Impact of Financial Development on Low Tangibility Firms

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Dissertation written under the supervision of professor Diana Bonfim

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Supervisor: Professor Diana Bonfim

Abstract

The significance of intangible capital is steadily increasing on corporate balance sheets. Previous studies have identified a positive relationship between the increase in intangible capital and the propensity to retain cash holdings. Companies experiencing a decline on their tangibility tend to hoard cash, forgoing investments. The present dissertation intends to explore whether financial development can facilitate firm growth by lowering cash hoarding and enhancing firm's investment across a sample of 100 countries spanning from 1990 to 2022.

The findings reveal a positive and significant correlation between the interaction term under analysis, $Asset\ Tangibility \times Financial\ Development,$ with the variable cash holdings. This supports the idea that a well-developed financial system may diminish the importance of tangible assets in cash holding strategies.

While additional findings underscore the negative influence of the interaction term on firm investment, their impact lacks statistical significance, indicating that financial development may not be a substantial factor in explaining the relationship between asset tangibility and investment. However, significant outcomes emerge when considering the financial constraints of firms, particularly for large and mature companies.

Finally, a negative and significant correlation between the interaction term concerning investment emerges within the subsample comprising firms operating in low tangibility industries. These findings suggest that advancements in financial development have the potential to alleviate underinvestment challenges specifically for firms in low-tangibility industries.

Similar results were observed in robustness tests, which included a subsample with a more balanced representation of observations across countries.

Keywords: financial development, asset tangibility, cash holdings, investment

Impacto do Desenvolvimento Financeiro em Empresas com Poucos Ativos Tangíveis

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Orientador: Professora Diana Bonfim

Resumo

O capital intangível tem aumentado significativamente nos balanços corporativos. Estudos anteriores identificaram uma relação positiva entre capital intangível e a propensão para manter reservas de dinheiro. Empresas com menor tangibilidade tendem a reter mais dinheiro, abdicando o uso do mesmo para investimentos. A presente dissertação pretende explorar se o desenvolvimento financeiro facilita o crescimento de uma empresa ao reduzir a necessidade de reservar dinheiro e promover o investimento, analisando uma amostra de 100 países de 1990 a 2022.

Os resultados demonstram uma relação positiva e significante entre o termo de interação, $Tangibilidade \times Desenvolvimento\ Financeiro,$ e as reservas de dinheiro de uma empresa. Suportando a ideia de que um sistema financeiro mais desenvolvido poderá reduzir a importância dos ativos tangíveis na escolha estratégica das reservas de dinheiro.

Apesar de resultados suplementares indicarem uma influência negativa do termo de interação no investimento das empresas, a falta de significância sugere que o mesmo pode não ser um fator explicativo na relação entre tangibilidade e investimento. No entanto, resultados significantes surgem ao considerar limitações financeiras, especialmente para empresas grandes e maturas.

Por último, salientar a correlação negativa e significante do termo de interação no que diz respeito ao investimento em empresas de setores com menor tangibilidade. Estes resultados indicam que melhorias no desenvolvimento financeiro de um país podem mitigar desafios de falta de investimento, particularmente para empresas em industrias com menor tangibilidade.

Resultados semelhantes foram verificados nos testes de robustez, que incluíam uma amostra com uma representação mais balanceada de observações entre países.

Palavras-chave: desenvolvimento financeiro, ativos tangíveis, reservas de dinheiro, investimento

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Contents

Introduction

In recent decades, as we transition towards a knowledge-based economy, there has been a notable increase in the significance of intangible capital on corporate balance sheets. Due to their firm-specific characteristics and the challenges in evaluation, intangible assets are not perceived as valuable collateral in the external financing processes of firms, making firms encountering difficulties when attempting to access external financing.

As a result, these companies typically reinforce their monetary holdings to ensure they have sufficient resources when needed. A growing body of literature has linked the rise in corporate intangible capital to an increase in firm's cash holdings (Bates et al., 2009; Falato et al., 2013; Lei et al., 2018; Diaw, 2021).

This paper seeks to address this challenge by investigating this relationship and whether a well-developed financial environment could potentially alter this scenario. Furthermore, it will extend to examining the influence of a good financial environment on firm's investment decisions.

While several scholars have attempted to explore the impact of a favourable financial context on overall company growth, there is an evident gap in research regarding whether firms with low tangibility tend to reduce their amounts of cash holdings when operating in better-developed countries.

The relevance of the current research is heightened by the contemporary relevance of the topic, with an increasing number of companies facing this problematic. The limited academic exploration of this problem further fuelled my motivation to study and contribute to the understanding of this phenomenon.

The research utilized a comprehensive dataset of all companies included in Compustat North America and Compustat Global over a 32 years-period from 1990 to 2022. Following through data cleaning, the final dataset encompassed 672,425 firm-year observations, covering 49,306 unique firms from 100 countries.

Hence, two analyses were conducted. The first aimed to discern whether there was a correlation between tangibility and cash holdings and whether financial development altered this relationship. The second attempted to understand how a firm's investment decision might be influenced by tangibility and if it persists in the presence of our variable of interest, financial development.

The research anticipates observing that a well-developed financial system encourages low tangibility firms to reduce their levels of cash holdings and enhance their investment decisions.

In this investigation, certain limitations arise from the non-uniform distribution of data across different countries. To address this issue, robustness tests were constructed to assess whether the findings remained consistent when excluding countries with extreme observations.

This research offers potential benefits for specific groups of individuals, such as policymakers and government officials. Insights from this study could potentially inform the design of effective economic policies aimed at promoting stability and sustainable economic growth.

The subsequent sections of the paper are structured as follows: Section 1 reviews pertinent related studies. Section 2 proposes the methodology that this investigation aims to approach. Section 3 discusses our data and initiates a first analysis to the data available. Section 4 presents the empirical results and Section 5 addresses robustness checks.

Section 1: Literature Review

A substantial body of theoretical and empirical literature suggests that firms which are capable of providing collateral find it easier to access to external financing (Hart and Moore, 1994; Butt, U., 2019; Chan and Thakor, 1987). This is primarily because in the event of default or bankruptcy, creditors are able to recover their losses by selling the collateral assets. In the United States, collateral plays a crucial role in domestic lending, considering that approximately 70% of all commercial and industrial loans are secured by such assets (Berger and Udell, 1990).

It is widely acknowledged that not all assets are suitable for collateralization. According to Hart and Moore (1994), banks will be more willing to lend if the assets being collateralized hold significant value. Conventional wisdom suggests that general and non-specific assets are ideal for debt financing, whereas specific or intangibles are better suited for equity financing (Long and Malitz, 1985; Titman and Wessels, 1988; Williamson, 1988). Tangible assets, due to their characteristics of low information asymmetries and high recovery rates, are considered the primary source of collateral (Lei et al., 2018; Williamson, 1988). In contrast, intangible assets, such as Research and Development, brand enhancement, and employee training, are more firm-specific and challenging to evaluate, making them difficult to be redeployable (Dell'Ariccia et al., 2020; Hart and Moore, 1994; Shleifer and Vishny, 1992).

However, with the evolution towards a knowledge-based economy, intangible assets are gaining prominence on corporate balance sheets. In light of the inherent difficulty in evaluating intangible assets, firms encounter challenges in securing external financing, particularly those that possess a substantial quantity of such assets. Consequently, they strengthen their internal cash reserves to guarantee sufficient funds to support their innovation and growth objectives, thereby limiting their potential expansion (Lei et al., 2018). A growing body of literature has linked the rise in corporate intangible capital to the increase in firms' cash holdings (Bates et al., 2009; Falato et al., 2013; Lei et al., 2018; Diaw, 2021).

As reported by the World Bank (2016) financial development is the overall efficiency and growth of a country's financial systems. Several scholarly works consider that financial development could be seen as a potential solution for firms in circumstances of credit scarcity due to their high levels of intangible assets. As a result, scholars suggest that this development can facilitate the use of intangible assets as collateral or the adoption of alternative instruments to mitigate borrower risk (Lei et al., 2018; Loumioti, 2014; Liberti and Mian, 2010).

This paper seeks to address whether firms with significant levels of intangible capital reduce their reliance on cash holdings and experience an increase in their investment in the context of a more robust financial system. If this hypothesis proves to be true, as expected, we could conclude that financial development plays a crucial role in facilitating firm growth by reducing cash hoarding and enhancing investment, especially for intangible-intensive firms.

While previous research has explored the relationship between financial development and economic growth, there is limited understanding of its impact on cash holdings and firm growth. This research is closely related to the recent work by Lei et al. (2018),.Their study focuses on the effect of financial development in firms' cash holdings through the collateral channel.

The available body of literature indicates that economic development, poverty alleviation, and economic stability are notably impacted by financial institutions, including banks and insurance companies, as well as financial markets (Levine, 2005). Previous literature has confirmed that firms tend to grow faster in countries with more developed financial markets (Rajan and Zingales, 1998; Levine, 1999). Additionally, the literature suggests that financial development reduces frictions that cause financing constraints and enhances investment in underinvested firms (Naeem and Li, 2019; Love, 2003; Castro, Kalatzis, and Martins-Filho, 2015). According to Čihák et al. (2012), robust financial systems excel in identifying and funding firms with best prospects, enhancing the allocation of capital and promoting economic growth.

In conclusion, this research intends to be a valuable addition to the prevailing literature, which considers the positive influence of financial development on economic growth. Furthermore, it aims to confirm the existing understanding that financial development can influence a company's cash management policies (Lei et al., 2018) and promote increased investment and growth within the firm (Rajan and Zingales, 1998; Levine, 1999).

Section 2: Methodology

While various studies have explored the relationship between financial development and economic growth (e.g. Naeem and Li, 2019; Love, 2003; Castro, Kalatzis, and Martins-Filho, 2015), there is a notable scarcity of research directly investigating the effects of financial development on corporate cash holdings and firm investment. Therefore, this study follows the best-defined and structured existing methodology of the work of Lei et al (2018).

The research was initiated by visually illustrating the trends of *Asset Tangibility* and *Cash-to-Assets* ratio across the sample period (1989-2022) for U.S. (Figure 1) and global (Figure 2)

firms, aiming, in an initial phase, to discern patterns and potential correlations between these two variables. For this purpose, it was extracted data from all U.S. companies in Compustat North America spanning from 1989 to 2022, and then from all companies in Compustat Global.

Asset Tangibility, as defined in previous literature (e.g., Lei et al, 2018; Berger, Ofek, and Swary, 1996; Almeida and Campello, 2007), can be quantified as $0.715 \times \text{receivables} + 0.547 \times \text{inventories} + 0.535 \times \text{fixed capital}$, deflated by the book value of total assets net of cash. *Cash-to-Assets* ratio is defined as cash plus marketable securities divided by total assets.

Figure 1: Annual Cash Ratio and Asset tangibility mean from 1989 to 2022 of U.S. firms

The current figure aims to illustrate the relationship between *Asset Tangibility* and *Cash-to-Assets* ratio, exploring the potential correlation between these two variables. The sample consists of U.S firms that align with the criteria outlined in Section 3.1..

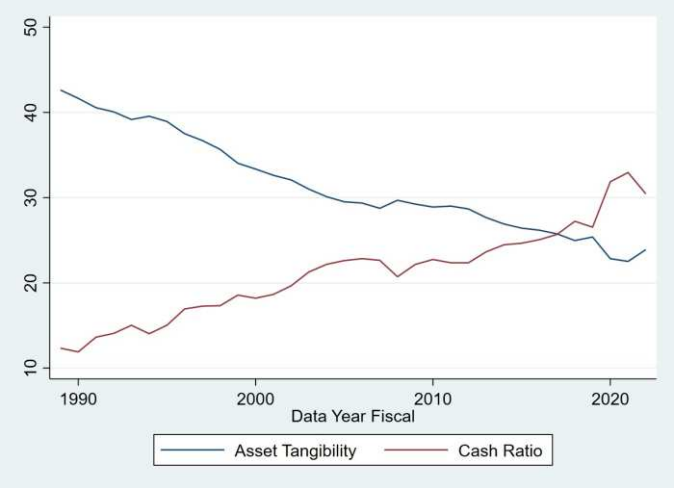

Figure 1 provides a detailed illustration of a significant trend observed in U.S. firms over the past three decades. It can be seen a clear inverse relationship between the *Cash-to-Assets* ratio and *Asset Tangibility*. As displayed, the increase in the cash ratio coincides with a notable decline in the tangibility of assets. This trend suggests that U.S. firms have been accumulating more cash as their assets become less tangible over time.

Figure 2: Annual Mean Cash Ratio and Asset Tangibility Trends across different countries

This Figure presents a scatter plot, which shows the annual mean *Cash-to-Assets* ratio plotted against the average *Asset Tangibility* for the fiscal years 1995, 2000, 2010 and 2015. The data includes information from both U.S. and global firms in accordance with the criteria outlined in Section 3.1. The purpose is to broaden the analysis to a global scale and visually depict the dynamics between *Asset Tangibility* and *Cash-to-Asset* ratio.

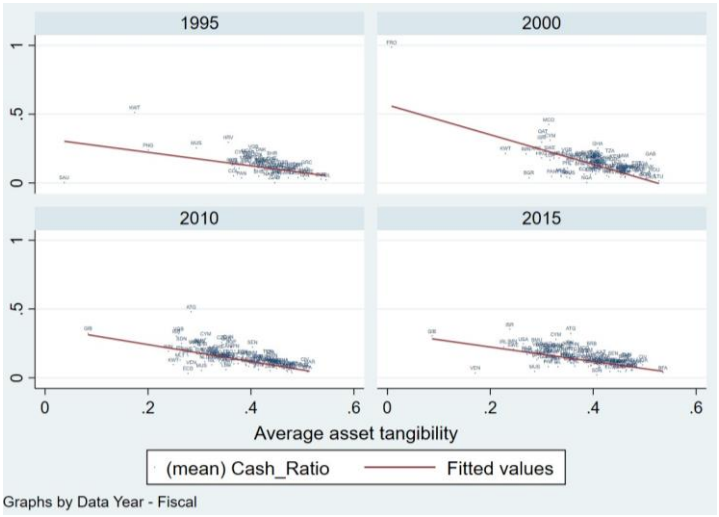

Figure 2 broadens the scope of the analysis by examining the same relationship but on a global scale, encompassing various countries. The data reveals interesting trends.

In 1995 and 2000, the majorities of countries within the dataset maintained an average *Asset Tangibility* ranging from approximately 0.4 to 0.6. However, as the years progress, a reduction in *Asset Tangibility* becomes evident, hovering around 0.3 to 0.5, which suggests that countries worldwide are progressively reducing the tangibility of their assets. Simultaneously, the average red line exhibits a slightly downward trajectory, suggesting a general increase in the cash ratio across different countries.

These figures provide an interesting first analyse on how these two variables interact, demonstrating a negative association between these metrics not only over time but also across various countries.

Consistent with existing methodologies (Lei et al, 2018; Rajan and Zingales, 1998; Cull, Haber, and Imai, 2011), this study employs the domestic credit provided to the private sector as a percent of GDP as a proxy for financial development. This metric, sourced from the World Development Indicators (WDI) database, is chosen to capture the economic efficiency of each country's financial environment. Another key fundamental metric utilized in this research will be cash holdings represented as the natural logarithm of the cash-to-assets ratio, aligned with the approach of previous scholars, including Lei et al (2018) and Dittmar, Mahrt-Smith, and Servaes (2003). Lastly, *Asset Tangibility*, another primary variable of this research, will be measured as previously described.

The initial phase of this research results will consist of an analysis to determine the influence of financial development and asset tangibility on corporate cash holdings. As previously mentioned in the literature review, tangible assets are the primary source of collateral in

securing debt financing, leading companies with substantial tangibles to maintain lower cash reserves. While conventional wisdom suggests a negative relationship between tangibility and cash holdings, our research attempts to investigate whether this dynamic is altered by introducing the variable financial development through the interaction term $Asset\ Tangibility \times Financial\ Development$. Our hypothesis is that a more developed financial system enhances a firm's ability to access external financing, even for those lacking tangible assets, thereby potentially reducing the necessity to maintain substantial cash reserves.

In the latter part of this paper, the aim is to investigate the real effect of financial development on promoting firm investment. To achieve this, two distinct data samples were constructed. The first data sample encompasses the entire dataset, while the second comprises firms from the industries with the lowest tangibility levels. The inquiry then extends to whether the presence of a well-developed financial system enables these firms to invest more effectively by alleviating financial constraints and facilitating resource allocation into investments.

Section 3: Data description and analysis

3.1 – Data Description

The data for this research was retrieved from Compustat North America and Compustat Global, assessed through the Wharton Research and Statistics platform, which includes information on all publicly traded companies. Following the data selection methodology used in prior studies on financial development and cash holdings, particularly that of Lei et al. (2018), this research utilizes a comprehensive dataset covering publicly traded firms in North America (U.S. and Canada) and globally. The dataset spans an extensive time frame of 32 years, from 1990 to 2022. Particularly, this is a more extended period compared to Lei et al.'s (2018) work, which began in the same year but only covered data until 2013. This research was intended to provide an up-to-date study with most recent and complete data available.

Consistent with the criteria applied in previous studies (Lei et al, 2018), some firms were excluded from the data sample. This includes financial firms (SIC code 6000-6999) and utility firms (SIC codes 4900-4999), firms with missing data for cash and equivalents, asset tangibility, or total assets, as well as firm-year observations with negative cash holdings, total assets or sales revenue. Additionally, observations with values for cash less than total assets and the book value of total assets less than $5 million (inflation-adjusted to 2006 U.S. dollars) were excluded. Moreover, it was extracted from the data sample countries with missing values on private credit per GDP and companies without Standard Industry Code (SIC). These data

cleaning procedures resulted in a final dataset consisting of 672,425 firm-year observations, covering 49,306 unique firms from 100 countries.

Finally, it is essential to highlight the data preprocessing undertaken to enhance the robustness of the analysis. Given the inherent potential for wide dispersion of values within the extensive dataset from Compustat Global and Compustat North America, a winsorizing process was implemented. This method, designed to mitigate the impact of extreme values, involved subjecting all key variables of interest, as well as the control variables, to a 1% winsorized test. By trimming extreme values at the 1% level, we aimed to ensure the stability and reliability of our results, contributing to a more accurate representation of the relationships between variables.

3.2 – Data analysis

Before proceeding to regression analysis, a more in-depth examination of the data was conducted. This involved a thorough exploration of summary statistics and a comprehensive cross-country analysis of the key variables in this research.

Table 1 presents the descriptive statistics of the original dataset, encompassing our four key variables, whereas table 2 shows the summary analysis of the variables by country.

Table 1: Descriptive Statistics

Table 1 presents a comprehensive descriptive statistics of our data, considering the four key variables under analysis. This presentation aims to enhance our understanding of the dataset and the main variables. Key metrics include mean, median, standard deviation, minimum, and maximum values, providing a detailed overview of the dataset's characteristics.

Variable	Observations	Mean	Median	Std. Dev.	Min	Max
Asset tangibility (%)	672,425	**36.33**	39.29	14.4	.570	59.916
Cash/net assets (%)	672,425	**16.643**	**10.37**	**18.37**	.0045	87.872
Private credit/GDP	622,174	**122.988**	128.245	52.13	16.84	216.327
Real GDP per capita	670,086	33,675.6	38,735.9	18759.96	2,571.15	90,195.8

Variable	Observations	Unique
Firms	672,425	**49,306**
Countries	672,425	**100**

Table 2: Summary analysis by country

Table 2 presents a summary analysis of the 14 countries under discussion in this section, while the complete analysis of the dataset is available in the appendix as Table 8. The Table provides a comprehensive examination of key financial indicators for each country, including the number of firm-years, the count of unique firms, and various economic metrics, such as Cash/Net Assets (%), Asset Tangibility (%), Private Credit/GDP, and Real GDP per Capita (2017 international $). Cash/Net Assets and Asset tangibility, both calculated as the average of all companies within the respective country, are presented as percentages. Both country-level variables represent averages for each country between 1990-2022 and are sourced from the World Bank's World Development Indicators (WDI) database.

Country	No. of firm-years	No. of unique firms	Cash/ net assets (%)	Asset tangibility (%)	Private credit/ GDP (%)	Real GDP per capita (2017 international $)
Antigua and Barbuda	20	**1**	41.94	29.9451	59.30787	20300.01
Barbados	8	**1**	7.21	44.88413	81.56433	15346.37
Burkina Faso	16	**1**	6.81	46.23967	22.98364	2571.15
China	**70,415**	4,851	21.50	36.74548	143.1468	11513.59
Dominican Republic	9	**1**	**4.87**	**47.73706**	23.64076	8934.952
Ecuador	42	3	**4.47**	38.97741	29.43287	10623.34
Japan	**83,697**	4,543	19.64	37.45532	177.4406	38079.95
Gabon	29	**1**	10.27	45.33589	16.83777	15252.23
Sweden	13,662	1,175	**20.62**	**26.91371**	111.6031	48089.45
Switzerland	5,384	309	17.31	36.64988	**150.3263**	62922.3
Sudan	19	**1**	9.13	35.53861	**16.83777**	4549.667
Uganda	78	5	7.04	47.76772	**16.83777**	2571.15
Ukraine	235	20	**5.82**	47.0537	57.58914	12120.1
United States	**119,923**	10,343	**20.21**	**32.14076**	**165.4083**	51261.58

Given the results displayed in Table 2, the United States emerges with the highest total firm year observations (119,923) and the largest number of unique firms (10,343). Following closely, we observe Japan with the second largest total firm observations (83,697), and China ranks third with 70,415 observations. However, the scenario shifts when considering the number of unique firms, where Japan has 4,543, and China has 4,851. Table 1 displays a total of 672,425 observations and 49,306 distinct firms across 100 countries.

Conversely, there are several countries with few firm observations, each having only one unique firm observed. These countries include Antigua and Barbuda, Barbados, Burkina Faso, Dominican Republic, Gabon, and Sudan.

Analysing the outcomes depicted in Table 1, particularly with a focus on the *Cash Ratio*, companies, on average, maintain a 16,64% level of cash on their balance sheets. The median value of 10.37% and the standard deviation of 18.37% suggest a notable dispersion of values within the data sample. This variability is not unexpected, given the diverse range of companies across various countries included in the sample. Therefore, it is normal to observe substantial differences in cash ratios among firms, with some maintaining a significant portion of their net assets in cash, while others uphold minimal cash reserves.

To illustrate this, column 4 of Table 2 confirms this wide variation in cash ratios values. For instance, the average *Cash Ratio* of firms in Sweden and U.S is around 20.62% and 20.21%, respectively, while the *Cash Ratio* is much lower in Ecuador, Dominican Republic, and Ukraine, such as, 4.47%, 4.87%, and 5.82%, respectively.

In contrast, as shown in column 5 of Table 2, the average *Asset Tangibility* of Sweden and U.S firms is 26.91% and 32.14%, respectively, whereas the share of tangibles assets is 38.98%, 47.74% and 47.05% for firms in Ecuador, Dominican Republic, and Ukraine, respectively. The mean *Asset Tangibility* of 36.33% in Table 1 indicates that, on average, a substantial portion of assets in the dataset is tangible, suggesting that companies in the dataset tend to have a significant proportion of their assets in physical form. The relatively low standard deviation of 14.4% indicates that, while there is some variability, the level of asset tangibility remains moderately consistent across observations.

The additional variables function as measures for the financial development variable, with *Private credit per GDP* accounting for the financial system efficiency and *Real GDP per Capita* serving as a control variable for economic development. Given the dataset's diverse range of companies spanning various countries, the observations for *Private Credit per GDP* range from a minimum of 16.84 to a maximum of 216.32. Particularly, countries such as the United States and Switzerland exhibit relatively high levels at 165.41 and 150.33, respectively, while others like Uganda and Sudan present exceptionally low levels at 16.84. The average value for this variable, as presented in Table 1, stands at 122.99.

Shifting our focus to the control variable, *GDP per Capita*, we observe a substantial dispersion in values across countries. For instance, Uganda records a figure of $2,571.15, while Switzerland boasts a significantly higher value of $62,922.3. This variance underscores the economic diversity captured within our dataset.

In conclusion, this chapter has provided a comprehensive overview of the dataset, revealing significant variations in firm-level observations across countries. These insights form the foundation for the subsequent sections of this research. Further exploration and interpretation of the previously analysed data will contribute to a more comprehensive understanding of the primary objective of this study.

Section 4: Empirical Results

4.1 – Baseline results: financial development, asset tangibility and cash holdings

To fully understand the impact of asset tangibility and financial development on cash holdings, the search for the results was initiated by constructing a baseline econometric model. This model was design to capture the relationship under investigation encompassing not only our primary variables of interest but also our control variables and fixed effects.

The construction of this baseline econometric model is outlined as follows:

$$\begin{aligned} Cash_{i,t} = \beta_0 &+ \beta_1 Asset\ Tangibility_{i,t} + \beta_2 Asset\ Tangibility_{i,t} \times Financial\ Development_{c,t} \\ &+ \beta_3 Financial\ Development_{c,t} \\ &+ \beta_4 Asset\ Tangibility_{i,t} \times \log(GDP\ per\ capita)_{c,t} + \beta_5 \log(GDP\ per\ capita)_{c,t} \\ &+ \beta_6 Ln(Total\ Assets_{i,t}) + \beta_7 Cash\ Flow_{i,t} \\ &+ \beta_8 Total\ Capital\ Expenditures_{i,t} + \beta_9 Total\ Book\ Leverage_{i,t} \\ &+ \beta_{10} R\&D\ Expenditures_{i,t} + \delta_c + \eta_j + \phi_t + \varepsilon_{i,t} \end{aligned}$$

The regression model incorporates *Asset Tangibility* and the *Interaction Term* ($Asset\ Tangibility \times Financial\ Development$) to discern the combined influence of financial development and firm-level tangibility on cash holdings. In line with what was done by previous scholars, (i.e. Liberti and Mian (2010), Lei et al. (2018)), the natural logarithm of income per capita (log(GDP per capita)) was included to control for the impact of a country's economic development, accounting for variations in the size of a country's population. Additionally, we include an interaction, to this logarithm, with *Asset Tangibility* to capture aspects of a country's economic activities beyond financial development. Included in the model are also additional variables beyond the primary variables of interest in order to minimize the potential confounding effects of other factors and to isolate the relationship between the main variables. To ensure consistency and comparability we considered the firm-level control variables similar to those used in other scholarly work by Lei et al. (2018) and Dittmar, Mahrt-Smith, and Servaes (2003), which are the natural logarithm of Total Assets (Ln(Total Assets)), Cash Flow, Total Capital Expenditures, Total Book Leverage and R&D Expenditures. Hence,

i, c, j and t denote firm, country, industry and year, respectively. Correspondingly, δc and ηj signify country and industry fixed effects, important to absorb systematic differences in liquidity management across countries and industries. ϕt, the year effect, captures common macroeconomic shocks that might impact firms' cash decisions.

The β_1 *Asset Tangibility* coefficient reports the direct association of tangibility on cash holdings. As previously indicated, tangible assets play a crucial role when seeking external financing, since they serve as a primary source of collateral. As observed in the preceding sections of this research, i.e. Figure 1 and Figure 2, firms with higher tangible assets on their balance sheets tend to hold less cash, given their ease of access to external funding. Therefore, the expectation is that the effect of *Asset Tangibility* on *Cash Holdings* would be negative ($\beta_1 < 0$).

However, having observed this negative relationship in a prior section (Section 2), the focus of this regression analysis shifts to understanding the interaction term, $Asset\ Tangibility \times Financial\ Development$) . The anticipation is that an efficient financial system would alleviate financial constraints for low tangibility firms, reducing the firm's need to hold cash. Consequently, the expectation is to observe a positive β_2 coefficient ($\beta_2 > 0$). This would suggest that in a more developed financial system, the importance of a firm's tangibility of assets when defining cash holdings strategies diminishes, suggesting a decrease of the importance in such assets when seeking external financial support.

Table 3: Baseline results: Financial Development and Asset tangibility effect on Cash Holdings with Robust Standard Errors

This Table examines how different levels of tangibility across varying degrees of financial development affects cash holdings. Values of t-statistics, reported in parentheses, are based on standard errors that are robust to heteroscedasticity and are country clustered. ***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Full	U.S.	Non-U.S.	Full	Full	Full
Dependent variable: Ln(Cash/Assets)	OLS	OLS	OLS	OLS	OLS	WLS
Asset tangibility	-4.655***	-4.67***	-4.939***	-4.85***	-11.95***	-9.254*
	(-25.52)	(-51.73)	(-16.21)	(-23.14)	(-6.97)	(-2.02)
Asset tangibility × Private credit per GDP					**0.009***	**0.007**
					(2.19)	(1.62)
Private credit per GDP	0.004**					
	(3.25)					
Asset tangibility × Log of GDP per capita					**0.549****	**0.333**
					(2.83)	(0.72)
Log of GDP per capita	-0.323					
	(-1.82)					
Log of real assets	-0.101*	-0.27***	-0.173***	-0.20***	-0.226***	-0.115***
	(-2.20)	(-33.80)	(-8.40)	(-6.91)	(-10.40)	(-10.90)
Cash flow	-0.0365*	0.043***	0.0789	0.00949	0.0230*	-0.139***
	(-2.41)	(3.81)	(0.78)	(0.77)	(2.01)	(-9.19)
Total book leverage	-0.366***	-0.31***	-0.277***	-0.27***	-0.270***	-0.556***
	(-14.87)	(-12.52)	(-3.81)	(-6.72)	(-8.03)	(-20.16)
R&D expenditures	-0.008***	-0.009**	-0.00151	-0.01***	-0.00489	0.00330
	(-3.68)	(-2.96)	(-0.14)	(-3.40)	(-1.58)	(0.27)
Constant	2.759	-0.291	1.233***	1.082***	1.625***	0.790*
	(1.52)	(-1.05)	(5.16)	(5.35)	(4.51)	(2.22)
Country fixed effects	Yes	No	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	164,139	63,978	113,093	177,071	164,139	164,139
Adj. R^2	0.33	0.48	0.48	0.46	0.46	0.49

Table 3 reports the estimation results of the previously expressed equation.

Column 1 displays the Ordinary Least Squares (OLS) estimation results considering the isolated impact of the variables *Private Credit per GDP* and *Income per Capita* on cash holdings, observing their effects without the interaction with *Asset Tangibility*. Columns 2-4 display the Ordinary Least Squares estimation results without the two, previously explained, interaction terms, while Column 5 presents the full sample OLS estimation results with the two interaction terms and Column 6 details the Weighted Least Squares (WLS) estimation outcomes with the two interaction terms.

Column 1 showcases the positive and significant impact that the variable *Financial Development*, proxied by the private credit per GDP, has on cash holdings. The findings suggest that, on average, heightened levels of financial development correlate with increased cash holdings. It is crucial to emphasize that various other factors may contribute to this positive relationship, including competitive business environments, interest rates, and credit availability.

As foreseen, the *Asset Tangibility* coefficient (β_1) is negative and highly statistically significant at a 1% significant level, indicating that *Asset Tangibility* is negative correlated with cash holdings. This negative trend is evident not only for U.S firms (Column 2) but also extends to

non-U.S. firms (Column 3). The comprehensive sample in Column 5 confirms this negative outcome, suggesting that, on average, *ceteris paribus*, a one unit increase in a firm's tangibility could be associated with a 4.85 p.p. decrease in firm's cash holdings. This result aligns with previous findings in this study and is consistent with existing literature, such as Lei et al. (2018).

Shifting focus to the central objective that this research aims to address, that is to assess whether financial development enables firms to reduce their need for cash holdings, thereby, facilitating their access to external financing.

Column 4 illustrates the baseline results of the previously mentioned equation, considering the full sample. Within this framework, we observe a positive and statistically significant β_2 coefficient, suggesting a positive correlation between the interaction term and firm's cash holdings. In a real-world scenario, assuming all other factors remain constant, a company operating in a well-developed financial system may experience a 0.009 p.p. decrease in its cash holdings levels for every one-unit reduction in tangibility, compared to one similar company operating in less developed financial environments. This finding suggests that the influence of asset tangibility on cash holdings fluctuates across diverse levels of financial development and that as financial development levels increase, there appears to be a trend where firms rely less on tangible assets in their considerations for determining cash holdings.

Additionally, these findings align with the expectations, suggesting that advancements in financial development could reduce firms' reliance on traditional tangible assets when determine their cash holdings. In broader terms, this leads to a decrease necessity for firms to hold cash, which, to some extent, contributes to the knowledge that financial development contributes to facilitate firms in obtaining external financing.

To address concerns about a potential bias stemming from a few developed countries with more extensive data availability, such as the U.S., Japan and China, a methodology in line with previous studies (e.g., Dittmar, Mahrt-Smith, and Servaes, 2003) was adopt. A weighted least squares (WLS) regression was employed, where all countries are treated equally in terms of the weight they carry in the estimation process, regardless of the number of observations each country contributes with. As illustrated in Column 6, our key finding, as reported in column 5, remains positive, but losses its statistical significance.

In summary, our baseline findings indicate that, while tangibility remains a significant factor, the influence it exerts on cash holdings is diminished by the efficiency of financial markets. However, the results are not strongly statistically significant.

4.2 – Real effects of financial development: firm investment

Having established that a developed financial market alleviates collateral constraints and facilitates more flexible liquidity management, particularly for low-tangibility firms, the subsequent analysis aims to understand whether financial development contributes to increased firm investment and, consequently, fosters growth.

To achieve this, we will delve into the impact of financial development on the investment decisions of firms in general and, more specifically, on firms operating within low-tangibility industries. The investigation includes two analyses, one involving the entire dataset and the other focusing on a subsample of firms operating within industries characterized by low tangibility levels.

4.2.1 – Financial development and firm investment

The analysis was initiated by considering the entire data sample. The independent variable, investment, is computed as the sum of Capital Expenditures, Research and Development and Advertising Expenses, divided by the book value of total assets. Similar to the previous analysis, we considered the interaction term between asset tangibility and financial development, $Asset\ Tangibility \times Financial\ Development,$ and the logarithm of income per capita, $Asset\ Tangibility \times \log(GDP\ per\ capita)$, as well as the previously mentioned control variables and fixed effects.

The forthcoming equation depicts the previously discussed regression:

$$\begin{aligned} Investment_{i,t} = {} & \beta_0 + \beta_1 Asset\ Tangibility_{i,t} \\ & + \beta_2 Asset\ Tangibility_{i,t} \times Financial\ Development_{c,t} \\ & + \beta_3 Financial\ Development_{c,t} \\ & + \beta_4 Asset\ Tangibility_{i,t} \times \log(GDP\ per\ capita)_{c,t} + \beta_5 \log(GDP\ per\ capita)_{c,t} \\ & + \beta_6 Ln\big(Total\ Assets_{i,t}\big) + \beta_7 Total\ Book\ Leverage_{i,t} \\ & + \beta_8 Pre - Investment\ earnings_{i,t} + \delta_c + \eta_j + \phi_t + \varepsilon_{i,t} \end{aligned}$$

In this analysis, we construct Table 4 in order to examine, on a broader scale, the influence of financial development and asset tangibility on firm investment. Additionally, we explore the influence of the interaction term by segmenting the sample based on firm age and size, with the aim of serving as a proxy for firm financial constraints.

The expectation is to observe a positive coefficient for *Asset Tangibility*, suggesting that firms with high tangibility levels tend, on average, to invest more compared to those with lower tangibility levels.

Furthermore, we expect a negative correlation between the interaction term and investment, suggesting as financial development increases, firms are likely to rely less on tangible assets when making investment decisions. This could be attributed to improved access to external financing options, reduced dependence on collateral, or enhanced flexibility in financial strategies. Therefore, we anticipate encountering a negative β_2 coefficient ($\beta_2 < 0$).

If our results yield a positive β_2 coefficient, ($\beta_2 > 0$), it would imply an enhanced correlation between asset tangibility and investment, particularly in the context of higher financial development. A positive β_2 coefficient would suggest that firms may place a greater emphasis on tangible assets when making investment decisions, potentially due to increased collateral value, or specific financial strategies favouring tangible assets.

Table 4: Firm Investment, Asset Tangibility and Financial Development with Robust Standard Errors

This table displays the results of ordinary least squares (OLS) regressions, examining how the dynamics of investment are influenced when considering both tangibility and the financial environment in which the company operates. Firms characteristics, age and size, are considered in order to capture for financial constraints. The sample is divided by median values in each country and year, with all regressions featuring country, industry, and year fixed effects. T-statistics, in parentheses, rely on heteroscedasticity-robust standard error, clustered by country. The significance levels of 1%, 5%, and 10% are symbolized by ***, **, and *, respectively.

				Firm age		Firm size	
Dependent variable: Investment	(1) Full sample	(2) Full sample	(3) Full sample	(4) Young	(5) Mature	(6) Small	(7) Large
Asset tangibility	0.297***	0.296***	0.297***	0.328***	0.239***	0.313***	0.178***
	(107.82)	(84.12)	(99.32)	(134.42)	(52.58)	(221.25)	(25.46)
Asset tangibility × Private credit per GDP			**-0.0005**	-0.0004	**-0.0006***	-0.002*	**-0.0005***
			(-1.47)	(-0.33)	(-2.17)	(-2.27)	(-3.35)
Private credit per GDP	-0.0002						
	(-1.84)						
Asset tangibility × Log of GDP per capita			0.00370	-0.0112	0.00346	0.0148	0.00668
			(0.26)	(-0.35)	(0.26)	(0.81)	(0.80)
Log of GDP per capita	0.0225						
	(0.81)						
Log of real assets	-0.0243***	-0.0244***	-0.0243***	-0.0292***	-0.0176***	-0.0306***	-0.00784***
	(-21.57)	(-21.51)	(-20.75)	(-57.33)	(-11.31)	(-77.86)	(-4.23)
Total book leverage	-0.00898***	-0.00768	-0.00897*	-0.00241	-0.0173**	-0.00170	-0.0150**
	(-7.91)	(-5.31)	(-7.63)	(-2.02)	(-22.47)	(-1.95)	(-10.59)
Pre-investment earnings	0.0288***	0.0275**	0.0287**	0.0164	0.0670***	0.0151	0.225***
	(16.09)	(13.74)	(15.88)	(4.75)	(18.54)	(6.35)	(25.06)
Constant	-0.00479	0.217***	0.201*	0.0300	0.157*	0.225	0.0668
	(-0.02)	(11.46)	(2.56)	(2.05)	(2.82)	(2.54)	(1.27)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	30,180	31,557	30,180	14,728	15,452	20,578	9,602
Adj. R^2	0.2495	0.2474	0.2495	0.2386	0.3263	0.2179	0.5891

Table 4 reports the estimation results of the previously expressed equation. Column 1, as previously done in Table 3, displays the Ordinary Least Squares (OLS) estimation results considering the isolated impact of *Private Credit per GDP* and *Income per Capita* on *Investment*, observing their effects without the interaction with *Asset Tangibility*. Column 2 presents the full sample OLS estimation results without the two interaction terms, while Column 3 presents the full sample OLS estimation results with the two interaction terms. Columns 4-7 focus on the dataset subdivided based on firm characteristics, such as age and size.

In Column 1, our findings reveal a negative and not significant β_3 coefficient, indicating that financial development, when considered in isolation, does not contributes to explain firm's investment dynamics.

In Table 4, we observe a positive and highly significant association between asset tangibility and investment. This implies that firms with a higher proportion of tangible assets are more likely to experience greater growth in their investments. This relationship is particularly evident

for young (Column 4) and small (Column 6) firms. In a real-world scenario, on average, considering only the impact of asset tangibility, a one-unit increase in a firm's tangibility is anticipated to correspond with an approximate 0.296 unit increase in investment, all other factors held constant.

When introducing the interaction term to assess whether financial development mitigates the importance of asset tangibility on investment, intriguing findings emerge. In Column 3, depicting results across the entire sample, a negative impact of the interaction term on investment is observed. However, it is important to highlight that the β_2 coefficient, contrary to expectations, lacks statistical significance. This suggests that financial development might not be a substantial factor in explaining the relationship between asset tangibility and investment. The absence of statistical significance could be attributed to factors such as the wide variability of data or other potential biases.

However, upon segmenting our dataset into two subsamples, based on firms characteristics, proxying for firm's financial constraints, statistically significant findings emerge, particularly for mature (Column 5) and large firms (Column 7). In this scenario, we observe a negative and statistically significant impact at the 10% level of significance for firms with these characteristics. These findings imply that, when required to reduce their tangibility, such firms may derive benefits in their investment decisions from operating within well-developed financial systems. In a broader context, the results suggest that when comparing two similar mature firms, one based in Switzerland with a financial development ($Private\ Credit\ per\ GDP$) of 150, and the other in the Dominican Republic with a financial development ($Private\ Credit\ per\ GDP$) of 24, it can be anticipated that, all else being equal, the Swiss firm might experience greater growth in investment if both companies undergo a reduction in tangibility. In a real-world scenario, holding all other factors constant, mature and large firms operating in a developed economic environment may experience, on average, a potential increase of 0.0006 units and 0.0005 units in investment, respectively, for every one-unit decrease in tangibility.

While the results for young and small firms exhibit negative trends, the significance is less pronounced or altogether absent. This implies that mature and large firms derive greater benefits from operating in a well-developed financial system. One possible explanation for this statistically observation could be the well-established position of large and mature firms within the market. This characteristic might not only enhance their access to capital but also provide

them with increased liquidity, thereby creating potentially favourable conditions for more substantial investment opportunities.

In summary, these findings reveal that firms with higher proportion of tangible assets are more inclined to invest, likely because tangible assets often serve as collateral, facilitating easier access to financing for investments. However, when considering financial development through the interaction term, the findings suggest that mature and large firms benefit from financial development as it diminishes the impact of asset tangibility on investment.

4.2.2 – Financial development and firm investment: subsample of low tangibility industries

Subsequently, following the approach of Lei et al. (2018), a subsample, consisting of companies operating within industries characterized by their low tangibility levels, was created. The objective was to understand whether these companies, specifically with these characteristics, would benefit more from financial development.

For this analysis, we exclusively focused on companies within the 25th percentile of the data sample. Specifically, we identified industries based on their SIC code, selecting only those with the lowest tangibility levels, as determined by their placement within the 25th percentile of the dataset. This process resulted in 72 industries, within the SIC code range 1130 to 9998, encompassing 15,484 companies. The tangibility levels in this subsample ranged from 10.20% to 32.28%. For additional details and insights, please refer to Table 8 in the accompanying appendix.

Following the creation of the subsample, we constructed six models to assess our objective. The succeeding equation expresses the investment function:

$$
\begin{aligned}
Investment_{i,t} = {} & \beta_0 + \beta_1 Asset\ Tangibility_{i,t} \\
& + \beta_2 Asset\ Tangibility_{i,t} \times Financial\ Development_{c,t} \\
& + \beta_3 Financial\ Development_{c,t} \\
& + \beta_4 Asset\ Tangibility_{i,t} \times \log(GDP\ per\ capita)_{c,t} + \beta_5 \log(GDP\ per\ capita)_{c,t} \\
& + \beta_6 Ln\big(Total\ Assets_{i,t}\big) + \beta_7 Total\ Book\ Leverage_{i,t} \\
& + \beta_8 Pre - Investment\ earnings_{i,t} + \delta_c + \eta_j + \phi_t + \varepsilon_{i,t}
\end{aligned}
$$

The expectations align closely with those outlined in subsection 4.2.1., anticipating a positive coefficient for *Asset Tangibility* and a negative one for the interaction term, $Asset\ Tangibility \times Financial\ Development$. In this context, we foresee a positive correlation between asset tangibility and investment, as previously observed, with its importance diminishing at higher

levels of financial development. Consequently, we anticipate encountering a negative β_2 coefficient, particularly accentuated in financially constrained firms, typically characterized by smaller and younger companies.

Table 5: Firm Investment, Asset Tangibility, and Financial Development considering a sub-sample of firms within industries with low levels of asset tangibility, with Robust Standard Errors

This table presents results from ordinary least squares (OLS) regressions, investigating whether firms operating within low tangibility industries benefit from functioning within economically developed financial systems. Firms characteristics, such as age and size, are considered in order to capture for financial constraints. The sample is divided by median values in each country and year, with all regressions featuring country, industry, and year fixed effects. T-statistics, shown in parentheses, rely on heteroscedasticity-robust standard errors, clustered by country. Significance levels are denoted by ***, **, and * for 1%, 5%, and 10%, respectively.

			Firm age		Firm size	
Dependent variable: Investment	(1) Full sample	(2) Full sample	(3) Young	(4) Mature	(5) Small	(6) Large
Asset tangibility	**0.383*** **	0.387***	**0.434*** **	0.275***	**0.394*** **	0.231***
	(59.35)	(60.09)	(119.91)	(31.23)	(221.11)	(11.26)
Asset tangibility × Private credit per GDP	**-0.002***		-0.00139	**-0.00141** **	-0.003*	**-0.0009*** **
	(-3.72)		(-1.13)	(-3.24)	(-2.25)	(-4.70)
Private credit per GDP		**-0.0005** **				
		(-3.00)				
Asset tangibility × Log of GDP per capita	-0.0111		-0.0218	-0.0128	-0.0221	-0.00302
	(-0.57)		(-0.53)	(-0.75)	(-1.10)	(-0.36)
Log of GDP per capita		-0.00984				
		(-0.25)				
Log of real assets	-0.029***	-0.0292***	-0.0340***	-0.0206***	-0.0350***	-0.00642**
	(-17.23)	(-17.30)	(-34.34)	(-9.59)	(-52.40)	(-2.77)
Total book leverage	-0.00310	-0.00299	0.00406	-0.0134	0.00668	-0.0109
	(-1.84)	(-1.90)	(2.45)	(-13.62)	(5.55)	(-4.76)
Pre-investment earnings	0.0292*	0.0292***	0.0295*	0.0432	0.0203	0.247***
	(5.89)	(5.93)	(4.06)	(13.94)	(4.14)	(25.23)
Constant	-0.0175	0.0811	0.0874	0.229**	0.455*	-0.0300
	(0.72)	(0.22)	(0.47)	(2.50)	(5.19)	(-1.05)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	13,428	13,428	8,230	5,198	10,254	3,174
R^2	0.1995	0.1996	0.2033	0.2311	0.1650	0.5322

Table 5 presents the results of the previously mentioned analysis. Column 1 presents the full sample Ordinary Least Squares (OLS) estimation results with the two interaction terms. Column 2, as previously done in Table 3 and Table 4, displays the OLS estimation results considering the isolated impact of *Private Credit per GDP* and *Income per Capita* on *Investment*, observing their effects without the interaction with *Asset Tangibility*. Columns 3-6 focus on the created dataset subdivided based on firm characteristics, such as age and size, as previously made in subsection 4.2.1.

In line with the observations in Table 4, Column 2 consistently displays a negative β_3 coefficient. It is imperative to highlight the significance of this coefficient in the present analysis. The results show that in industries characterized by low tangibility, a significant negative correlation surfaces between the country's financial environment and investment for these firms. This implies that, on average, higher levels of financial development are associated with a reduction in firms' investment. It is crucial to acknowledge that multiple factors may contribute to this negative significant relationship, including specific economic conditions and market dynamics.

As expected, the β_1 coefficient for *Asset Tangibility* in Table 5 underscores a positive and highly significant association with *Investment*. This suggests that firms, operating within low tangibility industries, with greater proportion of tangible assets are more likely to experience greater growth in their investments. This relationship is particularly pronounced for young (column 3) and small (column 5) firms. In a real-world scenario, on average, considering only the impact of asset tangibility, a one-unit increase in a firm's tangibility is anticipated to correspond with an approximate 0.383 unit increase in investment, all other factors held constant.

Examining the β_2 coefficient in Column 1 of Table 5, a negative and statistically significant correlation, at a 10% significant level, emerges between the interaction term, $Asset\ Tangibility \times Financial\ Development$, and $investment$. In contrast to Table 4, this analysis reveals a statistically significant β_2 coefficient when considering the entire sample. This suggests that financial development contributes to explain the relationship between tangibility and investment when we consider firms operating in low tangibility industries. Hence, all else being equal, the positive influence of asset tangibility on investment diminishes in highly developed economic environments for firms within low tangibility industries. In broader terms, this implies that firms operating in low-tangibility industries within a well-developed financial system, experiencing a decrease in tangibility by one-unit, might encounter a growth of approximately 0.002 units in their investment, compared to one similar company operating in less developed financial environment.

Based on our findings, we conclude that financial development enables firms operating in low-tangibility industries to reallocate low-productivity cash reserves towards investment, particularly within a promising financially developed system. This finding is consistent with the work of Lei et al. (2018).

When examining the interaction term within our two subsamples (Columns 2-5), categorized based on firm characteristics, particularly age and size, we observe outcomes similar to those presented in Table 4. However, in this instance, while small firms exhibit a negative β_2 coefficient, it lacks statistical significance. In contrast, mature and large firms display a negative interaction term coefficient statistically significant at 5% and 10% levels, respectively. This finding aligns with the previous results in Table 4, indicating that companies operating within low-tangibility industries benefit from a developed financial market in their investment decisions, especially compared to a company in similar conditions operating within a less developed financial landscape.

In summary, our findings suggest that advancements in financial development have the potential to mitigate underinvestment challenges for firms operating in low-tangibility industries, specially for mature and small firms. These results align with the research referenced in this analysis, particularly the study conducted by Lei et al. in 2018. Furthermore, our findings are consistent with the works of several scholars who have delved into this topic, such as Naeem and Li, 2019; Love, 2003; Castro, Kalatzis, and Martins-Filho, 2015. These scholars propose that financial development, characterized by a well-functioning and efficient financial system, plays a crucial role in enhancing investment in underinvestment firms.

Section 5: Robustness Check

In this Section, the objective is to enhance the reliability of the empirical findings presented in Section 4. While valuable insights have been inferred from the obtained results in the previous section, the incorporation of robust testing is essential to reinforce the stability of our results.

To achieve this, the process was initiated by creating a subsample that excludes firms with the potential to introduce bias into our analysis. Specifically, there were excluded countries exhibiting exceptionally high levels of observations within the entire data sample, such as the U.S., Japan and China.

Additionally, countries with only a single unique company, including Antigua and Barbuda, Barbados, Burkina Faso, Dominican Republic, Gabon, and Sudan, were excluded. This decision was made based on the understanding that attributing the characteristics of a single company to an entire country does not accurately reflect the diverse dynamics among companies within these nations.

Excluding these countries is essential to mitigate their potential influence on the overall results. By doing so, we are ensuring that the subsample becomes more representative of a diverse range of countries, thereby enhancing the reliability of the results.

5.1 – Financial development and cash holdings – Robustness check

In addition to the creation of the subsample, five models were constructed following the same approach as in section 4.1. Column 1 considers the entire created dataset without the two interaction terms. Columns 2 and 3 separately incorporate the interaction terms $Asset\ Tangibility \times Financial\ Development$ and $Asset\ Tangibility \times Log\ of\ GDP\ per\ capita$, respectively. Column 4 examines the full sample with both interaction terms. Finally, Column 5 considers the *Private Credit per GDP* and the *Income per Capita* without being in interaction with *Asset Tangibility*.

Table 6 was derived from the following equation:

$$\begin{aligned} Cash_{i,t} = \beta_0 &+ \beta_1 Asset\ Tangibility_{i,t} + \beta_2 Asset\ Tangibility_{i,t} \times Financial\ Development_{c,t} \\ &+ \beta_3 Financial\ Development_{c,t} \\ &+ \beta_4 Asset\ Tangibility_{i,t} \times \log(GDP\ per\ capita)_{c,t} + \beta_5 \log(GDP\ per\ capita)_{c,t} \\ &+ \beta_6 Ln(Total\ Assets_{i,t}) + \beta_7 Cash\ Flow_{i,t} \\ &+ \beta_8 Total\ Capital\ Expenditures_{i,t} + \beta_9 Total\ Book\ Leverage_{i,t} \\ &+ \beta_{10} R\&D\ Expenditures_{i,t} + \delta_c + \eta_j + \phi_t + \varepsilon_{i,t} \end{aligned}$$

Table 6: Baseline results - Financial Development and Asset tangibility effect on Cash Holdings with Robust Standard Errors - Robustness Check

This Table employs robust tests conducted through ordinary least squares regressions. The objective is to assess the persistence of the results presented in Table 3 under a more balanced representation of countries, excluding those with extreme observation values. The analysis explores variations in cash holdings concerning asset tangibility across diverse levels of financial development. All regressions featuring country, industry, and year fixed effects. Values of t-statistics, reported in parentheses, are based on standard errors that are robust to heteroscedasticity. ***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

Dependent variable: Ln(Cash/Assets)	(1) Full OLS	(2) Full OLS	(3) Full OLS	(4) Full OLS	(5) Full OLS
Asset tangibility	-4.46***	-5.169***	-17.72***	-18.39***	-4.561***
	(-11.22)	(-6.89)	(-16.09)	(-13.76)	(-9.56)
Asset tangibility × Private credit per GDP		**0.006*** **		**-0.0003**	
		(1.49)		(-0.14)	
Private credit per GDP					-0.00173
					(-1.64)
Asset tangibility × Log of GDP per capita			**1.284*** **	1.351***	
			(10.92)	(8.95)	
Log of GDP per capita					0.483***
					(3.93)
Log of real assets	-0.163***	-0.189***	-0.177***	-0.208***	-0.198***
	(-5.62)	(-6.71)	(-7.36)	(-10.66)	(-7.86)
Cash flow	0.0104	0.0481	0.00999	0.0494	0.0568
	(0.12)	(0.50)	(0.12)	(0.52)	(0.58)
Total book leverage	-0.410***	-0.376***	-0.348***	-0.303***	-0.355***
	(-5.11)	(-3.80)	(-6.33)	(-4.32)	(-4.05)
R&D expenditures	-0.00396	-0.00261	-0.0008	0.00132	-0.00284
	(-0.47)	(-0.21)	(-0.09)	(0.11)	(-0.24)
Constant	0.205	0.776**	0.417	0.696***	-4.191***
	(0.90)	(3.10)	(1.91)	(3.70)	(-3.46)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Number of observations	46,189	40,990	46,063	40,933	40,933
Adj. R^2	0.3817	0.3825	0.3964	0.3950	0.3792

Table 6 presents the results of the analysis outlined earlier.

Firstly, it is evident that the *Asset Tangibility* coefficient remains consistently negative and highly significant across all five models. This robustness reinforces the negative correlation between *Asset Tangibility* and cash holdings.

In Column 2 of Table 6, the interaction term is observed to be positive and highly significant at a 1% significant level. This finding highlights the robustness of the observation that the importance of tangibility diminishes when it interacts with financial development. Similar results are observed in Column 3, where the interaction term, $Asset\ Tangibility \times Log\ of\ GDP\ per\ capita$, is positive and highly significant. This suggests that, on average, holding other factors constant, in settings with higher financial development, a one-unit decrease in tangibility is associated with a 1.284 unit decrease in cash holdings.

Nevertheless, an interesting observation arises in Column 4. When both interaction terms are considered, the interaction term, $Asset\ Tangibility \times Financial\ Development,$ reveals to be negative and statistically not significant. This result implies that based on the data and model used, financial development does not significantly modify the influence of asset tangibility on cash holdings. These findings might be attributed to potential correlations among the variables under analysis, particularly given that *Asset Tangibility* is being represented in three distinct

variables. Furthermore, Column 5 of Table 6 presents a negative and not significant coefficient for the *Private Credit per GDP*, which is not consistent with the findings presented in Table 3.

In conclusion, the robustness test confirms the significant positive correlation between asset tangibility and cash holdings. It is important to note that the positive influence of financial development in alleviating the impact of asset tangibility on a company's cash holdings remains valid, but only when the interaction term, $Asset\ Tangibility \times Log\ of\ GDP\ per\ capita$, is not taken into consideration.

5.2 – Financial development and firm investment – Robustness check

Additionally, a robustness test was conducted considering financial development and firm investment. The results were build using the previously established sample. However, in this analysis, we aim to investigate whether the identified relationship between the interaction term and investment persists when excluding the previously mentioned countries from the sample.

The succeeding equation expresses the Table 7:

$$
\begin{aligned}
Investment_{i,t} = {} & \beta_0 + \beta_1 Asset\ Tangibility_{i,t} \\
& + \beta_2 Asset\ Tangibility_{i,t} \times Financial\ Development_{c,t} \\
& + \beta_3 Financial\ Development_{c,t} \\
& + \beta_4 Asset\ Tangibility_{i,t} \times \log(GDP\ per\ capita)_{c,t} + \beta_5 \log(GDP\ per\ capita)_{c,t} \\
& + \beta_6 Ln(Total\ Assets_{i,t}) + \beta_7 Total\ Book\ Leverage_{i,t} \\
& + \beta_8 Pre - Investment\ earnings_{i,t} + \delta_c + \eta_j + \phi_t + \varepsilon_{i,t}
\end{aligned}
$$

Table 7: Firm Investment, Asset Tangibility and Financial Development with Robust Standard Errors - Robust Check

This current Table presents robust tests results from ordinary least squares regressions. The primary goal is to assess the persistence of the findings presented in Table 4 within a dataset featuring a more balanced representation of countries, with the exclusion of those exhibiting extreme observation values. The analysis explores variations in investment decisions when accounting for asset tangibility across diverse levels of financial development. All regressions featuring country, industry, and year fixed effects. T-statistics, in parentheses, rely on heteroscedasticity-robust standard error clustered by country. Significance levels are denoted by ***, **, and * for 1%, 5%, and 10%, respectively.

Partition by financial const					
Dependent variable: Investment	(1) Full sample	(2) Full sample	(3) Full sample	(4) Full sample	(5) Full sample
Asset tangibility	0.283***	0.278***	0.295***	0.277***	0.289***
	(11.65)	(10.07)	(6.74)	(7.89)	(6.59)
Asset tangibility × Private credit per GDP			**-0.0003**		**-0.0004**
			(-0.34)		(-0.51)

Private credit per GDP		-0.00005			
		(-0.40)			
Asset tangibility × GDP per capita				0.0232*	0.0222
				(2.03)	(1.57)
GDP per capita		-0.0111			
		(-0.31)			
Log of real assets	-0.0208***	-0.0198**	-0.0207***	-0.02***	-0.02***
	(-3.93)	(-2.91)	(-4.51)	(-5.24)	(-4.57)
Total book leverage	-0.0185	-0.0177	-0.0169	-0.0174	-0.0165
	(-1.47)	(-1.08)	(-0.54)	(-0.67)	(-0.53)
Pre-investment earnings	0.00351	0.00505	0.000490	0.000720	0.00112
	(0.15)	(0.16)	(0.01)	(0.02)	(0.03)
Constant	0.0917	0.238	0.234***	-0.106	0.0238
	(1.10)	(0.73)	(3.76)	(-0.92)	(0.26)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Number of observations	2,229	1,758	1,742	2,167	1,738
Adj. R^2	0.3968	0.3882	0.3968	0.3818	0.3946

Table 7 illustrates the outcomes of the previously outlined equation. Similar to the approach employed in Section 5.1, we constructed five models for this analysis. Column 1 initially investigates the sample without the two interaction terms. Column 2 singularly studies the impact on investment of the variables involved in the interaction terms. The subsequent two models examine the interaction terms separately and the final model considers the full sample with both interaction terms.

Consistent with earlier findings, *Asset tangibility* continues to exhibit a positive and highly significant coefficient. This reaffirms the previously established positive relationship between *Asset Tangibility* and *Investment*, suggesting that companies with higher tangibility tend to invest more. Column 2, consistently presents a negative and statistically not significant coefficient for *Private Credit per GDP*.

In Columns 3 and 5, the association between the interaction term, and investment maintains its negative and not statistically significant result, corroborating the earlier findings presented in Table 4.

In conclusion, the analysis of this specific data sample allows us to infer some important results. The positive relationship between asset tangibility and investment remains robust in this test, continuing to be statistically significant. Furthermore, the interaction term, $Asset\ Tangibility \times Financial\ Development,$ maintains a consistent negative and not statistically significant relationship with investment.

Conclusion

We experience a shift towards a knowledge base economy and intangibles are gaining more prominence on corporate balance sheets. As a result, firms may find themselves constrained in terms of debt capacity and the need to hoard cash might be essential. This financial landscape might stimulate firms to maintain excessive cash reserves, often forgoing the use of these funds for new investment initiatives.

This paper studies whether financial development might alter the relationship between tangibility and cash holdings and, consequently, understand whether this financial landscape might diminish the significance of these assets on investment decisions.

In order to achieve this, we consider data across 100 countries from 1990 to 2023. Our findings reveal strong evidence that tangibility might reduce a firm's necessity to hold cash holdings. While our findings may not be strongly significant, they suggest a diminishing influence of tangibility on a firm's cash holdings when in interaction with financial development.

Our findings also highlight a positive correlation between firms possessing tangibles and investment. Nevertheless, the results indicate that mature and large firms might benefit from a well-developed financial system, as it diminishes the impact of tangible assets on investment. Additionally, the findings also suggest that advancements in financial development have the potential to mitigate underinvestment challenges for firms operating in low-tangibility industries, specially for mature and small firms.

Additionally, robustness tests were performed in order to understand the persistence of the outcomes when considering a more balanced sample, such that countries with exceptionally extreme observations would be excluded. The results indicate consistency, demonstrating that even without the inclusion of those countries, the findings remain consistent.

In sum, this paper unveils a crucial aspect of financial development through a cross-country firm-level analysis. This research provides empirical evidence supporting the theory that financial development can potentially contribute to enhance economic growth by reducing the dependence on tangible assets for cash holdings and stimulating increased firm investment.

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Appendix

Table 8. Summary analysis by country

This Table presents a summary analysis of the 100 countries consider in the data sample. The Table provides a comprehensive examination of key financial indicators for each country, including the number of firm-years, the count of unique firms, and various economic metrics, such as Cash/Net Assets (%), Asset Tangibility (%), Private Credit/GDP, and Real GDP per Capita (2017 international $). Cash/Net Assets and Asset tangibility, both calculated as the average of all companies within the respective country, are presented as percentages. Both country-level variables represent averages for each country between 1990-2022 and are sourced from the World Bank's World Development Indicators (WDI) database.

Country	No. of firm-years	No. of unique firms	Cash/ net assets (%)	Asset tangibility (%)	Private credit/ GDP (%)	Real GDP per capita (2017 international $)
Antigua and Barbuda	20	1	41.93999	29.9451	59.30787	20300.01
Argentina	1,284	71	8.358932	42.50206	18.23277	21013.61
Australia	26,595	2435	21.09492	31.43724	117.5982	44422.29
Austria	1,942	133	13.18237	38.3078	91.03803	48847.09
Bahamas, The	102	8	11.28319	38.33002	53.20898	34444.59
Bahrain	357	18	17.31678	31.6005	58.4515	47693.88
Bangladesh	2,4	206	7.430335	46.22947	39.79441	4596.698
Barbados	8	1	7.212616	44.88413	81.56433	15346.37
Belgium	2,727	171	14.658	36.85901	63.37512	46082.48
Botswana	229	15	15.75254	37.27056	29.36323	13576.1
Brazil	6,636	403	12.29889	35.69532	50.82487	13574.38
Bulgaria	897	74	7.920279	43.80327	55.41874	20047.98
Burkina Faso	16	1	6.807768	46.23967	22.98364	2571.15
Canada	23,53	2300	16.26503	37.01945	100.2553	43747.74

Chile	3,127	156	7.478189	41.1097	99.59706	20440.24
China	70,415	4851	21.49864	36.74548	143.1468	11513.59
Colombia	723	43	8.282496	35.98019	36.61374	11983.25
Cote d'Ivoire	286	18	12.15164	48.08711	17.98681	4275.893
Croatia	1,556	96	8.0302	45.38768	58.86715	25577.51
Cyprus	1,005	73	8.969893	41.43833	180.8298	37811.41
Czechia	303	31	12.05459	40.08514	46.43223	32539.49
Denmark	3,662	264	17.40783	35.87137	135.8006	50866.97
Dominican Republic	9	1	4.871522	47.73706	23.64076	8934.952
Ecuador	42	3	4.465474	38.97741	29.43287	10623.34
Egypt, Arab Rep.	2,151	152	13.75504	40.17871	32.89343	10466.78
Estonia	397	24	11.0716	38.75075	71.19033	27991.45
Finland	3,6	241	14.63997	34.90779	84.07042	43854.8
France	15,942	1125	16.47118	35.80262	93.50329	41218.46
Gabon	29	1	10.27343	45.33589	16.83777	15252.23
Germany	15,814	1082	15.49712	34.97475	92.40563	46282.46
Ghana	209	14	8.677355	48.05718	17.08772	4418.006
Greece	4,13	247	9.166923	44.85355	90.0085	31432.98
Hong Kong SAR, China	3,305	178	20.16444	31.02174	180.4011	48746.1
Hungary	324	25	11.54614	43.38304	39.45794	24057.12
Iceland	301	23	7.846827	32.93745	121.7428	50537.19
India	52,591	3236	7.914586	41.21092	45.12184	4559.09

Indonesia	9,852	734	11.26998	40.97326	36.02932	9225.024
Ireland	2,296	158	18.23832	29.61578	94.81754	56591.31
Israel	2,462	228	31.64075	27.74251	67.85483	35117.18
Italy	6,33	545	12.91166	37.72206	80.36154	42098.98
Jamaica	766	58	13.79898	39.29325	35.04154	9861.087
Japan	83,697	4543	19.64456	37.45532	177.4406	38079.95
Jordan	844	53	6.785969	41.04723	76.4172	10447.26
Kazakhstan	377	28	9.11602	42.18861	28.48398	22468.08
Kenya	491	30	8.196426	43.77325	28.56066	3979.172
Korea, Rep.	25,121	2368	17.77914	34.71895	135.5623	36890.37
Kuwait	1,544	97	13.77127	26.62674	76.20881	58974.21
Latvia	342	25	6.818457	46.82714	53.5527	24182.65
Lebanon	51	3	9.446978	38.39509	86.25105	16607.46
Liberia	69	6	11.15315	44.74266	16.83777	2571.15
Lithuania	534	36	6.010826	47.02473	43.83841	27377.69
Luxembourg	1,033	94	14.27047	32.58113	90.97448	89422.44
Malawi	97	5	10.97355	43.19651	16.83777	2571.15
Malaysia	18,319	1044	14.19076	40.10625	119.8011	20466.87
Malta	288	23	14.5364	29.31503	91.38337	37789.43
Mauritius	604	37	5.714544	33.79606	85.15467	18903.36
Mexico	2,639	158	8.947111	40.04476	25.4276	18150.52
Morocco	1,106	59	9.557569	48.02647	83.5744	6797.975

Namibia	87	7	16.21255	31.84919	67.35422	9447.09
Netherlands	4,573	343	14.3499	36.033	111.0735	49140.66
New Zealand	2,51	183	10.5535	35.81177	153.5701	38025.65
Nigeria	1,024	62	9.555526	44.92755	17.05347	4714.629
Norway	4,846	450	19.0187	32.66874	125.5024	60978.17
Oman	1,032	59	12.25258	44.17472	46.61683	36828.9
Pakistan	4,561	235	8.138566	46.70271	20.20933	4305.089
Panama	110	7	10.11664	38.18084	83.88333	21146.62
Papua New Guinea	180	10	12.48538	37.02382	21.25544	3318.367
Peru	1,775	88	6.637881	44.20257	32.55862	9688.605
Philippines	3,048	158	13.27086	32.24223	37.42336	6181.019
Poland	8,265	681	11.4628	40.7722	45.38438	26189.58
Portugal	1,223	81	7.129523	37.1809	127.2587	30749.88
Qatar	382	26	15.02351	28.99492	67.65157	89746.36
Romania	1,917	122	8.020582	45.4282	29.24319	23043.69
Russian Federation	3,027	206	9.353533	41.28466	43.81262	23905.63
Saudi Arabia	2,572	207	9.901735	40.33247	40.65999	45368.29
Senegal	31	2	12.58241	44.22273	25.85181	3081.513
Serbia	392	41	10.4678	47.13572	41.82143	16623.6
Singapore	12,422	783	19.67168	37.0791	106.2745	74652.04
Slovak Republic	202	14	8.683642	45.11996	49.63518	23244.81
Slovenia	573	34	8.036287	42.39004	59.71144	32961.69

South Africa	5,759	387	12.55531	38.35642	118.2972	12489.67
Spain	3,58	235	10.78311	37.65971	129.3284	35953.57
Sri Lanka	3,414	211	9.393103	42.41237	35.36762	10551.2
Sudan	19	1	9.130696	35.53861	16.83777	4549.667
Sweden	13,662	1175	20.62091	26.91371	111.6031	48089.45
Switzerland	5,384	309	17.31243	36.64988	150.3263	62922.3
Tanzania	136	8	14.37644	42.85019	16.83777	2573.169
Thailand	12,265	760	11.95189	41.09996	140.3069	14464.12
Trinidad and Tobago	242	13	12.9427	35.67345	34.49488	25725.08
Tunisia	778	51	14.41164	44.96544	69.44305	10290.79
Turkiye	5,817	428	10.64773	41.1824	59.79707	23816.52
Uganda	78	5	7.03848	47.76772	16.83777	2571.15
Ukraine	235	20	5.81967	47.0537	57.58914	12120.1
United Arab Emirates	871	68	16.0181	34.92699	81.39439	71735.83
United Kingdom	33,887	2943	15.42789	34.00231	134.2561	40641.87
United States	119,923	10343	20.21036	32.14076	165.4083	51261.58
Vietnam	4,973	436	14.7072	39.73231	95.21519	8079.686
West Bank and Gaza	245	18	7.506466	40.65144	34.59286	5756.043
Zambia	172	9	7.698145	43.49502	17.14257	3044.558
Zimbabwe	707	44	7.214264	45.22612	20.87204	2598.401

Table 9. SIC code identification and respective industry asset tangibility

This table presents an overview of the SIC codes utilized in the sub-sample established in Section 4.2. Encompassing a diverse array of industries, it associates each SIC code with the respective industry name. Instances where industry names were unavailable are denoted as "Industry not specified" to retain observations despite the absence of specific industry names. Column 3 showcases the asset tangibility linked with each corresponding SIC code, calculated as the average across all dataset observations belonging to that specific SIC code.

SIC Code (1)	Industry Name (2)	Industry Asset Tangibility (%) (3)
1130	Industry not specified	24.96
2711	Newspapers: publishing or publishing & printing	26.00
2721	Periodicals: publishing or publishing & printing	24.13
2741	Miscellaneous publishing	23.21
2771	Greeting cards	30.15
2780	Blankbooks, looseleaf binders & bookbindg & relatd work	30.86
2834	Pharmaceutical preparations	29.63
2835	In vitro & in vivo diagnostic substances	22.32
2836	Biological products, (no disgnostic substances)	13.37
3576	Computer communications equipment	27.91

3578	Calculating & accounting machines (no electronic computers)	31.39
3652	Phonograph records & prerecorded audio tapes & disks	28.24
3760	Guided missiles & space vehicles & parts	32.28
3826	Laboratory analytical instruments	27.76
3841	Surgical & medical instruments & apparatus	26.43
3843	Dental equipment & supplies	29.27
3845	Electromedical & electrotherapeutic apparatus	25.71
4700	Transportation services	27.00
4812	Radiotelephone communications	30.92
4822	Telegraph & other message communications	25.80
4832	Radio broadcasting stations	17.07
4833	Television broadcasting stations	24.87
4841	Cable & other pay television services	25.60
4860	Industry not specified	14.12
4888	Industry not specified	23.06
4899	Communications services, nec	29.36
5412	Retail-convenience stores	31.43
5812	Retail-eating places	31.73

5960	Retail-nonstore retailers	26.38
5961	Retail-catalog & mail-order houses	30.86
7200	Services-personal services	28.80
7310	Services-advertising	25.76
7311	Services-advertising agencies	31.74
7320	Services-consumer credit reporting, collection agencies	21.19
7323	Industry not specified	16.43
7340	Services-to dwellings & other buildings	31.57
7361	Services-employment agencies	30.73
7370	Services-computer programming, data processing, etc.	24.63
7371	Services-computer programming services	28.15
7372	Services-prepackaged software	22.00
7373	Services-computer integrated systems design	30.08
7374	Services-computer processing & data preparation	24.63
7380	Services-miscellaneous business services	29.93
7389	Services-business services, nec	29.45
7500	Services-automotive repair, services & parking	31.16

7812	Services-motion picture & video tape production	27.44
7822	Services-motion picture & video tape distribution	27.57
7829	Services-allied to motion picture distribution	25.84
7841	Services-video tape rental	29.97
7900	Services-amusement & recreation services	30.44
7941	Industry not specified	29.69
7990	Services-miscellaneous amusement & recreation	28.72
8000	Services-health services	30.00
8011	Services-offices & clinics of doctors of medicine	23.70
8050	Services-nursing & personal care facilities	28.42
8071	Services-medical laboratories	27.03
8082	Services-home health care services	29.54
8090	Services-misc health & allied services, nec	26.59
8093	Services-specialty outpatient facilities, nec	25.99
8111	Services-legal services	30.54
8200	Services-educational services	24.93

8300	Services-social services	30.06
8351	Services-child day care services	27.26
8600	Services-membership organizations	10.20
8700	Services-engineering, accounting, research, management	32.06
8721	Industry not specified	20.22
8731	Services-commercial physical & biological research	25.74
8741	Services-management services	25.96
8742	Services-management consulting services	27.47
8900	Services-services, nec	27.20
9995	Non-operating establishments	22.07
9998	Industry not specified	25.22