The role of capital markets in financing climate change mitigation[1]

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Abstract

As an investment gap of $6.9 trillion per year has been identified by the OECD to meet the Paris Agreement goals by 2030, capital markets are mostly taking capital out of large firms rather than providing it for investment purposes. We find that through corporate stock repurchases and distribution of dividends, stock markets have been divesting from large US firms since 1994 and from large Euro firms since 2001. Long-term debt is the only positive source of external financing for these firms. However, for large US firms, corporate bonds represent less than 20% of long-term debt financing since 1995. We obtain a sample of climate-aligned firms and find similar results for these companies, even though our sample contains some less mature firms that still choose to call on equity financing.

Keywords: Climate Change; Sustainable Finance; Capital Markets; Stock Markets; Corporate Bonds; Climate-aligned Firms

JEL classification: G23, M14, D22, Q2, G14, G10, G12

[1] This study has been realised in the frame of the Chair Finagri of the University Paris 1 Panthéon-Sorbonne. The works of the Chair have benefitted the joint participation of the IAE (*Institut d'administration des entreprises*) as well as the participation of professionals from the financial industry. We thank all the participants to the works of the Chair for their precious contribution to the improvement of this paper.

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1. Introduction

In a report performed in 2017 on the subject of public financing of climate-aligned growth, the OECD estimated global infrastructure investment needs to be consistent with a 2°C 66% scenario to amount to USD 6.9 trillion per year in the next 15 years (OECD, 2017a). This mostly covers energy (34%) and transport (43%) sectors, with between 60% to 70% required in emerging economies. Looking at the energy sector specifically, the international energy agency (IEA) estimates that consistency with this scenario would require 95% of the electricity to be low-carbon by 2050, that 70% of new cars would need to be electric, that the entire building stock would have to be modernized and that the industrial sector would need to produce 80% less CO2 (IEA, 2017). Through the exact amount of investments needed remains of course uncertain, there is no doubt that there is a pressing need for investments to make the economy more energy-efficient in the next few years.

Such important changes cannot be implemented without the participation of corporations that need to adapt their business models and provide new sustainable products in order to face climate change mitigation. However, one of the main challenges faced by these corporations concerns a lack of understanding and information on which activities and products are aligned with this 2°C 66% scenario, and which are not. This issue has been clearly identified by regulators such as the European Commission, which has developed a classification system for sustainable activities (EU Taxonomy) in which technical screening criteria for 70 climate change mitigation and 68 climate change adaptation activities have been created based on sector-specific metrics. (European Commission, 2020). This classification system is enforced by regulation which will require EU firms to declare the percentage of their turnover and capital expenditures that are "taxonomy-aligned". Financial market participants are also central to this regulation and will also be required to disclose the percentage of each financial product they offer in the EU that is "taxonomy-aligned" (Council of the European Union, 2019). In the near future, information of the precise participation in the climate change mitigation of every large EU firm and financial market participant concerned by the regulation will be publicly available.

A similar approach has been used by the Climate Bond Initiative (CBI) when the organization published a report on bonds and climate change in 2018 (CBI, 2018). In this report, the CBI identifies a $1.45 trillion climate-aligned bond universe composed of $389 billion of labelled green bonds, $811 billion of corporate bonds from climate-aligned issuers and $250 billion of municipal bonds from climate-aligned municipal issuers. In order to identify climate-aligned issuers, the CBI considered firms "that derived at least 75% of their revenue from green business lines in at least one of 6 climate themes: clean energy, low-carbon transport, water management, low-carbon buildings, sustainable land use." CBI then screened issuers who had no debt outstanding, had been acquired or had insufficient revenue information to determine the share of green revenues. To date and to the author's knowledge, this approach is the most robust means of identifying climate-aligned firms without further information on the specific business practices of corporations. A large literature also refers to specific environmental metrics to measure the environmental performance of corporations, but strong debate resides on the quality and comparability of this data and the resulting measures for environmental performance (Kotsantonis and Serafaim, 2019). By clearly identifying 6 economic activities that are structurally aligned with the Paris climate goals, the CBI has more certainty on the underlying positive environmental impact of corporations in its sample than it probably would with currently available data that is provided by corporations and not verified in a great majority of cases (Kotsantonis and Serafeim, 2019). The Climate Bond Initiative provided the author with a list of these identified climate-aligned firms throughout the world.

Before looking at climate-aligned firms specifically, we study cash-flow fundamentals of US non-financial firms in the S&P500 index and non-financial firms in the S&P 350 Europe index in the euro area since 2009 in order to understand the dynamics of these firms' operating activities, investing activities and financing activities. We find that between 2009 and 2019, an amount corresponding to $7.72 trillion has been paid by non-financial S&P500 firms to stockholders in the form of net stock repurchases (stock issuances subtracted from stock repurchases) and dividends, a sum that represents 80% of total net income over the period. Over the same period, for our sample of S&P 350 Europe firms in the euro area, this amount was of $3.75 trillion and 67% of total income, with dividends representing 60% of total income. Overall, for both US firms and euro firms in our sample, financing activities have constantly been negative since 2009, and the operating cash flow generated by firms in both regions has financed both investing and financing activities. This confirms the fact that once companies have reached a certain level of maturity and size, they finance their own operations and investments, even providing a generous amount of capital to stockholders. This first finding is quite alarming, specifically given the fact that the current climate mitigation urgency requires massive investments in climate-aligned activities in which we would expect financial capital markets and financing institutions to participate.

Following these initial findings, we study these firms' financing activities more specifically. We first focus on financing originating from stock markets. By studying average stock issuances, repurchases and dividends instead of total dollar amounts, our sample of US firms can be studied on a longer time period. We find that in the US, stock repurchases have been superior to stock issuances since 1994 at the exception of 2008 following the subprime crisis. Similarly, the only year that dividends have been inferior to stock issuances since 1971 for US firms was also 2008. We also find that the difference between average stock repurchases and dividends and stock issuances has been increasing steadily since the subprime crisis. For euro firms, the difference between stock issuances and repurchases is less pronounced, but dividends have consistently been much larger than stock issuances since 2001. These findings further illustrate how capital flow has been going from large US and euro firms to stock markets, which have been divesting from these firms instead of investing in them.

Long-term debt, however, has been a constant source of positive financing for both US and euro firms. We find that large US firms have been issuing an increasing amount of long-term debt since 1980, going from a market of $10 billions to more than $3 trillion of yearly long-term debt issuance starting in 2015. Even though long-term term reduction has been increasing accordingly, the change in long-term issuance has – at the exception of the short period following the subprime crisis – been positive since 1971 for US firms and since 1999 for euro firms since. But long-term debt is not solely composed of securities that are publicly traded on capital markets, but also of credit lines and bank loans. Using the FISD database, a database that provides information on the US bond market, I investigate the US corporate bond market and develop a methodology to determine the part of US long-term debt that is composed of corporate bonds in our sample of S&P 500 firms, in order to have a better understanding of the role played by capital markets in this positive long-term debt.

We find that on the period going from 1995 to 2018, corporate bond have represented on average 13.6% of newly issued long-term debt for US S&P500 non-financial firms, and 5.3% of yearly long-term debt reduction. These findings indicate that the participation of bond markets in financing large US firms is minimal and does not outweigh the negative capital flow stemming from large corporations to stockholders. Our results for the first part of this study indicate that capital markets are not financing large US corporations, but that on the contrary, it seems that large US corporations are providing capital stemming from their operating activities to capital market participants.

In this context, I use data provided by the Climate Bond Initiative to identify a set of US climate-aligned firms and investigate whether the participation of capital markets in financing these firms is similar to our findings for large US and euro firms.

2. Literature Review

The necessary investments needed to mitigate the worst impacts of climate change have been evaluated by the OECD in a special report in 2017 on the subject. In this work, the OECD focuses on infrastructure needs in energy, transport, water and telecommunications, and identifies large underinvestments in these areas. The organisation states that important investments are required to both maintain or upgrade current infrastructure and allow for basic service in middle-income countries, all the while preparing for a world population of 9 billion by 2050, with two thirds of this population being urban and with growth mostly concentrated in developing economies (OECD, 2017).

The OECD's estimate is that USD 95 trillion would be needed between 2016 and 2030, which represents USD 6.3 trillion per year, when current infrastructure spending ranges between USD 3.4 and USD 4.4 (IEA, 2017; IEA, 2016; Woetzel et al., 2016). This would have to be oriented in priority towards energy production and transport. According to the International Energy Agency (IEA), energy production represents around two-thirds of global GhG emissions, mostly due to the combustion of fossil fuels. The energy sector faces the key challenge of having to decarbonise its electricity production. On the one hand is the necessary phasing out of coal, and on the other further deployment of nuclear power, widespread deployment of renewable energy sources, as well as investments in negative emissions technologies (IEA, 2017). Transport is also a central industry, not only because the sector represents 23% of global CO2 emissions, but also because it is the fastest growing source globally. According to the OECD's International Transport Forum, CO2 emissions from transport could double by 2050 (OECD 2017). Necessary investments in transport focus mostly in multiplying low-emission or zero-emission transport as well as developing energy efficient technologies. Other sectors are considered by the OECD in its report, including the building sector, which could already benefit from the availability of energy efficient technologies that are not yet widespread amongst actors, and the agriculture, forestry and land use sector (AFOLU). The AFOLU sector represents 25% of GhG emissions, mostly through deforestation (9-10%) and agriculture (10-12% mostly methane and nitrous dioxide).

Part of the OECD's report focuses on the role that can be played by private finance in this sector by investing in this infrastructure, but also in innovative technologies and divestment from carbon-intensive assets. The role of private finance is all the more important in advanced economies where public actors play a smaller role in funding infrastructure (NCE, 2016; Ahmad, 2015). Amongst the different private actors that have been identified by the OECD, corporations represent a key source of finance in the transition. These actors can participate in many ways by directly investing in renewable projects, performing power purchase agreements (PPAs) and creating partnerships with active players in the energy or transport sectors. Most importantly, corporations can also invest in their own business activities to lower their emissions profile or promote renewable energy and transport. Large global companies are being held accountable for emissions since the industrial revolution. In a study using compiled data of firm carbon emissions, the Carbon Disclosure Project (CDP) identified companies that together represented 72% of annual global industrial GHG emissions in 2015 (Griffin, 2017). Within these companies, 100 fossil fuel producers represented 52% of GHG emissions in 2017. Given this new data, it is clear that major global companies are the central playing field where most sustainable investments need to be performed.

However, it seems that in recent years companies have not invested as much as they could, regardless of whether these investments were sustainable or not. In March 2016, BlackRock's CEO Laurence Fink stated in his yearly letter to the executives of S&P 500 firms that, "in the wake of the financial crisis, many companies have shied away from investing in the future growth of their companies. Too many companies have cut capital expenditure and even increased debt to boost dividends and increase share buybacks." Even though this issue seems to have been clearly identified by financial practitioners, academic literature on the subject is scarce. To the author's knowledge, recent studies that address the subject most thoroughly have been performed by Gutierrez and Philippon (2016, 2017). The authors base their first study on five facts which they demonstrate : (1) non-financial businesses are profitable but do not invest, (2) investments are low even when Tobin's Q is high, (3) depreciation has remained stable since 2000, which means that the decrease in net investment is due to a decrease of gross investment, (4) firm entry has decreased, with a sharp decline of entry rates, exit rates and average number of firms by industry and finally (5) institutional ownership and payouts have increased. Using these facts as a basis for their analysis, Gutierrez and Philippon (2016) explore 8 potential explanations for firm-underinvestment : financial frictions from external finance, bank dependence and safe asset scarcity, measurement errors in intangibles or due to globalization, lack of competition due to either regulation or other factors and tighter governance. The authors' conclusion is the following: "this investment wedge appears to be linked to decreased competition and changes in governance that encourage shares buyback instead of investment".

These results participate in several strands of literature that are quite recent. The first is that of competition, and the link between competition, investment and innovation. On this subject, Alghion at al. (2014) find that increased competition leads to increased R&D investments by firms that operate at the same technological level, but decreased R&D investment by firms that are trailing behind. Competition also reduces the number of firms that operate on the same technological level and reduces the number of industry leaders. However, in their study, Gutierrez and Philippon (2016) state that their data suggests that firms that operate in concentrated or aging industries and growing firms that do not face any entry risks could have weak incentive to invest. This notion is supplemented with the literature that supports the hypothesis that competition is decreasing in several economic sectors (CEA 2016), which could then explain why investments are decreasing. This subject is specifically addressed in Gutierrez and Philippon (2016), in which the authors find a causal relationship between competition and investment, and state that US businesses have been under-investing since the early 2000's.

Another strand of literature focuses on the recent trends and impact of institutional ownership. In Gutierrez and Philippon (2016), the authors showed that institutional share of ownership of US businesses had risen from 2% to around 6% between 1980 and 2015, a majority of these institutional investors being quasi-indexer which favor short-termism over dedicated investments. Noticing this trend, Fichtner et al. (2016) go further into this analysis and find that, taken together, the three largest asset managers - Blackrock, Vanguard and State Street - are the largest shareholder of 88% of the S&P 500 and 82% of the index's market capitalization. Adding to this subject, a pre-existing literature had already focused on the concept that common ownership amongst competitors reduces incentives for competition (Salop and O'Brien, 2000). The literature on ownership is closely related to that of corporate governance, and centers on the agency problem between managers and shareholders. For academics in the field, weak governance is synonymous to higher agency conflicts, and signifies that managers are less constrained by shareholder rights and ownership and therefore more independent from shareholders. In cases of weak governance, it is shown that managers spend more cash in capital expenditures and acquisitions (Harford et al., 2008;

Richardson, 2006). This is not necessarily a good sign given the fact that other academics have also demonstrated that cash-rich firms tend to make more value-decreasing acquisitions (Harford, 1999).

Changes in ownership can also have an influence in terms of short-termism, but the literature on the existence of short-termism and its possibly negative impact on investments and R&D is strangely scarce. However, one particular author has been focusing on this subject quite extensively. Focusing on the possible negative impacts of the concept of maximising shareholder value (MSV) on corporations and their use of funds, William Lazonick's position is that equity markets and stock-based compensation have led corporations to focus on short term share price instead of investment and innovation (Lazonick, 2015).

In their paper on the concept of maximising shareholder value (MSV), Lazonick et al. (2000) investigate the impacts of this ideology on corporate governance in US firms. They find that pay-out ratios (the ratio of dividends to after-tax adjusted corporate profits) of US firms stayed quite stable between 1960 and 1980 at around 42 per cent, but rose between 1980 and 1998 to more than 49 per cent. The authors investigate the growth of share repurchases that occurred during the 1980s, with share buy-backs representing less than 5 per cent of corporate profits before 1982 and exceeding 25 per cent by 1985. By 1989, dividends had risen to $134.4 billion and stock repurchases to over $60 billion, increasing the combined payout ratio to over 81 per cent.

The trend that had been identified by Lazonick et al. (2000) did not stop then, and in 2015 Lazonick published a study that focused specifically on the stock buyback issue and the concept of "retain-and-reinvest to downsize-and-distribute", a term coined to illustrate the shift that occurred in US firms as they started to use their profits to pay shareholders instead of reinvesting them in their business activity (Lazonick, 2015). For the period 2004-2013, Lazonick (2015) shows that companies in the S&P 500 paid $3.4 trillion in stock buybacks, which represented 51% of these companies' total income, when dividends already represented 35%. For the author, the explanation for this growth in repurchases is linked to the stock-based pay of firm executives. Between 2006 and 2013, these ranged from representing 66 per cent to 84 per cent of total annual remuneration of highest-paid executives in these same firms when salaries and bonuses only ranged from 5 to 12 per cent. Furthermore, Lazonick also adds that "the vesting of stock awards is often dependent on the company hitting quarterly earnings per share (EPS) targets, for which well-timed manipulative boosts from stock buybacks can be very helpful." In essence, highest-paid executives have a clear incentive to perform stock buybacks, which reduces the number of shares outstanding, increases EPS and helps them reach EPS targets to obtain stock awards.

Lazonick (2015) addresses two distinct flaws of the MSV approach. The first is that this approach is based on the assumption that shareholders are the sole corporate participants that bear risk, while this is not the case. The author argues that taxpayers and workers are also risk-bearers that have an economic claim on distribution of profits. One the one hand, the government invests and offers subsidies to large firms that may not generate profits that can be taxed. On the other hand, many workers' pay does not correspond to their level of participation in the firm's business activities (Lazonick, 1990). The arguments provided by Lazonick (2015) are ever more interesting when considering the climate change challenge that is currently faced by US firms and which concerns all of their stakeholders. The authors' second argument is that public shareholders are not long-term investors that invest in the value-creating capabilities of the corporation, but rather traders that wait for the share value of the firm to rise before selling their shares for a profit.

Finally, Lazonick (2015) provides a summary of his research on how stock buybacks undermine a firm's innovative capabilities. One of the impacts of stock buybacks on the firms concerns strategic control. Lazonick states that senior executives that choose to pay large yearly stock buybacks lose their capacity to understand what investments are needed for firms to remain innovative (Baldwin,1991; Christensen et al.,

2008), as stock buybacks represent a powerful incentive for executives to focus more on increasing their pay. Another consequence of large buybacks in a firm concerns skill development. Lazonick states that by spending cash on stock buybacks, the firm is not investing as much as it should in its employees' skills and careers, which penalizes the firm's innovative capacities. The last impact of stock buyback regards financial commitment. Lazonick argues that many companies that perform large stock buyback operations throughout the years lack cash once they enter a period of crisis and are unable to finance a restructuring process to become innovative again (Lazonick, 2015).

3. Data

In the context of this study, four sources of data are used. We use Compustat North America to obtain information on the financial cash flows of US firms in the S&P500 index and Compustat Global to obtain information on the financial cash flows of firms in the S&P350 Europe index in countries that use the euro as a currency. We obtain similar information for US climate-aligned firms and European climate-aligned firms. Compustat North America provides fundamental and market information on US and Canadian firms such as annual and quarterly income statements, balance sheets and statement of cash flows. Annual data for most companies is available since 1950, and quarterly history and monthly market history since 1962. Compustat North America also provides information on index constituents which allows us to obtain information on companies that are part of the S&P500 index. Compustat Global provides similar data in more than 80 countries other than the US and Canada and covers 96% of European market capitalization. It provides annual and quarterly information starting from 1987.

We use the Mergent Fixed Income Securities Database (FISD) to obtain information on the US corporate bond market and to evaluate the proportion of long-term corporate debt issued by US firms in the S&P500 that is traded on these capital markets. We obtain similar information for US climate-aligned firms. The FISD database contains information on issues of more than 140,000 publicly offered US bonds. This information can be specific to both corporate bond issuers and corporate issues.

Finally, we use data provided by the Climate Bond Initiative (CBI) to identify US climate-aligned firms and European climate-aligned firms. CBI is an international NGO that focuses on the bonds as financing solution for climate change mitigation and adaptation. In 2018, CBI identified firms around the world that had more than 75% of their turnover than originated from climate aligned activities. The CBI research team were kind enough to provide this list of firms to the author.

3.1. Cumulative Cash Flows for the period 2009-2019

In order to obtain the required information from the Compustat database, we first identify companies that are part of the S&P500 in Compustat North America and companies that are part of the S&P350 Europe Index in Compustat Global from 2009 to 2019. The S&P 500 index in Compustat contains a total of 754 companies that have been part or currently are part of the S&P 500 and the S&P 350 Europe Index contains 364. We exclude financial services companies from our sample and keep only companies that have available data from 2009 to 2019. Our final sample contains 531 companies from the S&P 500 Index and 233 companies from the Europe S&P 350 Europe Index.

In order to have a synthetic view of firms in our sample, we focus on the main fundamental indicators from cash flow statements, differentiating, much like it is the case in firm's consolidated accounts, net cash flow from operating activities from net cash flow from investing and financing activities. Main

fundamentals for each categories of activities are net income and depreciation and amortization for operating activities that provides us with the main information on the cash that is generated by the firm's activity throughout the year, capital expenditures and acquisitions for investing activities, and information on share sales and repurchases, dividends and changes in debt for financing activities. For each section of the cash flow statement, we include an "Other" category that sums up the remaining cash flow items in the section. In total, we obtain information from 15 cash flow items from cash flow statements of both US and European firms between 2009 and 2019.

3.2. Average Cash Flows for US 1971-2019 and Euro 1999 - 1919

The Compustat North America and Global databases can also be used to obtain average values for cash flow items of US and Euro firms going back many years before 2009. As aforementioned, the Compustat North America database provides annual information on US firms since 1950. However, the first year for which all cash flow information is available on the database is 1971. We therefore run our sample of average values for US cash flow from 1971 to 2019. The Compustat Global database provides data from 1987 but given the currency issue we face with this dataset, we run our sample from 1999 to 2019 provided that the euro was launched on the 1st of January 1999.

3.3. Corporate bonds issuances and reductions 1995 - 2018

We use the FISD database to identify corporate bond issuances and reductions from US firms in the S&P500 in order to understand what proportion of US long-term debt is composed of debt securities publicly tradable on US capital markets. FISD is considered as the most comprehensive database focusing on bonds and contains essential information on bond issuers as well as specific bond issues such as bond issue date, maturity, size, coupon, type, and any information that can be used to identify and categorize US bonds. FISD allows us to have visibility on the corporate bond market and understand operations that occur between companies that issue bonds and the market of bondholders. In addition to comprehensive information of bond issues and bond issuers, FISD provides detailed information on the amount outstanding history for every bond in its database. This information can be used to understand the different amounts that are either paid or received by companies during the lifespan of a corporate bond, which corresponds to amounts that are taken under account by firms when they report their yearly long-term debt issuances and long-term debt reductions.

We first identify corporations of our sample in the FISD database using CUSIP information. A CUSIP number is a unique identification given to each individual security. The CUSIP number is composed of nine characters. The first six characters of a CUSIP number identify the issuer, and the last three identify the specific security issued by this issuer. Compustat and FISD both provide CUSIP numbers for issuers and securities, and we are able to identify every security linked to US issuers in our sample using the first six characters of the CUSIP number. Using the FISD database, we obtain historical data on the different operations that altered the amount outstanding for each bond, from its date of issuance to its date of maturity if that date is reached, or to the corresponding date where the amount outstanding reaches zero due to another form of operation, such as a bond conversion or a call. A great number of these bonds are still active, and therefore the amount outstanding has not yet reached zero.

Some of the bond issuances of companies in our sample are performed using foreign currency. Even though this is the case for a minority of our bonds, we do need to convert these amounts in US dollars in order to be able to consider them. Much like it was the case for our sample of EU firms, we limit our sample to 1999 and the creation of the Euro, so that this conversion is more precise. There are five distinct currencies used by US issuers in our sample other than the US dollars: the Euro, the Japanese Yen, the Swiss Franc, the United Kingdom Pound Sterling and the Canadian Dollar. Using publicly available data on monthly historical conversion rates between these currencies and the US dollar provided by the Federal Reserve on its website[4], we convert values for every bond issued in a foreign currency to US dollars.

We then move on to categorizing every bond operation into either a bond issuance, where the company receives capital from bond holders, or a bond reduction, where the company provides capital to bondholders. This is a particularly complex operation given the different specific characteristics of bonds, which can be convertible, callable or reviewed during the life cycle of the bond.

In table 1, we provide an explanation of the different types of operations that are listed in the FISD database for our sample, and whether each operation is categorized as a bond issuance or a bond reduction. To summarize, initial offerings (type "I") correspond to the initial bond issuance where capital is provided by bondholders to firms. Operations such as "Initial Offering Increase", "Over-allotments" and "Reopenings" (type "II", "OA" and "RO") correspond to further bond issuances that occur after the initial bond offering, and also correspond to an operation where capital is provided by bondholders to firms. Different types of operations that occur during the bond's lifecycle are linked to calls, refunds, repurchases, firm reorganizations and tender-offers (type "B", "E","F","IRP","P","R","S" and "T") and correspond to bond reductions where capital is provided by the firm to the bondholders. The amount outstanding of a bond can also be increased or decreased following a review (type "REV"), in which case this operation is either an issuance or a reduction depending on whether the review led to a decrease or increase of funds. The bond can of course reach maturity (type "IM") in which case the remaining amount outstanding of the bond is payed to bond holders. Other important types of operations include when issues are converted into stocks (type "C") or exchanged for other securities (type "X"), in which case they either correspond to new share issuances or a new bond issuance. Since we already consider new bond issuances in our sample, this new bond issuance is already accounted for and type "C" and "X" operations are not taken under account.

Our available data for FISD spans to the end of 2018, therefore our sample consists in every bond operation for S&P 500 companies from 1999 to 2018. Our initial dataset for S&P 500 firms from Compustat contained 630 different issuers from 1971 to 2019, and we find information on 14,115 corporate bond operations for 456 bond issuers between 1999 and 2018 in the FISD database. The corresponding information on the different types of operations and their frequencies is available in table 1.

[4] See https://www.federalreserve.gov/releases/h10/Hist/

Table 1

Code	FISD Description	Description	Type of operation	Number of observations
B	Balance of Issue Called	Part of the issue is called by the issuer.	Reduction	281
C	Issue Converted	The issue is converted to the issuer's stocks.	Other	55
E	Entire Issue Called	Entire issue is called by issuer.	Reduction	406
F	Issue Refunded	Part or all of the issue is refunded by the issuer to bondholders.	Reduction	4
I	Initial Offering of An Issue	Initial bond issuance from to the issuer to bondholders.	Issuance	5502
II	Initial Offering Increase	The initial amount of the issue is increased.	Issuance	4
IM	Issue Matured	The issue has reached maturity and bondholders are paid the principal and final interests.	Reduction	1814
IRM	Issue Remarketed	Changes are made to specific conditions of the bond. In our sample, this does not affect bond amount outstanding.	Other	5
IRP	Issue Repurchased	Part of or all of the bond is repurchased by the issuer.	Reduction	138
OA	Over-Allotment	The initial amount of the issue is increased.	Issuance	274
P	Part of an Issue Called	Part of the issue is called by the issuer.	Reduction	71
R	Reorganization	Reorganization of the issuing firm leads to part or all of the bond being repurchased by the issuer.	Reduction	88
REV	Review	Review of the terms of the bond issuance can lead amount outstanding to be increased or decreased.	Reduction/Issuance	3126
RO	Reopening	Issuer re-opens, and the initial amount of the issue is increased.	Issuance	158
S	Sinking Fund Payment	Part or all of the issue is paid by the issuer's sinking fund.	Reduction	262
T	Issue Tendered	Issuer offers to repurchase a specific number of bonds to bondholders.	Reduction	859
X	Issue Exchanged	Bond issue is exchanged for another security.	Other	1065

3.4. US and Euro climate-aligned firms

Finally, we use a list of climate bond issuers provided directly by the Climate Bond Initiative (CBI) research team. This list was used by CBI in their study on the climate bond market (Climate Bond Initiative, 2018). To identify climate bonds, CBI identified issuers that originated at least 75% of their revenues from green business lines in either clean energy, low-carbon buildings and transport, water and waste management and sustainable land use. Climate bonds were included if they were issued after the 1st of January 2005 and before the end of Q2 2018.

The list provided by the CBI research team did not provide any form of identification number that could be used to rapidly identify issuers in the Compustat database, and firms have to be identified manually. We identify 28 US climate-aligned firms and 26 Euro climate-aligned firms.

4. Cumulative Cash Flows of US and Euro firms

4.1. The S&P500 and Euro firms in the S&P 350 Europe

Once we have performed our data treatment on cash flow items from Compustat and have kept only firms that provide data for the entire 2009-2019 period, we add these values across firms to get a general idea of the cash that has been coming in and out of US and Euro firms. Our results are available in Table 2. Looking at operating activities, US firms in our sample have had a steady increase in income since 2009,

while European firms seem to have had an immediate increase in income between 2009 and 2010 which has not been surpassed until 2017. In total, this has led EU firms to have generated little net income compared to the total value of depreciation and amortization of their assets for the same period. For Euro firms in the S&P 350 Europe index, depreciation and amortization represents 125% of total income over the period, when it only represents 64% for US firms. For these firms, depreciation and amortization represents 56% of total net cash flow obtained from operating activities, while these represent only 35% for US firms.

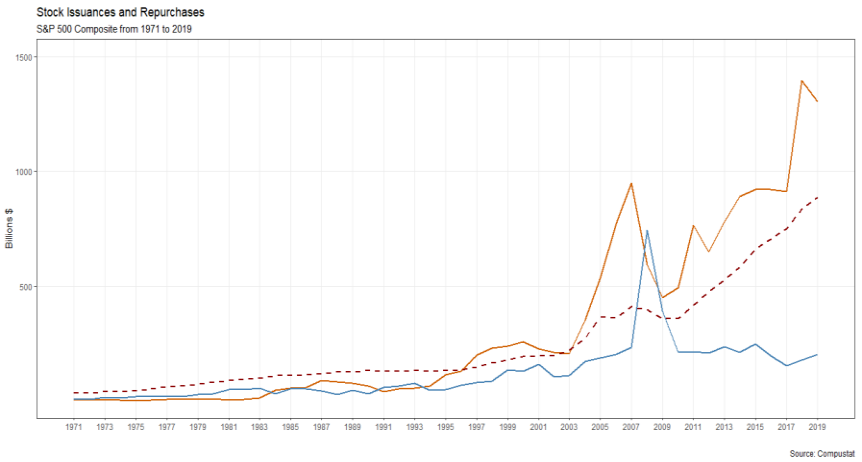
However, looking at investing activities, European firms are spending more in capital expenditures as a percentage of their net income, with total capital expenditures on the period reaching 131% of net income for European firms, compared to 69% for US firms. Acquisitions for both geographical regions are similar, though slightly higher for Euro firms, representing 27.5% of net income for US firms and 36% for European firms. However, US firms dedicate a significant amount of their investing cash flow to other investing activities such as the purchase of marketable and non-marketable securities, while EU firms have mostly generated cash from selling such securities. For this reason, a further 35% of income is spent in investing activities by US firms, when this pole generates 5% of net income in cash for EU firms.

Perhaps the most insightful information provided in table 2 regards financing activities of US and Euro firms. Over the course of the period going from 2009 to 2019, US firms in our sample have repurchased $5.226 trillion of their own stocks on the stock market, while they have issued only $1.379 trillion. Furthermore, $3.876 trillion in dividends have been distributed to shareholders. In comparison, the difference between proceeds and repayment for long-term debt totaled $1.318 trillion and -857 billion for current debt. This means that the only positive source of external financing for industrial US corporations in our sample between 2009 and 2019 has been long-term debt, as these corporation have been mostly repaying current debt and using most of the cash generated from their activity to pay their shareholders, either through repurchases, as the difference between sales and purchases of common and preferred stock correspond to $3.847 trillion and 39.4% of net income, or through dividends, which correspond to $3.876 trillion and 39.7% of net income.

Interestingly, Euro firm stock sales are superior to stock purchases by $34.6 billion, which represents 2% of total net income over the period. However, $965 trillion in dividends have been distributed, which corresponds to 55% of net income over the period. The difference between proceeds and repayments for long-term debt is also positive for European firms by $469 billion, and negative for current debt at -$133 billion. Thought financing activities represent a similar percentage of net income for US (-44%) and Euro firms (-46%), there are important differences between the two regions. Euro firms perform much less stock repurchases than US firms but spend more of cash dividends and obtain almost twice as much financing compared to their net income through long term debt (26% for Euro firms against 14% for US firms).

We understand from these results that both Euro and US firms have been providing cash steadily to their shareholders over the period 2009-2019. When looking exclusively at share issuances, repurchases and cash dividends, US firms have paid a net sum of $7.722 trillion to their shareholders and EU firms have paid a net sum of $930 trillion to their shareholders. Our findings are similar to that of the literature which

Figure 1


Stock Issuances and Repurchases
S&P 500 Composite from 1971 to 2019
Billions $
1500
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500
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Source: Compustat
Stock R
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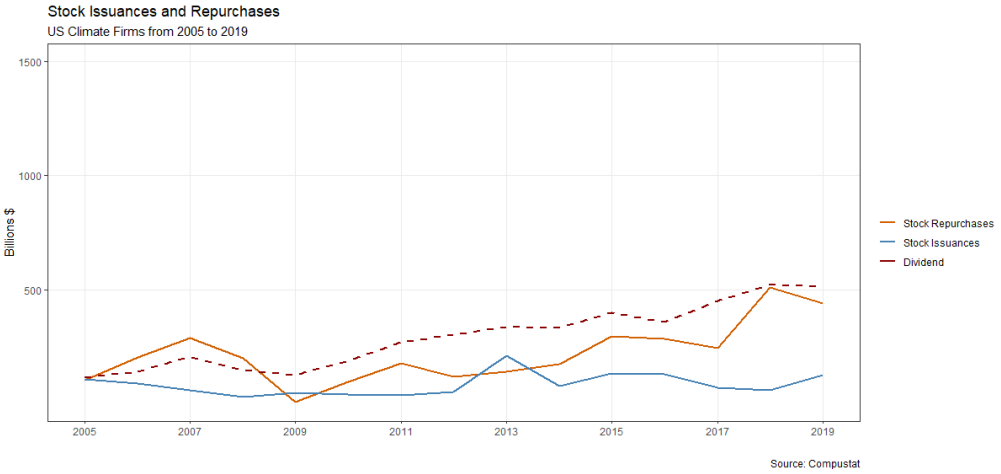
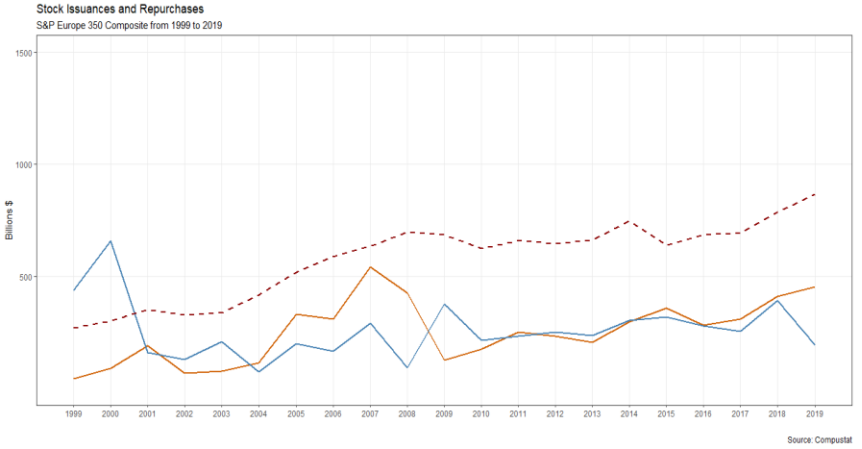
Dividen


Stock Issuances and Repurchases
US Climate Firms from 2005 to 2019
Billions $
1500
1000
500
2005 2007 2009 2011 2013 2015 2017 2019
Source: Compustat
Stock Repurchases
Stock Issuances
Dividend


Stock Issuances and Repurchases
S&P Europe 350 Composite from 1999 to 2019
Billions $
1500
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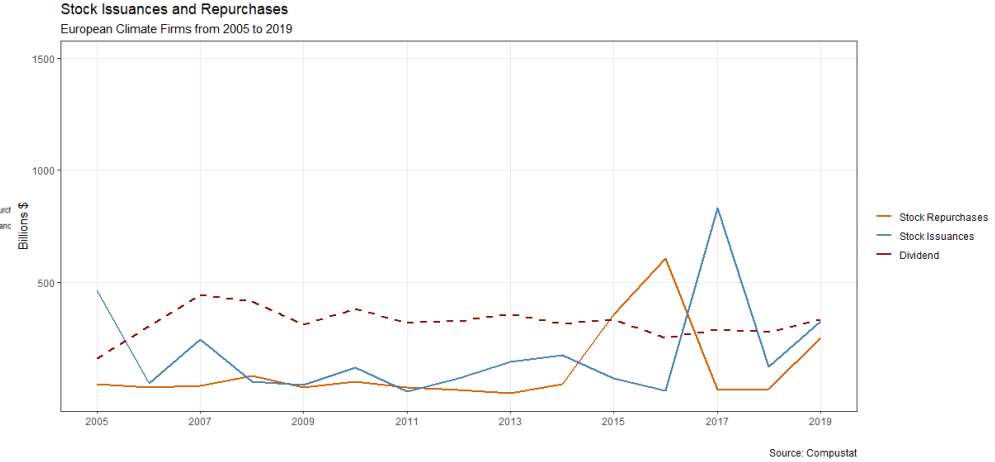
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Source: Compustat
Stock Repurc
Stock Issuanc
Dividend


Stock Issuances and Repurchases
European Climate Firms from 2005 to 2019
Billions $
1500
1000
500
2005 2007 2009 2011 2013 2015 2017 2019
Source: Compustat
Stock Repurchases
Stock Issuances
Dividend

states that stock markets are increasingly being financed by large firms instead of providing them with financing.

4.2. US and Euro Climate-aligned firms

Cash flow items for US and Euro climate-aligned firms differ from their traditional equivalents. US climate-aligned firms have slightly higher depreciation and amortization and significantly higher capital expenditures than US S&P 500 firms: depreciation and amortization represent 77% of net income for climate-aligned firms against 64% of S&P500 firms and capital expenditures represent 118% of net income for climate aligned-firms against 69% for S&P500 firms. Acquisitions for both samples are similar. This could very well indicate that US climate firms invest more in their business activities then S&P 500 firms.

Looking at financing activities, we find that US climate bonds also spend a large amount of cash on paying shareholders through either share repurchases or dividends. While 13% of net income is spent on share issuances, 32% of this same net income is spent on repurchasing shares. A further 52% of net income is spent on cash dividends, bringing the total amount of cash flow dedicated to shareholders to 71% of net income and $137 billion. US climate firms have a large part of their financing that is provided by long-term debt which represents 43% of their net income (against 14% of S&P 500 firms). Overall, US climate firms spend 20% more of their cash in investing activities than S&P500 firms and 20% less in financing activities.

While Euro firms in the S&P350 Europe index already had a large proportion of their net income dedicated to depreciation and amortization (125%), this is even more the case for EU climate firms for which this figure reaches 214%. Overall, more than two thirds of their operating cash flow for EU climate firms originates from depreciation and amortization of their assets. Furthermore, 382% of net income for these firms is dedicated to capital expenditures, with a further 33% in acquisitions, which indicates the EU climate firms are investing large amounts of cash in their business activities.

Interestingly, much like Euro firms in the S&P 350 index, Euro climate firms are issuing more stocks than they are purchasing, with 16% of net income spent on share issuances against 9% in repurchases. However, once again quite similarly to Euro firms in the S&P 350 index, cash dividends for Euro climate firms are also very high and represent 64% of net income. Long term debt for Euro climate firms is very high at 50% of net income. This resembles more the profile of US climate firms, which also issued a lot of long-term debt as a proportion of net income (43%). Overall, this causes financing activities for Euro climate firms to be slightly positive at 3% of net income, which is quite for from the -23% of US climate firms, and the -44% and -46% of S&P 500 and S&P 350 Europe firms. Looking at these cash flow items, it seems both US and Euro climate firms are spending most of their cash in reinvesting in their business activities.

5. Average Historical Cash Flows of US and Euro firms

5.1. Share issuances, repurchases and dividends

Looking at average stock issuances, stock repurchases and dividends of firms that have been or currently are part of the S&P 500 since 1971, we notice that stock issuances have only occasionally been

superior to stock repurchases: before 1984, between 1991 and 1993, and in 2008 following the subprime crisis. Furthermore, at the exception of 2008, dividends have always been higher than stock issuances for S&P500 firms since 1971. In Europe, we focus on firms that have been or currently are members of the S&P Europe 350 from countries that use the euro as a currency since 1999. We observe that since 1999, in average, firms in our sample have had relatively similar levels of stock issuances and stock repurchases, with higher levels of stock issuances in 1999 and 2000 and higher levels of stock repurchases in the few years before the subprime crisis. In Europe, dividends have been much higher than both stock issuances and stock repurchases since 2001. Looking at this data, we understand that stock markets have not participated in financing large EU and US firms in the last decades, but have rather been receiving cash from these large firms, either in the form of dividends in Europe, or both in the form of dividends in stock repurchases in the United States since the middle of the 1990s.

Overall, the situation for climate firms is quite similar, although the large differences between stock issuances and repurchases that exist for S&P500 firms do not exist either for US climate-aligned or Euro climate-aligned firms. For US climate-aligned firms, we do notice that stock repurchases have to a great majority been superior to stock repurchases, while dividends have constantly been higher to both stock issuances and repurchases since 2009. For Euro climate-aligned firms, it seems like stock issuances are slightly higher than stock repurchases. Stock repurchases peak in 2016, quickly followed by a peak of stock issuances in 2017. Much like US climate-aligned firms, dividends are constantly higher than stock issuances and stock repurchases except for these two peaks. However, we do observe that stock issuance, repurchases and dividends have been growing for US climate firms between 2005 and 2019 while they have been steadier in the case of Euro firms.

The main conclusion of these results is quite similar to that of the previous section: stock markets have not been a positive source of financing for either large US and Euro firms or their climate-aligned equivalents. This time-series analysis does allow us to observe the current tendencies that are occurring on each of these markets. US firms – either large traditional firms or climate-aligned firms – tend to have important differences between stock repurchases and issuances. This trend is quite pronounced for S&P500 companies since the mid-1990s, but a similar trend can be observed for US climate firms – though much smaller in magnitude – since 2014. For Euro firms, again both large Euro firms in the S&P 350 Europe and Euro climate-aligned firms, there is more balance between stock issuances and stock repurchases, though dividends have been high since the creation of the Euro. There is a growing trend for Euro dividend distribution, though less pronounced than that of large US firms.

5.2. Long-term debt and overall external financing

The situation for long-term and current debt for these same firms is not similar. At the exception of the post-crisis period corresponding to 2009-2010, US firms have always issued more long-term debt than they have reduced their existing long-term debt[5], even though both the amount of issued long-term debt

[5] In the Compustat database, long-term debt issuance includes increase in long-term and short-term debt when combined, long-term debt issued for or assumed in an acquisition, proceeds from bonds, capitalized lease obligations, or note obligations, and reclassification of current debt to long-

and reduction of long-term debt have grown extensively in the last decades, growing from a little more than $100 billion in issuances in 1980 to $3 trillion and more starting in 2015[6]. Whether it regards large US firms, large Euro firms or Euro and US climate-aligned firms, long-term debt has been a positive source of financing for the studied periods[7]. Figure 3 illustrates how different sources of external finance have helped finance both US firms and EU firms in recent decades. In order to have better visibility and understanding of the dynamics of each source of external funding for US and EU firms, we apply a smoothed conditional mean using a local polynomial regression fitting. This smoothing method is commonly used to detect patterns in datasets and corresponding graphical visualization and consists in creating a smoother representation of the data by fitting data points in accordance with points in the direct and indirect neighborhood of these data points. We provide these modified graphical representations in Figure 2. The original graphical representations of the data is available in Appendix 3 and further detail on this approach and corresponding literature in appendix 4.

Using this method, the constant presence of long-term debt in positive financing territory is made quite clear. This allows us to observe that long-term debt has been the main source of external finance for S&P 350 Europe firms in the Eurozone for the entire 20 years period represented in our sample, and since the beginning of the 90s for US companies in the S&P 500. This is also quite clear regarding both US and Euro climate-aligned firms.

Looking more precisely at trends for each sample, we observe that long-term debt has been the only positive source of financing for S&P500 firms since 2002, stabilizing at around $400 billion per firm. Much like we have observed in previous sections, negative stock market financing for large US firms has been growing steadily since the beginning of the 1990s. The situation for large EU firms is quite different. Since the starting period of our sample in 2005, though long-term debt has been by far the largest source of financing, it has never strayed too far from changes in share issuances, which were in positive territory between 1999 and 2003 and between 2011 and 2015. Dividends, however, have always been almost proportionally negative since the beginning of our sample period.

For climate-aligned firms in the US, our graphical representation illustrates a slow but constant growth of long-term debt financing since the beginning of our sample, mirrored by a slow but constant growth of distribution of dividends. Net share issuances, though being constantly negative since the beginning of our sample, have mostly decreased recently, between 2014 and 2019. Finally, the situation for climate-aligned Euro firms is also quite specific, with a larger participation of long-term debt financing between 2007 and 2011, after which long-term debt financing starts a slow but qui steady downward stream until the end of our sample period. Net share issuances alternate between slightly positive and slightly negative territory throughout the sample period. Overall, we do find interesting patterns in these graphical representations:

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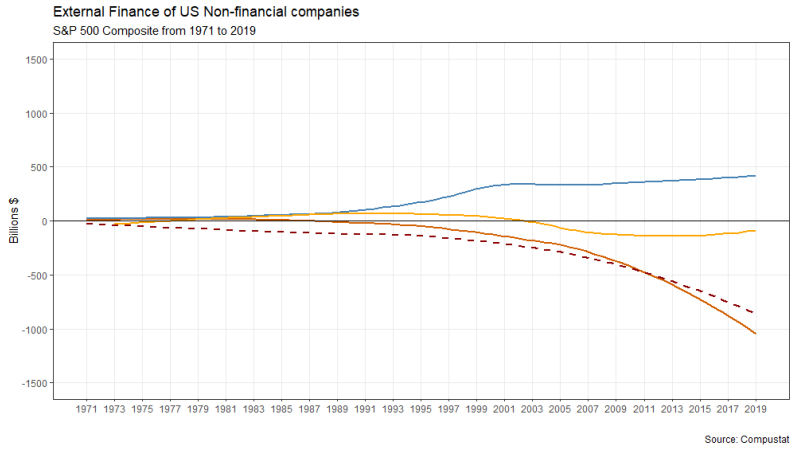
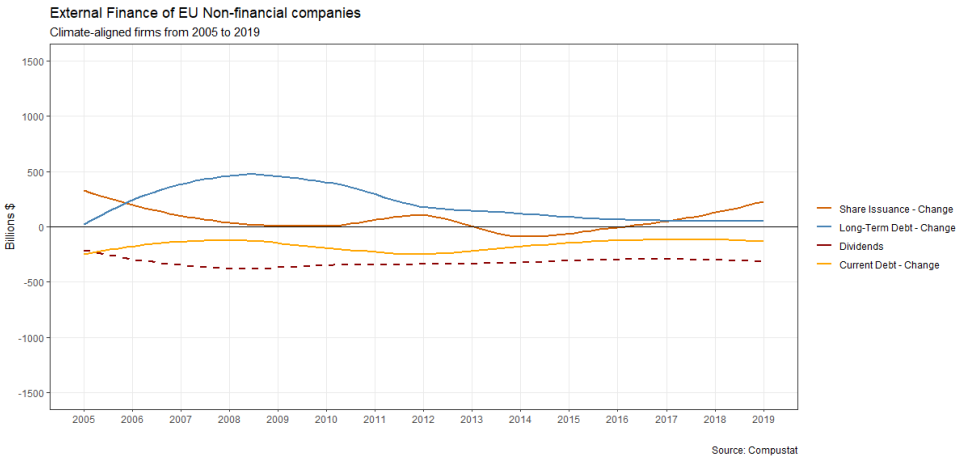
term debt. Long-term debt reduction includes conversion of debt to common stock, change in debt not classified into current and long-term debt in the cash-flow statement, change in long-term debt combined with change in current debt, current maturities of long-term debt for companies reporting a working capital statement, reclassification of long-term debt due to Chapter 11, transfers or reclassifications of long-term debt to current liabilities, decreases to long-term debt accounts, cash statements and LOC or revolving loan agreement

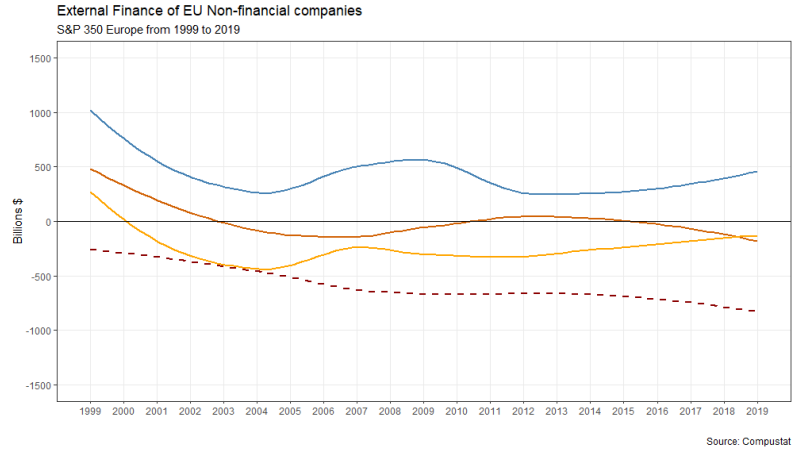
[6] Specific information on long-term debt issuance and long-term debt reduction is not available in Compustat Global, and therefore a similar analysis could not be performed for EU firms.

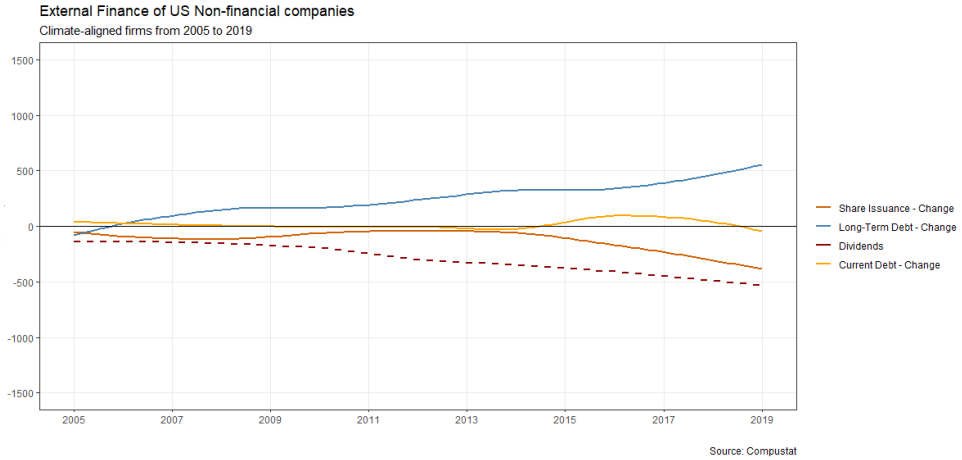
[7] Studied periods are 1971 to 2019 for S&P500 firms, 1999 to 2019 for Euro firms in the S&P350 Europe index, and 2005 to 2019 for both Euro and US climate aligned firms.

Figure 2


External Finance of US Non-financial companies
S&P 500 Composite from 1971 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of EU Non-financial companies
Climate-aligned firms from 2005 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of EU Non-financial companies
S&P 350 Europe from 1999 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of US Non-financial companies
Climate-aligned firms from 2005 to 2019
1500
1000
500
0
-500
-1000
-1500
2005 2007 2009 2011 2013 2015 2017 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat

while debt financing is the only constantly positive source of financing for all our sample, dividends always closely mirror long-term debt within negative territory. We also find that the behavior of net share issuances differ mostly between our two geographical regions: net share issuances are constantly negative in the US and alter between positive and negative territory in the Eurozone.

6. Corporate Bonds and Long-term debt for US firms

As the purpose of this paper is to understand the role of capital markets in financing firms, we can investigate further and try to understand what part of this long-term debt is constituted of publicly tradable securities. As we've explained in section 3 of this paper, we can extract corporate bond issuances and repayments for every US firms that has issued a corporate bond between 1995 and 2018. Using the Compustat US database, we can also extract total long-term debt issuances and repayments of these firms. This allows us to understand what part of these firms' long-term debt originates from capital markets through the US corporate bond market. This approach also applies to US climate-aligned firms.

Using this approach, we compute the total amounts of long-term debt and corporate bond issuances and repayments for both our sample of traditional firms and climate-aligned firms. Our main results are available in Table 2. Details on the total yearly amounts of long-term debt and corporate bond issuances and repayments for both traditional firms and climate-aligned firms are available in Appendix 4.

Table 2 - Long-term debt and corporate bond financing

	All corporate bond issuers (1995-2018)		Climate-Aligned Firms (2005-2018)	
Net Corporate Bond Debt	2956.99	*59%*	50.24	*66%*
Other Net Long-term Debt	2079.31	*41%*	26.23	*34%*
Total Net Long-Term Debt	**5036.30**		**76.47**	

Both yearly long-term debt issuances and long-term debt repayments are vastly superior to yearly corporate bond issuances and repayments. However, when computing the differences between issuances and repayments for total long-term debt and total corporate bond debt, we find that net corporate bond debt represents a majority of the total net long-term debt of US firms in our sample. With total net long-term debt on the period 1995 to 2018 reaching $5.036 trillion for firms in the FISD database, $2.957 trillion of this amount is corporate bond debt, which represents 59% of this total. This is quite interesting provided the fact that we observed in the previous section that long-term debt was already by far the primary source of financing for US firms in the S&P 500 by 1995. The importance of corporate bond financing for climate-aligned bonds is even pronounced, as it represents 66% of total net long-term debt between 2005 and 2018.

7. Conclusion

Our study of cash flow items of S&P500 firms and Euro firms in the S&P350 Europe Index confirms what has been displayed in the literature focusing on stock-buybacks and dividends: corporations are not getting new funding from stock markets, but are instead channeling cash generated by their business activities towards their shareholders, and in some sense financing stock markets instead of being financed by them. We find that a net sum of more than $7.7 trillion has been paid to shareholders by large US firms since 2009, and more than €3.7 trillion for large European firms in the Eurozone. By computing average cash flow items instead of cumulative cash flow items for our samples, we are able to look expend our period of analysis as far as 1971 for large US firms and 1999 for large European firms in the Eurozone. Our results confirm that stock markets have never been a true source of positive net financing for either large US or large Euro firms for these periods of time.

We then observe that long-term debt has been the only source of positive net financing for these firms during these large periods of time. Using the FISD database on US corporate bonds, we focus on the US debt market, and find that corporate bond financing composes a majority of this long-term debt financing. We understand from our data that the US corporate bond market, contrarily to the US stock market, does represent a positive source of financing for US firms in our sample, but also for US climate firms. This provides interesting insight on the possible positive role that could be played by corporate bond markets for sustainable finance and in financing solutions for climate change adaptation and climate change mitigation in the context of growing climate urgency.

As a recent literature that focuses on the relationship between sources of external finance for corporations and their capacity to innovate and invest is starting to develop, academics will undoubtedly have to look more closely and specifically at both stock markets and bond markets to understand their role and impact on the investment decisions of large firms throughout the world. It is becoming increasingly clear that a large part of the necessary efforts against climate change will have to be performed by large international corporations that constitute financial markets, and further research needs to be performed on these specific subjects. In this context, this study represents a first attempt in understanding the roles that are played and could be played by financial markets in providing capital to finance climate change mitigation and adaptation.

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Appendix 1

Panel A: Firms in S&P 500 from 2009 to 2019

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Percentage of Net Income
Income Before Extraordinary Items	619.37	757.19	848.65	803.01	928.26	914.88	790.38	834.09	976.74	1087.94	1199.58	9760.10	
Depreciation and Amortization	429.65	439.64	466.46	493.23	519.72	542.32	598.18	608.76	647.92	687.86	765.38	6199.11	64%
Other operating activities	186.58	144.28	251.40	191.76	330.47	148.71	263.76	124.40	-50.96	195.78	-2.35	1783.83	18%
Operating Activities - Net Cash Flow	**1235.60**	**1341.11**	**1566.51**	**1488.00**	**1778.46**	**1605.90**	**1652.32**	**1567.25**	**1573.70**	**1971.57**	**1962.61**	**17743.04**	**182%**
Capital Expenditures	-445.12	-474.46	-566.44	-625.13	-633.36	-689.41	-645.69	-608.70	-621.39	-712.97	-736.16	-6758.83	-69%
Acquisitions	-104.63	-171.78	-198.71	-208.65	-139.54	-171.36	-345.81	-400.77	-265.08	-417.65	-260.91	-2684.88	-28%
Other investing activities	351.62	15.47	-373.06	-515.26	-592.67	-548.70	-311.69	-478.11	-375.77	-372.14	-245.54	-3445.85	-35%
Investing Activities	**-198.14**	**-630.78**	**-1138.21**	**-1349.03**	**-1365.58**	**-1409.46**	**-1303.19**	**-1487.57**	**-1262.24**	**-1502.75**	**-1242.61**	**-12889.55**	**-132%**
Sale of Common and Preferred Stock	242.75	126.38	127.91	114.82	111.59	116.96	144.00	107.33	82.75	95.98	109.44	1379.94	14%
Purchase of Common and Preferred Stock	-272.86	-274.74	-431.23	-361.99	-424.21	-498.75	-512.87	-511.84	-499.13	-735.08	-703.77	-5226.47	-54%
Cash Dividends	-212.87	-219.94	-250.64	-293.36	-319.38	-355.35	-397.52	-413.20	-439.28	-479.44	-494.64	-3875.63	-40%
Long-Term Debt - Change	-107.74	-325.17	-194.13	-79.96	210.89	322.76	487.90	379.74	316.52	174.52	132.99	1318.32	14%
Current Debt Changes	-478.86	-64.77	-139.93	83.12	-154.62	31.96	-164.55	-12.63	88.92	9.67	-55.66	-857.37	-9%
Other financing activities	-49.75	85.50	589.31	437.95	252.45	184.60	178.98	349.25	268.65	266.80	386.15	2949.88	30%
Financing Activities	**-879.34**	**-672.74**	**-298.70**	**-99.43**	**-323.28**	**-197.81**	**-264.06**	**-101.35**	**-181.56**	**-667.54**	**-625.50**	**-4311.33**	**-44%**

Panel B: Firms in S&P Europe 350 from 2009 to 2019

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Percentage of Net Income
Income Before Extraordinary Items	94.48	181.89	160.49	151.75	136.70	153.20	116.54	158.26	226.50	204.93	184.33	1769.06	
Depreciation and Amortization	182.91	189.38	183.45	192.78	188.18	185.40	201.53	206.02	206.62	212.73	259.82	2208.81	125%
Other operating activities	75.57	-0.92	-17.35	-18.35	-0.62	-19.31	41.86	-5.79	-80.31	-33.00	-4.63	-62.85	-4%
Operating Activities - Net Cash Flow	**352.96**	**370.35**	**326.59**	**326.18**	**324.25**	**319.29**	**359.92**	**358.49**	**352.82**	**384.66**	**439.52**	**3915.02**	**221%**
Capital Expenditures	-210.10	-205.42	-205.12	-214.94	-205.49	-197.89	-211.44	-206.99	-217.27	-215.49	-230.54	-2320.69	-131%
Acquisitions	-80.05	-30.49	-45.79	-35.71	-20.79	-51.43	-79.01	-51.31	-67.86	-115.96	-53.68	-632.08	-36%
Other investing activities	32.13	-14.77	13.98	18.61	2.50	36.08	5.60	-19.55	13.91	9.31	-13.14	84.65	5%
Investing Activities	**-258.02**	**-250.68**	**-236.94**	**-232.04**	**-223.77**	**-213.24**	**-284.85**	**-277.85**	**-271.22**	**-322.15**	**-297.36**	**-2868.11**	**-162%**
Sale of Common and Preferred Stock	35.21	17.66	17.60	14.68	19.20	23.73	22.55	20.51	19.22	26.42	13.50	230.30	13%
Purchase of Common and Preferred Stock	-4.60	-9.09	-16.07	-9.28	-12.17	-20.57	-20.21	-19.56	-21.58	-28.75	-33.83	-195.71	-11%
Cash Dividends	-79.64	-71.82	-84.29	-81.09	-79.34	-95.82	-83.76	-86.33	-89.98	-100.89	-112.45	-965.40	-55%
Long-Term Debt - Change	84.56	-24.70	35.12	77.51	22.63	25.66	23.18	55.96	52.25	88.27	28.29	468.72	26%
Current Debt Changes	-29.69	-10.42	-4.78	-19.78	-13.85	-9.57	-0.47	-13.63	-17.74	-3.73	-8.94	-132.60	-7%
Other financing activities	-21.22	-23.00	-26.36	-35.94	-17.11	-27.79	-10.27	-25.71	-0.51	-20.34	-16.33	-224.59	-13%
Financing Activities	**-15.37**	**-121.38**	**-78.79**	**-53.90**	**-80.63**	**-104.35**	**-68.98**	**-68.75**	**-58.34**	**-39.03**	**-129.76**	**-819.29**	**-46%**

Appendix 2

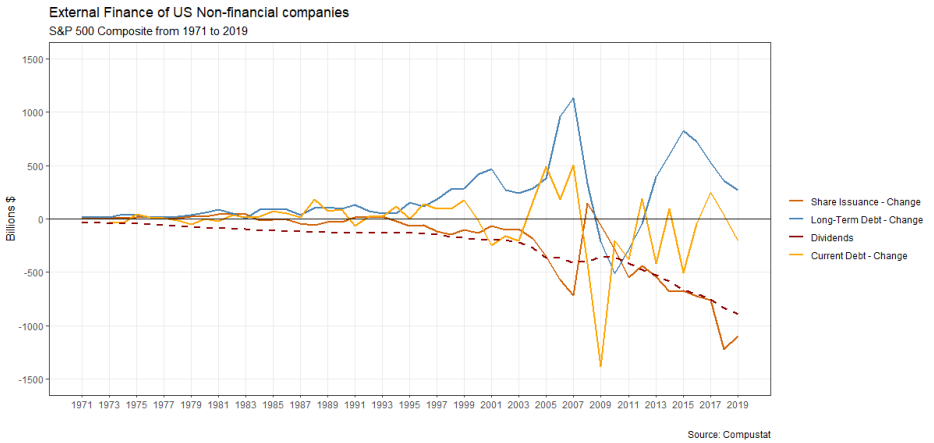
Panel A: US Climate Firms from 2009 to 2019

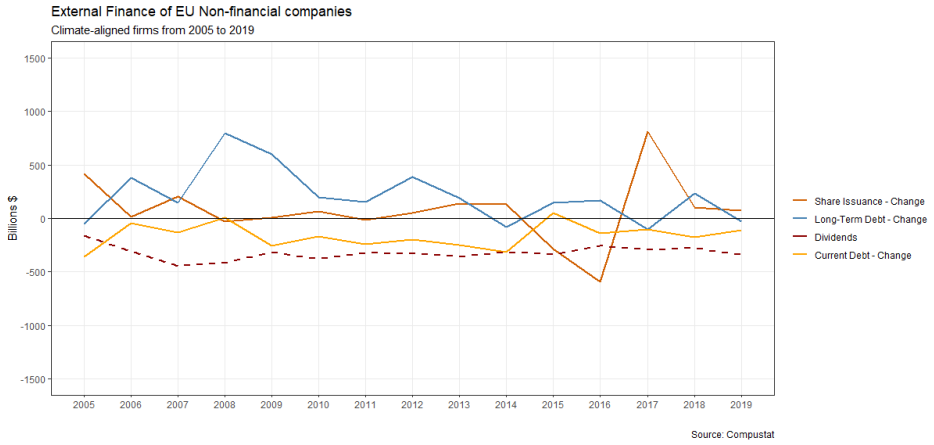
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Percentage of Net Income
Income Before Extraordinary Items	7.32	12.51	12.72	13.48	16.85	17.99	16.55	15.45	35.86	24.93	21.34	195.00	
Depreciation and Amortization	9.62	10.07	10.19	10.87	12.02	13.40	14.13	15.70	16.37	18.44	19.88	150.69	77%
Other operating activities	4.14	-0.79	3.35	2.66	1.84	1.72	2.25	3.92	-17.71	-1.13	3.29	3.55	2%
Operating Activities - Net Cash Flow	**21.08**	**21.78**	**26.27**	**27.01**	**30.71**	**33.11**	**32.93**	**35.08**	**34.52**	**42.24**	**44.51**	**349.24**	**179%**
Capital Expenditures	-12.50	-13.01	-17.89	-20.90	-18.81	-23.27	-25.96	-22.48	-25.28	-24.82	-25.00	-229.92	-118%
Acquisitions	-0.33	-2.18	-2.66	-4.75	-3.97	-4.30	-3.08	-3.41	-3.35	-1.83	-12.63	-42.48	-22%
Other investing activities	-2.59	-1.76	-0.08	-2.33	-1.16	-1.34	-3.51	-1.64	-1.21	-4.17	-3.59	-23.36	-12%
Investing Activities	**-15.41**	**-16.95**	**-20.63**	**-27.98**	**-23.94**	**-28.91**	**-32.55**	**-27.54**	**-29.84**	**-30.81**	**-41.22**	**-295.77**	**-152%**
Sale of Common and Preferred Stock	1.16	1.03	0.91	1.31	5.31	2.12	3.57	3.49	1.96	1.59	3.46	25.91	13%
Purchase of Common and Preferred Stock	-0.18	-2.31	-4.65	-3.09	-3.53	-4.58	-7.37	-7.14	-6.09	-13.31	-10.56	-62.81	-32%
Cash Dividends	-2.89	-4.51	-7.05	-8.20	-8.71	-9.03	-10.78	-9.66	-12.21	-14.10	-13.88	-101.03	-52%
Long-Term Debt - Change	-0.92	2.01	4.97	7.66	6.86	8.66	12.24	7.39	7.96	10.49	17.50	84.82	43%
Current Debt Changes	-0.40	-1.06	0.73	0.04	-0.62	0.63	-0.27	0.00	1.93	6.92	-4.97	2.92	1%
Other financing activities	-0.09	0.24	0.53	0.67	-1.10	-1.02	0.14	1.32	0.94	1.54	0.59	3.77	2%
Financing Activities	**-3.32**	**-4.60**	**-4.55**	**-1.62**	**-1.78**	**-3.21**	**-2.48**	**-4.60**	**-5.51**	**-6.88**	**-7.87**	**-46.41**	**-24%**

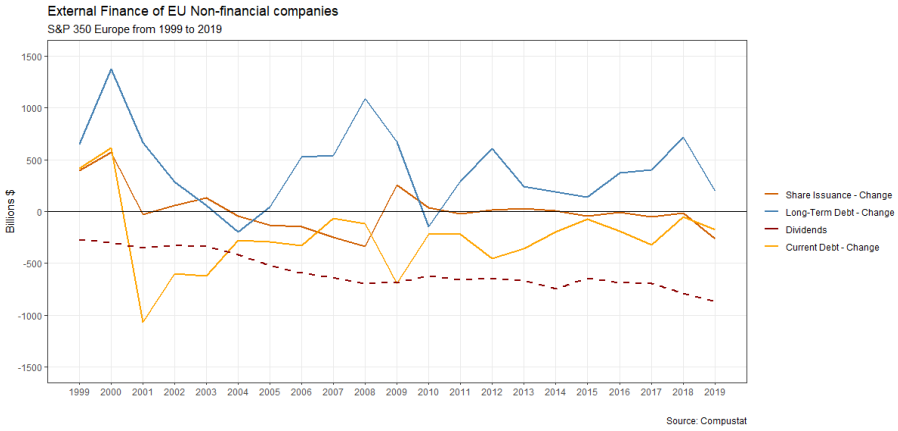
Panel B: Euro Climate Firms from 2009 to 2019

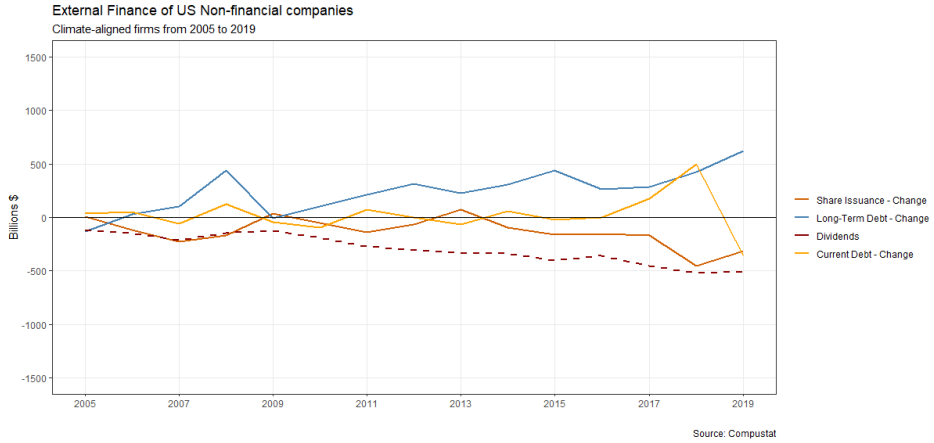
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Percentage of Net Income
Income Before Extraordinary Items	9.02	7.25	8.59	9.90	6.14	8.77	1.87	7.71	8.42	6.95	12.16	86.78	
Depreciation and Amortization	15.83	16.20	15.49	15.76	16.44	16.14	17.29	16.39	17.21	17.70	21.62	186.07	214%
Other operating activities	2.81	2.83	-2.26	-0.05	2.15	-0.40	4.74	0.85	-1.65	1.86	-2.94	7.94	9%
Operating Activities - Net Cash Flow	**27.66**	**26.28**	**21.82**	**25.61**	**24.73**	**24.51**	**23.90**	**24.95**	**23.98**	**26.51**	**30.84**	**280.79**	**324%**
Capital Expenditures	-30.74	-27.48	-26.89	-29.59	-27.99	-28.21	-30.27	-29.42	-31.39	-33.66	-35.99	-331.63	-382%
Acquisitions	-15.71	-0.98	-0.57	-0.64	-0.33	-0.20	-2.21	-1.28	-5.44	-0.45	-0.95	-28.76	-33%
Other investing activities	18.48	-0.95	11.82	6.73	7.50	13.21	20.26	4.97	13.13	7.28	11.26	113.69	131%
Investing Activities	**-27.97**	**-29.41**	**-15.64**	**-23.50**	**-20.82**	**-15.20**	**-12.22**	**-25.73**	**-23.70**	**-26.83**	**-25.68**	**-246.70**	**-284%**
Sale of Common and Preferred Stock	0.37	1.27	0.10	0.35	0.13	0.74	0.68	0.06	6.65	0.12	3.23	13.70	16%
Purchase of Common and Preferred Stock	-0.29	-0.33	-0.31	-0.20	-0.03	-0.45	-3.73	-0.08	-0.10	-0.30	-1.76	-7.58	-9%
Cash Dividends	-4.06	-5.36	-5.09	-5.88	-5.48	-5.21	-5.32	-3.83	-4.46	-4.81	-5.77	-55.27	-64%
Long-Term Debt - Change	13.33	4.44	3.32	8.66	5.17	-1.23	3.91	2.81	-2.66	4.04	1.61	43.40	50%
Current Debt Changes	-1.53	-0.85	-1.20	-0.98	-1.25	-1.59	0.26	-0.95	-0.53	-0.88	-0.53	-10.03	-12%
Other financing activities	-8.22	-0.23	3.91	-1.91	0.84	8.47	3.62	2.17	3.21	8.59	-1.71	18.74	22%
Financing Activities	**-0.40**	**-1.06**	**0.73**	**0.04**	**-0.62**	**0.73**	**-0.58**	**0.18**	**2.11**	**6.76**	**-4.93**	**2.96**	**3%**

Appendix 3


External Finance of US Non-financial companies
S&P 500 Composite from 1971 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of EU Non-financial companies
Climate-aligned firms from 2005 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of EU Non-financial companies
S&P 350 Europe from 1999 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat


External Finance of US Non-financial companies
Climate-aligned firms from 2005 to 2019
Billions $
1500
1000
500
0
-500
-1000
-1500
2005 2007 2009 2011 2013 2015 2017 2019
Share Issuance - Change
Long-Term Debt - Change
Dividends
Current Debt - Change
Source: Compustat

Appendix 4

Panel A: Corporate Bond and Long-term Debt Financing for all firms in the FISD dataset from 1995 to 2018

	1995-2000	2001-2005	2005-2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Corporate Bonds Issuances	263.18	463.95	899.75	219.02	263.13	336.04	309.87	488.99	415.62	502.51	300.88	4462.94
Long-Term Debt - Issuance	2772.88	4517.24	8727.86	1218.78	1452.25	1561.73	1755.39	1999.94	2041.81	2057.18	2051.06	30156.10
Corporate Bonds Repayments	69.70	173.63	293.49	64.80	76.27	97.66	110.67	98.70	164.24	178.02	178.76	1505.95
Long-Term Debt - Repayments	1975.81	3556.81	7473.27	1429.15	1494.50	1304.85	1333.66	1437.51	1582.91	1725.46	1805.86	25119.81
Net Corporate Bond Financing	**193.48**	**290.32**	**606.26**	**154.22**	**186.86**	**238.38**	**199.20**	**390.29**	**251.37**	**324.50**	**122.12**	**2956.99**
Net Long-Term Debt Financing	**797.06**	**960.43**	**1254.59**	**-210.37**	**-42.25**	**256.88**	**421.73**	**562.43**	**458.91**	**331.72**	**245.19**	**5036.30**

Panel B: Corporate Bond and Long-term Debt Financing for US Climate Firms from 2005 to 2018

	2005-2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Corporate Bonds Issuances	19.28	3.63	4.90	6.78	8.44	8.12	6.68	9.20	10.80	77.84
Long-Term Debt - Issuance	85.04	18.51	25.51	24.81	30.39	36.37	31.16	37.22	40.06	329.08
Corporate Bonds Repayments	12.21	1.22	1.51	0.72	2.12	2.91	1.79	3.18	1.95	27.60
Long-Term Debt - Repayments	76.09	13.75	17.42	17.89	21.63	23.65	23.43	29.09	29.66	252.61
Net Corporate Bond Financing	**7.08**	**2.41**	**3.39**	**6.05**	**6.33**	**5.21**	**4.89**	**6.03**	**8.85**	**50.24**
Net Long-Term Debt Financing	**8.95**	**4.77**	**8.10**	**6.92**	**8.76**	**12.72**	**7.73**	**8.13**	**10.40**	**76.47**