Working Capital Management: An Exploratory Study

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Working capital management is an issue in which finance research is scarce. One possible reason behind this fact might relate to the relative ease with which efficient financial markets correct deviations from optimal working capital policies. However, in less efficient financial markets, pervasive among emerging economies, working capital management is critical for both firms' performance and survival. The difference in the market's ability for providing immediate assistance to firms might explain the differential consequences on firms' profitability and financial distress. This article explains the fundamentals of working capital management, the importance of its interaction with financial markets, and how this interaction might explain working capital patterns around the world.

■Working capital management is probably one of the most basic and least studied topics in corporate finance. It should involve the analysis of the investments in operating assets and its corresponding financing. Nevertheless, this investment is carried out, most of the times without following a formal investment analysis, and the financing alternatives are not adequately evaluated. This paper digs into the fundamentals of working capital management exploring the rela-

tive importance of capital markets efficiency and industry and firm patterns.

There is some relevant research on the individual components of working capital, but little academic effort has been devoted to develop a comprehensive view.[1] There is, for example, a large stream of literature on trade credit, (both receivables and payables). It starts with the early contribution of Meltzer (1960) on the relation between monetary conditions and trade credit, and continues with numerous papers developing theories of trade credit; these, aiming to explain why firms decide to use trade credit, provide good insights on the usefulness of offering and/or accessing such a credit.[2] Additionally, some studies covering the dynamic of trade credit in times of financial distress or widespread financial turmoil, illustrate the consequences of these operating/financial decisions.[3] There is another stream of literature that discusses the importance of cash holdings, highlighting not only the typical transaction arguments, but also many modern theories that could help explaining the significant cash balances held by numerous firms (including agency, asym-

[1] Faus (1997), Genoni and Zurita (2003), Hill, Kelly and Highfield (2010), and Preve and Sarria-Allende (2010) provide a more comprehensive description of working capital management and its importance for corporate finance.

[2] See Ferris (1981), Emery (1984), Smith (1987), Brennan, Maksimovic, and Zechner (1988), Mian and Smith (1992), Lee and Stowe (1993), Long, Malitz, and Ravid (1993), Biais and Gollier (1997), Petersen and Rajan (1997), Frank and Maksimovic (1998), Cunat (2000), Burkart and Ellingsen (2002), Himmelberg, Love, and Sarria-Allende (2008), among others.

[3] See Petersen and Rajan (1997), Wilner (2000), Molina and Preve (2009 a, 2009 b), and Love, Preve, and Sarria-Allende (2007) among others.

metric information, hedging and many other concepts).[4] Finally, the other two working capital components –inventory and short-term debt– have been also widely covered by the literature.[5] Once again, none of these offers an integrated view of working capital management, rather, most of these studies tend to concentrate on specific topics or contexts.[6] An evolution in this aspect is the recent publication of two papers that consider trade receivables, inventories, and trade payables.[7]

An integrated analysis of working capital management is not facilitated at the business level, either. Business managers frequently talk about the working capital *requirements* of their businesses, but the first intuition that comes to their minds –based on a more computational view that defines working capital as current assets *minus* current liabilities – is typically associated to an investment component, i.e. as the operating investment of the firm. We consider this conception to be incomplete and misleading. In order to operate, the firm needs not only its working capital (i.e. current assets *minus* current liabilities) but its overall investment in current assets. A more accurate intuition of working capital emerges when we define working capital from the liabilities side (as long-term capital *minus* fixed assets, which is mathematically equivalent). The *net* result, still on the right side of the balance sheet, can be interpreted as a financial component, and therefore, as part of the capital structure decision of a firm. More specifically, working capital can be understood as the amount of long-term capital devoted to the financing of current assets.[8]

This refinement of the working capital intuition is not merely semantic; on the contrary, its impact on corporate finance practices could be very significant. The reason is that the focus is shifted from short-term operating decisions towards more structural ones. Moreover, framing working capital practices within the financing of operating investment helps to understand its key drivers, and to differentiate them –and their relative importance– from the key factors that shape the operating investment of a firm. Thus, in order to understand firms' working capital policies, it is imperative to identify (and differentiate) the investment and the financing components.

The operating investment of the firm, in general terms, includes cash balances, account receivables and inventory, and it is usually estimated as *net* of operating liabilities (which naturally emerge in any running business).[9] We call this figure Financial Needs for Operation (FNO), since it represents the operating investment that needs to be actively financed by the firm. The FNOs are critically affected by the

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firm's activity level; however, there are other potentially significant influences from: (i) the company, (ii) the industry, and (iii) the region in which the firm operates. The industry effect should be fairly clear: depending on whether firms operate in the manufacturing or service sector, the level of competitiveness and concentration of the industry and its supply chain, the type of goods they sell (durable vs. perishable), the cost or price of goods or services (in both absolute and relative terms), etc., they may have a propensity to have higher or lower levels of FNOs. Firms' specific decisions, on the other hand, may also have important effects and can even produce significant variations within industry patterns. Hence, we believe the differences in the FNOs to be primarily driven by industry characteristics and firm specific choices. In contrast, we consider the magnitude of country or regional effects to be of secondary order; mainly with an indirect link through the financing channel, as suggested by Meltzer (1960), or through other specific country characteristics that might affect operating investments.

Working capital, as we suggested, should be understood as the long-term capital a firm chooses to apply to the financing of the net operating investment, and therefore as part of the capital structure decision of a firm. To analyze the determinants of working capital patterns, it is important to keep this

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[4] See Baumol (1952), Opler, Pinkowitz, Stulz, and Williamson (1999), Bates, Kahle, and Stulz (2006), among others.

[5] See Singh (2008), Michalski (2007), Carpenter, Fazzari, Petersen, Kashyap, and Friedman (1994), Carpenter and Levy (1998), Titman and Wessels (1988), Faulkender and Petersen (2006), among others.

[6] Papers analyzing specific topics deal with issues such as debt structure (Bolton and Scharfstein, 1996), debt maturity (Danisevska, 2002; Demirguc-Kunt and Maksimovic, 1996; Barclay and Smith, 1995; Aivazian, Ge, and Qiu, 2005), etc. Other papers cover specific contexts, such as emerging economies (Demirguc-Kunt and Maksimovic, 1999; Schmukler and Vesperoni, 2000; and Broner, Lorenzoni ,and Schmukler, 2004).

[7] See Hill et al. (2010) and Baños-Caballero, García-Teruel, and Martinez-Solano (2010).

[8] We define long-term capital as the sum of long-term debt and equity. See Preve and Sarria-Allende (2010) for a more comprehensive treatment.

[9] Even though operating liabilities include a variety of concepts (such as account payables, accrued taxes, wages, etc.), in what follows, and without loss of generality, we will reduce this concept to the most significant component, namely account payables.

intuition in mind. In agreement with any other financing decision, we would expect firm and industry characteristics to have an influence on the level (or share) of working capital; however, given the worldwide ample disparity in financial markets' relative development, we expect country effects to be particularly relevant in shaping this choice. The reason is that one would expect firms to adjust capital structure decisions depending on issues such as capital markets development, stability of the local financial markets, volatility risk, country risk, quality of the governance, etc. Moreover, being at the core of the financing decisions, setting a wrong level of working capital can cause liquidity and profitability problems, which will depend on the efficiency of the capital markets in which the firms operate. In efficient markets, firms failing to establish the correct level of working capital can easily solve any emerging problem by going to the market to adjust their financing mix; at most, some minor costs of financial distress might occur in the meantime. On the contrary, a suboptimal financing of the operating investment for firms located in less efficient financial markets can cause serious financial problems, which might drag them into financial distress and potentially deep liquidity issues.

We have thus far identified an investment component – the FNO– and its financing counterpart –the working capital choice. Both need to be considered together, since one is a consequence of the other. This paper uses a framework that combines these two concepts, allowing us to take a first step towards a more integrated and insightful treatment of working capital practices, whose relevance would be context dependent.

Using data from firms in 42 industries and 51 countries, we pursue an exploratory study of the main patterns in working capital and FNOs across industries and regions. We describe the main variations we observe in the data and examine whether they could be reasonably linked to differences in business decisions, industry characteristics, or financial market development. This paper is only a first step, in which we aim at assessing the relative importance of firm, industry, and region components in the decisions regarding FNOs and working capital. Identifying the complete set of determinants of working capital and improving its current management practices, however, will require a more comprehensive study. Particularly, we expect subsequent research to provide a suitable analytical framework that helps identifying not only the main determinants of the operating investment and its optimal financing choice, but also their corresponding influence in terms of profitability and overall performance of the firms.

The analysis we present in this paper provides preliminary support to our initial conjectures. Particularly, we find that the investment decision –the FNOs– is mainly driven by firm and industry characteristics, and that the financing choice –the working capital– is primarily influenced by the

economic and financial market environment –country, region, institutions, etc.– surrounding the firms. Even though our empirical analysis shows that both working capital and FNO depend on the firm's specific business decisions (i.e. identifying company, industry, and country, it turns out that most of the annual variation is explained by firms' identification codes –based on Standard & Poor's Global Compustat company identifier - ID), we further observe that industry effects are stronger in explaining the differences of the operating investments (FNOs), than in explaining the differences of the financing choice (i.e., working capital). Moreover, we find this effect to be stronger for developed countries than for developing ones, for which the country variable shows a stronger effect. These results might suggest that financing decisions are more sensitive than investment choices to the presence of financing constraints.[10]

The rest of the paper proceeds as follows. In Section I, we describe the sample and the data selection process. Section II provides the analysis of the main cross sectional variations of FNOs and working capital at the industry level. In Section III we examine the regional patterns. In these two sections we use a simple inspection of basic summary statistics. Then, in Section IV, we present a deeper analysis based on variance decomposition. Finally, Section V concludes and presents interesting avenues for future research.

I. Data, Sample Selection, and Variable Definition

We use data from all listed companies in the North America and Global Compustat databases from 2000 to 2007, reorganizing the standard industrial classification (SIC) code described in Fama and French (1997). We eliminate repeated observations, as well as firms reporting missing or negative data in our key variables (i.e. total current assets, total assets or total revenues). We also remove potential outliers; specifically, we discard observations outside the interval given by the 1st and 99th percentile. We concentrate on data from all industries in four different regions (Asia, Europe, Latin America, and North America), excluding firms in the financial services and defense industries. Finally, in order to obtain a better assessment of the different component of variance – using Country, Industry, Country×Industry, Company and Annual observations – we exclude any subject with less than three nested observations. The final panel includes 122,892 observations from 20,515 companies in 51 different countries.

Our main variables are defined as follows: FNOs are computed as Current Assets minus all non-financial short-term liabilities. Working Capital, on the other hand, is the

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[10] This link is consistent with Fazzari and Petersen (1993) and Kieschnick, Laplante, and Moussawi, (2009). An additional reference to this topic could be found in Hill, Kelly and Highfield (2010).

Table I. Industry Patterns

Figures based on average information per firm (Period 2002-2007). *N* is the number of firms in each industry.

			Panel A. Industry Paterns				
		FNO_Rev			**WC_FNO**		
Industry	**N**	**Mean**	**se(mean)**	**p50**	**Mean**	**se(mean)**	**p50**
Agriculture	159	1.0008	0.1181	0.5557	0.2502	0.0580	0.3638
Aircraft	51	0.5659	0.0589	0.4302	0.3934	0.0749	0.5350
Apparel	339	0.5163	0.0301	0.3925	0.4616	0.0463	0.5893
Autos & Trucks	438	0.5179	0.0427	0.3256	0.2390	0.0388	0.4266
Beer & Liquor	155	0.6467	0.0760	0.4075	0.3183	0.0692	0.4863
Business Service	2,734	1.0836	0.0388	0.5203	0.2918	0.0196	0.4822
Business Supplies	303	0.3859	0.0157	0.3110	0.2567	0.0386	0.4224
Candy & Soda	29	0.2999	0.0789	0.1777	0.1576	0.1227	0.2768
Chemicals	761	0.6528	0.0471	0.3738	0.2720	0.0272	0.4389
Coal	47	0.5269	0.1419	0.3044	0.3586	0.1814	0.2382
Communication	665	0.6905	0.0524	0.3621	0.0122	0.0530	0.2624
Computers	933	0.7899	0.0358	0.4892	0.3895	0.0288	0.5921
Construction	497	0.8908	0.0554	0.5335	0.3005	0.0353	0.4055
Construction Mat.	775	0.5989	0.0328	0.3819	0.2355	0.0327	0.4803
Consumer Goods	461	0.5400	0.0270	0.3969	0.4028	0.0349	0.5029
Electrical Equipmt.	395	1.1353	0.1399	0.4794	0.4924	0.0266	0.5748
Electronic Equipmt.	1,397	0.9941	0.0442	0.5739	0.4952	0.0168	0.6586
Entertainment	389	0.6575	0.0549	0.2777	-0.0880	0.0757	0.2323
Fabricated Products	98	0.4866	0.0696	0.3330	0.3454	0.0669	0.4554
Food Products	685	0.4358	0.0240	0.2902	0.2248	0.0324	0.3850
Healthcare	200	0.3380	0.0335	0.2322	0.0325	0.0727	0.3471
Machinery	824	0.8005	0.0495	0.4668	0.4186	0.0213	0.5509
Measurement & Co.	289	0.9212	0.0520	0.6265	0.6006	0.0304	0.7004
Medical Equipmt.	418	1.5267	0.1227	0.6665	0.5341	0.0316	0.6919
Mines	170	1.8538	0.2403	0.6844	0.2070	0.1057	0.6152
Personal Services	149	0.6151	0.1107	0.2503	-0.0368	0.0952	0.1350
Petr.&Nat. Gas	753	1.2363	0.1041	0.2973	0.4425	0.0449	0.5435
Pharmaceutical	959	3.5849	0.1516	1.1639	0.5210	0.0212	0.6882
Precious Metals	93	1.7301	0.2363	0.8384	0.3197	0.1241	0.6243
Printing &Publish	214	0.5280	0.0432	0.3409	0.1275	0.0487	0.3136
Recreation	174	0.5610	0.0461	0.3924	0.4562	0.0580	0.5651
Restaurants & Hotels	386	0.5359	0.0757	0.1406	-0.3867	0.0914	-0.1769

Table I. Industry Patterns *(Continued)*

Industry	N	FNO_Rev Mean	se(mean)	p50	WC_FNO Mean	se(mean)	p50
Retail	873	0.3454	0.0314	0.1951	0.2487	0.0371	0.4727
Rubber & Plastic	289	0.4360	0.0311	0.3132	0.2392	0.0408	0.3817
Shipbuilding & Railroads	46	0.6705	0.1184	0.4384	0.1881	0.0831	0.3166
Shipping Containers	81	0.4482	0.0747	0.3298	0.2633	0.0912	0.4022
Steel Works	604	0.4442	0.0211	0.3551	0.2594	0.0317	0.4149
Textiles	372	0.6596	0.0566	0.4368	0.2516	0.0428	0.3848
Tobacco Products	19	0.5839	0.1439	0.4671	0.4669	0.0828	0.5494
Transportation	734	0.5110	0.0311	0.2589	0.0394	0.0401	0.2603
Utilities	636	0.4385	0.0362	0.2519	-0.3685	0.0423	-0.1713
Wholesale	921	0.4217	0.0231	0.2682	0.3981	0.0247	0.5474
Total	20,515	0.8841	0.0131	0.4050	0.2797	0.0067	0.4871

Panel B. Distribution of Firms per Industry and Region

	Asia	Europe	LATAM	NorAm	UK
Agriculture	89	16	13	29	12
Aircraft	2	10		34	5
Apparel	148	59	13	98	21
Autos & Trucks	255	51	9	107	16
Beer & Liquor	45	48	11	32	19
Business Services	483	549	11	1236	455
Business Supplies	124	68	15	81	15
Candy & Soda	5		5	16	3
Chemicals	449	89	35	160	28
Coal	23			19	5
Communication	155	111	45	294	60
Computers	318	189	3	357	66
Construction	266	110	20	49	52
Construction Material	404	147	34	146	44
Consumer Goods	223	67	13	116	42
Electrical Equipment	197	59	4	112	23
Electronic Equipment	674	146		503	74
Entertainment	68	80	3	144	94
Fabricated Products	47	17	3	27	4
Food Prods	370	114	41	126	34
Healthcare	31	23	3	130	13
Machinery	310	201	8	245	60
Measurement & Control Equipment	59	46		163	21
Medical Equipment	28	71		286	33

Table I. Industry Patterns *(Continued)*

	Asia	Europe	LATAM	NorAm	UK
Mines	35	14	13	73	35
Personal Services	24	12	1	88	24
Petroleum & Natural Gas	118	64	8	503	60
Pharmaceutical Products	265	118		502	74
Precious Metals	7	5		67	14
Printing & Publishing	55	53	3	71	32
Recreation	68	25	3	64	14
Restaurants & Hotels	119	35	4	162	66
Retail	204	140	31	392	106
Rubber & Plastic	152	33		84	20
Shipbuilding & Railroad Equipment	22	13		10	1
Shipping Container	47	9	3	18	4
Steel Works	361	80	38	112	13
Textiles	285	40	8	28	11
Tobacco Products	11			5	3
Transportation	282	166	26	195	65
Utilities	137	85	76	317	21
Wholesale	373	159	9	305	75
Total	7,338	3,322	512	7,506	1,837

Compustat variable, defined as current assets minus current liabilities (which is mathematically equivalent to the estimation based on long term capital minus fixed assets). To make our key variables comparable, we use the standard scaling factors. We scale FNO by total revenues, which help us to control for activity level and firm size. The working capital variable, on the other hand, is scaled by FNOs, leaving us with a ratio that represents the percentage of FNOs financed with working capital.

II. Cross Sectional Variation: The Industry Effect

In our first approach towards analyzing the patterns in working capital management we observe a set of summary statistics of our main variables, *FNO to Revenues* and *Working Capital to FNO*, by industry. The results are presented in Panels A and B of Table I.

We observe that even though on average firms have FNO equivalent to 88% of their revenues, there is an ample variation of this figure across industries. Several industries have operational investments exceeding their annual revenues; such is the case of Pharmaceutical Products, Medical Equipment, and Mines and Precious Metals, among others. Other industries, on the contrary, have relatively low operating investment; retailers, for example, invest on average only

35% of their yearly revenues (similar cases are Candy and Soda, Health Care, and Business Supplies, among others). As we suggested before, the level of the operating investment seems to be inspired at the industry level.

The working capital ratio, on the other hand, also presents wide variations across industries.[11] The average ratio denotes that around 28% of the operating investment is financed with long-term capital; however, while firms in the Measurement & Co, Medical Equipment and Pharmaceutical Products industries, for example, finance, on average, more than 50% of their operating investment with long-term capital, firms in the Communication, Healthcare, and Transportation industries support less than 5% of their FNO with long-term funds. There are even some other industries exhibiting a negative working capital to FNO average ratio (e.g. Entertainment, Restaurants & Hotels, and Personal Service firms). Such a negative ratio implies that firms are, on average, financing part of their fixed assets with short-term debt.

According to this pattern, manufacturing firms appear more inclined towards financing a larger share of the operating investment with long-term funds. One potential reason would be a lower cyclical component around these industries (i.e., having a more stable investment requirement, it is

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[11] Which is natural, given the financing interpretation of this concept (see Frank and Goyal, 2009).

Table II. Regional Patterns

Figures based on average information per firm (Period 2002-2007). *N* is the number of firms in each region.

Region/C	N	FNO_Rev			WC_FNO		
		Mean	se(mean)	p50	Mean	se(mean)	p50
Europe (*)	3,322	0.7141	0.0254	0.3657	0.3530	0.0120	0.4918
NorAm	7,506	1.0970	0.0285	0.3527	0.3133	0.0127	0.5538
UK	1,837	1.1050	0.0572	0.3641	0.1395	0.0248	0.3800
Developed	12,665	0.9977	0.0200	0.3581	0.2985	0.0090	0.5141
Asia	7,338	0.7163	0.0117	0.4787	0.2617	0.0100	0.4486
LATAM	512	0.4797	0.0339	0.3361	0.0730	0.0443	0.3550
Developing	7,850	0.7009	0.0112	0.4670	0.2494	0.0098	0.4443
Total	20,515	0.8841	0.0131	0.405	0.2797	0.0067	0.4871

(*) Excluding UK

reasonable to match it with a more stable financial source). In agreement with this, we also observe that the closer we get to the service sector, the more short-term funds are used to support operating investment needs. The use of short-term funds is even more radical in the most cyclical or sensitive service firms – such as those involved in the entertainment, restaurants and hotels and/or personal service business.

III. Cross Sectional Variation: The Regional Effect

After considering the influence of industry characteristics on FNOs and working capital policies, we examine to what extent these patterns differ across regions. We define four different regions; two corresponding to emerging markets, such as Asia and Latin America, and two consisting of developed markets, such as Western Europe and North America. Since the United Kingdom's (UK) capital and financial markets are more comparable to those operating in the United States (US) (as opposed to the other Western European countries') – being the former more capital market oriented and the latter more bank oriented – we present information on UK firms separate from other European countries' firms. Thus, we end up presenting five regions. The information is summarized in Table II.

Even though we observe ample variation across regional mean ratios, the difference is significantly narrowed when we consider median figures. This suggests that most of the variation is caused by extreme values (for example, due to the presence of some pharmaceutical and sophisticated medical equipment firms in the US – which lead to higher average FNO ratios in that region – and a number of financially constrained firms in emerging markets –which tilt average working capital ratios towards lower figures).

To gain a better understanding of working capital patterns, it is interesting to examine firms' data classified by industry

and region.[12] Within that setting, we observe several interesting features. For example, we observe that firms in the Pharmaceutical Products industry, which were reported as the ones with larger FNO on revenues in Table I, show a large variation across regions, ranging from 0.99 in Asia to 4.95 in North America.[13] Something similar happens with firms in the Precious Metals industry, in which the FNOs on revenues ratio ranges between 1.30 in North America to 5.31 in Europe. In the next section we undertake this analysis using a more accurate method in order to learn about the relative impact of different drivers on FNOs and working capital patterns.

IV. Cross Sectional Patterns: A Variance Decomposition Approach

To better understand what drives the cross-sectional variation of these ratios, we follow a variance decomposition analysis. Variance decomposition analyses have been approached using either Components of Variance techniques (ANOVA) procedures. In this paper, we analyze the components of variance using a cross-classified nested model.[14] The basic model for assessing firm, industry and country ef-

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[12] Which are obtained by merging Tables I and II; not reported in the paper, but available upon request.

[13] This figure could be capturing some non-operating current assets such as idle cash.

[14] Both techniques, "Analysis of Variance" (ANOVA) and "Components of Variance" (COV), estimate how much of the variance of the dependent variable is explained by the categories included as independent variables; but while ANOVA computes the variance of the estimates considering each categorical variable as having a fixed set of possible realizations, the COV technique computes the corresponding variance of the estimates, allowing the individual realizations within each categorical independent variable, to be randomly selected from an infinite population. See Brush, Bromiley, and Hendrickx (1999).

Table III. Variance Decomposition (Period 2002-2007)

The first line (for each variable. i.e. FNO/Revenues and WC/FNO) is the fixed component part of the model. In this particular case. it represents the average value of the corresponding dependent variable for the whole sample. The body of each table shows the random effect component. The first column shows the standard deviation of the explained variable across each level (i.e. Region, Industry, Region-Industry, Company, and Annual). As each of these values tends to zero it indicates a small difference across individuals in this level. The second column shows the relative weight of each level (Region, Industry, etc.) in the total variability of the variable in the model. A high percentage indicates that the variability of the dependent variable around its expected value —average value — is mostly explained by the variability at this level.

FNO / Revenues	0.7588	
	Std Err	**%**
Region Effect	0.0876	0.19
Industry Effect	0.4869	5.95
Region X Industry Effect	0.3646	3.34
Company Effect	1.4491	52.70
Annual + Residual	1.2275	37.82
		100.00
WC / FNO	0.2565	
	Std Err	**%**
Region Effect	0.0709	0.34
Industry Effect	0.1981	2.67
Region X Industry Effect	0.1270	1.10
Company Effect	0.7025	33.62
Annual + Residual	0.9560	62.26
		100.00

fects is the following:

$$x_{tiks} = \mu + \alpha_k + \varphi_s + \delta_{ks} + \beta_i + \varepsilon_{tiks}, \qquad (1)$$

where x_{tiks} denotes the dependent variable (FNO / Revenues or WC / FNO ratios) for year t, at the ith firm, in the kth region, and s^{th} industry. This model describes x_{tiks} as an overall mean (average ratio of all firms over the entire period), using a country or regional-specific effect, α_k, an industry effect, φ_s, an interaction between regional and industry effects, δ_{ks}, a firm-specific effects β_i, and an error term ε_{ikst}. The inclusion of the interaction geographical-industry effect follow from recent findings that report the presence of an important industry cluster effect in different countries – e.g., Brito and Vasconcelos (2006); Makino, Isobe, and Chan, (2004); and McGahan and Victer, (2008).

The usual assumption is that the error term, ε_{ikst}, corresponds to random disturbances, drawn independently from a distribution with zero mean and constant but unknown variance, σ^2. The model also assumes that all the other effects, are realizations of random processes with zero mean and constant, but unknown, variances. Finally, the model assumes that all the covariances equal zero.[15]

We estimate Equation (1) using a cross-classified nested model. It is nested, since the annual observations are nested at the firm level; the firm-specific effect is nested in the interaction region-industry which in turn is nested simultaneously in each of the main effects – region and industry. It is cross-classified, because it simultaneously estimates these two main effects.

A. The Total Sample

We start by examining the components of variance of FNO and working capital for the entire sample in order to explore the relative magnitude of the different effects. We consider firm, industry and regional effects. The results are reported in Table III.

The first thing we observe in Table III is that most of the variation both in FNO and working capital ratios is explained by firm effects and residuals. Interestingly, while the residuals seem to have major relevance in the variation of

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[15] It should be noticed that the model is of mixed effects, where the grand mean is the only fixed effect and all the others are random effects.

Table IV. Variance Decomposition: Developed and Emerging Countries (Period 2002-2007)

Developed countries include Western Europe and North America. Emerging Countries include Latin America and Asia.

	Developed	Emerging	Developed	Emerging
FNO / Revenues	0.7445	0.7190		
	Std Err		**%**	
Country Effect	0.1306	0.2894	0.31	5.56
Industry Effect	0.6418	0.1693	7.53	1.90
Country X Ind Effect	0.2051	0.1635	0.77	1.77
Company Effect	1.7264	0.8203	54.50	44.65
Annual + Residual	1.4202	0.8336	36.88	46.11
			100.00	100.00
	Developed	**Emerging**	**Developed**	**Emerging**
WC / FNO	0.2965	0.2479		
	Std Err		**%**	
Country Effect	0.0919	0.2026	0.55	3.04
Industry Effect	0.2307	0.1547	3.46	1.77
Country X Ind Effect	0.1015	0.1494	0.67	1.66
Company Effect	0.7033	0.6632	32.13	32.59
Annual + Residual	0.9864	0.9067	63.20	60.93
			100.00	100.00

working capital, the company effect is more important at the FNO level. Given that we interpret working capital policy as a financing choice, the intuition is straightforward: working capital decisions are more sensitive to unexpected variations in financial markets conditions (the unexplained component accounts for more than 62% of the working capital variance). On the contrary, the variance of FNO is more closely related to firm-specific effects, such as corporate strategy (company effect accounts for 52.7% of the FNO to sales ratio variance).

We find industry to have a more relevant impact on FNO than on working capital ratios (6% vs. 2.7%). Notice also the role of the region x industry interaction. It seems that while FNOs' industry patterns are relatively shared globally, working capital patterns are more influenced by country or region specific features.

In order to test the impact of inter annual variations within the model, we run an alternate version that includes a full set of year dummies interacted with region. This specification, not reported in the paper, does not show any significant difference with respect to reported results. As expected, we find that year dummies are significant, showing that year effects account for variations in working capital and FNOs. Yet, the main random effects under analysis are similar to those found in the paper.[16]

Even though using this framework we can observe some interesting patterns, more information can be expected from splitting the sample between developed and emerging markets.

B. Developed and Emerging Countries

Following the United Nations classification, we grouped countries into two broad categories: developed and emerging countries. We repeat the variance decomposition in each of these samples. Results are summarized in Table IV.

The differences between the average ratios of emerging and developed economies are somewhat suggestive. Particularly, we find differences in working capital ratios to be larger than differences in FNOs. This is interesting (again, given that working capital has a financing interpretation), since these deviations could be associated to some sort of financing constraints of less developed markets.

We also find some interesting patterns regarding FNOs' variance decomposition. The data suggests the impact of industry characteristics on FNO to be more relevant for developed than for emerging countries (7.5% vs. 1.9%), as

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[16] We decided to keep the former model, for simplicity and brevity.

expected. In addition, the country effect seems to be more significant in explaining the variation of FNO in emerging economies (5.6% vs. 0.3%). Both findings suggest that these FNO ratios, within emerging economies, are likely to be affected by certain constraints rather than being unconstrained goals. Emerging economies are more volatile (i.e. which can also be observed in their higher unexplained – inter annual-coefficients), and are likely to need permanent adjustment to unexpected changes, rather than being concentrated on keeping up with optimal industry figures; there is less possibility of long-term planning. This might also be supported by a larger proportion of unexplained changes in emerging countries (46.1% vs. 36.9% in developed ones).

Regarding working capital ratios, the variance decomposition does not suggest clear differences between emerging and developed economies. One possible explanation for this puzzling result can be found in our sample composition. The fact that firms in the developed markets represent a larger coverage of the country corporate landscape –that is, in more developed countries a larger number of firms quote in the capital markets and report data that is captured in the datasets – can bias our results. In emerging markets, only a few large firms float their stock in the market and therefore, we are likely to be capturing a smaller fraction of the corporate sector, namely the largest and more efficient firms.[17] This sample bias is likely to hide a significant portion of the differences in working capital management across different regions. Alternatively, this could be explained by the fact that there is a wide variety of countries within each category –in the next section, we propose a finer regional decomposition in order to evaluate this case.

C. Regional Perspective

In order to enhance our analysis, we follow a finer re-

> ...working capital decisions are more sensitive to unexpected variations in financial markets conditions (the unexplained component accounts for more than 62% of the working capital variance). On the contrary, the variance of FNO is more closely related to firm-specific effects, such as corporate strategy (company effect accounts for 52.7% of the FNO to sales ratio variance).

gional decomposition. We grouped firms into our four main regions and applied the variance decomposition analysis to each subsample. A major concern with this approach is that when generating the subsamples we are imposing a restriction in only one dimension of analysis – the region effect – biasing the overall results against the geographical effect. For that reason, we will not focus on the results per-se but in the comparison between regions. Results are summarized in Table V.[18]

A few additional patterns emerge from Table V. On the one hand, the emerging market grouping seems to be too coarse. Particularly, Asian average ratios do not seem to differ so widely from both European and North American ones. Latin American firms are the ones that present clear differentiation. For example, while the average FNO to revenues ratio is around 75% in the first three regions, it is barely 48% in Latin American firms. Similarly, the average working capital to FNO ratio in Latin American firms is between ⅓ or ½ of what it is in the other three regions. It is possible that Latin American firms present higher constraints to arrive at optimal figures – both in terms of investment and financing – given that the Asian *tigers* have suffered less volatility and have received larger financing inflows during the period under analysis.

In terms of variance decomposition, Table V seems to confirm the previous findings. On the one hand, industry characteristics influence FNO in developed economies more than what they do in emerging countries. Yet, the country effect looks relevant only in determining FNOs of Asian countries (as opposed to Latin American ones). Once more, even though the working capital variance decomposition does not show clear patterns across regions, we do find the country variable to be somewhat important among Latin American economies; certainly, in terms of financing, it is not the same to be in Brazil, Chile, Argentina, Bolivia, etc. To expand these results, it would be necessary to run a deeper econometrical analysis, using country specific data.

D. Note on Robustness

Theoretically the investment intuition we are trying to capture with the concept of FNOs is the operating invest-

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[17] Previous research has found that size is one of the determinants of some of the components of the FNOs (for example, Petersen and Rajan (1997) and Molina and Preve (2009a), among many others), as well as a factor that might influence capital structure decisions (see, for example, Titman and Wessels (1988) and Rajan and Zingales (1995), among others). In this setting, however, we are not exploring the specific determinants of FNOs and working capital, but rather helping characterize the investment and financing components through a variance decomposition analysis. Within this setting, the impact of size, as a specific factor, should be captured by the ID effect. Nevertheless, a smaller cross-sectional variation across the emerging market sample might influence the results of our analysis

[18] Table V does not include UK figures, since we cannot explore the impact of country effects in a single country setting.

Table V. Variance Decomposition: A Regional Perspective (Period 2002-2007)

	Europe	NorAm	Asia	LATAM	Europe	NorAm	Asia	LATAM
FNO / Revenues	0.7336	0.7647	0.7976	0.4831				
		Std Err				**%**		
Country Effect	0.1512	0.0417	0.3154	0.0591	0.79	0.03	6.37	0.39
Industry Effect	0.6074	0.7773	0.1642	0.2250	12.83	9.42	1.73	5.60
Country X Ind Effect	0.1595	0.1199	0.1752	0.0010	0.88	0.22	1.97	0.00
Company Effect	1.1642	1.8758	0.8290	0.6588	47.13	54.87	44.01	47.98
Annual + Residual	1.0504	1.5079	0.8469	0.6453	38.36	35.46	45.93	46.03
					100.00	100.00	100.00	100.00
	Europe	**NorAm**	**Asia**	**LATAM**	**Europe**	**NorAm**	**Asia**	**LATAM**
WC / FNO	0.2915	0.3723	0.2683	0.0802				
		Std Err				**%**		
Country Effect	0.1090	0.1108	0.1302	0.3811	1.17	0.70	1.31	7.78
Industry Effect	0.2195	0.2294	0.1505	0.2435	4.74	3.01	1.76	3.18
Country X Ind Effect	0.0005	0.1817	0.1347	0.1965	0.00	1.89	1.41	2.07
Company Effect	0.5039	0.7702	0.6625	0.6690	24.99	33.93	34.01	23.99
Annual + Residual	0.8380	1.0282	0.8910	1.0839	69.10	60.47	61.52	62.98
					100.00	100.00	100.00	100.00

ment of the firm; therefore, any non-operating factor included in this figure would have a distortive effect. It is well known that corporate cash holdings go much beyond a transaction component; in fact, there is a prolific research area analyzing many other motives for holding cash.[19] Therefore, the cash variable included in our estimation of FNO –which corresponds to the variable cash and marketable securities in Compustat– is likely to also include non-operating balances. Unfortunately, it is not possible to separate operating balances from precautionary, strategic, or any other sort of cash. As a result, the definition of FNOs used throughout Tables I through V might be overstating the operating investment (moreover, this could have a differential influence across regions, for example, based on differential inflation rates, or future cash flows volatility).[20] In order to circumvent this problem, and as a robustness check, we run the whole model with a different specification which now is tilt towards the opposite extreme. We remove cash holdings from the computation of the FNO, which are now estimated as net of cash. The results are very similar to those obtained in the base case

model and are available upon request.

Finally, to avoid the inclusion of some other non-operating current assets into the operating investment of the firm (for example, some intangibles or tax credits) we estimate FNOs by simply adding the basic individual components, arriving to an alternate (narrow) specification. Therefore we define FNO = Trade Receivables + Inventories – Trade Payables. This specification captures only the truly operational investment (nevertheless, we run the model on this new specification both including and excluding cash). Once again, results are very similar to the basic model, and are available upon request. This finding suggests that the definition of FNO we present is not introducing any bias, at least, within this sample.

V. Conclusion

In this paper, after presenting what we believe to be a more useful interpretation of working capital, we have pursued a preliminary exploration for a global sample. By looking at the differences across various groups, we have aimed to motivate further analysis that would lead to more relevant answers.

First, we restate the intuition of working capital, based on the consideration of two complementary concepts: financial needs for operations (FNO) and working capital, which we

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[19] See for example Dittmar, Mahrt-Smith and Serveas (2002), Opler, Pinkowitz, Stultz, and Williamson (1999) and Almeida, Campello, and Weisbach (2003), among others.

[20] We thank an anonymous referee for pointing out this issue.

directly connect to the investment and financing component, respectively. Under this view, working capital is interpreted as the long-term capital financing operating investment.

After analyzing the summary statistics of our variables by industry and region, we use a cross-classified nested model with mixed effects, to explore the main patterns that explain the variance of FNO and working capital ratios in a variety of empirical settings.

Our main findings can be summarized as follow:

At the aggregate level, we find most of the variation in FNO and working capital ratios to be captured by firm effects and unexplained (inter annual) residuals. Yet, while the latter component has more relevance in capturing the variation of working capital, the company effect is more prevalent at the FNO level. Additionally we find the industry effect to have a more relevant impact at the FNO level. That is, whereas the investment decision is more influenced by the industry and firm strategy, the financing choices are more sensitive to financial market conditions.

It is possible that Latin American firms present higher constraints to arrive at optimal figures – both in terms of investment and financing – given that the Asian tigers have suffered less volatility and have received larger financing inflows during the period under analysis.

When we compare average ratios between emerging and developed economies, we find differences in working capital to be larger than differences in FNOs; this could be associated to a larger influence of financing constraints in the emerging market context. Next, even though financing constraints appear to have a larger impact on financing decisions, we also find some influence on FNOs. More specifically, we find that while the impact of industry characteristics on FNO prevail in the developed world, the country effect is more significant in explaining the variation of FNO in emerging economies.

Finally, a more refined study on regional subsamples suggests the impact of financing constraints –which prevent firms from achieving optimal figures– to be more prevalent among Latin American countries. Moreover, following a working capital variance decomposition, we find the country effect to be more relevant among this group. These findings match with the perception that Asian economies have enjoyed more foreign investment inflows and that, within Latin American countries, the situation has been dissimilar.

This paper leaves a number of questions open for further research. It would be interesting – now that we have a more accurate interpretation of working capital – to explore a more complete set of determinants of working capital, to measure the impact of working capital policies on profitability and on the probability of bankruptcy, and to evaluate to which extent these effects relate to the efficiency of the financial and capital markets in which the firms operate.

An answer to these questions is absolutely critical if we want to emphasize the importance of the working capital choice from a managerial perspective. Even though, there are some studies that analyze the link between working capital management and firms' profitability, they all interpret working capital as an investment component, and therefore, tend to only concentrate on the correlation between the cash conversion cycle and firms' profitability.[21] Our understanding of working capital from the financing perspective leads to a completely different framework for this analysis. The level of working capital alone is not an indication of good or bad working capital management policies. Being a financing choice, working capital has to be determined as a function of the size of the operating investment and its corresponding volatility. Given that the variation of the activity level could be caused by either seasonality or growth –with obviously different capital structure implications–, it is critical to understand its source. Also, the relevance of the working capital choice and its influence on profitability is likely to be affected by the liquidity and risk characteristics of the specific market in which firms operate. Furthermore, we believe that the relation between working capital and profitability is unlikely to be captured by a linear model. Rather, we consider that setting wrong levels of working capital is likely to produce more noticeable effects when going beyond certain thresholds and in certain market conditions; effects that will certainly break any sort of linearity. We believe these observations leave an enormous room for future research, which would need to incorporate these factors as part of an integrated framework.

Similarly, it would be interesting to consider the relation between working capital policies and financial distress. There is an obvious trade-off between financing costs and rollover risk, which is expected to depend on market conditions and development. Therefore, there is another avenue of research that could analyze the correlation of inefficient working capital policies and events such as financial distress or bankruptcy, as well as its dispersion across different markets.

Finally, it would be interesting to analyze whether there is an optimal working capital ratio in general, and whether it should change according to industry, region and year specifications. Moreover, it would be interesting to explore

[21] See Deloof (2003), García Teruel and Martínez Solano (2006), Lazaridis and Tryfonidis (2006), Nobanee and Hajjar (2009a,b), Nobanee (2009), Nobanee, AlShattarat, and Haddad, (2009), among others.

the relevance of FNO and working capital individual components across countries and regions; in particular, whether deviations are more relevant depending on the specific component. ■

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