

# Rent Payments in a Pandemic

## Analysis of Affordable Housing in New York City

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**The Housing Crisis Research Collaborative** aims to address the longstanding inequities in access to safe, stable, and affordable rental housing that have been laid bare by the COVID-19 pandemic. We provide policymakers at all levels of government with the data and analysis they need to design, implement, and evaluate more equitable and effective rental housing and community development responses to pandemic and the ongoing rental housing affordability crisis. For more visit: [housingcrisisresearch.org](https://housingcrisisresearch.org).

## Introduction

While the COVID-19 pandemic has affected all New Yorkers, lower-income households have been among the most impacted by both the virus<sup>1</sup> and the economic shutdown.<sup>2</sup> At the onset of the pandemic, many low-income households had little-to-no savings to guard against such a disaster;<sup>3</sup> in 2018, 61 percent of adults reported that it would be difficult to cover a \$400 unforeseen expense, let alone the income shock felt by many during the crisis.<sup>4</sup> Low-income households were more likely to report uncertainty about their ability to pay rent than were other households early on in the pandemic.<sup>5</sup> Landlords have also raised concerns that missed rent payments undermine their ability to maintain their buildings and cover their mortgages.<sup>6</sup> Though the NYU Furman Center, the Urban Institute, Federal Reserve Bank of Philadelphia, and others have estimated the aggregated effects

of the crisis on rental assistance need,<sup>7,8,9</sup> little is known about actual rent payments and the accumulation of rental arrears at the household level, specifically for low-income renters residing in affordable housing.

In partnership with the New York State Association for Affordable Housing (NYSFAFH) and its members, as well as with feedback and support from the Housing Crisis Research Collaborative, the Furman Center compiled a novel data set of detailed information on rent charges and payments at the tenant level. NYSFAFH's members, including the firms that contributed data, build and manage affordable housing developments, such as projects built using the Low-Income Housing Tax Credit (LIHTC), as well as some rent regulated buildings. Using these data, we examine how rent payments and rental arrears (accumulated rent owed) changed for tenants residing in this sample provided by affordable housing owners and managers. While the data do not contain information on tenant income, these tenants are likely lower income given eligibility requirements for LIHTC units and other subsidies.

On one hand, we would expect low-income income tenants to be more vulnerable to income shocks. On the other hand, these low-income households are typically paying below market rate rent, which should afford some protection compared to low-income renters who do not live in below market rate units. In addition, a sizeable share of households in our sample have the added protection of

1 W. Holmes Finch and Maria E. Hernández Finch, *Poverty and Covid-19: Rates of Incidence and Deaths in the United States During the First 10 Weeks of the Pandemic*. *Frontiers in Sociology*, 2020(5): 47. <https://www.frontiersin.org/article/10.3389/fsoc.2020.00047>; Matthew A. Raifman, Julia R. Raifman, *Disparities in the Population at Risk of Severe Illness from COVID-19 by Race/Ethnicity and Income*. *American Journal of Preventive Medicine*, 2020;59(1):137-139. [https://www.ajpmonline.org/article/S0749-3797\(20\)30155-0/pdf](https://www.ajpmonline.org/article/S0749-3797(20)30155-0/pdf)

2 Kim Parker, Rachel Minkin, and Jesse Bennett, *Economic Fallout From COVID-19 Continues To Hit Lower-Income Americans the Hardest*. Pew Research Center, (September 24, 2020). <https://www.pewsocialtrends.org/2020/09/24/economic-fallout-from-covid-19-continues-to-hit-lower-income-americans-the-hardest/>

3 Kim Parker, Juliana Menasce Horowitz, and Anna Brown, *About Half of Lower-Income Americans Report Household Job or Wage Loss Due to COVID-19*. Pew Research Center, (April 21, 2020). <https://www.pewsocialtrends.org/2020/04/21/about-half-of-lower-income-americans-report-household-job-or-wage-loss-due-to-covid-19/>

4 *Report on the Economic Well-Being of U.S. Households in 2018*. Board of Governors of the Federal Reserve System, (May, 2019). <https://www.federalreserve.gov/publications/files/2018-report-economic-well-being-us-households-201905.pdf>

5 Solomon Greene and Alanna McCargo, *New Data Suggest COVID-19 is Widening Housing Disparities by Race and Income*. Urban Institute, (May 29, 2020). <https://www.urban.org/urban-wire/new-data-suggest-covid-19-widening-housing-disparities-race-and-income>

6 Noah Buhayar, Oshrat Carmiel, and Nic Querolo. *Landlords Squeezed Between Missed Rent and Overdue Mortgages*. Bloomberg (April 1, 2020). <https://www.bloomberg.com/news/articles/2020-04-01/rent-day-arrives-with-u-s-landlords-bracing-for-missed-payments>

7 *Understanding the Potential Magnitude of Rent Shortfalls in New York Due to COVID*. NYU Furman Center, (June 4th, 2020). <https://furmancenter.org/thestoop/entry/understanding-the-potential-magnitude-of-rent-shortfalls-in-new-york-state>

8 Sarah Stochak, Aaron Shroyer, Jung Hyun Choi, Kathryn Reynolds, and Laurie Goodman, *How Much Assistance Is Needed to Support Renters through the COVID-19 Crisis?* Urban Institute, (June 15, 2020). <https://www.urban.org/research/publication/how-much-assistance-needed-support-renters-through-covid-19-crisis>

9 Davin Reed and Eileen Divringi, *Household Rental Debt During COVID-19*. Federal Reserve Bank of Philadelphia, (October, 2020). <https://www.philadelphiafed.org/community-development/housing-and-neighborhoods/household-rental-debt-during-covid-19>

tenant level subsidies that pay a portion of the contract rent, and which adjust if the tenant's income changes. We categorize such assistance as "subsidies" in the analysis below, and these subsidies should provide an additional layer of protection.

This brief is the first in a series that will explore how rent payments and arrears for tenants in primarily affordable housing stock are changing during the pandemic. Specifically:

- What has happened to rental payments and rental arrears during the pandemic in New York City's affordable housing properties?
- Which tenants are most likely to fall short on rent? Are tenants without additional subsidies and tenants who have fallen behind on rent payments in the past less likely to cover their full rent charges?
- Which tenants are experiencing the greatest increase in rental arrears? Are those without subsidies and those who were already behind in rent in 2019, falling further behind?

In this installment of the series, we outline our initial findings on these questions for rent collections between January 2019 and September 2020. We will explore the research questions in more detail and expand the timeline of our analysis in future briefs.

Our initial analysis indicates that monthly payment rates (rental payments as a share of rent charges) decreased beginning after March 2020, though rates remained at or above 90 percent; total rental arrears also increased more quickly beginning after March 2020. The overall share of households in rental debt increased slightly (by 3 percentage points between September 2019 and September 2020) while the number of households in extreme debt more than doubled. Between March and September 2020, payment rates for tenants with subsidies were consistently higher and the growth in rental arrears consistently lower

than for tenants without subsidies. Tenant households that struggled to pay rent in 2019 were less likely to pay their rent after the shutdown, and experienced large increases in rent debt.

## Methods and Data

This analysis draws on detailed residential rent ledger data on 18,632 units in New York City between January 2019 and September 2020.<sup>10</sup> The sample consists of primarily below-market rate units, including buildings financed with Low Income Housing Tax Credits, and are mainly located in the Bronx and Brooklyn (46% and 26% of the total sample, respectively). LIHTC requires that rents be set to be affordable to low-income households (below 50 or 60% of Area Median Income). Tenants are subject to minimum and maximum income restrictions when first qualifying for the unit.

A portion of the tenants (or units) receive subsidies that further lower the tenant-portion of the rent. The rent ledger data track rental charges and payments using a series of charge codes and notes that identify each transaction (e.g. "Subsidy", "Section 8", etc.). In the analysis below, we use those codes and notes to identify units where the tenant has a subsidy that adjusts according to their income. For example, a household or unit with Section 8 is considered "subsidized" in the analysis, while a household with a Senior Citizen Rent Increase Exemption (SCRIE, which effectively freezes a unit's rent level) or a LIHTC unit with no additional unit subsidy are not.<sup>11</sup> Tenants with these additional subsidies generally have even lower incomes (30 or 40% of Area Median Income). Importantly, the subsidized household's portion of the rent depends on their income, and as such, may better protect against changes in income compared to those without.

<sup>10</sup> While some of the buildings in the sample include commercial tenants, we have pulled those units out for this residential analysis. There may be some segments of the market that are more reliant on commercial rent than the portfolios in our sample.

<sup>11</sup> For more information on our methodology, please see the technical appendix.

Our sample of affordable units was designed to give insight into the affordable stock and, as such, is not meant to be representative of the overall rental stock in New York City (Table 1). The buildings in our sample are larger on average than residential buildings in New York City—while 77 percent of buildings in our sample have 50 or more units, only 36 percent of buildings in the city are that large. Units in our sample are less likely to have

estimated rent levels (including both the tenant portion and any subsidy portion) of \$2,500 or more (2.8% of our sample and 12% of units in New York City), but are also less likely to have rents below \$1,000 (24% of our sample compared to 28% city-wide). These differences likely reflect that our sample is both primarily affordable housing (e.g., LIHTC), and does not include public housing.

**Table 1: Descriptive Statistics for the Sample and New York City**

Characteristic	Sample, N = 18,632	NYC, N = 2,135,960
<b>Building Size</b>		
1-Unit Building	0 (0%)	92,565 (4.3%)
2-Unit Building	6 (<0.1%)	224,513 (11%)
3-4 Unit Building	8 (<0.1%)	232,281 (11%)
5-9 Unit Building	308 (1.7%)	183,062 (8.6%)
10-19 Unit Building	601 (3.2%)	178,749 (8.4%)
20-49 Unit Building	3,343 (18%)	459,854 (22%)
50+ Unit Building	14,366 (77%)	764,936 (36%)
<b>Subsidy That Covers Part of Contract Rent</b>		
Subsidized	10,467 (56%)	N/A
Not Subsidized	8,165 (44%)	N/A
<b>Unit by Rent</b>		
< \$1,000	4,549 (24%)	606,325 (28%)
\$1,000-\$1,500	6,613 (35%)	607,732 (28%)
\$1,500-\$2,000	5,359 (29%)	449,954 (21%)
\$2,000-\$2,500	1,592 (8.5%)	215,379 (10%)
>= \$2,500	519 (2.8%)	256,570 (12%)

Note: We used keywords including Section 8, Sec 8, Subsidy, HAP, HUD, Tenant Based Voucher, NYCHA, ALP, and Public Assistance to identify subsidy information per the most recent tenant occupying the unit.

Sources: American Community Survey (2018 5-year) via IPUMS USA, 2015-2019 5-year American Community Survey, NYU Furman Center

## Findings

### Rent Payment and Arrears

We begin our analysis by looking at rental payments and arrears across our full sample of tenants and landlords.

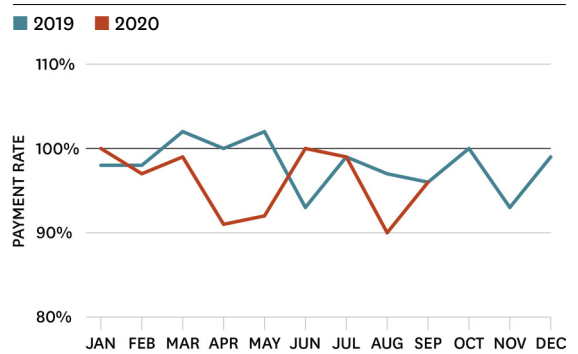
**Across our sample, rent payment rates were lower in 2020 than in 2019, resulting in a larger accumulation of rental arrears in 2020.**

In this analysis, we calculate the payments made by tenants and subsidy programs and what is charged by owners for the unit in each month and define those as rental payments and rent charges, respectively.<sup>12</sup> Rent payment rates—defined as total monthly payments divided by total monthly charges—provide a snapshot of the extent to which payments in that month are covering the charges levied in that same month. We find that payment rates were generally lower in 2020 than in 2019 (Figure 1). Between March and September 2020, monthly payment rates averaged 95 percent, a decrease from 98 percent during the same period in 2019. April, May, and August 2020 saw the lowest rates (at 91%, 92%, and 90%), following the shut-down and then the expiration of expanded unemployment benefits.

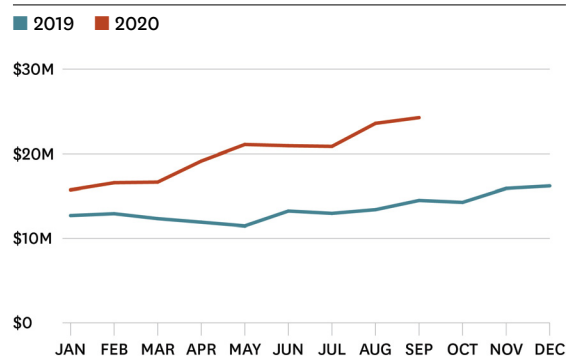
While payment rates at or above 90 percent may not seem concerning (and may reflect the protections afforded by the rent-restricted housing and subsidies in our sample), any payment rate below 100 percent contributes to payment arrears in that month; each month where full payment is not achieved leads to lost anticipated revenue for landlords, and rent arrears for individual households.

<sup>12</sup> It is worth noting that the rent ledger data may include some assorted fines and fees related to tenancy; we hope to unbundle those fees in future analyses. The scale of these fees are small—miscellaneous charges (transactions not identified as tenant or subsidy charges) represent an average of 2.7 percent of monthly total charges. For more information, please see the technical appendix.

**Figure 1: Monthly Rent Paid as a Share of Monthly Rent Charged**



**Figure 2: Total Rental Arrears**

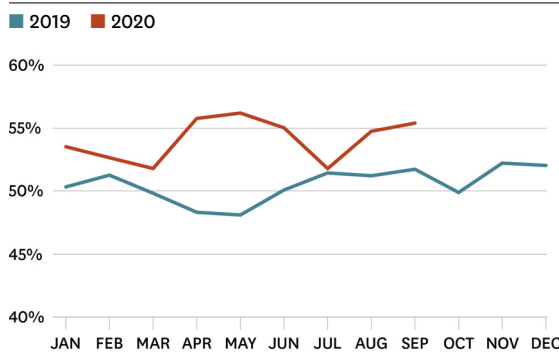


In addition to reviewing monthly payment rates, we are also able to identify the household balance in January 2019, and track how arrears accumulate over time (Figure 2). Focusing on 2020 (the red line), we see that the total rent arrears across our sample stayed relatively constant in the first few months before increasing in April and May, and again in August and September. The timing of these increases follows the beginning of the crisis in March and the expiration of extended federal unemployment benefits at the end of July. This increase in rental arrears implies that building owners may face challenges in paying mortgages and operating expenses. Importantly, we see that tenants already had significant arrears when the pandemic began. Total arrears had been increasing in the pre-pandemic period (June 2019 to March 2020), meaning that some tenants carried rental debt into the current crisis.

**Throughout 2019 and 2020, close to half of the tenants in our sample were in rental arrears.**

In 2019, before the economic crisis, the share of tenant households that had some amount of rental arrears hovered around 50 percent (Figure 3). That share increased after the onset of COVID-related shutdowns in March 2020, with a decline in July, only to increase again starting in August (when \$600 per week unemployment supplements ended). Overall, the share of households with rental arrears increased by 3 percentage points (from 52% to 55%) between September 2019 and September 2020.

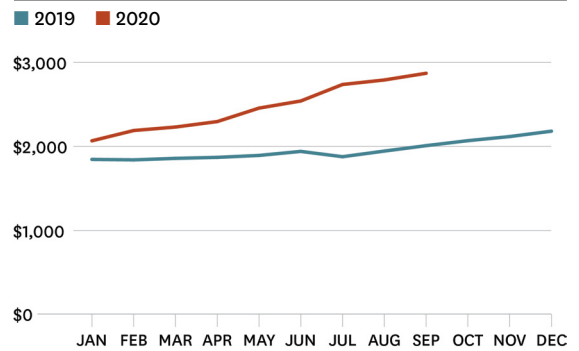
**Figure 3: Share of Tenants with Rental Arrears**



**Between September 2019 and September 2020, the average rental arrears for tenants that owed rent increased by 43 percent, to \$2,871.**

The cumulative effect of prior arrears and small but persistent declines in the payment rate resulted in a large increase in the average amount of rental arrears among tenants who owed rent. This average rose by 43 percent (from \$2,009 to \$2,871) (Figure 4). Much of the rental arrears accrued after the onset of the economic crisis in March 2020—at the beginning of 2020, average rent debt hovered around \$2,000 per household before increasing by more than 7 percent in May and an additional 8 percent in July. The increase in the share of households that owe rent and in the average amount of debt raises concerns about the lasting impact of the crisis on both tenants and building operators.

**Figure 4: Average Rental Arrears Owed**



## Payment Rate Variation Among Tenants

We next examine variation among tenants to shed light on who among our sample experienced the largest declines in monthly rent payment rates.

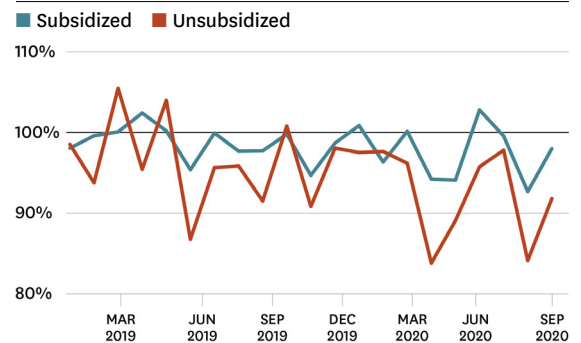
### **Payment rates were consistently higher and declined less after March 2020 for tenant households with subsidies than those without.**

One might expect households whose portion of the rent payment adjusts with changes to their income (defined as a “subsidy” for this analysis) to fare better during a crisis than their counterparts without subsidies. If a household with a subsidy loses income they can presumably recertify to lower their portion of the rent (without affecting the total rent collected by the building owner), while a household in a LIHTC unit remains accountable for the full rent.

Indeed, our analysis shows that the decline in payment rates after March 2020 was much smaller for subsidized households than for unsubsidized (Figure 5).<sup>13</sup> Between March and September 2019, the payment rate of households with subsidies hovered close to 100 percent, dipping below that in only 3 of the 7 months. This increased to 4 of the 7 months between March and September 2020 (post onset of COVID). By contrast, payment rates for households without subsidies were below 100 percent in 5 of the 7 months between March and September 2019, and persistently below 100 percent in all months after March 2020. Households without subsidies hit their lowest payment rate at 84 percent in April and August, and also had more variation in payment rates across the entire survey period.

Because this initial analysis does not separate rent payments by source, we cannot determine to what extent those payment rates were driven by the subsidy itself or some combination of the subsidy and tenant payments. For example, subsidized households may have missed the same share of their rent portion as unsubsidized households, but consistent subsidy payments bolstered the overall payment rate. In future briefs, we will distinguish between sources of payments to better understand what drives the payment rates for subsidized households.

**Figure 5: Monthly Rent Paid as a Share of Monthly Rent Charged With and Without Subsidy**



### **On average, households that were more than one month behind on their rent at the end of 2019 paid a lower share of their rent in 2020 than households who were not.**

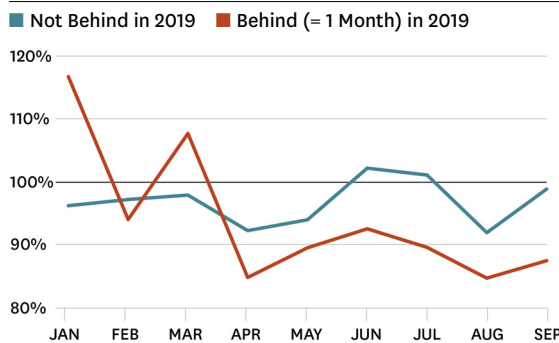
An alternative group one might expect to fare differently in the crisis are households who were already struggling to pay rent. To gain insight into this group, we compared payment rates for households that were more than one month behind in rent at the end of 2019 to households that were less than one month behind. Interestingly, the households that were more than one month behind at the end of 2019 actually overpaid their rent in January and March 2020, perhaps reflecting an effort to “catch up” on their rental arrears post-holidays and at the time of tax refunds (Figure 6). From April through September 2020, however, this group paid a lower share of their monthly charges

<sup>13</sup> Figures 1 and 5 both track payment rates over time but are structured differently. While Figure 1 tracks 2019 and 2020 payment rates on a year-long x-axis, Figure 5 traces tenants by subsidy status on an x-axis that runs from January 2019 to September 2020.

compared to their counterparts in the sample. Payment rates for households that were more than one month behind at the end of 2019 dipped below 90 percent in April, August, and September 2020, while the rest of the sample stayed above that level throughout the year.

Households that appeared to struggle with rent payments even before the pandemic may be particularly vulnerable to the financial stresses of the economic downturn. Households in this group are also less likely to be subsidized (44%) than our sample overall (56%). While the subsidized households in this group should be able to recertify to lower their portion of the rent if needed, they may also face additional obstacles to paying their portion. We will examine trends in this group in subsequent briefs, with data through early 2021.

**Figure 6: Monthly Rent Paid as a Share of Monthly Rent Charged in 2020**



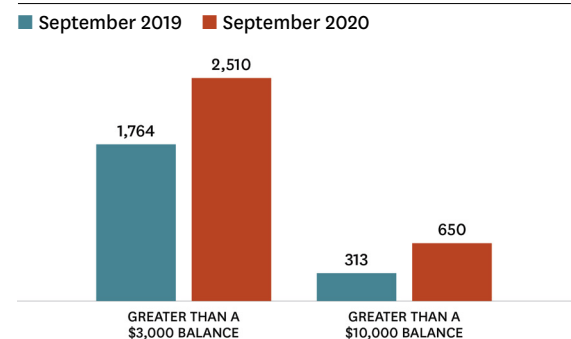
## Variation in Accumulated Rental Arrears Among Tenants

This last analysis examines the variation among tenants in terms of accumulated rental arrears, overall, and then by subsidy status and whether households entered 2020 already more than a month behind on rent.

### Between September 2019 and September 2020, the number of tenant households in extreme rental arrears more than doubled.

Between September 2019 and September 2020, the number of households in our sample owing more than \$3,000 (the equivalent of at least two month’s rent for 59% of our sample) increased by 42 percent (1,764 to 2,510) (Figure 7).<sup>14</sup> The number of households that owed more than \$10,000 in rent, which we call ‘extreme rental arrears,’ increased by 108 percent (313 to 650). Strikingly, the share of all rental debt owed by households that owed more than \$10,000 also increased from 35 percent in September 2019 to 50 percent a year later.

**Figure 7: Number of Households with Rental Arrears Greater than \$3,000 and \$10,000**

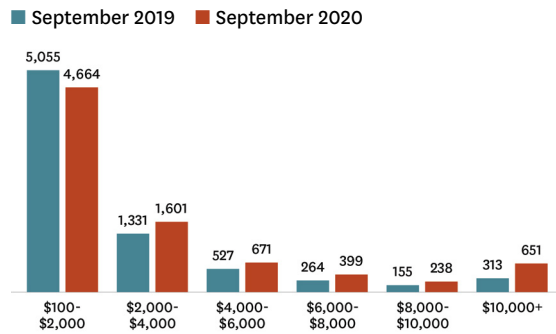


<sup>14</sup> Among our sample, 28 percent of households had overpaid their landlord and were ahead on their rent in September 2020 (similar to 27% in 2019). Tenants may overpay for a number of reasons. For example, they may be unaware of their true rent amount (perhaps due to a recent lease renewal) or the portion that they are expected to pay after recertifying for a subsidy. Reviewing the data, we see some tenants overpaying by a set amount on a recurring basis, suggesting that they may have autopay in place. Tenants may also effectively use their landlord as a unofficial banking system, prepaying rent against future months.



The spread and concentration of rent debt is most visible when comparing the distribution of rental arrears between September 2019 and 2020 (Figure 8).<sup>15</sup> In 2020, the distribution shifts to the right and the right tail gains heft, as more tenant households become more deeply in debt. The number of households owing between \$100 and \$2,000 in rental arrears decreased by 8 percent (5,055 to 4,664) between September 2019 and 2020. By comparison, over the same period the number of households that owed between \$8,000 and \$10,000 increased by 54 percent (155 to 238).

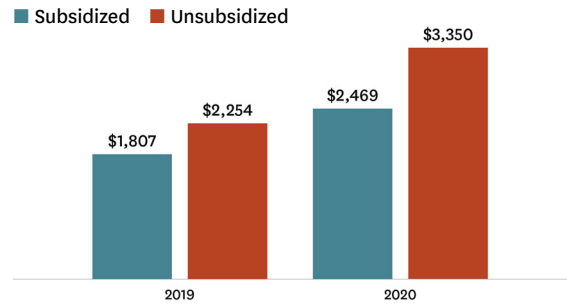
**Figure 8: Distribution of Rental Arrears in September of 2019 and 2020**



**Average rental arrears increased more among unsubsidized households, and the number of unsubsidized households in extreme rental arrears increased by 127 percent between September 2019 and 2020.**

Compared to their subsidized counterparts, unsubsidized households experienced greater increases in average rental arrears between September in 2019 and 2020. Over that time period, the average rent debt among those who owed for unsubsidized households increased by 49 percent, from \$2,254 to \$3,350, while rental arrears for subsidized households rose by 37 percent, from \$1,807 to \$2,469 (Figure 9). In terms of deep debt, the number of subsidized households that owed more than \$10,000 increased by 87 percent, while the number of unsubsidized households owing more than \$10,000 rose by 127 percent.

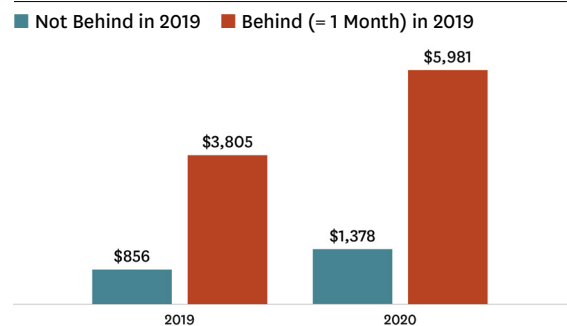
**Figure 9: Average Rental Arrears Owed in September of 2019 and 2020**



**Average rent arrears for households who started 2020 more than a month behind in rent increased from \$3,805 in September 2019 to \$5,981 in September 2020.**

Households that were more than one month behind at the end of 2019 saw their average arrears increase by 57 percent between September 2019 and September 2020, from \$3,805 to \$5,981. While households that were less than one month behind experienced a slightly larger percentage increase in their average rent arrears, 61 percent, this was from a much smaller initial base; increasing from \$856 in September 2019 to \$1,378 in September 2020 (Figure 10). Indeed, this group’s September 2020 rental arrears was well below half of the September 2019 rental arrears of households who would end 2019 more than a month behind. By September 2020, this latter group owed close to four months of rent on average, and more than four times as much rent compared to households that started 2020 less than one month behind.

**Figure 10: Average Rental Arrears Owed in September 2019 and 2020**



<sup>15</sup> For ease of presentation, we omit units with rent debt between \$0 and \$100 in this figure.

## Discussion

While rental payment rates in our affordable housing sample are generally quite high, we find that they dropped in 2020, causing an increase in the rate of accumulation of tenant rental arrears. Overall, average rental debt rose by 43 percent between September 2019 and 2020. Of particular note, households with extreme rental arrears (\$10,000 or more) accounted for 50 percent of the total rent owed to property owners by September 2020. Such sizable debts may pose tremendous challenges for tenants to pay off, and if they cannot do so, landlords will need to consider writing off a substantial amount of accumulated debt. The deepening and broadening of rental arrears indicates that, without assistance, more households could be liable for nonpayment eviction if taken to housing court or face other negative consequences.

We also examine which tenants experienced the largest declines in rent payments and greatest increase in rental arrears. We find that households with subsidies had higher and more stable payment rates through September 2020 compared to those without subsidies, and saw a smaller increase in rental arrears than households without subsidies. We also find that households that owed more than one month of rent at the end of 2019 were less likely to pay their full monthly rent during the crisis, with a subsequent large increase in rent owed. Those households were also less likely to be subsidized, suggesting that deeper subsidies may provide a greater level of protection for tenants and their landlords in the face of severe economic shocks.

While our analysis is descriptive, it can be interpreted within the context of the economic and policy changes that occurred during the sample period. We see clear increases in the rate of rent debt accumulation after the economic shutdown of New York City in March 2020. In June and July, rent debt stabilized across our portfolios, coinciding with the stimulus checks and increased Unemployment Insurance supplements provided under the CARES Act. Accumulated rental arrears began increasing again in August, just after the \$600 Unemployment Insurance supplements ended. Looking forward, many policymakers have raised the specter of an impending wave of eviction cases after the moratoria are lifted.

In future research, we will continue to expand our sample, tracking debt through the winter. We hope to refine our analysis and take a more detailed look at how rent payments vary according to building and program characteristics. While we do not have information about household characteristics, we also plan to examine variation in rent payments by the racial and economic composition of the neighborhood. We will explore trends in individual payment histories to gain deeper insight into the experience of tenants, and we hope to consider any evidence of changes in landlord behavior, such as forgiving rental debt. Finally, we will review changes in vacancies to see if certain buildings or certain types of neighborhoods have more empty units during the crisis.

## Technical Appendix

This appendix describes the data and estimates underlying the analysis outlined in this brief. The data were pulled directly from firms' property management systems (typically Yardi or Bostonpost) by their own employees and cleaned of any identifying information, including building address and tenant name, before being shared with our team. We then cleaned the data to ensure standardization across different portfolios. More detail on our methodology is provided below.

### Data

The data in this analysis combine information from rent ledgers, property directories, and tenant directories from January 2019 to September 2020. The rent ledger data track tenant payments and charges in each occupied unit along with the actual date of the transaction, the overall tenant balance, the post-date-month (or the intended date of the transaction, which can differ from the transaction date), a charge code for the type of transaction, and any related notes. The property directories list the units in each property as well as the property ZIP Code, and the tenant directories list the lease start and end dates, tenant move-in and move-out dates, and sometimes include unit- or tenant-level program information (such as subsidies or tax financing).

### Excluded Records

#### **Commercial Tenants**

For this analysis, we use the transaction-level charge codes and notes to identify and exclude any commercial tenants, such as grocery stores or offices, as well as "units" that represent building-level laundry or telecommunications income.

#### **Debt Write-Offs**

We also use charge codes to isolate and exclude debt write-offs. According to interviews with our participating firms, when they cannot collect a payment from a tenant, they will write off that charge or range of charges. The write-offs show up in the data as a reversing charge and are typically coded as "bad debt" or "write off charge." To more accurately reflect the cash flow over time, we drop these debt write-offs and include forgiven debt in the debt totals above. However, we are not able to exclude any debt write-offs that occurred before our data set begins in January 2019.

#### **Reverse Charges**

Reverse charges are also excluded from our analysis. Reverse charges reference charges that could have been made in error and which are subsequently reversed at a later date, transactions related to past tenants that have since left the building and have outstanding balances, or a specific issue related to a subsidy that was suspended.

#### **Miscellaneous Exclusions**

In addition to the aforementioned exclusions, we also remove transactions related to rents for building superintendents. We exclude monthly tenant total balances, and calculate our own accrued balance per tenant. Finally, we remove records for a handful of buildings that report very large subsidy payments in one month that are meant to cover transactions throughout a fiscal year, since those anomalous payments distort the sample's trajectory of payment rates over time.

### Constructed Variables

We estimate *rent* by calculating the median monthly charge during each tenancy. In addition, we calculate *balance* by summing charges and payments at the end of each month. A positive balance means that a tenant is in arrears, while a negative balance means that a tenant has overpaid. Currently, these charges and payments include tangential fees (like legal fees or key fees) as well as fines and damages levied against the tenant. In future analysis, we hope to unbundle these non-rent related charges.

Finally, we identify tenant and/or unit level *subsidies* based on keywords in the transaction charge codes and notes; if the record contains a matching keyword (e.g. “subsidy” or “HUD”), we classify the tenant as subsidized. Based on high-level estimates from our data providers, we believe that we are undercounting the number of subsidized tenants in certain portfolios. In future iterations of the project, we hope to collect more precise data on subsidies to further refine our analysis.

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