Revisiting Dominance Indicators

Comparing revenue-based and market capitalization-based indicators

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Abstract

Antitrust enforcement relies in practice on metrics of market power centered around revenue of firms. The metrics used in practice have a mix of theoretical and empirical underpinnings. We compare the correlation between profitability and revenue based market shares and concentration metrics, with market capitalization-based indicators using the data of 2,730 listed US firms. In the case of firms active in information technology, we establish a significant correlation between the profitability of firms and their size in terms of market capitalization in absolute as well as relative terms to other firms in the same industry. This correlation is stronger compared to the correlation of the profitability with revenue-based indicators on which antitrust authorities traditionally rely. We do not find strong correlations for other sectors.

Keywords: Concentration, HHI, Market Capitalization, Competition Policy, Profitability

1 Introduction

1.1 Context

Antitrust enforcement relies in practice on metrics of market power centered around revenue of firms. The metrics used in practice have a mix of theoretical and empirical underpinning. The empirical underpinning of revenue-based metrics dates back to the analysis conducted by Joe Bain across industrial sectors (Bain 1951).

This correlation between profits and concentration measured in terms of revenue shares has been confirmed in subsequent research (Weiss 1974 ; Peltzman 1977). The interpretation of the observed correlation between concentration and profitability as an indicator for market power has been contested in recent decades on the grounds that the correlation instead indicates efficiencies first and foremost (Clarke et al. 1984). Empirical studies on the relationship between profitability as indicator of market power and concentration metrics are often associated with the Structure Conduct Performance paradigm, which has been shunned by US and European antitrust professionals since the advent of the Chicago-school approach (Slade 2004). Numerous alternative metrics of market power have been explored and empirically tested as potentially better indicators of market power (Nawrocki and Carter 2010, Hausman and Sidak 2007). Despite the apparent and increasing sophistication of economic models used in antitrust enforcement, regulators in practice rely heavily on the revenue-based HHI index and on market shares when deciding to pursue or not antitrust investigations and merger cases (Slade 2004; United States Department of Justice 2015). In this article we by no means aim to discuss the merits of the SCP approach. We take as a starting point de facto reliance of antitrust authorities on revenue-based metrics of market power and we test the correlation of profits with such revenue-based indicators of market power.

We subsequently assess the correlation between profitability and market capitalization of firms as well as market capitalization shares of individual firms in their respective industries. For this purpose we construct an equivalent of market shares based on market capitalization rather than revenue shares. This finding – that there is greater correlation of profits with market capitalization-based indicators than with revenue-based indicators in the information technology sector – is particularly relevant because of the rise of the GAFAM (Google, Apple, Facebook, Amazon and Microsoft) companies that make up the five largest companies by market capitalization among U.S.-listed companies. The finding is also relevant because of the challenge in estimating revenue shares in the digital economy, which is characterized by zero-price goods (Crémer et al. 2019). Our findings also pave the way for a possible HHI-style index based on market capitalization rather than revenue shares.

Defining the Herfindahl-Hirschman Index (HHI)
The Herfindahl-Hirschman Index (HHI) is a measure of concentration that is computed as the sum of squared firm proportions within a predefined industry. Typically the HHI will vary between 0 and 1. While a high number closer to one will indicate a large degree of concentration in the market, a lower number will indicate more competitiveness (Nawrocki and Carter 2010). The HHI is denoted as following:

$$HHI = \sum_{i=1}^{n} s^2$$

1.2 Defining the market

To assess the strength of market capitalization as a predictor for market power all models calculated need to define a reasonable market in which firms operate and compete. In antitrust cases law enforcement agencies define markets in which a company operates (Katz/Shapiro 1999:10). Economic analyses typically use Industry Classifications as a multilayer system that divides the economy into various categories and layers of

industries (Philipps and Ormsby 2016: 1). Among the various Industry Classifications that exist, we use the North American Industry Classification System (NAICS) to define markets. The NAICS divides the economy into 24 sectors each with four sublayers (Werden and Froeb 2018: 3). This study focuses on US companies because of the availability of data on listed companies, in terms of a geographic market the data retrieved by construction covers the global activity of those companies, which is in this case a necessary approximation, because market capitalization data cannot be a priori divided into smaller geographic regions. We chose the NAICS because it fits the geographical scope of this study that focuses on the US economy. Although the US-American Standard Industry Classification (SIC) is still widely used it was replaced by the NAICS in 1997. With the introduction of the NAICS new industries from the ICT-sector were incorporated (Yuskavage 2007: 1). For the purpose of our study that focuses on the digital economy, the NAICS represents the most fitting industry classification currently available.

Various scholars have identified an array of issues associated with using industry classifications to assess market power. Too often they are too aggregated to mirror all business activities of a single company (Affeldt et al. 2021: 6-7). According to a study by Werden and Froeb industries as defined in merger cases cover about 0.18% to 0.51% of commerce volume that is covered by 6-digit NAICS industries (2018: 5).

Software companies in particular cannot be divided into a single subcategory (Berry et al. 2019: 46). GAFAM companies like Apple, Amazon, and Alphabet Inc. are assigned to different top-level industries in the NAICS classification. While only Alphabet Inc. belongs to the "Information" industry, Apple is assigned to "Manufacturing" and Amazon belongs to "Retail Trade". Considering that Amazon Q4 earnings 2020 came by 52% from its cloud-storage service Amazon Web Services (AWS) this classification of industries can and has been criticized (Novet 2021). Industry classifications therefore do not necessarily match the reality of the current digital economy.

Nonetheless, we choose to operationalize NAICS codes as a market definition. We thereby acknowledge that these industry classifications are not only standard in business research and economy analysis (Philipps and Ormsby 2016: 1). They are also common in antitrust agencies (Federal Trade Commission n.d.). Large digital companies including three of the five GAFAM can be found here. However, this classification excludes specific parts of the ICT-sector. When this analysis uses the "Information" industry as a proxy for digital markets, our analysis has to be taken with a grain of salt. The obtained results will reflect the inherent biases of the classification. For lack of a better economic market classification we will use the NAICS in this analysis anyways.

2 Methodological approach

2.1 Data

This analysis is based on data obtained from the commercial database ORBIS Bureau van Dijk, owned by rating agency Moody's. The data set obtained from ORBIS is limited to companies with an active status, excluding dissolved companies. This research criterion returned 16,809 firms. After excluding observations with missing values for the core variables of our model, the data set was reduced to 2.730 firms, which are the basis of our analysis.

The data set includes data on revenue (from 2011 to 2020), market capitalization (from 2010 to 2020), net profit margins (from 2011 to 2020) and the industry classification NAICS (2-, 4-, and 6-digit layer). The financial industry sector is excluded from the analysis because it displays sector specific dynamics in terms of financial performance indicators and is subject to specific regulation. The relationship between profitability and concentration in the financial industry has been analysed in a number of dedicated studies (Maniatis 2006).

Based on these variables, we calculate robust averages of profitability, revenue and market share for the three year period from 2017 to 2019 to exclude bias in the data induced by economic effects of the Corona pandemic in 2020. We opt for average profit margins over several accounting periods in order to reduce the effect of the volatility in yearly profits. These variables will be the basis for the treatment variables in both models. We use firm-level averaged revenue to calculate the HHI for the four largest firms in the 6 digits market ordered by revenue. Analogously, we calculate a standardized market concentration measure based on the four largest firms ordered by firm-level market capitalization. Furthermore, market shares by revenue and market capitalization are calculated based on the top six companies per 6-digit NAICS code.

2.2 Comparing the Correlation of Profitability with Revenue-Based and Market Capitalization-Based Indicators of Size and of Concentration

We assess the relationship between revenue and market capitalization as the treatment and profitability as the outcome in two models. A relatively high profitability can result from different circumstances, including efficiencies, it can be perceived as a reward for successful innovation, it can also indicate market power. We do not assess the reasons for higher profitability of certain companies, we limit ourselves in observing the presence or absence of correlation of profitability indicators (in this case net profit margins) on the one hand and revenue and market capitalization on the other hand.

Model I

The first model compares the association between profit margins and absolute revenue as well as profit margins and absolute market capitalization moderated by a set of relevant industries. This model provides a first, comprehensive overview of revenue and market capitalization and their potential to be significant predictors for profitability. Furthermore, the mediator Industry accounts for potential variation in the association between treatment and outcome for different industries. Methodologically, Model I is a moderation model. Therefore, we expect the association between the treatment and outcome variable to vary depending on the value of our moderator variable. More formally, the relation can be denoted as follows:

$$\begin{aligned} Y_{\text{Profit Margin}} =& \alpha + \beta_1(\text{Revenues}) \cdot \beta_2(\text{Industries}) + \\ & \beta_3(\text{Revenues} \cdot \text{Industries}) + \epsilon \end{aligned}$$

Market Capitalization:

$$\begin{aligned} Y_{\text{Profit Margin}} =& \alpha + \beta_1(\text{Market Capitalization}) \cdot \beta_2(\text{Industries}) + \\ & \beta_3(\text{Market Capitalization Shares} \cdot \text{Industries}) + \epsilon \end{aligned}$$

Potential issues in this model may arise from an endogeneity bias. As Market Capitalization is partially determined by the expectation of future profits, market capitalization is at least partially determined by profit margins. We limit ourselves to observing correlations and do not attempt to infer causality.

Model II: Market Shares

The second model compares the association between profit margins and individual firm shares within the industries as defined by the 6-level NAICS Codes. Shares are determined by revenue and market capitalization. In a second step we moderate the effect with a set of relevant 2-level NAICS industries to detect industry-specific effects. Formally the relationship between the variables can be denoted as follows:

$$\begin{aligned} Y_{\text{Profit Margin}} =& \alpha + \beta_1(\text{Revenue Shares}) \cdot \beta_2(\text{Industries}) + \\ & \beta_3(\text{Revenue Shares} \cdot \text{Industries}) + \epsilon \end{aligned}$$

Market Capitalization:

$$Y_{\text{Profit Margin}} = \alpha + \beta_1(\text{Market Capitalization Shares}) \cdot \beta_2(\text{Industries}) + \beta_3(\text{Market Capitalization Shares} \cdot \text{Industries}) + \epsilon$$

A concern in this model is the variation in the number of firms in each NAICS Code. While some NAICS Codes contain a wide array of companies others contain only a few firms. Given that a proportional share is based on the number of firms n within each industry this would lead to significant bias. We use the mechanism of the HHI and only the largest 6 firms in each market to calculate their respective shares ordered by revenue to counteract the bias. NAICS industries with less than 6 firms are omitted and only the top six firms are included. Consequently, the dataset is narrowed down to 678 observations of individual firms, that each carry a standardized individual measure of share for market capitalization and revenue.

The issue of endogeneity outlined in Model I does arise here. Market Capitalization is directly determined by what investors expect profits of a company to be in the future. Consequently, market capitalization is a function of future expected profits. Regressing market capitalization on profit margin may inflate the effect of the regression coefficient and lead to endogeneity. Exploring the circumstances of this endogeneity effect are out of scope of this study. Subsequent studies should further identify the theoretical underpinnings between market capitalization and future profits.

3 Analysis

3.1 Model I

Our first, naive model provides a comprehensive overview of the association between market capitalization and revenue and profit margins across the core industries in the United States. We compare the correlation of market capitalization and of revenue with profitability across a diverse set of industries. We rely on a moderation model in line with recent research (Nawrocki and Carter 2010) to allow for this comparative assessment.

Table 1: Coefficients for the partial effects per industry

	Outcome variable: Profitability margin	
Industry	Revenue	Market Capitalization
Information (1)	0.0002***	0.0001***
Manufacturing (3)	0.0001	0.0001
Management of Companies & Enterprises (1)	-0.0008***	-0.0001***
Mining (3)	-0.0001	0.00014
Professional, Scientific & Technical Services (2)	0.0012***	0,00014
Real Estate Rental & Leasing (1)	-0.0008**	-0.0009**
Transportation & Warehousing (1)	-0.0001***	0.0002*
Utilities (2)	-0.0003*	0.00012
Wholesale Trade (2)	0***	0.0003
Observations	2,411	2,411
R^2	0.391	0.400
Adjusted R^2	0.386	0.395
Residual Std. Error (df = 2391)	19.368	19.227
F Statistic (df = 19; 2391)	80.904***	83.954***
Note: calculated as sum of β_1 & interaction term, regression output is in the annex.		*p<0.1; **p<0.05; ***p<0.01

The interaction model shows that the effects and their significance greatly differ across industries. Due to this variation based on our moderator, an assessment of the relationship in the entire data set would distort the actual, more differentiated effect.

Three groups of coefficients exist in the model: (1) significant positive/ negative coefficients for market capitalization and revenue, (2) significant positive/ negative coefficient for either market capitalization or revenue, and (3) not significant positive/ negative coefficients for both.

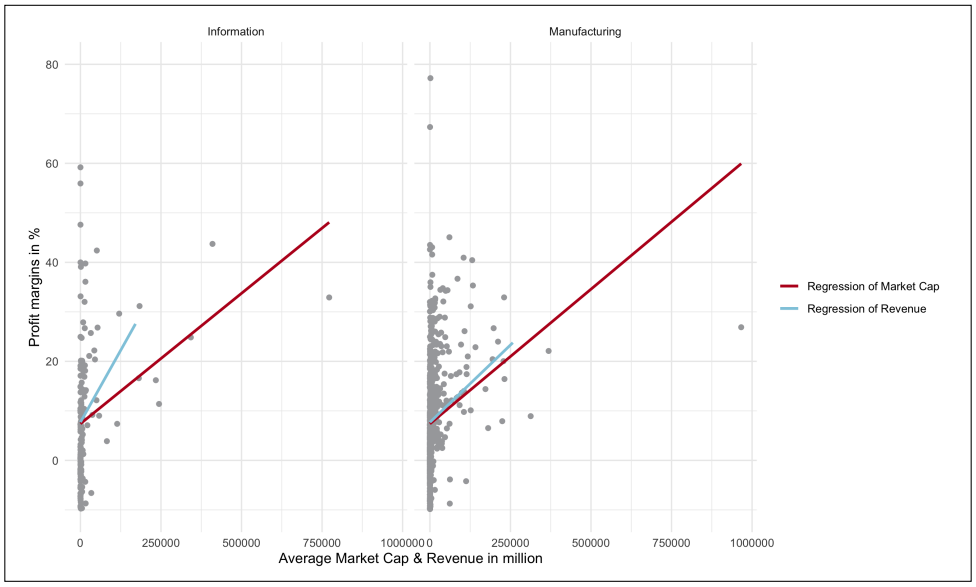

Figure 1: Model I for Information & Manufacturing

Group one is of particular interest, as both market capitalization and revenue seem to be relevant predictors for profitability for these sectors. Group one consists of our sector of interest, Information, Management of Companies and Enterprises, Real Estate Rental and Leasing, and Transportation and Warehousing. We consider negative and positive coefficients, as our main interest is, whether a significant association exists. When revenue increases by one million US Dollars, the profit margin in the information sector on average increases by 0.0002% or one billion US Dollar increase results in a 0.2% increase in profit margins. Analogously, a one billion US Dollar increase in market capitalization results in a 0.1% increase in profit margins. Negative correlation of revenue with profitability in sectors such as retail, is consistent with the importance of locality in the real estate business. It seems surprising that the largest sector by revenue, manufacturing, has no significant coefficients. This classification however accumulates a diverse set of industries and therefore oversimplifies the categorisation of markets. For manufacturing, a more differentiated analysis on the 2-, or 4-digit level would be appropriate. We acknowledge the shortcomings of comparing level variables with profitability rates, however we can observe that in some sectors and the information sector in particular the size of companies as measured by revenue and by market capitalization of firms are significant predictors of profitability. This can be explained by efficiencies as well as market power or other factors. We limit ourselves to empirical observations in this study.

The second group includes Professional, Scientific and Technical Services, Utilities, and Wholesale Trade. Those industries have a negative and significant coefficient for the association between revenue and profit margins, whilst the coefficient for market capitalization is not significant. The third and last group consists of Manufacturing and mining. For these two groups, we cannot find an association with profit margins and our two treatments.

Model I already shows promising results: market capitalization seems to be as good an indicator as revenue for profitability and possibly for market power. The effect of market capitalization in group one is occasionally

less significant, but consistently above the .1 threshold, when revenue is significant. In particular in the information sector, which comprises a substantial part of the digital sector, both effects are significant on the .01 level. Model II and III will further investigate the performance and comparability of the indicators.

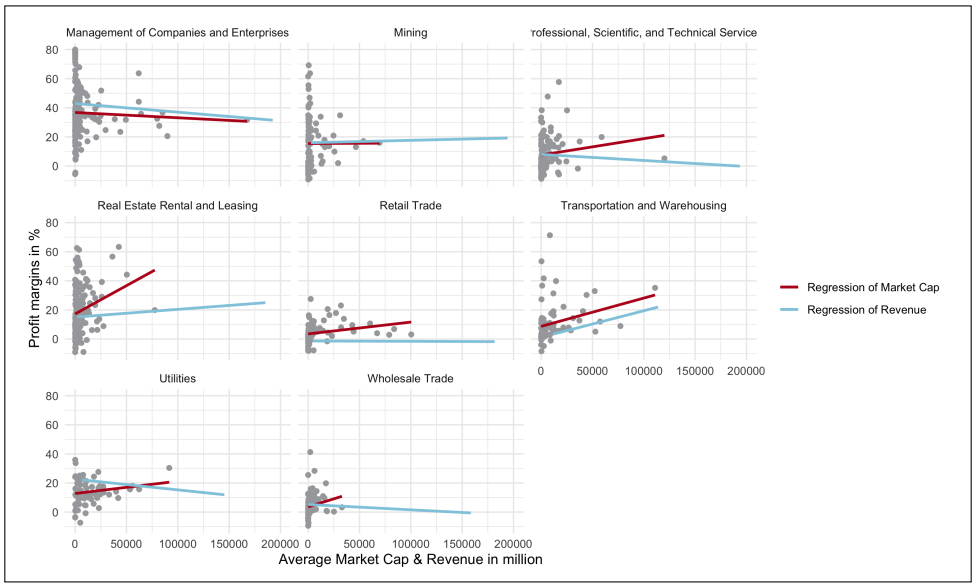

Figure 2: Model I for eight smallest sectors by revenue

3.2 Model II

As outlined in the previous chapter, the second model assesses the importance of market capitalization as a predictor for profitability by comparing the individual shares of each company within a predefined market.

The naive model yields highly significant results for both market capitalization and revenue shares. Interpreting the results substantively, we can state that on average a 10% increase in revenue shares of a firm leads to a 1.5% increase in profit margins. Similarly a 10% increase in market capitalization shares leads to a 2.16% increase in profit margins.

However, both R-squared coefficients in the naive model are rather small. Consequently, market capitalization shares and revenue shares do a poor job in explaining the variation of profit margins.

By testing both models for outliers with DFBETAS, we can identify one outlier in the market capitalization shares model. Outliers need to be dropped if they skew the regression coefficient by more than 2 points. However, after omitting the outliers, the model remains significant with market capitalization being the better predictor for profit margins. Consequently the take-away for the naive model is twofold: While both market capitalization and revenue are in general a rather poor predictor for profit margins, market capitalization shares are at least, a similar, if not a better predictor for profit margins than revenue shares.
Additionally, we calculated an interaction model in which shares are moderated by the NAICS 2-digit industry classification. To only account for industries that are relevant within the scope of this study we use the variable “Type” that functions as a derivative of the NAICS_2Digits variable only showing the sectors “Information”, “Manufacturing” as well as “Others” to allow for a sensible interpretation of results.

The interaction model does not consistently yield significant results. None of the interaction terms turns out to be significant. Within the interaction model of market capitalization shares only the effect within the “Information” industry is significant. In the interaction model with revenue shares as the independent variable, only the effect within the “Manufacturing” industry turns out to be significant. Thus, we can say little on the variation of coefficients within industries. Consequently there are no clear results on how market

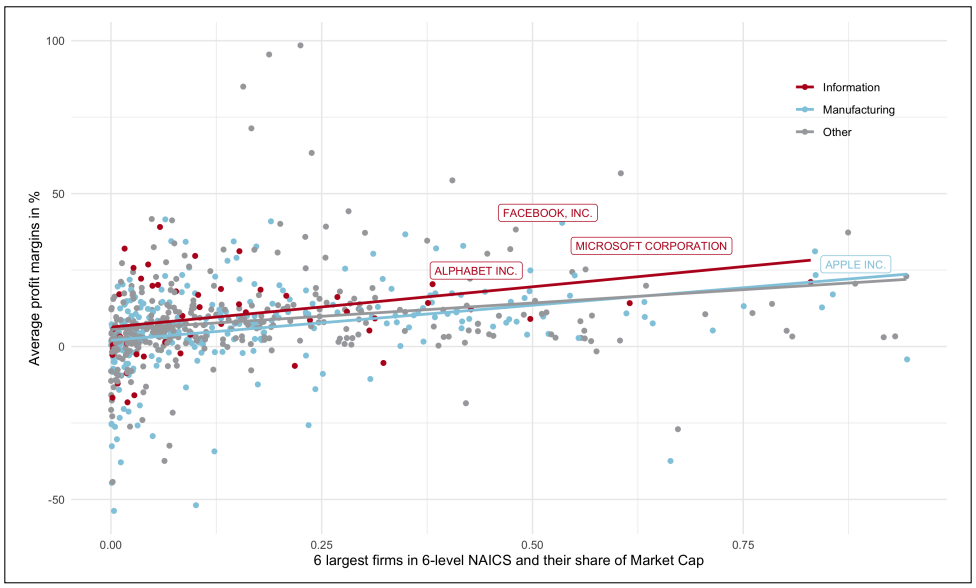

Figure 3: Model II

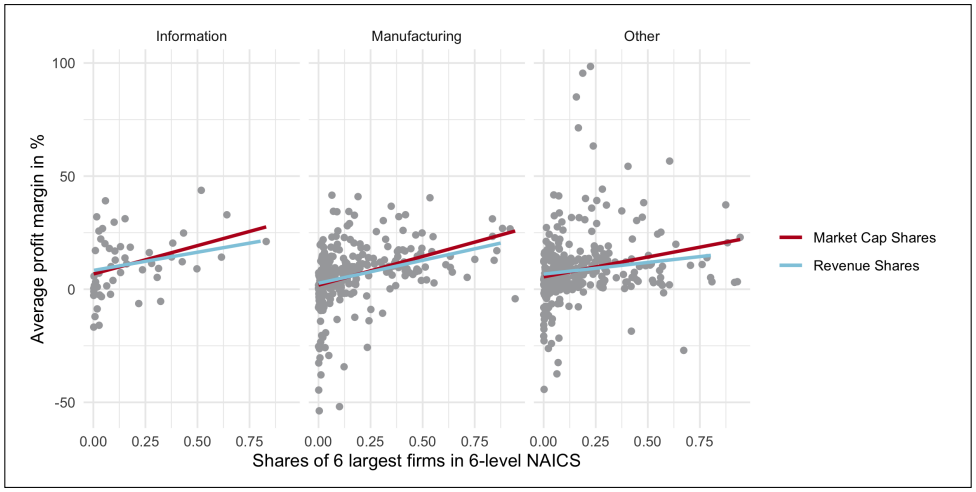

Figure 4: Model II

capitalization as an indicator for profitability behaves differently in various sub-industries.

Table 2

	Dependent Variable: Profit Margin			
	Naive		Interaction	
	(1)	(2)	(3)	(4)
Share Revenue	15.111***		15.272	
	(3.277)		(9.805)	
Share Market Cap		21.581***		25.084**
		(2.772)		(10.122)
Manufacturing			−5.569**	−4.905*
			(2.817)	(2.834)
Other			−1.455	−1.243
			(2.818)	(2.810)
Share Revenue * Manufacturing			4.044	
			(10.877)	
Share Revenue * Other			−5.149	
			(11.055)	
Share Market Cap * Manufacturing				0.233
				(10.948)
Share Market Cap * Other				−7.611
				(10.868)
Constant	5.005***	4.009***	8.204***	6.734**
	(0.783)	(0.711)	(2.567)	(2.621)
Observations	678	677	678	672
R^2	0.030	0.082	0.044	0.096
Adjusted R^2	0.029	0.081	0.037	0.089
Residual Std. Error	14.602 (df = 676)	14.119 (df = 675)	14.543 (df = 672)	14.053 (df = 666)
F Statistic	21.258*** (df = 1; 676)	60.626*** (df = 1; 675)	6.192*** (df = 5; 672)	14.068*** (df = 5; 666)
Note:				*p<0.1; **p<0.05; ***p<0.01

4 Conclusion

In this paper we compare to performance of revenue-based indicators and capitalization-based indicators in predicting the profitability of US firms across sectors. Revenue-based indicators are traditionally relied upon by antitrust regulators to assess market power of firms. A first model compares the association between profit margins and the absolute values of revenue and market capitalization moderated by a set of relevant industries. It establishes both market capitalization and revenue as significant predictors of profit margins in certain industries. In the information sector, which comprises a substantial part of the digital sector, both effects are significant at the .01 level. On average, a 10% increase in revenue shares of a firm leads to a 1.51% increase in profit margins. Similarly, a 10% increase in market capitalization shares leads to a 2.16% increase in profit margins. Market capitalization performs slightly better than revenue-based indicators of size of firms. For the purpose of a second model we estimate market shares based on revenue as well as market shares based on market capitalization of firms within sub-sectors of the economy. We establish that the market shares calculated as shares of market capitalization are again a slightly better predictors of profitability. Profitability is not an indicator of market power per se it can be explained by other factors such as efficiency. Generally, our results reflect the inherent biases of the NAICS classification and should be interpreted with caution.

Market capitalization is perceived by observers as indicative of the power of companies. This is in particular the case for GAFAM companies, which are defined as the five largest capitalizations in the US. However, there is a lack of empirical underpinning for these claims of perceived market power. This paper attempts to bridge the gap between theory and competition policy. This paper aims at contributing to the discussion by bringing some initial empirical findings and possibly paving the way to indicators analogous to the HHI and based on market capitalization rather than revenues alone.

References

Affeldt, P., Duso, T., Gugler, K. P. & Piechucka, J. (2021), 'Market concentration in europe: Evidence from antitrust markets'.

Amazon (1997), Amazon shareholder report, Technical report.
URL: *https://venturebeat.com/wp-content/uploads/2010/09/amzn_shareholder-letter-20072.pdf*

Bai, J., Philippon, T. & Savov, A. (2016), 'Have financial markets become more informative?', *Journal of Financial Economics* **122**(3), 625–654.

Bain, J. S. (1951), 'Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940', *The Quarterly Journal of Economics* **65**(3), 293–324.

Berry, S., Gaynor, M. & Scott Morton, F. (2019), 'Do increasing markups matter? lessons from empirical industrial organization', *Journal of Economic Perspectives* **33**(3), 44–68.

Black, B. S. & Gilson, R. J. (1998), 'Venture capital and the structure of capital markets: banks versus stock markets', *Journal of financial economics* **47**(3), 243–277.

Bureau, E. C. (2021), Selected sectors: Concentration of largest firms for the u.s, Technical report.
URL: *https://data.census.gov/*

Clarke, R., Davies, S. & Waterson, M. (1984), 'The Profitability-Concentration Relation: Market Power or Efficiency?', *Journal of Industrial Economics* **32**(4), 435–50. Publisher: Wiley Blackwell.

Commission, E. (2021), Commission decision of 27.6.2017 relating to proceedings under article 102 of the treaty on the functioning of the european union and article 54 of the agreement on the european economic area, Technical report.
URL: *https://ec.europa.eu/competition/antitrust/cases/dec_docs/39740/39740_14996_3.pdf*

Craig, P. & De Búrca, G. (2020), *EU law: text, cases, and materials*, Oxford university press.

Crémer, J., de Montjoye, Y.-A. & Schweitzer, H. (2019), Competition policy for the digital era, Final report, European Commission - Directorate-General for Competition, Brussels.
URL: *https://data.europa.eu/doi/10.2763/407537*

Hausman, J. A. & Sidak, J. G. (2007), 'Evaluating Market Power Using Competitive Benchmark Prices Rather than the Hirschman-Herfindahl Index', *Antitrust Law Journal* **74**(2), 387–407.

Katz, M. L. & Shapiro, C. (1999), Antitrust in software markets, *in* 'Competition, Innovation and the Microsoft monopoly: Antitrust in the digital marketplace', Springer, pp. 29–81.

Khan, L. M. (2020), 'The curse of bigness: Antitrust in the new gilded age', *Harvard Law Review* **133**(5), 1655.

Maniatis, P. (2006), 'Market Concentration And Industry Profitability: The Case Of Greek Banking (1997-2004)', *International Business & Economics Research Journal* **5**(10).

Massimo, M. (2004), 'Competition policy: Theory and practice', *Cambridge [113] Portafolio, Edición del* **16**.

Mueller, S. C., Bakhirev, A., Böhm, M., Schröer, M., Krcmar, H. & Welpe, I. M. (2017), 'Measuring and mapping the emergence of the digital economy: a comparison of the market capitalization in selected countries', *Digital Policy, Regulation and Governance* .

of Justice, U. S. D. (2015), 'Herfindahl-Hirschman Index'.
URL: *https://www.justice.gov/atr/herfindahl-hirschman-index*

Philippon, T. (2019), *The great reversal: how America gave up on free markets*, Harvard University Press.

Pomykalski, P. (2019), 'Revenue and valuation of companies with digital platform business models', *Nauki o Zarzadzaniu* **24**(1), 11–18.

Securities, U. S. & Commission, E. (2021), Sec edgar filing tracker, Technical report.
URL: *https://sec.report/*

Slade, M. E. (2004), 'Competing models of firm profitability', *International Journal of Industrial Organization* **22**(3), 289–308.

Statista (2021), The 100 largest companies in the world by mar-ket capitalization in 2020, Technical report.
URL: *https://statista.com/statistics/263264/top-companies-in-the-world-by-market-capitalization/.*

Werden, G. J. & Froeb, L. M. (2018), 'Don't panic: A guide to claims of increasing concentration', *Antitrust Magazine, forthcoming* .