are both strictly less than is obtained if renters obtain utility from a higher quality neighborhood (i.e. if there are positive externalities to neighborhood improvement).

[43] Compare with the payoff if there are no spillovers from quality. In that case, $D_1^* = \frac{2\bar{\theta}s_1}{4s_1-s_2}$ and the equilibrium payoff to the high quality landlord is $\Pi_1^*(s_1s_2) = \frac{4\bar{\theta}^2s_1^2(s_1-s_2}{(4s_1-s_2)^2}$. Similarly, the quantity demanded of the low quality property is $D_2^* = \frac{\bar{\theta}s_1}{4s_1-s_2}$, and the equilibrium payoff to the low quality landlord is $\Pi_2^*(s_1,s_2) = \frac{\bar{\theta}s_1s_2(s_1-s_2}{(4s_1-s_2)^2}$.

$$\frac{\partial \pi_j}{\partial s_j} = \frac{\bar{\theta}^2(s_i^2(4s_i - 7s_j) + 3\alpha^3(s_1+s_2)^3 + \alpha^2(16s_1^2 s_2 - 3s_1^3 + 21 s_1 s_2^2 + 2s_2)}{(4s_i - s_j + 3\alpha(s_1+s_2))^3} + \frac{\bar{\theta}^2\alpha(9s_1^3 - 16 s_1^2 s_2 - 12 s_1 s_2^2 + s_2^3)}{(4s_i - s_j + 3\alpha(s_1+s_2))^3} - s_j = 0 \quad (4.23)$$

A.3 Merged Landlords

If the merged landlord offers houses of the same quality, she faces demand equal to:

$$D(r_i, s_i) = \bar{\theta} - \frac{r_i}{(1+2\alpha)s}$$

Profits are $r_i D(r_i, s_i)$ so the profit-maximising price is equal to $r_i = \bar{\theta}s(1+2\alpha)/2$ and the optimal choice of quality is $s_i = \theta^2(1+2\alpha)/4$.

Consider the optimal price and quality if the landlord decides to split the market by offering two qualities of houses. The merged landlord faces a profit function equal to:

$$\Pi(r_1, r_2, s_1, s_2) = \Big[\bar{\theta} - \frac{r_1 - r_2}{s_1 - s_2}\Big]\Big(r_1 - \frac{s_1^2}{2}\Big) + \Big[\frac{r_1 - r_2}{s_1 - s_2} - \frac{r_2}{s_2 + \alpha(s_1+s_2)}\Big]\Big(r_2 - \frac{s_2^2}{2}\Big)$$

Hence, the optimal choice of rental price for the high quality house is $r_1^* = \bar{\theta}(s_1 - s_2)/(2(1-z))$ and the optimal rental price for the low quality house is $r_2^* = \bar{\theta}z(s_1 - s_2)/(2(1-z))$, where $z = (s_2 + \alpha(s_1+s_2))/(s_1 + \alpha(s_1+s_2))$.

However, given these prices and the quadratic costs to quality, it is never optimal for the merged landlord to offer different quality of houses. Consider an improvement δ to the high quality house. This results in a increase in profits of

$$\Pi(r_1, r_2, s_1, s_2) = \Big[\bar{\theta} - \frac{\bar{\theta}}{2}\Big]\Big(\frac{\bar{\theta}(s_1 + \delta - s_2)}{2(1 - z_\delta)} - \frac{(s_1 + \delta)^2}{2}\Big) + \Big[\frac{\bar{\theta}}{2} - \frac{\bar{\theta} z_\delta (s_1 + \delta - s_2)}{2(1 - z_\delta)(s_2 + \alpha(s_1 + s_2))}\Big]\Big(\frac{\theta z_\delta (s_1 + \delta - s_2)}{2(1 - z_\delta)} - \frac{s_2^2}{2}\Big)$$

where $z_\delta = (s_2 + \alpha(s_1 + \delta + s_2))/(s_1 + \alpha(s_1 + \delta + s_2))$. Note that the demand for the high quality house does not vary with the quality of the neighborhood.Indeed the equilibrium prices the merged landlord will set will always have a difference of $\frac{\theta(s_1 - s_2)}{2}$. Hence, an increase in the quality of the high quality house does not increase demand for the high quality house. However, it does increase the demand for the low quality house by improving the neighborhood. With quadratic improvement costs, it is more expensive for the landlord to improve the quality of the high quality house, so the landlord will always choose to improve the low quality house until a point where the two qualities are equal.

A.4 Three house model: Owner Occupier

Consider now the impact of a third house in the neighborhood. Let this landlord be an owner occupier who has the same utility function as a renter but makes mortgage payments instead of rental payments:

$$U_o = \theta(s_o + n) - m \tag{4.24}$$

where s_o is the quality of owner occupier's house and m is the cost of mortgage payments. Assume that the owner occupier faces a borrowing constraint of γh where h is the value of the house. Let the value of the house be equal to the value of the property as a rental in perpetuity $h = r_i/i$, where i is the discount rate. For simplicity, I let the discount rate on the property equal to mortgage repayment rate. The owner occupier faces the same

quadratic costs of improvement as other landlords, $c_o = s_o^2/2$.

Hence, the owner occupier chooses its level of home improvements to maximise its utility subject to its borrowing constraint $b \leq \gamma r_i/i$. Assuming the owner occupier has no mortgage initially, its utility is given by:

$$\theta(s_o + n) - \frac{is_o^2}{2}$$

and it maximises its utility where $s_o = \theta(1+\alpha)/i$. Assume that its θ is sufficiently high that the borrowing constraint is binding at the prevailing rental rate, r_i. That is, where $(\theta(1+\alpha))^2/2\gamma \geq r_i$. At this rate, the household will make improvements equal to $\sqrt{2\gamma r_i/i}$.

Consider the optimal behaviour of the merged landlord in this case. The landlord sets its price r_i in order to maximise:

$$\Pi(r_i, s_i) = \Big[\bar{\theta} - \frac{r_i}{s_i(1+2\alpha) + \alpha(2\gamma r_i/i)^{1/2}}\Big] r_i$$

Hence, it sets the rental price such that $t - \frac{r_i((4+8\alpha)s_i + 3\alpha(2\gamma r_i/i)^{1/2}}{2(s_i(1+2\alpha)+a(2\gamma r_i/i)^{1/2})^2} = 0$. In the first stage, it sets its quality to solve $\frac{(1+2\alpha)r_i^2}{(s_i(1+2\alpha)+\alpha(2\gamma r_i/i)^{1/2})^2} - s_i = 0$.

B Ownership Matching

Each year the tax assessor for each county in the United States compiles a list of property ownership (tax parcel) in that county. These ownership lists contain details of the owner, their contact address, and details of the property, including its location and its appraisal value (land and improvements). The ownership information included in these tax records allows easy identification of owner-occupiers, but the ownership information may not identify the ultimate owner if the owner is an investor. In particular, many investors use locally registered limited liability companies (LLCs) to invest in real estate. The name of these LLCs may or may not be useful in identifying the ultimate owner. For example, American Homes 4 Rent (one of the largest financial investors in single family housing) owns property through at least 478 different LLCs with various names including AH4R I GA LLC and AMH 2014-I Borrower LLC. In order to correctly identify the type and size of each large investor in my sample, it is critical that these individual LLCs be correctly matched to an ultimate owner.In this Appendix, I describe the process I take to match these listed owners to ultimate parent.

First, I match properties using Exhibit 21.1 in SEC 10-K filings that includes each company's subsidiaries in that financial year. It is important to match these to an ultimate parent using both name and year, because name rarely changes post-merger. For example, Invitation Homes continues to use "SWAY 2014-1 Borrower GP LLC" as its subsidiary even though this LLC experienced two institutional mergers to be acquired by Invitation Homes (it originally belonged to Starwood Waypoint). This approach achieves a very comprehensive matching of subsidiaries to their ultimate parent where parent is US-listed.

However, private and non-US institutions are not required to release subsidiary details. I identify subsidiaries of these entities starting from my ownership data. First, I filter out those properties that have been identified as belonging to an owner-occupier (i.e. where the owner contact address is the same as the property address). Once owner-occupiers

are removed, I sort all remaining owner-address pairs based on number of properties owned. I aim to find an ultimate owner for all those owner-address pairs with more than 50 properties under management.

I utilise OpenCorporates to assist in matching LLCs to ultimate owner. OpenCorporates contains the records of almost 200 million companies globally. I use OpenRefine to match records by name and jurisdiction to a record within the OpenCorporates database. Once I obtain a record identification number for each of the LLCs of interest, I use the OpenCorporates API to call the following information on each LLC: registered address, agent name, agent address, home company name, home company address, home company OpenCorporates URL, controlling entity name, controlling entity address, controlling entity URL.

Addresses alone are not useful without a database of ownership to match them to. I manually match 396 addresses to an ultimate parent. For example, the company "2015-3 IH2 BORROWER L.P" has a registered address of 1717 Main Street, Suite 2000, Dallas, Texas, 75201. This is one of the corporate offices of Invitation Homes. Therefore, I am able to match this obscurely-named LLC to an ultimate corporate parent.

However, this process can generate erroneous matches. For example, the address 2233 Peachtree Road, Suite 303, Atlanta, GA, 30309 belongs to a registered agent. Registered agents provide document collection services (especially for service of legal proceedings) for companies, so the address of a registered agent is uninformative in determining the ultimate owner. I collate a list of registered agents, lawyers, tax specialists, and other professional services firms to be excluded from the matching process. I cross-check the data to ensure that no address associated with more than 50 properties remains unidentified.

Finally, to ensure that I have captured all institutional owners, I search the Florida Division of Corporations. Florida is unique in providing corporations search based on address alone. Hence, I am able to identify the names of all subsidiaries operating in Florida whose contact address matches the corporate headquarters of an institutional

investor in my sample. I am able to identify (or verify) the ultimate parent of a further 117 SFR LLCs using this database.

C Census Matching

The Census database requires specific inputs including a street number, street name, and either city or zipcode to match a specific address to its corresponding entry in the Census database. One limitation of the tax parcel data for Fulton County is that only street number, street name, and street type were given for each tax parcel entry. Hence, this information alone was insufficient to match to an address in the Census database. To overcome this data limitation, I filtered for all those properties where the owner was identified as an owner-occupier in at least one year in the sample.. For these properties, the owner address (which contains both a city and zipcode) could be matched to an address in the Census database. This yielded XX exact matches to an entry in the Census database. For each of these properties, the Census information provided an estimated longitude and latitude, as well as the census tract number.

Next, I used these exact matches to find the census tract for other properties in my dataset. Census tracts are determined geographically, so it stands to reason that those properties that are geographically proximate would likely be in the same census tract. Using my existing matches, I identified all streets where there was a unique mapping between street name and type and census tract. I used this mapping to match all other properties on the same street to their imputed census tract.

There was not a unique mapping for every street in the sample. If the street was long or in a densely populated area, there could be multiple census tracts along the length of the street. In this case, I matches each address to the nearest neighbour for which census information was available. For example, I imputed that 6010 Spalding Drive, Sandy Springs, GA belonged to census tract 010108 from the information for 6018 Spalding Drive (rather than matching it to census tract 010107 that corresponded to 100 Spalding Drive, for example).

D Screening for SFR mergers within CapitalIQ

I use Capital IQ to identify the largest mergers in the SFR market. Within Capital IQ, I screen for transactions (mergers and acquisitions) that contain the following features:

- Industry Classification (Target/Issuer): Diversified Real Estate Activities (Primary), Residential Building Operators or Lessors (Primary), Residential Property Managers (Primary), or Residential REITs;
- Transaction Types: Merger/Acquisition;
- Geographic Locations (Target/Issuer): United States and Canada (Primary);
- Transaction Status: Closed, Effective, Settled, or Successful;
- All Transactions Announced Date: [1/1/2015-12/31/2020];
- All Transactions Closed Date: [1/1/2015-12/31/2020]

Institutional investment in SFR real estate is a sufficiently new category of investment that it does not yet have its own industry classification within CapitalIQ. Hence, the industry identification is necessarily broad to ensure that SFR investors are not excluded from the pool of transactions. [44] This screen produces 528 potential transactions.

I identify transactions involving the firms I have previously identified as SFR owners. Three of the identified mergers are within the 20 largest transactions in the broader dataset: Invitation Homes' acquisition of Colony Starwood; Tricon American's acquisition of Silver Bay Realty Trust; and American Homes 4 Rent's acquisition of American Residential Properties. I identify the Colony American/Starwood Waypoint merger from commentary on another transaction, and I find value and announced/completion dates from press releases within SEC filings for Colony Starwood (as it became known).

[44] SFR investors could be categorised into any of the suggested industry classifications. Some (not all) are structured as residential REITs; some (e.g. Main Street Renewal or Altisource) are primarily property managers who own/are in partnership with owners of SFR real estate; all are in the business of leasing real estate to the public, but this may not be classified as their primary business if they fall into another category as above.

E Institutional Investors and Arbitrage

Institutional investors may identify arbitrage opportunities, especially in situations of low market liquidity where there is a pricing gap in the market. Properties may be sold at lower than their fair market price if the seller is distressed, needs fast cash, or if the neighbourhood is quickly appreciating.

There are two possible mechanisms through which institutional investors may take advantage of arbitrage opportunities in the real estate market. The first is real estate speculation: it could be that institutional investors are better at identifying distressed sellers (or, conversely, neighbourhoods that are likely to improve) and choose to purchase from these individuals. This mechanism does not require the investor to make further improvements to the property following acquisition; it need only hold the property until prices increase. The second is house flipping: it could be that institutional investors purchase a number of properties in a neighbourhood with the intention to make improvements to the properties. These improvements improve the quality of the properties such that they may be resold at a higher price. This approach would be analogous to the "buy and build" strategy in private equity.

I do not find evidence in my data that institutional investors were able to purchase multiple distressed properties from a single seller in a single transaction. The inability to purchase portfolios of distressed assets was in large part a feature of the market. In 2009 and 2010, Fannie Mae and Freddie Mac, introduced the "First Look" program that gave home-owners and non-profit organisations the opportunity to bid on its REO properties before they became available to investors. In particular, the program restricted offers on all REO-owned properties to potential owner-occupiers (or non-profits) during each property's first 15 or 20 days on the market. [45] Given the average REO length is five months, these delays were non-trivial for investors. Perhaps most importantly, this programme excluded the opportunity for investors to purchase portfolios of

[45] Introductory documents on the First Look Initiative are available here and here

distressed/foreclosed properties from the REO owners.

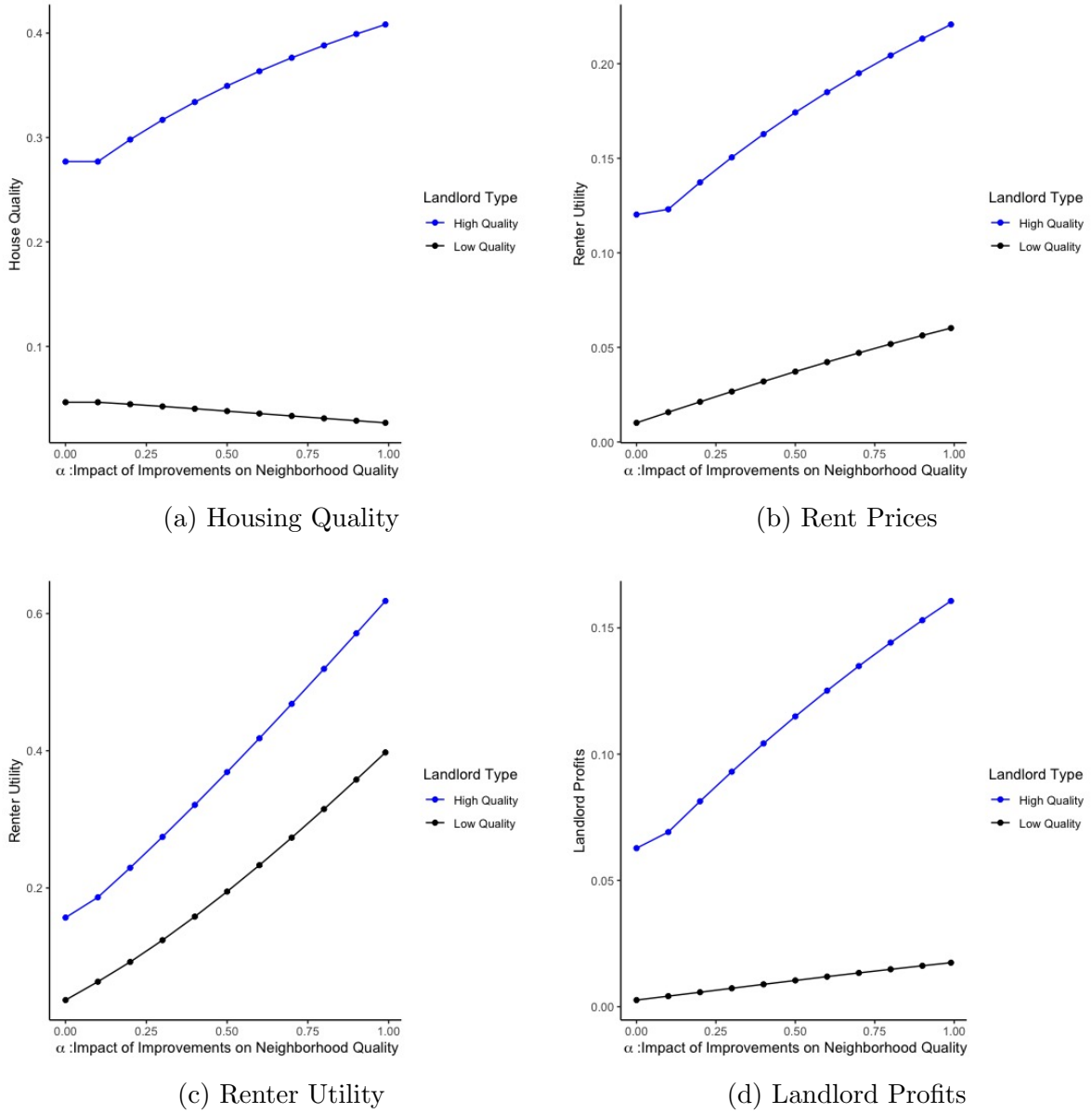
There was one notable exception to this. In 2012, Fannie Mae offered three portfolios of properties for sale to investors. [46]: These portfolios were:

- 699 properties in Central and Northeast, Southeast, and West Coast Florida
- 94 properties in Chicago, Illinois
- 970 properties in Arizona, California and Nevada

None of these portfolios included properties in Atlanta, Georgia, which suggests that institutional investors were not able to acquire portfolios of geographically proximate properties in my sample. The properties in each portfolio are sufficiently geographically disparate that it seems that these transactions cannot be used to evaluate the presence of geographic herding by or following institutional investors. Nevertheless, I have made a Freedom of Information Act request of Fannie Mae for the underlying transaction data. If the properties are more geographically concentrated than it would appear from the description, I may be able to use these transactions as to identify the impact of a sudden increase in institutional investment on neighbourhood improvements and permitting.

[46] Details of the portfolios and the offer process are available here

F Extra Figures



(a) Housing Quality

(b) Rent Prices

(c) Renter Utility

(d) Landlord Profits

Figure F.1: Model Outputs for Duopoly Case with No Excess Demand

This figure presents the optimal choice of housing quality and rent prices from the housing model for different values of α (the impact of individual housing improvements on neighborhood quality). It also presents the profits of each landlord and the renter utility at each level of α.

G Extra tables

Table A1: Tax Assessor Valuations around Mergers

(a) Total Valuations for Merged Landlords' Properties around Mergers

Acquisition	*Dependent variable:* ln(Total Valuation)			
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) AH4R	Institution x Post x Treat	-0.072**	-0.006	-0.001
		(-2.536)	(-0.383)	(-0.897)
	Adjusted R^2	0.396	0.396	0.396
(2) CSH	Institution x Post x Treat	0.009	-0.031	-0.002***
		(0.210)	(-1.181)	(-3.646)
	Adjusted R^2	0.327	0.327	0.327
(3) IH	Institution x Post x Treat	-0.013	-0.009	0.001
		(-0.311)	(-0.335)	(1.161)
	Adjusted R^2	0.345	0.345	0.345
(4) TAH	Institution x Post x Treat	-0.022**	-0.229***	-0.012***
		(-2.209)	(-4.759)	(-3.556)
	Adjusted R^2	0.297	0.297	0.297
All regressions	TractxYear FE	Yes	Yes	Yes

(b) Improvements Valuations for Properties around Mergers

Acquisition	*Dependent variable:* ln(Improvements (Home) Valuation)			
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) AH4R	Merged x Post x Treat	-0.289***	0.033	0.0005
		(-6.122)	(1.642)	(0.256)
	Adjusted R^2	0.336	0.336	0.336
(2) CSH	Merged x Post x Treat	0.457***	0.063*	-0.008***
		(5.270)	(1.949)	(-5.713)
	Adjusted R^2	0.303	0.303	0.303
(3) IH	Merged x Post x Treat	-0.091	-0.010	0.002***
		(-1.453)	(-0.262)	(3.446)
	Adjusted R^2	0.290	0.290	0.290
(4) TAH	Merged x Post x Treat	-0.017	-1.318***	-0.047***
		(-0.496)	(-6.689)	(-3.774)
	Adjusted R^2	0.219	0.219	0.219
All regressions	TractxYear FE	Yes	Yes	Yes

This table presents estimates of difference-in-difference regressions of property valuations for institutional investor owned properties around the four mergers of institutional investors. I use the following abbreviations for acquirers: AH4R = American Homes 4 Rent; CSH = Colony Starwood Homes; IH = Invitation Homes; TAH = Tricon American Homes. The sample includes all properties in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes three years before each merger until four years after. The dependent variable for each regression is the natural logarithm of the tax assessor valuation. Panel A summarizes regression results for total property valuations of properties owned by a merged landlord following a merger, while Panel B summarizes the regression results for home/improvements valuations of properties owned by a merged landlord a merger. I disaggregate into each individual merger (merger identified by acquirer name in the first column). In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include tract x year in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A2: Change in property-level valuations around mergers

Dependent variable:	ln(Tax Assessor Valuation)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties> 10)	Δ Properties Count
AcquirerxPostxTreat	0.010	−0.025**	−0.0001
	(0.031)	(0.012)	(0.0001)
TargetxPostxTreat	0.038	−0.023	0.0001
	(0.075)	(0.015)	(0.0001)
Post	0.0001	−0.0003***	−0.0001
	(0.0001)	(0.0001)	(0.0002)
Treat	0.0001*	0.0003***	0.00002**
	(0.0001)	(0.0001)	(0.00001)
PostxTreat	−0.0001	0.0005***	0.00001
	(0.0001)	(0.0001)	(0.00001)
Acquirer	−0.035	−0.083***	−0.082***
	(0.042)	(0.016)	(0.009)
AcquirerxPost	−0.020	0.012	−0.007
	(0.030)	(0.011)	(0.005)
AcquirerxTreat	−0.041	0.010	0.0002
	(0.043)	(0.018)	(0.0001)
Target	0.055	−0.055***	−0.059***
	(0.066)	(0.015)	(0.011)
TargetxPost	−0.052	0.006	−0.022***
	(0.075)	(0.014)	(0.007)
TargetxTreat	−0.120*	−0.010	−0.0001
	(0.067)	(0.018)	(0.0002)
Census tract x Year FE	Yes	Yes	Yes
Adjusted R^2	0.615	0.615	0.615
Observations	16,521,800	16,521,800	16,521,800

This table presents estimates of difference-in-difference regressions of property valuations. The sample includes the property valuations of properties in merged neighbourhoods, as well as properties in neighbourhoods where at least one acquiring firm owned a property prior to the acquisition. The dependent variable is the natural logarithm of the tax assessor (total) valuation of each property. In column 1, Treat is a binary variable that takes the value of 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. MergerLandlord is a binary variable that equals 1 if the property is owned by either the acquirer or the target firm. I include census tract x year fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A3: All Applications for Loans for Home Improvements (with controls)

Dependent variable:	ln(Mean Value of Improvement Applications)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	4.131***	4.289***	4.290***
	(36.328)	(44.885)	(42.874)
Treat	-0.127***	-0.147***	-0.011***
	(-2.924)	(-3.022)	(-5.286)
PostxTrans	0.292***	0.172***	0.007**
	(3.863)	(2.692)	(2.242)
LagHPI	0.004***	0.004***	0.004***
	(4.143)	(3.892)	(3.903)
One_Four_Homes	0.0003	0.0003	0.0003
	(0.920)	(0.886)	(0.934)
log(Median_Income)	16.845***	16.901***	16.863***
	(27.475)	(27.018)	(26.908)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,739	3,739	3,739
Adjusted R^2	0.899	0.899	0.899

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A4: Owner Occupier Applications for Loans for Home Improvements (with controls)

Dependent variable:	ln(Mean Value of Improvement Applications)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	4.070***	4.239***	4.236***
	(36.306)	(44.720)	(42.665)
Treat	-0.139***	-0.149***	-0.012***
	(-3.225)	(-3.052)	(-5.428)
PostxTrans	0.312***	0.181***	0.008**
	(4.127)	(2.797)	(2.526)
LagHPI	0.004***	0.004***	0.004***
	(4.002)	(3.717)	(3.742)
One_Four_Homes	0.0002	0.0002	0.0002
	(0.678)	(0.654)	(0.701)
log(Median_Income)	17.054***	17.118***	17.078***
	(27.953)	(27.450)	(27.365)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,738	3,738	3,738
Adjusted R^2	0.898	0.898	0.898

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A5: Investor Applications for Loans for Home Improvements (with controls)

Dependent variable:	ln(Mean Value of Improvement Applications)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	4.439***	4.523***	4.565***
	(20.085)	(23.939)	(23.308)
Treat	0.002	0.004	-0.003
	(0.021)	(0.041)	(-0.847)
PostxTrans	0.102	-0.065	-0.008
	(0.737)	(-0.453)	(-1.313)
LagHPI	0.007***	0.007***	0.007***
	(3.655)	(3.556)	(3.531)
One_Four_Homes	0.0004	0.0004	0.0004
	(0.612)	(0.642)	(0.645)
log(Median_Income)	18.637***	18.663***	18.599***
	(14.523)	(14.438)	(14.295)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	2,382	2,382	2,382
Adjusted R^2	0.869	0.869	0.869

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A6: Mean Value of All Loans Originations for Home Improvements (with controls)

Dependent variable:	ln(Mean Value of Improvement Originations)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	4.025***	4.241***	4.244***
	(35.593)	(44.183)	(42.168)
Treat	-0.197***	-0.191***	-0.013***
	(-3.976)	(-3.265)	(-4.308)
PostxTrans	0.400***	0.251***	0.010**
	(4.583)	(2.881)	(2.145)
LagHPI	0.004***	0.003***	0.003***
	(3.134)	(2.786)	(2.770)
One_Four_Homes	-0.00001	-0.00002	0.00001
	(-0.033)	(-0.038)	(0.018)
log(Median_Income)	17.147***	17.237***	17.211***
	(24.708)	(24.311)	(24.247)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,608	3,608	3,608
Adjusted R^2	0.886	0.885	0.885

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A7: Owner Occupier Loan Originations for Home Improvements (with controls)

Dependent variable:	ln(Mean Value of Improvement Applications)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	3.933***	4.160***	4.154***
	(36.078)	(44.614)	(42.493)
Treat	-0.208***	-0.214***	-0.014***
	(-4.135)	(-3.634)	(-4.831)
PostxTrans	0.430***	0.300***	0.013***
	(4.868)	(3.364)	(2.845)
LagHPI	0.004***	0.004***	0.004***
	(3.240)	(2.880)	(2.883)
One_Four_Homes	-0.0002	-0.0002	-0.0002
	(-0.585)	(-0.576)	(-0.517)
log(Median_Income)	17.545***	17.636***	17.611***
	(24.822)	(24.411)	(24.364)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,566	3,566	3,566
Adjusted R^2	0.883	0.883	0.883

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A8: Mean Value of Loan Originations for Home Improvements by Investors (with controls)

Dependent variable:	ln(Mean Value of Improvement Originations)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	3.273***	3.215***	3.366***
	(10.040)	(11.314)	(11.395)
Treat	0.080	0.218	0.007
	(0.574)	(1.485)	(1.117)
PostxTrans	-0.212	-0.443	-0.038***
	(-0.860)	(-1.362)	(-2.817)
LagHPI	0.002	0.002	0.002
	(0.560)	(0.537)	(0.441)
One_Four_Homes	0.002**	0.002**	0.002**
	(2.033)	(2.118)	(2.101)
log(Median_Income)	24.675***	24.695***	24.586***
	(11.569)	(11.611)	(11.638)
LagInvestorsApprovals	0.035***	0.035***	0.034***
	(3.709)	(3.687)	(3.497)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	1,027	1,027	1,027
Adjusted R^2	0.869	0.869	0.870

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes all years from 2010-2021. The dependent variable is the natural logarithm of 1 + the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A9: Investor Home Loan Applications (with controls)

Dependent variable:	ln(Investor Loan Applications)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.047*	0.061***	0.057**
	(1.808)	(2.771)	(2.554)
Treat	-0.0005	0.032**	0.001
	(-0.034)	(2.157)	(0.670)
PostxTrans	0.014	-0.031	-0.0003
	(0.609)	(-1.184)	(-0.285)
LagHPI	-0.00005	-0.0001	-0.0001
	(-0.142)	(-0.271)	(-0.209)
One_Four_Homes	0.0001	0.0001	0.0001
	(1.130)	(1.175)	(1.143)
log(Median_Income)	0.544***	0.559***	0.553***
	(3.078)	(3.154)	(3.116)
LagInvestorsApprovals	0.033***	0.033***	0.033***
	(18.967)	(18.859)	(18.892)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.767	0.767	0.767

This table presents estimates of difference-in-difference regressions of mortgage applications by investors around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of investor applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the lag of the house price index, the lag of investor approvals (as a proxy for number of investment properties), the tract median incomes, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A10: Investor Home Loan Approvals (with controls)

Dependent variable:	ln(Investor Loan Originations)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.061**	0.062**	0.056**
	(2.150)	(2.581)	(2.299)
Treat	0.003	0.021	-0.00003
	(0.172)	(1.201)	(-0.024)
PostxTrans	0.005	0.008	0.001
	(0.216)	(0.258)	(0.795)
LagHPI	-0.0004	-0.0004	-0.0004
	(-1.226)	(-1.243)	(-1.178)
One_Four_Homes	0.0001	0.0001	0.0001
	(1.155)	(1.153)	(1.155)
log(Median_Income)	0.577***	0.582***	0.578***
	(3.039)	(3.074)	(3.055)
LagInvestorsApprovals	0.042***	0.042***	0.042***
	(16.319)	(16.300)	(16.334)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.712	0.712	0.712

This table presents estimates of difference-in-difference regressions of mortgage applications by investors around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of investor applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the lag of the house price index, the lag of investor approvals (as a proxy for number of investment properties), the tract median incomes, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A11: Owner Occupier Permit Activity Around Mergers

Dependent variable:	ln(1+ Permits Issued)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.004	0.462***	0.320**
	(0.022)	(3.481)	(2.148)
Treat	-0.253**	-0.033	-0.013*
	(-2.257)	(-0.326)	(-1.922)
Post x Treat	0.584***	0.277	0.033***
	(3.089)	(1.661)	(2.671)
LagHPI	-0.018***	-0.019***	-0.018***
	(-8.160)	(-8.474)	(-8.361)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	965	965	965
Adjusted R^2	0.433	0.424	0.429

This table presents estimates of difference-in-difference regressions of building permits issued for owner occupier owners around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of owner occupier permits issued in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A12: Small Investor Permit Activity Around Mergers

Dependent variable:	ln(1+ Permits Issued)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.085	0.201**	0.118
	(-0.519)	(2.095)	(1.113)
Treat	-0.174*	-0.055	-0.008
	(-1.893)	(-0.655)	(-1.554)
PostxTrans	0.388**	0.256*	0.023**
	(2.589)	(1.888)	(2.224)
LagHPI	-0.010***	-0.011***	-0.011***
	(-5.480)	(-5.812)	(-5.729)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	965	965	965
Adjusted R^2	0.362	0.359	0.361

This table presents estimates of difference-in-difference regressions of building permits issued for small investor owners around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of small investor permits issued in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A13: Large Investor Permit Activity Around Mergers

Dependent variable:	ln(1 + Permits Issued)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.487	0.537***	0.587**
	(1.512)	(2.672)	(2.587)
Treat	0.026	0.068	0.012
	(0.148)	(0.435)	(1.121)
PostxTrans	0.062	0.042	-0.007
	(0.234)	(0.166)	(-0.358)
LagHPI	-0.010***	-0.011***	-0.011***
	(-2.956)	(-3.029)	(-3.050)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	965	965	965
Adjusted R^2	0.520	0.521	0.521

This table presents estimates of difference-in-difference regressions of building permits issued for large investor owners around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of large investor permits issued in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression, and the lag of the house price index. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A14: SFR Investor Permit Activity Around Mergers

Dependent variable:	ln(1+ Permits Issued)		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.048	0.094	0.100
	(0.844)	(1.251)	(1.251)
Treat	-0.030	-0.029	-0.0004
	(-1.139)	(-0.672)	(-0.143)
PostxTrans	0.065	0.043	0.001
	(1.324)	(0.606)	(0.187)
LagHPI	-0.001	-0.001	-0.001
	(-1.180)	(-1.174)	(-1.207)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	965	965	965
Adjusted R^2	0.081	0.081	0.081

This table presents estimates of difference-in-difference regressions of building permits issued for large investor owners around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the natural logarithm of 1 + the number of large investor permits issued in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression, and the lag of the house price index. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A15: Mortgage applications by race/ethnicity around mergers: 2010-2021

Dependent Variable		$\ln(1+\text{Applications}_{g,n,t})$		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Black	Post x Treat	0.128***	0.108**	0.004***
		(2.815)	(2.557)	(2.949)
	Adjusted R^2	0.764	0.763	0.763
(2) White	Post x Treat	0.105**	0.149***	0.007***
		(2.394)	(3.295)	(3.583)
	Adjusted R^2	0.897	0.897	0.897
(3)Latino	Post x Treat	0.236***	0.222***	0.009***
		(5.381)	(5.255)	(3.855)
	Adjusted R^2	0.670	0.668	0.669
(4) Asian	Post x Treat	0.081*	0.151***	0.006***
		(1.910)	(3.049)	(3.332)
	Adjusted R^2	0.753	0.753	0.753
(5) Native American	Post x Treat	−0.004	0.019	0.0004
		(-0.241)	(1.264)	(0.662)
	Adjusted R^2	0.138	0.138	0.138
(6) Mixed Race	Post x Treat	0.030	0.029	0.002
		(0.890)	(0.735)	(1.347)
	Adjusted R^2	0.530	0.530	0.530
(7) Non-White	Post x Treat	0.124***	0.127***	0.005***
		(3.029)	(3.351)	(3.911)
	Adjusted R^2	0.755	0.755	0.755
All regressions	CountyxYear FE	Yes	Yes	Yes
All regressions	Tract FE	Yes	Yes	Yes
All regressions	Observations	6,512	6,512	6,512

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes all years from 2010-2021. The dependent variable for each regression is the natural logarithm of 1 + the application count in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A16: Mortgage originations by race/ethnicity around mergers: 2010-2021

Dependent Variable		$\ln(1+ \text{Originations}_{g,n,t})$		
	Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
(1) Black	Post x Treat	0.126***	0.100**	0.005***
		(2.659)	(2.090)	(2.715)
	Adjusted R^2	0.669	0.668	0.668
(2) White	Post x Treat	0.015	0.040	0.001
		(0.298)	(0.905)	(0.891)
	Adjusted R^2	0.866	0.866	0.866
(3)Latino	Post x Treat	0.200***	0.157***	0.006***
		(4.835)	(3.378)	(2.990)
	Adjusted R^2	0.611	0.610	0.610
(4) Asian	Post x Treat	0.071*	0.147***	0.006***
		(1.731)	(2.935)	(3.073)
	Adjusted R^2	0.707	0.708	0.708
(5) Native American	Post x Treat	0.011	-0.002	-0.0002
		(1.126)	(-0.178)	(-0.483)
	Adjusted R^2	0.083	0.082	0.082
(6) Mixed Race	Post x Treat	-0.050	-0.082**	-0.002
		(-1.617)	(-2.476)	(-1.203)
	Adjusted R^2	0.472	0.473	0.472
(7) Non-White	Post x Treat	0.113**	0.119***	0.005***
		(2.455)	(2.878)	(3.013)
	Adjusted R^2	0.691	0.691	0.691
All regressions	CountyxYear FE	Yes	Yes	Yes
All regressions	Tract FE	Yes	Yes	Yes
All regressions	Observations	6,512	6,512	6,512

This table presents estimates of difference-in-difference regressions of mortgage originations by race/ethnicity around the four mergers of institutional investors. The sample includes the originations in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The time period includes all years from 2010-2021. The dependent variable for each regression is the natural logarithm of 1 + the origination count for each race/ethnicity group in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A17: Black/African American Mortgage Applications (with controls)

Dependent variable:	Black/African American Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.020	1.070**	0.496
	(-0.030)	(2.186)	(0.969)
Treat	-1.335**	-1.754**	-0.146***
	(-2.543)	(-2.243)	(-3.447)
Post x Treat	2.541***	2.839**	0.221***
	(2.696)	(2.141)	(3.248)
LagHPI	-0.030***	-0.032***	-0.029***
	(-2.842)	(-2.998)	(-2.813)
One_Four_Homes	0.002	0.002	0.002
	(0.478)	(0.437)	(0.491)
log(Median_Income)	13.526***	13.777***	13.427***
	(3.196)	(3.195)	(3.170)
All_Approvals_Count	0.331***	0.335***	0.332***
	(7.655)	(7.784)	(7.730)
LagInvestorsApprovals	0.134***	0.131***	0.135***
	(3.279)	(3.084)	(3.206)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.781	0.780	0.783

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to the transaction until four years after. The dependent variable is the number of Black/African American applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A18: White Mortgage Applications (with controls)

Dependent variable:	White Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	1.798**	1.756***	2.034***
	(2.390)	(3.177)	(3.567)
Treat	0.341	1.419***	0.080***
	(0.680)	(3.053)	(3.712)
Post x Treat	-0.814	-2.607***	-0.149***
	(-0.964)	(-3.189)	(-4.029)
LagHPI	-0.019	-0.021	-0.022*
	(-1.504)	(-1.632)	(-1.695)
One_Four_Homes	0.001	0.001	0.001
	(0.141)	(0.200)	(0.157)
log(Median_Income)	-29.578***	-29.321***	-29.337***
	(-5.615)	(-5.636)	(-5.634)
All_Approvals_Count	0.521***	0.522***	0.523***
	(16.698)	(16.973)	(16.973)
LagInvestorsApprovals	-0.030	-0.032	-0.034
	(-0.822)	(-0.862)	(-0.907)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.958	0.958	0.958

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A19: Latino/Hispanic Mortgage Applications (with controls)

Dependent variable:	Latino/Hispanic Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.409	0.128	0.041
	(-1.324)	(0.481)	(0.149)
Treat	-0.660***	-0.724**	-0.029*
	(-3.305)	(-2.311)	(-1.746)
Post x Treat	1.295***	1.514***	0.070**
	(3.648)	(2.820)	(2.429)
LagHPI	0.012***	0.011**	0.011**
	(2.627)	(2.481)	(2.528)
One_Four_Homes	-0.001	-0.001	-0.001
	(-0.345)	(-0.383)	(-0.318)
log(Median_Income)	8.224***	8.382***	8.494***
	(4.021)	(4.093)	(4.151)
All_Approvals_Count	0.106***	0.108***	0.108***
	(11.410)	(11.749)	(11.736)
LagInvestorsApprovals	-0.023*	-0.025*	-0.025*
	(-1.656)	(-1.746)	(-1.711)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.658	0.658	0.658

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the number of Latino/Hispanic applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage approvals in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A20: Asian Mortgage Applications (with controls)

Dependent variable:	Asian Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.017	-0.460	-0.407
	(-0.040)	(-1.444)	(-1.280)
Treat	0.356	-0.372	0.002
	(1.468)	(-0.879)	(0.176)
Post x Treat	-0.543	0.583	0.008
	(-1.269)	(0.976)	(0.380)
LagHPI	0.002	0.003	0.003
	(0.253)	(0.493)	(0.431)
One_Four_Homes	0.001	0.001	0.001
	(0.751)	(0.690)	(0.726)
log(Median_Income)	-3.961	-4.285	-4.130
	(-1.220)	(-1.328)	(-1.282)
All_Approvals_Count	0.182***	0.180***	0.180***
	(7.722)	(7.636)	(7.631)
LagInvestorsApprovals	-0.017	-0.015	-0.015
	(-0.801)	(-0.693)	(-0.719)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.815	0.815	0.815

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of Asian applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage approvals in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A21: Mixed Race/Ethnicity Mortgage Applications (with controls)

Dependent variable:	Mixed Race/Ethnicity Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	0.047	-0.110	-0.072
	(0.305)	(-0.857)	(-0.544)
Treat	0.196**	0.244***	0.013***
	(2.304)	(3.637)	(4.188)
Post x Treat	-0.370***	-0.420***	-0.023***
	(-2.895)	(-3.387)	(-3.930)
LagHPI	0.008***	0.008***	0.008***
	(3.945)	(4.127)	(4.057)
One_Four_Homes	-0.001	-0.001	-0.001
	(-1.102)	(-1.070)	(-1.128)
log(Median_Income)	2.439***	2.401***	2.400**
	(2.628)	(2.601)	(2.591)
All_Approvals_Count	0.030***	0.029***	0.029***
	(8.349)	(8.249)	(8.291)
LagInvestorsApprovals	0.006	0.006	0.006
	(0.729)	(0.775)	(0.748)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.516	0.515	0.516

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of mixed race/ethnicity applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage approvals in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A22: Non-White Mortgage Applications (with controls)

Dependent variable:	Non-White Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.378	0.712	0.125
	(-0.540)	(1.270)	(0.215)
Treat	-1.526***	-2.771***	-0.168***
	(-3.194)	(-4.239)	(-5.352)
Post x Treat	3.102***	4.790***	0.290***
	(3.620)	(4.426)	(5.597)
LagHPI	-0.014	-0.014	-0.013
	(-1.200)	(-1.242)	(-1.085)
One_Four_Homes	0.003	0.003	0.003
	(0.696)	(0.614)	(0.705)
log(Median_Income)	19.305***	19.352***	19.263***
	(3.794)	(3.816)	(3.824)
All_Approvals_Count	0.628***	0.631***	0.628***
	(16.163)	(16.325)	(16.261)
LagInvestorsApprovals	0.091*	0.089*	0.093*
	(1.891)	(1.813)	(1.909)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.868	0.869	0.870

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before the merger until four years after. The dependent variable is the number of non-white applications in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage approvals in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A23: Black/African American Mortgage Originations (with controls)

Dependent variable:	Black/African American Originations		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.271	0.140	-0.172
	(-0.637)	(0.440)	(-0.519)
Treat	-0.565*	-0.863*	-0.080***
	(-1.700)	(-1.893)	(-3.241)
Post x Treat	1.037*	1.353*	0.114***
	(1.751)	(1.781)	(2.910)
LagHPI	-0.019***	-0.019***	-0.018***
	(-2.780)	(-2.917)	(-2.722)
One_Four_Homes	0.002	0.002	0.002
	(0.821)	(0.781)	(0.842)
log(Median_Income)	9.070***	9.127***	8.894***
	(3.272)	(3.271)	(3.225)
All_Approvals_Count	0.212***	0.213***	0.211***
	(7.479)	(7.626)	(7.553)
LagInvestorsApprovals	0.075***	0.074***	0.076***
	(2.776)	(2.649)	(2.750)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.745	0.745	0.748

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to the transaction until four years after. The dependent variable is the number of Black/African American originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage applications in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A24: White Mortgage Originations (with controls)

Dependent variable:	White Mortgage Originations		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.771	-0.997***	-0.768**
	(-1.600)	(-2.827)	(-2.073)
Treat	0.495	1.213***	0.072***
	(1.583)	(3.793)	(4.947)
Post x Treat	-0.963*	-2.111***	-0.122***
	(-1.764)	(-3.979)	(-4.895)
LagHPI	-0.004	-0.004	-0.005
	(-0.465)	(-0.541)	(-0.632)
One_Four_Homes	-0.0004	-0.0002	-0.0004
	(-0.161)	(-0.092)	(-0.151)
log(Median_Income)	-11.346***	-11.235***	-11.203***
	(-3.834)	(-3.847)	(-3.838)
All_Approvals_Count	0.390***	0.390***	0.391***
	(17.425)	(17.688)	(17.717)
LagInvestorsApprovals	-0.067***	-0.067***	-0.069***
	(-2.870)	(-2.886)	(-2.949)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.965	0.965	0.965

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of white originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage approvals in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A25: Latino/Hispanic Mortgage Originations (with controls)

Dependent variable:	Latino/Hispanic Mortgage Originations		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.587***	-0.310*	-0.360*
	(-2.868)	(-1.743)	(-1.969)
Treat	-0.359**	-0.372*	-0.012
	(-2.528)	(-1.728)	(-1.159)
Post x Treat	0.691***	0.858**	0.039**
	(2.822)	(2.341)	(2.159)
LagHPI	0.008**	0.007**	0.008**
	(2.554)	(2.482)	(2.512)
One_Four_Homes	-0.001	-0.001	-0.001
	(-0.575)	(-0.605)	(-0.547)
log(Median_Income)	7.770***	7.853***	7.940***
	(5.366)	(5.457)	(5.518)
All_Approvals_Count	0.073***	0.074***	0.074***
	(11.306)	(11.675)	(11.603)
LagInvestorsApprovals	-0.017*	-0.017*	-0.017*
	(-1.732)	(-1.791)	(-1.770)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.654	0.654	0.654

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before each merger until four years after. The dependent variable is the number of Latino/Hispanic loan originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage originations in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A26: Asian Mortgage Originations (with controls)

Dependent variable:	Asian Mortgage Originations		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.301	-0.479*	-0.480*
	(-0.995)	(-1.950)	(-1.964)
Treat	0.021	-0.339	-0.004
	(0.129)	(-1.110)	(-0.409)
Post x Treat	-0.109	0.612	0.020
	(-0.386)	(1.459)	(1.174)
LagHPI	0.002	0.003	0.003
	(0.466)	(0.639)	(0.607)
One_Four_Homes	0.001	0.001	0.001
	(0.604)	(0.537)	(0.581)
log(Median_Income)	-2.796	-2.953	-2.845
	(-1.270)	(-1.350)	(-1.300)
All_Approvals_Count	0.128***	0.127***	0.127***
	(7.488)	(7.425)	(7.424)
LagInvestorsApprovals	-0.014	-0.013	-0.013
	(-0.909)	(-0.830)	(-0.841)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.804	0.804	0.804

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of Asian loan originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage originations in the tract, the lag of investor mortgage originations (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A27: Mixed Race/Ethnicity Mortgage Originations (with controls)

Dependent variable:	Mixed Race/Ethnicity Mortgage Originations		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post	-0.059	-0.180**	-0.152*
	(-0.556)	(-2.083)	(-1.734)
Treat	0.161***	0.203***	0.012***
	(2.773)	(4.029)	(5.287)
Post x Treat	-0.299***	-0.368***	-0.019***
	(-3.166)	(-4.156)	(-4.989)
LagHPI	0.005***	0.005***	0.005***
	(2.970)	(3.093)	(3.029)
One_Four_Homes	-0.001**	-0.001**	-0.001**
	(-2.109)	(-2.058)	(-2.139)
log(Median_Income)	2.572***	2.544***	2.545***
	(3.635)	(3.615)	(3.601)
All_Approvals_Count	0.022***	0.022***	0.022***
	(9.152)	(9.008)	(9.046)
LagInvestorsApprovals	0.002	0.003	0.003
	(0.453)	(0.507)	(0.480)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.520	0.519	0.520

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years prior to each merger until four years after. The dependent variable is the number of mixed race/ethnicity mortgage originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage originations in the tract, the lag of investor approvals (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Table A28: Non-White Mortgage Originations (with controls)

Dependent variable:	Non-White Applications		
Treatment Variable:	I (Δ Properties > 0)	I (Δ Properties > 20)	Δ Properties Count
Post x Treat	1.498***	2.669***	0.165***
	(2.797)	(4.562)	(6.321)
Post	-1.172**	-0.711*	-1.058***
	(-2.445)	(-1.903)	(-2.771)
Treat	-0.831***	-1.484***	-0.092***
	(-2.755)	(-4.095)	(-6.047)
LagHPI	-0.007	-0.007	-0.006
	(-0.974)	(-0.981)	(-0.824)
One_Four_Homes	0.002	0.002	0.002
	(0.668)	(0.583)	(0.669)
log(Median_Income)	15.314***	15.287***	15.243***
	(4.661)	(4.707)	(4.713)
All_Approvals_Count	0.422***	0.423***	0.421***
	(16.842)	(17.072)	(16.971)
LagInvestorsApprovals	0.041	0.041	0.043
	(1.191)	(1.165)	(1.237)
County x Year FE	Yes	Yes	Yes
Tract FE	Yes	Yes	Yes
Observations	3,740	3,740	3,740
Adjusted R^2	0.871	0.872	0.873

This table presents estimates of difference-in-difference regressions of mortgage applications by race/ethnicity around the four mergers of institutional investors. The sample includes the applications in all neighbourhoods where the acquirer and target both owned properties, as well as neighbourhoods in which at least one acquiring firm owned a property prior to the acquisition. The sample includes from three years before the merger until four years after. The dependent variable is the number of non-white mortgage originations in each tract. In column 1, Treat is a binary variable that equals 1 if the acquirer gained at least one additional property in a neighbourhood as a result of the merger. In column 2, Treat is a binary variable that equals 1 if the acquirer gained at least ten properties in the neighbourhood following the merger. In column 3, Treat is the count of properties the acquirer gained in a neighbourhood following the acquisition. I include county x year and tract fixed effects in each regression. I also include a variety of controls including the total number of mortgage originations in the tract, the lag of investor loan originations (as a proxy for number of investment properties), the tract population, the lag of the house price index, and the number of one-to-four family homes in the tract. I report t-statistics using standard errors clustered by census tract in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Chapter 5

Heterogeneous Creditors and Cov-Lite Loans

5.1 Introduction

Covenants are a key element of financial contracting by allocating control between borrowers and lenders. In 2021, over 91% of new syndicated leveraged loan issuances have been 'cov-lite'. Cov-lite loans are stripped on traditional financial 'maintenance' covenants that require the borrower to maintain certain financial ratios within a specified range throughout the life of the loan. Such covenants have traditionally been thought to provide creditors with protection by enabling them to demand loan repayment if the firm's financial condition deteriorates to the point that the firm defaults on a covenant. By contrast, cov-lite loans only enable the lender to intervene in the loan if the firm pursues an *active* event, such as a debt issuance, sale of assets, or merger. Practitioners and regulators have expressed concern that the rise of cov-lite lending may lead to higher losses for "unprotected" lenders at the turn of the next credit cycle.

In this paper, I develop a model in which cov-lite loans *protect* a syndicated lender from shocks originating in its fellow lenders. The intuition is simple. Syndicated lending creates

potential misalignment with both the borrower and the other lenders with whom you co-lend. Other lenders may experience liquidity shocks, require portfolio rebalancing, or otherwise seek early and inefficient repayment of a loan. Maintenance financial covenants, if breached, enable lenders to demand loan repayment even if the expected return from continuation is higher than liquidation. Hence, if there is a sufficiently high probability that a co-lender will seek early repayment, lenders may prefer cov-lite loan terms even if it reduces their oversight of the borrower.

This argument applies even if the parties can costlessly trade their loan shares. Both the covenant breach and a lender demanding repayment cause other lenders to revise their expectations of future payment downward, limiting the circumstances in which they would be willing to purchase the other lender's loan share. I show that where the financial covenant is imprecise in predicting the future prospects of the project, lenders force loan repayment even when they observe a positive public signal about the prospects of the project. This inefficient liquidation means lenders prefer cov-lite loans even if they can purchase the other lender's loan share if she demands liquidation.

My paper contributes to the literature on covenants by providing a new rationale for excluding maintenance covenants from syndicated loans based on asymmetric information between lenders. I formalise this intuition by introducing lender liquidity shocks into a model. My paper is the first to propose concerns about disparate repayment preferences as a motivation for the decline in maintenance covenants in syndicated lending contracts.

This theoretical model produces four testable empirical hypothesis. First, lenders would be expected to exit from cov-heavy loans in response to a liquidity shock, whereas they would not exit from similar cov-lite positions. Second, cov-lite loans are more likely to occur in syndications with a large number of participants and where the composition of participants is diverse. These hypotheses are consistent with the finding in Becker and Ivashina (2016) that the rise of cov-lite lending coincided with a rise in the number and diversity of lender types in the syndicated market. Finally, cov-lite loans are more

likely to occur in industries and companies where the intermediate returns are imprecise predictors of future success (i.e. high growth industries and young companies). This hypothesis is contrary to what would be expected from the traditional view of covenants as a form of lender protection that enable early intervention to discipline the borrower.

The remainder of the paper is organised as follows. Section 2 provides institutional details of cov-lite loans and an overview of the existing literature on the role of covenants in lending contracts. Section 3 presents the foundations of the model, including the information and covenant structure, and applies it to a single lender benchmark. This provides the intuition that underlies the trade-offs that determine the preferred covenant structure. Section 4 outlines the full model with multiple lenders and trade between lenders. Section 5 concludes. Proofs and further extensions are provided in the Appendix.

5.2 Institutional Details and Literature Review

There is a large literature that studies the optimal design of debt contracts with incomplete contracting. It finds that contracts can be designed to align the incentives of borrowers and lenders by optimally allocating control rights and cash flows contingent on the borrower's performance.[1]. Covenants are one of the principal means that rights are assigned within a debt agreement, and may be relaxed or renegotiated as the lender learns about the borrower or project (Berlin and Mester (1992), Gârleanu and Zwiebel (2008)).

Financial covenants can be split into two broad categories: maintenance covenants and incurrence covenants. Maintenance covenants specify the interval or threshold that certain financial metrics must satisfy for the duration of the contract, e.g. debt to EBIT ratio. Lenders check periodically whether these covenants are satisfied. If the borrower violates one of these covenants, it constitutes technical default, which enables lenders

[1]Notable examples include Aghion and Bolton (1992), Nachman and Noe (2015)Anderson and Sundaresan (2015)

to take certain actions to protect their interests (e.g. lenders may choose to accelerate loan payments). Lenders may also use the threat of accelerated loan payments to renegotiate the loan on more favourable terms. [2] Incurrence covenants require the borrower to comply with specified metrics only on the occurence of an *active* event, e.g. a debt issuance that may reduce the firm's ability to service its existing debt. A cov-lite loan is characterised by having only incurrence covenants. Such loans first became a significant feature of in the years proceding the GFC, and they now account for over 90% of the leveraged loan market.

Recent literature has explored the potential rationales for the existence and prevalence of cov-lite loans. Becker and Ivashina (2016) attribute the prevalence of cov-lite loans to rising creditor coordination costs. They argue that wider syndication and the diverse incentives of institutional lenders imply that optimal contracts likely involve weaker covenants (i.e. are more like a public bond). They find that loans that have dispersed institutional ownership are much more likely to be cov-lite. Billett et al. (2016) provide an alternative explanation based on relationship lending. They posit that banks have greater incentives than non-bank investors to maintain a lending relationship in order to accrue relationship rents. They provide theoretical and empirical evidence of a hockey stick relationship between the proportion of bank involvement in a syndicate and covenant tightness: as the proportion of bank involvement declines, covenants tighten, until the relationship reverses once a low threshold is reached. Unlike Becker and Ivashina (2016), in Billett et al. (2016) the number of institutions involved in a syndication is not relevant as different institutions of the same type are assumed to always agree on a strategy. Davydenko et al. (2020) argue the preference for cov-lite is related to the leverage of the underlying firm rather than characteristics of lenders. They construct a structural model that shows that financial covenants have no value to creditors of highly leveraged firms because enforce-

[2] Roberts (2015) shows that more the typical loan is renegotiated five times (or on average every nine months). He finds pricing, loan amount, maturity, and covenants may be modified at each renegotiation and hence change significantly over the life of a loan. Roberts and Sufi (2009) find breach of covenants have persistent negative impacts on a firm's debt issuance, and borrowers rarely switch lenders following a violation despite less favourable terms.

ment would result in a lower expected payoff than allowing continued operation under the shareholders' control.

Berlin et al. (2020) argue that evaluations of covenant protections should include all loans issued at the same time. In particular, they find that many term loans classified as 'cov-lite' are issued with a revolving credit facility contemporaneously. Revolving credit facilities overwhelming have maintenance covenants which are monitored by the bank providing the revolving facility. Hence, these contracts are collectively subject to 'split control rights' where the bank has exclusive monitoring and renegotiation rights which reduces the inefficiencies of contract renegotiation described in Becker and Ivashina (2016).

The decision of optimal covenant structure is inherently linked to a lender's incentive to monitor. Covenants create incentives for a lender to monitor, but the presence of other claimants reduces the value of monitoring to each individual lender (Rajan and Winton (1995)). Winton and Yerramilli (2021) find that banks' incentives to monitor syndicated loans may be enhanced by reputational concerns, but these incentives fall during periods of high loan demand (e.g. credit booms). Consistent with the mechanism proposed in this paper, borrowers themselves may prefer multiple bank lending (or syndication) as a means of mitigating their exposure to the lender's loan repayment preferences. Detragiache et al. (2000) posit that internal problems may prevent a lender from continuing to finance a project. In such cases, it may be difficult for the borrower to refinance with another lender due to adverse selection, so multiple bank lending reduces the risk to the borrower of early liquidation.

5.3 Model Development

5.3.1 Model Foundations

Consider a firm that needs to finance a project that has an uncertain final payoff. The model has three periods. In the first, the firm approaches investors to finance a project that requires an investment of I dollars. This project will either succeed yielding a cash flow of Y in the final period, or will fail, producing nothing. In either case the project may be sold for a salvage value of L_2.

The borrower can offer the lenders a contract that has a maintenance financial covenant or a contract that does not (i.e. is covenant-lite). Let the face value of the loan equal D. In the first period, lenders may observe interim signals of the project's success. Based on these signals, the lenders may have an opportunity to liquidate the project for the value L_1. Assume that $L_2 < L_1 < Y + L_2$ so if there is a low probability of success in period 2, it is efficient to liquidate during period 1. I assume all agents are risk neutral and have a required return of zero. All cash flows and asset values are verifiable.

See Figure 5.3.1 for the time line of events.

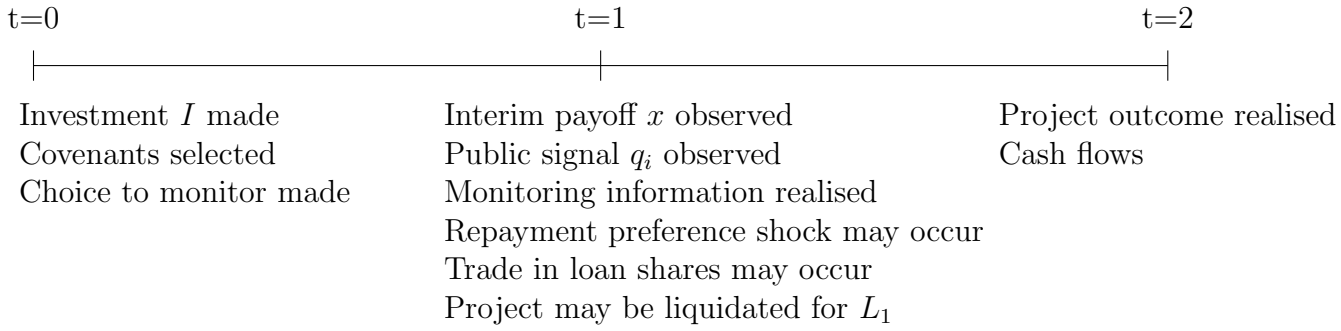


Figure 5.3.1: Time line of events: At date zero, financing is negotiated, including choice of covenants, and lenders choose whether to monitor. At date one, if a covenant is violated, the lenders must either agree to waive the covenant or to liquidate the loan. One of the lenders may also experience a repayment preference shock. The lenders may trade their loan shares. At date two, the outcome of the project and any outstanding cash flows are realised.

For simplicity, I assume that the borrower will never liquidate the project. It may be

that firm management have an 'empire building' motive that means they are unwilling to liquidate., or that early liquidation damages a manager's reputation, so firms hold onto projects even when they are unlikely to be successful. Alternatively, firm management may receive some additional payment outside the model for holding onto inefficient projects. [3]The assumption that the borrower will never liquidate could be relaxed, but allows the model to focus on the conflict between multiple lenders rather than negotiation between lenders and the borrower.

5.3.2 Informational assumptions and choice of covenants

Information is structured similarly to Rajan and Winton (1995). The key information is the probability of the project's success in period 2. In period 0, all agents believe that the probability of success is $p \in (0, 1)$. In period 1, lenders have an opportunity to receive a more precise signal of the firm's probability of success by monitoring for a cost c. The value of this signal $s_i \in \{s_1, s_2\}$ with $0 \leq s_1 < s_2 \leq 1$ is the firm's probability of success given that signal. Assume that both signals are equally likely so that $p = (s_1 + s_2)/2$. If the lender monitors, with probability η he receives signal s_i, while with probability $(1 - \eta)$ he receives no additional information.

Lenders may freely observe a noisy public signal $q \in \{q_1, q_2\}$. This signal can be thought of as the state of the economy or a growth forecast for project's industry. The probability of observing a signal q_i conditional on the true signal being s_i is α where $1/2 < \alpha < 1$. Hence, $q_1 = \alpha s_1 + (1 - \alpha)s_2$ and $q_2 = (1 - \alpha)s_1 + \alpha s_2$, and $s_1 < q_1 < q_2 < s_2$. By symmetry, $Pr[s = s_i|q = q_j] = Pr[q = q_j|s = s_i]$ and the unconditional probabilities of q_1 and q_2 are $1/2$.

Neither s_i nor q_i is verifiable in court, so they cannot be contracted upon directly. However, if an investor monitors, she also observes an intermediate signal $x \in \{x_1, x_2\}$ that is verifiable. This signal can be thought of as an intermediate payout from the project

[3]Management fees calculated as a percentage of assets under management would be an example in the private equity context.

or a particular financial ratio. The probability of observing x_i given the true signal s_i is given by $\phi \in (1/2, 1)$. Hence, $x_1 = \phi s_1 + (1-\phi)s_2$ and $x_2 = (1-\phi)s_1 + \phi s_2$, and $s_1 < x_1 < x_2 < s_2$. Again, by symmetry, $Pr[s = s_i | x = x_j] = Pr[x = x_j | s = s_i]$ and the unconditional probabilities of x_1 and x_2 are $1/2$.

There is also some probability that there may be an unanticipated additional cost of the project in the first period. If this cost occurs, the borrower must ask raise additional financing of Z in order to avoid liquidation. The probability of the borrower requiring additional financing is γ. If the borrower requires additional financing, he must notify the lender. We assume for simplicity that it is never efficient to carry on the project if it requires additional financing, i.e. $Y + L_2 - Z < L_1 < Y + L_2$

Since it is impossible to contract on s_i and q_i, contracts can be enforced in two ways: either the intermediate payment x does not satisfy a condition in the contract, or the firm is unable to refinance at time 1. Assume that the lender may impose two different covenants on the contract. The first covenant (an 'incurrence' covenant) gives the lender the right to liquidate if the project requires refinancing in the first period. I assume that violation of this covenant can be observed without monitoring. The second covenant (a 'maintenance' covenant) gives the lender the right to liquidate the project if the first period cash flow x equals x_1. We assume that the lender must monitor in order to observe adherence with this covenant.

If the maintenance covenant is breached (i.e. $x = x_1$), the lender will choose to waive the covenant or liquidate based on the information received. As the private signal s is the true probability of success of the project, the lender will use this information, if received, to determine whether to allow the project to continue. If the lender has not received the private signal, the lender has knowledge of both the intermediate return and the public signal q on which to base her decision. I assume both the intermediate return x and the public signal q are conditionally independent given s. Hence, the lender updates its beliefs of the true signal s according to the following process.

Lemma 1. *A lender updates its beliefs of the true signal being s_i given x_1 and q_i according to the following equations:*

$$P(s_1|q_1, x_1) = 2\phi\alpha$$
$$P(s_2|q_1, x_1) = 2(1-\phi)(1-\alpha)$$
$$P(s_1|q_2, x_1) = 2\phi(1-\alpha)$$
$$P(s_2|q_2, x_1) = 2\alpha(1-\phi)$$

Hence, the expected probability of the project's success following a low intermediate signal x_1 and a low public signal q_1:

$$b_1 \equiv P(s_1|q_1, x_1)s_1 + P(s_2|q_1, x_1)s_2 = 2(\phi\alpha s_1 + (1-\phi)(1-\alpha)s_2)$$

The expected probability the project's success following a low intermediate signal x_1 and a high public signal q_2 is:

$$b_2 \equiv P(s_1|q_2, x_1)s_1 + P(s_2|q_2, x_1)s_2 = 2(\phi(1-\alpha)s_1 + \alpha(1-\phi)s_2)$$

where $b_2 > b_1$ for $\phi < s_2$. Note that $b_1 < x_1$, $b_1 < q_1$, and $b_2 < q_2$, so receiving a negative intermediate signal unambiguously lowers the lender's expectations of the project's success.

All proofs are in the Appendix.

5.3.3 Single lender contracts: choice of covenants, and monitoring

Suppose there is a single lender who provides debt with face value $D \geq I > L_1$. If the debt has covenants, the lender has power to force repayment (equivalently, liquidation) if she can prove that a covenant has been violated. As discussed above, I assume there are two

possible covenants that could be imposed on the contract. The first covenant (an 'incurrence' covenant) attaches to the borrower's request for refinancing. The lender can costlessly observe the borrower's adherence with this covenant. Hence, the lender's expected return under a contract containing only this covenant is $(1-\gamma)[pD+(1-p)L_2]+\gamma L_1$. With this covenant, the lender can only force liquidation in the first period if the borrower requests additional financing, otherwise the project continues to the second period. Since the lender cannot influence the repayment decision beyond the freely observed request for additional finance, she has no incentive to monitor.

The second covenant (a 'maintenance' covenant) attaches to the private intermediate signal x. In order to observe adherence to this covenant, the lender must pay a cost of c. Monitoring the intermediate signal x allows the lender the possibility of observing the unverifiable true probability of success s at no extra cost. I assume that the signal x and the public signal q are conditionally independent.[4]

Assume that the lender has a contract that contains both a maintenance covenant based on the verifiable signal x and an incurrence covenant based on whether the borrower requires additional financing in the first period. If x_1 occurs, the lender has the right to force liquidation but in order to exercise rights under the covenant the lender must monitor.

Suppose the lender monitors its loan. If x_2 is realised, the debt remains in place until period two. However, if x_1 is realised and the borrower does not request additional financing, the lender must decide whether to liquidate the loan or let the debt stay in place. If the lender observes the additional private information s, she decides whether to liquidate on the basis of that information, else she must decide on the basis of public information q and the intermediate signal x.

[4]If we think of the intermediate signal as an output from the project and the public signal as a forecast of the state of the market in the following period, it is reasonable to assume these are independent. I provide an analysis of the case where the signals are perfectly correlated in the Appendix B. Of course, the case with some degree of correlation would fall between these results.

Consider the case where the lender receives the signal s. When $s_i(D_2 - L_2) + L_2 < L_1$ the lender demands repayment in the first period, forcing liquidation for a return of L_1. Conversely, if $s_i(D - L_2) + L_2 > L_1$, she waives the covenant, leaves the debt in place and receives an expected payment of $s_i(D - L_2) + L_2$ in the final period. Hence, I define the liquidation threshold based on private information $T_s \equiv (L_1 - L_2)/(D - L_2)$, so the single lender demands repayment when $s_i < T_s$

If the lender only receives the public information, she uses both the intermediate signal and the public information to update her beliefs according to Lemma 1. She forces liquidation when $b_i Y + L_2 < L_1$, and allows the debt to stay in place when $b_i(D - L_2) + L_2 > L_1$ where $, b \in 1, 2,$. Hence, the liquidation threshold at which the single lender demands repayment with only public information and the intermediate signal is $b < (L_1 - L_2)/(D - L_2) \equiv T_b$

Thus, if the lender monitors, his expected payoff (excluding the monitoring cost c) is:

$$(1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2, L_1] + (1-\phi)\max[s_2(D-L_2)+L_2, L_1]\Big]$$
$$+(1-\eta)\big(1/2\max[b_1(D-L_2)+L_2, L_1]+1/2\max[b_2(D-L_2)+L_2, L_1]\big)+\Big(\max[x_2(D-L_2)+L_2, L_1]\Big)\Big]$$
$$+\gamma L_1$$

Whereas, if the lender does not monitor, his expected payoff is $(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1$.

I define the value of monitoring Δ_M to be the difference between the lender's expected payoffs when she monitors and when she does not.

Proposition 1. *Suppose the single lender provides a loan with a face value of D. The loan contract contains two covenants: one that is violated if the borrower requires additional financing and another that is violated when the intermediate cash flow $x \leq x_1$. The following statements hold: (i) If $T_s < s_1$, the value of monitoring is zero. The borrower*

optimally offers a cov-lite contract with face value $D = [(I - \gamma L_1)/(1-\gamma) - L_2]/p + L_2$ *which the lender accepts.*

(ii) If $s_2 < T_s$*, the project is always liquidated in the first period for a liquidation value below investment cost. Hence, the lender never provides a loan.*

(iii) If $s_1 < (L_1 - L_2)/(D - L_2) < b_1$ *the value of monitoring is decreasing in the value of debt. The minimum face value of debt that the lender would accept is:*

$$D_S^{s1} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - \eta\phi(L_1 - L_2) - 2L_2}{(1-\eta\phi)s_1 + s_2} + L_2$$

(iv) If $b_1 < (L_1 - L_2)/(D - L_2) < b_2$ *the value of monitoring is increasing in the value of debt. The minimum face value of debt that the lender would be willing to accept is*

$$D_S^{b1} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - 1/2(1-\eta(1-2\phi))(L_1 - L_2) - 2L_2}{\big[1 - \phi(\eta + \alpha(1-\eta))\big]s_1 + \big[\phi + (1-\phi)(\eta + (1-\eta)\alpha)\big]s_2} + L_2$$

(v) If $b_2 < (L_1 - L_2)/(D - L_2) < s_2$ *the value of monitoring is decreasing in the face value of debt. The minimum level face value of debt at which the lender would be willing to lend is:*

$$D_S^{b2} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - (1-\eta(1-\phi))(L_1 - L_2) - 2L_2}{(1-\phi)s_1 + (\phi + \eta(1-\phi))s_2} + L_2$$

For (ii)-(v) the borrower will only choose the corresponding face value of debt if it is less than the face value of cov-lite debt (i.e., $D_S^{s1} < D_S^{cv}$,$D_S^{b1} < D_S^{cv}$*, or* $D_S^{b2} < D_S^{cv}$*)).*

Part (i) and (ii) follow directly from Lemma 1. Outside $s \in (s_1, s_2)$ the lender will either always liquidate or always keep the loan in place, in either case the value of monitoring is zero. The value of monitoring in (iii)-(v) follows from the expected payoff with monitoring specified above minus the expected payoff absent monitoring. The impact of the face value of debt on the lender's willingness to monitor depends on the information received by the

lende

The choice of debt contract follows from the lender's individual rationality constraint. If the lender monitors, he receives either repayment of the face value of debt or the first period liquidation value, L_1. Conversely, if the lender does not monitor, he always receives the second period payment, which equals the face value of debt when the project is successful. Hence, an increase in the face value of debt is more important for the lender when he does not monitor than when he does. r.

I assume that the borrower prefers to minimise its payment to the lenders, so it will offer the lowest face value contract that the lender will accept given a set of covenants. If two contracts have the same face value, the borrower prefers the contract with less restrictive covenants. When the probability of receiving additional information from monitoring is low (η is low), the expected payoff from monitoring is less than the cost, so the borrower offers a cov-lite contract that the single lender accepts. Conversely, the borrower will offer a covenant-heavy contract where the probability of receiving additional information through monitoring is high.

Proposition 2. *Suppose the following conditions hold:*

$$c \leq \Delta_{SL}(D_S^{SL*})$$

$$Y + L_2 \geq D_S^{SL*}$$

then the debt provided by a single lender with face value D_S^{SL*} and a covenant at x results in monitoring by the lender. If either conditions is violated, the single lender will not lend and monitor.

The first condition ensures that once the loan is made, the lender will find it incentive compatible to monitor. The second guarantees that the minimum face value of debt that

fulfils the lender's individual rationality constraint is feasible (i.e. the borrower cannot promise a repayment higher than $D_S = Y + L_2$).

I now expand this basic set up to include multiple lenders.

5.4 Multiple Lender Contracts, Choice of Covenants, and Monitoring

In the previous section, I established that in the single lender case the lender will prefer a debt contract with a maintenance covenant where the cost of monitoring is less than the value of information. Absent any other friction, such a contract would also be preferred by multiple lenders provided as the cost of monitoring remains below the value of information.[5]

Now consider the optimal contract if lenders are not assumed to be always aligned. In particular, a lender may wish to liquidate the loan early if it suffers a liquidity shock such that it requires cash in the first period. Equivalently, a lender may be capital constrained and receive a better investment opportunity in the first period such that it needs to liquidate the initial project in order to invest in the new project. I refer to such circumstances broadly as a 'repayment preference' shock.

Lenders must agree together the terms on which they offer debt financing to the borrower, and if a covenant is breached, all lenders must agree whether to allow the borrower to continue into the next period or to liquidate the loan. Contracts are structured such that if one lender does not waive a covenant violation, the loan must be liquidated (i.e. it is not possible for there to be partial liquidation). I assume that all contracts contain a covenant that gives any lender the right to liquidate following a breach. Hence, if one lender faces a repayment preference shock he may force first period liquidation if the

[5]It is trivial to show that as the size of investment is divided between multiple lenders, the cost of monitoring, if fixed, would eventually be larger than the value of information.

maintenance covenant is breached even if she (and all other lenders) face a loss (recall $L_1 < I$).

For simplicity, consider the case of two lenders. Assume that there is some probability k that Lender B will face a repayment preference shock in the first period such that he will choose to liquidate the loan regardless of the information he has received. This shock is private unverifiable information. I assume that if both lenders monitor, the signal received by one is independent of the signal received by the other, so both face a probability η of receiving additional information s about the likely success of the project. Hence, if Lender B refuses to waive a first period covenant violation (i.e. demands liquidation), Lender A does not necessarily know whether this is because Lender B has superior information about the loan's prospects (i.e. received signal s_1) or whether it is because of a repayment preference shock.

Lender A will agree to the debt contract that maximises his expected profit *given* the expected behaviour of Lender B. Consider the expected payoff to Lender A for a contract that contains both a maintenance and an incurrence covenant. First assume that neither lender can sell his interest in the loan to the other lender.

As in the single lender case, if the borrower requires additional financing in the first period (i.e. breaches the incurrence covenant), both lenders are better off liquidating the loan in the first period ($s_2Y + L_2 - Z < L_1$). This occurs with probability γ.

If Lender A monitors, there is ex-ante probability 1/2 that the covenant is not breached (i.e. $x = x_2$) in which case the project invariably continues to the second period. If the maintenance covenant is breached (i.e. $x = x_1$) Lender A needs to decide whether to waive the covenant violation (hence the project to continue to the next period) or liquidate the loan. There is a probability η that he receives an additional signal s about the likely payoff to the project: if he observes s_1 (which occurs with probability ϕ) he liquidates the project ($s_1Y + L_2 < L_1$), while if he observes s_2 (which occurs with probability $(1 - \phi)$, he allows the project to continue into the following period. If he does not receive an

additional signal, he updates his believes according to the public signal and the negative intermediate signal received.

Hence, the only interval on which there may be disagreement between the two lenders is where Lender A has additional information that the project will be positive ($s = s_2$) yet Lender B wants to liquidate. I will consider the optimal contract for the borrower to offer both where the lenders can trade loan shares and where they cannot.

Assume lenders make their first period decisions independently and contemporaneously. If the borrower's intermediate output is x_1, each lender elects to either waive the covenant or liquidate the project. The project is not liquidated only if both lenders agree to waive the covenant. Under these assumptions the following proposition holds:

Proposition 3. *a) A lender that does not face a liquidity constraint will always truthfully report his wish to waive the covenant or liquidate. A lender who is liquidity constrained will always report a desire to liquidate; b) The maximum price that a non-liquidity constrained lender will offer to purchase the other lender's loan stake is* $1/2L_1$

To build intuition, I first assume that the public signal q and the intermediate signal x are perfectly correlated. This eliminates one additional channel of information and allows an intuitive analysis of when different contract structures would be preferred.

5.4.1 Public signal and intermediate signal perfectly correlated

No trade in loan shares

If lenders are unable to trade their shares of the loan, then the loan must be liquidated should one lender not wish to proceed with the loan agreement. Hence, if Lender A monitors, his expected payoff (excluding the monitoring cost c) is:

$$(1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2,L_1]+(1-\phi)\Big((1-\eta)L_1+\eta kL_1$$
$$+\eta(1-k)\max[(s_2(D-L_2)+L_2,L_1]\Big]+(1-\eta)\max[q_1(D-L_2)+L_2,L_1]+\Big(x_2(D-L_2)+L_2\Big)\Big]+\gamma L_1$$

If Lender A does not monitor his payoff is $(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1$.

I have assumed that if the contract contains a covenant the lender will monitor. It is also possible to cover the case that the contract contains a covenant but the lender does not monitor and instead relies on the other lender to monitor, but I reserve that for future work.

Therefore the return to monitoring Δ_{TL} is:

$$\Delta_{TL}=(1-\gamma)1/2\Big[\big(1-\eta\eta(1-\phi)(1-k)\big)s^L-\phi s_1-(1-\phi)[1-\eta\eta(1-k)]s_2\Big](D-L_2)$$

Proposition 4. *Suppose there are two lenders who provide a loan with a face value of D. The loan contract contains two covenants: one that is violated if the borrower requires additional financing and another that is violated if the intermediated cash flow $x \leq x_1$. The lenders cannot trade their shares in the first period. The following statements hold: (i) If $s^{TL} \leq s_1$ the maintenance covenant attaching to intermediate cash flow is never violated and the value of monitoring Δ_{TL} is zero; (ii) If $s^{TL} \geq s_2$, neither lender would choose to lend because both would expect to always liquidate in the first period, so the value of monitoring is zero; (iii) If $s^{TL} \in (s_1, s_2)$ the value of monitoring is* $\Delta_{TL}=(1-\gamma)1/2\Big[\big(1-\eta\eta(1-\phi)(1-k)\big)s^L-\phi s_1-(1-\phi)[1-\eta\eta(1-k)]s_2\Big](D-L_2)$;

(iv) Δ_{TL} *is maximised where* $D = D^{TL*}$ *where:*

$$D^{TL} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - (1 - \eta(1-\phi)\eta(1-k))L_1 - (1 + \eta(1-\phi)\eta(1-k))L_2}{(1-\phi)s_1 + (\phi + \eta(1-\phi)\eta(1-k))s_2} + L_2 \tag{5.1}$$

which is the smallest face value of debt D *such that two lenders would be willing to lend and monitor.*

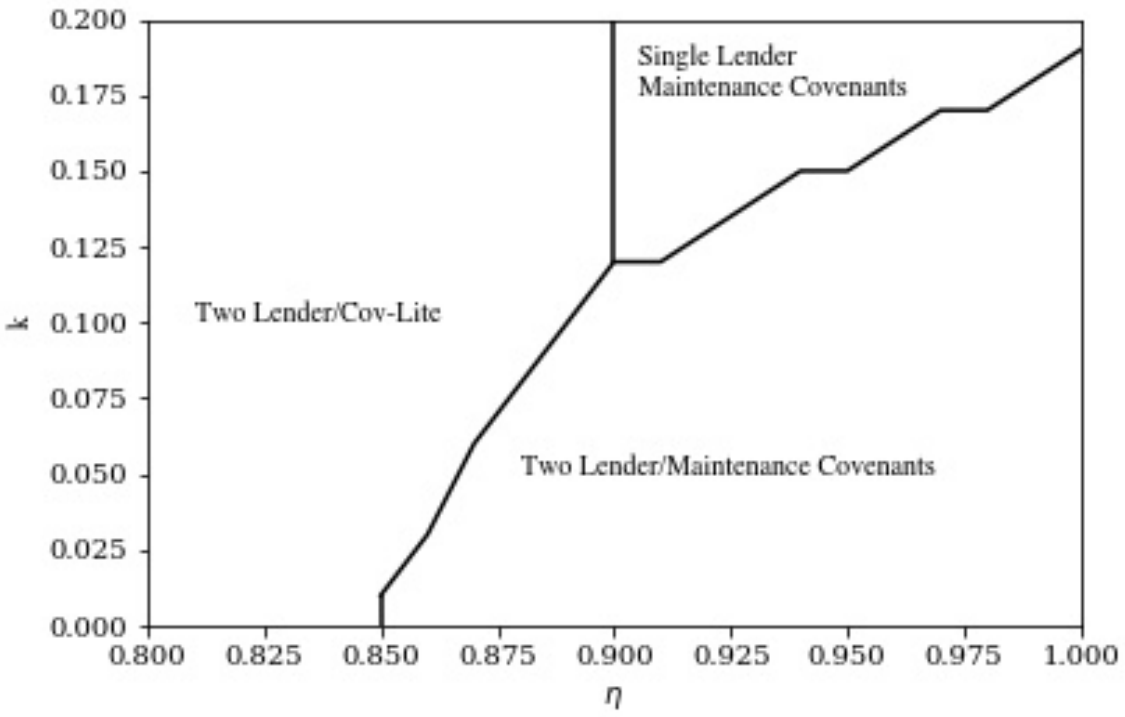


Figure 5.4.1: Borrower's preferred contract (lowest face value D) for different probabilities of repayment preference shocks and precision of information
This chart assumes $\gamma = 0.05$ and the "monitoring cost" of the two lenders being lower than the monitoring cost of the single lender.

Trade in loan shares

Let the lenders be able to trade their loan shares. Assume that ex ante each lender owns one half of the loan. If Lender B wishes to liquidate, he would be willing to sell his share of the loan to Lender A provided as he is paid at least L_1 (the return he would receive if the loan is liquidated during the first period).

Hence, Lender A will offer Lender B L_1 for his portion of the liquidated loan provided as the expected return is greater than the cost (i.e. if $2(s_2(D_S - L_2) + L_2) - L_1 > L_1$).

Hence, if Lender A monitors, his expected payoff (excluding the monitoring cost c) is:

$$(1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2,L_1]+(1-\phi)\Big((1-\eta+\eta k)\max[2(s_2(D-L_2)+L_2)-L_1,L_1]$$
$$+\eta(1-k)\max[s_2(D-L_2)+L_2,L_1]\Big]+(1-\eta)\max[q_1(D-L_2)+L_2,L_1]+\Big(x_2(D-L_2)+L_2\Big)\Big]+\gamma L_1$$

If Lender A does not monitor his payoff is $(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1$.

I have assumed that if the contract contains a covenant the lender will monitor.

The optimal contract for the borrower to offer the lender is formalised in the following proposition.

Proposition 5. *Suppose there are two lenders who provide equal shares in a loan with a face value of D. The loan contract contains two covenants: one that is violated if the borrower requires additional financing and another that is violated when the intermediate cash flow $x \leq x_1$. The lenders may costlessly trade their loan shares in the first period. The following statements hold: (i) A lender will never offer more than L_1 to acquire the other lender's loan share. (ii) The return to monitoring Δ_{TLT} is:*

$$\Delta_{TLT} = (1-\gamma)1/2\Big[\Big(1-\eta(1-\phi)\big(2-\eta(1-k)\big)\Big)(L_1-L_2)...$$
$$-\Big(\phi s_1+s_2(1-\phi)\big(1-\eta(2-\eta(1-k))\big)\Big)(D_S-L_2)\Big]$$

(iii) The amount of debt that maximises the return to monitoring is:

$$D_{TLT} = \frac{2(I+c-\gamma L_1)/(1-\gamma)-\big(1-\eta(1-\phi)(2-\eta(1-k))\big)L_1}{\Big((1-\phi)s_1+\big(\phi+\eta(1-\phi)(2-\eta(1-k))\big)s_2\Big)D}$$
$$-\frac{\big(1+\eta(1-\phi)(2-\eta(1-k))\big)L_2}{\Big((1-\phi)s_1+\big(\phi+\eta(1-\phi)(2-\eta(1-k))\big)s_2\Big)D}+L_2$$

5.4.2 Public signal and intermediate signal independent

Consistent with the single lender case analysed above, this section assumes that the public signal and the intermediate signal are independent.

As in the single lender case, if the borrower requires additional financing in the first period (i.e. breaches the incurrence covenant), both lenders are better off liquidating the loan in the first period ($s_2Y + L_2 - Z < L_1$). This occurs with probability γ. There is ex-ante probability 1/2 that the covenant is not breached (i.e. $x = x_2$) in which case the project invariably continues to the second period.

If the maintenance covenant is breached (i.e. $x = x_1$) Lender A needs to decide whether to waive the covenant violation (hence the project to continue to the next period) or liquidate the loan. There is a probability η that he receives an additional signal s about the likely payoff to the project: if he observes s_1 (which occurs with probability ϕ) he liquidates the project ($s_1Y + L_2 < L_1$), while if he observes s_2 (which occurs with probability $(1 - \phi)$, he continues with the project. If he does not receive an additional signal, he relies only on the public signal q that has an outcome independent of x.

First, I consider the optimal contract where lenders are unable to trade their loan shares before considering the case where lenders may trade their loan shares.

No trade in loan shares

If lenders are unable to trade their shares of the loan, then the loan will be liquidated if one lender receives bad signals or a liquidity shock. Hence, if Lender A monitors, his expected payoff (excluding the monitoring cost c) is:

$$(1-\gamma)1/2\Bigg[\eta\Big[\phi\max[s_1(D-L_2)+L_2,L_1]$$
$$+(1-\phi)\Big((1-\eta)(1-k)(1/2(s_2(D-L_2)+L_2)+1/2L_1)+kL_1+\eta(1-k)\max[(s_2(D-L_2)+L_2,L_1]\Big)\Big]$$
$$+(1-\eta)[(1-k)E_q[\max[q(D-L_2)+L_2,L_1]+kL_1]+\Big(x_2(D-L_2)+L_2\Big)\Bigg]+\gamma L_1$$

If Lender A does not monitor his payoff is $(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1$.

The optimal contract to for the borrower to offer and the return to monitoring can be summarised in the following proposition.

Proposition 6. *(i) For private signals $s \in (s_1, s_2)$ the return to monitoring Δ_{TLI} is:*

$$\Delta_{TLI} = (1-\gamma)1/2\Bigg[\Big(1+k+\eta(1-k)(\phi-\eta(1-\phi))\Big)(L_1-L_2)/2$$
$$-\Big(\phi s_1+(1-\phi)(1-\eta\eta(1-k))s_2-(1-k)(1-\eta(\eta(1-\phi)+\phi)q_2/2\Big)(D-L_2)\Bigg]$$

The return to monitoring is decreasing in the face value of debt.

(ii) The amount of debt that maximises the return to monitoring is:

$$D_S^{TLI} = \frac{2(I+c-\gamma L_1)/(1-\gamma)-\Big(1+k+\eta(1-k)(\phi-\eta(1-\phi))\Big)L_1/2}{(1-\phi)s_1+(\phi+\eta(1-\phi)\eta(1-k))s_2+(1-k)\big(1-\eta(\phi-\eta(1-\phi))\big)q_2/2}$$
$$-\frac{\Big(3-k-\eta(1-k)(\phi-\eta(1-\phi))\Big)L_2/2}{(1-\phi)s_1+(\phi+\eta(1-\phi)\eta(1-k))s_2+(1-k)\big(1-\eta(\phi-\eta(1-\phi))\big)q_2/2}+L_2$$

5.4.3 Trade in loan shares

Let lenders be able to costlessly trade their loan shares. Assume both lenders take ex ante equal shares in the loan with face value D. Assume that Lender A has unlimited capital to reinvest in the project. If Lender B wishes to liquidate, Lender A will offer Lender B L_1 for his portion of the liquidated loan provided as the expected return is greater than the cost (i.e. if $2(s_2(D_S - L_2) + L_2) - L_1 > L_1$).

Hence, if Lender A monitors, his expected payoff (excluding the monitoring cost c) is:

$$(1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2, L_1]+(1-\phi)\Big((1-\eta)(1-k)1/2E_q[\max[qY+L_2, L_1]$$
$$+(1/2(1-\eta)(1-k)+k)\max[2(s_2(D-L_2)+L_2)-L_1, L_1]+\eta(1-k)\max[(s_2(D-L_2)+L_2, L_1]\Big)\Big]$$
$$+(1-\eta)[(1-k)E_q[\max[qY+L_2, L_1]+1/2k\max[2(q_2(D-L_2)+L_2)-L_1, L_1]]$$
$$+1/2kL_1+\Big(x_2(D-L_2)+L_2\Big)\Big]+\gamma L_1$$

Note that where Lender A only receives public information (with probability $(1-\eta)$) there is only opportunity for trade where Lender B receives a liquidity shock. This assumes that the lenders rely exclusively on their own signals and do not draw inference from the signals of the other lenders.

Proposition 7. *Suppose there are two lenders who hold equal shares in a loan with a face value of D. The loan contract contains two covenants: one that is violated if the borrower requires additional financing and another that is violated when the intermediate cash flow $x \leq x_1$. The lenders may costlessly trade their loan shares in the first period. The following statements hold: (i) Each lender's return to monitoring, Δ_{TLIT}, is:*

$$(1-\gamma)1/2\Big[\Big(1-k-\eta\big(2-3\phi-k\phi-\eta(1-k)(1-\phi)\big)\Big)(L_1-L_2)/2$$
$$-\big(\phi s_1+(1-\phi)(1-\eta(1+k))s_2-\big((1-\eta)k+1/2(1-k)(1-\eta(\phi+\eta(1-\phi)))q_2\big)(D-L_2)\Big]$$

The return to monitoring is decreasing in the face value of debt.

(ii) The amount of debt that maximises the return to monitoring is:

$$D_S^{TLIT}=\frac{2(I+c-\gamma L_1)/(1-\gamma)-(1-k-\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_1/2}{(1-\phi)s_1+(\phi+1/2\eta(3+k-3\phi-\phi k-\eta(1-k)(1-\phi))s_2+(1-\eta)(1+k)q_2/2}$$
$$-\frac{(3+k+\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_2/2}{(1-\phi)s_1+(\phi+1/2\eta(3+k-3\phi-\phi k-\eta(1-k)(1-\phi))s_2+(1-\eta)(1+k)q_2/2}+L_2$$

Naive trade in loan shares where the intermediate signal is independent of the public signal yields the intuitive result that the required return on debt is always lower than without trade. I find that required return on debt is decreasing in the expected first period of the other lender k. This is intuitive: the higher the probability that the other lender will seek to withdraw credit in the first period, the greater the probability that Lender A will be able to acquire Lender B's loan share for a fraction of its expected value.

More interesting, the required return on debt is decreasing in the probability of receiving additional information η. When both lenders have the same probability of receiving additional information through monitoring, Lender A is better off having a reduced probability of additional information such that there is a higher probability of being able to acquire Lender B's share in the first period than better information himself.

If lenders are able to trade their loan shares costlessly, then again the benefits of cov-lite loans disappear because a lender with good information does not need to liquidate the loan when the other lender is unwilling to renegotiate following a covenant violation.

5.5 Conclusion and further directions of analysis

This paper presents a theoretical model of cov-lite lending where lenders are exposed to the repayment preference shocks of other lenders. Cov-lite loans limit the circumstances in which lenders can withdraw credit and thus insulate lenders in a syndicate from costly repayment preference shocks in the other lenders.

The intuition is simple. Repayment preference shocks occur where a lender wishes to withdraw credit early due to internal factors within their own institution. These may be liquidity constraints, portfolio rebalancing or superior investment opportunities. The ability of lenders to act on such repayment preference shocks is determined by the covenant structure of the loan contract. Maintenance covenants enable lenders facing such a shock to liquidate the loan on breach of a covenant irrespective of the expected value of continuation. Cov-lite contracts limit the circumstances that lenders can withdraw credit/liquidate the loan, hence protect all lenders in the syndicate from inefficient early liquidation by one lender.

Without trade in loan shares, I find that cov-lite lending will be preferred where monitoring is imperfect and the probability that the other lender will suffer a repayment preference shock is higher. However, if the lenders are able to costlessly trade their loan shares, maintenance covenants reduce the cost of lending (the face value of debt) by enabling purchase of the other lender's loan share for less than its expected value of continuation.

One of the primary limitations of the analysis contained in this paper is the assumption that lenders simultaneously decide whether to enforce a covenant. It is only after that decision that trade may take place. However, if decisions were to take place sequentially (such that one lender could learn the action of the other prior to announcing its position), then the lender's could learn from each other's signals. In particular, each lender would only sell its loan share to the other for L_1 if it suffers a liquidity shock. Else, it will correctly infer from the other lender's willingness to continue/buy its loan share that the

other lender has received a positive signal. This in turn shrinks the region on which it is profitable for either lender to monitor the loan.

This paper has also assumed that lenders will always monitor if there is a covenant in place. But it may be profitable for one lender to attempt to free ride off the monitoring effort of the other. Yet the gains to freeriding would not be evenly spread across heterogeneous lenders. If each lender knows its own probability of experiencing a repayment preference shock in the first period, those lenders who have the highest probability have the greatest incentive to monitor to enable them to liquidate the loan in the first period. Likewise, it could be that some lenders have lower costs of monitoring than others, which would justify the assignment of a delegated monitor. Intuitively this model suggests that this role is best filled by an institution whose capital/liquidity position is most transparent (such as a bank).

Both of sequential decisions and free-riding present interesting potential extensions to the model but I leave those for future analysis.

Appendix

A Proofs and Derivations

Proof of Lemma 1

Assume that the intermediate signal x and the public signal q are conditionally independent given s. Given this, what can a lender infer about the probability of s_i given it has observed x_i and q_i, i.e. what is $P(s_i|q_i, x_i$?

Let $q_i, x_i \equiv C_{ii}$. By the definition of conditional probability:

$$P(s_i|q_i, x_i) = P(s_i|C_{ii}) = \frac{P(s_i \cap C_{ii})}{P(C_{ii})} = \frac{P(s_i \cap (q_i \cap x_i))}{P(q_i \cap x_i)} = \frac{P(s_i \cap q_i \cap x_i)}{P(q_i \cap x_i)}$$

From the chain rule of probability:

$$P(s_i \cap q_i \cap x_i) = P(x_i|s_i \cap q_i)P(s_i|q_i)P(q_i)$$

and $P(q_i \cap x_i) = P(x_i|q_i)P(q_i)$.

With two events, x_i and q_i, conditionally independent with respect to a third event s_i with $P(s_i) > 0$, $P(x_i \cap q_i|s_i) = P(x_i|s_i)P(q_i|s_i)$. From the definition of conditional probability $P(x_i|q_i) = P(x_i \cap q_i)/P(q_i)$. Conditioning on the event s_i this becomes:

$$P(x_i|q_i, s_i) = \frac{P(x_i \cap q_i|s_i)}{P(q_i|s_i)}$$

provided as $P(q_i|s_i) > 0$. Thus we have:

$$P(x_i|q_i, s_i) = \frac{P(x_i \cap q_i|s_i)}{P(q_i|s_i)} = \frac{P(x_i|s_i)P(q_i|s_i)}{P(q_i|s_i)} = P(x_i|s_i)$$

Hence:

$$P(s_i|q_i, x_i) = \frac{P(s_i \cap q_i \cap x_i)}{P(q_i \cap x_i)} = \frac{P(x_i|s_i \cap q_i)P(s_i|q_i)P(q_i)}{P(x_i|q_i)P(q_i)} = \frac{P(x_i|s_i)P(s_i|q_i)P(q_i)}{P(x_i|q_i)P(q_i)}$$

It follows that the assumption of the conditional independence of q and x given s yields the results in the text:

$$P(s_2|q_2, x_1) = \frac{P(x_1|s_2)P(s_2|q_2)P(q_2)}{P(x_1|q_2)P(q_2)} = \frac{(1-\phi)\alpha 1/2}{(1/2)(1/2)} = 2\alpha(1-\phi)$$

$$P(s_1|q_2, x_1) = \frac{P(x_1|s_1)P(s_1|q_2)P(q_2)}{P(x_1|q_2)P(q_2)} = \frac{\phi(1-\alpha)1/2}{(1/2)(1/2)} = 2\phi(1-\alpha)$$

$$P(s_2|q_1, x_1) = \frac{P(x_1|s_2)P(s_2|q_1)P(q_1)}{P(x_1|q_1)P(q_1)} = \frac{(1-\phi)(1-\alpha)1/2}{(1/2)(1/2)} = 2(1-\phi)(1-\alpha)$$

$$P(s_1|q_1, x_1) = \frac{P(x_1|s_1)P(s_1|q_1)P(q_1)}{P(x_1|q_1)P(q_1)} = \frac{\phi\alpha 1/2}{(1/2)(1/2)} = 2\phi\alpha$$

It follows that the probability of the project's success following a low public signal q_1 and the low intermediate signal x_1 is:

$$b_1 \equiv P(s_1|q_1, x_1)s_1 + P(s_2|q_1, x_1)s_2 = 2(\phi\alpha s_1 + (1-\phi)(1-\alpha)s_2)$$

The probability of the project's success following a low intermediate signal x_1 and a high public signal q_1 is:

$$b_2 \equiv P(s_1|q_2, x_1)s_1 + P(s_2|q_2, x_1)s_2 = 2(\phi(1-\alpha)s_1 + \alpha(1-\phi)s_2)$$

b_2 will be greater than b_1 where $s_2 > \phi/(1-\phi)s_1$, i.e. where ϕ is not too large and the distance between s_1 and s_2 is not too small.

Proof that $b_2 > b_1$ where :

$$\begin{aligned} b_2 - b_1 &= 2\phi(1-\alpha)s_1 + 2\alpha(1-\phi)s_2 - 2\alpha\phi s_1 - 2(1-\phi)(1-\alpha)s_2 \\ &= -4\phi\alpha(s_1+s_2) + 2\phi(s_1+s_2) + 4\alpha s_2 - 2s_2 \\ &= 2\phi(1-2\alpha)(s_1+s_2) - 2(1-2\alpha)s_2 \\ &= 2(1-2\alpha)(\phi s_1 - (1-\phi)s_2) \end{aligned}$$

which is negative provided as $s_2 > \phi/(1-\phi)s_1$.

Proof that $b_1 < q_1$:

$$\begin{aligned} q_1 - b_1 &= \alpha s_1 + (1-\alpha)s_2 - 2\alpha\phi s_1 - 2(1-\phi)(1-\alpha)s_2 \\ &= \alpha(1-2\phi)s_1 + (1-\alpha)(2\phi-1)s_2 \\ &= (1-2\phi)(\alpha s_1 - (1-\alpha)s_2) \end{aligned}$$

which is positive provided as $s_2 > \alpha/(1-\alpha)s_1$.

Proof that $b_1 < x_1$:

$$\begin{aligned} x_1 - b_1 &= \phi s_1 + (1-\phi)s_2 - 2\alpha\phi s_1 - 2(1-\phi)(1-\alpha)s_2 \\ &= \phi(1-2\alpha)s_1 + (1-\phi)(2\alpha-1)s_2 \\ &= (1-2\alpha)(\phi s_1 - (1-\phi)s_2) \end{aligned}$$

which is positive provided as $s_2 > \phi/(1-\phi)s_1$.

Proof that $b_2 < q_2$:

$$\begin{aligned} q_2 - b_2 &= (1-\alpha)s_1 + \alpha s_2 - 2\phi(1-\alpha)s_1 - 2\alpha(1-\phi)s_2 \\ &= (1-\alpha)(1-2\phi)s_1 + \alpha(2\phi-1)s_2 \\ &= (1-2\phi)((1-\alpha)s_1 - \alpha s_2) < 0 \end{aligned}$$

which is negative for all values (where $\alpha > 0.5$, $\phi > 0.5$, $s_2 > s_1$).

Proof of Proposition 1

(i) If $T_s < s_1$, then $(L_1 - L_2)/(D - L_2) < s_1$, which can be written as $L_1 < s_1(D-L_2)+L_2$. As $s_1 < b_1 < b_2 < s_2$, the lender always waives the covenant regardless of the first period signal received. Hence, the expected payoff from monitoring (excluding monitoring costs) is: $(1-\gamma)1/2\big[\eta\phi s_1(D-L_2)+L_2)+\eta(1-\phi)(s_2(D-L_2)+L_2)+(1-\eta)1/2[(b_1+b_2)(D-L_2)+L_2]+x_2(D-L_2)+L_2)\big]+\gamma L_1$. Note that $b_1+b_2 = \phi s_1+(1-\phi)s_2 = x_1$, so this simplifies to $(1-\gamma)1/2\big[\eta x_1(D-L_2)+L_2)+(1-\eta)[x_1(D-L_2)+L_2]+x_2(D-L_2)+L_2)\big]+\gamma L_1 = (1-\gamma)[1/2(x_1+x_2)(D-L_2)+L_2]+\gamma L_1$ Recall that $(x_1+x_2)/2 = p$ so the expected value of monitoring is $(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1$. It follows that the value of monitoring

$\Delta_M = (1-\gamma)[p(D-L_2)+L_2] + \gamma L_1 - (1-\gamma)[p(D-L_2)+L_2] - \gamma L_1 = 0$. With the value of monitoring at zero, both the lender and borrower know that the lender will never monitor regardless of the covenants available. Hence, the borrower optimally offers the lender a cov-lite loan with the face value $D_S^{cl} = [(I-\gamma L_1)/(1-\gamma) - L_2]/p + L_2$

(ii) If $s_2 < T_s$, then $s_2(D-L_2)+L_2 < L_1$. As $s_2 > b_2 > b_1 > s_1$, the lender always liquidates the project regardless of the first period signal. With the liquidation value less than the investment cost, $L_1 < I$, the lender never provides a loan.

(iii) If $s_1 < (L_1-L_2)/(D-L_2) < b_1$ the expected payoff from monitoring is: $(1-\gamma)1/2\big[\eta\phi(L_1-L_2) + 2L_2 + ((1-\eta\phi)s_1+s_2)(D-L_2)\big] + \gamma L_1$. It follows that the value of monitoring is: $(1-\gamma)1/2\big[\eta\phi(L_1-L_2) - \eta\phi s_1(D-L_2)\big]$, which is decreasing in the face value of debt D. Correspondingly the minimum face value of debt that satisfies the lender's individual rationality constraint is:

$$D_S^{s1} = \frac{2(I+c-\gamma L_1)/(1-\gamma) - \eta\phi(L_1-L_2) - 2L_2}{(1-\eta\phi)s_1 + s_2} + L_2$$

(iv) If $b_1 < (L_1-L_2)/(D-L_2) < b_2$ the expected payoff from monitoring is: $(1-\gamma)1/2\big[\eta\phi L_1 + \eta(1-\phi)(s_2(D-L_2)+L_2) + 1/2(1-\eta)L_1 + 1/2(1-\eta)(b_2(D-L_2)+L_2) + x_2(D-L_2)+L_2\big] + \gamma L_1$. It follows that value of monitoring is equal to $(1-\gamma)1/2\big[1/2(1-\eta(1-2\phi))(L_1-L_2) + [\phi(1-2\alpha)(s_1-s_2) + (2\alpha-1+\eta(1-\phi))s_2](D-L_2)]\big]$, which is increasing in the face value of debt D. Correspondingly, the minimum face value of debt that satisfies the lender's individual rationality constraint is

$$D_S^{b1} = \frac{2(I+c-\gamma L_1)/(1-\gamma) - 1/2(1-\eta(1-2\phi))(L_1-L_2) - 2L_2}{\big[1-\phi(\eta+\alpha(1-\eta))\big]s_1 + \big[\phi+(1-\phi)(\eta+(1-\eta)\alpha)\big]s_2} + L_2$$

The borrower will only choose this face value of debt if it is less than the cost of cov-lite debt (i.e. $D_S^{b1} < D_S^{cl}$).

(v) If $b_2 < (L_1-L_2)/(D-L_2) < s_2$ the expected payoff from monitoring is $(1-\gamma)1/2\big[(1-$

$\eta(1-\phi))(L_1-L_2)+2L_2+\big[(1-\phi)s_1+(\phi+\eta(1-\phi))s_2\big](D-L_2)\big]+\gamma L_1$. It follows that the value of monitoring is $(1-\gamma)1/2\big[(1-\eta(1-\phi))(L_1-L_2)+\big[-\phi s_1+(\eta-1)(1-\phi)s_2\big](D-L_2)\big]$ which is decreasing in the face value of debt. The minimum face value of debt that satisfies the lender's individual rationality constraint is

$$D_S^{b2} = \frac{2(I+c-\gamma L_1)/(1-\gamma) - (1-\eta(1-\phi))(L_1-L_2) - 2L_2}{(1-\phi)s_1 + (\phi+\eta(1-\phi))s_2} + L_2$$

The borrower will only choose this face value of debt if it is less than the face value of cov-lite debt ($D_S^{b2} < D_S^{cv}$).

Proof of Proposition 2

The first condition, $c \leq \Delta_{SL}(D_S^{SL*})$, means that the lender's expected gain from monitoring is higher than its cost, so the lender will choose to monitor once it has made the loan. If this condition does not hold, the lender will not monitor as its value of monitoring is not high enough for it to be worthwhile.

The condition that $Y + L_2 \geq D_S^{SL*}$ implies that it is feasible for a single lender to lend with face value D_S^{SL*}. If this condition is violated, then the maximum face value of debt ($D_S = Y + L_2$) is not high enough for the lender to break even when he lends and monitors. As such, no lending can take place without this condition being satisfied.

Proof of Proposition 3

Part (i)

Note that lenders make their decisions contemporaneously and independently. Hence if both choose to enforce the covenant in the first period, the loan is liquidated, while if both choose to waive the covenant, the loan continues to the final period.

First consider a lender who does not receive a liquidity shock in the first period. Assume he receives a high private signal $s = s_2$ but reports that he wants the loan to be liquidated. The highest possible value that the other lender would be willing to pay for his loan share

is the expected value of the project given the high private signal. Hence, the lender has no incentive to report a willingness to liquidate.

Now assume the lender receives a positive public signal and does not receive any private information. He could report the a wish to liquidate if he believed the other lender could have received a positive private signal, and as such would be willing to pay up to the expected value of the private signal (assuming the other lender has not suffered a repayment preference shock). If this is the case, the lender would only misreport if the return for misreporting a desire to liquidate were higher than the return truthfully reporting:

$$1/2\Big[(1-k)\Big(\eta(\phi L_1 + (1-\phi)(s_2 Y + L_2)) + (1-\eta)L_1\Big) + kL_1\Big]$$
$$\geq 1/2\Big[(1-k)\Big(\eta(\phi L_1 + (1-\phi)(s_2 Y + L_2)) + (1-\eta)(b_2 Y + L_2)\Big) + kL_1\Big]$$

This is never the case where $q_2 Y + L_2 > L_1$, which holds by assumption. Hence, irrespective of the other lender's probability of default and willingness to sell, the return to misreporting a desire to liquidate is lower than the expected return from continuation.

(Note this proof is assumes that the lenders are symmetrical so that if it is better for you to misreport a desire to liquidate following a positive public signal then it would also be profitable for the other lender to do so, which would result in liquidation. Even assuming that the other lender is always truthful, it is not better to misreport because the maximum the other lender would be willing to pay for your stake is the expected return (i.e. $1/2 q_2 Y + L_2$ from the public signal).

If the lender receives a negative signal yet misreports a desire to continue, the other lender will not make him an offer to purchase his stake. Therefore, he will only misreport a willingness to waive the covenant following a negative private signal if:

$$1/2\Big[(1-k)\Big(\eta(s_1Y+L_2)+(1-\eta)1/2(q_2Y+L_2+L_1)\Big)+kL_1\Big] \geq$$
$$1/2\Big[(1-k)\Big(\eta L_1+(1-\eta)1/2(q_2Y+L_2+L_1)\Big)+kL_1\Big]$$

This never holds because $s_1Y + L_2 < L_1$ by assumption.

Similarly, the lender will only misreport a willingness to waive the covenant following a negative public signal if:

$$1/2\Big[(1-k)\Big(\eta L_1+(1-\eta)(q_1Y+L_2)\Big)+kL_1\Big] \geq 1/2\Big[(1-k)\Big(\eta L_1+(1-\eta)1/2L_1)\Big)+kL_1\Big]$$

This never holds because it $q_1Y + L_2 < L_1$ by assumption.

If a lender receives a liquidity shock, he will be required to report a willingness to liquidate his share in the first period regardless of the signal he has received.

Part (ii)

Assume that Lender A has received a repayment shock in the first period, so reported a desire to liquidate per 3(i). By symmetry, if Lender B has received a negative signal, he will report a desire a liquidate. Hence, the project will be liquidated for L_1.

If Lender B receives a positive signal (either public or private), what offer will he make to purchase Lender A's loan share?

Assume Lender B has received a positive private signal. If Lender A reports a willingness to sell, he is either facing a liquidity shock or has received a negative public signal. Lender B should be willing to pay up to the expected value of $1/2(s_2Y + L_2)$ - but he also knows that his willingness to purchase the loan stake given the negative public signal indicates to Lender A that he has received a positive private signal. Hence, Lender A will refuse

any offer for his loan stake of less than $1/2(s_2Y + L_2$ if he is not liquidity constrained. This price for Lender A's loan share only allows Lender B to break even. But Lender B also knows that with probability k Lender A has suffered a liquidity shock so will accept any offer equal to L_1. Hence, Lender B offers a price of L_1 for Lender A's share. If Lender A is liquidity constrained, he accepts, otherwise he declines, the loan covenants are waived, and loan continues to the following period.

Assume Lender B receives a positive public signal. If Lender A reports a willingness to sell, he is either facing a liquidity shock or has received a negative private signal. Lender B should be willing to pay up to the expected value of $1/2(q_2Y + L_2)$ but he also knows that Lender B is only willing to sell because he has received a liquidity shock or a negative private signal. In either case, Lender A would be willing to accept L_1 for his loan share (if he has received a negative private signal, his expected payoff from rejecting Lender B's offer is $s_1Y + L_2 < L_1$).

It follows that neither lender would be willing to pay more than $1/2L_1$ for a loan share even with negotiation.

Proof of Proposition 4

Part (i)-(ii) follow exactly the same reasoning as in Proposition 1.

Part (iii)

Suppose $s^{TL} \in (s_1, s_2)$. Δ_{TL} is equal to the difference between the lender's expected payoff if he monitors and his expected payoff if he does not:

$$\Delta_{TL} = (1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2, L_1] + (1-\phi)\Big((1-\eta)L_1+\eta k L_1+\eta(1-k)\max[(s_2(D-L_2)+L_2, L_1]\Big)\Big] + (1-\eta)\max[q_1(D-L_2)+L_2, L_1] + \Big(x_2(D-L_2)+L_2\Big)\Big] + \gamma L_1 - \Big[(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1\Big]$$

Using the definition of $s^{TL} \in (s_1, s_2)$ we have:

$$\Delta_{TL} = (1-\gamma)1/2\Big[\eta\Big[\phi L_1 + (1-\phi)\Big((1-\eta)L_1+\eta k L_1+\eta(1-k)[s_2(D-L_2)+L_2]\Big)\Big] + (1-\eta)L_1 + (x_2(D_S-L_2)+L_2)\Big] + \gamma L_1 - (1-\gamma)[p(D-L_2)+L_2] - \gamma L_1$$

Substitute in the definition of $x_2 = (1-\phi)s_1 + \phi s_2$ and $p = (s_1+s_2)/2$ so we have:

$$\Delta_{TL} = (1-\gamma)1/2\Big[\big(1-\eta\eta(1-\phi)(1-k)\big)(L_1-L_2) - \big(\phi s_1+(1-\phi)s_2[1-\eta\eta(1-k)]\big)(D-L_2)\Big]$$

with $s^L \equiv (L_1-L_2)/(D-L_2)$ this can be rewritten as:

$$\Delta_{TL} = (1-\gamma)1/2\Big[\big(1-\eta\eta(1-\phi)(1-k)\big)s^L - \phi s_1 - (1-\phi)[1-\eta\eta(1-k)]s_2\Big](D-L_2)$$

Part (iv)

From (iii) , Δ_{TL} is decreasing in D for $s^{TL} \in [s_1, s_2]$, so the value of monitoring is

maximised where the face value of debt is minimised. However, this is subject to the lender's individual rationality constraint, i.e. the face value of debt must be high enough that the lender is willing to lend and monitor (from (ii) the lender will no longer rationally lend if $s^{TL} \geq s_2$). If the lender does lend, it receives the expected return from the loan minus the investment and monitoring cost. That is:

$$(1-\gamma)1/2\Big[\big(1-\eta(1-\phi)\eta(1-k)\big)L_1+\big(1+\eta(1-\phi)\eta(1-k)\big)L_2 \\ +\big((1-\phi)s_1+(\phi+\eta(1-\phi)\eta(1-k))s_2\big)(D-L_2)\Big]+\gamma L_1-I-c$$

This must be weakly greater than zero for the lender to be willing to lend and monitor. Note this expression is increasing in D, so setting this expression equal to zero will minimise D while satisfying the lender's individual rationality constraint. Solving for the value that satisfies this yields:

$$D^{TL}=\frac{2(I+c-\gamma L_1)/(1-\gamma)-(1-\eta(1-\phi)\eta(1-k))L_1-(1+\eta(1-\phi)\eta(1-k))L_2}{(1-\phi)s_1+(\phi+\eta(1-\phi)\eta(1-k))s_2}+L_2$$

Proof of Proposition 5

The proof of Part (i) follows directly from Proposition 3.

Part (ii)

Suppose $s^{TLT} \in (s_1, s_2)$. Δ_{TLT} is equal to the difference between Lender A's expected return if he monitors and his expected payoff if he does not. This difference is:

$$(1-\gamma)1/2\Big[\eta\Big[\phi\max[s_1(D-L_2)+L_2,L_1]+(1-\phi)\Big((1-\eta+\eta k)\max[2(s_2(D-L_2)+L_2)-L_1,L_1]$$
$$+\eta(1-k)\max[s_2(D-L_2)+L_2,L_1]\Big]+(1-\eta)\max[q_1(D-L_2)+L_2,L_1]$$
$$+\Big(x_2(D-L_2)+L_2\Big)\Big]+\gamma L_1-[(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1]$$

Using the definition of $s^{TLT} \in (s_1, s_2)$ we have:

$$(1-\gamma)1/2\Big[\eta\Big[\phi L_1+(1-\phi)\Big((1-\eta+\eta k)[2(s_2(D_S-L_2)+L_2)-L_1]+\eta(1-k)[s_2(D_S-L_2)+L_2]\Big]$$
$$+(1-\eta)L_1+\Big(x_2(D_S-L_2)+L_2\Big)\Big]+\gamma L_1-(1-\gamma)[p(D-L_2)+L_2]-\gamma L_1]$$

Substitute in the definition of $x_2 = (1-\phi)s_1 + \phi s_2$ and $p = (s_1+s_2)/2$ this can be simplified to:

$$\Delta_{TLT} = (1-\gamma)1/2\Big[\Big(1-\eta(1-\phi)\big(2-\eta(1-k)\big)\Big)(L_1-L_2)$$
$$-\Big(\phi s_1+s_2(1-\phi)\big(1-\eta(2-\eta(1-k))\big)\Big)(D-L_2)\Big]$$

Part (iii)

From (ii) Δ_{TLT} is decreasing in D for $s^{TL} \in [s_1, s_2]$, so the value of monitoring is maximised where the face value of debt is minimised. However, this is subject to the lender's individual rationality constraint, i.e. the face value of debt must be high enough that the lender is willing to lend and monitor (from Lemma 5 (ii) the lender will no longer rationally lend if $s^{TL} \geq s_2$). If the lender does lend, it receives the net expected value of

the loan minus the investment and borrowing cost. That is,

$$(1-\gamma)1/2\Bigg[\Big(1-\eta(1-\phi)(2-\eta(1-k))\Big)L_1+\Big(1+\eta(1-\phi)(2-\eta(1-k))\Big)L_2 \\ \Big((1-\phi)s_1+\big(\phi+\eta(1-\phi)(2-\eta(1-k))\big)s_2\Big)\big(D-L_2\big)\Bigg]+\gamma L_1-I-c$$

This must be weakly greater than zero for the lender to be willing to lend and monitor. Note this expression is increasing in D_S so setting this expression equal to zero will minimise D_S while satisfying the lender's individual rationality constraint. Solving for the value that satisfies this yields:

$$D_{TLT}=\frac{2(I+c-\gamma L_1)/(1-\gamma)-\big(1-\eta(1-\phi)(2-\eta(1-k))\big)L_1}{\Big((1-\phi)s_1+\big(\phi+\eta(1-\phi)(2-\eta(1-k))\big)s_2\Big)D} \\ -\frac{\big(1+\eta(1-\phi)(2-\eta(1-k))\big)L_2}{\Big((1-\phi)s_1+\big(\phi+\eta(1-\phi)(2-\eta(1-k))\big)s_2\Big)D}+L_2$$

Proof of Proposition 6

Part (i) Suppose $s^{TL}\in(s_1,s_2)$. Δ_{TLI} is equal to the difference between the lender's expected payoff if he monitors and his expected payoff if he does not:

$$\Delta_{TLI}=(1-\gamma)1/2\Bigg[\eta\Big[\phi\max[s_1(D-L_2)+L_2,L_1] \\ +(1-\phi)\Big((1-\eta)(1-k)E_q[\max[q(D-L_2)+L_2,L_1]+kL_1+\eta(1-k)\max[(s_2(D-L_2)+L_2,L_1]\Big)\Big] \\ +(1-\eta)[(1-k)E_q[\max[q(D-L_2)+L_2,L_1]+kL_1]+\Big(x_2(D-L_2)+L_2\Big)\Bigg]+\gamma L_1 \\ -\Big[(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1\Big]$$

Using the definition of $s^{TL} \in (s_1, s_2)$ we have:

$$\Delta_{TLI} = (1-\gamma)1/2\Big[\eta\Big[\phi L_1 + (1-\phi)\Big((1-\eta)(1-k)(q_2(D-L_2)+L_2+L_1)/2 + kL_1 ...$$
$$+ \eta(1-k)[s_2(D-L_2)+L_2]\Big)\Big] + (1-\eta)[(1-k)(q_2(D-L_2)+L_2+L_1)/2 + kL_1]$$
$$+ (x_2(D-L_2)+L_2)\Big] + \gamma L_1 - (1-\gamma)[p(D-L_2)+L_2] - \gamma L_1$$

Substitute in the definition of $x_2 = (1-\phi)s_1 + \phi s_2$ and $p = (s_1+s_2)/2$ so we have:

$$\Delta_{TLI} = (1-\gamma)1/2\Big[\Big(1+k+\eta(1-k)(\phi-\eta(1-\phi))\Big)(L_1-L_2)/2$$
$$- \Big(\phi s_1 + (1-\phi)(1-\eta\eta(1-k))s_2 - (1-k)(1-\eta(\eta(1-\phi)+\phi)q_2/2\Big)(D-L_2)\Big]$$

Part (ii)

From (i), Δ_{TLI} is decreasing in D for $s^{TL} \in [s_1, s_2]$, so the value of monitoring is maximised where the face value of debt is minimised. However, this is subject to the lender's individual rationality constraint, i.e. the face value of debt must be high enough that the lender is willing to lend and monitor (from Lemma 6 (ii) the lender will no longer rationally lend if $s^{TLI} \geq s_2$). If the lender does lend, it receives the net expected value from the loan minus the investment and monitoring cost. That is:

$$(1-\gamma)1/2\Big[\eta[1+k+(1-k)(\phi-\eta(1-\phi))]L_1/2 + [3-k-\eta(1-k)(phi-\eta(1-\phi))]L_2/2$$
$$+ [(1-\phi)s_1 + (\phi+1/2\eta(1-k)(1-\phi)(1+\eta))s_2 + (1-k)(1-\eta)q_2/2)](D_S-L_2)\Big]$$
$$+ \gamma L_1 - I - c$$

This must be weakly greater than zero for the lender to be willing to lend and monitor. Note this expression is increasing in D_S, so setting this expression equal to zero will minimise D_S while satisfying the lender's individual rationality constraint. Solving for the value that satisfies this yields:

$$D_S^{TLI} = \frac{2(I+c-\gamma L_1)/(1-\gamma) - \eta\Big(1+k+(1-k)(\phi-\eta(1-\phi))\Big)L_1/2}{(1-\phi)s_1 + (\phi+1/2\eta(1-k)(1-\phi)(1+\eta))s_2 + (1-k)(1-\eta)q_2/2)} - \frac{\Big(3-k-\eta(1-k)(\phi-\eta(1-\phi))\Big)L_2/2}{(1-\phi)s_1 + (\phi+1/2\eta(1-k)(1-\phi)(1+\eta))s_2 + (1-k)(1-\eta)q_2/2)} + L_2$$

Proof of Proposition 7

Part (i)

Suppose $s^{TL} \in (s_1, s_2)$. Δ_{TLIT} is equal to the difference between each lender's expected return if he monitors and his expected payoff if he does not. This difference is:

$$(1-\gamma)1/2\Bigg[\eta\Big[\phi\max[s_1(D-L_2)+L_2, L_1]+(1-\phi)\Big((1-\eta)(1-k)1/2E_q[\max[q_2(D-L_2)+L_2, L_1]$$
$$+(1/2(1-\eta)(1-k)+k)\max[2(s_2(D-L_2)+L_2)-L_1, L_1]+\eta(1-k)\max[(s_2(D-L_2)+L_2, L_1]\Big)\Big]$$
$$+(1-\eta)[(1-k)E_q[\max[q_2(D-L_2)+L_2, L_1]+1/2k\max[2(q_2(D-L_2)+L_2)-L_1, L_1]+1/2kL_1]$$
$$+\Big(x_2(D-L_2)+L_2\Big)\Bigg]+\gamma L_1-\Big[(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1\Big]$$

Using the definition of $s^{TL} \in (s_1, s_2)$ we have:

$$(1-\gamma)1/2\Big[\eta\Big[\phi L_1+(1-\phi)\Big((1-\eta)(1-k)1/2(q_2(D-L_2)+L_2)+(1/2(1-\eta)(1-k)+k)...$$
$$*\,(2(s_2(D-L_2)+L_2)-L_1)+\eta(1-k)(s_2(D-L_2)+L_2)\Big)\Big]$$
$$+(1-\eta)\Big[(1-k)(q_2(D-L_2)+L_2+L_1)/2+1/2k(2(q_2(D-L_2)+L_2)-L_1)$$
$$+1/2kL_1Big]+\Big(x_2(D-L_2)+L_2\Big)\Big]+\gamma L_1-\Big[(1-\gamma)[p(D-L_2)+L_2]+\gamma L_1\Big]$$

Substitute in the definition of $x_2 = (1-\phi)s_1 + \phi s_2$ and $p = (s_1+s_2)/2$ so we have:

$$(1-\gamma)1/2\Big[\Big(1-k-\eta\big(2-3\phi-k\phi-\eta(1-k)(1-\phi)\big)\Big)(L_1-L_2)/2$$
$$-\big(\phi s_1+(1-\phi)(1-\eta(1+k))s_2-\big((1-\eta)k+1/2(1-k)(1-\eta(\phi+\eta(1-\phi)))q_2\big)(D-L_2)\Big]$$

Part (ii)

From 7(iii) Δ_{TLIT} is decreasing in D for $s^{TL} \in [s_1, s_2]$, so the value of monitoring is maximised where the face value of debt is minimised. However, this is subject to the lender's individual rationality constraint, i.e. the face value of debt must be high enough that the lender is willing to lend and monitor (from Lemma 7 (ii) the lender will no longer rationally lend if $s^{TLIT} \geq s_2$). If the lender does lend, it receives the net expected value from equation 20 minus the investment and borrowing cost. That is,

Now doing it again with this halved to represent the initial investment being shared between two people:

$$(1-\gamma)1/2\Big[1/4(1-k-\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_1+1/4(3+k+\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_2$$
$$+[1/2(1-\phi)s_1+1/2(phi+1/2\eta(3+k-3\phi-\phi k-\eta(1-k)(1-\phi))s_2+1/4(1-\eta)(1+k)q_2](D-L_2)\Big]$$
$$+\gamma L_1/2 - I/2 - c/2$$

This must be weakly greater than zero for the lender to be willing to lend and monitor. Note this expression is increasing in D so setting this expression equal to zero will minimise D while satisfying the lender's individual rationality constraint. Solving for the value that satisfies this yields:

$$D_S^{TLIT} = \frac{2(I+c-\gamma L_1)/(1-\gamma) - (1-k-\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_1/2}{(1-\phi)s_1+(\phi+1/2\eta(3+k-3\phi-\phi k-\eta(1-k)(1-\phi))s_2+(1-\eta)(1+k)q_2/2}$$
$$-\frac{(3+k+\eta(2-3\phi-\phi k-\eta(1-k)(1-\phi))L_2/2}{(1-\phi)s_1+(\phi+1/2\eta(3+k-3\phi-\phi k-\eta(1-k)(1-\phi))s_2+(1-\eta)(1+k)q_2/2}+L_2$$

B Perfectly correlated intermediate and public signals

B.1 Single Lender

In the case of a single lender facing perfectly correlated intermediate and public signals the following proposition holds:

Proposition 8. *Suppose the single lender provides a loan with a face value of D. The loan contract contains two covenants: one that is violated if the borrower requires additional financing and another that is violated when the intermediate cash flow $x \leq x_1$. The following statements hold:*

(i) If $s^{SL} \leq s_1$, the value of monitoring is zero ($s_1(D_S - L_2) + L_2 \geq L_1$). It follows that even if the lender receives the lower signal s_1, he won't liquidate the loan. The borrower optimally offers a cov-lite contract with face value $D = [(I - \gamma L_1)/(1-\gamma) - L_2]/p + L_2$ which the lender accepts.

(ii) If $s^{SL} \geq s_2$, the project is always liquidated in the first period for a liquidation value below investment cost. Hence, the lender never provides a loan.

(iii) If $s^{SL} \in (s_1, s_2)$ the value of monitoring is $\Delta_{SL} = (1-\gamma)1/2\Big[(1-\eta(1-\phi))(L_1 - L_2) - [\phi s_1 + (1-\eta)(1-\phi)s_2](D - L_2)\Big]$ and is decreasing in the value of debt.

(iv) The minimum face value of debt that the lender would accept is:

$$D^{SL*} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - (1-\eta(1-\phi))L_1 - (1+\eta(1-\phi))L_2}{(1-\phi)s_1 + (\eta(1-\phi)+\phi)s_2} + L_2$$

(v) The optimal level of debt is decreasing in the level of precision ϕ for low levels of η and γ but starts increasing in the level of precision as γ and η approach 1.

(vi) D^{SL*} is increasing in γ, the probability of the project requiring further investment in the first period.

Proof of 8

Part (i)

Suppose $s^{SL} \leq s_1$ and the maintenance covenant is violated (i.e. $x = x_1$). From the definition of $s^{SL} = (L_1 - L_2)/(D - L_2) \leq s_1$ so $s_1(D - L_2) + L_2 \geq L_1$. It follows that even if the lender receives the lower signal s_1, he won't liquidate the loan. Hence, the lender never enforces covenant violation attaches to intermediate cash flow and its incentive to monitor is zero as required. Note the lender will liquidate the loan if the borrower requests additional financing, which can be observed without monitoring.

Part (ii)

Suppose $s^{SL} \geq s_2$. From the definition of $s^{SL} = (L_1 - L_2)/(D - L_2) \geq s_2$ so $s_2(D - L_2) + L_2 \leq L_1$. It follows that regardless of the signal the lender receives of the project's probability of success, he will always liquidate the loan. Since $L_1 < I$, the lender will never be willing to make the loan, and will accordingly not monitor. Note that the lender always liquidates the loan in the first period if the incurrence covenant is violated (i.e. the borrower requests additional financing), which can be observed without monitoring.

Part (iii)

Suppose $s^{SL} \in (s_1, s_2)$. From the text, Δ_{SL} is equal to the difference between the his expected payoff if the lender monitors and his expected payoff if he does not.

$$\Delta_{SL} = (1-\gamma)1/2\Big[\eta\Big[\phi \max[s_1(D-L_2)+L_2, L_1] + (1-\phi)\max[s_2(D-L_2)+L_2, L_1]\Big] + (1-\eta)\max[q_1(D-L_2)+L_2, L_1] + \Big(x_2(D-L_2)+L_2\Big)\Big] + \gamma L_1 - \Big[(1-\gamma)[p(D-L_2)+L_2] + \gamma L_1\Big] \tag{5.2}$$

Using the definition $s^{SL} \in (s_1, s_2)$, we have:

$$\Delta_{SL} = (1-\gamma)1/2\Big[\eta\Big[\phi L_1 + (1-\phi)[s_2(D-L_2)+L_2]\Big] + (1-\eta)L_1 + \Big(x_2(D-L_2)+L_2\Big)\Big] + \gamma L_1 - \Big[(1-\gamma)[p(D-L_2)+L_2] + \gamma L_1\Big] \quad (5.3)$$

Substitute in the definition of $x_2 = (1-\phi)s_1 + \phi s_2$, and $p = (s_1+s_2)/2$, so we have:

$$\Delta_{SL} = (1-\gamma)1/2\Big[(1-\eta(1-\phi))(L_1-L_2) - [\phi s_1 + (1-\eta)(1-\phi)s_2](D-L_2)\Big] \quad (5.4)$$

as required.

Part (iv)

From (iii), Δ_{SL} is decreasing in D for $s^{SL} \in [s_1, s_2]$, so the value of monitoring will be maximised where the face value of debt is minimised. However, this is subject to the lender's individual rationality constraint, i.e. that the face value of debt must be high enough that the lender is willing to lend and monitor (from Lemma 3(ii), the lender will no longer rationally borrow if $s^{SL} \geq s_2$). If the lender does lend, it receives the net expected value from equation 5 minus the investment I and the monitoring cost c. That is:

$$(1-\gamma)1/2\Big[(1-\eta(1-\phi))L_1+(1+\eta(1-\phi))L_2+[(1-\phi)s_1+(\eta(1-\phi)+\phi)s_2](D-L_2)\Big]+\gamma L_1-I-c \quad (5.5)$$

This must be weakly greater than zero for the lender to be willing to lend and monitor. Note this expression is increasing in D, so setting this expression equal to zero will minimise the D while satisfying the lender's individual rationality constraint. Solving for

the value that satisfies this yields:

$$D^{SL*} = \frac{2(I + c - \gamma L_1)/(1-\gamma) - (1 - \eta(1-\phi))L_1 - (1 + \eta(1-\phi))L_2}{(1-\phi)s_1 + (\eta(1-\phi) + \phi)s_2} + L_2 \tag{5.6}$$

as required.

Part (v)

The partial derivative of D^{SL*} with respect to ϕ is:

$$\frac{(-\eta L_1 + \eta L_2)((1-\phi)s_1 + (\eta(1-\phi) + \phi)s_2)}{\Big(2(I + c - \gamma L_1)/(1-\gamma) - (1 - \eta(1-\phi))L_1 - (1 + \eta(1-\phi))L_2\Big)^2}$$
$$- \frac{(-s_1 - \eta s_2 + s_2)\Big(2(I + c - \gamma L_1)/(1-\gamma) - (1 - \eta(1-\phi))L_1 - (1 + \eta(1-\phi))L_2\Big)}{\Big(2(I + c - \gamma L_1)/(1-\gamma) - (1 - \eta(1-\phi))L_1 - (1 + \eta(1-\phi))L_2\Big)^2} \tag{5.7}$$

The numerator can be simplified to:

$$(s_2 - s_1)(L_1 + L_2 + \gamma(L_1 - L_2) - 2(I + c))/(1-\gamma) + 2\eta s_2(I + c - L_1)/(1-\gamma) \tag{5.8}$$

Note that where $\gamma = 0$ and $\eta = 0$ (this is the case in Rajan and Winton (1995)) this is unequivocally negative:

$$(s_2 - s_1)(L_1 + L_2 - 2(I + c)) < 0 \tag{5.9}$$

because $L_2 < L_1 < I$ so that $L_1 + L_2 < 2I$ and $c > 0$.

Consider this as $\eta \to 1$

$$(-s_2(1-gamma)(L_1-L_2) - s_1\gamma(L_1-L_2) + 2s_1(I+c) - s_1(L_1+L_2))/(1-\gamma) \quad (5.10)$$

As $\gamma \to 1$ this becomes:

$$(-s_1L_1 + 2s_1(I+c) - s_1L_1)/(1-\gamma) \quad (5.11)$$

because $I > L_1$ and $c > 0$ the derivative is increasing as $\gamma \to 1$ and $\eta \to 1$. Hence, the optimal level of debt is decreasing in the level of precision ϕ for low levels of η and γ but starts increasing in the level of precision as γ and η approach 1. Note that as γ approaches 1 the lender will stop lending as the anticipated return L_1 is less than the investment cost I.

Part (vi)

D^{SL*} is increasing in γ, the probability of the project requiring further investment in the first period. This is intuitive: as the probability of the project requiring further investment in the first period increases, the required return to the lender also increases (because it is never efficient for the lender to put additional funds into the project).

Chapter 6

Conclusion

This thesis presents three papers on the law and finance of private markets and real estate funds.

In the first paper, I explore how concentrated ownership by private funds and REITs affects local market competition. First, I show that the opacity of ownership by private funds and REITs enables these owners to acquire sufficient concentration to have some degree of market power that would enable them to act anti-competitively. I find that increased concentration of ownership by private funds correlates with decreased consumer satisfaction. To examine the causal impact of increased concentration of private fund ownership on consumer satisfaction, I use a national fund merger that created quasi-exogenous variation in concentration of fund ownership at a local level. I find that an increased concentration of ownership has no impact on customer experience. Yet overall customer experience and customer perceptions of value decline at competitors following the entrance of a private equity owner into the market. This occurs despite there being no change in the number of competitors in the market, and controlling for local market conditions.

In my second paper, I explore how concentrated ownership by institutional owners affects residential housing in neighborhoods, and whether such concentration influences the be-

haviour of other owners in a neighborhood. I use a series of national mergers to examine three channels through which institutional ownership may affect communities. First, I directionally confirm previous findings that increased concentration of institutional ownership is associated with higher house and rental prices. I find house prices increase by 6.0% and rental prices by 3.5% in the three years following an institutional merger in neighborhoods that experience a large change in concentration of institutional ownership as a result of a merger.

Higher house and rental prices relax households' borrowing constraint that induces greater spending on home improvements by owner occupiers and small investors. I find that owner occupiers and small investors apply for more permits for home improvement and higher value loans for home improvement in the years following an institutional merger in their neighborhood. In the four years following a merger, owner occupiers are issued with 78% more permits and apply for home improvement loans that are 54% higher in value in neighborhoods in which there was a change in concentration of ownership as a result of an institutional merger. Investors that own less than 10 properties ('small' investors) have a similar increase in permitting activity with 47% more permits issued to small investors in neighborhoods that experience an increase in concentration of institutional ownership.

There is no evidence that institutional investors make more home improvements to properties in areas in which they have an increased market share as a result of a merger. In fact, property valuations for houses owned by the merged landlord are lower in areas in which they gain a larger market share following a merger. I rationalize this finding through forensic examination of tax appeals. I find institutional investors appeal property valuations with a frequency of 16.8% (over 18 times the rate at which owner occupiers appeal). Tax appeals by institutional investors are more successful at reducing the property valuation than appeals by owner occupiers. Once I control for the difference between the tax assessor and owner valuations, there is no difference in the size of the reduction

in property valuation obtained as a result of a successful appeal across owner types. These appeals are economically significant. Assuming a property tax rate of 1% and the median difference between tax and realized (sale) valuation, institutional investors are saving $4.1b through tax appeals. This finding suggests that tax minimization may be another source of value-add pursued by private equity backed companies.

Increased institutional ownership correlates with greater racial and socio-economic diversity in neighborhoods. High house prices following institutional mergers do not reduce diversity of home loan applications or approvals. Rather, I find that home loan applications and approvals for people of color increase in neighborhoods in which there is a greater concentration of institutional ownership following a merger. One potential reason for this is that higher rent prices following a merger may create a greater supply of rental housing. In Atlanta, a large share of rental housing is used by people of color, so a greater supply of rental housing may encourage greater neighborhood diversity. Increased diversity may be a factor that makes a neighborhood more attractive when purchasing a home, especially for minority communities.

To conclude, my second paper finds that increased concentration of institutional ownership has nuanced effect on communities. Although it is correlated with increased prices, it seems to generate greater improvements to housing quality, both in rental and owner-occupied homes. Crucially, I find no evidence that increased concentration of ownership results in less diverse neighborhoods. One caveat to this analysis is that Atlanta is one of the areas in the country that has seen the highest levels of institutional ownership, so there are questions as to whether we would observe the same effects in areas where institutional ownership is lower or more dispersed. Further work will examine a national sample to test the external validity of these findings.

My third paper examines how contracts in the syndicated lending and private debt markets have evolved as the predominant market participant has shifted from banks to other investment funds. In particular, I explore covenant-lite loans as a mechanism to insulate

lenders in a syndicate from costly repayment preference shocks in the other lenders. The paper presents a theoretical model of covenant-lite lending where lenders are exposed to the repayment preference shocks of other lenders. By limiting the circumstances in which lenders can withdraw or renegotiate credit, covenant-lite loans limit the circumstances in which lenders can respond to their own repayment preference shocks.

The intuition is simple. Repayment preference shocks occur where a lender wishes to withdraw credit early due to internal factors within their own institution. These may be liquidity constraints, portfolio rebalancing or superior investment opportunities. The ability of lenders to act on such repayment preference shocks is determined by the covenant structure of the loan contract. Maintenance covenants enable lenders facing such a shock to liquidate the loan on breach of a covenant irrespective of the expected value of continuation. Cov-lite contracts limit the circumstances that lenders can withdraw credit/liquidate the loan, hence protect all lenders in the syndicate from inefficient early liquidation by one lender.

Without trade in loan shares, I find that cov-lite lending will be preferred where monitoring is imperfect and the probability that the other lender will suffer a repayment preference shock is higher. However, if the lenders are able to costlessly trade their loan shares, maintenance covenants reduce the cost of lending (the face value of debt) by enabling purchase of the other lender's loan share for less than its expected value of continuation.

One of the primary limitations of the analysis contained in this paper is the assumption that lenders simultaneously decide whether to enforce a covenant. It is only after that decision that trade may take place. However, if decisions were to take place sequentially (such that one lender could learn the action of the other prior to announcing its position), then the lender's could learn from each other's signals. In particular, each lender would only sell its loan share to the other for L_1 if it suffers a liquidity shock. Else, it will correctly infer from the other lender's willingness to continue/buy its loan share that the

other lender has received a positive signal. This in turn shrinks the region on which it is profitable for either lender to monitor the loan.

This paper has also assumed that lenders will always monitor if there is a covenant in place. But it may be profitable for one lender to attempt to free ride off the monitoring effort of the other. Yet the gains to freeriding would not be evenly spread across heterogeneous lenders. If each lender knows its own probability of experiencing a repayment preference shock in the first period, those lenders who have the highest probability have the greatest incentive to monitor to enable them to liquidate the loan in the first period. Likewise, it could be that some lenders have lower costs of monitoring than others, which would justify the assignment of a delegated monitor. Intuitively this model suggests that this role is best filled by an institution whose capital/liquidity position is most transparent (such as a bank).

Both of sequential decisions and free-riding present interesting potential extensions to the model but I leave those for future analysis.

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