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Are stock buybacks crowding out real investment? Empirical evidence from U.S. firms*

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Abstract

We investigate the role of financialization in the decline of investment for U.S. non-financial firms from 1992 - 2017. We show that the tendency to maximize shareholder value, fuelled by stock-based manager compensation, has led U.S. firms to divert resources from real investment to share repurchases to increase stock prices. Using micro-data from U.S. firms balance sheets and manager compensation, we estimate two dynamic panel data models: (i) to analyze the effects of share repurchases on capital investment; (ii) to examine the interaction between stock-based CEO pay and the likelihood of share repurchases. We find that stock buybacks have a negative effect on capital investment with this effect being stronger among large firms, operating in non-competitive markets. Moreover, an increase in stock options make firms more likely to repurchase shares. Our findings suggest that stock-based compensation creates incentives for managers to focus on increasing shareholder value by repurchasing shares at the cost of declining real investment and long-run growth.

Keywords: Share repurchases, stock options, investment, shareholder value, firm data

JEL Codes: C23, D20, G11, G31, G35

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1 Introduction

A spectre is haunting the U.S. economy - the spectre of stock buybacks.

In March 2014, Laurence Fink, BlackRock's CEO, warns in a letter to S&P 500 corporate executives 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."[1] Yet, by looking at the recent figures, it seems that US corporate executives did not take Mr Fink's concerns too seriously.

In the course of 2018, indeed, S&P 500 companies spent an all-time high of $811 billion in share repurchases, nearly 50% up from 2017, over $200 billion more than the previous record set in 2007.[2] Some have linked the recent upsurge in stock buybacks to the Tax Cuts and Jobs Act (TCJA), a fiscal reform passed by U.S. Congress in November 2017 that triggered massive tax savings on corporate earnings and repatriation of overseas profits; economic resources that, instead of financing new investment projects, were largely redirected to the stock market, potentially fuelling a new financial bubble.[3][4]

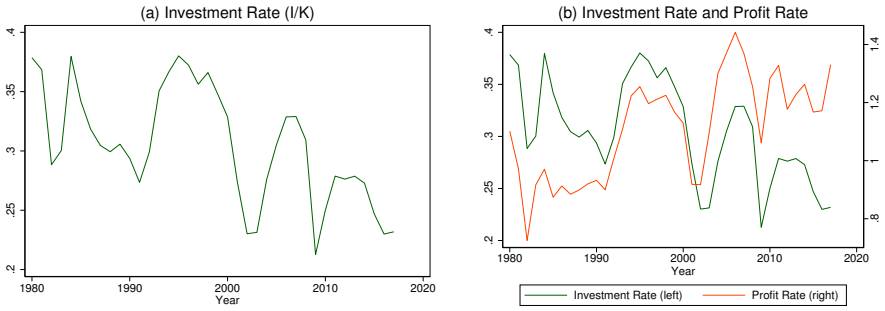

Figure 1.1: Source: Calculation based on Compustat database from WRDS.

Taking a longer-term view, it emerges that the investment rate of U.S. firms has been constantly slowing down over the past four decades, as shown in Figure 1.1; the annual growth rate of gross capital stock for 1695 S&P non-financial corporations was around 32% in the 1980s and declined steadily up to 26% in

[1] The text of the letter by BlackRock's CEO, Laurence Fink, is available online: http://online.wsj.com/public/resources/documents

[2] https://www.goldmansachs.com/insights/pages/top-of-mind/buyback-realities/report.pdf

[3] Bennett et al. (2019) decompose the effects of TCJA's tax cuts on corporate policies and find that the sharp increase in share buybacks was mainly driven by the cut in the repatriation tax, while tax savings from corporate income were primarily used to pay down debt and finance new capital expenditure.

[4] https://www.washingtonpost.com/business/economy/a-year-after-their-tax-cuts-how-have-corporations-spent-the-windfall/2018/12/14/e966d98e-fd73-11e8-ad40-cdfd0e0dd65a_story.html

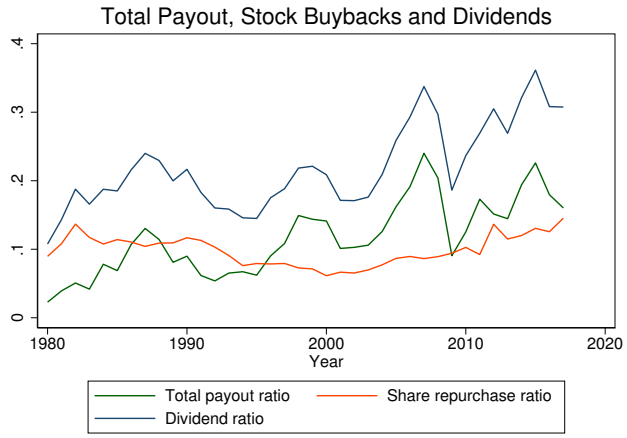

Figure 1.2: Source: Calculation based on Compustat database from WRDS.

the 2010s. Yet, from the right panel, it can be seen that the decline in physical investment has occurred despite a high and increasing profit rate, with this gap getting wider after the dot-com crash of the early 2000s and, to a greater extent, after the Great Recession of 2008. This means that, in the last two decades, the U.S. business sector has been systematically under-investing with respect to profitability.

Furthermore, by looking at the evolution of the gross payout ratio in Figure 1.2, it can be seen that, while investment was faltering, U.S. firms have been distributing an increasing share of profits to shareholders. The total payout almost doubled from 33% in 1995 to 60% in 2016. In this figure, it is also clearly shown that the rise in the payout ratio is primarily driven by the increase in stock buybacks, which, since the mid-90s, have increased, on average, by 20 percentage points – from 14% to 34% –, whereas dividend payment remains roughly constant around 20% of net earnings over the entire period.

Meanwhile, empirical research have documented that the average share-based component, consisting in stocks and stock options, of CEO in S&P 500 firms has significantly increased, going from 25% in 1992 to 60% in 2014 (Bhargava, 2013; Edmans et al., 2017), as shown in Figure 1.3.

This evidence raises a few questions: why should U.S. firms prefer to distribute profits to shareholders by repurchasing shares instead of investing in capital assets? Did the shift towards share-based executive compensation affect managers' incentives structure in favor of short-term market valuation? What is the role of expectations of financial investors on the future development of stock price in influencing firm's investment decisions?

The aim of this paper is to empirically investigate whether the tendency to maximize the stock market value, fueled by stock-based manager compensation, has led U.S. firms to divert resources from capital investment towards share

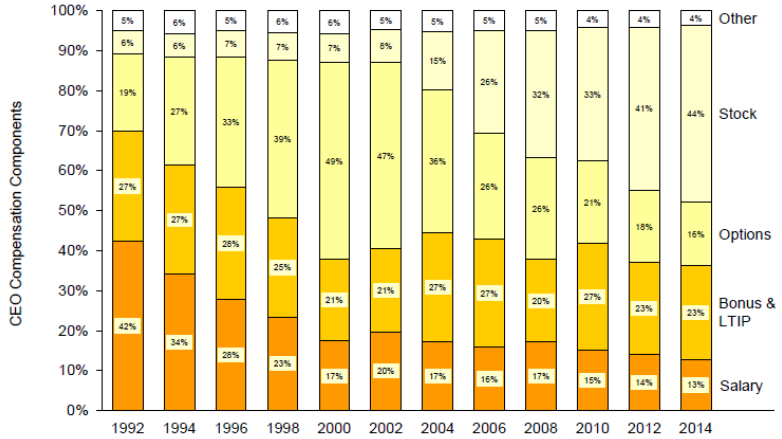

Figure 1.3: CEO compensation by different components in S&P 500 firms, 1992-2014. Source: From Edmans et al. (2017).

repurchases in order to boost stock prices. Indeed, by simultaneously increasing the demand of shares and reducing the supply of total shares outstanding, stock buybacks are expected to have a positive effect on the share price.[5] With a substantial part of total compensation consisting in stocks and stock options, managers might have a personal interest in creating value for shareholders by repurchasing shares at the cost of declining investment and long-run growth.

Using micro-data from U.S. firms balance sheets and manager compensation, we estimate two panel data models: (i) an investment model to analyze the effects of stock buybacks on capital investment and (ii) a share repurchase model to examine the interaction between stock-based CEO pay and the likelihood of share repurchases. The investment model is estimated by using the Arellano-Bond GMM estimator, which allows to control for both unobserved heterogeneity and the endogeneity problem arising from the dynamic setting; whereas for the share repurchase model we adopt a Random Effect-Tobit regression, since this approach is particularly suitable in case of censored dependent variables.

We find that share repurchases have a negative effect on capital investment, with this effect being stronger among large firms operating in non-competitive markets. Additionally, an increase in exercised and un-exercised exercisable stock options makes firms more likely to repurchase shares. Our findings, therefore, suggest that stock-based compensation creates incentives for managers to focus on shareholder value by repurchasing shares, with this coming at the cost of lower investment.

[5]The actual impact of share buybacks on the stock price ultimately depends on the market reaction, and thus on financial investors' expectations, to a share repurchase announcement, whose effect is ambiguous in the literature (**?**).

2 Literature review

This section presents the recent developments in the empirical literature on investment and share buybacks, starting from a discussion about the origins, the role and the limits of the principle of shareholder value maximization in corporate governance.

2.1 Preliminary debate

Since the emergence of the modern corporation at the dawn of the 20th century, many scholars have questioned whether the separation of ownership and control would give rise to a conflict of interests between shareholders and managers and more broadly entail a qualitative change in the decision making process within the firm.

According to Fama and Jensen (1983) and Jensen (1986), agency problems arise because those who manage the organization do not bear a major share of risk and wealth effects of their decisions; consequently, they are likely to take advantage of opportunistic behaviour that deviate from the interest of the ultimate risk-bearer, i.e. the owner. Therefore, to limit the managers' discretionary power over corporate resources and realign their interests with shareholders', the agency theory contends that publicly-listed corporations need to introduce 'mechanisms of control' that ensure the company is run according to the maximization of shareholder value. These mechanisms include: (i) the constitution of a board of directors appointed by shareholders, (ii) the adoption of share-based management remuneration (alias internal or organizational factors), and (iii) the development of efficient capital markets, or market of corporate control (alias external or market-based factors).

The economic rationale underlying the agency theory is the following: as long as the share price correctly reflects the discounted value of the expected future stream of cash flows, all internal decisions undertaken by the firm should be aimed at maximizing the market value of equity. Accordingly, shareholder value maximization is not only the primary goal of corporate governance, but also the ultimate measure through which each and every company's activity is to be assessed.

Despite its increasing popularity in economics and finance textbooks as well as among policy makers, the agency theory has become object of numerous criticisms over the years.

Scholars from behavioural corporate finance (cfr. Shefrin, 2001) point out that, in a context of 'irrational' markets, rational managers eager to maximize the stock market value may be led to undertake misguided decisions which eventually impair the future growth prospects of the firm. If the stock market is populated by speculative investors, in fact, the emphasis on the creation of shareholder value might induce managers to overlook long-term investment projects, in favour of short-term financial operations (Baker and Wurgler, 2004b, 2013).

This critique is embraced and further extended by Lazonick and O'sullivan

(2000), who blame the agency theory for the disappointing economic performances of the U.S. corporate sector throughout the 1980s, a time in which the international competition from developing countries was tightening. The authors argue that the increasing orientation towards shareholder value, fostered by those institutional and organizational factors firmly advocated by agency theorists, have induced a shift in the management strategy from "retain-and-reinvest" to "downsize-and-distribute". While during the glorious thirty years following WWII corporations used to retain and reinvest most of their profits in the production process, the rise of 'shareholder value ideology' encouraged a quest for short-term profits through cuts in the labor force and a rapid distribution to shareholders by means of dividend payment and stock buybacks.

2.2 Empirical literature

2.2.1 Alternative hypotheses of low investment

The prolonged period of economic slowdown that is characterizing the development of the global economy in the aftermath of the Great Recession has reinvigorated the research interest in the driving forces of investment and growth. As we have seen in Figure 1.1 and 1.2, the investment rate for the U.S. corporations had been declining even before the financial crisis, while in the same period average profitability and market valuation were growing.

Against the background, Gutiérrez and Philippon (2016) distinguish between two different theories of low investment: "theories that predict low investment *because* they predict low Tobin's Q and theories that predict low investment *despite* high Tobin's Q". Given that over the last twenty years investment has systematically lagged behind Tobin's Q, the authors believe that the second group of theories requires a deeper investigation. Among them, the recent empirical literature has paid particular attention to the following hypotheses: weak aggregate demand, uncertainty, market concentration and financialization.

Bond et al. (????) highlight that in case of persistent bubbles in stock market, the standard Q-ratio is affected by measurement errors which cast doubt on its explanatory power; in this case, cash flow variables may provide additional information to explain corporate investment. Yet, the interpretation of cash flow variables is not always straightforward, in that the latter can be seen as a measure of either financing constraints (Fazzari et al., 1987) or expected future profitability not captured by Tobin's Q (Bond et al., ????). To disentangle the effects of cash flow between financing conditions and expected profits, the authors test the effects of professional earnings forecasts from IBES database. Based on a sample of 700 publicly traded UK companies, the results show that, once they control for analysts forecasts, cash flow variable becomes insignificant, meaning that, rather than financing constraints, such a variable reflects the expectations on future profits that are not captured by Tobin's Q. Yet, when alternative cash-flow measures, such as sales growth, are considered, the estimated coefficient turns out to be still positive and significant.

In the Keynesian literature, cash flow variables, like sales, are conceived as a proxy for capacity utilization and thus aggregate demand, which play a crucial role in the determination of the expectations of future profits and investment decisions. Early attempts in this field comprise the 'accelerator investment models' (e.g. Meyer and Kuh, 1957; Evans, 1967) as well as the studies on the Post-Keynesian theory of investment function (Fazzari and Mott, 1986; Bhaduri and Marglin, 1990). Lately, many empirical works have emphasized the role of weak demand and radical uncertainty in explaining the investment decline, especially in the aftermath of the Global Financial Crisis (e.g. Bond et al. (2015) on Italian manufactoring sector; Bussière et al. (2015) on a set of 22 advanced economies).

The aforementioned hypotheses emphasize the role of real factors in the decline of investment, such as weak demand, low expected profits, high uncertainty, etc. Little regard has been paid to financial factors, except for financing constraints which, as we have seen, have played only a limited role. However, it should be noted that the long-lasting decline in the investment rate has occurred in a context of global financial deepening. This unusual coexistence between economic stagnation and financial expansion led many scholars to question the relationship between the real and the financial sector of the economy, with a particular focus on the impact that the development of capital markets had had on ownership structure, corporate governance and investment decisions in non-financial corporations, both in developed and developing countries.

Gutiérrez and Philippon (2016, 2017) investigate the effects of market concentration and common ownership on investment and stock buybacks for U.S. companies. The idea is that firms operating in non-competitive markets do not face the threat of entry firms and thus have weak incentive to innovate and invest. Moreover, those firms whose shares are held by institutional investors, i.e., quasi-indexer institutional ownership, are more focused on short-term market capitalization rather than long-run growth; by reducing manager's planing horizon, common ownership puts pressure on managers to create value for shareholders by increasing payout ratios and financial investment at the cost of lower real investment. The authors claim that, despite the fact that they invest less, "these firms spend a disproportionate amount of free cash flows buying back their shares" (Gutiérrez and Philippon, 2017).

Stockhammer (2004) has had a pioneering role in the empirical investigation on the link between 'financialization' and investment. According to a widely-cited definition put forth by Epstein (2005), financialization is "the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies". In his paper, Stockhammer develops a microeconomic theory of the firm to explain how financialization, by shifting the balance of power towards shareholders, shifts management's priorities towards short-term profits at the cost of a lower desired growth rate. Building on this theoretical framework, he conducts an empirical analysis on the effects of financialization on capital accumulation in four advanced economies, viz. US, UK, Germany and France. The variable used as a proxy for financialization is 'rentier income', that is the ratio of in-

terests and dividends gained from the financial sector over value added. The underlying hypothesis is that an increase in rentier income arising from financial opportunities would create an incentive for managers to invest in financial rather than productive activities, because the latter involves greater a risk and a longer gestation period. He finds that financialization has a negative impact on real investment in the Anglo-Saxon countries, while this effect is negligent in Germany and France.

Similarly to Stockhammer (2004), Van Treeck (2008) carries out an empirical and theoretical analysis to study how the increasing orientation towards shareholder value has influenced the accumulation of capital in several developed countries. Yet, differently from the previous author who focuses on rentier income, van Treeck investigates the role of financial payments, i.e. the sum of interest and dividend, in impeding real investment by reducing the availability of internal funds. He finds a significant negative effect of financialization on investment in U.S., while the effects are somehow mixed for U.K., Germany and France.

While both Stockhammer and Van Treeck's analyses are grounded on a time series framework using country-level data, Orhangazi (2008) assesses the financialization hypothesis through a panel data model using firm-level data from U.S. non-financial corporations. His objective is to jointly test the two channels through which financialization affects investment, i.e. the 'incentive' channel and the 'resource' channel, by employing two different financial variables: (i) *financial profits*, that is, the amount of income gained from financial operations, measured by the sum of interest income and equity in net earnings, and (ii) *financial payouts*, that is, the total payments to the financial sector, given by the sum of interest expense, cash dividends and stock buybacks. The regression results show that financial payments have a negative effect on investment, regardless the type of industry and firm size, whereas the impact of financial profits is negative for large firms but positive for small ones, suggesting that the latter may use proceeds from financial activities to finance real investment. More recently, the financialization hypothesis has received further support from Davis (2018) for the US business sector and Tori and Onaran (2015, 2018) for the UK and other European countries. Furthermore, Villani (2019) finds that financialization, by promoting a model of accumulation based on shareholder value that discourages long-term investment, has exacerbated the saving-investment imbalance among G7 countries, paving the way to the rise of corporate net lending.

In the aforementioned empirical works, the role of financialization on investment is captured by the stream of financial payments and/or financial profits which firms payout to or receive from the financial market. However, in Figure 1.2 we have seen that the rise in payout ratio of U.S. corporations is primarily driven by the increase in stock buybacks, which since the mid-90s have systematically overcome dividend payments, becoming the primary source to remunerate shareholders.[6] For this reason, we believe that an investigation on the role of

[6]In Europe, the dividend payment remains the preferred method to remunerate share-

stock buybacks and their effect on investment deserve more attention.

2.2.2 Stock buybacks: motives and consequences

The corporate finance literature provides valuable insights into the analysis of the underlying motives of stock buybacks and their effects on firm performance.

A variety of explanations for the rise in share buybacks has been put forward in the empirical literature. A non-exhaustive list includes the following contributions:

- *price support hypothesis*: companies undertake share buybacks in order to boost the stock price and generate abnormal returns, also in presence of overvalued equity (Liu and Swanson, 2016)[7],
- *free cash flow hypothesis*: share repurchases serve to distribute cash flow in excess of that required to fund profitable investment in order to avoid over-investment and mitigate agency problems (Jensen, 1986; Grullon and Michaely, 2004; Lee and Suh, 2011),
- *signaling* (or information content) *hypothesis*: by repurchasing shares, firms send signals about future profitability to investors when markets are incomplete (Massa et al., 2007),
- *catering hypothesis*: firms tend to "cater" to prevailing investor demand for cash payouts by increasing buybacks if they perceive a positive stock market premium, while they cut payouts when the premium is negative (Baker and Wurgler, 2004a,b; Jiang et al., 2013).

As regards the effects of stock buybacks on investment and firm performance, Bhargava (2013) studies the dynamic inter-relationship between CEO pay, share repurchases and investment from a sample of 700 US firms. He finds that while stock-based remuneration schemes, such as exercised and granted options, have a positive impact on firms' propensity to repurchase shares, stock buybacks are negatively related with real investment, such as R&D and capital assets.

Almeida et al. (2016) examine the impact of EPS forecast on the likelihood of share repurchases and the consequent effect on the real investment. The results show that the probability of repurchasing is higher for those firms that would just miss the EPS forecast in absence of a repurchase program, confirming the idea that buybacks are used as a strategic operation to meet financial targets. Moreover, similarly to Bhargava (2013), they find that EPS-motivated repurchases are detrimental to real investment in so far as share buybacks are largely financed with resources that could have been spent for real, productive investment, such as employment, R&D and capital expenditure.

holders, though, since the late 1990s, stock buybacks have dramatically increased also among European firms (Sakinc (2017).

[7]This view is also embraced by the famous American investor Warren Buffet, who in his 2000 Berkshire letter states: "repurchases are all the rage, but too often are made for an unstated and, in our view, ignoble reason: to pump or support the stock price".

By providing a comprehensive analysis of the role of financialization in the decline of real investment, the present paper attempts to build a bridge between the empirical literature on investment and that on stock buybacks. Indeed, the goal is not only to investigate the effects of financialization on investment, but also to shed lights on the underlying mechanisms that may induce firms to be increasingly focused on shareholder value. To do this, we estimate two panel data models: (i) an investment model to study the effects of stock buybacks on capital investment, and (ii) a share repurchase model to explore the role of share-based manager compensation in influencing the likelihood of share buybacks.

3 Descriptive evidence

To explore the relationship between investment, share repurchases and stock-based compensation, we first inspect the descriptive statistics from our sample population, by comparing mean values of key variables by groups: (i) repurchasing versus non-repurchasing firms, and (ii) option-paying versus non-option-paying firms. Additionally, the t-test for equal means is performed to check whether such differences are statistically significant.

Table 3.1: Repurchasing vs Non-repurchasing firms, t-test. 1980-2017

	(1) Repurchasing m1	(2) Non-repurchasing m2	(3) Difference m2-m1
Re-investment rate	0.37	0.44	0.07***
Profit rate	0.17	0.15	-0.02***
Dividend rate	0.10	0.08	-0.02***
Cash/Assets	0.16	0.18	0.02***
Market-to-Book	2.91	2.53	-0.37***
EPS	1.72	0.90	-0.82***
Observations	15835	15264	31099

Note: *Re-investment rate*: capital expenditure (CAPEX) over gross operating surplus (OIBDP); *Profit rate*: gross operating surplus (OIBDP) over capital stock (PPENT); *Dividend rate*: dividend payment (DVDP) over total asset (AT); Cash*/Asset*: cash holding (CHE) over total asset (AT); *Market-to-Book ratio*: Market value of equity (CSHO*PRCC_F) over book value of equity(AT-LT); *EPS*: net operating surplus (OIADP) over common shares outstanding (CSHO). The group of (non-) repurchasing firms is made of firm-year observations with (zero) positive share repurchase (PRSTKC).

From Table 3.1 we notice that, on average, firms that repurchase shares (column 1) have a higher profit rate (+2%) but lower re-investment rate (-7%) with respect to firms that do not repurchase shares (column 2). Meaning that,

although they earn more, they re-invest less. Furthermore, repurchasing firms tend to pay more dividend (+2%) and accumulate less cash holdings (-2%). Consequently, it is not surprising that repurchasing firms report better financial performance, as reflected by the higher market valuation and EPS, respectively +15% and +91% in percentage points. In summary, share repurchasing firms tend to retain and reinvest a lower share of profit than non-repurchasing firms, despite of their higher profitability and market valuation. Moreover, the higher dividend ratio and lower cash holdings seem to suggest that, consistent with the free cash-flow hypothesis, the richest firms tend to distribute cash flow in excess to shareholders by repurchasing shares to avoid over-investment and mitigate agency problems.

Table 3.2: Options paying vs Non-option paying firms, t-test. 1980-2017

	(1) Option paying m1	(2) Non-option paying m2	(3) Difference m2-m1
Re-investment rate	0.34	0.43	0.08***
Profit rate	0.19	0.15	-0.04***
Share Repurchase ratio	0.21	0.09	-0.12***
Market-to-Book	3.58	2.36	-1.21***
EPS	2.06	1.00	-1.06***
Dividend rate	0.09	0.09	-0.00
Cash/Asset	0.17	0.17	0.00
Observations	9270	21829	31099

Note: *Re-investment rate*: capital expenditure (CAPEX) over gross operating surplus (OIBDP); *Profit rate*: gross operating surplus (OIBDP) over capital stock (PPENT); *Dividend rate*: dividend payment (DVDP) over total asset (AT); *Share repurchase ratio*: share repurchase (PRSTKC) over common shares outstanding (CSHO); *Cash/Asset*: cash holding (CHE) over total asset (AT); *Market-to-Book ratio*: Market value of equity (CSHO*PRCC_F) over book value of equity(AT-LT); *EPS*: net operating surplus (OIADP) over common shares outstanding (CSHO). The group of (non-) option-paying firms is made of firm-year observations with (zero) positive exercised (OPT_EXER_VAL) stock options.

Table 3.2 shows the difference in mean between option-paying vs non-option paying firms, with the corresponding significance level from the t-test. Similarly to repurchasing firms, stock option-paying firms on average have a higher operating surplus (+4%) but a lower re-investment rate (-8%) than their counterparts. Moreover, share repurchases are considerably higher (+12%) among firms paying stock options to CEOs, which also exhibit significantly higher values of market valuation (+51%) and EPS (+106%). Therefore, in line with our hypothesis, this evidence seems to corroborate the idea that firms paying stock options to managers are more likely to repurchase shares to support market valuation – a hypothesis that will be further explored in the regression

model. Finally, the differences in average dividend and cash holdings are insignificant between the two groups. To sum up, we observe similar patterns in investment behavior and operating performance between repurchasing and option-paying firms, vis-à-vis their respective counterparts. Like their repurchasing peers, stock option-paying firms retain and re-invest a lower share of profits than non-option paying firms, despite a relatively higher profitability and market valuation. There seems to be no substantial differences in dividend and cash holdings, whereas share repurchases are significantly higher among those firms that pay stock options to managers.

In Figure 3.1, average investment and share repurchase rate by size quintiles are compared, where size is defined by firm's total asset (in log). The figure shows that the investment rate is monotonically decreasing along firm size, whereas repurchase rate is monotonically increasing. Therefore, on average, small firms have a higher investment rate than large firms, 27% against 20% respectively, and tend to repurchase a lower amount of shares of less than 1% of operating surplus in contrast to 20% spent by firms in the largest cohort. One can interpret these figures by arguing that small firms invest more because of higher growth opportunities than large firms which, conversely, have reached a mature phase with declining growth prospects. The market structure in which those firms operate also matters. Indeed, large firms tend to be concentrated in less competitive markets, where the decline in competition creates an incentive to adopt collusive behavior to defend their market position at the cost of lower innovation and investment (Gutiérrez and Philippon, 2017).

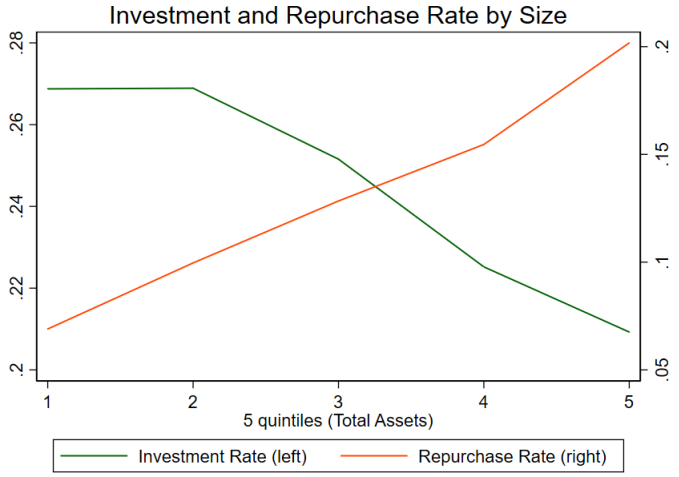

Figure 3.1: Source: Calculation based on Compustat from WRDS.

From Table 3.3 we can also see that, on average, the largest firms not only

Table 3.3: Sample mean of selected variables by firm size, 1980-2017

Size	Investment	Repurchase	Profits	Cash	Leverage	MtB
1 Smallest	0.27	0.07	0.14	0.23	0.17	2.26
2	0.27	0.10	0.17	0.21	0.17	2.50
3	0.25	0.13	0.17	0.18	0.20	2.60
4	0.24	0.15	0.18	0.13	0.26	2.90
5 Largest	0.20	0.20	0.17	0.12	0.28	3.38
N	31026	31026	31026	31026	31026	31026

Note: All variables are scaled by total assets, except investment by capital stock.

invest less and repurchase more with respect to the smaller ones, but they also exhibit a higher profit rate, a higher leverage ratio, while they tend to keep a lower share of assets as cash holdings.

From this descriptive evidence it emerges that, although large firms have a greater capacity to raise funds both internally via profits and externally via borrowings than small firms, they retain and reinvest less, but report significantly higher payout ratio.

4 Data

To estimate the panel data models on investment and share repurchases, we use two different data sets from U.S. firms, namely S&P Compustat for annual balance data and ExecuComp for annual manager compensation data.

The data cleaning process is carried out in accordance with standard procedures in the literature. We start with a data set containing all firm-year observations for S&P Compustat U.S. firms between 1980-2017. Then we exclude financial (SIC codes 6000-6999) and utility (SIC codes 4000-4999) companies because they are subject to a specific regulatory framework. Moreover, we require the dependent variables (capital expenditure and share repurchase), as well as some main explanatory variables (market-to-book ratio, sales, cash dividend), to have non-missing and non-negative values. Firm-level data are known to be characterized by the presence of large outliers. To tackle this issue, we adopt a twofold strategy: first, all variables included in the regression model are winsorized, that is, observations falling into the upper or lower 1% of each variable's distribution are dropped; second, we exclude firms with permanently negative operating profits, which is a signal of unusual financial troubles. In addition, we require firms to have at least 4 years of life to exclude newly born firms whose economic performance might be impaired with respect to the average firm. After the cleaning process, the resulting data set consists of 31,099 firm-year observations across 1695 firms and 38 years, from 1980 to 2017.[8]

[8] As a robustness check, we re-estimate all the regression models presented in Section 2.5 by using before-cleaning raw data sets. The results, available upon request, do not report significant qualitative differences.

The ExecuComp database provides information about managers' personal characteristics and compensation by income type from 3671 firms since 1992. In order to compare the two data sets, manager data are rearranged by firm: for each variable the yearly average of top five executives by firm is computed. This method permits to compare ExecuComp with Compustat annual data on firms by using firm's identifier (code 'gvkey') to match common firm-year observations. Following Bhargava (2013), the focus is restricted to the top five executives in that they are likely the most influential individuals in the corporate governance, those who undertake the relevant decisions concerning the business model and the investment strategy of the company. the top five executives are defined by ranking all the company's managers by income (salary plus bonus) and keeping those with the five highest scores. Given the extremely high variance in stock options across firms, the same data screening process used for Compustat data is applied. In this case, because the distribution of stock options is highly skewed towards the left, meaning that many firms do not use stock-based compensation at all, we drop observations only in the upper 1% of the distribution. Except for in-the-money stock option, whose observations falling into the bottom 1% are also cut, given the presence of highly negative values in the left-tail of the distribution. Finally, we exclude missing values for the main explanatory variables included in the regression model, that is exercised stock options, unexercised stock options and in-the-money vested options. The final data set consists of 3,671 firms across 26 years, for a total of 43,659 time-year observations.

Subsequently, the Compustat and ExecuComp data sets are merged using firm identifier and year. Of the total 61,627 firm-year observations, only 13,131 are matched after merging the two data sets, consisting in 1006 Compustat firms exhibiting non-missing values of stock-options for the period of 1992-2017. This is the data set used to estimate our regression models.

Some considerations about the size and the nature of the panel data might be useful. Firstly, it is possible that our panel data is not very representative of the entire population of U.S. firms but is likely to over-represent large firms.[9] Consequently, it is important to bear in mind that our conclusions apply especially to medium-large public corporations. Nevertheless, to prove that the empirical relationship between investment and share repurchases is robust to wider samples of firms, we estimate the investment model (in which stock options are not included) also using pre-merger Compustat firm data which starts from 1980, thereby including both options-paying and non-options-paying firms. Therefore, contrary to other works (Bhargava, 2013), we use an unbalanced panel data in order to avoid excessive sample biases arising from a balanced panel.

The table of summary statistics of the regression variables is available in Appendix A.

[9]This is due essentially to two reasons: (i) large firms can afford to pay stock options to corporate managers more than what small firms can do; (ii) private non-listed companies are a priori excluded from Compustat data set.

5 Regression analysis

This section discusses in details the regression strategy used to estimate the investment and share repurchase models, that is the variables definition for each model specification as well as the estimation methods and results.

5.1 Investment model

5.1.1 Definition of variables

Let us examine the variables employed in the regression model of the investment function.[10] The investment equation we are going to estimate is

$$(I/K)_{it} = \beta_0 + \beta_1 (I/K)_{it-1} + \beta_2 (REP/TS)_{it-1} + \beta_3 (X)_{it-1} + \eta_t + \mu_i + \epsilon_{it}. \quad (5.1)$$

Given that the investment process is an intrinsically dynamic phenomenon, we adopt a dynamic panel data model. Indeed, in so far as firms make investment decisions based on expectations of future returns, which, in turn, are affected by past performances, we expect capital stock to slowly adjust to changing economic conditions. The inclusion of the lagged dependent variable on the right-hand side captures the dynamics of the changes in capital to its desired level, while the first lag of the explanatory variables reflects the role of past performance on the current investment decision.

The dependent variable is the investment rate, given by the ratio of gross capital expenditure (CAPEX) over beginning-of-the-year capital stock (L.PPENT); this is a measure of the annual growth rate of capital stock, before depreciation. The main explanatory variable consists in the share repurchase ratio, that is the gross repurchase (PRSTKC) over the lagged total common shares outstanding (CSHO). We also employ an alternative, more formally correct, measure of share repurchase according to the simulation experiment by Banyi et al. (2008), that is gross share repurchase (PRSTKC) minus preferred stock (PRSK) over lagged total book assets (AT). In line with the empirical literature on investment, we include a set of independent variables ($X_{i,t-1}$) from firms balance sheets, which are presented below, as well as time year dummies to control for macroeconomic shocks.

Among the set of independent variables, first the following cash flow variables are considered: sales (SALES), as a proxy for capacity utilization to capture the demand effects (Fazzari and Mott, 1986) and operating surplus (OIBDP = "operating income before depreciation"), which might both explain financing constraints (Fazzari et al., 1987) or expected future profitability (Bond et al., ????); both variables are scaled by lagged capital stock (L.PPENT). As an alternative measure of operating performance, ROA is also considered, that is net income (OIADP-XINT-TXT = operating surplus before depreciation minus taxes and interest expenses) over lagged book asset.

Second, to analyze the effects of financing constraints on investment which are not captured by cash flow variables we include the leverage ratio, that is

[10] Compustat variable's label is reported in brackets.

the ratio of total debt (the sum of short (DLC) plus long (DLTT) term debt) scaled by lagged book asset. Other financial measures, such as the market leverage ratio, i.e. total debt over the sum of debt plus market value of equity, and interest expense, i.e. interest and related expense (XINT) over lagged book asset, are also taken into account in additional model specifications.

Moreover, Tobin's Q and the Market-to-Book ratio are used as a proxy for a company's market valuation. Following Gutiérrez and Philippon (2016), Tobin's Q is defined as the market value of equity plus book value of total asset (AT) minus book value of equity divided by book value of total assets, where the market value of equity is given by common shares outstanding (CSHO) times the closing stock price at the end of the year (PRCC_F), while its book value is total assets (AT) minus total liabilities (LT). The Market-to-Book ratio is simply computed as market value of equity over book value of equity as defined before.

Since we are mostly interested in the relationship between share repurchase and investment, the variables just described are treated as control variables, pointing to firm characteristics and operating performance that in some way necessarily affect firm's investment decisions and, as such, must be included in every model specification; leaving them out would cause a problem of endogeneity due to omitted variables.

Yet, there might be alternative explanations of the recent slump in investment which are not captured by our regressors. To test the economic relevance of these hypotheses and to check whether the effects of share repurchase remain significant, we estimate alternative model specifications including additional explanatory variables. For instance, it is argued that the recent slowdown of physical investment can be explained by the rise of intangible assets brought about by technological change and the ICT revolution (Döttling et al., 2018). We test the intangible hypothesis by employing two different variables: investment in intangible assets, that is the ratio of intangible asset (INTA) over lagged total assets and investment in R&D (XRD), defined as R&D expenditure over lagged total assets.

Furthermore, we examine the effects of rising market concentration on investment: a decline in competition might put lower pressure on firms to invest, in so far as the enhanced market power would allow them to maximize profit by rising prices instead of adjusting the productive capacity. To this end, we compute the commonly-used Herfindahl-Hirschman (HH) index, which captures the firm's market share, in terms of sales or market value, with respect to its industry. More specifically, the sales HH index is given by the sum of the squares of firm's sales over total industry sales, where the industry is defined by taking the first two digits of the SIC code (Standard Industrial Classification).

5.1.2 Methodology and results

Our econometric strategy is the following: first we estimate the investment model to analyze the effects of share repurchases on capital investment and, second, we estimate the share repurchase model to examine the interaction

between share repurchases and stock options. The rationale is that in the first place we want to prove that the increase in share repurchases, by taking away resources that could be invested in capital assets, have had an adverse effect on real investment; secondly, we want to investigate the determinant factors behind the firm's decision to repurchase, focusing on the role played by stock-based manager compensation. If this second relationship is also verified, we will be led to conclude that the tendency to maximize the stock market value fostered by share-based remuneration schemes encourages managers to increase share buybacks at the cost of declining long-term real investment.

First, we estimate the investment equation (5.1) through an Ordinary Least Square (OLS) and a Fixed-effects (FE) models. Both estimation techniques are inconsistent in case of dynamic models: in the OLS the lagged dependent variable is positively correlated with the fixed effects in the error term, leading to upward biased estimate; by applying the mean-deviation transformation, the FE estimator removes time-invariant individual effects, but it does not eliminate the "dynamic panel bias" (Nickell, 1981) stemming from the negative correlation between the transformed lagged dependent variable and the transformed error term (Roodman, 2009), leading to downward bias estimate. Yet, as Bond (2002) points out, the fact that the estimated coefficients are biased in two opposite directions constitutes a useful check because it determines the range within which a consistent estimate should lie.

To overcome the endogeneity problem, the first-differenced Arellano-Bond GMM estimator is used. This technique has at least three advantages that make it a suitable estimation methods for our investment model. First, the first-differenced GMM estimator allows to eliminate individual effects by taking the first difference from the model equation. Second, the source of endogeneity is removed by instrumenting the lagged dependent variable with its own lags. The latter, indeed, are uncorrelated with the error term but correlated with the variable itself. Moreover, this method is particularly suitable when the model contains non-strictly exogenous explanatory variables. This is very likely to be the case in our investment model where it is reasonable to assume that firm's cash flow, operating performance and other financial measures are endogenous to investment decisions. Hence, potentially endogenous independent variables are treated in the same way as the lagged dependent variables: their lags will be available as instrumental variables and thus enter the set of instruments.

One problem associated with the first-differenced GMM estimator is that it amplifies the number of missing values which, in the case of unbalanced panel data with gaps, could lead to a non-negligible loss of information and efficiency. This motivates the adoption of a GMM with "forward orthogonal deviation" (FOD) transformation as an alternative estimation technique, which, rather than subtracting the previous observation from the current value – as in the first-differenced case –, it substracts the average of all the future available observations of the variable. Consequently, only the last observation of the sample will be lost.

Table 5.1 shows the regression coefficients of the investment model. The first

Table 5.1: Investment Model, 1992-2017

	(1) OLS	(2) FE	(3) diff-GMM	(4) fod-GMM
L.Investment/Capital Stock	0.447***	0.203***	0.216***	0.407***
	(0.0164)	(0.0213)	(0.0666)	(0.0471)
L.Sales/Capital Stock	0.00112***	0.00320***	0.00164	0.000619
	(0.000253)	(0.000666)	(0.00234)	(0.00102)
L.Opeating Surplus/Capital Stock	0.0189***	0.0230***	0.0272**	0.0119*
	(0.00265)	(0.00434)	(0.0109)	(0.00719)
L.Leverage/Assets	-0.124***	-0.141***	-0.523***	-0.260***
	(0.0118)	(0.0205)	(0.124)	(0.0489)
L.Market-to-Book ratio	0.00593***	0.00815***	0.00271	0.00706***
	(0.000672)	(0.000902)	(0.00293)	(0.00145)
L.Share Repurchase ratio	-0.00465***	-0.00150	-0.0138**	-0.0108***
	(0.00108)	(0.00131)	(0.00586)	(0.00339)
Observations	10842	10842	9147	10842
Number of firms		990	960	990
R^2	0.475	0.276		
Time effects	yes	yes	yes	yes
p-value Hansen test			0.583	0.198
p-value A-B test (AR2)			0.124	0.275

Standard errors in parentheses: * < 0.1, ** < 0.05, *** < 0.01.

thing to notice is that the lagged dependent variable coefficients from the two consistent GMM models, columns 3 and 4, fall within the range defined by the estimates of the OLS and FE models, meaning that these models are not only consistent but also well specified. Secondly, in line with our expectations, the share repurchase variable reports a negative sign, which is significant in three out of the four models, and, most importantly, in both consistent models. This means that a higher share repurchase results in a lower capital investment in the following period.[11]

Now let us focus on the third column reporting the results from the first-differenced GMM model. In this specification, the second lag of the dependent variables and the first lag of the independent variables are included in the instrument set and then collapsed, to limit the number of instruments, which amounts to 163. Thereby, the lagged dependent variable is considered as endogenous while the explanatory variables as predetermined. The estimation results shows that operating surplus is positively correlated with investment rate, while leverage and share repurchases are negatively correlated; sales and Market-to-Book ratio, instead, are not statistically significant. As previously argued and reported in the table, the first-differenced GMM model suffers from a low number of observations due to the fact that gaps in unbalanced panel data are magnified after taking a first-difference. This effect can be avoided by implementing a forward orthogonal deviation transformation, whose regression coefficients are shown in column 4. In this specification, all variables are treated as endogenous, with the second and third lags entering the instrument set. It can be seen that not only the sign of the *share repurchase*, *leverage*, *operating surplus* are unchanged, but, in this specification, also the *market-to-book ratio* turns out to be positive and significant, while *sales*, quite surprisingly, remains insignificant.

At this point, as a robustness check, we estimate additional panel data models based on different time periods and by different firm size. The first two columns of Table 5.2 shows the regression results from the investment model for, respectively, the decade before and after the financial crisis of 2007-8. These models are estimated using the FOD-GMM estimator, which proved to be more efficient amongst the consistent estimators in case of unbalanced panel data with gaps.

By looking at the results in Table 5.2, it emerges that the estimated coefficients of share repurchases are negative and statistically significant both the decade before and after the 2007-8 sub-prime mortgage crisis. Interestingly, we also notice that the degree of significance of *operating surplus* and *sales* variables varies across time periods: in the pre-crisis period operating surplus plays a significant role in driving investment while sales becomes relevant in the aftermath of the Great Recession. Indeed, in these periods, the fall in aggregate demand, captured by sales variables, drives drown investment, whereas profits recovers faster and becomes uncorrelated to investment. This evidence confirms

[11] Importantly, the Hansen test of over-identifying restrictions does not reject the validity of the instruments used in the model. Additionally, the Arellano and Bond (1991) test rejects the presence of second-order autocorrelation in the first-differenced model equation.

Table 5.2: Robustness check of investment model by time and firm size

	(1) pre-crisis ('98-'08)	(2) post-crisis (08-'17)	(3) Large firms	(4) Small firms
L.Investment/Capital Stock	0.368***	0.249***	0.395***	0.242***
	(0.0599)	(0.0578)	(0.0561)	(0.0831)
L.Sales/Capital Stock	0.001	0.003**	-0.001	0.004***
	(0.00109)	(0.00128)	(0.00150)	(0.00100)
L.Operating Surplus/Capital Stock	0.016**	0.014	0.022**	-0.001
	(0.00845)	(0.00903)	(0.0106)	(0.0112)
L.Leverage/Assets	-0.207***	-0.156**	-0.171*	-0.183*
	(0.0575)	(0.0634)	(0.100)	(0.0949)
L.Market-to-Book	0.007***	0.006***	0.002	0.008
	(0.00187)	(0.00205)	(0.00194)	(0.00517)
L.Share Repurchase/Total Shares	-0.010**	-0.007*	-0.016***	-0.001
	(0.00442)	(0.00323)	(0.00589)	(0.0141)

Clustered standard errors in parentheses: * < 0.1, ** < 0.05, *** < 0.01.

the hypothesis that, especially after the financial crisis, weak aggregate demand is a key factor in explaining low investment (Bond et al., 2015; Bussière et al., 2015). Moreover, these results provide support to the notion of missing link between profit-investment (Stockhammer, 2005; Van Treeck, 2008), which could also be observed in Figure 1.2.

The columns 3 and 4 in Table 5.2 show the estimates of investment model for large (3) and small (4) firms, which are defined, respectively, by the top and the bottom quantile of the total assets distribution. Unsurprisingly, the estimated coefficient of share repurchases is a highly significant for large firms while it is insignificant for small firms, meaning that stock buybacks are more detrimental to investment among large firms, while they have no significant effects among the small one. This result could have been partially deduced from Table 3.3 showing that large firms, on average, have spent 20% of their operating surplus between 1980-2017, contrary to the 0.7% of the smallest firms. In addition, we can see that the determinant factors for investment decisions vary substantially across firm size: among large firms, *operating surplus* and *leverage* are significant predictors of investment, whereas among small firms investment are more dependent on *sales* and *market-to-book ratio*. The interpretation might be the following: small firms rely more on domestic demand than large firms, which, on average, have better access to external markets and whose investment are more sensitive to variation in profits and financing conditions, rather than internal sales.

We now estimate two additional model specifications to control for plausible alternative explanations for low investment: intangible assets and market

concentration. The aim is to check whether the inclusion of these variable sensibly affects the size or significance of the estimated coefficient of our explanatory variable, in which case previous results would be biased due to omitted variables.

The results shown in column 1 of Table 5.3 show that intangible assets have a negative but not significant effect on capital investment, while the coefficient of share repurchases remain negative and statistically significant. Similar results are obtained if, instead of intangibles, R&D expenditure is included. Therefore, the rise of intangible assets does not seem to provide additional information on the decline of physical investment among our sample of firms.

Table 5.3: Investment Model - 1992-2017 + intangibles & concentration

	(1) diff-GMM	(2) diff-GMM	(3) diff-GMM
L.Investment/Capital Stock	0.229***	0.246***	0.247***
	(0.0748)	(0.0569)	(0.0546)
L.Sales/Capital Stock	-0.000483	0.000793	0.000643
	(0.00266)	(0.00222)	(0.00221)
L.Opeating Surplus/Capital Stock	0.0354**	0.0337***	0.0355***
	(0.0146)	(0.0102)	(0.0101)
L.Leverage/Assets	-0.532***	-0.294***	-0.352***
	(0.183)	(0.0703)	(0.0869)
L.Market-to-Book	0.00336	0.00734***	0.00582**
	(0.00391)	(0.00194)	(0.00234)
L.Intangible assets/Total assets	-0.141		
	(0.167)		
L.Share Repurchase/Total Shares	-0.0196**		
	(0.00920)		
L.Concentration (HHI)		-0.533***	
		(0.194)	
Conc_0×Repurchase			-0.00880**
			(0.00448)
Conc_1× Repurchase			-0.201*
			(0.121)
Observations	8335	9179	9147
Number of firms	953	961	960
R^2			
Time effects	yes	yes	yes
p-value Hansen test	0.659	0.131	0.512
p-value A-B test (AR2)	0.0109	0.975	0.919

Clustered standard errors in parentheses: * < 0.1, ** < 0.05, *** < 0.01.

As discussed above, another popular explanation of the recent slump in investment in U.S. economy points to the adverse effect of the increased market concentration on firms' propensity to invest (Gutiérrez and Philippon, 2016,

2017).

The results in column 2 of Table 5.3, indeed, show that the Herfindahl-Hirschman index has a negative and statistically significant impact on investment. We now want to understand whether market concentration and share buybacks jointly affect investment. Indeed, it is possible that firms operating in more concentrated industry tends to accumulate extra surplus from rent activities and, consequently, will be more oriented to distribute cash to shareholders by means of share repurchases. This is in tune with Jensen's (1986) "free cash flow hypothesis", according to which agency costs are higher in presence of non-competitive markets in that oligopolistic firms gain substantial economic rents or quasi-rents which should be distributed to shareholders to avoid over-investment problems. In these cases, Jensen argues, "monitoring by the firm's internal control system and the market for corporate control are more important". To compute the cross-effect of buybacks and concentration, we take the cross product of the two variables, with the latter being transformed into a dummy that takes value one if the firm falls in the top quantile of the Herfindahl-Hirschman distribution and zero otherwise. The results displayed in column 3 show that the coefficient of share repurchases is negative and significant regardless of market structure. Yet, the size of the coefficient is significantly higher in case of highly concentrated markets (when the concentration dummy is equal to one). This evidence provides support to the idea that the negative relationship between share repurchases and capital investment is stronger among firms operating in less-competitive markets.

5.2 Share repurchase model

5.2.1 Definition of variables

To analyze whether stock-based remuneration schemes make managers of U.S. firms more likely to buyback stocks, we estimate the share repurchase model given by

$$(REP/TS)_{it} = \beta_0 + \beta_1(OPT/TS)_{it} + \beta_2 X_{it} + \eta_t + \mu_i + \epsilon_{it}. \qquad (5.2)$$

The dependent variable is the share repurchase ratio (REP/TS), which is the explanatory variable used in the investment model, while as a main regressor (OPT/TS) we employ three different measures of stock options, all scaled by beginning-of-the-year common shares outstanding: exercised option (OPT_EXER_VAL), that is the value realized on option exercise; unexercised option (OPT_UNEX_EXER_EST_VAL), that is the value of unexercised exercisable options; in-the-money vested option (OPT_UNEX_EXER_EST_VAL), that is the estimated value of in-the-money unexercised exercisable options. The latter stands for the estimated gains a manager would earn if she exercised her option. The last two variables, i.e. unexercised options and in-the-money vested option, are of particular interest for our purpose. In the literature (Chen and Wang, 2012), indeed, they are typically regarded as a proxy for "manager hubris",

that is, the manager's degree of over-confidence about future equity returns. In particular, it is argued that, in so far as over-confident managers expect stock returns to increase in the future, they will delay the exercise of stock options and meanwhile repurchase shares to boost the stock price and gain even higher returns in the next periods. Similarly to the investment model, a set of independent variables reflecting firm characteristics is included, as well as time year and industry dummies.

5.2.2 Methodology and results

We estimate the share repurchase model in Equation (5.2) by using two different techniques: a Random Effects (RE) model and a Tobit regression model. The RE model delivers more efficient estimates than FE model if individual effects are uncorrelated with the regressors. It is quite reasonable to assume that this is the case if we consider that repurchasing and option-paying firms constitute a relatively homogeneous subset of the total population of Compustat firms.

Moreover, it is important to bear in mind that the repurchase variable exhibits a significant number of zero observations, meaning that many firms do not buyback stocks at all. In this case, it would be inappropriate to restrict attention to positive observations only by using a linear model (Verbeek, 2008). The discontinuity in the distribution of the y-variable can be captured by employing a censored dependent variable model, such as the Tobit regression model. Indeed, the Tobit model describes, on the one hand, the probability of the dependent variable to be non-zero and, on the other, the expected value of the dependent variable given that it is positive. In addition to that, we also estimate a third model combining both approaches described above in an unique regression equation, that is a Random Effect-Tobit model.

Table 5.4 reports the regression results for the share repurchase model. From the first three rows we can immediately see that *exercised* and *unexercised options* are always significant and positively associated with share buybacks, while *in-the-money options* is insignificant in the RE model, but turns significant in the Tobit model. Thereby, our hypothesis seems confirmed: stock-based compensation has a positive impact on the probability of repurchase. By looking at the coefficients of other independent variables, we notice that *Market-to-Book ratio*, *EPS* and *ROA* enter with positive sign and are always statistically significant. Hence, there is a positive relationship between the probability of repurchase and the firm's profitability and market valuation. This provides evidence to the hypotheses that stock buybacks are undertaken to support the share price (Liu and Swanson, 2016) and to meet EPS forecasts (Almeida et al., 2016). Moreover, all model specifications report a negative and statistically significant relationship between stock buybacks and *Cash/Asset*, indicating that a decrease in cash liquidity is associated with a higher propensity to repurchase, in tune with the free cash-flow hypothesis. Finally, firm size matters and is positively correlated with the probability of repurchase, as also shown in Table 3.3.

Table 5.5 reports the regression results for the share repurchase model using

Table 5.4: Share Repurchase Model, 1992-2017

	(1) RE	(2) RE	(3) RE	(4) Tobit	(5) Tobit	(6) Tobit
Exercised Options	0.00182**			0.00410***		
	(0.000840)			(0.00135)		
Unexercised Options		0.0137**			0.0392***	
		(0.00574)			(0.00944)	
In-the-money Options			0.000255			0.00136*
			(0.000440)			(0.000697)
Market-to-Book	0.0960***	0.100***	0.0982***	0.120***	0.129***	0.120***
	(0.0123)	(0.0122)	(0.0128)	(0.0174)	(0.0172)	(0.0179)
EPS	0.196***	0.198***	0.197***	0.268***	0.278***	0.271***
	(0.0150)	(0.0151)	(0.0153)	(0.0281)	(0.0283)	(0.0286)
ROA	0.680*	0.746**	0.732**	3.549***	3.723***	3.659***
	(0.359)	(0.360)	(0.359)	(0.755)	(0.764)	(0.762)
Cash/Assets	-0.711***	-0.692***	-0.687***	-0.908***	-0.904***	-0.875***
	(0.129)	(0.125)	(0.127)	(0.202)	(0.197)	(0.200)
Dividend/Assets	-1.661	-1.689	-1.791	-3.894**	-3.933**	-3.980**
	(1.166)	(1.172)	(1.170)	(1.738)	(1.749)	(1.771)
Leverage/Assets	-0.209*	-0.229*	-0.207*	-0.503**	-0.554**	-0.498**
	(0.124)	(0.124)	(0.124)	(0.215)	(0.216)	(0.215)
Size	0.151***	0.158***	0.149***	0.217***	0.233***	0.214***
	(0.0175)	(0.0186)	(0.0177)	(0.0249)	(0.0262)	(0.0250)
var(e.rep_ts)				2.817***	2.816***	2.823***
				(0.130)	(0.130)	(0.130)
Observations	10235	10235	10235	10235	10235	10235
Number of firms	971	971	971			
R^2 overeall	0.293	0.292	0.291			
Time effects	yes	yes	yes	yes	yes	yes
Log-Likelihood				-15606.3	-15598.0	-15613.8
pseudo-R^2				0.0988	0.0993	0.0984

Standard errors in parentheses: * < 0.1, ** < 0.05, *** < 0.01.

Table 5.5: Share Repurchase Model, 1992-2017

	(1) RE-Tobit	(2) RE-Tobit	(3) RE-Tobit
Exercised Options	0.00160**		
	(0.000752)		
Unexercised Options		0.0138**	
		(0.00675)	
In-the-money Options			0.000412
			(0.000397)
Market-to-Book	0.0728***	0.0765***	0.0763***
	(0.0108)	(0.0107)	(0.0110)
EPS	0.234***	0.237***	0.237***
	(0.0103)	(0.0102)	(0.0104)
ROA	2.907***	2.978***	2.968***
	(0.431)	(0.431)	(0.431)
Cash/Assets	-1.196***	-1.173***	-1.167***
	(0.150)	(0.150)	(0.150)
Dividend/Assets	-0.616	-0.639	-0.816
	(1.089)	(1.088)	(1.097)
Leverage/Assets	-0.587***	-0.609***	-0.585***
	(0.140)	(0.140)	(0.140)
Size	0.302***	0.309***	0.300***
	(0.0228)	(0.0233)	(0.0229)
Observations	10235	10235	10235
Number of firms	971	971	971
R^2 overeall			
Time effects	yes	yes	yes
Log-Likelihood	-14766.7	-14766.9	-14768.9
pseudo-R^2			
Rho	0.303	0.303	0.305

Standard errors in parentheses: * < 0.1, ** < 0.05, *** < 0.01.

a Random Effect-Tobit model. This method combines the two approaches described before in an unique estimator which allows to control for both censored dependent variable and unobserved heterogeneity at the same time, provided that individual effects are randomly distributed. The results are largely similar to those observed in Table 5.4, with *exercised* and *unexercised options* being positively and significantly associated with the probability of repurchase, while *in-the-money options* insignificant, as well as *dividend payment*.

In summary, we find empirical evidence that stock-based management compensation is an important motive for share repurchases. Of the alternative measures of stock options adopted in the analysis, exercised and unexercised exercisable options are highly significant in every regression models, while in-the-money options have a lower explicative power once controlled for unobserved heterogeneity. Moreover, we find that share repurchases are positively and significantly associated with Market-to-Book ratio, EPS and ROA. Consistent with price support (Liu and Swanson, 2016) and signalling hypotheses (Massa et al., 2007; Chen and Wang, 2012), these findings reveal that firms with higher market valuation and better financial performance are more likely to repurchase shares.

6 Concluding remarks and discussion

In this paper we explore the motives behind shareholder value maximization and its effect on firm's investment decisions. We argue that, in a context of weak aggregate demand, the tendency to maximize shareholder value, fuelled by stock-based manager compensation, has encouraged firms to divert resources from real investment towards stock buybacks to boost stock prices. This is due to the fact that stock buybacks, by simultaneously increasing the demand of shares and reducing the supply of total shares outstanding, are expected to increase stock prices. With a substantial part of total compensation consisting in stocks and stock options, managers have a personal interest in creating value for shareholders by repurchasing shares with resources that could be invested in productive activities, such as capital expenditure, R&D and employment.

More specifically, using micro-data from U.S. firms balance sheets and manager compensation, in this paper we estimate two dynamic panel data models: (i) to analyze the effects of share repurchases on capital investment; (ii) to examine the interaction between stock-based CEO pay and the likelihood of repurchases. We find that stock buybacks have a negative effect on capital investment, both before and after the financial crisis, especially among large firms operating in highly concentrated industry. Moreover, the probability to repurchase shares is positively associated with stock options, specially exercised and un-exercised but exercisable ones, confirming that share-based compensation can influence managers' planning horizon and incentive structure, by making them more focused on short-term capital gains for shareholders instead of long-run growth of the company.

This hypothesis is also supported by the positive relation between firm's

market valuation and share buybacks, suggesting that firms with a higher stock price are indeed more likely to repurchase shares.

From an empirical perspective, further research is needed to investigate the engines of the 'financialization' of non-financial corporations, here defined as the increasing tendency to maximize stock market value. In particular, this paper sheds light on the role of organizational factors (e.g. share-based remuneration) in influencing managers' incentive structure and investment decisions. However, a more complete picture of the phenomenon at stake would require an investigation of the role played by institutional factors, such as the increasing influence of speculative investors in the ownership structure, as previously studied by Gutiérrez and Philippon (2016, 2017).

From a theoretical standpoint, our findings suggest that the tendency to maximize shareholder value may have ambiguous effects on the firm's performance and, consequently, on the overall economy: on the one hand, it may induce managers to distribute an increasing share of profits to shareholders, leading to stock prices revaluations and rising asset holders' wealth; on the other, by discouraging long-term investment projects, it may impair firms future competitiveness and growth prospects.

References

Almeida, H., V. Fos, and M. Kronlund (2016): "The real effects of share repurchases," *Journal of Financial Economics*, 119, 168–185.

Arellano, M. and S. Bond (1991): "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *The Review of Economic Studies*, 58, 277–297.

Baker, M. and J. Wurgler (2004a): "Appearing and disappearing dividends: The link to catering incentives," *Journal of Financial Economics*, 73, 271–288.

——— (2004b): "A catering theory of dividends," *The Journal of Finance*, 59, 1125–1165.

——— (2013): "Behavioral corporate finance: An updated survey," in *Handbook of the Economics of Finance*, North Holland: Elsevier, vol. 2, 357–424.

Banyi, M. L., E. A. Dyl, and K. M. Kahle (2008): "Errors in estimating share repurchases," *Journal of Corporate Finance*, 14, 460–474.

Bennett, B., A. V. Thakor, and Z. Wang (2019): "Stock Repurchases and the 2017 Tax Cuts and Jobs Act," *Available at SSRN 3443656*.

Bhaduri, A. and S. Marglin (1990): "Unemployment and the real wage: the economic basis for contesting political ideologies," *Cambridge Journal of Economics*, 14, 375–393.

Bhargava, A. (2013): "Executive compensation, share repurchases and investment expenditures: econometric evidence from US firms," *Review of Quantitative Finance and Accounting*, 40, 403–422.

Bond, S., G. Rodano, and N. Serrano-Velarde (2015): "Investment Dynamics in Italy: Financing Constraints, Demand and Uncertainty," *Bank of Italy Occasional Paper*.

Bond, S. R. (2002): "Dynamic panel data models: a guide to micro data methods and practice," *Portuguese Economic Journal*, 1, 141–162.

Bond, S. R., A. Klemm, R. Newton-Smith, M. Syed, and G. W. Vlieghe (????): "The roles of expected profitability, Tobin's Q and cash flow in econometric models of company investment," *Bank of England working paper*.

Bussière, M., L. Ferrara, and J. Milovich (2015): "Explaining the recent slump in investment: The role of expected demand and uncertainty," .

Chen, S.-S. and Y. Wang (2012): "Financial constraints and share repurchases," *Journal of Financial Economics*, 105, 311–331.

Davis, L. E. (2018): "Financialization and the non-financial corporation: An investigation of firm-level investment behavior in the United States," *Metroeconomica*, 69, 270–307.

Döttling, R., T. Ladika, and E. C. Perotti (2018): "The (self-) funding of intangibles," .

Edmans, A., X. Gabaix, and D. Jenter (2017): "Executive Compensation: A Survey of Theory and Evidence," in *The Handbook of the Economics of Corporate Governance*, North Holland: Elsevier, vol. 1, 383–539.

Evans, M. K. (1967): "A Study of Industry Investment Decisions," *The Review of Economics and Statistics*, 48, 151–164.

Fama, E. F. and M. C. Jensen (1983): "Separation of ownership and control," *The Journal of Law and Economics*, 26, 301–325.

Fazzari, S., R. G. Hubbard, and B. C. Petersen (1987): "Financing constraints and corporate investment," *National Bureau of Economic Research*.

Fazzari, S. and T. L. Mott (1986): "The investment theories of Kalecki and Keynes: an empirical study of firm data, 1970–1982," *Journal of Post Keynesian Economics*, 9, 171–187.

Grullon, G. and R. Michaely (2004): "The information content of share repurchase programs," *The Journal of Finance*, 59, 651–680.

Gutiérrez, G. and T. Philippon (2016): "Investment-less growth: An empirical investigation," Tech. Rep. 22897, National Bureau of Economic Research.

——— (2017): "Declining Competition and Investment in the US," Tech. Rep. 23583, National Bureau of Economic Research.

Jensen, M. C. (1986): "Agency costs of free cash flow, corporate finance, and takeovers," *American Economic Review*, 76, 323–329.

Jiang, Z., K. A. Kim, E. Lie, and S. Yang (2013): "Share repurchases, catering, and dividend substitution," *Journal of Corporate Finance*, 21, 36–50.

Lazonick, W. and M. O'sullivan (2000): "Maximizing shareholder value: a new ideology for corporate governance," *Economy and Society*, 29, 13–35.

Lee, B. S. and J. Suh (2011): "Cash holdings and share repurchases: International evidence," *Journal of Corporate Finance*, 17, 1306–1329.

Liu, H. and E. P. Swanson (2016): "Is price support a motive for increasing share repurchases?" *Journal of Corporate Finance*, 38, 77–91.

Massa, M., Z. Rehman, and T. Vermaelen (2007): "Mimicking repurchases," *Journal of Financial Economics*, 84, 624–666.

Meyer, J. R. and E. Kuh (1957): *The investment decision: An empirical study*, Cambridge, MA: Harvard University Press.

Nickell, S. (1981): "Biases in dynamic models with fixed effects," *Econometrica*, 49, 1417–1426.

Orhangazi, Ö. (2008): "Financialisation and capital accumulation in the non-financial corporate sector: A theoretical and empirical investigation on the US economy: 1973–2003," *Cambridge Journal of Economics*, 32, 863–886.

Roodman, D. (2009): "How to do xtabond2: An introduction to difference and system GMM in Stata," *The Stata Journal*, 9, 86–136.

Sakinc, M. E. (2017): "Share Repurchases in Europe. A Value Extraction Analysis," *The Academic-Industry Research Network Working Paper (16/2017 May)*, 1–27.

Shefrin, H. (2001): "Behavioral corporate finance," *Journal of Applied Corporate Finance*, 14, 113–126.

Stockhammer, E. (2004): "Financialisation and the slowdown of accumulation," *Cambridge Journal of Economics*, 28, 719–741.

——— (2005): "Shareholder value orientation and the investment-profit puzzle," *Journal of Post Keynesian Economics*, 28, 193–215.

Tori, D. and Ö. Onaran (2015): "The effects of financialization on investment: Evidence from firm-level data for the UK," *Cambridge Journal of Economics*.

——— (2018): "Financialization, financial development and investment. Evidence from European non-financial corporations," *Socio-Economic Review*.

Van Treeck, T. (2008): "Reconsidering the investment–profit nexus in finance-led economies: an ARDL-based approach," *Metroeconomica*, 59, 371–404.

Verbeek, M. (2008): *A Guide to Modern Econometrics*, Oxford, UK: John Wiley & Sons.

Villani, D. (2019): "The rise of corporate net lending among G7 countries: A firm-level analysis," *Available at SSRN 3552786*.

Appendix

Table 6.1: Summary Statistics, US non-financial corporations, 1992-2017

Variable		Mean	Std. Dev.	Min	Max	Observations
Investment/l.Capital	overall	.2755226	.2202772	0	1.405282	N=13131
	between		.1627881	.0347161	1.199221	n=1008
	within		1698172	-.4183661	1.49936	T-bar=13.0268
Sales/l.Capital	overall	10.89269	16.75242	.2695035	101.4943	N = 13131
	between		16.70522	.2725111	101.4943	n = 1008
	within		6.758624	-59.17667	96.09325	T-bar = 13.0268
Operating Surplus/l.Capital	overall	1.254541	1.694654	-2.691603	9.571048	N = 13131
	between		1.571133	-2.318099	9.571048	n = 1008
	within		1.000607	-8.931476	10.124	T-bar = 13.0268
Leverage/l.Assets	overall	.2117312	.180841	0	.7826437	N = 13111
	between		.1531881	0	.7485911	n = 1008
	within		.1106644	-.3051703	.9310447	T-bar = 13.0069
Market-to-Book	overall	3.950975	4.207393	.1005536	29.8311	N = 13115
	between		3.022311	.3081198	23.08858	n = 1008
	within		3.185117	-18.34694	30.68529	T-bar = 13.0109
Share repurchase/Tot. Shares	overall	.9026933	1.518543	0	7.410381	N = 13091
	between		.92524	0	6.540037	n = 1007
	within		1.228272	-5.637344	7.894656	T-bar = 13

Source: author's calculation based on Compustat database from WRDS.
Note: N=number of observations, n=number of groups, $T-bar$=average time period.