

## Performance, working capital management, and the liability of smallness: A question of opportunity costs?

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# Performance, working capital management, and the liability of smallness: A question of opportunity costs?

Vivien Lefebvre 

EM Strasbourg Business School, University of Strasbourg, France

## ABSTRACT

This article studies the relationship between working capital management and firm operating performance and focuses on the moderating effect of size. We use a large sample of 56,221 small, medium, and large firms from France, Germany, and Italy, and our results indicate that the impact of working capital management on performance strongly depends on size. We identify a higher sensitivity of performance to underinvestment in net operating working capital for small firms, but no higher sensitivity to overinvestment. These findings suggest that small firms experience high opportunity costs from lost sales when their net operating working capital is low. Financial constraints and lack of financial management are discussed as potential explanations because both are expressions of the liability of smallness.

## KEYWORDS

Working capital management; performance; small business/small and medium enterprises

## Introduction

The performance and survival of firms largely depends on the manager's ability to acquire, create, and manage resources (Penrose, 1959). Among them, financial resources, internal organization, and strong reputation to attract customers are some of the most important ones or, at least, are so perceived by managers (Aldrich & Auster, 1986; Dodge, Fullerton, & Robbins, 1994; Stinchcombe, 1965). The literature commonly refers to the liability of smallness to describe the fact that small firms have only a limited amount of resources and difficult access to new ones. As a result, they face a higher rate of failure or bankruptcy and lower operating performances than larger firms. Working capital management (WCM) is, we suggest, one dimension of this liability.

*Working capital management* refers to a firm's ability to identify and finance an efficient level of investment in the fraction of inventories and accounts receivable that is not covered by accounts payable. Intuitively, firms should maintain a low level of investment in these components to minimize the interest expenses required to finance them and the storage costs of inventories. However, there are also benefits to a higher level of investment in WCM components. For example, small firms alleviate lack of reputation by increasing payment delays to

suppliers, which can result in additional sales (Wilson & Summers, 2002). Thus, there is an optimal level of investment in WCM that balances these costs and benefits, and maximizes the firm's performance and value (Aktas, Croci, & Petmezas, 2015; Baños-Caballero, García-Teruel, & Martínez-Solano, 2012, 2014). Consistent empirical findings in the literature confirm that the relationship between performance and WCM is concave. However, to our knowledge no previous article has investigated whether and to what extent this relationship is influenced by firm size.

Filling this gap appears important for several reasons. First, as small firms strongly rely on internally generated cash, the role of WCM is likely to be more important for them because it conditions the speed at which cash is available (Berger & Udell, 1998; Cassar, 2004). Larger firms on the other side have easier access to external funding and therefore have more flexibility in WCM, meaning they can more easily and at a lower cost finance a higher investment in WCM components (Kieschnick, Laplante, & Moussawi, 2013). Second, financial management is rather poor among small firms so, despite their importance, WCM practices are often deficient for these firms (Howorth & Westhead, 2003; Peel & Wilson, 1996; Peel, Wilson, & Howorth, 2001). For example, lack of WCM monitoring implies that small firms adjust WCM slower than larger firms, making the effect of an inadequate level of WCM on performance more damaging. Thus, identifying the extent to which small firms' performance is affected by WCM is of significant interest for small firms' managers who lack time, skills, and cash to dedicate to WCM (Peel & Wilson, 1996).

In this article, we show that the performance of small firms is more sensitive to underinvestment in WCM components than that of large firms, a finding we interpret as an expression of the liability of smallness. Small firms do not adjust investment in WCM either because they are driven by the need for internally generated cash or because they do not monitor WCM often enough. Both cases result in significant opportunity costs due to lost sales. Strikingly, we observe no conclusive difference between small, medium, and large firms when it comes to overinvestment in the operating components of working capital. This suggests that small firms adjust faster investment in this latter case because they observe the costs of overinvestment.

Our work contributes to the literature in several ways. First, we extend the financial management literature as we investigate the role of size in the WCM-performance relationship. Second, and unlike previous studies, we find that after controlling for endogeneity between performance and WCM, only underinvestment in WCM components impacts the performance of small and medium firms. Finally, we show that the impact of underinvestment in WCM components on performance is higher for small firms than for medium or large firms.

The rest of the article is organized as follows. First, we review the literature on the relationship between firm performance and WCM, and develop our hypotheses in the particular case of small firms. Next, we present our sample and methodology and describe our results. We also describe how we performed several robustness tests and controlled for reverse causality. Last, we discuss our findings and potential implications of our work for managers, policy-makers, and research, and present our conclusions.

## **Theoretical foundations and hypotheses development**

### ***Working capital management and firm performance***

Firms need to purchase raw materials to produce finished goods and eventually sell them, which results in accounts receivables and, depending on payment delays, cash. As the time it takes to produce, sell, and cash-in is longer than the payment delays granted by suppliers, firms invest money in inventories and accounts receivables that remains locked up. This amount of cash, which is the fraction of working capital not covered by accounts payable, is referred to as *net operating working capital* (NOWC) (Hill, Kelly, & Highfield, 2010). When NOWC is positive, it means that firms need to finance this requirement, which is mostly achieved through banking debt (Kieschnick et al., 2013). Therefore, firms seek to keep NOWC as low as possible because the higher it is, the higher the amount of financial expenses the firm has to pay (Hill et al., 2010). If the NOWC is negative, it means that the firm generates available cash through its day-to-day operations, a situation that is generally considered as favorable.

The agility with which a firm adjusts the level of NOWC to internal and external conditions is called working capital management. WCM represents an important part of financial management because it conditions the availability of internally generated cash or, in other words, the speed at which cash flows in. When a company grows and sales increase, the amount of NOWC grows as a mechanical result of an increase in inventories and accounts receivable. Thus, additional financing is required. A stylized fact in the WCM literature is that firms largely overinvest in NOWC (Aktas et al., 2015; Deloof, 2003). As a result, huge amounts of cash are unnecessarily locked up in inventories and accounts receivable, suggesting that most firms could improve their WCM by reducing investment in NOWC.<sup>1</sup>

When it comes to WCM, firms adopt two approaches (Hill et al., 2010). The “aggressive” approach consists of cutting investment in NOWC by reducing the levels of inventories and by asking customers to pay faster. Thus, NOWC is smaller, which means that less cash is tied up in the

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<sup>1</sup>As noted by Aktas et al. (2015), longitudinal observations of WCM shows that the adoption of just-in-time practices in the last twenty years reduced the amount firms invest in inventories and, thus, in NOWC.

operating cycle. Costs induced by the financing of NOWC are lowered which should, in turn, increase profitability. However, there are drawbacks to this aggressive WCM because low levels of inventories increase the risk of stockouts. As emphasized by Corsten and Gruen (2004), when customers face stockouts they just go somewhere else to find the products they want and sales are lost for the firm. Additionally, the risk of an interruption in the production process is also increased when firms maintain low levels of inventories. These opportunity costs negatively affect a firm's profitability, suggesting that the relationship between firm profitability and investment in NOWC is not linear.

The "conservative" approach is the opposite of the aggressive approach. It means that firms grant longer payment delays and keep high levels of inventories because they expect specific benefits. The risk of stockouts is, for example, lower for a conservative WCM and it gives time to customers to assess product quality which, in turn, reduces information asymmetry between suppliers and customers (Blinder & Maccini, 1991; Long, Malitz, & Ravid, 1993; Ng, Smith, & Smith, 1999). Granting longer payment delays to customers is also a way to gain and build trust with new clients (Wilson & Summers, 2002). Customers may also select a supplier because it grants longer payment delays if no other criterion is available to differentiate between different suppliers (Shipley & Davis, 1991). These expected benefits should positively affect a firm's profitability as they represent a potential gain in sales. The drawback of the conservative strategy is that it increases the amount of inventory and receivables and, thus, the need for finance. As we already explained, as firms use banking debt to finance NOWC, a conservative WCM brings additional financial expenses (Kieschnick et al., 2013). Storage costs, as well as related costs such as insurance and security expenses, also increase as a result of a conservative WCM (Kim & Chung, 1990).

Overall, both WCM approaches have benefits and drawbacks that impact firm performances, making the investigation of the role of WCM on firm performance the major research stream in the WCM literature. This literature reports consistent findings about the fact that the relationship between WCM and firm performance has an inverted-U shape as suggested by the previous arguments. In other words, there is an optimal level of investment in NOWC that balances the benefits and costs of WCM strategies (Aktas et al., 2015; Baños-Caballero et al., 2012, 2014; Ben-Nasr, 2016).

The WCM literature considers both aggressive and conservative WCM as "strategies" (Hill et al., 2010). Therefore, it looks like an implicit assumption that firms target a NOWC level that best suits their current strategy, and that they try to achieve this level as soon as possible (Baños-Caballero, Garcia-Teruel, & Martínez-Solano, 2010). While this assumption is plausible for firms that have access to a large amount of resources, it appears less realistic for small firms that are known to have limited access to resources, especially financial ones. It is indeed possible that small firms deliberately constrain investment in NOWC to

finance other fixed assets investments and operating expenses. Moreover, because small firms lack financial management, as we develop in the next section, it is likely that some of them have no concrete WCM practices or a “passive” WCM (Khoury, Smith, & McKay, 1999). This makes the investigation of the moderating role of size in the WCM-performance relationship an important issue that has not been previously addressed by the literature. Indeed, most of the recent works in the WCM literature consider only large or listed firms (Aktas et al., 2015; Baños-Caballero et al., 2014; Ben-Nasr, 2016; Deloof, 2003; Kieschnick et al., 2013). While Ebben and Johnson (2011) and Baños-Caballero et al. (2012) used samples of small and medium enterprises (SMEs) in WCM studies, it was not their purpose to compare large firms with small firms. Thus, we want to investigate the following research question: To what extent does size influence the NOWC-performance relationship?

### ***Small firms and working capital management***

For firms, the acquisition of resources is one of the keys to growth (Penrose, 1959). A manager’s ability to identify and acquire those resources is therefore a central aspect of firm growth. The combination of newly acquired resources with the ones the firm already has conditions the achievement of performance (Barney, 1991; Wernerfelt, 1984). Scarcity of internal resources and difficult access to external resources are obviously some of the biggest weaknesses small firms face, a concept that is commonly referred to as the *liability of smallness* (Aldrich & Auster, 1986). Among them, lack of reputation and bargaining power (Crook & Combs, 2007; Stinchcombe, 1965; Wilson & Summers, 2002), poor internal organization and management (Dodge et al., 1994), and constrained access to external finance (Cassar, 2004) appear to be those with the strongest impact on WCM.

The lack of external financial resources is one of the major constraints that small firms have to face. Berger and Udell (1998) provide a theoretical explanation to these constraints based on information asymmetry. As small firms are informationally opaque, external investors are reluctant to provide them with cash because such an investment is riskier than in the case of a larger firm that has more collateral and a longer accounting track record. This reduces the amount of external finance small firms can access and increases the cost of these funds (Audretsch & Elston, 1997; Berger & Udell, 1998; Cassar, 2004; Stiglitz & Weiss, 1983). As a result, small firms need alternative sources of finance to grow in the early stages. A manager’s ability to acquire financial resources and configure them to create value, which is financial management, is thus a key factor of survival and performance (Brinckmann, Salomo, & Gemuenden, 2011; Penrose, 1959). Brinckmann et al. (2011) distinguish between several aspects of financial management such as external financing and financing through operations. They show that, while most of the literature on small firms’ finance focuses

on external financing, the role of financing through operations is even more crucial for small firms to grow. In other words, firms that generate cash internally alleviate limitations in the access to external finance. The bootstrapping literature offers several examples of techniques that startups' managers implement to generate cash internally. For example, such firms offer customers discounts on upfront payments and delay payment to suppliers (Winborg & Landström, 2001). These practices have direct implications on WCM because they reduce the investment in NOWC as accounts receivable are lower and accounts payable are higher. Bootstrapping firms keep their NOWC as low as possible because they need to release cash quickly to finance operating expenses or investment. This means that, because of their resource constraint, small firms use what we describe as aggressive WCM to generate available cash. Because small firms may not have any other financing source, we expect them to maintain a low level of investment in NOWC even if this increases the risk of stockouts and possible opportunity costs.<sup>2</sup> Therefore, the potential negative impact of an aggressive WCM on performance is expected to be higher for small firms because they cannot easily adjust investment in NOWC.

A modest, but consistent, stream of research shows that small firms struggle with WCM<sup>3</sup> and that this contributes to explain a significant portion of small firms' failures (Berryman, 1983). Survey based studies by Peel and Wilson (1996), Khoury et al. (1999), and Peel et al. (2001) show that financial management is rather poor among small firms. For example, the use of capital budgeting techniques to assess investment profitability is very low when compared to larger firms' standards (see, for example, Graham & Harvey, 2001). In the case of WCM, small firms lack efficient practices in the management of the components of NOWC. This is particularly true for inventory management as more than a third of surveyed firms indicate that they never review inventory levels, turnover, or reorder levels (Howorth & Westhead, 2003; Peel & Wilson, 1996). Additionally, small firms' managers report that they review their WCM practices "whenever necessary" and not on a regular basis (Khoury et al., 1999). In the same vein, Howorth and Westhead (2003) show that small firms' WCM is based on routines. As small firms' managers have only limited resources to dedicate to WCM, both in terms of time and cash, they focus on only specific aspects of WCM for which they expect important returns. In other words, small firms' managers invest time in WCM when they need to release internally generated cash faster. Ebben and Johnson's (2011) study of a sample of US small firms shows that small firms' managers are more reactive than proactive when it comes to WCM, suggesting hereby a lack of

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<sup>2</sup>We acknowledge that small firms' managers sometimes have external financing aversion and that they prefer internal financing, even if this constrains their firm's growth as suggested by Howorth (2001). This, however, does not impact our reasoning, as the consequence of external financing aversion is that investment in NOWC is low as the need for internally generated cash is high. The impact of NOWC on firm performance is therefore the same whether a small firm is constrained by external factors or by internal preferences.

<sup>3</sup>Arend and Wisner (2005) show that small firms' performance is negatively related with supply-chain management.

WCM monitoring. This means that if small firms implement, deliberately or not, an inefficient level of investment in NOWC, they will realize and adjust it slower than larger firms. Thus, the impact of NOWC on smaller firms performance is likely to be higher than for larger firms.

*Hypothesis 1 (H1): The performance of smaller firms is more sensitive to underinvestment in NOWC than that of larger firms.*

*Hypothesis 1a (H1a): The performance of small firms is more sensitive to underinvestment in NOWC than that of medium firms.*

*Hypothesis 1b (H1b): The performance of small firms is more sensitive to underinvestment in NOWC than that of large firms.*

*Hypothesis 1c (H1c): The performance of medium firms is more sensitive to underinvestment in NOWC than that of large firms.*

While the previous arguments indicate that smaller firms' performance should be more sensitive to underinvestment in NOWC, we also expect it to be more sensitive to overinvestment. Indeed, external financing costs are higher for smaller firms, so financing investment in NOWC is more costly for them than for larger firms (Berger & Udell, 1998; Cassar, 2004). Using the same argument, storage costs are also higher for smaller firms. The financing costs of NOWC are overall higher for smaller firms than for larger firms, which means that their impact on performance is expected to be higher than in the case of large firms. Finally, the lack of WCM monitoring we described previously is also likely to apply. This means that smaller firms will not quickly enough realize that their investment in NOWC is too high regarding a change in their operating conditions because they do not review their WCM practices often enough. We expect therefore the performance of smaller firms to be more sensitive to overinvestment in NOWC than the performance of larger firms.

*Hypothesis 2 (H2): The performance of smaller firms is more sensitive to overinvestment in NOWC than that of larger firms.*

*Hypothesis 2a (H2a): The performance of small firms is more sensitive to overinvestment in NOWC than that of medium firms.*

*Hypothesis 2b (H2b): The performance of small firms is more sensitive to overinvestment in NOWC than that of large firms.*



*Hypothesis 2c (H2c): The performance of medium firms is more sensitive to overinvestment in NOWC than that of large firms.*

## Methods

### Sample

To test our hypotheses, we used a sample of European firms. We used Bureau Van Dijk's Amadeus database to collect our data. This database provides access to financial and accounting information for private and public European firms. We included all German, French, and Italian firms for which 10 years of data were available, which considerably reduced the number of firms for which we have information.<sup>4</sup> The observation period covered the years 2009 to 2018. The choice of these countries was motivated by the fact that they are all bank-oriented economies, which is important to capture the impact of the financing costs of WCM. Moreover, these countries have different practices about payment delays<sup>5</sup> so we alleviated concerns that our results might be driven by a country's specific trade credit practices. The initial sample included 62,014 firms and we excluded financial and administration firms, which is a common practice in the literature on WCM (Aktas et al., 2015; Baños-Caballero et al., 2012, 2014). *Financial and administration firms* are defined as firms with a Standard Industrial Classification (SIC) code between 6000 and 6900 (finance) and between 9000 and 9900 (administration). This left 58,588 firms. Next, we eliminated cases with missing value and errors. Due to the construction of one of our control variable (sales volatility), firm-year observations from the first two years were necessary to create the panel but not studied. The final sample included 473,049 firm-year observations and 56,221 unique firms.<sup>6</sup> Finally, we should mention that we winsorized our data at the first and ninety-ninth percentiles to mitigate the impact of extreme values (Aktas et al., 2015).

### Measures

#### Dependent variable

While other WCM studies have used a stock price-based measure to assess firm performance, we considered private companies and could not use the market value of equity or Tobin's Q as a dependent variable (Aktas et al.,

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<sup>4</sup>The calculation of one of our control variables, sales volatility, motivates this choice. We acknowledge that this choice reduces the generalizability of our findings because many small firms, especially newly founded ones, are excluded from the analysis.

<sup>5</sup>Germany is the country in Continental Europe with the shortest payment delays, while Italy is the one with the longest payment delays and France stands at the median (Source: ECCBSO, Financial Statement Analysis Working Group).

<sup>6</sup>We provide a sample breakdown by country, years, and industries as Appendix A and B.

2015; Baños-Caballero et al., 2014). Therefore, following Deloof (2003) and Baños-Caballero et al. (2012), we used return on assets (ROA) as our main performance measure. We calculated ROA as operating income after financial expenses divided by total assets.

### **Independent variables**

We considered WCM as our main variable of interest and we measured it through NOWC, which is equal to the sum of inventories and accounts receivables less accounts payable divided by total sales (Aktas et al., 2015; Hill et al., 2010). But a firm's level of NOWC largely depends on industry characteristics. Thus, we estimated the industry-adjusted NOWC as our independent variable (Aktas et al., 2015). To calculate it, we subtracted from the NOWC of a given firm the annual median NOWC of the industry in which the firm operates and denoted this variable *IndAdjNowc*. We use the four-digit SIC codes to classify firms in their industries:

$$\text{Industry} - \text{adjustedNowc} = \text{NOWC} - \text{AnnualindustrymedianNOWC}$$

When the industry-adjusted NOWC is positive, it means that the firm is adopting a conservative WCM and that it is overinvesting in NOWC. This suggests that a more efficient WCM, meaning a reduction of the NOWC, should result in higher performances. Of course, if the industry-adjusted NOWC is negative, it means that the WCM is aggressive and that the risk of lost sales and opportunity costs is high (Aktas et al., 2015). This approach is intuitively based on the assumption that the optimal NOWC is the industry-median NOWC.

Our primary goal was to identify if the sensitivity of firm performance to NOWC is moderated by firm size. Thus, we needed to be able to distinguish between the sensitivity of a firm to a decrease in NOWC when the industry-adjusted NOWC is positive from its sensitivity to an increase in NOWC when industry-adjusted NOWC is negative. Both are expected to result in a higher level of performance. To capture these effects, we needed to allow the slope in our models to be different for positive industry-adjusted NOWC and for negative industry-adjusted NOWC. Therefore, we created a dummy variable *D* which equals one if the industry-adjusted NOWC is positive and zero otherwise. Finally, we calculated the interaction term between *D* and industry-adjusted NOWC, and the interaction term between one minus *D* and industry-adjusted NOWC.

To distinguish between different sizes, we created size categories. According to the criteria of the European Commission, we considered a firm as small if its number of employees is less than 50 and either its total assets or its sales revenue is less than 10 M€. We also defined a medium firm as one with less than 250 employees and either less than 43 M€ of total assets or less than 50 M€ of sales. A firm that is neither small nor medium is

thus large. This classification means that our sample included approximately 34.96 percent of large firms, 44.47 percent of medium firms, and 20.57 percent of small firms.

### **Control variables**

Following Aktas et al. (2015), we used a large set of control variables known to affect firms' ROA. As we already discussed, the extent to which firms are financially constrained impacts the WCM-performance relationship (Baños-Caballero et al., 2014; Kieschnick et al., 2013). First, we controlled for the extent to which a firm is indebted and included *Leverage*, calculated as total financial debt divided by total assets, as a control variable. We also created a dummy *Financial distress*, which is equal to one if a firm meets two conditions and zero otherwise. First, it has to be overleveraged, meaning that its leverage is in the top two deciles of its industry for a given year. Second, the cost of financial debt is high when compared to internally generated cash resources. Therefore, we calculated the interest coverage ratio as operating income plus depreciation and amortization divided by total interests paid. If the interest coverage ratio is lower than 0.8 during any given year or lower than 1 during two consecutive years, the second condition is met (Aktas et al., 2015; Hill et al., 2010; Molina & Preve, 2009).

*Cash ratio*, calculated as cash and equivalents divided by total assets, was also included as a control variable because cash and NOWC are substitutes (Bates, Kahle, & Stulz, 2009). As operating conditions impact WCM, we also controlled for *Sales growth*, which is the percentage change in sales between two consecutive years, and *Sales volatility*. Hill et al. (2010) indicate that it is difficult for firms to identify the appropriate level of inventory to face an increase in sales volatility because it also depends on their trade credit policy and need for cash. Thus, *Sales volatility*, which is the standard deviation of sales over a rolling five-year period scaled by total assets, was included as a control variable. *Age* is the natural logarithm of the number of years since a firm's creation and is also a common control variable in the WCM literature as it indicates the bargaining power regarding payment delays (Baños-Caballero et al., 2010; Aktas et al., 2015). *Size* calculated as the natural logarithm of total assets was also included as an additional control variable (Baños-Caballero et al., 2012).

Last, Fazzari and Petersen (1993) show that firms reduce investment in NOWC when internally generated cash decreases. This helps them to maintain constant the level of investment in fixed assets when availability of cash fluctuates. Therefore, we also introduced a control variable *Fixed Assets*, which is the growth rate between two consecutive years in a firm's fixed assets.

## Results

Table 1 presents the descriptive statistics and a correlation matrix. The average firm is 22.5 years old and holds 16.18 M€ of total assets, and NOWC represents 18 percent of its total assets. This figure is in line with other WCM studies (Aktas et al., 2015; Baños-Caballero et al., 2012). As some correlations exist between our variables, we calculated the variance inflation factors (VIF) to ensure that multicollinearity is not an issue with our data. The highest VIF is 1.20 which is well below the threshold of 10, so multicollinearity does not affect the results of our estimations.

We used a firm and year-fixed effects model to estimate the relationship between NOWC and firm performance measured as ROA. Table 2 shows the results for the regressions with robust standard errors clustered at the company level (Aktas et al., 2015). The first column shows the results for the entire sample. As expected, underinvestment in NOWC is positively related to ROA and overinvestment in NOWC is negatively related with ROA. This is consistent with the view that the relationship between NOWC and firm performance is concave. Our results corroborate those of Aktas et al. (2015) and Ben-Nasr (2016), who used the same methodology and they are also in line with those of Baños-Caballero et al. (2012, 2014)).

The next three columns of Table 2 present the results for large, medium, and small firms subsamples. The sensitivity of performance to underinvestment is statistically significant for all the size buckets. We observed that the differences<sup>7</sup> between the unstandardized coefficients are statistically significant at the 1 percent level when comparing small firms with medium and large firms. This means that small firms' performance is more sensitive to underinvestment in NOWC than that of medium or large firms. We did not observe that the performance of medium firms is more sensitive than that of large firms to underinvestment in NOWC. The results support our H1a and H1b. However, while the sensitivity of performance to overinvestment is statistically significant for all the size buckets, there is no statistically significant difference between the unstandardized coefficients. Our results show, therefore, that the sensitivity of performance to NOWC is not different between large, medium, and small firms when it comes to overinvestment. Thus, none of our H2a, H2b, and H2c are validated. The economic significance of the results confirms this observation. Indeed, a one standard deviation decrease in overinvestment in NOWC is associated with a 0.29 percent increase in ROA for large firms, a 0.32 percent increase for medium firms, and a 0.35 percent increase for small firms. However, the results are striking for small firms when it comes to underinvestment in NOWC. A one standard

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<sup>7</sup>To estimate the existence of statistically significant differences between samples, we calculate the difference between the two samples' coefficients divided by the square root of the sum of their squared errors. Then, we use a standard *t*-test to estimate whether or not the differences are statistically significant.

**Table 1.** Descriptive statistics and correlation table.

|    | Mean               | Median | SD   | 1    | 2            | 3            | 4            | 5            | 6            | 7            | 8            | 9           | 10           |
|----|--------------------|--------|------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|--------------|
| 1  | Nowc               | 0.18   | 0.13 | 0.24 |              |              |              |              |              |              |              |             |              |
| 2  | Ind Adj Nowc       | 0.04   | 0.00 | 0.22 | <b>0.93</b>  |              |              |              |              |              |              |             |              |
| 3  | ROA                | 0.05   | 0.04 | 0.10 | <b>-0.06</b> | <b>-0.07</b> |              |              |              |              |              |             |              |
| 4  | Sales growth       | 0.08   | 0.03 | 0.32 | <b>-0.03</b> | <b>-0.03</b> | <b>0.09</b>  |              |              |              |              |             |              |
| 5  | Leverage           | 0.15   | 0.08 | 0.18 | <b>0.14</b>  | <b>0.15</b>  | -0.01        |              |              |              |              |             |              |
| 6  | Size               | 9.69   | 9.43 | 1.26 | <b>0.16</b>  | <b>0.12</b>  | <b>-0.04</b> | <b>0.06</b>  |              |              |              |             |              |
| 7  | Fixed assets       | 0.14   | 0.00 | 0.69 | -0.01        | <b>0.03</b>  | <b>0.17</b>  | 0.00         | <b>-0.03</b> |              |              |             |              |
| 8  | Age                | 3.12   | 3.14 | 0.69 | <b>0.09</b>  | 0.00         | <b>-0.14</b> | 0.00         | <b>0.20</b>  | <b>-0.09</b> |              |             |              |
| 9  | Sales volatility   | 0.16   | 0.12 | 0.16 | <b>0.17</b>  | <b>0.15</b>  | <b>0.10</b>  | 0.01         | -0.01        | <b>0.07</b>  | <b>-0.16</b> |             |              |
| 10 | Cash ratio         | 0.10   | 0.05 | 0.13 | <b>-0.16</b> | <b>-0.14</b> | <b>0.02</b>  | <b>-0.26</b> | <b>-0.17</b> | <b>0.01</b>  | <b>-0.02</b> | 0.00        |              |
| 11 | Financial distress | 0.03   | 0.00 | 0.16 | <b>0.05</b>  | <b>-0.25</b> | <b>-0.03</b> | <b>0.30</b>  | <b>0.04</b>  | 0.00         | <b>-0.01</b> | <b>0.08</b> | <b>-0.07</b> |

Note.  $N = 473,049$ . Correlation coefficients significant at  $p < 0.05$  are shown in bold.  
SD = standard deviation; ROA = return on assets.

**Table 2.** Fixed effects regressions of the impact of net operating working capital on firm operating performance by firm size.

| ROA is the dependent variable        | All firms          | Large firms        | Medium firms       | Small firms        |
|--------------------------------------|--------------------|--------------------|--------------------|--------------------|
| <i>Ind Adj Nowc</i> * <i>D</i>       | -0.017***<br>0.002 | -0.016***<br>0.003 | -0.016***<br>0.002 | -0.020***<br>0.004 |
| <i>Ind Adj Nowc</i> * (1- <i>D</i> ) | 0.080***<br>0.004  | 0.058***<br>0.007  | 0.071***<br>0.006  | 0.118***<br>0.008  |
| <i>Sales growth</i>                  | 0.022***<br>0.001  | 0.020***<br>0.001  | 0.025***<br>0.001  | 0.023***<br>0.001  |
| <i>Leverage</i>                      | -0.082***<br>0.002 | -0.067***<br>0.003 | -0.092***<br>0.003 | -0.093***<br>0.004 |
| <i>Size</i>                          | 0.008***<br>0.001  | 0.005***<br>0.001  | 0.011***<br>0.001  | 0.014***<br>0.002  |
| <i>Fixed assets</i>                  | 0.001***<br>0.000  | 0.000<br>0.000     | 0.001***<br>0.000  | 0.001**<br>0.000   |
| <i>Age</i>                           | 0.010***<br>0.002  | 0.010***<br>0.003  | 0.011***<br>0.002  | 0.001<br>0.003     |
| <i>Sales volatility</i>              | -0.050***<br>0.002 | -0.055***<br>0.003 | -0.055***<br>0.002 | -0.046***<br>0.004 |
| <i>Cash ratio</i>                    | 0.124***<br>0.003  | 0.106***<br>0.005  | 0.118***<br>0.004  | 0.128***<br>0.005  |
| <i>Financial distress</i>            | -0.076***<br>0.001 | -0.076***<br>0.002 | -0.073***<br>0.002 | -0.071***<br>0.003 |
| Firm fixed effects                   | YES                | YES                | YES                | YES                |
| Year fixed effects                   | YES                | YES                | YES                | YES                |
| Number of observations               | 473,049            | 165,396            | 210,365            | 97,288             |
| <i>F</i> -statistics                 | 736.59***          | 206.09***          | 349.02***          | 171.31***          |
| Adjusted <i>R</i> <sup>2</sup>       | 0.688              | 0.740              | 0.732              | 0.738              |

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Note. Errors are robust and clustered at the firm level. We report them under the coefficients. ROA = return on assets.

deviation increase in underinvestment in NOWC is associated with a 0.45 percent increase in ROA for large firms, a 0.52 percent increase for medium firms, and a 0.93 percent increase for small firms.

### Robustness tests

In this section, we performed several robustness tests to assess the validity of our results. First, as our sample includes firms from three different countries, institutional differences as well as economic conditions can have different impacts on our results. For example, there has been a banking crisis in Italy in recent years that likely affected Italian firms' access to banking debt and the subsequent cost of NOWC. We therefore estimated different regressions for the three countries and present the results in Table 3. In each country subsample, the industry-median NOWC is calculated for firms operating in this very country as the optimal NOWC is likely different between the three countries.<sup>8</sup>

<sup>8</sup>We thank an anonymous referee for this remark.

**Table 3.** Fixed effects regressions of the impact of net operating working capital on firm operating performance by firm size and country clusters.

| ROA is the dependent variable | All firms          | Large firms        | Medium firms       | Small firms        |
|-------------------------------|--------------------|--------------------|--------------------|--------------------|
| <b>Germany</b>                |                    |                    |                    |                    |
| <i>Ind Adj Nowc * D</i>       | -0.035***<br>0.007 | -0.035***<br>0.010 | -0.031***<br>0.009 | -0.053<br>0.041    |
| <i>Ind Adj Nowc * (1-D)</i>   | 0.007<br>0.016     | -0.004<br>0.023    | 0.004<br>0.021     | 0.110<br>0.098     |
| <i>Sales growth</i>           | 0.034***<br>0.002  | 0.028***<br>0.003  | 0.041***<br>0.002  | 0.029***<br>0.009  |
| <i>Leverage</i>               | -0.051***<br>0.005 | -0.055***<br>0.007 | -0.048***<br>0.007 | -0.083***<br>0.025 |
| <i>Size</i>                   | -0.001<br>0.003    | 0.003<br>0.004     | -0.003<br>0.004    | 0.010<br>0.012     |
| <i>Fixed assets</i>           | 0.002***<br>0.001  | 0.001<br>0.001     | 0.002*<br>0.001    | 0.006**<br>0.003   |
| <i>Age</i>                    | 0.016***<br>0.004  | 0.012**<br>0.006   | 0.018***<br>0.007  | 0.050**<br>0.025   |
| <i>Sales volatility</i>       | -0.052***<br>0.005 | -0.060***<br>0.008 | -0.056***<br>0.008 | -0.035<br>0.024    |
| <i>Cash ratio</i>             | 0.112***<br>0.007  | 0.101***<br>0.010  | 0.115***<br>0.010  | 0.110***<br>0.031  |
| <i>Financial distress</i>     | -0.104***<br>0.004 | -0.095***<br>0.005 | -0.107***<br>0.005 | -0.155***<br>0.023 |
| Firm fixed effects            | YES                | YES                | YES                | YES                |
| Year fixed effects            | YES                | YES                | YES                | YES                |
| Number of observations        | 71,873             | 34,685             | 34,196             | 2,992              |
| F-statistics                  | 283.97***          | 51.63***           | 59.41***           | 6.90***            |
| Adjusted R <sup>2</sup>       | 0.703              | 0.722              | 0.726              | 0.816              |
| <b>France</b>                 |                    |                    |                    |                    |
| <i>Ind Adj Nowc * D</i>       | -0.020***<br>0.003 | -0.017***<br>0.004 | -0.023***<br>0.005 | -0.026***<br>0.008 |
| <i>Ind Adj Nowc * (1-D)</i>   | 0.124***<br>0.007  | 0.091***<br>0.009  | 0.114***<br>0.012  | 0.213***<br>0.020  |
| <i>Sales growth</i>           | 0.024***<br>0.001  | 0.021***<br>0.001  | 0.024***<br>0.001  | 0.031***<br>0.002  |
| <i>Leverage</i>               | -0.081***<br>0.003 | -0.072***<br>0.004 | -0.081***<br>0.005 | -0.116***<br>0.007 |
| <i>Size</i>                   | 0.009***<br>0.001  | 0.009***<br>0.002  | 0.019***<br>0.002  | 0.011***<br>0.003  |
| <i>Fixed assets</i>           | 0.000<br>0.000     | 0.000<br>0.000     | 0.000<br>0.001     | -0.001<br>0.001    |
| <i>Age</i>                    | 0.007***<br>0.003  | 0.006<br>0.004     | 0.016***<br>0.005  | 0.001<br>0.006     |
| <i>Sales volatility</i>       | -0.061***<br>0.003 | -0.060***<br>0.004 | -0.070***<br>0.004 | -0.059***<br>0.007 |
| <i>Cash ratio</i>             | 0.130***<br>0.004  | 0.116***<br>0.006  | 0.128***<br>0.006  | 0.142***<br>0.008  |
| <i>Financial distress</i>     | -0.076***<br>0.002 | -0.074***<br>0.003 | -0.070***<br>0.003 | -0.079***<br>0.005 |
| Firm fixed effects            | YES                | YES                | YES                | YES                |
| Year fixed effects            | YES                | YES                | YES                | YES                |
| Number of observations        | 203,490            | 94,398             | 70,056             | 39,036             |
| F-statistics                  | 291.59***          | 123.17***          | 102.58***          | 69.28***           |
| Adjusted R <sup>2</sup>       | 0.694              | 0.750              | 0.742              | 0.751              |

(Continued)

**Table 3.** (Continued).

| ROA is the dependent variable | All firms          | Large firms        | Medium firms       | Small firms        |
|-------------------------------|--------------------|--------------------|--------------------|--------------------|
| <i>Italy</i>                  |                    |                    |                    |                    |
| <i>Ind Adj Nowc * D</i>       | -0.013***<br>0.002 | -0.012***<br>0.004 | -0.012***<br>0.003 | -0.017***<br>0.005 |
| <i>Ind Adj Nowc * (1-D)</i>   | 0.049***<br>0.004  | 0.025***<br>0.009  | 0.049***<br>0.005  | 0.062***<br>0.007  |
| <i>Sales growth</i>           | 0.018***<br>0.001  | 0.014***<br>0.001  | 0.021***<br>0.001  | 0.019***<br>0.001  |
| <i>Leverage</i>               | -0.094***<br>0.003 | -0.059***<br>0.007 | -0.120***<br>0.004 | -0.082***<br>0.004 |
| <i>Size</i>                   | 0.010***<br>0.001  | -0.003<br>0.003    | 0.011***<br>0.002  | 0.016***<br>0.002  |
| <i>Fixed assets</i>           | 0.001***<br>0.000  | 0.001<br>0.001     | 0.001***<br>0.000  | 0.001***<br>0.000  |
| <i>Age</i>                    | 0.006***<br>0.002  | 0.012**<br>0.005   | 0.002<br>0.003     | -0.003<br>0.004    |
| <i>Sales volatility</i>       | -0.041***<br>0.002 | -0.040***<br>0.005 | -0.046***<br>0.003 | -0.039***<br>0.004 |
| <i>Cash ratio</i>             | 0.113***<br>0.004  | 0.071***<br>0.011  | 0.103***<br>0.005  | 0.112***<br>0.007  |
| <i>Financial distress</i>     | -0.068***<br>0.001 | -0.067***<br>0.003 | -0.066***<br>0.002 | -0.063***<br>0.003 |
| Firm fixed effects            | YES                | YES                | YES                | YES                |
| Year fixed effects            | YES                | YES                | YES                | YES                |
| Number of observations        | 197,686            | 36,313             | 106,113            | 55,260             |
| F-statistics                  | 1225.71***         | 121.07***          | 228.90***          | 114.16***          |
| Adjusted R <sup>2</sup>       | 0.668              | 0.728              | 0.726              | 0.715              |

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Note. Errors are robust and clustered at the firm level. We report them under the coefficients. ROA = return on assets.

The French subsamples show similar results to those observed on the entire sample. The sensitivity of performance to underinvestment and overinvestment in NOWC is statistically significant, and the difference between the coefficients for large and medium firms, medium and small, and large and small French firms is statistically significant. Hypothesis 1 is thus fully validated for the French subsample. The Italian subsamples present statistically significant differences between large and small firms and large and medium firms only for the sensitivity of performance to underinvestment in NOWC. Only H1b and H1c are therefore confirmed for the Italian subsample. With respect to the German subsamples, we observed a statistically significant relationship between overinvestment in NOWC and performance for large and medium firms, but not for small firms. We also observed no statistically significant relationship between underinvestment in NOWC and performance for small firms. Thus, we did not validate our hypotheses for the German subsample.

The study of potential differences of size in the NOWC-performance relationship raises the question of potential omitted variables that could affect only firms of a particular size and not others. We identified affiliation to a business group (BG) as such a potential issue. Deloof and Jegers (1996,



1999) report trade credit, which is an important aspect of WCM, depends on a firm's affiliation to a BG. Indeed, firms affiliated to a BG can benefit from financial management at the group level that helps them improve WCM practices. Moreover, if one assumes a common financial management within a BG, it is likely that cash-rich affiliates extend more trade credit to cash-poor affiliates (Deloof & Jegers, 1996). Thus, the optimal level of WCM for a single firm is not necessarily the same as for a firm that is affiliated to a BG. As BGs are a common form of industrial organization in Western Europe, affiliation to a BG could obviously affect our results. Thus, we first created subsamples to distinguish between firms that are not affiliated to a BG (single firms), firms affiliated to a small BG (less than 6 subsidiaries), firms affiliated to a medium BG (more than 6 or less than 20 subsidiaries), and large BG (more than 20 subsidiaries). The thresholds we used to classify BG sizes are close to those set by Khanna and Palepu (2000). Then, we ran our regressions on each of these subsamples. The results are provided in Table 4.

The relationship between the performance of single firms and overinvestment in NOWC is statistically significant for medium and small firms only. Regarding underinvestment in NOWC, there is a positive and significant relationship with the performance of single firms of all size. Moreover, there is a statistically significant difference between the sensitivity of small single firms and medium single firms, confirming our H1a but not our H1b and H1c. We observed no statistically significant differences between firms affiliated to a small BG. However, we found support for our H1a for firms affiliated to both medium and large BG. We also found support for our H1b in the case of large BG, indicating that the sensitivity of performance to underinvestment in NOWC is higher for small firms than for large firms. Overall, we found conclusive results except for the case of firms affiliated to small business groups.

We now turn the problem of potential endogeneity between performance and WCM. It is indeed possible that the observed level of NOWC which measures WCM is dependent on firm performance. Thus, we used a two-stage regression approach to estimate the extent to which a firm overinvests or underinvests in NOWC as the residuals of a first-stage regression. This allowed us to alleviate the concern that industry median-adjusted NOWC we used in the previous approach may not be a good estimation of the optimal NOWC. Building on the methodology suggested by Baños-Caballero et al. (2012) and Aktas et al. (2015), we estimated the excess investment in NOWC as the residuals of a first-stage regression. In this first-stage regression, we regressed NOWC on *Sales growth*, *Sales volatility*, *Age*, *Size*, *Financial distress*, *Leverage*, and *country dummy variables* for each industry/year. These variables were taken from Hill et al. (2010), Baños-Caballero et al. (2012), and Aktas et al. (2015). We excluded those industry/years for which we had less than 30 observations to ensure that we had enough observations to run

**Table 4.** Fixed effects regressions of the impact of net operating working capital on firm operating performance by business group affiliation and firm size.

| ROA is the dependent variable | Large BG           | Medium BG          | Small BG           | Not affiliated to a BG |
|-------------------------------|--------------------|--------------------|--------------------|------------------------|
| Large firms                   |                    |                    |                    |                        |
| <i>Ind Adj Nowc * D</i>       | -0.024***<br>0.004 | -0.008<br>0.008    | -0.008<br>0.006    | 0.000<br>0.006         |
| <i>Ind Adj Nowc * (1-D)</i>   | 0.035***<br>0.009  | 0.083***<br>0.019  | 0.088***<br>0.014  | 0.102***<br>0.017      |
| <i>Sales growth</i>           | 0.019***<br>0.001  | 0.023***<br>0.002  | 0.021***<br>0.002  | 0.020***<br>0.002      |
| <i>Leverage</i>               | -0.055***<br>0.004 | -0.070***<br>0.008 | -0.096***<br>0.007 | -0.063***<br>0.009     |
| <i>Size</i>                   | 0.006***<br>0.002  | 0.002<br>0.004     | 0.006**<br>0.003   | 0.002<br>0.003         |
| <i>Fixed assets</i>           | 0.000<br>0.001     | 0.001<br>0.001     | 0.000<br>0.001     | 0.000<br>0.001         |
| <i>Age</i>                    | 0.017***<br>0.004  | 0.014**<br>0.006   | 0.000<br>0.005     | -0.007<br>0.007        |
| <i>Sales volatility</i>       | -0.056***<br>0.004 | -0.062***<br>0.008 | -0.055***<br>0.006 | -0.030***<br>0.008     |
| <i>Cash ratio</i>             | 0.073***<br>0.008  | 0.117***<br>0.011  | 0.141***<br>0.008  | 0.134***<br>0.011      |
| <i>Financial distress</i>     | -0.074***<br>0.003 | -0.084***<br>0.005 | -0.084***<br>0.004 | -0.067***<br>0.006     |
| Firm fixed effects            | YES                | YES                | YES                | YES                    |
| Year fixed effects            | YES                | YES                | YES                | YES                    |
| Number of observations        | 76,485             | 29,116             | 40,985             | 18,810                 |
| F-statistics                  | 226.23***          | 45.77***           | 76.40***           | 25.24***               |
| Adjusted R <sup>2</sup>       | 0.728              | 0.747              | 0.754              | 0.769                  |
| Medium firms                  |                    |                    |                    |                        |
| <i>Ind Adj Nowc * D</i>       | -0.018***<br>0.005 | -0.016***<br>0.005 | -0.013***<br>0.003 | -0.013***<br>0.004     |
| <i>Ind Adj Nowc * (1-D)</i>   | 0.066***<br>0.011  | 0.076***<br>0.014  | 0.082***<br>0.009  | 0.069***<br>0.011      |
| <i>Sales growth</i>           | 0.027***<br>0.001  | 0.026***<br>0.002  | 0.024***<br>0.001  | 0.022***<br>0.002      |
| <i>Leverage</i>               | -0.060***<br>0.005 | -0.089***<br>0.007 | -0.123***<br>0.005 | -0.108***<br>0.006     |
| <i>Size</i>                   | 0.008***<br>0.002  | 0.011***<br>0.003  | 0.014***<br>0.002  | 0.014***<br>0.003      |
| <i>Fixed assets</i>           | 0.000<br>0.001     | 0.002***<br>0.001  | 0.001***<br>0.000  | 0.001**<br>0.001       |
| <i>Age</i>                    | 0.022***<br>0.005  | 0.013**<br>0.006   | 0.001<br>0.004     | 0.001<br>0.005         |
| <i>Sales volatility</i>       | -0.067***<br>0.004 | -0.053***<br>0.006 | -0.046***<br>0.004 | -0.038***<br>0.005     |
| <i>Cash ratio</i>             | 0.088***<br>0.007  | 0.140***<br>0.010  | 0.135***<br>0.006  | 0.121***<br>0.009      |
| <i>Financial distress</i>     | -0.084***<br>0.003 | -0.075***<br>0.004 | -0.070***<br>0.003 | -0.061***<br>0.004     |
| Firm fixed effects            | YES                | YES                | YES                | YES                    |
| Year fixed effects            | YES                | YES                | YES                | YES                    |
| Number of observations        | 63,460             | 38,703             | 73,346             | 34,856                 |
| F-statistics                  | 97.98***           | 67.05***           | 163.38***          | 213.54***              |
| Adjusted R <sup>2</sup>       | 0.729              | 0.711              | 0.743              | 0.770                  |

(Continued)

**Table 4.** (Continued).

| ROA is the dependent variable        | Large BG           | Medium BG          | Small BG           | Not affiliated to a BG |
|--------------------------------------|--------------------|--------------------|--------------------|------------------------|
|                                      |                    |                    | Small firms        |                        |
| <i>Ind Adj Nowc</i> * <i>D</i>       | -0.027***<br>0.008 | -0.019*<br>0.010   | -0.020***<br>0.006 | -0.014*<br>0.007       |
| <i>Ind Adj Nowc</i> * (1- <i>D</i> ) | 0.148***<br>0.024  | 0.126***<br>0.021  | 0.104***<br>0.011  | 0.112***<br>0.013      |
| <i>Sales growth</i>                  | 0.022***<br>0.003  | 0.022***<br>0.003  | 0.022***<br>0.001  | 0.024***<br>0.002      |
| <i>Leverage</i>                      | -0.066***<br>0.011 | -0.095***<br>0.010 | -0.101***<br>0.005 | -0.090***<br>0.006     |
| <i>Size</i>                          | 0.019***<br>0.005  | 0.011***<br>0.004  | 0.014***<br>0.003  | 0.012***<br>0.003      |
| <i>Fixed assets</i>                  | -0.001<br>0.001    | 0.001<br>0.001     | 0.002***<br>0.001  | 0.000<br>0.001         |
| <i>Age</i>                           | 0.001<br>0.010     | 0.007<br>0.010     | -0.001<br>0.004    | 0.002<br>0.006         |
| <i>Sales volatility</i>              | -0.073***<br>0.009 | -0.067***<br>0.011 | -0.038***<br>0.005 | -0.022***<br>0.006     |
| <i>Cash ratio</i>                    | 0.090***<br>0.013  | 0.139***<br>0.016  | 0.139***<br>0.007  | 0.133***<br>0.009      |
| <i>Financial distress</i>            | -0.087***<br>0.007 | -0.070***<br>0.006 | -0.071***<br>0.004 | -0.065<br>0.004        |
| Firm fixed effects                   | YES                | YES                | YES                | YES                    |
| Year fixed effects                   | YES                | YES                | YES                | YES                    |
| Number of observations               | 16,307             | 13,209             | 41,728             | 26,044                 |
| <i>F</i> -statistics                 | 27.50***           | 25.92***           | 83.20***           | 54.86***               |
| Adjusted <i>R</i> <sup>2</sup>       | 0.766              | 0.728              | 0.722              | 0.736                  |

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Note. Errors are robust and clustered at the firm level. We report them under the coefficients. ROA = return on assets; BG = business group.

the regressions, so we ended up with 3,336 regressions. We do not report the results of these regressions for brevity, but the average adjusted  $R^2$  is 31.27 percent which is in the same range as Hill et al. (2010) and Aktas et al. (2015). Furthermore, the average  $F$ -statistics is 6.52 indicating that the regression model fits correctly the data. Next, we used the residuals of this first regression as the excess investment in NOWC and denoted them *ExcessNowc*. This is our independent variable in our second-stage regression which is the same as in Model 1. Table 5 displays the results with ROA as dependent variable. The coefficients are statistically highly significant and the differences between them are also statistically significant in each case ( $p < .01$  between small firms and medium firms and between small firms and large firms and at  $p < .05$  between medium and large firms) regarding underinvestment in NOWC. This brings additional credibility to our results<sup>9</sup> as it provides support to all our hypotheses.

<sup>9</sup>We also reestimate the regressions for the country clusters and the business group affiliation clusters with this alternative approach and observe comparable results.

**Table 5.** Fixed effects regressions of the impact of regression based net operating working capital on firm operating performance by firm size.

| ROA is the dependent variable | All firms          | Large firms        | Medium firms       | Small firms        |
|-------------------------------|--------------------|--------------------|--------------------|--------------------|
| <i>ExcessNwc * D</i>          | -0.026***<br>0.002 | -0.025***<br>0.004 | -0.027***<br>0.002 | -0.030***<br>0.004 |
| <i>ExcessNwc * (1-D)</i>      | 0.071***<br>0.003  | 0.052***<br>0.005  | 0.068***<br>0.005  | 0.102***<br>0.007  |
| <i>Sales growth</i>           | 0.021***<br>0.001  | 0.019***<br>0.001  | 0.024***<br>0.001  | 0.021***<br>0.001  |
| <i>Leverage</i>               | -0.077***<br>0.002 | -0.063***<br>0.004 | -0.089***<br>0.003 | -0.086***<br>0.004 |
| <i>Size</i>                   | 0.010***<br>0.001  | 0.006***<br>0.002  | 0.012***<br>0.001  | 0.017***<br>0.002  |
| <i>Fixed assets</i>           | 0.001***<br>0.000  | 0.000<br>0.000     | 0.001***<br>0.000  | 0.001**<br>0.000   |
| <i>Age</i>                    | 0.010***<br>0.002  | 0.011***<br>0.003  | 0.009***<br>0.002  | 0.003<br>0.004     |
| <i>Sales volatility</i>       | -0.042***<br>0.002 | -0.048***<br>0.003 | -0.047***<br>0.002 | -0.033***<br>0.003 |
| <i>Cash ratio</i>             | 0.123***<br>0.003  | 0.105***<br>0.004  | 0.117***<br>0.004  | 0.125***<br>0.005  |
| <i>Financial distress</i>     | -0.077***<br>0.001 | -0.077***<br>0.002 | -0.074***<br>0.002 | -0.073***<br>0.003 |
| Firm fixed effects            | YES                | YES                | YES                | YES                |
| Year fixed effects            | YES                | YES                | YES                | YES                |
| Number of observations        | 450,693            | 157,287            | 199,296            | 94,110             |
| F-statistics                  | 23012.68***        | 6545.03***         | 22756.80***        | 6304.72***         |
| Adjusted R <sup>2</sup>       | 0.688              | 0.741              | 0.733              | 0.738              |

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Note. Errors are bootstrapped because *ExcessNwc* is estimated in a first-stage regression. We report them under the coefficients. ROA = return on assets.

Last, Baños-Caballero et al. (2012, 2014) indicate that studies on the sensitivity of performance to NOWC should control for the influence of past values of performance on the current level of performance. Thus, we reestimated both our fixed-effects model and our two-stage regression model with the generalized method of moments estimator developed by Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond (1991). This estimator uses lagged observations of the variables as instruments and is common in the WCM literature (Baños-Caballero et al., 2012, 2014). As our panel data includes a large number of individuals and a small number of time periods (large  $N$ , small  $T$  panels), this methodology is relevant in this study (Roodman, 2009).

We included all the right-hand-side variables of our Model 1 lagged up to two times as instruments. To control for firm unobserved heterogeneity, we used the first difference in our observations and we included time dummies to control for macroeconomic conditions that could affect firm performance. We used a Hansen test for overidentifying restrictions to check that there was no correlation between our instruments and the error term, which was the case in all our specifications. We also reported the Arellano-Bond  $m_2$  statistic to test for the absence of second-order serial correlation in the first difference

residuals. Finally, we indicated the results for both the one-step and two-step estimators with robust standard errors, the latter including Windmeijer's correction because the two-step estimator's standard errors are downward biased (Arellano & Bond, 1991; Windmeijer, 2005).

The results in Table 6 show that the sensitivity of performance to NOWC is not significant for overinvestment in NOWC except for medium firms. This suggests that endogeneity indeed affects some of our previous results and we found no support for our H2. However, the sensitivity of performance to NOWC for underinvestment remains statistically significant for the entire sample as well as for medium and small firms. While the coefficients indicate that the sensitivity of performance to NOWC is higher for small firms than for medium or large firms, the difference is not statistically significant at the conventional levels. However, the fact that there is no significant impact of underinvestment in NOWC on performance in the case of large firms, but only for medium and small firms, supports our H1b and H1c.

In summary, we found support for our H1a and H1b that the performance of small firms is more sensitive to underinvestment in NOWC than that of medium and large firms. To a lesser extent, this is also true for medium firms when compared to large firms. However, we found no robust evidence that the performance of small firms is more sensitive to overinvestment in NOWC than that of medium and large firms, so we reject our H2.

## Discussion

In this article, we studied the impact of investment in NOWC on firm performance. While we observed that the performance of large, medium, and small firms is influenced by underinvestment in NOWC, our results indicate no significant effect of overinvestment in NOWC after controlling for endogeneity. This contrasts with previous findings by Baños-Caballero et al. (2012), Aktas et al. (2015), and Ben-Nasr (2016), who document that overinvestment in NOWC affects operating performances. As most of these studies consider observation periods that are prior to the financial crisis, it is possible that liquidity constraints after the crisis impacted WCM practices. More specifically, it is possible that most firms dramatically reduced investment in NOWC, making the impact of overinvestment in NOWC on performance lower. Another possible argument to explain the differences between our results and those of previous studies is suggested by Aktas et al. (2015), who indicate a general decline in the levels of current assets over the past 30 years. The generalization of just-in-time inventory management is likely to explain these changes.

**Table 6.** Dynamic panel data estimations of the impact of net operating working capital on firm operating performance.

| ROA is the dependent variable | All firms                      |                                |                                | Large firms                    |                                |                                | Medium firms                   |                                |                                | Small firms                    |                                |                                |
|-------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                               | One step robust difference GMM | Two step robust difference GMM | Two step robust difference GMM | One step robust difference GMM | Two step robust difference GMM | Two step robust difference GMM | One step robust difference GMM | Two step robust difference GMM | Two step robust difference GMM | One step robust difference GMM | Two step robust difference GMM | Two step robust difference GMM |
| <i>Ind Adj Nowc * D</i>       | -0.037**                       | -0.029*                        | -0.018                         | -0.015                         | -0.018                         | -0.031                         | -0.031                         | -0.032*                        | -0.042                         | -0.043                         | -0.043                         | -0.043                         |
| <i>Ind Adj Nowc *</i>         | 0.110***                       | 0.107***                       | 0.013                          | 0.049                          | 0.019                          | 0.019                          | 0.083***                       | 0.018                          | 0.052                          | 0.046                          | 0.052                          | 0.151**                        |
| (1-D)                         |                                |                                |                                |                                |                                |                                |                                | 0.076***                       | 0.201***                       | 0.151**                        | 0.201***                       | 0.151**                        |
| <i>Sales growth</i>           | 0.024                          | 0.024                          | 0.045                          | 0.044                          | 0.045                          | 0.031                          | 0.031                          | 0.029                          | 0.061                          | 0.060                          | 0.061                          | 0.060                          |
|                               | 0.014***                       | 0.011**                        | 0.011                          | 0.011                          | 0.011                          | 0.017***                       | 0.017***                       | 0.015***                       | -0.001                         | 0.003                          | -0.001                         | 0.003                          |
|                               | 0.005                          | 0.005                          | 0.008                          | 0.007                          | 0.008                          | 0.006                          | 0.006                          | 0.006                          | 0.006                          | 0.005                          | 0.006                          | 0.005                          |
| <i>Leverage</i>               | -0.081***                      | -0.082***                      | -0.071***                      | -0.075***                      | -0.071***                      | -0.078***                      | -0.078***                      | -0.083***                      | -0.087***                      | -0.077***                      | -0.087***                      | -0.077***                      |
|                               | 0.008                          | 0.008                          | 0.014                          | 0.015                          | 0.014                          | 0.014                          | 0.014                          | 0.014                          | 0.017                          | 0.017                          | 0.017                          | 0.017                          |
| <i>Size</i>                   | -0.041***                      | -0.040***                      | -0.073***                      | -0.087***                      | -0.073***                      | -0.020                         | -0.020                         | -0.008                         | -0.039**                       | -0.024                         | -0.039**                       | -0.024                         |
|                               | 0.009                          | 0.009                          | 0.015                          | 0.014                          | 0.015                          | 0.015                          | 0.015                          | 0.015                          | 0.016                          | 0.016                          | 0.016                          | 0.016                          |
| <i>Fixed assets</i>           | -0.016**                       | -0.015**                       | -0.025***                      | -0.033***                      | -0.025***                      | -0.006                         | -0.006                         | -0.004                         | 0.010                          | 0.003                          | 0.010                          | 0.003                          |
|                               | 0.007                          | 0.007                          | 0.007                          | 0.008                          | 0.007                          | 0.008                          | 0.008                          | 0.008                          | 0.008                          | 0.008                          | 0.008                          | 0.008                          |
| <i>Age</i>                    | -0.006**                       | -0.007***                      | -0.018***                      | -0.023***                      | -0.018***                      | 0.001                          | 0.001                          | -0.001                         | 0.005                          | 0.004                          | 0.005                          | 0.004                          |
|                               | 0.003                          | 0.003                          | 0.007                          | 0.007                          | 0.007                          | 0.004                          | 0.004                          | 0.004                          | 0.005                          | 0.005                          | 0.005                          | 0.005                          |
| <i>Sales volatility</i>       | -0.045***                      | -0.042***                      | -0.040***                      | -0.051***                      | -0.040***                      | -0.030***                      | -0.030***                      | -0.025**                       | -0.047***                      | -0.029*                        | -0.047***                      | -0.029*                        |
|                               | 0.007                          | 0.007                          | 0.012                          | 0.012                          | 0.012                          | 0.011                          | 0.011                          | 0.011                          | 0.017                          | 0.017                          | 0.017                          | 0.017                          |
| <i>Cash ratio</i>             | 0.097***                       | 0.093***                       | -0.006                         | -0.018                         | -0.006                         | 0.139***                       | 0.139***                       | 0.147***                       | 0.109***                       | 0.113***                       | 0.109***                       | 0.113***                       |
|                               | 0.016                          | 0.015                          | 0.034                          | 0.033                          | 0.034                          | 0.022                          | 0.022                          | 0.022                          | 0.031                          | 0.030                          | 0.031                          | 0.030                          |
| <i>Financial distress</i>     | -0.019                         | -0.024*                        | -0.007                         | -0.003                         | -0.007                         | -0.020                         | -0.020                         | -0.026                         | -0.068***                      | -0.037*                        | -0.068***                      | -0.037*                        |
|                               | 0.014                          | 0.013                          | 0.014                          | 0.015                          | 0.014                          | 0.015                          | 0.015                          | 0.017                          | 0.022                          | 0.020                          | 0.022                          | 0.020                          |
| Number of observations        | 411,622                        | 411,622                        | 141,346                        | 141,346                        | 141,346                        | 186,135                        | 186,135                        | 186,135                        | 84,141                         | 84,141                         | 84,141                         | 84,141                         |
| m2 statistics                 | -0.02                          | -0.35                          | 1.92*                          | 1.67*                          | 1.92*                          | -0.47                          | -0.47                          | -0.51                          | -1.51                          | -0.22                          | -1.51                          | -0.22                          |
| Hansen test                   | 234.04 (92)                    | 234.04 (92)                    | 168.04 (103)                   | 168.04 (103)                   | 168.04 (103)                   | 178.58 (91)                    | 178.58 (91)                    | 178.58 (91)                    | 99.73 (92)                     | 99.73 (92)                     | 99.73 (92)                     | 99.73 (92)                     |

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Note. m2 is the Arellano-Bond test for autocorrelation of second-order asymptotically distributed as a  $N(0,1)$  under the null hypothesis of no serial autocorrelation. ROA = return on assets.

Hansen test is a test of overidentifying restrictions, asymptotically distributed as a chi-squared under the null hypothesis of validity of instruments. Degrees of freedom are indicated under brackets.

Our results do not demonstrate a difference in the sensitivity of performance to overinvestment in NOWC between small and large firms. This seems surprising as we expected small firms to have poorer WCM and less NOWC monitoring. Both should affect the sensitivity of performance to underinvestment and to overinvestment. One possible explanation is that the monitoring argument is not valid when it comes to overinvestment in NOWC because smaller firms observe the costs of overinvestment in NOWC. But it is likely that they do not observe the opportunity costs of underinvestment in NOWC. This interpretation is consistent with Howorth and Westhead (2003), who indicate that small firms adjust their WCM only when cash availability is an issue. They found that small firms turn to WCM only when they need cash, and that they cut investment in NOWC in this case. Moreover, Howorth and Westhead (2003) show that larger firms adjust WCM at the same speed as smaller firms when they need cash. This suggests that the sensitivity of performance to overinvestment in NOWC is close for small, medium, and large privately held firms because they all rely heavily on internally generated cash.

We found that the sensitivity of performance to underinvestment in NOWC is higher for small firms than for large or medium firms. This means that small firms could improve their profitability by increasing investment in NOWC when they are currently underinvesting in NOWC because they would reduce opportunity costs of lost sales. This raises the question of why they are currently underinvesting in NOWC. The first, and maybe the most obvious explanation, is that they do not have the skills or the time to do it (Peel & Wilson, 1996; Peel et al., 2001). In other words, small firms' managers do not realize the opportunity costs of underinvestment in NOWC precisely because they are not directly observable and they do not monitor NOWC often enough. However, it is also possible that managers decide to keep their investment in NOWC as low as possible because they believe this to be an efficient way of reducing the costs related to storage and to the financing of NOWC. In this case, our results clearly indicate the limitations of this reasoning. As small firms maintain low levels of inventory and accounts receivable, they increase the risk of stockouts and potential customers choosing other suppliers because they offer longer payment delays. This results in large opportunity costs for small firms.

We believe that there is a third possible explanation. Consistent with the bootstrapping literature (Winborg & Landström, 2001), small firms' managers use customer-related techniques and late payment as financing sources when external financing is not available. It means that they keep a very low level of investment in NOWC, or even a negative NOWC, to finance investments in fixed assets or to face operating expenses. To put it shortly, WCM is driven by financial resource constraints for small firms. Our results show the limitations of such bootstrapping techniques because they result in lost sales,

which are more harmful for the performance of small firms than for that of larger companies. This comes from the fact that small firms lack a reputation more than large firms (Aldrich & Auster, 1986; Stinchcombe, 1965). Lost sales harm both small and large firms' profitability, but they hinder small firms' growth more as they reduce potential reputation benefits of successful business transactions (Basdeo, Smith, Grimm, Rindova, & Derfus, 2006). Our results suggest that, despite the common wisdom on WCM that the lower the NOWC the better the performance, maintaining a low level of NOWC is not relevant for small firms. Moreover, we believe that small firms' managers should usually carefully use bootstrapping techniques that constrain investment in NOWC and that external financing, while costly, offers a better cost-performance trade-off.

### **Implications**

This article has a number of implications for managers, policy-makers, and research.

For managers, our findings show that moving away from an optimal level of investment in NOWC reduces firm performance. In the case of small firms, underinvestment in NOWC is especially problematic. Contrary to the widespread view that investment in NOWC should be very low, we suggest that small firms invest more in NOWC to earn benefits related to increased sales and reputation. Additionally, a more frequent monitoring of WCM components is essential to regularly adjusting investment in NOWC. From this perspective, relationships with the bank appear crucial. Jonsson and Lindbergh (2011) indicate that banks can bring financial management expertise to small firms' managers in addition to the financing of investments. Thus, small firms' managers could benefit from banks' advice on WCM which would, in turn, help the bank to better assess the small firms' creditworthiness.

Our work has implications for policy-makers as well. Hyttinen and Toivanen (2005) and Beck, Demirgüç-Kunt, and Maksimovic (2008) show that the role of institutional environment is crucial for small firms to access external finance. More specifically, small, young, and fast-growing firms benefit from governmental financial support and advice (Fischer & Reuber, 2003; Hyttinen & Toivanen, 2005; Storey & Tether, 1998). However, Lee (2018) shows that there are limited benefits of government financial support to small firms on regional development. Thus, we suggest that policy-makers consider more deeply the financing of NOWC of small and young firms when providing support to them. We interpret our results as indirect evidence that if small firms had had better access to external finance and also better guidance in financial management, they could have invested more in NOWC. This would have a direct effect on the performance of the firm that



is government backed, but also an indirect spillover effect on the firm's trade partners because of increased payment delays to customers.

Finally, we contribute to the growing stream of research on working capital management as well as to the discussion on the liability of smallness. Our results corroborate previous findings by Baños-Caballero et al. (2012, 2014), Aktas et al. (2015) and others and extend them by considering mostly small and medium privately held firms. Furthermore, we show that size should be considered in future WCM research as it shapes the performance-WCM relationship. We also add to our understanding of factors that affect small firms' performance in general and not only high-tech or high-growth firms. Brush and Chaganti (1999) indicate that for these less "glamorous" firms, capabilities of the firm and resource combination activities better explain small firms' performance than strategy. WCM is, we argue, closer to resource management activities than to strategy for small firms. Indeed, the greater sensitivity of performance to underinvestment in NOWC we observe is likely explained by the constraints faced by small firms in accessing external finance. Thus, their WCM is driven by the need for available money which means that, as long as a firm cannot have access to external finance, it will maintain a low level of investment in NOWC. This affects the firm's performance. But it is also possible that small firms do not lack financial resources but only financial management, and that their WCM is poor because it is performed only "whenever necessary" (Khoury et al., 1999). Both explanations are possible expressions of the liability of smallness.

### ***Limitations and future research***

This study has several limitations. The first, and maybe the most obvious one, is that we observed the outcome of WCM through only our NOWC measure and not WCM practices. Thus, we cannot distinguish between firms that have very different WCM practices resulting in the same level of NOWC. For example, we cannot distinguish between a financially constrained small firm that relies on bootstrapping finance and a less financially constrained firm that decides to maintain a very low level of investment in NOWC. Both of them would have the same sensitivity of performance to underinvestment in NOWC. We can only call for additional research on WCM that would be based on case studies and surveys to understand how small firms manage WCM when they are financially constrained and the resulting impact on firm performance. While several researchers have explored WCM practices among small firms (Howorth & Westhead, 2003; Peel & Wilson, 1996; Peel et al., 2001), they have focused on the United States and the United Kingdom, and they did not really consider WCM as a whole

but rather its components. Moreover, they did not bridge WCM practices with the resulting performance.

Another limitation comes from the fact that, while we studied the role of size on the performance-NOWC relationships, our sample does not include a significant number of fast-growing and high-tech firms. Therefore, our results cannot be fully generalized to this category of firms, and future research could investigate the role and practices of WCM in startups and its relationship with bootstrapping techniques.

## Conclusion

What explains firm performance? This question is at the core of research on management, strategy, finance, and entrepreneurship. In this article, we make a modest contribution to the literature as we provide empirical evidence on the role of size in the sensitivity of firm performance to investment in NOWC. Using a large sample of international firms, we show that small firms' performance is more sensitive to underinvestment in NOWC than that of larger firms. Our goal was to demonstrate the role of WCM in our understanding of small firms' management and performance, and to shed some light on this sometimes neglected aspect of financial management.

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## ORCID

Vivien Lefebvre  <http://orcid.org/0000-0002-4453-8596>

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**Appendix A.** Number of observations per country and size.

| Country | Large   | Medium  | Small  | Total   |
|---------|---------|---------|--------|---------|
| France  | 94,398  | 70,056  | 39,036 | 203,490 |
| Germany | 34,685  | 34,196  | 2,992  | 71,873  |
| Italy   | 36,313  | 106,113 | 55,260 | 197,686 |
| Total   | 165,396 | 210,365 | 97,288 | 473,049 |

**Appendix B.** Number of observations per industry.

| Industry   | Number of observations |
|--|------------------------|
| Agricultural Production – Crops                                    | 1,964                  |
| Agricultural Production – Livestock and Animal Specialties         | 1,085                  |
| Agricultural Services  | 1,896                  |
| Forestry   | 51                     |
| Fishing Hunting and Trapping                                       | 142                    |
| Metal Mining   | 154                    |
| Coal Mining  | 42                     |
| Oil and Gas Extraction   | 316                    |
| Mining and Quarrying of Nonmetallic Minerals Except Fuels          | 1,178                  |
| Building Construction – General Contractors and Operative Builders | 8,484                  |
| Heavy Construction Except Building Construction – Contractors      | 5,587                  |
| Construction – Special Trade Contractors                           | 14,002                 |
| Food and Kindred Products  | 23,219                 |
| Tobacco Products   | 90                     |
| Textile Mill Products  | 4,171                  |
| Apparel Finished Products from Fabrics and Similar Materials       | 3,315                  |
| Lumber and Wood Products Except Furniture                          | 3,084                  |
| Furniture and Fixtures   | 2,657                  |
| Paper and Allied Products  | 7,014                  |
| Printing Publishing and Allied Industries                          | 5,909                  |
| Chemicals and Allied Products                                      | 13,448                 |
| Petroleum Refining and Related Industries                          | 845                    |
| Rubber and Miscellaneous Plastic Products                          | 10,489                 |
| Leather and Leather Products                                       | 1,885                  |
| Stone Clay Glass and Concrete Products                             | 5,891                  |
| Primary Metal Industries   | 7,489                  |
| Fabricated Metal Products Except Machinery and Transport Equipment | 19,777                 |
| Industrial and Commercial Machinery and Computer Equipment         | 22,650                 |
| Electronic Electrical Equipment                                    | 10,197                 |
| Transportation Equipment   | 6,815                  |
| Measure Analyze Control Instruments; Optic Goods; Watches Clocks   | 4,662                  |
| Miscellaneous Manufacturing Industries                             | 2,153                  |
| Railroad Transportation  | 305                    |
| Local Suburban Transit and Interurban Highway Passenger Transport  | 4,976                  |
| Motor Freight Transportation                                       | 10,623                 |
| United States Postal Service                                       | 245                    |
| Water Transportation   | 2,394                  |
| Transportation by Air  | 1,104                  |
| Pipelines Except Natural Gas                                       | 195                    |
| Transportation Services  | 9,156                  |
| Communications   | 2,275                  |
| Electric Gas and Sanitary Services                                 | 17,170                 |
| Wholesale Trade – Durable Goods                                    | 79,652                 |
| Wholesale Trade – Nondurable Goods                                 | 45,003                 |
| Building Materials Hardware Garden Supply and Mobile Home Dealers  | 1,253                  |
| General Merchandise Stores   | 994                    |

(Continued)

**Appendix B.** (Continued).

| Industry  | Number of observations |
|---|------------------------|
| Food Stores   | 18,839                 |
| Automotive Dealers and Gasoline Service Stations                | 2,812                  |
| Apparel and Accessory Stores                                    | 3,644                  |
| Home Furniture Furnishings and Equipment Stores                 | 2,834                  |
| Eating and Drinking Places                                      | 2,137                  |
| Miscellaneous retail  | 5,892                  |
| Hotels Rooming Houses Camps and Other Lodging Places            | 2,920                  |
| Personal Services   | 1,638                  |
| Business Services   | 25,692                 |
| Automotive Repair Services and Parking                          | 2,622                  |
| Miscellaneous Repair Services                                   | 1,997                  |
| Motion Pictures   | 1,697                  |
| Amusement and Recreation Services                               | 2,976                  |
| Health Services   | 11,815                 |
| Legal Services  | 500                    |
| Educational Services  | 1,365                  |
| Social Services   | 2,654                  |
| Museums Art Galleries and Botanical and Zoological Gardens      | 231                    |
| Membership Organizations  | 67                     |
| Engineering Accounting Research Management and Related Services | 14,498                 |
| Other   | 213                    |
| Total   | 473,049                |