UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ECONOMIA, ADMINISTRAÇÃO E CONTABILIDADE
DEPARTAMENTO DE ADMINISTRAÇÃO
PROGRAMA DE PÓS-GRADUAÇÃO EM ADMINISTRAÇÃO

JULIANO RIBEIRO DE ALMEIDA

PEERS EFFECT, WORKING CAPITAL MANAGEMENT, AND FIRM VALUE

EFEITO DOS PARES, GESTÃO DO CAPITAL DE GIRO E VALOR DA EMPRESA

São Paulo

2019

Prof. Dr. Vahan Agopyan

Reitor da Universidade de São Paulo

Prof. Dr. Fábio Frezatti

Diretor da Faculdade de Economia, Administração e Contabilidade

Prof. Dr. Moacir de Miranda Oliveira Junior

Chefe do Departamento de Administração

Prof. Dr. Eduardo Kazuo Kayo

Coordenador do Programa de Pós-Graduação em Administração

JULIANO RIBEIRO DE ALMEIDA

PEERS EFFECT, WORKING CAPITAL MANAGEMENT, AND FIRM VALUE

EFEITO DOS PARES, GESTÃO DO CAPITAL DE GIRO E VALOR DA EMPRESA

Tese apresentada ao Programa de Pós-Graduação em Administração do Departamento de Administração da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo, como requisito parcial para a obtenção do título de Doutor em Ciências.

Área de concentração: Finanças

Orientador: Prof. Dr. Eduardo Kazuo Kayo

Versão Corrigida

(versão original disponível na Biblioteca da Faculdade de Economia, Administração e Contabilidade)

São Paulo

2019

Autorizo a reprodução e divulgação total ou parcial deste trabalho, por qualquer meio convencional ou eletrônico, para fins de estudo e pesquisa, desde que citada a fonte.

Ficha catalográfica
Elaborada pela Seção de Processamento Técnico do SBD/FEA
com os dados inseridos pelo(a) autor(a)

Almeida, Juliano Ribeiro de.

Peers Effect, Working Capital Management, and Firm Value / Juliano Ribeiro de Almeida. - São Paulo, 2019.
68 p.

Tese (Doutorado) - Universidade de São Paulo, 2019.
Orientador: Eduardo Kasuo Kayo.

1. Capital de giro. 2. Valor da empresa. 3. Pares. 4. Investimento corporativo. 5. Desempenho financeiro. I. Universidade de São Paulo. Faculdade de Economia, Administração e Contabilidade. II. Título.

DEDICATÓRIA

À Gabriela e aos meus pais, Armando e Marina, pelo apoio incondicional.

AGRADECIMENTOS

Aos meus pais, Armando e Marina, por todo o apoio, esforço e amor dedicados ao longo de toda minha vida.

À minha esposa Gabriela, pelo apoio incondicional em todos os momentos e por me tornar uma pessoa melhor e mais feliz.

Ao meu orientador, Prof. Dr. Eduardo Kazuo Kayo, pelo enorme apoio e dedicação ao longo de todo meu período como aluno da Pós-graduação na FEA/USP.

Aos membros da banca examinadora, Prof. Dr. Roy Martelanc, Profa. Dra. Rosana Tavares e Prof. Dr. Wilson Toshiro Nakamura, por disporem de seus tempos e contribuírem para o aperfeiçoamento deste trabalho.

Ao Prof. Dr. José Roberto Ferreira Savoia, Prof. Dr. Daniel Reed Bergmann e Profa. Dra. Fabiana Lopes da Silva, por todo apoio e amizade.

À Dra. Veronica A. da Motta Cezar-Ferreira, por me estimular a tocar em frente e por me ajudar a me tornar uma pessoa melhor.

E aos meus colegas da turma de finanças do Programa de Pós-Graduação em Administração da FEA/USP, pelo acompanhamento da trajetória e pela amizade que espero manter daqui para frente.

RESUMO

ALMEIDA, J. R. (2019). *Efeito dos Pares, Gestão do Capital de Giro e Valor da Empresa*. (Tese de Doutorado). Faculdade de Economia e Administração, Universidade de São Paulo, São Paulo.

Utilizamos uma amostra de empresas americanas de manufatura de 1989 a 2018 para avaliar o efeito do capital de giro líquido (NWC) sobre o desempenho da empresa. Empregamos várias análises econométricas para testar nossas hipóteses, assim como diferentes especificações de nossas variáveis dependentes e principal. Nossos resultados são robustos e consistentes com pesquisas anteriores sobre a influência dos pares sobre as decisões de investimento corporativo das empresas. Além disso, nossos resultados sugerem que: (i) a relação entre investimento em capital de giro e desempenho da empresa é não linear (para empresas com investimento excessivo em capital de giro, a redução de recursos atrelados ao capital de giro no ano anterior está positivamente associada a um melhor desempenho da empresa ao longo do ano subsequente; no entanto, para empresas com baixo nível de NWC, não podemos afirmar que o oposto é verdadeiro); (ii) encontramos um efeito significativo dos pares que está positivamente associado ao investimento das empresas em capital de giro, e descobrimos que um aumento de um desvio padrão no investimento em capital de giro médio dos pares leva a um aumento de 11% no investimento da empresa “*i*”, após controlar para fatores específicos da empresa; e (iii) estimamos o impacto do investimento em capital de giro no desempenho da empresa usando uma estrutura de regressão com variável instrumental que confirma que as empresas com nível excessivo de capital de giro estão associadas a um pior desempenho.

Palavras-chave: capital de giro; valor da empresa; pares; investimento corporativo; desempenho financeiro.

ABSTRACT

ALMEIDA, J. R. (2019). *Peers Effect, Working Capital Management, and Firm Value*. (Doctoral Thesis). Faculdade de Administração, Economia e Contabilidade, Universidade de São Paulo, São Paulo.

We use a sample of US manufacturing firms from 1989 to 2018 in order to evaluate the effect of net working capital (NWC) on firm performance. We employ several econometric analyses to test our hypotheses and different specifications of our dependent and main variables of interest. Our results are robust and consistent with prior research on peer effects influencing corporate investment decisions. In addition, our results suggest that (i) the relation between excess working capital investment and company performance is non-linear (for firms with excessive working capital investment, the reduction in resources tied up in working capital in the previous year is positively associated with a better company performance over the subsequent year; however, for firms with low level of NWC, we cannot state that the opposite is true); (ii) we find significant peer effect that are positively associated with firms' investment in working capital, and find that a one standard deviation increase in the average peer firm working capital investment leads to an 11% increase in firm i 's investment, after controlling for firm-specific factors; and (iii) we estimate the impact of working capital investment on firm's performance using an instrumental variable framework that confirm that firms with a higher level of working capital are associated with worst level of firm's performance.

Key Words: working capital; valuation; peers; corporate investment; financial performance.

CONTENTS

1. INTRODUCTION.....	15
1.1. RESEARCH QUESTION	15
1.2. RESEARCH SHORTCOMINGS	19
2. LITERATURE REVIEW AND CONSTRUCTION OF THE HYPOTHESIS	21
2.1. PEERS INFLUENCE OVER THE FIRM'S FINANCIAL DECISIONS	21
2.2. WORKING CAPITAL INVESTMENT AND FIRM VALUE	24
2.3. CONSTRUCTION OF THE HYPOTHESES	27
3. METHODOLOGY.....	29
3.1. SAMPLE	29
3.2. DESCRIPTION OF THE METHODOLOGY ON WORKING CAPITAL INVESTMENT AND FIRM VALUE.....	32
3.3. DESCRIPTION OF THE METHODOLOGY ON THE PEERS' EFFECT AND FIRM INVESTMENT.....	36
4. ANALYSIS OF RESULTS.....	39
4.1. SUMMARY STATISTICS.....	39
4.2. PRELIMINARY ANALYSIS	42
4.3. EFFECT OF NET WORKING CAPITAL INVESTMENT ON COMPANY VALUE	43
4.4. PEERS EFFECT OVER THE FIRM'S NET WORKING CAPITAL INVESTMENT	50
4.5. ROBUSTNESS CHECK.....	55
5. CONCLUSIONS.....	60
REFERENCES.....	63

FIGURES LIST

FIGURE 1 – EVOLUTION OF FIRM’S INVESTMENTS IN ABSOLUTE TERMS (1989 TO 2018)	17
FIGURE 2 – EVOLUTION OF FIRM’S INVESTMENTS SCALED BY TOTAL ASSETS (1989 TO 2018)...	17
FIGURE 3 – SUMMARY STATISTIC FOR NWC-TO-SALE RATIO	31
FIGURE 4 – YEARLY AVERAGE OF WORKING CAPITAL COMPONENTS (INVENTORIES, RECEIVABLES AND PAYABLES), SCALED BY SALES.....	31

TABLES LIST

TABLE 1 - AVERAGE VALUES BY YEAR.....	30
TABLE 2 – SUMMARY STATISTICS.....	40
TABLE 3 – SUMMARY STATISTICS FOR NWC-TO-SALES RATIO BY INDUSTRY	41
TABLE 4 – SAMPLE CHARACTERISTICS OF FIRMS WITH NEGATIVE AND POSITIVE <i>EXCESS_NWC</i> 42	
TABLE 5 – REGRESSIONS RESULTS OF EXCESS NET WORKING CAPITAL ON TOBIN’S Q.....	44
TABLE 6 – REGRESSIONS RESULTS OF EXCESS NET WORKING CAPITAL ON STOCK PERFORMANCE (ROBUSTNESS CHECK)	45
TABLE 7 – REGRESSIONS RESULTS OF NET WORKING CAPITAL ON TOBIN’S Q	48
TABLE 8 – REGRESSIONS RESULTS OF NET WORKING CAPITAL ON STOCK PERFORMANCE (ROBUSTNESS CHECK)	49
TABLE 9 – INSTRUMENTAL VARIABLE REGRESSIONS RESULTS OF NWC-TO-SALE ON TOBIN’S Q.....	51
TABLE 10 – INSTRUMENTAL VARIABLE REGRESSIONS RESULTS OF NET WORKING CAPITAL ON TOBIN’S Q.....	53
TABLE 11 – INSTRUMENTAL VARIABLE REGRESSIONS RESULTS OF NWC-TO-SALE ON STOCK PERFORMANCE (ROBUSTNESS CHECK)	56
TABLE 12 – INSTRUMENTAL VARIABLE REGRESSIONS RESULTS OF NET WORKING CAPITAL ON STOCK PERFORMANCE (ROBUSTNESS CHECK)	58

1. Introduction

1.1. Research question

Short-term assets and liabilities are important components of the total assets of a company and need to be treated and managed carefully. The management of short-term assets and liabilities is known as working capital management and is related to the required capital to run the business in the short-term (Mahmoudzadeh et al, 2018), that is, the need for working capital arises from the difference in the timing of when costs of goods or services are incurred and when revenues are received by the company. Ernst and Young (2015), in a report devoted to the working capital management of 2,000 major US and European companies in 2014, points out that the excess amount of working capital of these companies is about US\$ 1.3 trillion and this amount is equivalent to 7% of the aggregate revenue of these firms.

In addition, the efficient working capital management plays a very important role in the strategy of any company, especially with respect to profitability (Shin and Soenen, 1998; Deloof, 2003; Pais and Gama, 2015; Lyngstadaas and Berg, 2016), risk (Gardner et al., 1986; Weinraub and Visscher, 1998), firm value (Kieschnick et al, 2013; Almeida and Eid Jr, 2014; Aktas et al., 2015), as well as regarding to financing constraints (Ding et al., 2013). That is, it seems clear that efficient working capital management is a key part of the overall strategy of any company to create shareholder value.

The literature on working capital management highlights two distinct views for corporate investment in working capital. On one hand, the additional investment in working capital may have positive effects, particularly for companies with low levels of working capital. This is the case of companies operating with high levels of inventories in order to, among other aspects, reduce logistics costs, provide protection against commodity price fluctuations and minimize the possibility of loss of sales due to potential lack of inventory, as highlighted by Blinder and Maccini (1991), Fazzari and Petersen (1993) and Corsten and Gruen (2004). In addition, increasing working capital by supplying credit to customers (trade credit) can also positively impact firms sales because, for example, it allows for price discrimination, serves as a guarantee for the quality of the product sold and helps promote a long-term relationship with customers, as highlighted by Brennan et al. (1988), Long et al. (1993), Petersen and Rajan (1997), Wilson and Summers (2002), among others.

On the other hand, excessive working capital investment can have adverse effects and lead to value destruction for shareholders, as shown by Kieschnick et al. (2013), Almeida and Eid Jr (2014) and Aktas et al. (2015). The main idea is that, like any other investment, additional investment in working capital requires additional funding, which in turn involves financing and opportunity costs. Therefore, high working capital investment is expected to be associated with high-interest expenses and higher credit risk (Aktas et al., 2015). In addition, higher levels of inventories are associated with other costs, like warehouse rent, insurance, and security (Baños-Caballero et al., 2014) which, in turn, may reduce firm performance. Another aspect of excessive working capital investment is related to the fact that many resources invested in working capital may also impede companies from implementing value-enhancing investment projects in the short term, as pointed out by Ek and Guerin (2011).

That is, combining the positive and negative effects, studies on working capital management seem to suggest the existence of a non-linear relationship between the level of investment in working capital and company's performance: (i) for companies with high level of working capital (excess working capital), the expected relationship is negative (in these cases, the increase in working capital would not create value for the company); and (ii) for companies with low level of working capital (underinvestment in working capital), the expected relationship is positive (in these cases, the increase in working capital would create value for the company). In this sense, Baños-Caballero et al. (2012), Baños-Caballero et al. (2014), Aktas et al. (2015) and Ben-Nasr (2016) found an inverted U-shaped relationship between firm value and working capital investment.

However, one concern about the above relationship between investment in working capital and firm's performance is about the endogeneity of this relationship, that is, some unobserved factors, Z_i , may affect jointly the investment in working capital and the company's performance, which would lead to biased results. So, in this paper, to deal with this potential endogeneity problem, we estimate the impact of excess working capital investment on firm's performance using an instrumental variable framework, in which we use peer firms *Industry's NWC* as instruments for the *company's NWC* in order to generate an exogenous variation in the firm's working capital. *Industry's NWC* is constructed as the average (median) of all firms within an industry-year combination, excluding the i^{th} observation, like in Foucault and Fresard (2014) and Leary and Roberts (2014). Therefore, the purpose of the present study is to provide novel evidence regarding the impact of working capital investment on firm's performance, after control for the peers' effect on firm's investment decisions.

To do so, this study uses firm-level panel data for a sample of US manufacturing firms, covering the period 1989-2018, to estimate peer effects in a specific kind of corporate investment policies (working capital). We define the peer reference groups based on the firm's industry, using the Fama-French 49-industry classification, like in Aktas et al. (2015). Firms have significant economic links at the industry level, as they compete for the same customers, capital (Foucault and Fresard, 2014; Leary and Roberts, 2014), and executive talent (Albuquerque et al., 2013; Francis et al., 2016). So, we examine whether peer effects¹ operate on firm managerial policies such as corporate investment.

Figure 1 – Evolution of firm's investments in absolute terms (1989 to 2018)

Figure 1: Time series of firm's investments in absolute terms (in 1 million USD of 2018). This figure plots cross-sectional amount of firm's investments (Capex, NWC and R&D) by year from 1989 to 2018. NWC corresponds to inventories plus accounts receivables minus accounts payable.

Figure 2 – Evolution of firm's investments scaled by total assets (1989 to 2018)

Figure 2: Time series of firm's investments in relative terms (scaled by total assets). This figure plots cross-sectional evolution of firm's average investments (Capex, NWC and R&D), scaled by total assets, by year from 1989 to 2018. NWC corresponds to inventories plus accounts receivables minus accounts payable.

¹ Peer effects refer to the broad class of externalities that arise when a firm's own behavior is responsive to the behavior as well as the characteristics of other firms in its chosen reference group (Patnam, 2011).

The importance of working capital over firms' investments is clear when we analyze data presented in Figure 1 and Figure 2, which presents the evolution of firms' investment types in our sample over time, both in (nominal) amount and in relative terms (scaled by total assets). The first thing to highlight is the relative importance of working capital in our sample of manufacturing firms. In absolute terms, working capital investment has shown great variation over time, reaching about US\$ 16 billions (in 2018 dollars) at the final of 2018, representing almost 15% of the volume invested in Capex in 2018. Regarding R&D, it is possible to see an almost linear growing trend of this investment type over the period, reaching almost US\$ 90 billions of investments at the final of 2018 in our sample. After we scale the firms' investment amount by total assets (Figure 2), it is clear that the average working capital investment in our sample is much less important than the investment in Capex and R&D (at the end of 2018, working capital investment was almost 1,2% of total assets). Scaled by total assets, the investments in Capex and R&D show a more stable pattern over 30 years from 1989 to 2018, representing each one about 4% to 6%, on average, of the total assets.

Our study contributes to the existing literature in three major ways. First, our results suggest that the relation between excess working capital and company performance is non-linear. But, unlike others studies which found an inverted U-shaped relation between NWC investment and firm value, particularly Baños-Caballero et al. (2012) for medium-sized Spanish firms, Baños-Caballero et al. (2014) for British firms, Aktas et al. (2015) for US firms and Ben-Nasr (2016) for a multinational sample of privatized firms from 54 countries, our findings show the relationship between excess NWC and company performance is non-monotonic, i.e., for firms with high level of NWC (excessive working capital investment), additional investment in NWC decreases firm value; however, for firms with low level of NWC, additional investment in NWC is indifferent regarding creating shareholder value. Second, we confirm that the firm's NWC is positively correlated with *Industry's NWC* (peers' effect) and find that a one standard deviation increase in the average peer firm working capital investment leads to an 11% increase in firm *i*'s investment, after controlling for firm-specific factors. And third, we estimate the impact of working capital investment on firm's performance using an instrumental variable framework that confirms that firms with a higher level of working capital are associated with a worst level of firm's performance. Our results are robust to changes in the estimation methods, as well as to changes in the specification of our dependent variables (Tobin's Q and 1-year stock excess return) and our main variable of interest (net working capital).

In general terms, our study is part of a recent and growing literature that investigate the behavior of peers firms in shaping various aspects of corporate policies (Patnam, 2011; Shue, 2013; Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; Ozoguz et al., 2018), as well to the literature that investigate the effect of working capital investment on firm value (Kieschnick et al, 2013; Almeida and Eid Jr, 2014; Baños-Caballero et al., 2014; Aktas et al., 2015; Ben-Nasr, 2016; Zeidan and Shapir, 2017).

We organize the remainder of this study as follows: section 2 will provide the literature review and the construction of the hypothesis; section 3 will present the details of the selection criteria for the sample of firms and the description of the methodology used in this study. Section 4 presents summary statistics for each variable and we will explore the relationship between working capital investment and firm stock performance, using different estimation methods and different specification of our variable of interest. Section 5 concludes the study.

1.2. Research shortcomings

One shortcoming of the study relies on the geographic scope of our sample of firms. This study focuses exclusively on the United States capital market and derives a conclusion based on American firms. We select this region because American capital markets are the most developed, liquid and relevant in the world. However, if we choose another market, like the Brazilian one, our conclusions could be different².

Another shortcoming correlated to the latter is regarding a specific dimension of our sample. We limited our sample only to manufacturing firms (SICs codes 2000 to 3999), because of the relative importance of working capital management for this kind of firm. Other studies on working capital management (Kieschnick et al, 2013; Aktas et al., 2015; Ben-Nasr, 2016) use a broad sample of firms that include other kinds of industries (including agriculture firms, utilities, construction, services, etc). The use of a different sample of firms could lead to different conclusions.

Another shortcoming is related to our definition of peer groups. We define the peer reference groups based on the firm's industry, using the Fama-French 49-industry

² Although theoretical links are similar in developed and developing countries, owing to their institutional conditions (lesser availability of trade credit, the severity of financial frictions, and shallower financial markets), firms in developing countries, *ceteris paribus*, need more working capital to run their business (Chan, 2014).

classification. Other studies on the effect of peers on firm's decision use different classification, defining peer groups in various ways, including common industrial classifications – i.e., 3-digit SIC codes – (Leary and Roberts, 2014; Grennan, 2019), product markets (Hoberg and Phillips, 2016)³, analyst coverage (Kaustia and Rantala, 2015), or even executives' business school alma maters (Shue, 2013). The use of a different industry classification could lead to different conclusions.

³ Hoberg and Phillips (2016) create a new set of industries based on the 10-K product descriptions filed with the U.S. Securities and Exchange Commission – SEC.

2. Literature Review and Construction of the Hypothesis

In this section, we present the literature review, especially related to peers' influence over the firm's financial decisions and, then the literature on working capital investment and firm value. After that, we present the hypotheses formulated in this study.

2.1. Peers influence over the firm's financial decisions

The literature on corporate finance show the role of peers in firms' decision making, playing a central role in shaping various aspects of corporate policies (e.g., Gilbert and Lieberman, 1987; Lieberman and Asaba, 2006; Shue, 2013; Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Kaustia and Rantala, 2015; Hoberg and Phillips, 2016; Fracassi, 2017; Mama, 2017; Adhikari and Agrawal, 2018; Grennan, 2019; Foucault and Fresard, 2019; among others). In addition, survey evidence indicates that corporate executives also consider peer firms' decisions when choosing their own firms' policies (Graham and Harvey, 2001). According to Shue (2013)⁴, peer interactions could affect managerial decision making because information and beliefs travel through social networks.

Existing empirical evidence suggests that the behavior of peer firms may matter for investment decisions of firms (Patnam, 2011; Foucault and Fresard, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; Ozoguz et al., 2018). Foucault and Fresard (2014) show that firms' investment is positively and significantly related to their peers' valuation and the sensitivity of firms' investment to their peers' valuation is about half the sensitivity to their own valuation. According to Foucault and Fresard (2014), the market valuation of a firm's peers influences its investment because this valuation informs managers about the firm's growth opportunities, complementing thereby other information available to managers, such as the firm's own stock price.

Leary and Roberts (2014), using peer firms' idiosyncratic returns as an instrument for leverage peer effects, show that peer effects are more important for capital structure determination than most previously identified determinants. The authors present evidence that a one standard deviation increase in peer firms' leverage ratios is associated with a 10% increase

⁴ Shue (2013), using the random assignment of MBA students to different sections as an identification strategy, the author explore how executive peer networks can affect managerial decisions, and finds that executives who graduated from Harvard Business School have more similar firm policies if they were assigned to the same core-class section, with the strongest effects in executive compensation and mergers and acquisitions strategy.

in firm i 's leverage ratio, an effect greater than that of any other determinants. In addition, Leary and Roberts (2014) find that leverage is strongly negatively related to peer firm equity shocks and debt and equity issuance decisions are negatively and positively related to peer firm equity shocks, respectively.

Dougal et al. (2015) provide evidence of peer effects in the firm's investment decisions, that is, the influence of peers' investment on the firm's investment. According to Dougal et al. (2015), their research suggests very strong local effects in corporate investments, that is, when deciding how much to invest in a given year, what a firm's local neighbors are doing is about half as important as what other firms in its industry are doing.

Fracassi (2017) finds that managers are influenced by their social peers when making corporate policy choices and more connections companies share with each other, more similar are their capital structure. Patnam (2011) finds significant network peer effects that are positively associated with firms' investment strategy and executive compensation among Indian public companies. Ozoguz et al. (2018) also confirm the positive relationship between firms' investment and peers' valuation.

Park et al. (2017) also analyze the effect of peer firms on firm investment strategies by using idiosyncratic equity returns as an instrument variable, in order to use 2-stage least squares regression to identify this effect. According to Park et al. (2017), more financially constrained firms show greater dependence on peers' investment decisions (i.e. firms in lack of finance tend to invest in a risk-averse way, dependent on its peer's decisions).

Mama (2017) use a sample of listed firms from Europe over the 1991-2011 period to explore whether and how firms learn from stock prices when making investment decisions and, according to author, he documents patterns of firm learning from stock prices that diverge from those reported in a U.S. context (e.g. Foucault and Fresard 2014; Leary and Roberts 2014). For Mama (2017), this is consistent with European managers adopting more conservative strategies relative to their US-based peers, and stock prices being less informative in Europe than in the U.S.

Hoberg and Phillips (2016) use a different classification of industry (they use a new time-varying measures of product similarity based on text-based analysis of firm 10-K product descriptions filed with the SEC to create a new set of industries in which firms can have their own distinct set of competitors) to examine how industry membership and rival similarity

change over time in response to exogenous industry shocks and whether advertising and R&D serve as endogenous barriers to entry. Hoberg and Phillips (2016) find evidence that firm advertising and R&D are associated with subsequent differentiation from competitors.

Adhikari and Agrawal (2018) and Grennan (2019) show that firms' payout policies are significantly influenced by the payout policies of their industry peers. According to Adhikari and Agrawal (2018), a firm's decisions on whether to start paying dividends, how much dividend to pay, and whether and how much to repurchase are significantly influenced by those of its industry peers. Grennan (2019) analyzes peer effects in the context of Lintner's partial-adjustment model of dividends and demonstrates that dividend decisions of peer firms are important determinants of firm dividend policy.

Albuquerque et al. (2013), starting from the idea that companies commonly use peer companies to help determine compensation packages for CEOs, an approach is known as benchmarking, hypothesizes that the peer pay effect could also represent a reward for executive talent, which captures managerial success in managing complex organizations and achieving high performance. Albuquerque et al. (2013) find that the link between a firm's selection of highly paid peers and CEO pay mostly represents compensation for executive talent.

Kaustia and Rantala (2015) show that recent stock splits by peer firms increase a firm's propensity to follow suit and split its stock and the effect is comparable to an increase of 40–50% in the share price.

In a nutshell, recent studies have found that firms' financial decisions are not only determined by own firm's circumstances, but also by the behaviors of other firms (peers). These studies on peers firm effect over firm decisions explore various aspects of corporate policies, especially that related to capital structure (Leary and Roberts, 2014), dividend policies (Adhikari, 2018; Grennan, 2019), investment policies (Patnam, 2011; Foucault and Fresard, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; Ozoguz et al., 2018), CEO compensation (Albuquerque et al., 2013; Francis et al., 2016), and stock splits (Kaustia and Rantala, 2015).

2.2. Working capital investment and firm value

The efficient working capital management plays a very important role in the strategy of any company to create shareholder value, especially with respect to profitability (i.e., the profitability of a company is inversely proportional to its cash conversion cycle), like have shown the studies of Shin and Soenen (1998), Deloof (2003), García-Teruel and Martínez-Solano (2007), Pais and Gama (2015) e Lyngstadaas and Berg (2016). Enqvist et al. (2014) examined the simultaneous relation of working capital-profitability and business cycle using a sample of Finnish firms over a period of 18 years from 1990 to 2008 and found that the impact of efficient working capital management on operational profitability increases in economic downturns. In a recent paper, Afrifa (2016), using a sample of small and medium enterprises (SMEs) over a 10-year period (2004-2013) in the UK, examined the relationship between NWC and firm performance by taking cash flow into consideration and found that the NWC relationship to firm performance is concave; but, after taking into consideration the interaction effects of the availability of cash flow, this relationship becomes convex.

Regarding to risk, there is a long debate concerning the risk / return tradeoff between different working capital policies (i.e., high risk, high return working capital investment and financing strategies are referred to as aggressive; lower risk and return strategies are called conservative), according to Gardner et al. (1986) and Weinraub and Visscher (1998). And regarding to the firm value, several empirical studies report evidence suggesting a negative relation between NWC overinvestment and firm value; that is, increasing NWC is associated, on average, with a decrease in excess stock return, according to studies of Kieschnick et al (2013) for a sample of US firms, Almeida and Eid Jr (2014) for a sample of Brazilian firms, and Autukaite and Molay (2014) for a sample of French firms. In a recent paper, Zeidan and Shapir (2017) decompose working capital investments in the cash conversion cycle and growth effects in the presence of x-inefficiency (the difference between theoretical predictions of what managers should do and what they actually do) and predict that reductions in the cash conversion cycle should increase shareholder value. According to Zeidan and Shapir (2017), the cash conversion cycle management, controlling for effects on operating margins, results in higher free cash flow to equity, stock prices, and profits.

As Almeida and Eid Jr (2014) point out, the investment in working capital is an important component of free cash flow, and it is easy to conclude that the efficient management of working capital is value relevant to any company. In this sense, a reduction in working capital

requirements generates positive free cash flow for the firm that could be immediately distributed to shareholders in the form of dividends or share repurchase or yet used to pay down debt. For example, if a company is able to reduce its working capital requirements by \$100,000 permanently, this company will be able to distribute this \$100,000 released from working capital as an extraordinary dividend to its shareholders immediately and, thus, increase firm value by the same amount. Similarly, if we were evaluating a project, reducing the project's net working capital needs over the project's life reduces the opportunity cost associated with this use of capital, creating shareholder value.

However, studies on working capital management highlight two distinct views on how investment in working capital can affect firm value. On one hand, the additional investment in working capital can have positive effects, particularly for companies with low levels of working capital, and may increase sales and profitability and, hence, firm value. This is the case of companies operating with high levels of inventories in order to reduce logistics costs, provide protection against commodity price fluctuations and minimize the possibility of loss of sales due to potential lack of inventory (in this case disappointed customers could switch to one of the firm's competitors), as highlighted by Schiff and Lieber (1974), Blinder and Maccini (1991), Fazzari and Petersen (1993) and Corsten and Gruen (2004). Furthermore, increasing working capital by granting trade credit to customers may also positively impact sales because, for example, it allows for price discrimination, serves as a guarantee for the quality of the product sold, helps promote a long-term relationship with customers, encourages customers to buy products at times of low demand, as highlighted by Emery (1987), Brennan et al. (1988), Long et al. (1993), Petersen and Rajan (1997), Wilson and Summers (2002), among others. Another positive aspect related to the additional investment in working capital is that companies with higher investment in working capital are considered more liquid and, therefore, they have lower bankruptcy risk (Dunn and Cheatham, 1993). Additionally, for financial constrained firms, Ding et al. (2013) find that firms characterized by excess working capital display high sensitivities of investment in working capital to cash flow and low sensitivities of investment in fixed capital to cash flow, suggesting that they are able to use working capital to alleviate the effects of cash flow shocks on fixed capital investment.

On the other hand, there are also possible adverse effects of additional investment in working capital, which may lead to a negative impact on firm value and to value destruction for shareholders, as shown by García-Teruel and Martínez-Solano (2007), Kieschnick et al. (2013), Almeida and Eid Jr (2014) e Autukaite and Molay (2014). The main idea is that, like any other

investment, additional investment in working capital requires additional funding, which in turn involves financing and opportunity costs. Therefore, high working capital investment is expected to reduce firm's return on invested capital (ROIC) and to be associated with high-interest expenses⁵ and higher credit risk (Aktas et al., 2015). Besides, higher levels of inventories are associated with other costs, like warehouse rent, insurance and security (Baños-Caballero et al., 2014) which, in turn, may reduce firm performance. Another negative aspect of excessive investment in working capital is related to the fact that keeping high working capital levels means that money is locked up (Deloof, 2003) and may also impede companies from implementing value-enhancing investment projects in the short term, as pointed out by Ek and Guerin (2011).

The above discussions seem to suggest that there is a trade-off between the benefits and costs of investment in working capital. Combining the positive and negative effects, studies on working capital management seem to suggest the existence of a non-linear relationship between the level of working capital and the company's performance, that is: (i) for companies with a high level of working capital (excess working capital), the expected relationship is negative (in these cases, the increase in working capital may not create value for the company); and (ii) for companies with low level of working capital (sub-investment in working capital), the relationship is positive (in these cases, the increase in working capital may create value for the company).

Consistent with this point of view, Baños-Caballero et al. (2012), using a sample of small and medium-sized Spanish enterprises, show that there is a non-monotonic (concave) relationship between working capital and firm profitability, which indicates that firms have an optimal working capital level that maximizes their profitability. Baños-Caballero et al. (2014), using a sample of non-financial UK companies, found strong support for an inverted U-shaped relation between investment in working capital and firm performance. In the same direction, Aktas et al. (2015), using a large sample of US firms between 1982-2011, show the existence of an optimal level of working capital and firms that converge to that optimal level (either by increasing or decreasing their investment in working capital) improve their stock and operating

⁵ Chen and Kieschnick (2018) investigate how changes in the availability of bank credit influence how firms manage their working capital requirements and found that the working capital policies of bank-dependent and non-bank-dependent companies are significantly different (i.e., bank-dependent firms tend to hold more current assets and depend more on current liabilities when managing their working capital than do less bank-dependent companies). In addition, Chen and Kieschnick (2018) found that the most important factors influencing firms working capital policies are its size, the proportion of its tangible assets, its profit margins, its sales and general administrative expense, its sales growth, and its use of fixed claims financing.

performance. Recently, Ben-Nasr (2016), using a large multinational sample of privatized firms from 54 countries from emerging and developed countries, show evidence indicating that the value-NWC curve is U-shaped, and that shareholders value less (more) increasing NWC in government-controlled (foreign-controlled) firms with a low level of NWC when compared to their non-government-controlled (non-foreign-controlled) peers.

The literature on working capital management in Latin America is very scarce. Almeida and Eid Jr (2014), using a sample of Brazilian firms from 1995 to 2009, find the increasing investment in working capital at the beginning of a fiscal year reduces company value. Mongrut et al. (2014), using a sample of public companies listed in five Latin American countries, show that firms in Argentina, Brazil, Chile, and Mexico overinvest in cash and a possible explanation for this overinvestment could be related to the short-term investment horizon and political instability that characterized these countries in the past years. Also, Mongrut et al. (2014) show that the industry cash conversion cycle, firm market power, its future sales and country risk have an important influence on the way Latin American firms manage their working capital, with significant differences among countries in the region. Palombini and Nakamura (2012) used a sample of 93 public companies from Brazil for the period from 2001 to 2004 and find that (i) debt level, size, and growth rate can affect the working capital management of Brazilian companies; (ii) companies with a high level of debt choose to work with lower levels of working capital; and (iii) large companies and companies with high growth rates have lower working capital levels. Sheng et al. (2013) analyze if trade credit is used as a substitute for bank credit during crisis periods in Latin America. Using a sample of public firms from Argentina, Brazil, and Mexico from 1994 to 2009, Sheng et al. (2013) found that for small firms, the substitution hypothesis was not rejected; and unlike Brazilian and Argentine firms, Mexican firms use more cash reserves than trade credit.

2.3. Construction of the hypotheses

Based on the above discussion, particularly in relation to the peers effect in the firm investment decisions (Patnam, 2011; Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; Ozoguz et al., 2018), as well as in relation to the effect of working capital investment and firm value (Kieschnick et al, 2013; Almeida and

Eid Jr, 2014; Baños-Caballero et al., 2014; Aktas et al., 2015; Ben-Nasr, 2016; Zeidan and Shapir, 2017), we posit the following hypotheses:

- H₁: The expected relationship between peer firms' investment in working capital and firms' investment in working capital is positive, i.e., firms act mimicking their peers' investment in working capital.
- H₂: The expected relationship between working capital investment and firm performance is negative when there is an over-investment in working capital (positive excess working capital), i.e., in this case, the increase in working capital investment does not create value for the company.
- H₃: The expected relationship between working capital investment and firm performance is positive when there is a sub-investment in working capital (negative excess working capital), i.e., in this case, the increase in working capital investment creates value for the company.

3. Methodology

This section brings the details of the selection criteria for the sample of firms used in the calculations to test the hypothesis formulated before. Then, we present the description of the methodology used in this study, firstly emphasizing the methodology on working capital investment and firm value, and then we present the methodology on how we handle the endogeneity of this relationship using an instrumental variable framework in which we use *Industry's NWC* as a proxy for peers' working capital investment in order to create an exogenous effect on firm's working capital investment.

3.1. Sample

We constructed a sample of all manufacturing firms (SICs codes 2000 to 3999) over the 1989 to 2018 period with data available from Capital IQ. From the initial sample, like in Almeida (2004), we eliminate firms for which total assets in a given year was lower than US\$ 10 million (in 2018 dollars), firms for which book value of equity is negative and those firms displaying sales or asset growth exceeding 100% in a given year (this last screen eliminate from our sample firms that displayed a large evolution of size or sales, that are indicative of mergers & acquisitions or other corporate events). In total, our final sample consists of 1,363 unique firms and 40,890 firm-years observations. The summary statistics for the full sample can be found in Table 2.

We winsorized our firm-specific factors and dependent variables at the top and bottom 1% tails measured using the full sample, to reduce the impact of outliers.

Table 1 reports the average values for our sample of firms. Note that the number of companies in our sample range from 67 in 1989 to 595 in 1996. The relative stable number of listed firms after the year 2000 is consistent with the increasing number of going private transactions after the promulgation of the Sarbanes-Oxley Act of 2002 (Engel et al., 2007).

Table 1 also shows the average values for each year of the reporting period for total assets, sales, cash holdings, net working capital and its components (inventories, accounts receivable and accounts payable). All values are expressed in millions of United State Dollar (USD) and are converted to 2018 currency by the consumer price index – CPI. The last line of Table 1 shows the average annual growth rate of each variable.

Table 1 - Average values by year

This table reports yearly average values for total assets, sales, cash holdings, net working capital (NWC) and its component. The NWC variable corresponds to inventories plus accounts receivables, minus accounts payable. The sample includes only manufacturing firms (SICs codes 2000 to 3999) gathered from Capital IQ database from 1989 to 2018. All values are expressed in millions of United State Dollar (USD), and adjusted to 2018 currency by the consumer price index (CPI). The last row displays the compound annual growth rate of each corresponding variable.

Year	Number of firms	Total assets	Sales	Cash	NWC	Inventories	Accounts receivable	Accounts payable
1989	67	2,643.54	3,103.65	116.69	543.21	535.26	373.14	370.72
1990	79	2,432.08	4,861.18	112.68	497.38	493.01	355.39	350.97
1991	183	4,291.22	4,483.60	166.21	716.02	639.44	551.13	470.61
1992	242	4,553.95	4,098.19	171.58	792.71	659.99	514.56	377.38
1993	344	4,059.68	2,969.70	138.17	641.72	525.67	446.33	327.49
1994	463	2,804.73	2,519.69	101.82	490.96	417.14	339.91	263.56
1995	579	2,404.14	2,592.14	96.37	435.00	365.35	306.08	231.13
1996	595	2,452.31	2,682.76	116.57	433.89	370.81	294.87	226.21
1997	565	2,631.72	3,081.56	146.53	460.78	384.52	319.58	237.77
1998	505	3,201.60	3,326.01	134.48	533.99	448.29	370.27	279.57
1999	462	3,557.19	3,609.70	162.23	556.27	480.35	390.18	311.57
2000	426	4,022.90	4,058.41	195.55	605.83	534.04	429.22	354.99
2001	412	4,169.49	3,904.96	252.60	564.97	470.53	415.41	320.74
2002	406	4,060.17	3,586.53	253.91	530.16	454.22	400.90	325.76
2003	401	4,415.03	3,874.14	342.72	560.43	501.36	417.60	360.32
2004	405	4,740.92	4,270.08	427.06	629.07	568.48	452.80	393.18
2005	405	4,668.24	4,486.98	444.95	621.92	566.63	446.86	392.51
2006	408	4,790.28	4,663.93	387.19	668.87	594.54	488.17	413.02
2007	399	5,141.55	5,145.48	441.33	697.20	646.49	503.94	451.34
2008	403	5,160.91	6,133.69	487.62	737.16	615.37	549.87	430.99
2009	408	5,187.67	4,717.15	490.64	631.25	576.91	465.19	410.17
2010	408	5,915.81	5,373.34	508.08	657.93	652.07	517.57	510.05
2011	412	6,281.18	6,274.82	558.80	724.35	688.03	579.41	540.78
2012	412	6,690.77	6,431.07	545.80	749.53	701.82	606.62	555.36
2013	417	7,005.72	6,298.89	578.48	740.08	712.00	600.42	567.18
2014	424	6,995.31	6,280.71	528.71	697.64	674.47	594.58	562.12
2015	431	7,101.15	5,571.08	557.35	657.68	610.07	577.19	513.88
2016	441	6,959.22	5,168.99	602.93	616.11	600.62	552.64	508.09
2017	439	7,360.42	5,524.15	594.84	665.69	677.32	611.54	590.84
2018	428	7,799.51	6,191.90	555.21	729.88	743.88	684.01	664.61
Growth rate	N/A	3.7%	2.3%	5.3%	1.0%	1.1%	2.0%	2.0%

First, it is important to note that the sample composition has changed over time, with some firms came in and several other ones came out of the sample. Nevertheless, we note that: (i) while the volume of funds held in cash was about 20% of the volume held in NWC at the beginning of the sample period, cash holdings become as important as the average investment in NWC towards the end of the sample period (in 2018, cash holding represent almost 80% of the funds in NWC); (ii) between 1989 and 2018, the yearly average growth rate of all variable is positive (i.e., there is a clearly increasing trend for all the considered variables) and, in

particular, the average volume held in cash has growth at the highest level among all the considered variables (5.3% a year), a pattern which is consistent with Bates et al. (2009) and Aktas et al. (2015); (iii) the average amount invested in NWC in our sample of manufacturing firms increased less relatively to total assets, sales and cash holdings, with an annual growth rate of only 1.0%; (iv) inventories is the component of NWC with the lowest annual growth rate (along the 30 years of our sample period, while the inventories has growth at an annual average rate of 1.1%, receivables and accounts payables has growth at 2.0% a year; (v) on average, firms hold relatively less working capital through time, and in particular inventories (at the beginning of the sample period, firms' NWC relative to total assets was about 20%, while in 2018 this proportion was reduced to 9%).

Figure 3 – Summary statistic for NWC-to-sale ratio

Figure 3: Time series of summary statistics for the NWC-to-sales ratio. This figure plots cross-sectional summary statistics for the NWC-to-sales ratio, for a sample of manufacturing firms, by year from 1989 to 2018. NWC corresponds to inventories plus accounts receivables minus accounts payable.

Figure 4 – Yearly average of working capital components (inventories, receivables and payables), scaled by sales

Figure 4: Yearly average inventories, receivables, and accounts payable. This figure plots the cross-sectional average for inventories, receivables, and payables, scaled by sales, for a sample of manufacturing firms by year from 1989 to 2018.

Figure 3 plots cross-sectional summary statistics for the NWC-to-sales ratio during the period from 1989 to 2018. The average and the median NWC-to-sales ratio over this period is 23.9% and 22.1%, respectively. In addition, there is a slightly decreasing time trends in average and median NWC-to-sales ratio from 1989 to 2018. Figure 3 also reports the cross-sectional standard deviation for the NWC-to-sales ratio, which has shown a more stable trend, indicating that firm heterogeneity in terms of the NWC-to-sales ratio did not change significantly through time.

Figure 4 plots the cross-sectional average for inventories, receivables, and payables, scaled by sales, to our sample of manufacturing firms. Of the three components of the NWC-to-sales ratio, receivables have decreased slightly more significantly through time, while accounts payables have shown a more stable time trend.

3.2. Description of the methodology on working capital investment and firm value

One objective of this research is to analyze the effect of working capital management on firm performance. So, we use a similar methodology approach from that developed by Aktas et al. (2015), with some adaptations, to test the hypotheses H_2 and H_3 of this study, in which the dependent variable measures the company performance.

When referring to the company's performance, we use firm's Tobin's Q , defined as the market value of equity plus total debt value, divided by total assets, as our main variable of interest. The underlying idea is that, managing working capital efficiently, companies may reduce their dependence on external funding and use resources released from working capital to fund new investments, improving the company's financial flexibility. Therefore, these additional investments should also lead to an increase in the firm's Tobin's Q in the future.

We also use a different dependent variable in order to expand our analysis regarding the relationship between working capital and firm value. That is, we also explore the impact of excess NWC on stock excess return over the year, defined as the realized return of stock i during year t minus the return of stock i 's benchmark portfolio during year t . The construction of the reference portfolios⁶ is designed to compensate for the component of the expected stock return that is due to its size and its book-to-market ratio (B/M), as suggested by Fama and French (1993). It is also important to mention that the model proposed by Fama and French (1993) includes the construction of 25 (twenty-five) reference portfolios formed by firms size and B/M ratio, and the return of these portfolios was obtained by weighting the market value of each company included in each portfolio (value-weighted approach).

⁶ We also explore a different specification of this dependent variable. Alternatively, we calculate excess stock return using a benchmark portfolio that is industry-based. That is, the benchmark portfolio for firm i in year t is the equally-weighted return of a portfolio formed only by firms at the same industry of firm i in year t . Our classification of industry use using the Fama-French 49-industry classification. We have checked that our findings hold when we use this different specification of the benchmark portfolios.

Thus, at the end of year t , we sort stocks by size and (independently) by B/M ratio. For size sort, we use the market value of equity measured at the end of December; and for B/M sort, we use both book value of equity and market value of equity at the end of the calendar year $t - 1$. In doing so, we allocate each sample stock to five size quintiles and five B/M quintiles. We construct 25 (twenty-five) benchmark portfolios from the intersection of firm size and B/M quintiles and calculate value-weighted annual returns on these portfolios from December of t to December of $t + 1$. Therefore, the return of the stock i 's benchmark portfolio during year t is the return of the portfolio of which the stock i belongs at the beginning of fiscal year t .

Thus, to evaluate the effect of excess working capital on the firm performance, we use the following linear regression model:

$$V_{i,t} = \alpha_t + \beta_1 \times \text{Excess_NWC}_{i,t-1} + \beta_2 \times \text{Controls}_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

The dependent variable, V , measures the company's performance (firm's Tobin's Q or excess stock return), as defined above. The *Excess_NWC* variable is the main independent variable of interest and measures the excess (or the lack) of working capital on the company's performance. The study of Hill et al. (2010) points out that the needs and practices related to working capital management are different from one industry to another and, so, it is important we control for changes in the characteristics of each industry. Thus, to determine the *Excess_NWC* variable, as in Aktas et al. (2015), we subtract from the NWC-to-sales ratio of company i in year t the ratio of the median NWC-to-sales ratio of the corresponding industry of company i in year t , and NWC is equal to inventories plus accounts receivable minus accounts payable. We define industries using the Fama-French 49-industry classification, and the summary statistics on NWC-to-sale by industry are presented in Table 3. By adopting this procedure, we are implicitly assuming that the efficient level of the company's working capital is equivalent to the industry-median level of working capital (in which there would be no excess in working capital).

In other words, the idea is that for each company in a given year, the *Excess_NWC* variable measure the unnecessary cash invested in working capital, meaning that (i) when the *Excess_NWC* is positive, the company has an over-investment in working capital, which implies

that the company has room to improve its efficiency of working capital management (which could occur, for example, by reducing inventory levels and payment terms granted to customers); and (ii) when *Excess_NWC* is negative, the company has a sub-investment in working capital, indicating that the company has adopted a very aggressive working capital policy, which could increase the risk of loss of sales due to potential lack of inventory, as shown by the studies of Fazzari and Petersen (1993) and Corsten and Gruen (2004). In this second case (companies with low working capital levels), additional investment in working capital is expected to be more valuable because, for example, it would allow the increase of trade credit supply to customers, which could positively impact sales by allowing a better price discrimination, serve as a guarantee for the quality of the product sold and help promote a long-term relationship with customers, as shown by Brennan et al. (1988), Long et al. (1993) and Wilson and Summers (2002).

Thus, a negative coefficient β_1 in the equation (1) measures the increase in the company's performance associated with a reduction of one unit in the *Excess_NWC* variable over time. And, similarly, a positive coefficient β_1 measures the reduction in the company's performance associated with a reduction of one unit in the *Excess_NWC* variable over time.

In addition, as one objective of this research is to analyze the effect of working capital management on the company's performance, it is important to control for other factors that may be correlated with changes in working capital and may also interfere with corporate performance. Thus, in the regression model presented in (1), *Controls* refers to a set of variables that may affect company's performance (Kieschnick et al, 2013; Aktas et al., 2015; Ben-Nasr, 2016), and includes the following variables:

- *Cash reserves*: is defined as the sum of the cash account and cash equivalents (highly liquid securities) divided by total assets. Bates et al. (2009) point out that there is a substitution effect between cash reserves and working capital components that can be quickly converted into cash. Thus, to mitigate any concerns that our results could be biased by this substitution effect, the cash reserves control variable was included in the regression models;
- *Firm size*: is defined as the natural logarithm of the market value of equity;

- *Leverage*: is defined as total debt divided by total assets (we also use an alternative specification defining leverage as total debt divided by market value of equity, and our main results hold after this change);
- *Risk*: is defined as the standard deviation of daily stock return during each year, as suggested in Coles et al. (2006) and Armstrong and Vashishtha (2012);
- *Intangible assets*: is defined as intangible assets divided by total assets;
- *Asset growth*: Cooper et al. (2008) and Lipson et al. (2011) point out that stock performance also relates to asset growth. Thus, one of the independent control variables is the annual growth rate of fixed assets (we do not use the growth rate of total assets because it includes components of the working capital);
- *Cash flow*: is defined as operating profit before depreciation and amortization (EBITDA) divided by total assets;
- *Sales growth*: is defined as the growth rate of sales during one year, that is, the result of the following equation: $(\text{sales}_t - \text{sales}_{t-1}) / \text{sales}_{t-1}$;
- *Sales volatility*: following Hill et al. (2010), it is defined as the standard deviation of the company's annual sales over the previous five years period (the observation is only included in the database in a given year only if the company has at least three observations in the previous five years period). The variable company's annual sales is scaled by the company's net assets, defined as total assets minus cash and cash equivalents;
- *R&D*: is defined as research and development expenditure, divided by total assets;
- *Age*: is defined as the number of years since the firm's year foundation. The regression uses the log of this variable.

Further, given the reference estimates in Eq. (1), we also estimated the following linear regression model, with a different specification⁷ of our variable of interest (NWC):

⁷ Our specification in (2) is different from that in Aktas et al. (2015), who estimate an asymmetric model in which the authors try to capture different coefficients of the *Excess_NWC* variable when firm has positive or negative excess working capital.

$$V_{i,t} = \alpha_t + \beta_1 \times NWC_{i,t-1} + \beta_2 \times Positive_NWC_{i,t-1} + \beta_3 \times (Positive_NWC_{i,t-1} \times NWC_{i,t-1}) + \beta_4 \times Controls_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Where $NWC_{i,t-1}$ corresponds to inventories plus accounts receivables minus accounts payable, scaled by sales, for firm i in year $t - 1$, and $Positive_NWC_{i,t-1}$ is a dummy variable that assumes value equal to 1 if firm i 's $Excess_NWC$ in year $t - 1$ is positive (i.e., in this case, firm i has an over-investment in working capital when compared to the median of the industry) and value 0 otherwise. In this specification, we also include an interaction variable ($Positive_NWC \times NWC$) in order to capture the effect on firm performance of excessive investment in working capital.

Finally, important to note that all independent variables in (1) and (2) are lagged by one period in order to mitigate concerns that working capital and company's performance may be simultaneously determined in equilibrium, as pointed out by Aktas et al. (2015).

Endogeneity is a major concern for empirical finance research in general, as highlighted by Roberts and Whited (2013). So, when estimating Eq. (1) and (2), we try to take care of endogeneity of our independent variable (NWC) applying the following methods: we estimated both equations using the fixed effect (FE) regression to control for the time-invariant characteristics of companies, and we used robust standard errors, clustered at firm level, to consider heteroscedasticity and serial correlation of error terms. Besides, one of our main independent variable specification ($Excess_NWC$) is constructed at the industry-level, so it is exogenous for the firms.

3.3. Description of the methodology on the peers' effect and firm investment

We also estimate the impact of working capital on firm's performance using an instrumental variable framework (see the results presented in section 4.4).

It should be stressed that the estimates in Eq. (1) and (2) should not necessarily be interpreted as the causal effect of excess working capital on the firm's performance. That is, a

concern about the endogeneity of this relationship is that some unobserved factors, Z_i , can affect jointly the working capital and the company's performance, which would lead to biased estimates of the parameters in (1) and (2). To deal with this potential endogeneity problem, we employ an instrumental variable framework using the *Industry's NWC* as instruments for the *company's NWC* in order to generate an exogenous variation in the firm's working capital. We assume that the average (median) ratio of net working capital to sales among firms that are in the same industry is a suitable index for the intrinsic needs of working capital of a specific firm.

In this study, we use *Industry's NWC* in order to evaluate the exogenous effect on the firm's working capital investment. The instrument used in this study is the average (median) of the peers' investment in working capital. The financial literature supports the positive relationship between the level of peers firms investment and the level firm investment (Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; and Ozoguz et al., 2018) and, at the same time, there is no theoretical or empirical reference that indicates that the level of peers' investment in working capital directly affects the firm's return.

By doing so, using the *Industry's NWC* as an instrument, we specify a different regression framework in order to study the relation between firms' working capital and firm's performance in a two-stage least squares (2SLS) regression framework. Following other studies (Foucault and Fresard, 2014) on the sensitivity of investment to the stock price, we use Tobin's Q as our proxy for a firm's stock price and valuation. It is defined as a firm's stock price times the number of shares outstanding plus the book value of total debt minus the book value of equity, scaled by book assets. In section 4.4 we also use another variable (the excess stock return over the year, defined as the realized return of stock i during year t minus the return of stock i 's benchmark portfolio during year t , as defined in section 3.2) to measure company valuation and to check the robustness of our results

In the first stage, firms' working capital is regressed onto the instrumental variable and control variables; and in the second stage, the company's performance is regressed onto the instrumented firms' working capital and control variables. So, the first stage regression specification is given by:

$$NWC_{i,j,t} = \alpha_{i,j,t} + \beta_1 \times \text{Industry's NWC}_{-i,j,t-1} + \beta_2 \times \text{Controls}_{i,j,t-1} + \varepsilon_{i,j,t} \quad (3)$$

Where $NWC_{i,j,t}$ refers to the NWC-to-sale ratio for firm i in industry j in year t , and $Industry's\ NWC_{-i,t-1}$ is the median (average) ratio of net working capital to sales among firms that are in the same industry, excluding firm i 's NWC-to-sale ratio. To identify peer effects specific to a firms' industry group, we construct the peer group based on the Fama-French 49-industry classification, among those industries that refer to manufacturing firms (SICs codes 2000 to 3999). *Controls* refer to a vector of variables known to correlate with investment decisions and include the same variables as in Eq. 1. In addition, we account for time-invariant firm heterogeneity by including firm fixed effects⁸ and time-specific effects by including year fixed effects.

The estimated value of the NWC-to-sale ratio for firm i in industry j in year t , instrumented by $Industry's\ NWC_{-i,t-1}$, as obtained in the first stage, is used in the second stage of the regression, as presented in Eq. (4), in which the firm's valuation (Tobin's Q or excess stock return) is the dependent variable:

$$V_{i,t} = \alpha_t + \beta_1 \times NWC_{i,t-1} + \beta_2 \times Controls_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

Where $NWC_{i,t}$ in the second stage is instrumented by $Industry's\ NWC$ in the first stage. $V_{i,t}$ is regressed onto lagged firms characteristics, controlled by firm and year fixed-effects.

⁸ In section 4.4 we also present the results considering pooled OLS and random effects regressions.

4. Analysis of Results

In this section, we explore the relationship between working capital investment and firm performance and test the hypotheses formulated. Our empirical analysis is based on a sample of U.S. manufacturing public firms from 1989 to 2018 and considers firms with data available in the Capital IQ database. We grouped data using the panel methodology with fixed effects at the firm level in order to mitigate omitted variables problems. In addition, in order to mitigate the influence of extreme values, we winsorized all variables at the 1st and 99th percentiles.

Following, section 4.1 presents the summary statistics for each of the variables used in this study. In Section 4.2 we present some preliminary analysis of our independent variable of interest (NWC-to-sale ratio) and in section 4.3 we present the results of the regressions performed regarding working capital investment and firm value. As we have shown in section 3.3, to deal with the potential endogeneity problem, in section 4.4 we employ an instrumental variable framework using *Industry's NWC* as instruments for the company's *NWC* and reevaluate the effect of working capital investment on company performance. In section 4.5 we change some specifications of our instrumental variable framework using to check the robustness of our results.

4.1. Summary statistics

Before presenting the results of multiple regressions that consider the effect of working capital management on the firm performance, in this section, we present in Table 2 summary statistics of each variable used in the calculations. Note that the mean (median) NWC-to-sale ratio is 23.94% (22.14%) and for the variable NWC-to-sale adjusted for industry-median (*Excess NWC*), the mean is 1.72% and the median is 0%, by construction. In addition, the median firm has a 1-year excess stock return of -10.83%, while the mean excess stock return is -21.29% (i.e., differently from Aktas et al. (2015), the distribution of our excess stock returns variable is negatively skewed). The mean Tobin's Q in our sample is 1.4292, while the median is 1.1574, indicating that the distribution of Tobin's Q is positively skewed in our sample.

Table 2 – Summary statistics

This table provides summary statistics on our sample firms. Q1 and Q3 denote the first and third quartiles, respectively. The sample includes manufacturing public firms (SICs codes 2000 to 3999) gathered from the Capital IQ database from 1989 to 2018. *Excess_NWC* is the industry-median adjusted NWC-to-sales ratio. We provide variable definitions in section 3.2 of this study. N denotes the sample size.

Variable	Mean	Median	Q1	Q3	Min	Max	Std. Dev.	N
NWC_to_sale	0.2394	0.2214	0.1549	0.3042	-0.0018	0.7165	0.1289	11,916
Excess_NWC	0.0172	0.0000	-0.0527	0.0671	-0.2281	0.4762	0.1178	11,916
Tobin's Q	1.4292	1.1574	0.8044	1.7161	0.3080	5.8665	0.9674	9,854
Stock excess return	-0.2129	-0.1083	-0.4967	0.1686	-1.9669	0.9937	0.6775	17,115
Cash reserves	0.0905	0.0571	0.0192	0.1320	0.0004	0.4583	0.0952	11,820
Firm size	18.6586	19.2000	17.0063	21.1564	7.2439	25.4724	3.6832	16,109
Leverage	0.2247	0.2140	0.1133	0.3183	0.0011	0.6308	0.1450	10,458
Risk	0.8373	0.4134	0.2792	0.7215	0.1202	8.1419	1.2535	14,018
Intangible assets	0.1728	0.1234	0.0468	0.2614	0.0019	0.6563	0.1584	9,074
Fixed asset	0.0707	0.0261	-0.0436	0.1260	-0.4102	1.1405	0.2245	11,027
Cash flow	0.0868	0.0886	0.0410	0.1426	-0.3294	0.3511	0.1026	11,918
R & D	0.0618	0.0420	0.0213	0.0804	0.0018	0.3100	0.0607	4,647
Sales growth	0.0701	0.0607	-0.0183	0.1495	-0.4237	0.6621	0.1748	11,773
Sales volatility	0.1449	0.1135	0.0676	0.1854	0.0147	0.6605	0.1135	10,486
Age (ln)	3.5279	3.6889	2.9444	4.3438	0.0000	5.0689	1.0344	19,563

In addition, from the analysis of data presented in Table 2, we can see that: (i) the median firm holds a cash reserve that is equal to 5.71% of its total assets, while the mean is almost 10% (the distribution of this variable in our sample is positively skewed); (ii) the mean leverage of our sample of manufacturing firms is 22.47% of its total assets (the median is almost equal, representing 21.4% of its assets); (iii) the median firm spent the equivalent of 6.18% of its total assets per year with research and development; and (iv) the mean and the median firm market capitalization (market value of equity) in our sample is \$ 127 millions and \$ 218 millions (in 2018 dollars), respectively.

Table 3 shows, for each industry, the summary statistics for the NWC-to-sale variable. To group companies into different industries, as shown in Table 3, we use the Fama-French 49-industry classification. The distribution of the NWC-to-sale variable among industries shows that there is great heterogeneity in terms of working capital management practices across industries: (i) companies that built “measuring and control equipment” have a highest mean NWC-to-sale from our sample (on average, 1/3 of the firms’ assets from this industry is held in

working capital resources; and (ii) companies from “oil and gas” and “candy & soda” industries have, on average, the lowest NWC-to-sale ratio among industries.

Table 3 – Summary statistics for NWC-to-sales ratio by industry

This table provides summary statistics for the NWC-to-sales ratio variable sorted by industry. The sample includes manufacturing public firms (SICs codes 2000 to 3999) gathered from the Capital IQ database from 1989 to 2018. For each industry in our sample period, we compute the mean, median, first quartile (Q1), third quartile (Q3) and standard deviation of the NWC-to-sales ratio. N denotes the number of observations.

Industry	Mean	Median	Q1	Q3	Std. Dev.	N
Aircraft	0.291	0.277	0.215	0.355	0.112	262
Apparel	0.242	0.229	0.174	0.299	0.094	519
Automobiles and trucks	0.187	0.173	0.117	0.230	0.111	615
Beer & Liquor	0.269	0.164	0.078	0.412	0.230	137
Business Services	0.233	0.226	0.155	0.298	0.085	22
Business Suppliers	0.155	0.152	0.110	0.198	0.069	572
Candy & Soda	0.072	0.073	0.054	0.086	0.032	102
Chemicals	0.227	0.210	0.158	0.269	0.121	658
Computers	0.264	0.262	0.175	0.332	0.121	326
Construction materials	0.243	0.231	0.162	0.307	0.126	985
Consumer Goods	0.245	0.232	0.163	0.298	0.127	527
Defense	0.262	0.270	0.197	0.328	0.087	58
Electrical Equipment	0.288	0.270	0.217	0.332	0.106	414
Electronic Equipment	0.256	0.226	0.165	0.327	0.146	1,148
Fabricated Products	0.254	0.242	0.184	0.314	0.103	164
Food Products	0.171	0.153	0.112	0.210	0.091	634
Machinery	0.283	0.259	0.206	0.330	0.123	1,074
Measuring and Cont. Equip	0.329	0.290	0.220	0.380	0.146	617
Medical Equipment	0.301	0.298	0.228	0.369	0.119	522
Petroleum and Nat. Gas	0.082	0.056	0.022	0.111	0.077	160
Pharmaceutical Prod	0.232	0.216	0.140	0.307	0.139	505
Printing and Publishing	0.167	0.166	0.095	0.224	0.086	177
Recreation	0.290	0.295	0.206	0.360	0.121	261
Rubber and Plastic Products	0.213	0.200	0.148	0.261	0.090	360
Shipbuilding, Railroad Equip	0.172	0.169	0.112	0.211	0.095	117
Shipping Containers	0.136	0.128	0.101	0.158	0.056	129
Steel Works Etc	0.229	0.207	0.158	0.297	0.111	514
Textiles	0.247	0.237	0.195	0.296	0.090	206
Tobacco Products	0.191	0.162	0.093	0.186	0.151	33
Total	0.239	0.221	0.154	0.304	0.129	11,916

4.2. Preliminary analysis

Table 4 shows the mean and median values of our dependent and control variables for two subsamples of firms based on the sign of the *Excess_NWC* variable (positive or negative). It is noteworthy that for each variable showed in Table 4, the last two columns display the p-values from a test of mean differences and a test of median differences between negative and positive excess NWC subsamples, respectively.

Table 4 – Sample characteristics of firms with negative and positive *Excess_NWC*

This table compares the sample characteristics of firms with negative and positive *Excess_NWC*. *Excess_NWC* is the industry-median adjusted NWC-to-sales ratio. The sample includes manufacturing public firms (SICs codes 2000 to 3999) gathered from the Capital IQ database from 1989 to 2018. We provide variable definitions in section 3.2 of this study. For each variable, the last two columns display the p-values from a test of mean differences and a test of median differences between negative and positive *Excess_NWC* subsamples, respectively.

Variable	Negative excess NWC		Positive excess NWC		p-value for a test of differences	
	Mean	Median	Mean	Median	Mean	Median
NWC-to-sale	0.1543	0.1596	0.3177	0.2977	0.0000	0.0000
Tobin's Q	1.5002	1.2134	1.3599	1.1008	0.0000	0.0000
Stock excess return	-0.1270	-0.0338	-0.1523	-0.0655	0.0330	0.0002
Cash reserves	0.0951	0.0631	0.0844	0.0510	0.0000	0.0000
Firm size	20.6682	20.7668	19.7485	19.7378	0.0000	0.0000
Leverage	0.2254	0.2146	0.2243	0.2140	0.6991	0.5759
Risk	0.4240	0.3397	0.4473	0.3665	0.0023	0.0000
Intangible assets	0.1848	0.1371	0.1610	0.1117	0.0000	0.0000
Fixed asset growth	0.0666	0.0282	0.0730	0.0243	0.1320	0.5728
Cash flow	0.0962	0.0961	0.0806	0.0825	0.0000	0.0000
R & D	0.0592	0.0385	0.0620	0.0442	0.1060	0.0015
Sales growth	0.0726	0.0620	0.0683	0.0594	0.1803	0.2639
Sales volatility	0.1555	0.1197	0.1321	0.1076	0.0000	0.0000
Age (ln)	3.8638	4.0690	3.8001	3.9120	0.0002	0.0000

By analyzing firms' characteristics reported in Table 4, the evidence suggests that there are significant differences between the two subsamples of firms (positive versus negative *Excess_NWC*). That is, firms with negative *Excess_NWC* are, on average, bigger and hold more cash reserves than firms with positive *Excess_NWC* (in this aspect, Palombini and Nakamura (2012), using a sample of Brazilian companies from 2001 to 2008, found similar results). The evidence reported in Table 4 also suggests that firms with negative *Excess_NWC* have on

average more resources invested in intangible assets, tend to have more growth opportunities and tend to have more volatile sales. Besides, firms with positive *Excess_NWC* have on average significantly lower stock return in comparison to firms with negative *Excess_NWC*.

4.3. Effect of net working capital investment on company value

The evidence reported in Table 4 suggests that there are firms' characteristics that are significantly different across firms with positive and negative *Excess_NWC* (industry-median adjusted NWC-to-sales ratio). So, in the multivariate analysis to be reported ahead we control for firms' characteristics in order to explore, in a first moment, the relationship between excess NWC and company performance (see Table 5). Table 5 show the regressions results in which we evaluate the relationship between excess NWC and company performance (it is important to highlight that the dependent variable is the firm's Tobin's Q, defined as the market value of equity plus total debt value, divided by total assets, and all the independent variables are lagged by one period with respect to the dependent variable).

The relation between excess NWC and company performance is negative (the coefficient of variable *Excess_NWC* is negative and statistically significant at 1% level) in columns 1-3 and this relation is robust to the inclusion of control variables in column 6 (fixed effect regression). That is, the evidence reported in Table 5 show that firms with excessive net working capital (with respect to the industry median) reduce their financial performance, causing value destruction for shareholders, in line with García-Teruel and Martínez-Solano (2007), Kieschnick et al. (2013), Almeida and Eid Jr (2014), Autukaite and Molay (2014), Aktas et al. (2015) and Ben-Nasr (2016). In order to test the robustness of our results, Table 6 present the results of the regressions using 1-year excess stock return as our dependent variable to test for the impact of excessive working capital investment on stock performance. The results of Table 6 confirm our finding regarding the relation between *Excess_NWC* and stock performance (see columns 4-6, in which we consider all control variables).

Table 5 – Regressions results of excess net working capital on Tobin's Q

This table provides the results of the regressions of excess net working capital (the industry-median adjusted NWC-to-sales ratio) on Tobin's Q. In each regression, the dependent variable is the firm Tobin's Q, defined as the market value of equity plus total debt value, divided by total assets. All the independent variables are lagged by one period with respect to the dependent variable. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Excess_NWC	-0.9507*** (0.2482)	-0.8328*** (0.1883)	-0.8743*** (0.2061)	0.2677 (0.3017)	-0.0555 (0.2860)	-0.4958** (0.2124)
Firm size				0.1187*** (0.0215)	0.2046*** (0.0201)	0.3413*** (0.0283)
Intangible assets				0.1775 (0.2086)	-0.5961** (0.2415)	-1.1588*** (0.1688)
Leverage				-0.1948 (0.2470)	-0.2030 (0.2045)	-0.0786 (0.1564)
Risk				0.2495* (0.1369)	0.2911** (0.1138)	0.3188*** (0.0828)
Fixed asset growth				-0.0135 (0.1077)	-0.0015 (0.0848)	-0.0283 (0.0690)
Cash reserves				0.9232** (0.3574)	0.3597 (0.2937)	-0.1062 (0.2166)
Cash flow				5.6035*** (0.8550)	3.3165*** (0.5572)	2.5386*** (0.2712)
R & D				6.1494*** (0.8971)	4.2443*** (1.0476)	3.3564*** (0.7530)
Sales volatility				0.1756 (0.2743)	0.2624 (0.2000)	0.1875 (0.1564)
Sales growth				-0.3565** (0.1481)	-0.2252* (0.1157)	-0.2351** (0.0985)
Age				-0.1186*** (0.0422)	-0.0889** (0.0427)	0.2081*** (0.0797)
Constant	1.2916*** (0.0976)	1.4790*** (0.0552)	0.9129*** (0.0795)	-1.7928*** (0.3985)	-2.6695*** (0.5036)	-6.3065*** (0.7899)
Observations	9,340	9,340	9,340	2,350	2,350	2,350
R-squared	0.0438	0.0414	0.0806	0.4685	0.2744	0.2926
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		763	763		211	211

However, it is important to highlight that not all firms have the means to reduce their net working capital and improve their performance. As pointed out by Aktas et al. (2015), for companies with already low working capital levels, additional NWC reduction may increase the risk of stock-outs and loss of sales, negatively affecting their performance. That is, superior company performance is expected only when there is a reduction of excessive working capital (i.e., for companies with positive excess NWC).

In order to examine this potential non-linearity in the relation between excessive working capital investment and company performance, we specify a different model in which we

introduce a dummy variable that assumes value equal to 1 if firm i 's *Excess_NWC* in year $t-1$ is positive (i.e., in this case, firm i has an excessive investment in working capital when compared to the median of the industry) and value 0 otherwise, and an interaction variable (*Positive_NWC* $\times$ *NWC*) in order to capture the effect on firm performance of an excessive working capital investment. The results of this model are presented in Table 7, in which the dependent variable is firm's Tobin's Q, and in Table 8, in which the dependent variable is firm's 1-year excess stock return.

**Table 6 – Regressions results of excess net working capital on stock performance
(robustness check)**

This table provides the results of the regressions of excess net working capital (the industry-median adjusted NWC-to-sales ratio) on stock performance. In each regression, the dependent variable is the 1-year excess stock return over year t . All the independent variables are lagged by one period with respect to the dependent variable. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Excess_NWC	-0.0761 (0.0564)	-0.0768 (0.0616)	-0.0084 (0.1016)	-0.3552*** (0.1362)	-0.3298** (0.1353)	-0.2909** (0.2565)
Firm size				-0.0385*** (0.0114)	-0.0389*** (0.0111)	-0.2690*** (0.0353)
Intangible assets				-0.0669 (0.0984)	-0.0633 (0.0982)	0.2067 (0.1555)
Leverage				0.0123 (0.1279)	0.0351 (0.1253)	-0.0717 (0.1725)
Risk				-0.1022 (0.0844)	-0.1013 (0.0832)	0.0264 (0.0778)
Fixed asset growth				-0.0419 (0.0704)	-0.0406 (0.0711)	0.0132 (0.0805)
Cash reserves				-0.2373 (0.1818)	-0.2150 (0.1808)	0.3438 (0.2081)
Cash flow				0.0959 (0.2211)	0.0974 (0.2202)	0.4708 (0.3135)
R & D				-0.1602 (0.4283)	-0.0492 (0.4185)	0.7682 (0.8367)
Sales volatility				-0.0286 (0.1274)	-0.0170 (0.1278)	0.0639 (0.1540)
Sales growth				-0.0571 (0.0983)	-0.0687 (0.0989)	-0.0430 (0.1103)
Age				0.0240 (0.0166)	0.0285* (0.0172)	0.1467 (0.0945)
Constant	0.0012 (0.0380)	-0.2228*** (0.0230)	-0.0593 (0.0424)	0.4775* (0.2687)	0.6416** (0.2631)	4.5596*** (0.7952)
Observations	10,875	10,875	10,875	2,437	2,437	2,437
R-squared	0.0322	0.0369	0.0392	0.0864	0.0917	0.1273
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		811	811		219	219

The results presented in Table 7 confirm our prevision. Columns 4-9 of Table 7 show that, for firms with positive excess NWC, the increase in excess NWC in the previous year is negatively associated with company performance over the subsequent year (note that the coefficient of variable *NWC x Positive_NWC* is negative and statistically significant at 1% level in the specifications presented in columns 7-9). Or in other words, for firms with excessive working capital investment, the reduction in resources tied up in working capital in the previous year is positively associated with better company performance over the subsequent year.

The evidence presented in Table 7 shows that, for example, for those firms that have positive excess NWC, the cost reduction (like warehouse rent, insurance, and security) originated from a reduction in inventories in the previous year may improve firm company performance. This evidence supports the hypothesis H_2 formulated in this study.

On the other hand, for firms that have negative excess NWC (i.e., firms with sub-investment in working capital), the increase in excess NWC in the previous year is not positively associated with firm performance over the next year. In this case, for companies with low level of working capital, this evidence suggests that the increase of inventories in order to, for example, reduce logistics costs, provide protection against commodity price fluctuations and minimize the possibility of loss of sales due to potential lack of inventory, does not create value for the company. So, this evidence does not support the hypothesis H_3 formulated in this study.

Taken together, the results reported in Table 7 suggest the existence of a non-linear relationship between NWC investment and firm value. That is, companies with a high level of NWC (i.e., the company's NWC-to-sale ratio is higher than the corresponding year industry-median of the NWC-to-sale ratio) may reduce firm value by making additional investment in NWC, but we cannot state that the opposite is true (i.e., firms with low level of NWC can create shareholders value when they invest additional resources in NWC). So, unlike other studies (Baños-Caballero et al., 2014; Aktas et al., 2015; Ben-Nasr, 2016), our study shows the relationship between excess NWC and company performance is non-monotonic, i.e., for firms with high level of NWC (excess NWC), additional investment in NWC decreases firm value; however, for firms with low level of NWC, additional investment in NWC is indifferent regarding creating shareholder value.

In addition, if we look at the coefficients of control variables in Table 7, we see that the coefficients of firm size, intangible assets, risk, cash flow, R&D and sales growth are statistically significant at conventional levels (firm's Tobin's Q increases with risk, cash flow, R&D as intuitively expected, that is, riskier firms, with robust cash generation and with greater R&D expenses have more growth opportunities and show better performance).

In Table 8, we expand our analysis presented in Table 7 regarding the relationship between working capital investment and firm value, using a different dependent variable. Now we explore the effect of excessive working capital investment on stock return (in this case, the dependent variable is the firm's 1-year excess stock return and all the independent variables are lagged by one period with respect to the dependent variable, the same procedure adopted previously). In Table 8, we use the same econometric approach and the same set of control variables used in Table 7, and the results, despite suggesting weaker evidence, also suggest the existence of a non-linear relationship between NWC investment and firm stock return.

In addition, the results of the analysis presented so far ignore the potential correlation of the residuals across firms. Therefore, this approach is likely to understate standard errors and affect statistical inferences. To address this issue, we reestimated all the linear regressions using the Fama-MacBeth (1973) cross-sectional regressions approach. The estimated average slope in the previous equations from Fama-MacBeth (1973) cross-sectional regressions were estimated at the annual frequency. The results remain qualitatively unaffected.

Table 7 – Regressions results of net working capital on Tobin's Q

This table provides the results of the regressions of net working capital (NWC) on Tobin's Q. In each regression, the dependent variable is the firm Tobin's Q, defined as the market value of equity plus total debt value, divided by total assets. *Positive_NWC* is a dummy variable taking value one if the corresponding excess NWC is positive and 0 otherwise. All the independent variables are lagged by one period with respect to the dependent variable. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS	Random Effects	Fixed Effects	Pooled OLS	Random Effects	Fixed Effects	Pooled OLS	Random Effects	Fixed Effects
NWC-to-sale	-0.7912*** (0.2329)	-0.8716*** (0.1965)	-0.9945*** (0.2223)	-0.2433 (0.3487)	-0.6211*** (0.2055)	-0.7363*** (0.2209)	1.0582*** (0.3496)	0.3838 (0.3143)	-0.1134 (0.3785)
Positive_NWC				0.1031 (0.1038)	0.0637 (0.0811)	0.0806 (0.0861)	0.2942** (0.1317)	0.2529* (0.1330)	0.2653* (0.1535)
Positive_NWC * NWC				-0.6883* (0.3554)	-0.4280* (0.2368)	-0.4966** (0.2518)	-1.4189*** (0.4060)	-1.1887*** (0.3623)	-1.2733*** (0.4389)
Firm size							0.1153*** (0.0214)	0.1997*** (0.0200)	0.3469*** (0.0462)
Intangible assets							0.0998 (0.2108)	-0.6099** (0.2425)	-1.1484*** (0.2905)
Leverage							-0.1927 (0.2520)	-0.2244 (0.2055)	-0.0781 (0.2302)
Risk							0.2656* (0.1387)	0.2823** (0.1112)	0.3012*** (0.1148)
Fixed asset growth							-0.0245 (0.1076)	-0.0075 (0.0843)	-0.0359 (0.0894)
Cash reserves							0.8942** (0.3559)	0.3381 (0.2922)	-0.1375 (0.2981)
Cash flow							5.6253*** (0.8545)	3.3348*** (0.5549)	2.5255*** (0.5568)
R & D							6.1869*** (0.8836)	4.2337*** (1.0364)	3.3721** (1.3438)
Sales volatility							0.1606 (0.2792)	0.2332 (0.1984)	0.1538 (0.2098)
Sales growth							-0.3266** (0.1467)	-0.2142* (0.1158)	-0.2311** (0.1155)
Age							-0.1184*** (0.0419)	-0.0950** (0.0440)	0.1841 (0.1602)
Constant	1.4916*** (0.1225)	1.6692*** (0.0728)	1.1616*** (0.0943)	1.4157*** (0.1336)	1.6466*** (0.0755)	1.1301*** (0.0946)	-1.9133*** (0.4193)	-2.5635*** (0.5179)	-6.1862*** (1.2737)
Observations	9,340	9,340	9,340	9,336	9,336	9,336	2,349	2,349	2,349
R-squared	0.0416	0.0824	0.0826	0.0437	0.0838	0.0840	0.4738	0.2811	0.3003
Firm FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of id		763	763		763	763		211	211

Table 8 – Regressions results of net working capital on stock performance (robustness check)

This table provides the results of the regressions of net working capital (NWC) on stock performance. In each regression, the dependent variable is the 1-year excess stock return over year t . *Positive_NWC* is a dummy variable taking value one if the corresponding excess NWC is positive and 0 otherwise. All the independent variables are lagged by one period with respect to the dependent variable. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pooled OLS	Random Effects	Fixed Effects	Pooled OLS	Random Effects	Fixed Effects	Pooled OLS	Random Effects	Fixed Effects
NWC-to-sale	-0.0606 (0.0512)	-0.0473 (0.0571)	0.0710 (0.1042)	0.1760* (0.0991)	0.1824* (0.1029)	0.1706 (0.1311)	-0.2560 (0.2338)	-0.2560 (0.2338)	0.3971 (0.3035)
Positive_NWC				0.0365 (0.0297)	0.0369 (0.0327)	0.0337 (0.0438)	-0.0067 (0.0719)	-0.0067 (0.0719)	-0.1737* (0.0960)
Positive_NWC * NWC				-0.2943*** (0.1122)	-0.3147** (0.1227)	-0.3155* (0.1612)	-0.1287 (0.2561)	-0.1287 (0.2561)	0.3656 (0.3059)
Firm size							-0.0416*** (0.0114)	-0.0416*** (0.0114)	-0.2729*** (0.0361)
Intangible assets							-0.0137 (0.0970)	-0.0137 (0.0970)	0.2025 (0.1531)
Leverage							0.0126 (0.1253)	0.0126 (0.1253)	-0.1175 (0.1756)
Risk							-0.0509 (0.0720)	-0.0509 (0.0720)	0.0321 (0.0781)
Fixed asset growth							-0.0607 (0.0690)	-0.0607 (0.0690)	0.0010 (0.0800)
Cash reserves							-0.1749 (0.1752)	-0.1749 (0.1752)	0.2563 (0.2109)
Cash flow							-0.0207 (0.2167)	-0.0207 (0.2167)	0.3807 (0.3200)
R & D							-0.1427 (0.4345)	-0.1427 (0.4345)	0.8108 (0.8572)
Sales volatility							-0.0818 (0.1265)	-0.0818 (0.1265)	0.0635 (0.1511)
Sales growth							-0.0095 (0.0998)	-0.0095 (0.0998)	-0.0167 (0.1118)
Age							0.0181 (0.0163)	0.0181 (0.0163)	0.1576* (0.0949)
Constant	0.0169 (0.0406)	-0.2133*** (0.0264)	-0.0777 (0.0496)	-0.1939*** (0.0680)	-0.2074*** (0.0296)	-0.0531 (0.0518)	0.9566*** (0.2966)	0.8189*** (0.2819)	4.5793*** (0.8020)
Observations	10,875	10,875	10,875	10,469	10,469	10,469	2,406	2,406	2,406
R-squared	0.0321	0.0369	0.0392	0.0375	0.0398	0.0400	0.0928	0.0938	0.1305
Firm FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of id		811	811		794	794		216	216

4.4. Peers effect over the firm's net working capital investment

As working capital is not a strictly exogenous variable (it is due to a decision made by firms) and, therefore, can cause self-selection problems (endogeneity). That is, some unobserved factors, Z_i , may affect jointly the working capital investment and the company's performance, which would lead to biased estimates in the results from Eq. (1) and (2). So, we consider a form of instrumentalization of working capital in a two-stage least squares (2SLS) regression framework.

We use the *Industry's NWC* as instruments for the *company's NWC* in order to generate an exogenous variation in the firm's working capital. We assume that the median (average) ratio of net working capital to sales among firms that are in the same industry is a suitable index for the intrinsic needs of the working capital of a specific firm. The financial literature supports the positive relationship between the level of peers' firms investment and the level of firm's investment (Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; and Ozoguz et al., 2018). The idea behind this is simple, companies that are in the same industry face similar institutional environments, investment opportunities and consumption demands, dispute talented executives, and are more likely to make similar investment decisions (Chen and Ma, 2017).

We find that using an instrumental variable for the concept of firms' NWC does not change the negative significant correlation of our main variable of interest ($NWC_{i,t}$) with firm performance measure ($V_{i,t}$), compatible with our hypothesis H_2 .

Table 9 and Table 10 reports the instrumental variable estimation results, which are, in sum, very similar to those of prior section 4.3. Panel B from Tables 9 and 10 show that, using Tobin's Q in the next one year to measure future corporate performance, firms with excessive net working capital investment reduce their financial performance, causing shareholders value destruction. If we look at the variable *NWC-to-sale* in Panel B of Table 9, all coefficients are negative and significant at 1% level (i.e., firms can improve financial performance over the next year by reducing working capital investment). The literature on the topic shows similar results (García-Teruel and Martínez-Solano, 2007; Kieschnick et al., 2013; Almeida and Eid Jr, 2014; Autukaite and Molay, 2014; Aktas et al., 2015; Ben-Nasr, 2016), even when the studies are based in different samples from distinct countries. Besides, this evidence also supports the hypothesis H_2 formulated in this study.

Table 9 – Instrumental variable regressions results of NWC-to-sale on Tobin's Q

This table provides the instrumental variable regressions results for our estimation of the firm's NWC-to-sale ratio. In the first stage (Panel A), firms' NWC is regressed onto the instrumental variable (Industry's NWC) and control variables; and in the second stage (Panel B), firms' performance is regressed onto the instrumented firms' NWC and control variables. In the second stage, the dependent variable is the firm Tobin's Q, defined as the market value of equity plus total debt value, divided by total assets. In columns 1-3 we use the median peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i , while in columns 4-6 we use the mean peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i . We use Fama-French 49-industry classification to group firms into peers groups. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Panel A – First stage						
Industry's NWC	0.4917*** (0.0510)	0.4518*** (0.0540)	0.3974*** (0.0661)	0.2614*** (0.0407)	0.2614*** (0.0407)	0.0799** (0.0364)
Firm size	-0.0187*** (0.0014)	-0.0145*** (0.0015)	0.0105*** (0.0029)	-0.0187*** (0.0014)	-0.0187*** (0.0014)	0.0104*** (0.0029)
Intangible assets	0.0276* (0.0164)	0.0289* (0.0167)	0.0009 (0.0173)	0.0382** (0.0165)	0.0382** (0.0165)	0.0012 (0.0174)
Leverage	-0.0669*** (0.0178)	-0.0590*** (0.0173)	0.0150 (0.0160)	-0.0743*** (0.018)	-0.0743*** (0.0180)	0.0170 (0.0161)
Risk	-0.0418*** (0.0132)	-0.0275** (0.0113)	-0.0122 (0.0085)	-0.0421*** (0.0133)	-0.0421*** (0.0133)	-0.0101 (0.0085)
Fixed asset growth	0.0060 (0.012)	0.0339*** (0.0099)	0.0046 (0.0070)	0.0069 (0.0122)	0.0069 (0.0122)	0.0047 (0.0071)
Cash reserves	-0.0798*** (0.0294)	-0.0895*** (0.0271)	-0.0128 (0.0221)	-0.0714** (0.0297)	-0.0714** (0.0297)	-0.0124 (0.0222)
Cash flow	-0.0027 (0.0344)	-0.0900*** (0.0318)	-0.0430 (0.0275)	-0.0155 (0.0347)	-0.0155 (0.0347)	-0.0472* (0.0277)
R & D	0.2513*** (0.0607)	-0.0535 (0.0619)	-0.1749** (0.0761)	0.2506*** (0.0614)	0.2506*** (0.0614)	-0.1735** (0.0766)
Sales volatility	-0.1189*** (0.0229)	-0.0395* (0.0204)	-0.0090 (0.0160)	-0.1216*** (0.0232)	-0.1216*** (0.0232)	-0.0071 (0.0161)
Sales growth	0.0092 (0.0170)	-0.0454*** (0.0141)	-0.0259*** (0.0100)	0.0115 (0.0172)	0.0115 (0.0172)	-0.0265*** (0.0101)
Age	-0.0040 (0.0029)	-0.0093*** (0.0032)	-0.0074 (0.0082)	-0.0048 (0.0030)	-0.0048 (0.0030)	-0.0086 (0.0082)
Constant	0.5730*** (0.0334)	0.5304*** (0.0354)	-0.0381 (0.0715)	0.6257*** (0.0331)	0.6257*** (0.0331)	0.0413 (0.0706)

Panel B – Second stage (cont. Table 9)						
NWC-to-sale	-1.1985 (0.7305)	-1.9013** (0.9496)	-6.7221*** (1.8583)	-4.5815*** (1.2780)	-4.5815*** (1.2885)	-13.1812* (6.9962)
Firm size	0.0918*** (0.0168)	0.1173*** (0.0184)	0.4046*** (0.0377)	0.0284 (0.0266)	0.0284 (0.0268)	0.4726*** (0.0861)
Intangible assets	0.2406** (0.1196)	0.0402 (0.1384)	-1.1408*** (0.1929)	0.4035*** (0.1482)	0.4035*** (0.1494)	-1.1370*** (0.2673)
Leverage	-0.3037** (0.1386)	-0.3576** (0.1520)	0.0349 (0.1822)	-0.5819*** (0.1809)	-0.5819*** (0.1824)	0.1622 (0.2831)
Risk	0.1845* (0.0984)	0.1974** (0.0938)	0.2433** (0.0969)	0.0305 (0.1236)	0.0305 (0.1246)	0.1727 (0.1518)
Fixed asset growth	0.0041 (0.0850)	0.0662 (0.0856)	-0.0093 (0.0791)	0.0332 (0.1005)	0.0332 (0.1013)	0.0190 (0.1132)
Cash reserves	0.8187*** (0.2109)	0.5849*** (0.2270)	-0.1468 (0.2476)	0.6217** (0.2546)	0.6217** (0.2567)	-0.2232 (0.3515)
Cash flow	5.5430*** (0.2421)	4.2760*** (0.2720)	2.2884*** (0.3198)	5.4015*** (0.2881)	5.4015*** (0.2904)	1.9846*** (0.5385)
R & D	6.4990*** (0.4651)	5.1885*** (0.4945)	2.4721*** (0.9062)	7.3486*** (0.5973)	7.3486*** (0.6022)	1.3789 (1.6696)
Sales volatility	-0.0124 (0.1896)	0.1319 (0.1685)	0.1102 (0.1796)	-0.4815* (0.2590)	-0.4815* (0.2611)	0.0513 (0.2557)
Sales growth	-0.3445*** (0.1205)	-0.3852*** (0.1194)	-0.3687*** (0.1224)	-0.2890** (0.1428)	-0.2890** (0.1440)	-0.5409** (0.2425)
Age	-0.1267*** (0.0210)	-0.1401*** (0.0278)	0.1542* (0.0923)	-0.1466*** (0.0254)	-0.1466*** (0.0256)	0.1021 (0.1382)
Constant	-0.2450 (0.5539)	-0.3373 (0.6644)	-6.1282*** (0.7866)	2.1155** (0.9276)	2.1155** (0.9352)	-5.7668*** (1.1487)
Observations	2,349	2,350	2,349	2,349	2,349	2,349
R-squared	0.4544	0.2323	0.1698	0.2421	0.3179	0.1122
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		211	211		211	211

It is important to highlight that, in columns 1-3 of Table 9, we use the median peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i , while in columns 4-6 we use the mean peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i . The results reported in Table 9 regarding the effect of peers' firms working capital investment on firms' working capital investment are similar using median or mean *Industry's NWC*, and both of them are statistically significant in all specifications.

In addition, Panel A of Table 9 presents the results of the first-stage regressions and suggests that peer effects influence corporate investment decisions. The results in Table 9, Panel A, suggest that peer effects play a significant role in determining variation in investment decisions. When making these choices, firms respond to their competitors, like prior studies on this topic (Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017 and Ozoguz et al., 2018).

Table 10 – Instrumental variable regressions results of net working capital on Tobin's Q

This table provides the instrumental variable regressions results for our estimation of the firm's NWC. In the first stage (Panel A), firms' $\ln_NWC$ is regressed onto the instrumental variable (Industry's $\ln_NWC$) and control variables; and in the second stage (Panel B), firms' performance is regressed onto the instrumented firms' $\ln_NWC$ and control variables. In the second stage, the dependent variable is the firm Tobin's Q, defined as the market value of equity plus total debt value, divided by total assets. In columns 1-3 we use the median peers NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i , while in columns 4-6 we use the mean peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i . We use Fama-French 49-industry classification to group firms into peers' groups. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Panel A – First stage						
Industry's $\ln_NWC$	0.1238*** (0.0389)	0.1009*** (0.0205)	-0.0842*** (0.024)	0.1359*** (0.0167)	0.0489** (0.0222)	0.0198 (0.0322)
Firm size	0.717*** (0.0189)	0.6324*** (0.0106)	0.3919*** (0.0166)	0.7041*** (0.0083)	0.6547*** (0.0103)	0.3915*** (0.0171)
Intangible assets	-0.4495** (0.2268)	-0.2323** (0.0991)	0.0947 (0.0998)	-0.5368*** (0.0948)	-0.3306*** (0.1014)	0.1140 (0.1011)
Leverage	0.3574 (0.2672)	0.7296*** (0.096)	0.5568*** (0.0924)	0.3664*** (0.1030)	0.6803*** (0.0994)	0.5996*** (0.0938)
Risk	-0.2899* (0.1649)	-0.1875*** (0.0555)	-0.0956** (0.0487)	-0.3439*** (0.0749)	-0.2025*** (0.0583)	-0.0700 (0.0487)
Fixed asset growth	-0.0562 (0.0881)	-0.0176 (0.0477)	0.0784* (0.0406)	-0.0430 (0.0692)	-0.0148 (0.0504)	0.0605 (0.0408)
Cash reserves	-1.5656*** (0.3565)	-0.6915*** (0.1426)	-0.1162 (0.1289)	-1.633*** (0.1711)	-0.8913*** (0.1489)	-0.1407 (0.1306)
Cash flow	-1.8485*** (0.5185)	-1.1673*** (0.1693)	-0.6367*** (0.1589)	-1.786*** (0.1962)	-1.1890*** (0.1765)	-0.6183*** (0.1620)
R & D	-0.5774 (0.8329)	-0.6691* (0.3802)	-0.4035 (0.4376)	-1.4214*** (0.3645)	-1.4038*** (0.3948)	-0.3075 (0.4561)
Sales volatility	-0.1925 (0.263)	-0.3487*** (0.104)	-0.309*** (0.0922)	-0.2082 (0.1294)	-0.3513*** (0.1077)	-0.2856*** (0.0914)
Sales growth	0.214* (0.1299)	0.1517** (0.0679)	0.1644*** (0.0578)	0.2092** (0.0983)	0.1177 (0.0721)	0.1485*** (0.0579)
Age	0.1634*** (0.04)	0.189*** (0.023)	0.1896*** (0.0469)	0.1539*** (0.0168)	0.1799*** (0.0217)	0.1755*** (0.0466)
Constant	-10.4951*** (0.4673)	-9.0042*** (0.2446)	-2.9428*** (0.4193)	-10.3078*** (0.1861)	-9.1403*** (0.2356)	-3.4851*** (0.4273)

Panel B – Second stage(cont. Table 10)						
Ln_NWC	-0.9198*** (0.3501)	-0.8495*** (0.3069)	-1.3352** (0.5691)	-0.5203*** (0.1402)	-1.1224 (0.7066)	-2.6951 (4.7829)
Firm size	0.7781*** (0.2545)	0.7391*** (0.1962)	0.8548*** (0.2248)	0.4957*** (0.1014)	0.9274** (0.4659)	1.4107 (1.8826)
Intangible assets	-0.3338 (0.2963)	-0.7184*** (0.1696)	-0.9992*** (0.2081)	-0.1724 (0.1311)	-0.8075*** (0.2790)	-0.9696 (0.6311)
Leverage	0.1261 (0.2760)	0.3996 (0.2660)	0.6713* (0.3739)	-0.0654 (0.1266)	0.4648 (0.5013)	1.3850 (2.8829)
Risk	-0.0569 (0.1526)	0.1145 (0.1027)	0.1862* (0.1109)	0.0700 (0.0964)	0.0356 (0.1633)	0.1066 (0.3649)
Fixed asset growth	-0.0564 (0.0929)	-0.0116 (0.0718)	0.0568 (0.0908)	-0.0193 (0.0791)	-0.0186 (0.0789)	0.1176 (0.3154)
Cash reserves	-0.7342 (0.6476)	-0.1687 (0.3142)	-0.2015 (0.2643)	-0.0209 (0.3087)	-0.5291 (0.6773)	-0.5293 (0.7798)
Cash flow	3.8676*** (0.9433)	2.4560*** (0.4346)	1.7192*** (0.4906)	4.4674*** (0.3437)	2.1609** (0.8940)	0.6798 (3.0217)
R & D	5.0230*** (1.1329)	3.6061*** (0.6365)	3.0379*** (0.9073)	5.7639*** (0.4592)	3.2017*** (1.1705)	2.6278 (1.9949)
Sales volatility	-0.0109 (0.2947)	-0.0218 (0.1923)	-0.2095 (0.2458)	0.0521 (0.1507)	-0.1231 (0.2997)	-0.6059 (1.3934)
Sales growth	-0.1595 (0.1659)	-0.1034 (0.1111)	0.0406 (0.1506)	-0.2024* (0.1158)	-0.0706 (0.1399)	0.2338 (0.7361)
Age	0.0325 (0.0665)	0.0651 (0.0684)	0.4552*** (0.1414)	-0.0376 (0.0300)	0.0963 (0.1329)	0.6949 (0.8508)
Constant	-10.1581*** (3.4770)	-9.7997*** (2.6509)	-10.9620*** (2.0742)	-6.2264*** (1.3940)	-12.2690* (6.3259)	-15.9423 (16.3151)
Observations	2,329	2,329	2,329	2,273	2,273	2,261
R-squared	0.4649	0.2570	0.1885	0.5463	0.2408	
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		208	208		205	204

From Table 9, Panel A, we can see that *Industry's NWC* is positively correlated with firm's NWC in all specification of Table 9. This evidence supports the hypothesis H₁ formulated in this study (the expected relationship between peers firms' investment in working capital and firms' investment in working capital is positive). Besides, the economic interpretation of coefficients from Panel A of Table 9 is quite substantial – if we look at the coefficient on the *Industry's NWC* in column 3, a one standard deviation increase in the average peer firm working capital investment leads to an 11% (calculation: $(0.3974 \times 0.0665)/0.2405$) increase in firm *i*'s investment, after controlling for firm-specific factors.

In Table 10 we use a different specification of the firm's working capital from that in Table 9 in order to test the robustness of our results. While in Table 9 we use net working capital to sale ratio from firm's *i* as our principal variable of interest, in Table 10 we use the natural logarithm of firm's *i* net working capital (that is, the natural logarithm of inventories plus

accounts receivables minus accounts payable). Our main results hold when we change the specification of our variable of interest.

Specifically, from the results presented in Table 10, when we use the median *Industry's NWC* all the main results are statistically significant (columns 1-3), while when using the average *Industry's NWC*, only the specification in column 4 is statistically significant ($p\text{-value} < 0,01$).

In sum, the results confirm that, even after accounting for the potential endogeneity of working capital, firms with a higher level of working capital investment are associated with a lower level of firm's performance over the subsequent year. Using our instrumental variable framework, the results obtained confirm (i) the positive relationship between the level of peers' firms investment and the level of firm's investment (Foucault and Fresard, 2014; Leary and Roberts, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; and Ozoguz et al., 2018); and (ii) the negative relationship between the level of firm's working capital investment and firm's performance (Shin and Soenen, 1998; Deloof, 2003; García-Teruel and Martínez-Solano, 2007; Kieschnick et al., 2013; Almeida and Eid Jr, 2014; Autukaite and Molay, 2014; Aktas et al., 2015; Pais and Gama, 2015; Lyngstadaas and Berg, 2016; Ben-Nasr, 2016).

4.5. Robustness check

We check the robustness of our findings from the prior section to changes in our dependent variable. That is, in this section, we change firm's Tobin's Q as our dependent variable to 1-year stock excess return in order to check the effect of working capital investment on firm performance using an instrumental variable framework. To do so, we use again *Industry's NWC* (the median or the average ratio of net working capital to sales among firms that are in the same industry of firm i , excluding firm i 's NWC-to-sale ratio) in order to evaluate an exogenous effect on firm value from working capital investment.

Table 11 – Instrumental variable regressions results of NWC-to-sale on stock performance (robustness check)

This table provides the instrumental variable regressions results for our estimation of the firm's NWC-to-sale ratio. In the first stage (Panel A), firms' NWC is regressed onto the instrumental variable (Industry's NWC) and control variables; and in the second stage (Panel B), firms' performance is regressed onto the instrumented firms' NWC and control variables. In the second stage, the dependent variable is the 1-year excess stock return over year t . In columns 1-3 we use the median peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i , while in columns 4-6 we use the mean peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i . We use Fama-French 49-industry classification to group firms into peers groups. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Panel A – First stage						
Industry's NWC	0.4913*** (0.132)	0.4851*** (0.0517)	0.3971*** (0.0648)	0.2692*** (0.0406)	0.2692*** (0.0406)	-0.0554* (0.0345)
Firm size	-0.0185*** (0.0037)	-0.0167*** (0.0014)	0.0101*** (0.0028)	-0.0185*** (0.0014)	-0.0185*** (0.0014)	0.0102*** (0.0028)
Intangible assets	0.0222 (0.0418)	0.0329** (0.0165)	0.0089 (0.0168)	0.0323** (0.0164)	0.0323** (0.0164)	0.0085 (0.017)
Leverage	-0.0707 (0.0469)	-0.0731*** (0.018)	0.0141 (0.0156)	-0.0787*** (0.0179)	-0.0787*** (0.0179)	0.0204 (0.0158)
Risk	-0.0408* (0.0242)	-0.0442*** (0.0131)	-0.0123 (0.0083)	-0.0412*** (0.0132)	-0.0412*** (0.0132)	-0.0121 (0.0084)
Fixed asset growth	0.0073 (0.0126)	0.0293** (0.012)	0.0075 (0.0068)	0.0078 (0.0119)	0.0078 (0.0119)	0.0074 (0.0069)
Cash reserves	-0.1002 (0.0661)	-0.127*** (0.0292)	-0.0108 (0.0215)	-0.0933*** (0.0291)	-0.0933*** (0.0291)	-0.0104 (0.0217)
Cash flow	0.0027 (0.0702)	-0.0662* (0.0341)	-0.043 (0.0268)	-0.0095 (0.034)	-0.0095 (0.034)	-0.046* (0.027)
R & D	0.2268* (0.1376)	0.1522** (0.0603)	-0.1700** (0.0719)	0.2241*** (0.0602)	0.2241*** (0.0602)	-0.1702** (0.0725)
Sales volatility	-0.1244** (0.0541)	-0.1119*** (0.0232)	-0.0084 (0.0157)	-0.1261*** (0.0231)	-0.1261*** (0.0231)	-0.0102 (0.0159)
Sales growth	0.0107 (0.0201)	-0.0211 (0.0168)	-0.0245** (0.0097)	0.0124 (0.0169)	0.0124 (0.0169)	-0.0255*** (0.0098)
Age	-0.0043 (0.0067)	-0.0071** (0.003)	-0.009 (0.0078)	-0.0052* (0.0029)	-0.0052* (0.0029)	-0.0091 (0.0078)
Constant	0.577*** (0.0912)	0.5684*** (0.0331)	-0.0239 (0.0331)	0.6286*** (0.0328)	0.6286*** (0.0328)	0.0791 (0.0692)

Panel B – Second stage (cont. Table 11)						
NWC-to-sale	-1.4002** (0.6725)	-1.3934** (0.6103)	-4.3169** (1.8556)	-0.4092 (0.8448)	-0.4092 (0.8516)	-6.0078 (7.5258)
Firm size	-0.0599*** (0.0162)	-0.0563*** (0.0130)	-0.2251*** (0.0372)	-0.0415** (0.0175)	-0.0415** (0.0176)	-0.2079** (0.0839)
Intangible assets	0.0331 (0.1090)	-0.0004 (0.0990)	0.2341 (0.1919)	-0.0080 (0.0981)	-0.0080 (0.0989)	0.2491 (0.2154)
Leverage	-0.0801 (0.1468)	-0.0927 (0.1163)	-0.0303 (0.1808)	0.0059 (0.1239)	0.0059 (0.1249)	0.0014 (0.2365)
Risk	-0.0969 (0.0799)	-0.1572* (0.0809)	-0.0218 (0.0968)	-0.0524 (0.0832)	-0.0524 (0.0839)	-0.0413 (0.1331)
Fixed asset growth	-0.0616 (0.0703)	-0.0071 (0.0713)	0.0424 (0.0790)	-0.0708 (0.0673)	-0.0708 (0.0678)	0.0552 (0.1009)
Cash reserves	-0.2353 (0.1773)	-0.3379* (0.1799)	0.1950 (0.2452)	-0.1555 (0.1762)	-0.1555 (0.1776)	0.1769 (0.2738)
Cash flow	-0.0356 (0.2247)	-0.0390 (0.2040)	0.1393 (0.3167)	-0.0005 (0.1917)	-0.0005 (0.1932)	0.0613 (0.4767)
R & D	0.0937 (0.4710)	-0.0053 (0.3571)	-0.2133 (0.8765)	-0.1285 (0.3870)	-0.1285 (0.3901)	-0.5029 (1.5577)
Sales volatility	-0.2253 (0.1761)	-0.1799 (0.1545)	0.0324 (0.1797)	-0.0831 (0.1770)	-0.0831 (0.1784)	0.0178 (0.2025)
Sales growth	0.0184 (0.1013)	-0.0660 (0.0968)	-0.1570 (0.1204)	0.0006 (0.0959)	0.0006 (0.0967)	-0.2001 (0.2253)
Age	0.0131 (0.0175)	0.0130 (0.0178)	0.1132 (0.0900)	0.0194 (0.0173)	0.0194 (0.0174)	0.0971 (0.1186)
Constant	1.5174*** (0.5270)	1.4880*** (0.4588)	5.1930*** (0.7876)	0.8203 (0.6189)	0.8203 (0.6238)	5.3099*** (0.9816)
Observations	2,406	2,437	2,406	2,406	2,406	2,406
R-squared	0.0659			0.0924		
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		219	216		216	216

In Table 11 and Table 12 our dependent variable in the second stage is the stock excess return over year – the realized return of stock i during year t minus the return of stock i 's benchmark portfolio during year t (the benchmark portfolios, as proposed by Fama and French (1993), is designed to control for the stock expected return that is due to its size and book-to-market ratio). Our results from Table 11 are very similar to those presented in the prior section: (i) in Panel A of Table 11, all specifications (except column 6) show that the variable *Industry's NWC* is positive and statistically significant at 1% level (i.e., the result holds even using median or average NWC-to-sale ratio among firms that are in the same industry of firm i , excluding firm i 's NWC-to-sale ratio observation), and reinforce the positive relationship between the level of peers' firms investment and the level of firm's investment, as in Foucault and Fresard (2014), Leary and Roberts (2014) and Dougal et al. (2015); (ii) in Panel B of Table 11, the variable NWC-to-sale is negative and statistically significant at 1% level only in columns 1-3, which use median *Industry's NWC* as instruments for company's *NWC-to-sale* ratio, and

confirm the negative relationship between firm's working capital investment and firm's financial performance, as in Kieschnick et al. (2013), Aktas et al. (2015), and Ben-Nasr (2016).

Table 12 – Instrumental variable regressions results of net working capital on stock performance (robustness check)

This table provides the instrumental variable regressions results for our estimation of the firm's NWC. In the first stage (Panel A), firms' $\ln_NWC$ is regressed onto the instrumental variable (Industry's $\ln_NWC$) and control variables; and in the second stage (Panel B), firms' performance is regressed onto the instrumented firms' $\ln_NWC$ and control variables. In the second stage, the dependent variable is the 1-year excess stock return over year t . In columns 1-3 we use the median peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i , while in columns 4-6 we use the mean peers' NWC-to-sale (excluding firm's i observations) as an instrument for NWC_i . We use Fama-French 49-industry classification to group firms into peers groups. We provide variable definitions in section 3.2 of this study. Symbols ***, ** and * denotes statistical significance at 1%, 5% and 10%, respectively. Standard errors are robust and clustered at the firm level (in parentheses).

Variables	(1) Pooled OLS	(2) Random Effects	(3) Fixed Effects	(4) Pooled OLS	(5) Random Effects	(6) Fixed Effects
Panel A – First stage						
Industry's $\ln_NWC$	0.1200*** (0.0389)	0.0781*** (0.0181)	-0.0547** (0.023)	0.1233*** (0.0166)	0.1552*** (0.0171)	-0.0764*** (0.0279)
Firm size	0.7237*** (0.0188)	0.6834*** (0.0092)	0.3953*** (0.0164)	0.7129*** (0.0081)	0.7033*** (0.0083)	0.4025*** (0.0166)
Intangible assets	-0.4814** (0.2272)	-0.3836*** (0.0972)	0.119 (0.0979)	-0.5727*** (0.0945)	-0.5741*** (0.0942)	0.1443 (0.099)
Leverage	0.3718 (0.2617)	0.6339*** (0.0973)	0.5426*** (0.0908)	0.3816*** (0.1024)	0.3759*** (0.1021)	0.5745*** (0.092)
Risk	-0.2833* (0.1622)	-0.2154*** (0.0602)	-0.0824* (0.0479)	-0.3334*** (0.0745)	-0.3307*** (0.0741)	-0.0593 (0.0478)
Fixed asset growth	-0.0727 (0.0846)	-0.03 (0.052)	0.0836** (0.0397)	-0.062 (0.0683)	-0.0701 (0.0683)	0.0637 (0.04)
Cash reserves	-1.6551*** (0.352)	-1.0846*** (0.149)	-0.1384 (0.127)	-1.7273*** (0.1676)	-1.7024*** (0.1673)	-0.1661 (0.1282)
Cash flow	-1.9197*** (0.5135)	-1.4479*** (0.1732)	-0.6878*** (0.1557)	-1.8745*** (0.1921)	-1.8025*** (0.1918)	-0.6789*** (0.1578)
R & D	-0.7421 (0.8283)	-0.8822** (0.3598)	-0.3068 (0.4156)	-1.5518*** (0.3566)	-1.5636*** (0.3569)	-0.0667 (0.4322)
Sales volatility	-0.166 (0.261)	-0.2952*** (0.1115)	-0.2813*** (0.0911)	-0.1773 (0.1294)	-0.1578 (0.1289)	-0.2641*** (0.0902)
Sales growth	0.1981 (0.1275)	0.1663** (0.0739)	0.1915*** (0.0565)	0.191** (0.0964)	0.1836* (0.0962)	0.1742*** (0.0564)
Age	0.1591*** (0.0396)	0.1686*** (0.0197)	0.1422*** (0.0449)	0.1507*** (0.0166)	0.146*** (0.0166)	0.1314*** (0.0445)
Constant	-10.5765*** (0.4606)	-9.742*** (0.2192)	-3.0138*** (0.4088)	-10.3805*** (0.1851)	-10.3857*** (0.1811)	-2.963*** (0.4176)

Panel B – Second stage (cont. Table 12)						
Ln_NWC	0.2856 (0.1790)	0.3667 (0.3056)	0.4101 (0.7640)	-0.5516*** (0.1601)	-0.3737*** (0.1234)	-0.5264 (0.7024)
Firm size	-0.2425* (0.1344)	-0.3062 (0.2094)	-0.4347 (0.3025)	0.3671*** (0.1167)	0.2369*** (0.0902)	-0.0557 (0.2802)
Intangible assets	0.1288 (0.1585)	0.1726 (0.1826)	0.1462 (0.2053)	-0.3422** (0.1437)	-0.2359* (0.1261)	0.2529 (0.2119)
Leverage	-0.0314 (0.1535)	-0.0888 (0.2329)	-0.3502 (0.4520)	0.2172 (0.1343)	0.1588 (0.1226)	0.1250 (0.4445)
Risk	0.0528 (0.0839)	0.0281 (0.1044)	0.0538 (0.1075)	-0.2177** (0.1015)	-0.1596* (0.0916)	-0.0059 (0.1009)
Fixed asset growth	-0.0457 (0.0715)	-0.0493 (0.0688)	-0.0060 (0.0944)	-0.1022 (0.0817)	-0.1023 (0.0770)	0.0479 (0.0887)
Cash reserves	0.3891 (0.3939)	0.3835 (0.4019)	0.3417 (0.2517)	-1.1590*** (0.3486)	-0.8442*** (0.2878)	0.2015 (0.2712)
Cash flow	0.5625 (0.4553)	0.5684 (0.4936)	0.5995 (0.6073)	-1.0225*** (0.3845)	-0.6665** (0.3205)	-0.0570 (0.5554)
R & D	0.1835 (0.5312)	0.7716 (0.5871)	0.7172 (0.7858)	-1.4546*** (0.4898)	-1.1428*** (0.4418)	0.6936 (0.8327)
Sales volatility	0.0104 (0.1466)	0.0929 (0.1730)	0.2051 (0.2658)	-0.1271 (0.1569)	-0.0954 (0.1465)	-0.0230 (0.2543)
Sales growth	-0.0612 (0.1139)	-0.1156 (0.1098)	-0.1301 (0.1798)	0.0804 (0.1188)	0.0393 (0.1106)	0.0337 (0.1618)
Age	-0.0231 (0.0361)	-0.0159 (0.0584)	0.0805 (0.1334)	0.1078*** (0.0325)	0.0811*** (0.0272)	0.2156* (0.1252)
Constant	3.3902* (1.8770)	4.2413 (2.8638)	6.3813** (2.5914)	-4.9588*** (1.6056)	-3.1833** (1.2439)	3.0741 (2.4467)
Observations	2,385	2,385	2,385	2,326	2,314	2,311
R-squared	0.0543	0.0993	0.0980		0.0357	0.0419
Firm FE	NO	NO	YES	NO	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Number of id		213	213		209	209

In Table 12 we use a different specification of the firm's working capital from that in Table 11 in order to test the robustness of our results. While in Table 11 we use net working capital to sale ratio from firm's i as our principal variable of interest, in Table 12 we use the natural logarithm of firm's i net working capital (that is, the natural logarithm of inventories plus accounts receivables minus accounts payable). In Panel A of Table 12, all specifications show that the variable *Industry's NWC* is statistically significant at 1% level; however, in columns 3 and 6 (fixed effect regressions), the coefficient is negatively correlated to the firm's NWC, contrarian the expected. And in Panel B of Table 12, the variable natural logarithm of firm's i NWC is negative and statistically significant at 1% level only in columns 4 and 5, in which both of them use the average *Industry's NWC* as instruments for company's *NWC*.

5. Conclusions

In this study, we use a sample of US manufacturing firms (SICs codes 2000 to 3999) from the period of 1989 to 2018 in order to evaluate the effect of working capital investment on firm performance. We deal with the endogeneity of this relationship by using an instrumental variable framework, in which we use peer firms' investment in working capital as instruments for the firm's working capital. The objective of such instrumentalization is to generate an exogenous variation in the firm's working capital, and then analyze the effect on firm performance. Therefore, the purpose of the present study is to provide novel evidence regarding the impact of working capital investment on the firm's performance, after control for the peers' effect on the firm's investment decisions. Our study belongs to the growing literature that explores the role of peers firms on the allocation of resources across firms (Patnam, 2011; Foucault and Fresard, 2014; Dougal et al., 2015; Fracassi, 2017; Park et al., 2017; Ozoguz et al., 2018).

Our results suggest that the relation between excess working capital and company performance is non-linear. But, unlike others studies which found an inverted U-shaped relation between NWC investment and firm value, particularly Baños-Caballero et al. (2012) for medium-sized Spanish firms, Baños-Caballero et al. (2014) for British firms, Aktas et al. (2015) for US firms and Ben-Nasr (2016) for a multinational sample of privatized firms from 54 countries, we only can state that working capital investment is negatively correlated to firm value when the firm have excessive capital tied up in working capital. In other words, firms with a high level of net working capital (i.e., the firm's NWC-to-sale ratio is higher than the corresponding year industry-median of the NWC-to-sale ratio) showed poor performance when making additional investment in NWC over the subsequent year.

In addition, we confirm that the firm's NWC is positively correlated with Industry's NWC (peers' effect) and find that a one standard deviation increase in the average peer firm working capital investment leads to an 11% increase in firm *i*'s investment, after controlling for firm-specific factors.

Regressions estimative of working capital investment on firm's performance using an instrumental variable framework confirm that firms with a higher level of working capital are associated with worst level of firm's performance, in line to prior literature on this topic

(Kieschnick et al, 2013; Almeida and Eid Jr, 2014; Baños-Caballero et al., 2014; Aktas et al., 2015; Ben-Nasr, 2016; Zeidan and Shapir, 2017).

Our main results hold when we change the specification of our variable of interest and when we change our dependent variables (Tobin's Q and 1-year stock excess return) to measure corporate performance.

Our findings regarding working capital and company performance imply that, at higher levels of working capital, managers should avoid holding too much cash unnecessarily tied up in working capital in order to avoid shareholders value destruction and should aim an optimal level of such assets – an efficient working capital management should provide a new source of internally-generated funds to firms, which could be invested in more profitable opportunities at the benefit of the shareholders. Besides, at lower levels of working capital, although we do not find evidence that additional investment in working capital create shareholders value, managers would prefer to increase the investment in this kind of assets in order to minimize the possibility of loss of sales due to potential lack of inventory, reduce logistics costs, provide firms protection against commodity price fluctuations, and supply credit to customers to allow price discrimination and to promote a long-term relationship with customers, as suggested by Aktas et al. (2015).

Finally, regarding to some directions for future research, we suggest (i) analyze if constrained and unconstrained firms show different patterns in terms of working capital investment and firm value using the approach proposed by Almeida et al. (2004) e/or Hadlock and Pierce (2010); and (ii) analyze the impact on firm value from each component of firm's working capital (inventories, accounts receivables and accounts payable).

References

- Adhikari, B. K.; & Agrawal, A. (2018). Peer influence on payout policies. *Journal of Corporate Finance*, 48, 615–637.
- Afrifa, G. A. (2016). Net working capital, cash flow and performance of UK SMEs. *Review of Accounting and Finance*, 15(1), 21–44.
- Aktas, N, Croci, E.; & Petmezas, D. (2015). Is working capital management value-enhancing? Evidence from firm performance and investments. *Journal of Corporate Finance*, 30, 98–113.
- Albuquerque, A. M.; De Franco, G.; & Verdi, R. S. (2013). Peer choice in CEO compensation. *Journal of Financial Economics*, 108, 160–181.
- Almeida, H.; Campello, M.; & Weisbach, M. S. (2004). The Cash Flow Sensitivity of Cash. *Journal of Finance*, 59, 1777–1804.
- Almeida, J. R.; & Eid Jr, W. (2014). Access to finance, working capital management and company value: Evidences from Brazilian companies listed on BM&FBOVESPA. *Journal of Business Research*, 67, 924–934.
- Armstrong, C. S.; & Vashishtha, R. (2012). Executive stock options, differential risk-taking incentives, and firm value. *Journal of Financial Economics*, 104, 70–88.
- Autukaite, R.; & Molay, E. (2014). Cash holdings, working capital and firm value: Evidence from France. *Bankers, Markets & Investors*, 132, 53–62.
- Baños-Caballero, S.; García-Teruel, P. J.; & Martínez-Solano, P. (2012). How does working capital management affect the profitability of Spanish SMEs? *Small Business Economics*, 39(2), 517–529.
- Baños-Caballero, S.; García-Teruel, P. J.; & Martínez-Solano, P. (2014). Working capital management, corporate performance, and financial constraints. *Journal of Business Research*, 67, 332–338.
- Bates, T. W.; Kahle, K. M.; & Stulz, R. M. (2009). Why do U.S. firms hold so much more cash than they used to? *Journal of Finance*, 64(5), 1985–2022.

- Ben-Nasr, H. (2016). State and foreign ownership and the value of working capital management. *Journal of Corporate Finance*, 41, 217–240.
- Blinder, A. S.; & Maccini, L.J. (1991). The resurgence of inventory research: what have we learned? *Journal of Economic Surveys*, 5(4), 291–328.
- Brennan, M. J.; Maksimovic, V.; & Zechner, J. (1988). Vendor financing. *Journal of Finance*, 43(5), 1127–1141.
- Chan, R. (2014). Financial Constraints, Working Capital and the Dynamic Behavior of the Firm. *World Bank*, Policy Research Working Paper no. 6797.
- Chen, C.; & Kieschnick, R. (2018). Bank credit and corporate working capital management. *Journal of Corporate Finance*, 48, 579–596.
- Chen, S.; & Ma, H. (2017). Peer effects in decision-making: Evidence from corporate investment. *China Journal of Accounting Research*, 10, 167–188.
- Coles, J. L.; Daniel, N. D.; & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, 79, 431–468.
- Cooper, M. J.; Gulen, H.; & Schill, M. J. (2008). Asset growth and the cross-section of stock returns. *Journal of Finance*, 63(4), 1609–1651.
- Corsten, D.; & Gruen, T. (2004). Stock-outs cause walkouts. *Harvard Business Review*, 82, 26–28.
- Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business, Finance and Accounting*, 30(3-4), 573–587.
- Ding, S.; Guariglia, A.; & Knight, J. (2013). Investment and financing constraints in China: Does working capital management make a difference? *Journal of Banking & Finance*, 37, 1490–1507.
- Dougal, C.; Parsons, C. A.; & Titman, S. (2015). Urban Vibrancy and Corporate Growth. *The Journal of Finance*, 70(1), 163–210.

- Dunn, P.; & Cheatham, L. (1993). Fundamentals of small business financial management for start-up, survival, growth, and changing economic circumstances. *Managerial Finance*, 19(8), 1-13.
- Ek, R.; & Guerin, S. (2011). Is there a right level of working capital? *Journal of Corporate Treasury Management*, 4(2), 137-149.
- Emery, G.W. (1987). An optimal financial response to variable demand. *Journal of Financial and Quantitative Analysis*, 22, 209-225.
- Engel, E.; Hayes, R.M.; & Wang, X. (2007). The Sarbanes-Oxley Act and firms' going-private decisions. *Journal of Accounting and Economics*, 44, 116–145.
- Enqvist, J.; Graham, M.; & Nikkinen, J. (2014). The impact of working capital management on firm profitability in different business cycles: Evidence from Finland. *Research in International Business and Finance*, 32, 36-49.
- Ernst, Young. (2015). All tied up: working capital management report. Available at: www.ey.com. Accessed on 08/29/2016.
- Fama, E. F.; & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33, 3-56.
- Fama, E. F.; & MacBeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy*, 81(3), 607–636.
- Fazzari, S.; & Petersen, B. (1993). Working capital and fixed investment: New evidence on financing constraints. *RAND Journal of Economics*, 24(3), 328-342.
- Foucault, T.; & Fresard, L. (2014). Learning from peers' stock prices and corporate investment. *Journal of Financial Economics*, 111, 554–577.
- Foucault, T.; & Fresard, L. (2019). Corporate Strategy, Conformism, and the Stock Market. *The Review of Financial Studies*, 32(3), 905–950.
- Fracassi, C. (2017). Corporate Finance Policies and Social Networks. *Management Science*, 63(8), 2420–2438.

- García-Teruel, P. J.; & Martínez-Solano, P. (2007). Effects of working capital management on SME profitability. *International Journal of Managerial Finance*, 3(2), 164-177.
- Gardner, M. J.; Mills, D. L.; & Pope, R. A. (1986). Working capital policy and operating risk: An empirical analysis. *The Financial Review*, 21(3), 31-31.
- Gilbert, R. L.; & Lieberman, M. (1987). Investment and coordination in oligopolistic industries. *The RAND Journal of Economics*, 18(1), 17–33.
- Graham, J. R.; & Harvey, C. (2001). The practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, 60, 187–243.
- Grennan, J. (2019). Dividend payments as a response to peer influence. *Journal of Financial Economics*, 131, 549–570.
- Hadlock, C. J.; & Pierce, J. R. (2010). New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. *Review of Financial Studies*, 23(5), 1909-1940.
- Hill, M. D.; Kelly, G. W.; & Highfield, M.J. (2010). Net Operating Working Capital Behavior: a First Look. *Financial Management*, 39, 783-805.
- Hoberg, G.; & Phillips, G. (2016). Text-Based Network Industries and Endogenous Product Differentiation. *Journal of Political Economy*, 124(5), 1423–1465.
- Kaustia, M.; & Rantala, V. (2015). Social learning and corporate peer effects. *Journal of Financial Economics*, 117, 653–669.
- Kieschnick, R.; Laplante, M., & Moussawi, R. (2013). Working capital management and shareholders' wealth. *Review of Finance*, 17(5), 1827-1852.
- Leary, M. T.; & Roberts, M. R. (2014). Do Peer Firms Affect Corporate Financial Policy?. *The Journal of Finance*, 69(1), 139-178.
- Lieberman, M. B.; & Asaba, S. (2006). Why do firms imitate each other? *Academy of Management Review*, 31(2), 366–385.
- Lipson, M. L.; Mortal, S.; & Schill, M. J. (2011). On the scope and drivers of the asset growth effect. *Journal of Financial and Quantitative Analysis*, 46(6), 1651-1682.

- Long, M. S.; Malitz, I. B.; & Ravid, S. A. (1993). Trade credit, quality guarantees and product marketability. *Financial Management*, 22(4), 117-127.
- Lyngstadaas, H.; & Berg, T. (2016). Working capital management: evidence from Norway. *International Journal of Managerial Finance*, 12(3), 295-313.
- Mahmoudzadeh, A.; Nili, M.; & Nili, F. (2018). Real effects of working capital shocks: Theory and evidence from micro data. *The Quarterly Review of Economics and Finance*, 67, 191–218.
- Mama, H. B. (2017). The interaction between stock prices and corporate investment: is Europe different? *Review of Managerial Science* 11, 315–351.
- Mongrut, S.; O'Shee, D. F.; Zavaleta, C. C.; & Zavaleta, J. C. (2014). Determinants of Working Capital Management in Latin American Companies. *Revista Innovar*, 24(51), 5-17.
- Ozoguz, A.; Rebello, M. J.; & Wardlaw, M. (2018). Information, Competition, and Investment Sensitivity to Peer Stock Prices. SMU Cox School of Business Research Paper No. 18-24. Available at SSRN: <https://ssrn.com/abstract=3164386>.
- Pais, M. A.; & Gama, P. M. (2015). Working capital management and SMEs profitability: Portuguese evidence. *International Journal of Managerial Finance*, 11(3), 341-58.
- Palombini, N. V. N.; & Nakamura, W. T. (2012). Key factors in working capital management in the Brazilian market. *Revista de Administração de Empresas*, 52(1), 55-69.
- Park, K.; Yang, I.; & Yang, T. (2017). The peer-firm effect on firm's investment decisions. *North American Journal of Economics and Finance*, 40, 178–199.
- Patnam, M. (2011). Corporate Networks and Peer Effects in Firm Policies. (Working paper). University of Cambridge.
- Petersen, M.; & Rajan, R. (1997). Trade credit: theories and evidence. *Review of Financial Studies*, 10(3), 661-691.
- Roberts, M.; & Whited, T. (2013). Endogeneity in empirical corporate finance. In: Constantinides, G., Harris, M., Stulz, R. (Eds.), *Handbook of the Economics of Finance*, (2), Elsevier, Amsterdam, 493–572.

- Schiff, M.; & Lieber, Z. (1974). A model for the integration of credit and inventory management. *Journal of Finance*, 29(1), 133-140.
- Sheng, H. H.; Bortoluzzo, A. B. & Santos, G. A. (2013). Impact of Trade Credit on Firm Inventory Investment During Financial Crises: Evidence from Latin America. *Emerging Markets Finance and Trade*, 49(sup4), 32–52.
- Shin, H.; & Soenen, L. (1998). Efficiency of working capital management and corporate profitability. *Financial Practice and Education*, 8(2), 37–45.
- Shue, K. (2013) Executive networks and firm policies: Evidence from the random assignment of MBA peers. *Review of Financial Studies*, 26(6), 1401–1442.
- Weinraub, H. J.; & Visscher, S. (1998). Industry practice relating to aggressive conservative working capital policies. *Journal of Financial and Strategic Decision*, 11(2), 11–18.
- Wilson, N.; & Summers, B. (2002). Trade credit terms offered by small firms: survey evidence and empirical analysis. *Journal of Business Finance & Accounting*, 29(3-4), 317–335.
- Zeidan, R.; & Shapir, O. M. (2017). Cash conversion cycle and value-enhancing operations: Theory and evidence for a free lunch. *Journal of Corporate Finance*, 45, 203–219.