Fragile Market

THE IMPACT OF MUTUAL FUNDS ON THE CORPORATE BOND MARKET

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Master Thesis

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Abstract

This master's thesis investigates whether mutual funds can induce fire sales on the Swedish corporate bond market between August 2019 and August 2020 to determine whether mutual funds aggravated the COVID-19 crash, and if their solution to temporarily freeze withdrawals were a viable remedy. Moreover, the thesis addresses this question using a panel-data framework that includes mutual fund-specific variables, control variables suggested by previous literature, entity, and time-fixed effects, allowing the thesis to capture divergences between corporate bonds and months. The key conclusions are that mutual fund flows can cause fire sales on the Swedish corporate bond market, with the effect on return being -50bps on average. In addition, the remaining fund-specific variables have a detrimental impact on returns. When evaluating the characteristic adjusted return, fire sales have an even more significant impact, as corporate bonds with fire sales underperform their sector by -70bps on average. Meanwhile, the study discovers that proxies for market liquidity and volatility have an adverse impact on returns.

Keywords:

Corporate Bonds; Mutual Funds; Fire Sale; Liquidity; Covid-19

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1. Introduction

The bond market is crucial for society because it is one of the primary sources of funding for a variety of ventures that cannot be funded solely by other financings, as it can finance government public expenditures or new project initiatives by corporations that investors can support (FI, 2022; Bonthron et al., 2016). As a result, any market disruptions could impede credit provision (FI, 2022). Moreover, Swedish bonds with higher credit ratings are traded more frequently and have better liquidity (Nguyen, 2014; Bonthron et al., 2016), however, as outlined by FI (2022), bonds with high credit ratings have offered lower yields in recent years, as a result, investors have shifted their focus to bonds with lower credit quality and potentially higher yields. Decreased liquidity in the corporate bond market makes it more expensive to invest, as the rational investor will want a higher yield to compensate for the liquidity risk, which may force issuers to pay higher interest rates on debt (FI, 2022; Amihud and Mendelson, 1986).

The efficiency of the corporate bond market can be questioned, and market participants can cause fire sales both during a crisis and non-crisis periods, which can be derived from fund flows (Qin and Wang, 2022; Manconi et al., 2012) or credit rating downgrades (Ellul et al., 2011). For example, insurance companies face regulatory constraints and hold a large portion of investment-grade corporate bonds. When these bonds are downgraded to high-yield, insurance companies need to liquidate the bonds, resulting in a fire sale and significant price pressure (Ellul et al., 2011). Subsequently, it's mentioned by Ellul et al. (2011) that insurance companies' regulatory limits are crucial in understanding fire sales in the corporate bond market. Meanwhile, insurance companies play an important role in market liquidity, as demonstrated in the paper by Manconi et al. (2012) because they were small net buyers when mutual funds sold their corporate and securitized bonds during the global financial crisis and could mitigate the effect of fund flows. Because insurance firms do not have the same liquidity constraints as mutual funds, they can retain bonds until maturity. Since these companies have customers who are locked with their money until retirement, with penalties for unexpected withdrawals, hence they have more reliable outflows than mutual funds (ibid.).

Additionally, mutual funds encounter customer redemptions daily, hence, may need to liquidate holdings to satisfy the customer's requests. It is typical for mutual funds to sell the most liquid holdings first, which tend to be corporate bonds with higher credit ratings, supporting evidence is found by Qin and Wang (2022), Manconi et al. (2012), and Choi et al. (2020). Because high-yield bonds are less liquid during times of instability, they may be forced to sell below their underlying value. As a result, Choi et al. (2020) state that if mutual funds hold more illiquid bonds, they are more likely to encounter "extreme liquid shortfalls", hence, are more vulnerable to liquidity risk.

Similar research has been conducted on the stock market, with Coval and Stafford (2007) analyzing the effect of fire sales in the USA, driven by fund flows, and discovering that fire sales can also have a significant effect, with the effect tending to last 6 months and even more to rebound when fire sales occur among mutual funds. Because the authors write that when these funds become homogenous in the sense that they execute transactions on the same securities, this can have a significant effect on the price development (ibid.).

Interestingly, Choi et al. (2020) discover that corporate bond mutual funds in the USA, employ different buffers to maintain redemptions more frequently than stock mutual funds with lower buffers since the alternative cost is higher. As a result, when investors withdraw money from mutual funds, it is common for corporate bond mutual funds to leave most of their portfolio unchanged, whereas equity mutual funds sell more. Choi et al. (2020) write that corporate bond funds "do not transact on 59.26% of their corporate bond positions, and distressed equity funds do not transact on 11.34% of their equity positions".

In addition, bond allocation is a popular investment allocation, accounting for a large portion of Swedish household portfolios (FI, 2022). Moreover, the advent of the COVID-19 pandemic triggered financial market volatility (Qin and Wang, 2022), and several asset classes had the greatest drawdowns since the global financial crisis, market liquidity disappeared and could be a contributing factor to the collapse. As a result, the Swedish corporate bond market imploded, and mutual funds halted customer withdrawals (Dagens Industri, 2020). Interestingly, green corporate bond funds experienced positive inflows, and green corporate bond bid-ask spreads

recovered significantly faster and did not have the same degree of dramatic drops as conventional corporate bonds (Pareto and CICERO, 2020).

Furthermore, this thesis contribution will be to examine the Swedish corporate bond market during the COVID-19 crisis, under the period August 2019 to August 2020, and whether mutual fund flows aggravated the crash in the corporate bond market. Moreover, no current study covers this problem with empirical evidence, to my knowledge, therefore the paper will contribute to the research on mutual funds' impact on the Swedish corporate bond market. This paper finds explanations for why Swedish mutual funds halted customer withdrawals. Consequently, the thesis question is as follows: *Did mutual fund flows affect corporate bond returns during the COVID-19 crash, and can they induce fire sales?*

The outline for the paper is as follows, it will begin with an introduction to the Swedish corporate bond market, displaying its development, structure, and size. Thereafter, the paper discusses previous research done in the field, given that there does not exist empirical research in Sweden it will include international research. Further, the paper then includes a description of the dataset, the methodology of the paper, an outline the of econometric model, and how the fire sale measurement is constructed. Moreover, the paper displays the results derived from the method and relates to the previous sections. Lastly, the paper ends with a conclusion and policy reflections.

2. The Swedish Corporate Bond Market

Since the global financial crisis, the outstanding nominal amount of bonds in the Swedish bond market has increased, but the traded volume has not expanded to the same extent, resulting in poorer liquidity (Bonthron et al., 2016). Because corporate bond issuance has increased significantly over the last ten years, the total outstanding nominal amount in 2013 was roughly 600 billion SEK, compared to 1,600 billion SEK in 2022 (FI, 2022). Interestingly, the issue divided by currency has remained rather steady throughout time, with issuance in SEK and EUR accounting for the largest proportion of the outstanding amount, 88% of the outstanding amount (ibid.). Consistently to the OECD (2022), the currency composition of non-financial company bond issuance has been 48% in EUR and 44% in SEK from 2011 to 2021. Additionally, in terms of where the bonds are listed by amount, 66% are listed abroad, with Luxembourg accounting for 39% (ibid.). As a result, foreigners are the major owners of non-financial corporate bonds, with a relatively consistent proportion of 60% in 2020, investment funds at 17%, and insurance companies at 9% (ibid.). Moreover, as corporate bond issuance has steadily increased over the last ten years, asset under management (AuM) for mutual funds has increased, with total AuM in 2014 being around 75 billion SEK and slightly beneath 200 billion SEK in 2022, nonetheless there was a sharp decline during the COVID-19 crisis (FI, 2022). In addition, during the COVID-19 crisis in Sweden, credit spreads for corporate bonds more than doubled. As liquidity returned, among other factors, credit spreads began to rebound, and by the end of 2020, credit spreads were slightly lower than pre-crisis levels (FI, 2021).

Interestingly, Green corporate bonds have gained a larger share of the total outstanding nominal amount in the Swedish market, accounting for 20% of the market in 2020 (Pareto & CICERO, 2020). The difference between green and conventional corporate bonds is that "…the proceeds are earmarked for investments with positive environmental effects" (ibid.). Bendrioua and Jarbratt (2019) conducted a study to see whether there is a difference between green and conventional corporate bonds. According to the findings, there is a liquidity premium for green bonds, with the effect being more pronounced for municipal bonds rather than corporate bonds (ibid.). Given that green bonds were first introduced in 2007-2008, the premium could be associated with them being less mature than

conventional bonds. However, the issuance of green bonds has increased steadily since their inception and accounts for a significant proportion of the total outstanding volume (ibid.).

Furthermore, Rosengren and Söderström (2021) conducted interviews with six participants in the Swedish corporate bond market, from the perspectives of issuers, investors, and intermediaries, to explain the growth in the corporate bond market. The respondent from the real estate industry provided the issuer's perspective, stating that bond issuance provides the issuer with greater flexibility and fewer limitations than a traditional bank loan because the issuer pays quarterly coupons and amortizes the bond at maturity (ibid.). Further, the investors explain that the growth can be ascribed to the low-interest rate environment and Basel-III restrictions, which constrained the bank's lending ability (ibid.). Lower yields have prompted investors to decrease their demands on credit quality, nudging the investors further out on the risk curve, when looking for greater yields. It is stated that knowledge of the high-yield bond market is limited, as is transparency, however, as the market grows, these informational gaps will close (ibid.). Finally, according to the intermediary, "the regulation and increased difficulties of getting bank loans with fair conditions…", the low-interest rate environment has contributed to the astounding growth in the corporate bond market, as corporations can find cheaper financing through the capital market. Additionally, one statement of the largest banks in Sweden "…the largest banks still have a central position as they developed a new function of the banks, where they operate as an advisor to both issuers and investors", resulting in advising fees without contributing their capital (ibid.).

The real estate sector in Sweden is the most reliant on the corporate bond market (FI, 2021; Rosengren and Söderström, 2021; OECD, 2022), accounting for approximately 42% of the total outstanding nominal amount of corporate bonds of non-financial corporations in 2021 (FI, 2021). In recent years, the annual growth rate for issuing corporate bonds has been higher than for bank loans in the real estate sector, since in 2012 corporate bonds accounted for only 9% and bank loans the rest, and by 2021 this share has grown to an astonishing 33% (ibid.). As a result, the outstanding debt for the real estate industry has increased, however, real estate prices have also climbed (ibid.), mitigating the loan-to-value.

Since the turn of the millennium, the credit quality of the Swedish corporate bond market has deteriorated, with the average credit rating falling around BBB-, equivalent to the frontier of investment grade, which can be linked to the reduced interest rate environment and the desire for higher yield (OECD, 2022; Fidelity, 2023). During the same period, 46% of issuances do not have a credit rating, one likely explanation for the high proportion of unrated bonds is the high expense of obtaining a credit rating from the main credit rating institutions (OECD, 2022). This is also consistent with Bonthron's (2014) finding that the issuing of corporate bonds with lower credit grades or no credit rating has increased, in Sweden.

Furthermore, according to the OECD (2022), electronic trading accounts for a minor portion of the activity in the Swedish secondary corporate bond market, and deals are more frequently negotiated over the phone or through chat services, such as in the Bloomberg Terminal. According to the paper, the bond market has lower liquidity than the stock market because most trading occurs near the issuance date and drops after three quarters (ibid.). Moreover, this is consistent with Bonthron et al. (2016) and Bonthron (2014), because most transactions are executed on the OTC market, where the market maker may be the transaction's counterparty. There are several reasons for this, including the fact that interest in a specific paper may not occur simultaneously among sellers and buyers, and participants in the bond market are also fewer than in the stock market, because the majority are professional institutions, and transactions are usually large and occur less frequently (ibid.). Additionally, unlike equities, bonds have a maturity date, which causes most investors to hold the bond until maturity, reducing market activity (ibid.).

The liquidity of corporate bonds in the secondary market is crucial for the primary market, Bonthron et al. (2016), if liquidity in the secondary market is poor, investors will demand higher yields when issuers issue new bonds, resulting in higher costs. Moreover, the issuer and the investors may not have the same time horizon, for example, if the investor is a mutual fund, they may need to sell the bond to reconcile the fund flows, and the investor can then sell the bond on the secondary market (ibid.).

Further, the OECD (2022) investigated the Swedish corporate bond market and identified five essential issues. The first issue is “the growing share of investment fund ownership” which can be a problem because these funds are open-ended, meaning investors can redeem the funds at any time. Given the illiquidity of the bond market, this will amplify the downward pressure during a crisis as many retail investors become homogenous. Because, the mutual funds are traded daily, whereas the underlying assets are not traded as frequently. The second concern is “industry concentration and the exposure of real estate companies”, because the real estate sector accounts for 48% of total issuance and 39% of outstanding amounts in 2021, and a relatively “small number of companies” accounts for this share, making the bond market very concentrated and more fragile if an adverse event occurs in the real estate sector. It is an issue, according to Bacco and Gustafsson (2021), because it makes diversification difficult and increases systematic risk. The third issue is “the large share of unrated corporate bonds”, which is also mentioned by Rosengren and Söderström (2021), because credit ratings help investors evaluate corporate bonds and can magnify the risk associated with a specific bond, therefore, if there are unrated bonds, certain funds may only invest in corporate bonds with credit ratings. However, Bacco and Gustafsson (2021) conducted interviews with corporate bond market participants, and asset managers do not believe it is a concern because credit ratings are not always in line with their analyses. The fourth concern is the “Lack of information about the security and the issuer available to potential investors during the issuance and placement process”, which makes issuers less transparent, and the information should be more easily accessible. The final issue is “pricing transparency in the corporate bond market”, which is also outlined by Bacco and Gustafsson (2021) as the most important factor that needs to be improved, because it is more difficult to find reliable prices in the corporate bond market compared to the stock market, for example, one would need to have a subscription to Bloomberg Terminal (or another provider), and the prices reported by market makers are indicative (Bonthron et al., 2016), which decreases the transparency for the market.

Additionally, the Swedish corporate bond market lacks transparency, resulting in informational asymmetry, with larger investors having more knowledge than smaller participants (Bonthron, 2014). Hence, increasing market openness may increase the number of market participants and improve market liquidity. Because Pagano and Röell (1996) discovered that increasing transparency tightens the bid-ask spread, lowers transaction costs, and increases market liquidity. Whereas Bonthron (2014) claims that increasing transparency would reduce market information asymmetry, FI (2020) claims that improved transparency of market volume and traded prices would increase liquidity.

The Swedish corporate bond market has problems and needs to be improved to boost market liquidity, numerous alternative solutions could be implemented. According to FI (2022), mutual funds' "liquidity management" needs to be improved. Because, as observed in the USA, research by Choi et al. (2020) demonstrates that corporate bond mutual funds prefer to keep a buffer to control typical levels of investor redemptions and discover that the influence of mutual fund flows on corporate bonds is not significant.

Authorities have attempted to improve liquidity and transparency in the market, for example, with MIFID 2 and MIFIR, but Persson and Svensson (2020) find that liquidity did not improve after implementation, which is consistent with interviews with market participants in their paper. The respondents were also asked if they believe transparency has improved, and they believe it has worsened. One of the respondents mentioned that the corporate bond market is the last major OTC market that lacks transparency because the information is not easily accessible (ibid.). The findings are also consistent with FI (2019), which found no gains in transparency following the adoption of MIFID 2 and MIFIR.

Furthermore, Swedish government yields have steadily declined over the last three decades, as illustrated in Figure 1. The Swedish 10-year government bond and the 3-month treasury bill reached the highest yields in the '90s, approximately 14% and 22% respectively, which can be compared to the low-interest rate environment during the 10's when the lowest yield was approximately -0.3% and -0.8% respectively. However, since 2022, rates have begun to rise, causing turbulence in the Swedish bond markets. Moreover, FI (2022) stated that the low-interest rate

environment has caused investors to shift their focus to corporate bonds with lower credit quality, as investors began to chase higher yields because higher-rated bonds offered too low yields, a phenomenon known as TINA ("There Is No Alternative"), consequently, excessive risk-taking occurred. As previously stated, the decline in yields has caused the corporation to begin issuing more bonds, as they take advantage of the lower interest rate environment because it lowers the cost of debt for the company, which could explain why the total nominal amount of corporate bonds has increased significantly in recent years. In addition, falling interest rates have made issuing floating rate notes (FRN) attractive, as the fraction was 53% in 2021, up from 18% in 2010 (OECD, 2022).

Figure 1: Development of the Swedish government bond yields, numbers in percent, retrieved from the Riksbank.

Furthermore, FI (2022) discussed the implications of the higher yields and if the higher yields could potentially make the corporate bond market return to its normal functioning and increase liquidity. Because, as can be seen in the figure from FI (2022) in the Appendix there is a relationship between the interest rate and liquidity in the market. The higher interest rates make the bonds generate a more normal return from a historical perspective. The higher returns could lead more investors to participate in the market, subsequently leading to better liquidity. Moreover, the higher yields can also improve the conditions for the market makers, making it more attractive to increase activity, and potentially, generate more liquidity for the market.

3. Literature Review

There is no empirical study on the influence of fund flows on the Swedish corporate bond market, the literature review will include research from the United States that is more relevant. This section will begin by discussing how market liquidity affects corporate bonds from a distinct perspective.

Nguyen (2014) investigates the impact of market liquidity on yield spreads in Sweden, concluding that market liquidity affects yield spreads on investment-grade bonds, as decreased liquidity widens the spreads. Dick-Nielsen et al. (2012), among others, support the fact that market liquidity has an impact on corporate bonds, for example, during the global financial crisis, the increase in credit spreads was substantially due to a worsening in liquidity (ibid.). Moreover, Nguyen (2014) has yield spread as the dependent variable and different explanatory variables, including two different proxies for liquidity, the bid-ask spread, and zero-trading days within a given quarter, where the former is statistically significant, whereas the latter is insignificant. Other explanatory variables included, among others, the spread between the 10-year and 1-year swap rates, time to maturity, credit rating, and credit default swaps. In addition, the data was obtained from Bloomberg and Prime, with quarterly data points in 2013, and it is stated in the study that certain variables would require a longer period to produce better results (ibid.).

Qin and Wang (2022) examine fire sales during the COVID-19 crisis in the United States, using corporate bond ETF flows, and discover that the impact of fire sales on characteristics-adjusted return (CAR) is greater during the crisis period, with significant outflows. Interestingly, during the COVID-19 crisis, investment-grade bonds were sold more extensively than high-yield bonds, and investment-grade ETFs had large discounts on the NAV (ibid.). This can be related to the fact that investment-grade corporate bonds have higher liquidity and are thus more easily sold during the crisis period, as opposed to selling high-yield bonds, which have less liquidity and would require a large discount to execute. Moreover, the authors analyzed 135 corporate bond ETFs from July 2019 to June 2020, and identify the fire sale measure "… as those in the top decile sorted by the exposure to ETFs' flow-driven net sells in a particular trading day, where flow-driven net sells are defined as sells by ETFs within the top quartile of outflows minus the ETFs within the top quartile of inflows" (ibid.). The price impact of fire sales caused by ETF flows was

greater for investment grade than for high yield, and it was significantly greater during the crisis period (ibid.). In addition, data from Morningstar, TRACE, and FISD is used in the paper.

Consistent with Qin and Wang (2022), research by Manconi et al. (2012) finds that yield spreads and bond sales increase more for corporate bonds with mutual funds that have high exposure to securitized bonds compared to unexposed mutual funds, and the effect is stronger when the mutual fund is affiliated with commercial banks. The authors discover that a bond's holding exposure affects the yield spread: "An increase in holder's exposure from 0% to 50% is associated with a 70 bps increase in the yield spread in the first two-quarters of the crisis". This demonstrates that fund flows have an impact during a crisis period, as mutual funds hold more of a particular bond, they must reduce their exposure to fulfill redemptions. Moreover, high-yield bonds are more commonly sold than investment-grade bonds, and selling pressure from mutual funds has a greater impact on credit spreads for a bond with a lower rating that also had securitized bonds during the global financial crisis, because securitized bonds were the most illiquid asset in mutual fund portfolios (ibid.). Qin and Wang (2022), on the other hand, demonstrated that during the COVID-19 crisis, it was more usual to sell investment-grade bonds than high-yield bonds, and the effect was stronger on investment-grade bonds. Fund turnover and fund flow volatility were utilized as proxies for liquidity needs by Manconi et al. (2012). Higher volatility in fund flows would necessitate mutual funds holding more cash and cash equivalents to satisfy investors. During the subprime crisis, insurance companies were net buyers of corporate and securitized bonds, whereas mutual funds had to liquidate many of their assets to meet investor redemptions (ibid.). In addition, the paper focused on data from Lipper, CRSP, and FISD, among other sources.

On the contrary, Choi et al. (2020) suggest that bond mutual funds that exhibit large redemptions from their holders, do not result in fire sale price pressure when controlling for "time-varying firm-level information". Because they argue that when controlling for these effects "…thus enabling us to distinguish between redemption-induced price declines and fundamental-driven price declines". Moreover, Choi et al. (2020) state that mutual funds use buffers rather than selling corporate bonds initially, the buffer can comprise cash or other liquid securities. As a result, the consequences of unexpectedly large redemptions can be minimized if mutual funds

have a high buffer, which may explain why a fire sale from mutual funds has no statistically significant effect on credit spreads. Mutual funds in their sample have a rather high share of cash in their portfolio, on average 10% (ibid.). The research examines the impact of quarterly fund flows from 2005 to 2014, utilizing data from CRSP, TRACE, FISD, and Morningstar. In addition, the paper's assessment for fire sales is based on the aggregate change in mutual fund holdings versus the amount outstanding, which is utilized to produce a dummy variable (ibid.). When correcting for issuer-month effects, the dummy variable is statistically insignificant (ibid.).

4. Method

4.1 Data

In Sweden, the corporate bond database is modest (Bonthron et al., 2016), compared to substantial databases in the United States, such as TRACE, among others. As a result, this paper will exclude certain measurements, as did Nguyen (2014), who examined the Swedish corporate bond market, because the Amihud liquidity measurement requires data on trading volumes, which is commonly utilized in the literature. Because the data is more easily acquired, this liquidity measurement is widely used in papers addressing the United States. Moreover, the optimal data frequency would be daily, however, due to the restricted data in Sweden, this paper will include monthly data, even though fire sales and the crisis period were only brief periods, as indicated by Qin and Wang (2022). Because mutual fund data is only available on a monthly or quarterly basis, it is the best option for studying the impact of fund flows on corporate bonds.

Furthermore, data for the paper was obtained from Bloomberg, Morningstar Direct, OECD, SCB, Investing.com, and the Riksbank. Bloomberg variables include the bid and ask prices, maturity date, and outstanding nominal amount for each corporate bond. Moreover, the monthly mutual fund flows are obtained from Morningstar Direct, the dataset also includes a full description of the mutual fund's holdings, which will be utilized to create the dummy variable for a fire sale. The OECD provides the business confidence index (BCI), the SCB provides the yearly inflation rate (CPI), and Investing.com provides the MOVE index. Finally, the Riksbank is utilized to obtain the government bond yields shown in the section 2, and will be employed in the regression as a measure of the curve steepening.

The Move index is used because it is more easily accessible than other Swedish indices and because global financial markets have become more homogeneous, as they are more connected now than in the past, the MOVE index is a good proxy for how the development in the Swedish bond market should have developed. Additionally, the index's data source is Investing.com, which is compared to other data sources to ensure validity.

This paper's sample period is August 2019 to August 2020, which is compatible with Qin and Wang's (2022) data period of July 2019 to June 2020. Furthermore, the sample period will include the month of interest, March 2020, which experienced the most outflows from mutual funds and the most turbulence in the financial markets. Considering that the mutual funds only publish their assets once a month, the data frequency will be monthly. The reason for the relatively short evaluation period is that it required a significant amount of manual work to download the holdings for each mutual fund for the respective months, and then consolidate all the data into one dataset. Given the time constraint for the thesis, it was decided to have a shorter period and include more mutual funds.

Furthermore, the thesis will include 20 corporate bond mutual funds, which are among the most significant mutual funds in Sweden, as can be seen in Figure 2, displaying the smallest to the largest AuM over the period analyzed. Before the market turmoil, the AuM for all funds was nearly 180 billion SEK, which is consistent with other data sources (FI, 2022). Furthermore, the mutual fund selection is only to include corporate bond funds that only invest in Sweden and have a sizeable AuM, among other factors. In the end, as mentioned above, the thesis needed to limit the mutual funds to a rather small selection of deleted mutual funds with a negligible AuM, whose effect would not be of interest.

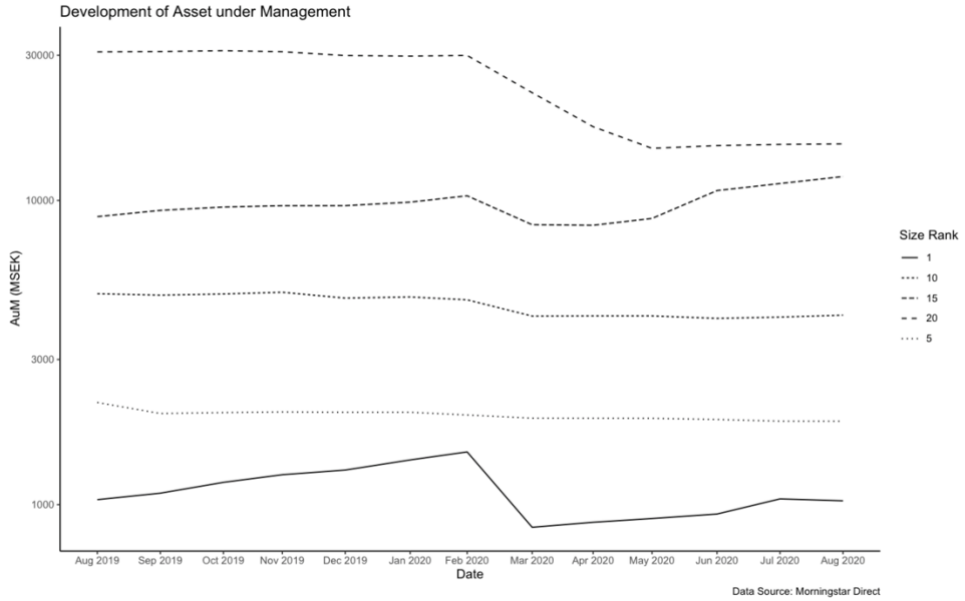

Figure 2: Development of AuM for different mutual funds, size rank, 1 smallest, and 20 largest mutual funds.

In addition, the mutual fund holdings were filtered to include only Swedish corporate bonds with maturities greater than one year, following earlier research. Covered bonds are also included to increase the sample size, and the corporate bonds are either dominated in SEK, USD, EUR, or NOK, but the issuer has a domicile in Sweden, however, the mutual funds in the sample contain foreign bonds, but they are excluded because the paper focuses solely on Swedish issuers. Meanwhile, there were other cleaning procedures where other assets found in the Morningstar Direct datasets, such as convertible bonds, commercial papers, government debt, and different types of derivative contracts, were not relevant to the thesis. The entire sample includes 655 unique corporate bonds and 13 different sectors, which may seem like a small sample size, but the data available is limited, whereas mutual funds seem to prefer to hold comparable corporate bonds, and mutual funds also hold international bonds. The mutual fund's ownership of corporate bonds is detailed in the Appendix, where most bonds have up to 30% ownership and a few bonds have 100% ownership.

Furthermore, there is one limitation to using Bloomberg bid prices from the market makers, because the prices displayed in the Terminal are indicative (Bonthron et al., 2016), however, these prices tend to be in line with the most recent transactions made in the market with significant volume, which mitigates the effect and is the best proxy available. Moreover, the reasoning for selecting the bid price is that the market was weak under the analyzed period and the buyers had the bargaining power, hence if one would like to purchase or sell it would be closer to the bid price than the asking price, as the bid price is the price that a potential buyer biding for the corporate bond. The majority of bid prices are based on BGN, which is Bloomberg's measurement of executable prices that consider all other pricing sources for the individual bond, reducing reliance on a single market maker. Bloomberg (2023) explains on its website about the measurement as follows "BGN is designed to track executable bid/ask rates and to be resistant to manipulation by market participants".

Additionally, the use of the mutual fund flow collected from Morningstar Direct has one restriction in that it is an estimate of the flow, nonetheless, the paper has been consulting with one of the mutual funds in the sample, and the estimated values are fairly consistent with the real fund flows. The measurement is calculated by Morningstar as follows from the database:

$$Fund\ Flow_{i,t} = AuM_{i,t} - AuM_{i,t-1} * \left(1 + r_{i,t}\right)$$

4.1.1 Corporate Bond Returns

The dependent variable utilized in previous literature varies, with some papers using credit spreads and others using return, nevertheless, this paper will use monthly returns as the main dependent variable in all regressions, similar to Ellul et al. (2011) and Qin and Wang (2022). The return measurement is based on the development of bid prices retrieved from the Bloomberg Terminal, where the first pricing source is BGN, Bloomberg's measurement, which considers all market makers for a specific corporate bond, if BGN does not exist, Swedbank's prices will be used, and if Swedbank does not exist, Nordea will be used as a last alternative, and the remaining bonds will be deleted, which may explain why the sample is small. Subsequently, Swedbank and Nordea were chosen since they are among the largest participants in the Swedish bond market, and their pricing, tends to be in line with recent transactions.

Further, several determinants influence the return on corporate bonds, and some of these will be included as additional variables in the regressions. Given the relatively limited data in Sweden, the paper will exclude certain variables such as credit rating because many corporate bonds do not have an official credit rating, which mitigates the effect of omitting this variable. Additionally, the study will include the characteristic adjusted return (CAR) as an alternative to the primary dependent variable, since Ellul et al. (2011) and Qin and Wang (2022) used this method.

Figure 3 depicts the performance of each sector over the period. All sectors were affected by the COVID-19 crisis and had their greatest drawdowns in March 2020, but there was a swift comeback in the months following the crash. Additionally, the communication services sector had the worst performance, while covered bonds had the best performance, the other sectors experienced a -6% loss in March.

Interestingly, covered bonds and agency debt provided the most protection against the crash, which is understandable given their proximity to the safer alternatives, government bonds. These bonds should be less affected by vanishing liquidity in the market because demand is high, finding supporting evidence by Schölander and Zhechev (2014).

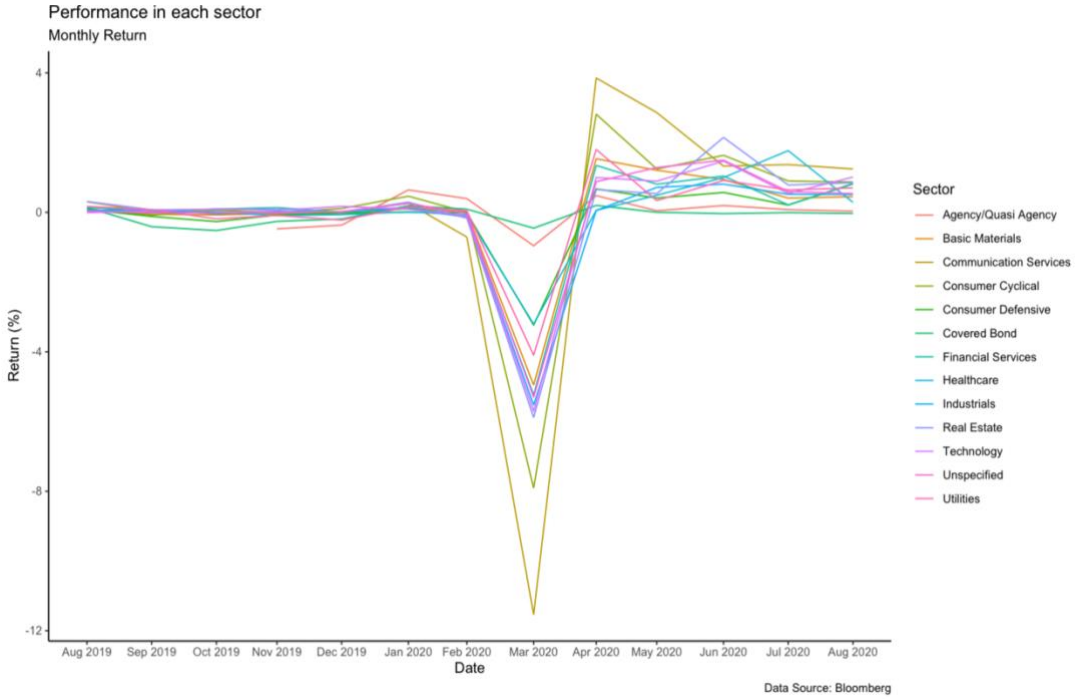

Figure 3: Monthly return for each sector under the period analyzed.

Furthermore, as can be seen in the tails of the histogram in the Appendix, the distribution of monthly returns for the corporate bond sample is significantly skewed, as there were bonds with extreme returns, which can affect the regression models. On the contrary, most of the bonds are centered around 0% and are slightly tilted to the positive side, but there are more extreme observations with negative returns, which is reasonable given that the paper analyzes the COVID-19 crash, and the distribution is likely to improve if the sample period is increased.

4.1.2 Mutual Fund Flows

Previous papers employ mutual fund flows and devise a measurement based on mutual fund flows to quantify if it has an impact on corporate bonds, which Qin and Wang (2022) and Manconi et al. (2012) found to be supported. Because mutual funds hold a significant part of the outstanding bonds in Sweden, and in the sample, there

are certain bonds where mutual funds hold 100% of the outstanding nominal amount, see Appendix, increasing the likelihood that a fire sale from mutual funds will have a significant impact. This would be consistent with a prior study (Bonthron et al., 2016), which found that liquidity in the Swedish bond market is fragile, and upheaval may have a severe impact on bonds, amplifying the effect of fire sales in the market, as few participants could purchase the mutual fund liquidations. During the period studied, there were only three months when average mutual fund flows were negative, nonetheless, these months are much bigger than mutual fund inflows. Because, as shown in Figure 4, there was an aggregate outflow of 28.6 billion SEK from mutual funds in March 2020, where the three largest funds had more than 6 billion SEK in outflows. Several factors contributed to these outflows, with one important contributor being a homogeneous investor group that wished to withdraw their money from these funds as financial markets deteriorated. The paper anticipates that the mutual fund flow estimate will be positive in the regressions, as a higher inflow would imply that the mutual funds need to allocate more towards bonds or another asset, which would most likely have an upward pressure, as the mutual funds begin to buy corporate bonds, pushing up the price, and vice versa.

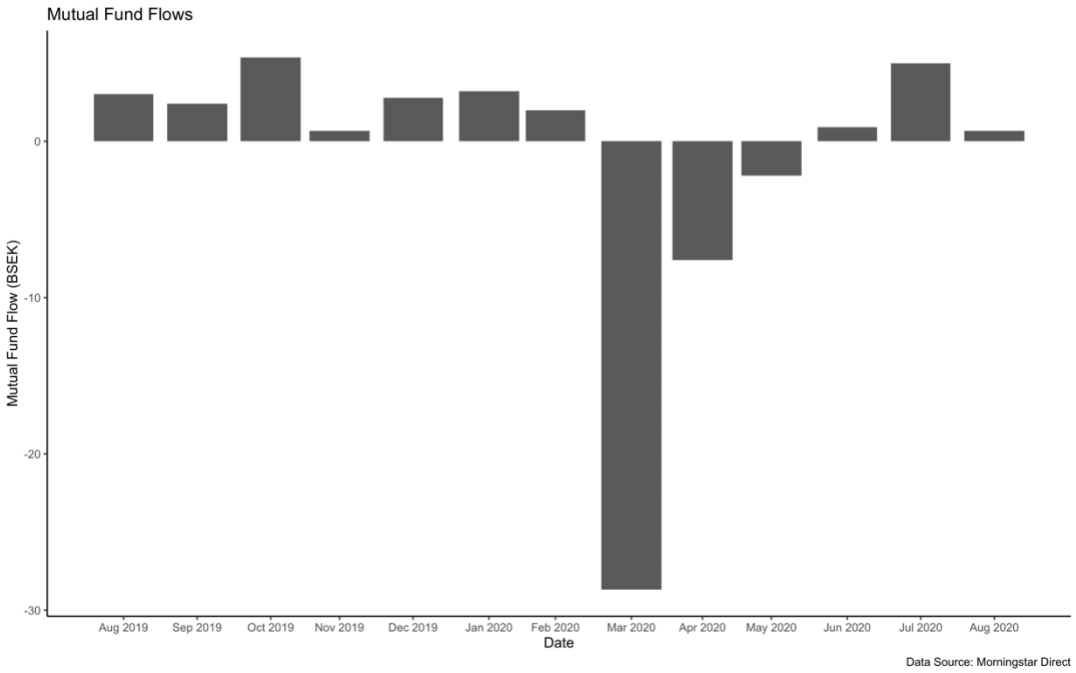

Figure 4: The aggregate mutual fund flows under the historical period.

4.1.3 Market Volatility

The paper will include a volatility index that can capture the volatility of the corporate bond market, as higher volatility increases the riskiness of financial assets. The MOVE (Merrill Lynch Option Volatility Estimate) is one of the most used measurements in the USA when looking at bonds and has similar characteristics as the counterparty for equity markets, the VIX index (ICE, 2020). Moreover, the MOVE index was very volatile during the sample period but had a downward trend if February was excluded. The pattern of MOVE is consistent with the return of bonds, as market volatility peaked, the return bottomed and began to climb, similarly, the index began to decline in the following months. Consequently, the paper anticipates the MOVE index estimate in the regressions to be negative, as increased volatility signals a riskier market.

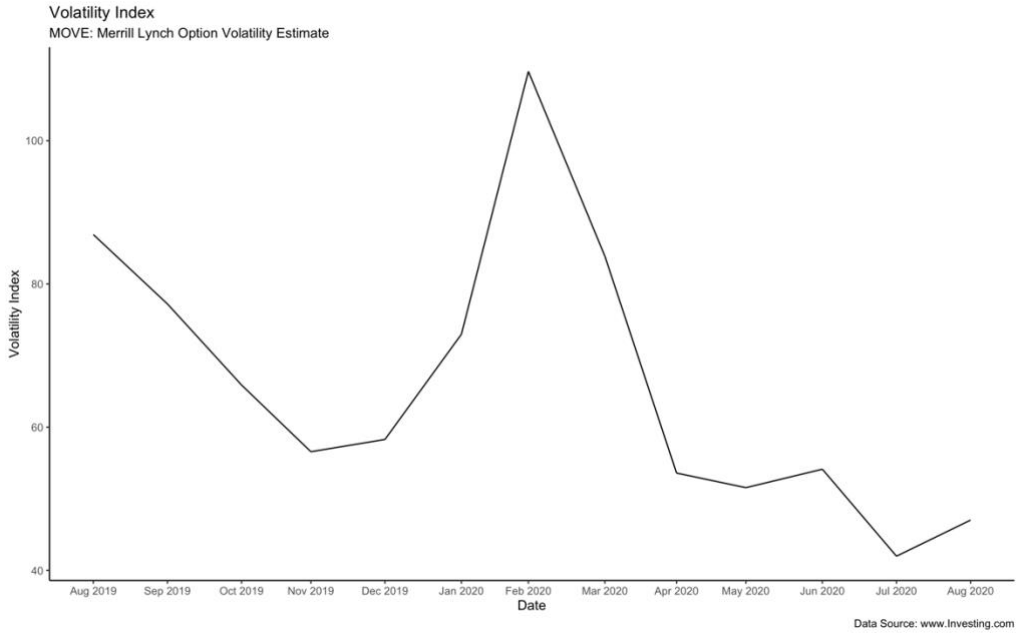

Figure 5: The MOVE index, a proxy for volatility in the Swedish bond market, displayed over the historical period.

4.1.4 Market Liquidity

The bid-ask spread of financial assets is frequently used as a proxy for market liquidity, as a wider spread indicates lower liquidity (Bankrate, 2022). The wider the spread, the higher the cost of transactions to trade the security, because the spread is a fee that goes to the market maker as they act as intermediaries and provide liquidity in the market (ibid.). Moreover, previous research has discovered that market liquidity is a major determinant in bond pricing (Nguyen, 2014; Bendrioua and Jarbratt, 2019; Amihud and Mendelson, 1986), as investors require more compensation for holding less liquid bonds, thus higher yields, to justify the

investment compared to a security with greater liquidity. Figure 6 depicts the average bid-ask spread for each sector. The spreads increased significantly during the COVID-19 crash and began to revert to more normal levels in the following months, by August 2020, the spreads were already near their pre-crisis levels, which can be attributed to the central bank's market interventions to support market liquidity, among other factors. Interestingly, the graph has a similar pattern as the return for each sector but inverted, with communication services having the highest bid-ask spread and covered bonds having the lowest spread. This finding is consistent with Schölander and Zhechev (2014), who finds that covered bonds have good market liquidity, almost as good as government bonds. Moreover, poor market liquidity has a negative association with corporate bond prices, the paper predicts the estimate for bid-ask spreads to be negative in all regressions.

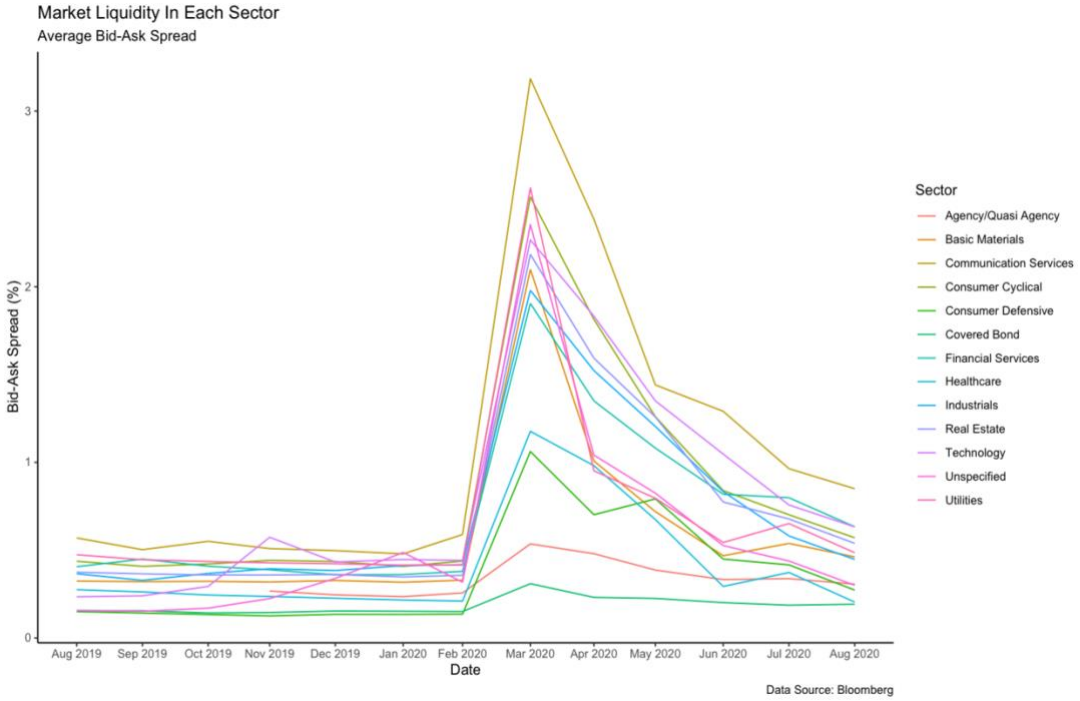

Figure 6: The average Bid-Ask spread for each sector under the period analyzed.

4.1.5 Time to Maturity

Previous research has used the time to maturity of bonds (TTM) as an explanatory variable in their regression models (Nguyen, 2014; Qin, 2022; Choi et al. 2020; Bendrioua, 2019; Persson 2020). Previous studies have found TTM to be statistically significant in explaining corporate bond pricing, it will be included as a control variable in this paper. Moreover, the impact of TTM can be explained by a bond with a longer-term period being more likely to default than a short-term bond, due to greater uncertainty in investing in long-term bonds, among other factors, resulting in

investors requiring higher yields to compensate for the risk (Corporate Finance Institute, 2023), which is linked to the liquidity premium. The paper will omit corporate bonds with maturities of less than one year, which is consistent with the previous paper by Choi et al. (2020), contributing to the limited sample size because many mutual funds own short-term bonds. The reasoning for excluding short-term bonds is that the period analyzed is 13 months, which attempts to mitigate any effects associated with the maturity of these bonds. In addition, long-term bonds are more sensitive to interest rate changes, i.e. the duration effect (Corporate Finance Institute, 2023), making it more interesting to evaluate long-term bonds. Further, the distribution of TTM in the sample is skewed because some bonds have remarkably long TTM, hence the natural logarithm has been used to mitigate this effect. The histogram that depicts TTM distribution, is in the Appendix, there are bonds with a TTM of 160 years, these are perpetual bonds with no intended maturity and a call date on which the issuer might call the bond and pay back the principal to the investors. Because there is less liquidity in long-term corporate bonds, the paper predicts the estimate for TTM to have a negative effect in all regressions.

4.1.6 Term Spread

The term spread, which is the difference between the Swedish 10-year government bond and the 3-month treasury bill, is included as a control variable in the regressions, earlier research has also included this variable (Lin, 2020; Nguyen, 2014). Moreover, the variable is included because it reflects the bond market's perception of the economic outlook, with a steep upward-sloping yield curve indicating greater confidence and vice versa. Because, according to the Federal Reserve Bank of New York (2021), an inversion of the yield curve can have predictive value in foreseeing an impending financial crisis and can have a significant effect. Rising short-term interest rates, on the other hand, are the primary cause of the yield curve inversion (ibid.). The term spread is depicted in Figure 8, over the period studied, the term spread was extremely volatile, and the yield curve inverted in March 2020, with the 3-month treasury bill yielding incrementally than the 10-year government bond. Following the outbreak of COVID-19, the Swedish economy entered a recession, and the term spread might plausibly explain the variation in corporate bond prices, as a poor economic outlook would lead to lower

prices. The paper predicts the term spread estimate in the regressions to be positive, as a steep yield curve suggests greater optimism and economic growth.

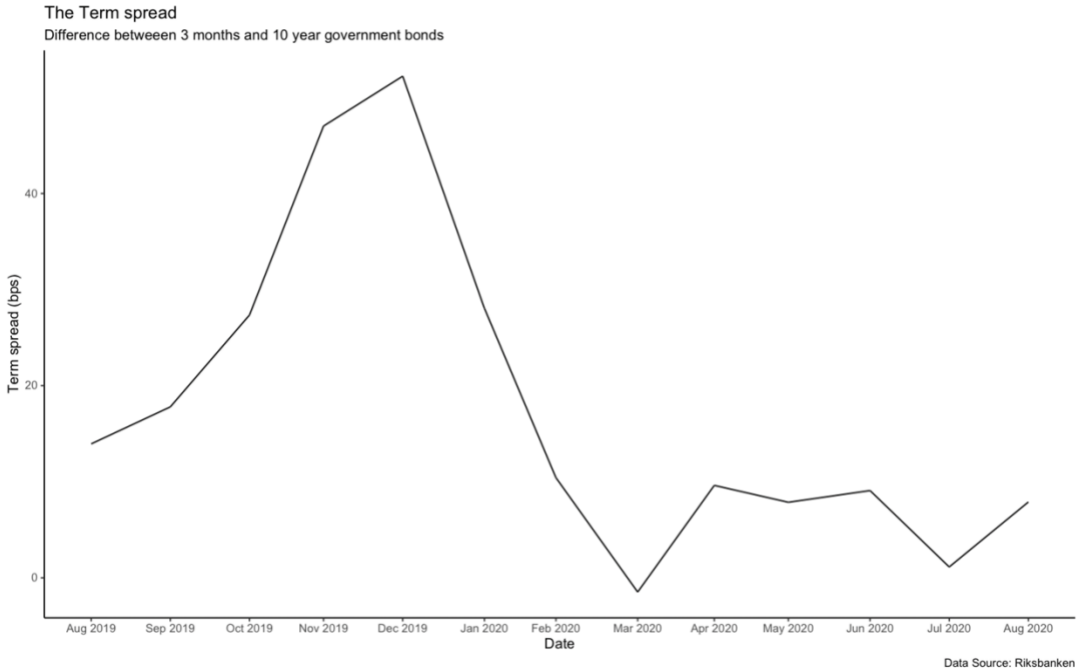

Figure 8: The term spread, the difference between the Swedish 10-year government bond and 3-month treasury bill, in basis points.

4.1.7 Business Confidence Index

The business confidence index can potentially explain the variation in the return, as the measurement is used to examine the corporation's perception of the outlook. Because OECD (2023) states "provides information on future developments, based upon opinion surveys on developments in production, orders, stocks of finished goods in the industry sector. It can be used to monitor output growth and to anticipate turning points in economic activity". Moreover, the index is designed in such a way that a value greater than 100 signals optimism about future business activity (ibid.), and vice versa. As a result, a more optimistic business sector may imply that businesses will raise sales, expand margins, and improve profitability in the near term, which should be good for corporate bonds. The BCI is shown in Figure 9, during the analyzed period, the BCI reached its lowest value in May 2020, two months after the financial markets recovered, indicating that it may have lagged to some extent, however, the index was in the pessimistic territory before the crash. Further, the government involvement occurred after market turmoil in March, therefore the interventions by the agencies may have increased corporate confidence, resulting in a rise in the index in the subsequent months. The paper anticipates that

the estimate for BCI in the regressions will be positive, as a more confident business sector would suggest higher returns.

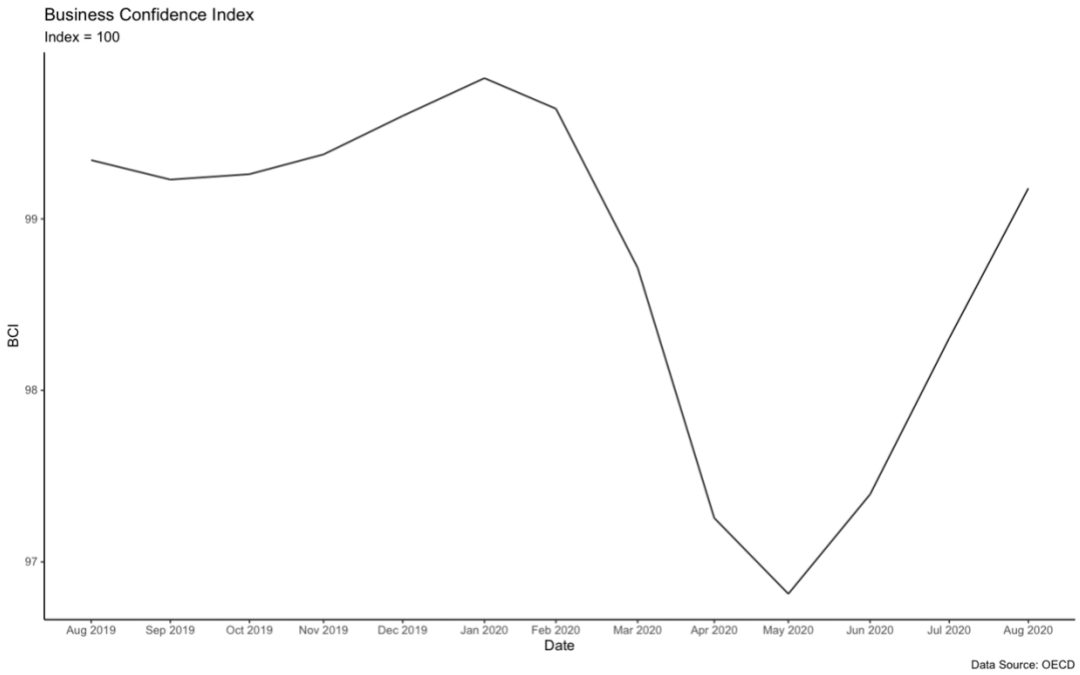

Figure 9: The Business Confidence Index for Sweden, index = 100.

4.1.8 Consumer Price Index

Inflation is one of the bond's worst enemies because it is a fixed-income security that pays a fixed amount until maturity (Daintree Capital Management, 2018). As a result, if inflation begins to rise, investors will need to be compensated for the higher costs in the economy, causing bond prices to fall and yields to rise. However, significant proportion of corporate bonds are floating rate notes (FRN), as was given in section 2, meaning that the coupon interest is changed frequently, mitigating the effect. Inflationary structural changes can have an impact on company profitability. Because inflation on goods and services can increase nominal sales growth, it can be beneficial to the company, however, if the company lacks pricing power and is unable to pass on the increase in input prices to customers, it can harm margins and increase credit risk. In addition, during the examined period, Swedish inflation was below the Swedish central bank target (2%) for the entire period, however, at the outbreak of COVID-19, Swedish inflation went negative.

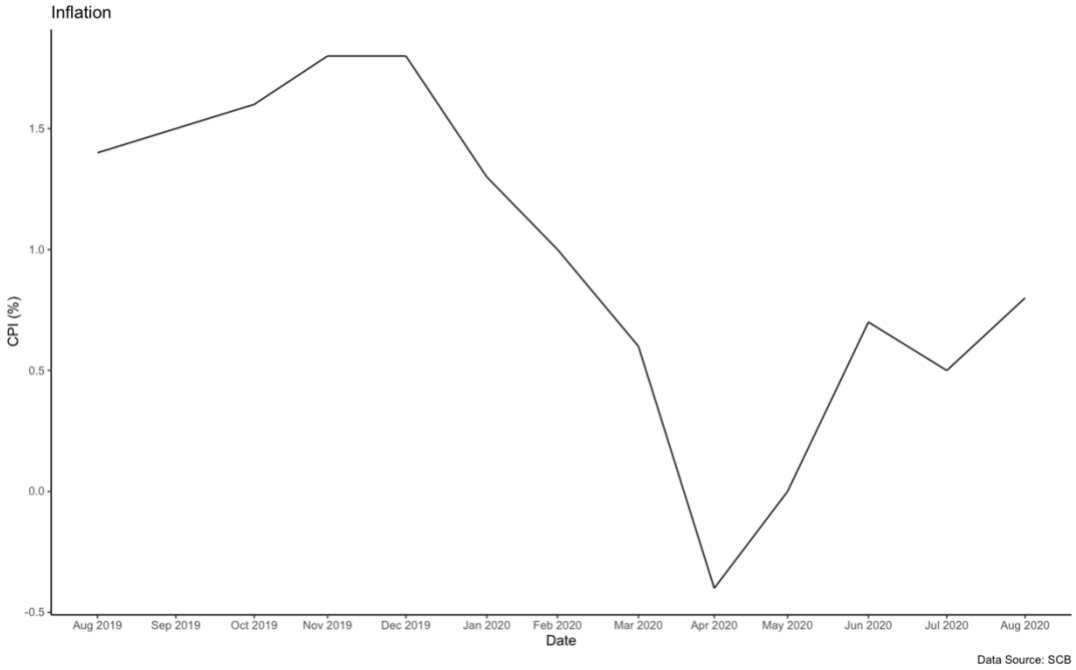

Figure 10: The Consumer Price Index for Sweden, year over year growth, numbers in percent.

4.2 Statistical Quality

4.2.1 Correlation Matrix

The correlation matrix of all variables in the dataset is shown in the Appendix and is used to determine whether there is a problem with multicollinearity when one regressor is substantially correlated with another. Moreover, the variable of interest, return, has the largest correlation with the bid-ask spread, MOVE index, fund flows, BCI, and the dummy for a fire sale, all of which have a negative relationship except for fund flows. Characteristic adjusted return, on the other hand, is less connected with the explanatory variables and has the largest correlation with bid-ask spread and fund flows, which are like the main dependent variable. Further, the bid-ask spread is linked with most factors in the dataset and has a negative correlation with most variables, which could lead to multicollinearity. Mutual fund ownership of corporate bonds has no meaningful link with the other variables and is thus removed from the regressions.

4.2.2 Time Fixed Effects

Figure 11 shows the average monthly returns for the whole dataset, with 95 percent confidence intervals for each monthly return. The Swedish bond market was affected by the COVID-19 crash in March 2020, with positive returns in the following months. Additionally, the graph shows that monthly returns are heterogeneous across time, implying that the study should include time-fixed factors. Because time-fixed effects reduce the impact of unobservable changes that occur between months but are consistent between entities (Stock and Watson, 2014). One possible solution would be to just include a dummy variable for March 2020, as done in a prior study (Qin and Wang, 2022), although the months following the crash diverge from the months before the crash. There were incremental improvements in utilizing the former choice when examining the time-fixed effects and a dummy variable. Additionally, the reason why the average return may seem low can be attributed to the rather diverse sample of corporate bonds from different sectors as well as investment grade and high-yield mutual funds and the fact that the return is based on bid prices from the maker makers and not transactions done in the market, which can be the reason why this data may differ from other publications.

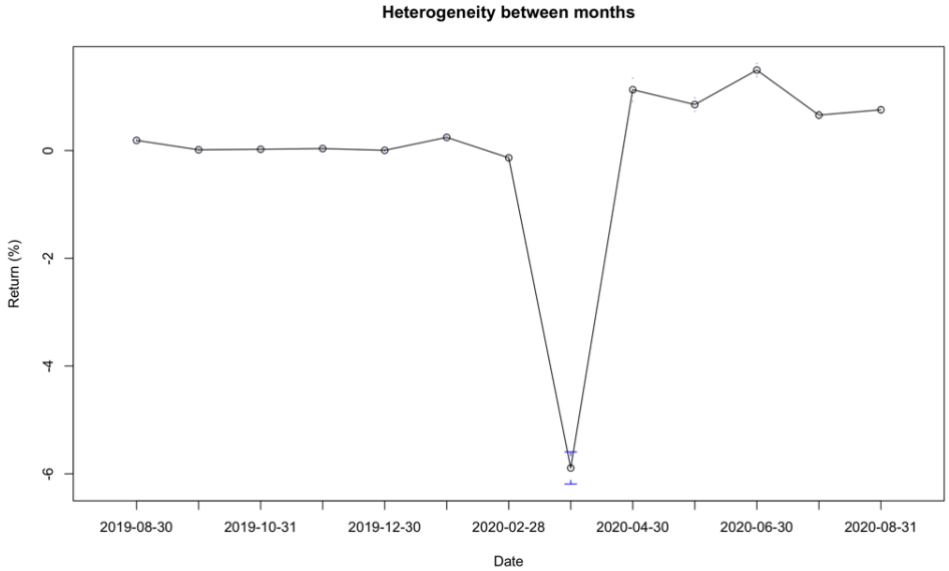

Figure 11: Average returns with an associated confidence interval, conducted on the entire sample.

4.2.3 Entity Fixed Effects

Figure 12 depicts the average monthly return within each sector with a 95% confidence interval, there is great dispersion between sectors, and the mean return fluctuates around 0%, however, certain sectors have higher deviations from their mean, as evidenced by the wider confidence intervals. As a result, entity-fixed effects will be included in the study to offset the bias of unobservable characteristics that change between corporate bonds but remain constant over time (Hanck et al., 2018). Moreover, the explanation for presenting the sectors rather than each corporate bond is that 655 unique corporate bonds would not fit into the graph, hence, it is easier to display how the average monthly returns, as the corporate bond within each sector, tends to move homogeneously.

Furthermore, as seen in the data section, certain variables were omitted from the paper because they were challenging to retrieve from different databases that contained more corporate bond-specific information, such as credit rating, coupon rate, or issuer profitability. However, the issuer-specific data is often reported quarterly, hence is better to have a higher frequency of the data instead. Given the time constraints for the paper, it was decided to stick with the existing variables and include entity-fixed effects that can mitigate this issue (Stock and Watson, 2014). Because omitted variable bias is one of the most frequently encountered forms of endogeneity (ibid.), entity fixed effects can contain information that fluctuates between corporate bonds but remains constant over time, resolving the issue.

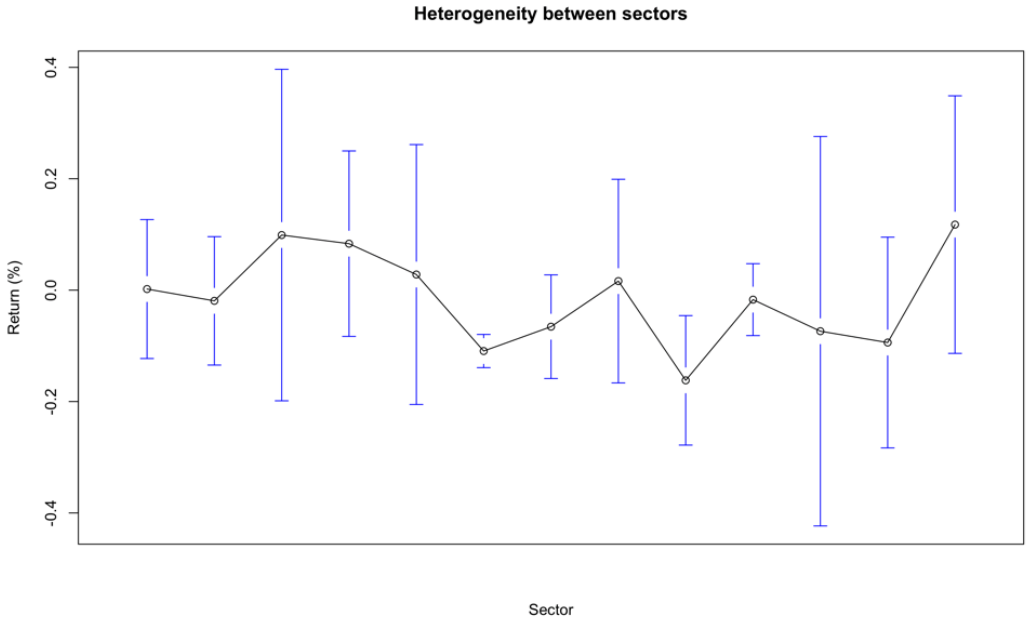

Figure 12: Average return with an associated confidence interval for each sector in the sample.

4.2.4 Stationary Effects

Before proceeding to empirical results, the research employs the unit root test to rule out any potential non-stationarity in the regressors. The augmented dickey-fuller (ADF) test is used in the paper to examine whether the models contain higher-order autoregressive processes. This test is based on the unit root hypothesis (non-stationarity), and the lower the ADF statistic, the stronger the null hypothesis is rejected. Moreover, because all the variables are stationary, the paper does not need to take the first-order difference on any variable and may proceed with the suggested regression models. Additionally, the research ran an alternate test for non-stationary variables, and when using auto-correlation function plots, they show comparable results to the ADF-test, since all variables had substantial autocorrelation and a slow decay.

4.2.5 Statistical Metrics

The research will use White robust standard errors for all regression models to reduce the possibility of unknown form heteroscedasticity, and the White robust errors produce more reliable estimates (Wooldridge, 2020). Moreover, if the residuals are homoscedastic, the White robust errors will produce similar findings to the standard errors (ibid.), hence it's fair to include the former as it produces more trustworthy estimates and is preferable to the common errors. Additionally, the figure for the residual distribution is shown in the Appendix, the distribution of the residuals reveals that the residuals are not randomly plotted, therefore the thesis will contain White robust standard errors.

Furthermore, the study will use AIC, BIC, and adjusted R^2 when analyzing each regression model to determine which model is preferable. In addition, the AIC, Akaike Information Criteria, computation is based on the number of regressors, and the maximum likelihood estimate for the model (Akaike, 1974). Alongside, the related measurement BIC, Bayesian Information Criteria, is derived similarly, but using a different methodology. Lower scores are desirable when comparing measurements between models since models with stronger explanatory power have lower scores. Moreover, because the ordinary R^2 will be inflated when the regression model contains more regressors, the adjusted R^2 is presented in the result table for all regression estimates (Stock and Watson, 2015).

4.3 Empirical Method

This research will undertake four panel-data model specifications with variables generated from mutual fund flows as primary regressors, as well as other regressors, and all these factors will be utilized to explain the variation in corporate bond return. The primary regressors will be a fire sale, buy pressure, pressure measurement, and mutual fund flows. The following additional variables will be included in all regressions: Bid-Ask spread (%), MOVE index, term spread (bps), BCI index, annual CPI (%), and TTM. Further, prior sections suggested that including both entity and time-fixed effects is required to reduce any potential biases.

4.3.1 Fire Sale Measurement

Previous research on the impact of fund flows on financial markets (Coval and Stafford, 2007; Qin and Wang, 2022; Choi et al., 2020) has served as the foundation for the fire sale measurement. There have been some changes to prior research examining the impact in the United States because they have more reliable transaction data and transactions occur more frequently than in Sweden. Following, the thesis will sort the mutual fund flows (*f*), pick the most negative months (20 percentiles), and then examine how mutual fund holding (*i*) fluctuates each month. Moreover, to determine the relevance of a change in a specific corporate bond, the difference is divided by the outstanding nominal amount of the corporate bond (*i*), since this will indicate the relevance of the transaction. Because the change in holding is proportional to the outstanding volume, it implies that it could have a greater impact on the price of that corporate bond, whilst smaller transactions should have a limited impact. Subsequently, the methodology for calculating the fire sale measurement, the paper will select the 20 percentiles of fund flows for each mutual fund (*f*), and then calculate the aggregate change in holding (*i*), from all mutual funds, for a specific corporate bond (*i*) to the outstanding nominal amount (*i*), resulting in the new variable, pressure, the calculation for which is outlined at the end of this paragraph. Moreover, the paper chooses the 20 percentiles of the new variable, pressure, that will be defined as a fire sale and hence will be equal to 1, otherwise 0. Previous works frequently used the bottom percentile, the 10 percentiles, however, the sample size in this paper is lower, it was chosen to use a higher percentile.

Additionally, according to the newly developed measurement, 4.03% of the observations in the overall sample were under fire sale.

$$Pressure_{i,t} = \frac{\sum_{f=1}^{F} \Delta Holding_{i,f,t}}{Outstanding\ Nominal\ Amount_i} \quad where\ f \in \{flow_{f,t} < Percentile(20^{th})\}$$

The pressure variable distribution is shown in the Appendix, most transactions are modest to the outstanding volume because they occur at 0%, but there is a considerable dispersion when looking at the complete sample. Because certain transactions account for 100% of the outstanding volume for those corporate bonds when the change is positive, the most negative change occurs slightly above 50% of the time, but the frequency is much lower when compared to the positive change because the distribution is positively skewed. In addition to the pressure variable, as the distribution shifts to the positive side, the paper will investigate whether the opposite of a fire sale, when mutual fund flows are significantly positive, puts pressure on mutual funds to purchase corporate bonds, and whether this has an impact on corporate bonds. As a result, the paper will define the buy pressure variable similarly to the previous fire sale variable, but it will only look at the top 20% of fund flows (*f*) and then select the top 20% of the pressure measurement, which will be equal to 1 if it is in the given percentiles. Moreover, according to the newly developed measurement, 3.98% of observations in the overall sample were under buy pressure.

4.3.2 Model Specifications

The first model will include the fire sale dummy as the main regressor in addition to the control variables, previous studies find that fire sales caused by mutual funds have a significant negative effect on corporate bonds as excessive selling creates downward pressure on these corporate bonds that exhibit fire sales. Moreover, the model is outlined below, where $\boldsymbol{C}_{i,t}$ is a vector of all the control variables, θ_i is entity fixed effects, γ_t is the time fixed effects, and $\varepsilon_{i,t}$ is the error term.

$$Return_{i,t} = \beta_1 Fire\ Sale_{i,t} + \beta \boldsymbol{C}_{i,t} + \theta_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

The second model replaces the fire sale dummy with the buy pressure dummy, to see if the reverse effect from fund flows would have an impact on corporate bonds, previous studies find the effect to be significant, as a larger inflow creates higher pressure for the mutual funds to purchase corporate bonds which put upward pressure

on these corporate bonds. The regression model is outlined below, where $\boldsymbol{C}_{i,t}$ is a vector of all the control variables, θ_i is entity fixed effects, γ_t is the time fixed effects, and $\varepsilon_{i,t}$ is the error term.

$$Return_{i,t} = \beta_1 Buy\ Pressure_{i,t} + \beta \boldsymbol{C}_{i,t} + \theta_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

The third model replaces the buy pressure dummy with the pressure measurement, which is a continuous variable compared to the dummy variables, the newly added variable has similar characteristics as the previous dummy variables, as this variable includes the aggregate change for each corporate bond each month, which enable the paper to see whether any changes in the holdings would have an impact on corporate bonds, without only looking at extreme mutual fund flows. Moreover, there is an advantage to using continuous variables instead of dummy variables, as the continuous variable contains more information, and some of this information would be lost in the transformation to a dummy variable (Lazic, 2008). The regression model is outlined below, where $\boldsymbol{C}_{i,t}$ is a vector of all the control variables, θ_i is entity fixed effects, γ_t is the time fixed effects, and $\varepsilon_{i,t}$ is the error term.

$$Return_{i,t} = \beta_1 Pressure_{i,t} + \beta \boldsymbol{C}_{i,t} + \theta_i + \gamma_t + \varepsilon_{i,t} \quad (3)$$

Finally, the fourth model replaces the pressure measurement with the fund flows, which is also a continuous variable, which has some superior advantages over dummy variables. Moreover, the new regression model allows the paper to interpret how the mutual fund flows affect the corporate bond market, and whether large outflow would harm the prices, given that the mutual funds (*f*) account for a significant proportion of the holdings of corporate bonds, changes in their liquidity needs would presumably have an impact on the pricing of corporate bonds. The regression model is outlined below, where $\boldsymbol{C}_{i,t}$ is a vector of all the control variables, θ_i is entity fixed effects, γ_t is the time fixed effects, and $\varepsilon_{i,t}$ is the error term.

$$Return_{i,t} = \beta_1 Fund\ Flow_{f,t} + \beta \boldsymbol{C}_{i,t} + \theta_i + \gamma_t + \varepsilon_{i,t} \quad (4)$$

4.3.3 Characteristic Adjusted Return

The paper will utilize the same technique as earlier papers by Ellul et al. (2011) and Qin and Wang (2022), which use characteristic adjusted returns as the dependent variable, as this measurement will allow the paper to see how individual corporate bonds perform in comparison to each sector. Further, Qin and Wang (2022) divided each corporate bond into different groups using credit ratings, however, because this paper does not have access to credit ratings, it divides each corporate bond into each sector rather than computing the difference between the average of the entire sample as certain sectors perform differently and are more sensitive, which would underestimate or overestimate the excess return. One disadvantage of this methodology is that there may be a dispersion in credit quality within each sector, which credit rating may have alleviated. Moreover, because the return is dependent on the quoted prices in Bloomberg Terminal, noise inaccuracies may occur. The new dependent variable will be utilized in the same regression models outlined in section 4.3.2, where the return is substituted by CAR. Further, the reasoning for replacing return with CAR, is to enable the paper to see how corporate bonds perform relative to their sector, and if there are any differences. In addition, the characteristic adjusted returns are calculated as follows[1]:

$$CAR_{i,t} = Return_{i,s,t} - Sector\ Return_{s,t}$$

[1] Sector return is calculated by taking the average return in each sector for each month.

5. Results

5.1 Empirical Results

The empirical results from the regression models are summarized in Table 1, where the different models can be compared to see which regressor can explain the variation of corporate bond returns over the historical period. All regression models include both time and entity-fixed effects and have been removed from the regression table because they are not of interest. Additionally, the reason for not having regressions for each respective sector is due to the small sample of corporate bonds, the divergence between sectors is mitigated by the entity fixed effects, and the paper aims to evaluate the corporate bond market and not specific sectors.

Empirical Estimations

	Dependent variable:			
	return			
	(1)	(2)	(3)	(4)
Fire Sale	-0.505***			
	(0.189)			
Buy Pressure		-0.102*		
		(0.053)		
Pressure			0.0004	
			(0.001)	
Fund Flow (MSEK)				0.0002***
				(0.00004)
Bid-Ask Spread (%)	-1.132***	-1.142***	-1.142***	-1.125***
	(0.141)	(0.141)	(0.141)	(0.141)
Volatility Index	-0.037***	-0.035***	-0.035***	-0.038***
	(0.003)	(0.003)	(0.003)	(0.003)
Term Spread (bps)	0.074***	0.070***	0.071***	0.084***
	(0.007)	(0.007)	(0.007)	(0.008)
Business Confidence Index	-0.724***	-0.724***	-0.726***	-0.724***
	(0.054)	(0.054)	(0.054)	(0.054)
Inflation (%)	0.901***	0.884***	0.885***	0.845***
	(0.181)	(0.182)	(0.182)	(0.183)
Log(TTM)	0.047	0.053	0.052	0.028
	(0.122)	(0.122)	(0.122)	(0.122)
Entity Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
AIC	56131	56167	56169	56036
BIC	61198	61235	61236	61103
Observations	14,079	14,079	14,079	14,079
Adjusted R^2	0.527	0.526	0.526	0.531
Significance levels				*p<0.1; **p<0.05; ***p<0.01

(The robust standard errors are in a parenthesis under each estimate)

Table 1: Regression results, return is in percent (%).

First, the **fire sale** dummy has a large negative influence on corporate bond returns, with an estimate near -50bps on average, ceteris paribus. Moreover, when a fire sale occurs in Sweden during the analyzed period, which is driven by a large outflow of fund flows, mutual funds are forced into selling corporate bonds in the market, pushing down prices. The findings are consistent with the paper's expectations and earlier research on whether the proxy for fire sales driven by fund flows affects corporate bonds. Meanwhile, the reason for this small estimate could be attributed to the rather diverse sample, which contains both covered bonds and risky bonds, resulting in a relatively small average impact. On the contrary, considering that the average return in each sector was close to 0%, a 50bps fall in return, should be significant. This variable has the greatest influence on corporate bond returns, which are fund specific.

Second, the **buy pressure** dummy has a marginally negative effect on corporate bond returns, with an estimate near -10bps on average. In contrast, the effect of buy pressure is negative when other factors are controlled because a large inflow of fund flows should nudge mutual funds to purchase more existing or new bonds, due to an alternative cost, this should potentially push the prices higher, resulting in positive returns. Moreover, the findings contradict the paper's projections and past studies on the influence of corporate bonds in the United States. In addition, one potential explanation is that information from the continuous variables of fund flow and pressure was lost when developing the dummy variable, yet the fire sale dummy turned out to be following predictions and is statistically significant.

Third, the paper indicates that the **pressure** variable has a positively insignificant impact on corporate bond returns, with an estimate that for each percentage point rise in the pressure variable, the return will increase by 0.0004 percentage points on average, ceteris paribus. As a result, as shown in the Appendix of the pressure variable distribution, a few corporate bonds had 100% and -50%, resulting in a gain in returns of 4bps and a loss in returns of -2bps, respectively, the impact is small when compared to the fire sale dummy. Moreover, if the aggregate change by mutual funds of a specific corporate bond is equivalent to the outstanding volume, this should have an impact when the mutual funds are required to conduct trades. However, mutual funds have a conditional impact on mutual fund flows because extreme flows force mutual fund managers to execute trades that deviate from

fundamental value. There have been no earlier studies that attempted similar regression, nonetheless, the regressor has similar properties to those utilized by others, which were determined to be positively significant.

Fourth, according to the report, **mutual fund flows** have a significant positive effect on corporate bond returns. According to the model, every million SEK fund flow increases the return by 0.0002 percentage points on average. Following, the average fund flow from each mutual fund in March 2020, was near 1,400 million SEK, resulting in an impact of -28bps. Further, the estimate is consistent with earlier research as well as the paper's expectation, as extraordinary fund flows are expected to put pressure on corporate bonds.

Furthermore, except for the natural logarithm of **TTM**, all the control variables were significant at a 1% significance level. In addition, the **bid-ask spread**, which serves as a proxy for market liquidity, has the greatest influence on corporate bond returns in all models, with a -110bps impact for each percentage point increase in the bid-ask difference. Consistently, the **MOVE** index, Sweden's proxy for bond market volatility, also affects corporate bond returns, as higher volatility increases the riskiness of investing in corporate bonds, models estimate the impact to be slightly less than -4bps for each unit increase in the MOVE index, the MOVE index reached its peak of 110, in this dataset, resulting in a negative impact of -440bps. The **term spread**, which serves as a predictor of the economic climate, has a positive effect on corporate bond returns, and models suggest that each basis point increase in the term spread will result in a positive effect of approximately 7bps. When the yield curve inverts, it indicates that a recession is expected in the near term, resulting in a negative term spread and a negative return on corporate bond returns. Moreover, the estimates for the two control variables, **BCI** and **inflation**, are skewed, contradicting the paper's expectations. Because bonds are fixed income, better confidence in the business sector should imply higher returns, whereas higher inflation should imply lower returns.

Finally, the regression models have a rather significant explanatory power overall, with adjusted R^2 ranging from 52.7% to 53.1% and can thus explain the deviation of the corporate bond return. Moreover, the paper will judge which regression model performed the best based on the AIC and BIC score because the adjusted R^2 is similar, the most fundamental regression performed the best, i.e. the fourth model, but the difference between all regressions is negligible because the deviations are small relative to the scores. One potential explanation is that information is lost when continuous data is transformed into a dummy variable, resulting in less explanatory power. Meanwhile, when examining the alternative regressions, the fourth regression has the strongest explanatory power based on all statistical measures, nonetheless, the total explanatory power has decreased dramatically, with the adjusted R^2 ranging from 12% to 12.8%.

5.2 Alternative Approach

When performing comparable regressions but changing the dependent variable to CAR, there are some differences from prior regressions, the regression table may be found in the Appendix. The **fire sale** variable remains statistically significant, and the negative impact has increased incrementally to -70bps, implying that the effect of a fire sale is increasing. On the contrary, **buy pressure**, gained its significance level while the estimate declined to -13bps. Further, the significance levels for the other fund-specific variables, **pressure**, and **mutual fund flows** remained similar, however, the estimate for the pressure variable turned negative, which is contrary to the paper's expectations, but still insignificant. The variable of which is fund-specific that has the greatest impact on corporate bond returns is still the fire sale variable, which causes the return to fall by -70bps on average. Surprisingly, all the fund-specific variables can cause the excess returns to become negative, as mutual funds transact in the specific paper, the bond performs worse than its sector.

Furthermore, while examining the remaining control variables, the natural logarithm of **TTM** remains positively insignificant, and the significance levels have reduced overall when compared to the main regressions. Moreover, the **bid-ask spread** is still statistically significant in all regressions at a 1% significance level, and the influence on excess return has dropped by around 0.1 percentage point, -100bps for each percentage point increase in the spreads. Interestingly, the volatility index,

MOVE, has dropped in significance, only one regression is significant at a 1% level, and all estimates are positive, implying that increasing volatility increases the excess return. Following, the effect of the **term spread** has also dropped, remaining positive slightly above 1bps for each basis point rise in the term spread on average, albeit the statistical significance has fallen, and one regression is still significant at 1%. The impact of **BCI** on returns declined in all regressions, with an average estimate of -9bps, which is a more plausible estimate than the prior regressions but is only significant at 10%. Continuing, the significance of **inflation** remained unchanged at 1%, whereas the estimate in all regression models turned negative to around -50bps for each percentage point increase in inflation, which is consistent with the paper's expectation as well as other findings because bonds are fixed income, and higher inflation will reduce investor's purchasing power.

Furthermore, when filtering the dataset for transactions that have been made in the corporate bonds by mutual funds, the sample size declines to 12,817 observations, which serves as a robustness check, since the paper only has access to transactions made by mutual funds. The results are like the previous regressions, however, the effect of a fire sale has declined, albeit still significant, see Appendix.

6. Conclusion

This thesis investigates whether mutual funds flows affect corporate bond returns in Sweden from August 2019 to August 2020, and provides empirical answers using time and entity fixed effects panel methods. According to the empirical findings, mutual fund flows and the consequent fire sale have an impact on corporate bond returns, this section will begin with policy reflections and end with a discussion.

6.1 Policy Reflections

According to previous research, the Swedish corporate bond market suffers from inefficiencies such as a lack of liquidity and transparency, among other factors. This paper shows that mutual fund flows have an impact on corporate bond returns and can cause fire sales, hence, it is in the interest of policymakers as well as market participants to evaluate policies.

First, Swedish mutual funds can increase their buffers based on historical flows as well as the portfolio manager's perception of the market's outlook, as this would mitigate sudden fluctuations in flows and not force the mutual funds into fire sales. Because Choi et al. (2020) discovered in the United States that mutual funds with enough buffers maintain their portfolio holdings constant. As a result, the Swedish mutual fund's buffer could include bonds or other assets that are within the fund's mandate, which are associated with sufficient liquidity, or have a very short TTM, such as covered bonds or commercial paper, since holding only cash would be associated with an alternative cost and reduce the performance of the fund. In Sweden, a paper by Schölander and Zhechev (2014) finds that long-term covered bonds have better liquidity than long-term government bonds, but short-term government bonds have better liquidity than covered bonds, during a crisis, short-term government bonds tend to remain liquid. Following Bonthron et al. (2016), covered bonds have high liquidity in normal times, in Sweden.

Second, mutual funds can extend the redemption period, i.e. from daily to weekly or monthly redemptions, as this paper shows that mutual funds have an impact on corporate bond returns combined with the fact that liquidity is poor and mutual funds own a significant portion of domestic bonds, the effect could be mitigated if the redemption period were extended. Because an extended redemption period would give the fund managers more time to execute the transactions to meet the upcoming transactions, rather than liquidating a large portion of the portfolios in a short period, which could potentially cause a fire sale in the specific corporate bonds. Since funds with other asset classes that have low liquidity or that the fund managers have anticipated a scenario in the company, such as hedge funds, have longer redemption periods, hence, more time to execute the trades. This finding is consistent with FI (2021) and Bacco and Gustafsson (2021), daily redemptions should not be combined with illiquid assets because the impact on the assets will be exacerbated. Subsequently, the mutual fund's decision to temporarily freeze withdrawals from the funds in 2020 may be supported by the notion that they might sell the bonds required to reconcile with the projected outflows, thus alleviating the pressure.

Third, mutual funds can conduct a stress test, which can be transmitted to the Swedish Financial Supervisory Authority (FI) and used inside mutual funds to evaluate the potential risk. Because it can provide an overview of the mutual fund's overall performance, and if it contains a large proportion of highly illiquid bonds, it should nudge managers to improve liquidity management and reduce exposure to illiquid corporate bonds as preventive maintenance, lowering the likelihood that the mutual fund will suffer from a fire sale and increasing the overall return.

Lastly, the paper has pointed out the issue of transparency in the Swedish corporate bond market, addressing this issue and boosting transparency could increase market liquidity and maybe reduce the likelihood of fire sales. Bond-specific data in Sweden, for example, is difficult to obtain, and the published prices in Bloomberg are indicative, however, these prices tend to be following the recent trades. Subsequently, one enhancement would be to maintain a database of all recent corporate bond market transactions to which all market players would report, and which would be accessible to any interested investor. Because, in comparison to the equity market, it is more transparent, as recent transactions can be accessed more easily from several sources.

6.2 Discussion

Using panel data approaches such as time and entity fixed effects, this thesis examines whether mutual funds had an impact on corporate bond returns during the COVID-19 crisis and whether they exacerbated the financial collapse. The thesis discovers that mutual funds have an impact on returns by employing several fund-specific factors, such as a fire sale dummy and mutual fund flows, which show a relationship with returns. Moreover, the paper adds to the existing literature by analyzing the impact of mutual funds on the corporate bond market in Sweden during the COVID-19 crisis, using data from August 2019 to August 2020. When compared to previous studies, that conducted qualitative studies, this paper provides empirical evidence of how mutual funds impacted the return of corporate bonds in Sweden. Because there is no literature on the Swedish corporate bond market, the results were compared to research from the United States, which aligned with the findings.

Furthermore, the paper has identified various drivers of corporate bond returns, including fund-specific characteristics and some of the additional variables that have a statistically significant association with the return. The fire sale dummy reduces average return, the effect may not appear large but considering that the average monthly return within each sector is near 0%, a negative impact of 50bps should be considered significant. As a result, the dummy variable shows that when a corporate bond is subjected to a fire sale, it experiences a negative impact relative to regular selling pressure. As shown in Figure 11, the return swiftly rebounded following the drop in March 2020, when most fire sales occurred. Subsequently, the impact of the buy pressure dummy was only statistically significant in the alternative model at -10bps, indicating that extreme mutual fund flows force mutual funds to buy corporate bonds that will eventually result in a negative return. In addition, the mutual fund flow is statistically significant in both regressions, as extreme fund flows should presumably put pressure on corporate bond prices, as mutual funds are forced to either sell or buy more corporate bonds to reconcile customer demands. According to these findings, mutual fund flows impact corporate bond returns and can amplify a crisis.

The research concludes that liquidity proxies and market volatility are important predictors of corporate bond returns because these variables had the greatest impact on returns. Because, as previously mentioned, market liquidity is a crucial factor, investors want greater returns to compensate for reduced liquidity. Volatility can also explain variation in corporate bond returns because higher market volatility increases the risk of investing in a corporate bond, affecting returns. Following that, another determinant is the term spread, with an increased spread implying a higher return, because the variable is a good predictor of the economic outlook, as a steep yield curve, i.e. a high spread, indicates a prospering economic environment, whereas the opposite suggests a near-term recession.

Future research can assess the influence of mutual funds over a longer period, as this thesis only evaluated the effects for one year using monthly data, therefore, future studies could extend the duration to see if the results alter. Moreover, a few factors did not perform as expected, as buy pressure and BCI were both negative in all regressions, whereas TTM was insignificant in all regressions and inflation had to

change estimates in the main vs alternative regressions. Consequently, increasing the time horizon may allow the variable to become closer to its fundamental estimate.

Interestingly, market makers, who should supply liquidity in the market, appear to have stepped down during the crisis, when natural buyers deserted the market and sellers had to rely more on market markers. As a result, they widen the bid-ask spreads, when mutual funds sought to sell their holdings, market makers moved their prices downward, pushing the market even lower, therefore, market makers may be drawn to those who exacerbated the crisis. Hence, this demonstrates the inefficiencies and lack of liquidity in the Swedish corporate bond market. Additionally, while actual traded prices might be more interesting for future studies, quoted prices serve as a fair approximation.

Regarding the internal validity of the empirical data, the research attempted to reduce potential biases by adding both time and entity fixed effects, stationary variables, multicollinearity, and heteroscedasticity, albeit certain difficulties may remain unresolved. There may be simultaneous causality between return and fund flows, since higher returns may entice investors to invest in the fund, resulting in higher inflows, and vice versa. The sample has a high dispersion because it includes a wide range of different corporate bonds, it could have been better to evaluate specific sectors or credit ratings, but given the limited dataset, the paper decided to combine all the bonds and include entity fixed effects as a remedy. Moreover, because the research is based on Swedish corporate bonds, there may be an issue with external validity regarding the estimates and they may not be comparable with other markets, however, the main regressions are in line with studies in the United States.

In conclusion, the thesis finds that mutual fund flows have an impact on the returns on the Swedish corporate bond market, that mutual funds can induce fire sales, and that mutual funds had an impact on the COVID-19 crash, though the impact is small when compared to other explanatory variables. Hence, the paper’s findings support the mutual fund’s decision to temporarily freeze withdrawals. Moreover, the thesis discovers that market sentiment can significantly predict bond returns. Consequently, future studies attempting to predict corporate bond returns should incorporate mutual fund specific as well as market sentiment variables.

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Appendix

Figure 1: The Swedish Financial Supervisory Authority, The functioning, and outlook of the Swedish bond market, p.15, 2022-09-29.

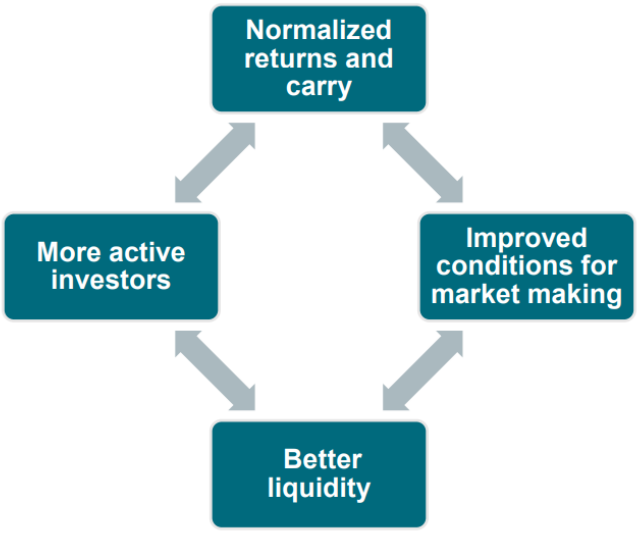

Figure 2: Distribution of monthly returns of the corporate bond returns in the sample, from August 2019 to August 2020.

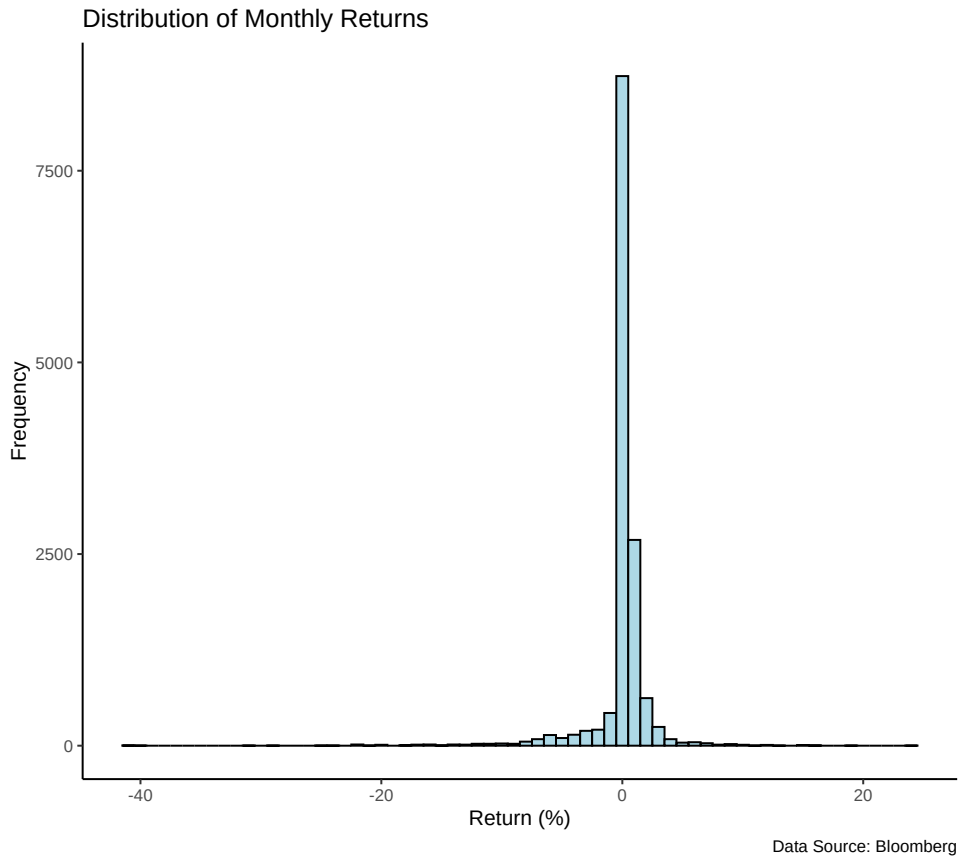

Figure 3: Histogram of the natural logarithm of Time to Maturity (TTM).

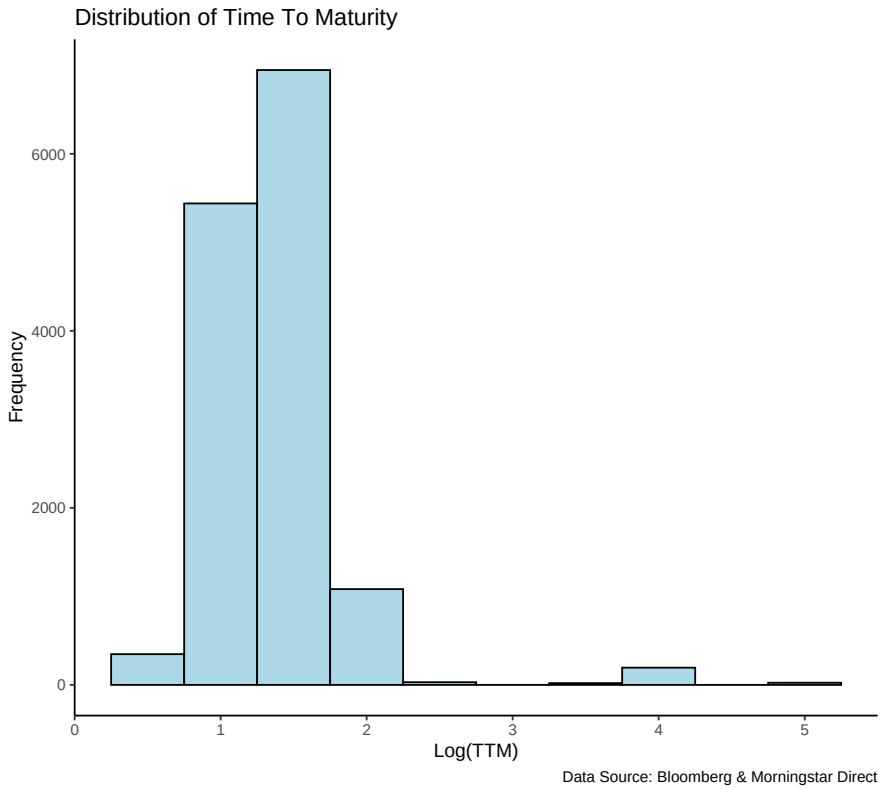

Figure 4: Correlation matrix of all variables included in the paper.

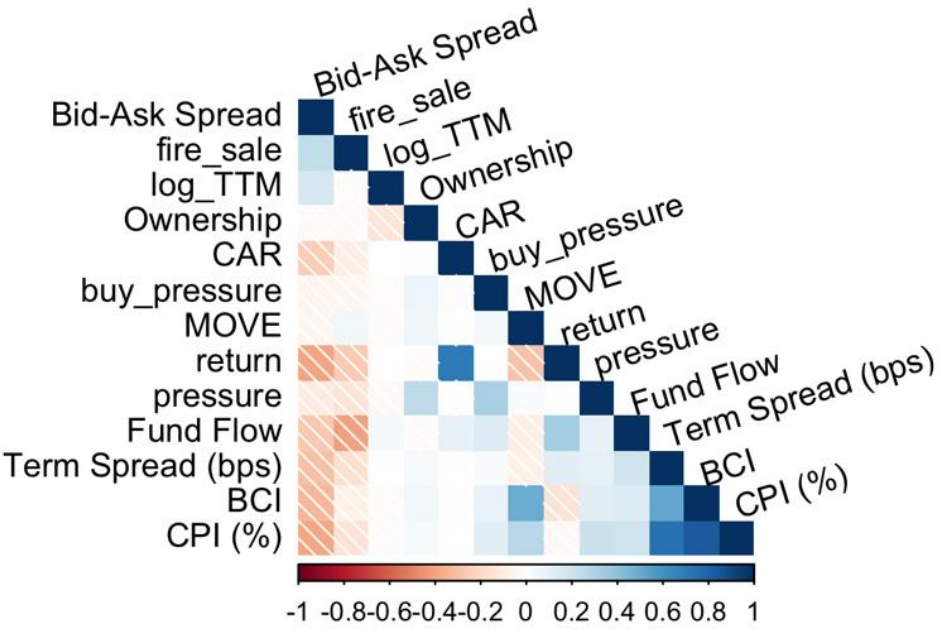

Figure 5: Histogram of the newly created pressure variable, most of the change is in the positive territory.

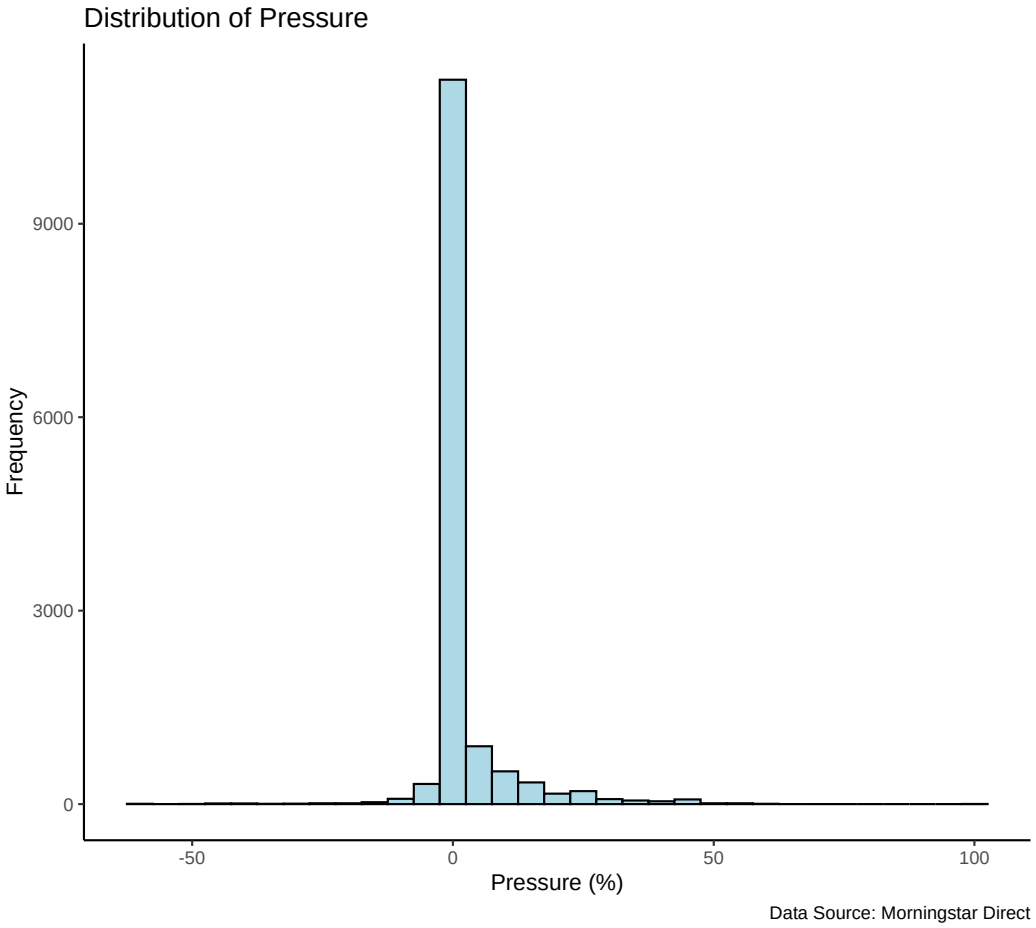

Figure 6: Histogram of the ownership of the corporate bonds by the mutual funds in the sample.

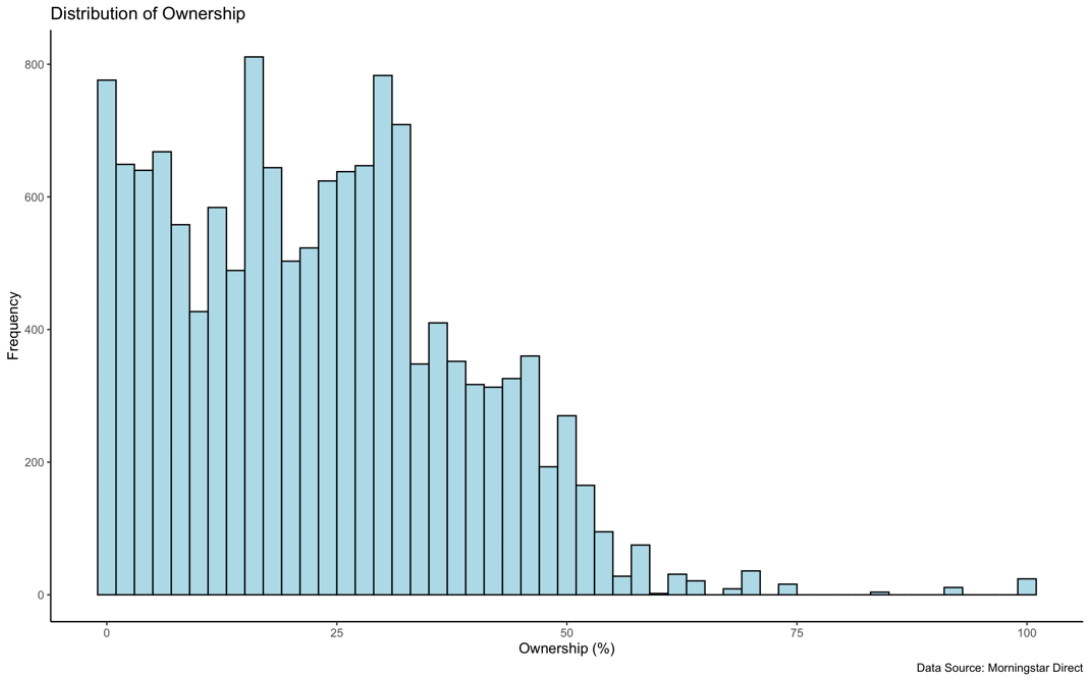

Table 1: Regression results for the alternative methods, Characteristic-Adjusted Return (left), and Return (right) when filtering for transactions made in the corporate bonds by mutual funds.

Empirical Estimations

	Dependent variable:			
	CAR			
	(1)	(2)	(3)	(4)
Fire Sale	-0.684***			
	(0.171)			
Buy Pressure		-0.131***		
		(0.049)		
Pressure			-0.0005	
			(0.001)	
Fund Flow (MSEK)				0.0002***
				(0.00004)
Bid-Ask Spread (%)	-1.018***	-1.031***	-1.031***	-1.015***
	(0.135)	(0.136)	(0.136)	(0.136)
Volatility Index	0.005*	0.007***	0.007**	0.005
	(0.003)	(0.003)	(0.003)	(0.003)
Term Spread (bps)	0.013*	0.007	0.008	0.021***
	(0.007)	(0.007)	(0.007)	(0.007)
Business Confidence Index	-0.092*	-0.092*	-0.094*	-0.092*
	(0.051)	(0.052)	(0.052)	(0.052)
Inflation (%)	-0.516***	-0.538***	-0.538***	-0.573***
	(0.172)	(0.173)	(0.173)	(0.174)
Log(TTM)	0.051	0.058	0.057	0.036
	(0.111)	(0.110)	(0.110)	(0.111)
Entity Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
AIC	54538	54613	54616	54494
BIC	59605	59681	59684	59562
Observations	14,079	14,079	14,079	14,079
Adjusted R^2	0.125	0.121	0.120	0.128
Significance levels				*p<0.1; **p<0.05; ***p<0.01

(The robust standard errors are in a parenthesis under each estimate)

Empirical Estimations

	Dependent variable:			
	return			
	(1)	(2)	(3)	(4)
Fire Sale	-0.335*			
	(0.192)			
Buy Pressure		-0.087*		
		(0.048)		
Pressure			0.0002	
			(0.001)	
Fund Flow (MSEK)				0.0002***
				(0.00004)
Bid-Ask Spread (%)	-1.129***	-1.134***	-1.134***	-1.118***
	(0.144)	(0.144)	(0.144)	(0.143)
Volatility Index	-0.038***	-0.036***	-0.037***	-0.039***
	(0.003)	(0.003)	(0.003)	(0.003)
Term Spread (bps)	0.081***	0.077***	0.078***	0.092***
	(0.008)	(0.007)	(0.007)	(0.008)
Business Confidence Index	-0.734***	-0.734***	-0.736***	-0.730***
	(0.059)	(0.059)	(0.059)	(0.059)
Inflation (%)	0.868***	0.858***	0.858***	0.813***
	(0.198)	(0.199)	(0.199)	(0.200)
Log(TTM)	0.070	0.071	0.070	0.043
	(0.145)	(0.144)	(0.144)	(0.144)
Entity Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
AIC	51760	51774	51775	51658
BIC	55773	55786	55787	55671
Observations	12,817	12,817	12,817	12,817
Adjusted R^2	0.526	0.525	0.525	0.529
Significance levels				*p<0.1; **p<0.05; ***p<0.01

(The robust standard errors are in a parenthesis under each estimate)

Figure 6: Distribution plot for the residuals, i.e. homoscedasticity plots, the four plots to the right are from the main dependent variable (return), whereas the plots to the left are the alternative dependent variable (CAR).