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Corporate Inequality: Role of Competition and Institutions

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Abstract

In this paper, we analyze micro panel data from over 70 countries over 1980-2017 to understand the presence and behavior of star firms, defined as the top 10 percentile of firms in the world in terms of return on invested capital (ROIC). While star firms are more likely to occur in high income countries and manufacturing industry, there is an increasing share of star firms from middle income countries and the services sector over time. Star firms have higher markups and produce and invest more per dollar of invested capital than non-star firms. We find no evidence that star firms are differentially exposed to competitive shocks than non-star firms when we use cuts in import tariffs to identify exogenous intensification of competition at the industry level. Using the end of cartel membership as an additional exogenous shock to competition, we again find no reduction in markups post the break-up of the cartel and in fact, a reduction in output and investment compared to non-stars. Our results find little support that star firms are differentially protected from trade shocks or that they restrict output and investment as in traditional monopolies.

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Introduction

Recent academic and policy debate has raised concerns about a few large firms dominating the world economy and the role of competition in general.[1] The original debate was spurred by the finding in both academic studies and anecdotal evidence of a sharp increase in the performance of a small percentage of "star" firms compared to the broad population of firms in the United States (see Furman and Orszag [2015], Koller, Goedhart, and Wessels [2017], Autor, Dorn, Katz, Patterson, and Van Reenen [2017]). On the one hand, this could be reflective of reduced competitiveness, increasing market power, and economic inefficiency (e.g., Grullon, Larkin, and Michaely 2019, De Loecker and Eeckhout [2017], and Gutiérrez and Philippon [2017]). On the other hand, as originally argued by Demsetz [1973], the high profits earned need not necessarily be monopolistic, although monopoly may play a role. Increases in profits could arise due to greater efficiency and greater investment in intangible capital in the new knowledge economy (e.g., Autor et al. [2017], Crouzet and Eberly [2018], and Ayyagari, Demirguc-Kunt, and Maksimovic [2023]).

The two mechanisms have very different policy implications and this is of particular importance in developing countries where the success of one or two firms in export markets may have important economy-wide consequences.[2] More importantly, once we broaden the horizon to look internationally it is not clear what is the role of competition given that differences in firm performance may occur for a variety of reasons including differences in income level and level of financial development, trade barriers, human capital, and overall institutions.[3] Thus, it is an empirical question as to whether star firms in emerging markets are a manifestation of greater efficiency and investment in intangible capital or are reflective of poor quality of institutions that protect incumbents and encourage anti-competitive behaviors.

In this paper, we take a close look at star firms around the world and how they may differ

[1] See "The pandemic shock will make big, powerful firms even mightier", *The Economist*, May 26th 2020.

[2] See, for example, Freund and Pierola [2015a] and Gaubert and Itskhoki [2021] who show that "granular" forces i.e. exports driven by a few large individual firms, explain the trade pattern of countries. See also press reports on the effect of Nokia's setbacks for Finland (For instance, "One firm economies: The Nokia Effect", *The Economist*, August 25, 2012 edition.)

[3] A large literature has focused on different factors responsible for differential growth of firms across countries including level of financial development (e.g. Rajan and Zingales [1996]), legal and financial institutions (e.g., La Porta, Lopez-de Silanes, Shleifer, and Vishny [2000], Beck, Demirgüç-Kunt, and Maksimovic [2005]), and management practices and human capital (e.g. Bloom and Van Reenen [2007], Bruhn, Karlan, and Schoar [2010])

between developed and developing countries. We begin by analyzing the institutional and industry characteristics that are associated with the existence of star firms, focusing in particular on the role of intangible capital and competition. We define star firms as firms in the top 10% of return on invested capital (ROIC)[4] in the world in a particular year.

Our focus is on exploring if there is evidence of star firms achieving their status by cutting output and investment relative to non-star firms, and if so, how this may differ across different countries and competitive environments. Specifically, we examine if star firms are differentially affected by competitive shocks. We first look at how cuts in industry import tariffs affects the probability of being a star firm and their output and investment. Next we study the incidence of star firms as members of collusive arrangements such as cartels and if star firms are particularly hurt by the break-up of the cartel. If star firms indeed derive their profits from cutting output and investment, when a cartel ends (typically due to cartel members self reporting in exchange for amnesty), we should expect to see a decline in the markups and increase in output for all firms but especially so for star firms compared to other members of the cartel. We should also expect the decline in markups and increase in output for star firms to be lower in high intangible capital industries where star firms may be becoming stars because of greater efficiency rather than due to anti-competitive behavior.

To analyze star firms, we use data on listed companies around the world from 1991-2017 from Thomson Reuters Worldscope database. The database captures over 99% of world market capitalization and the long time series panel data allows us to examine how the gap between the top 10% of companies in the world and the others has changed over time. Based on the ROIC metric, we define *World Stars* as firms in the top 10% of ROIC in the world in a year and *Country Stars* as firms in the top 10% of ROIC in each country in a year. To this database, we merge in tariff data from Schott [2008] and data from the Private International Cartel (PIC) database described in Connor [2014]. The PIC database provides rich information on the universe of private international cartels over the period 1990-2012 and includes firms' names, country of incorporation, beginning and end year of the cartel and details on penalties imposed.

[4]ROIC is an important profitability metric in corporate finance measuring how efficiently a company can allocate its capital to profitable investment and has been widely used in the literature (e.g., Ben-David, Graham, and Harvey 2013, Furman and Orszag 2015) and by practitioners (e.g., Koller 1994, Koller et al. 2017).

Summary statistics on the incidence of star firms show that a greater proportion of World stars are from high income countries (average of 66.21% across our sample period), though this has been declining over time. The percentage of stars from middle income countries has gone from less than 1% in the 1980's to 47% in 2017 (14% from Lower-Middle income countries and 33% from Upper-Middle income countries). Across industries, while a majority of World stars are from manufacturing (average of 47% across our sample period), an increasing percentage over time are from Services. In addition, 40% of World Stars are high intangible capital firms.

We also see that while star firms are persistent in their future returns, growth, and productivity, there is a fair degree of churning in the composition of star firms, especially in high income countries. For instance, in high income countries, 21% of the star firms each year were in the bottom 50% of ROIC in the world four years ago but that number drops to 13% for middle income countries. The greater churn in the population of star firms in high-income countries, suggests the importance of good institutions and creative destruction for the rise of star firms.

Next, we find that firm markups, a measure of competitive pressures at the firm level, are positively associated with greater probability of being a star firm. However, this relation is moderated by the level of intangible capital investments. That is, the interaction of markups and intangible capital investment is negatively associated with probability of being a star firm, suggesting that for firms with high intangible capital, charging high markups are not the typical route for high intangible capital firms to rise to star status. These results are robust to alternate definitions of star status, defined both across the world and within countries, including a size criterion by defining star firms as large and profitable firms, and across both tradeable and nontradeable sectors.

The strong association between markups and star status on the one hand could be reflective of greater firm efficiency - low cost firms have higher markups and higher profits. On the other hand, the high markups and profits could also be driven by the exercise of market power in an anti-competitive setting. Establishing a valid counter-factual to test whether it is efficiency or market power driving the high profits of star firms in a cross-country study such as this is econometrically very challenging. Hence, we approach this question by performing a number of tests aimed to test the market power hypothesis.

First, if star firms are achieving their star status primarily by exercising market power we should expect them to restrict investment and output. However, empirically we show that at every level of intangible capital, star firms have higher Investment (both Capex and R&D investment) and Output (sales/invested capital) and this holds in both high income and middle income countries.

Second, if high markups and profits of star firms are due to anti-competitive behavior, we would expect an increase in competition to dampen the relationship between markups and star status. To explore this, we exploit two different competitive shocks. As a first step, we use exogenous variation in industry-level (SIC 4-digit) import tariffs as a quasi-natural experiment following Fresard [2010]. The softening of trade barriers substantially increases the competitive pressure faced by a firm and therefore its ability to generate high returns for its investors. We find that increases in competition either does not affect the association between markups and star status (as we see for high income countries and for high intangible capital firms)[5] or positively moderates the association between markups and star status (as we see for middle income countries and for low intangible capital firms).

Next, we look at an explicit case of the end of monopolistic collusion with the breakup of cartels. In a difference-in-difference setting, we compare firms that were part of a cartel (*treated*) over a nine year period from *t-3* to *t+5* where t is the year of the end of cartel, to other firms in that country, industry, and size class that were never part of cartels (*control*). We see that less than 10% of cartel firms are star firms. Treated firms have lower markups post break-up compared to the control group. Importantly, when we split the treated firms into stars and non-stars, only the non-stars show a reduction in markups post break-up of the cartel whereas the star treated firms experience a reduction in output, and investment.[6]

Overall, our results show that there is little evidence that star firms across the world are gaining their distinction by cutting output and investment or that they are protected differentially from competition than non-star firms.

Our findings contribute to the recent international literature focusing on the rising dominance

[5]This is consistent with the finding in Ayyagari et al. [2023] that star firms are not differentially affected by import competition compared to other firms in the economy.

[6]When we compare treated star firms to treated non-stars, we see that treated stars do not have lower markups than the non-stars, post dissolution of cartel. In addition, they have lower output and investment compared to the non-stars.

of few firms. While we identify star firms on the basis of realized returns, an emerging literature has focused on dominant firms in terms of trade patterns, market power, and productivity. For instance, Freund and Pierola [2015b] show that much of the exports of many countries can be attributed to a small number of firms which they refer to as export superstars. Andrews, Criscuolo, Gal, et al. [2015] highlight the notion of frontier firms, a small number of firms that are much more efficient than the bulk of their competitors. Other studies have focused on the global increase in market power. De Loecker and Eeckhout [2018] use similar data as our paper from Worldscope and document a world-wide increase in markups or price-cost margins, with the largest increase being in high income countries. Diez, Leigh, and Tambunlertchai [2018] show that the increase in markups in advanced economies is mostly driven by a few firms that managed to extract high markups, while markups in other firms have essentially been flat. None of these papers look at returns or the role played by intangible capital.

Our paper is also related to the growing literature on the macroeconomic effects of market power (see Syverson [2019] for a review). Empirical studies have documented the rise in profits(Furman and Orszag [2015] and Ayyagari et al. [2023]), concentration (Grullon et al. [2019]) and price-cost margins(De Loecker and Eeckhout [2017]) simultaneously accompanied by decline in labor's share of income (see Barkai [2016], Autor et al. [2017]), and investment in physical capital (Gutiérrez and Philippon [2017] and Alexander and Eberly [2018]). One interpretation of these disparate trends is that it reflects increased market power and rents to firms and reduced competitiveness and economic efficiency. An alternate interpretation is that it reflects productivity differences between firms leading to a reallocation of demand towards the most productive firms (Autor et al. [2017] and Crouzet and Eberly [2018]). While most of these studies are based on US firms, an exception is Diez et al. [2018] who show that across countries, at low levels of markups, an increase in market power is associated with more investment, but eventually higher markups are associated with lower investment, particularly for companies operating in industries with high levels of market concentration. They argue that these results suggest that as companies increase their market power, they appropriate a growing share of the rents from production, leaving smaller returns accruing to labor. In contrast to these papers, our paper explicitly tests if there is evidence of welfare reducing monopolistic behavior by star firms across the world and we find none. This is not to argue that

there may be other concerns with greater danger of market foreclosure if these star firms prevent entry and buy new technologies that might threaten their star status. Instead, the findings in our paper suggest that the new knowledge economy requires a different focus of anti-trust regulation than one that looks at output and prices alone as determinants of anti-competitive behavior.

A large literature in international trade has also focused on the links between producer markups and trade showing that trade barriers leads domestic firms to exercise market power (see Levinsohn [1993], Harrison [1994], Krishna and Mitra [1998], and Konings, Cayseele, and Warzynski [2005]).[7]. More recently, Edmond, Midrigan, and Xu [2015] use Taiwanese producer-level data to show that opening up to trade increases competition and reduces markup distortion thereby reducing misallocation and increasing productivity. De Loecker, Goldberg, Khandelwal, and Pavcnik [2016] study the effects of both input and output tariffs reductions during India's trade liberalization and find that the net effect was an increase in markups because of the large declines in marginal costs from input tariff liberalization whereas prices do not fall as much. However, they do find that conditional on marginal costs, there are pro-competitive effects of output tariffs on markups.

Our paper also contributes to the literature on cartels and their effect on profits and corporate governance. Dong, Massa, and Žaldokas [2019] show that global leniency programs which reduced fines or provided immunity for cartel conspirators that cooperated with antitrust authorities had the desired effect of leading to more cartel detections and lower margins of affected firms. Other studies have also shown a link between leniency programs and increased competition (e.g. Miller [2009] and Borrell, Jiménez, and García [2014]). None of these studies focus on the difference between star firms and non-stars.

1 Data and Methods

1.1 Defining Star firms and Markups

We use data from Thomson Reuters Worldscope database that provides comprehensive and detailed financial information on publicly traded firms across 134 countries starting in 1980. Although public

[7] See Feenstra [2018] for a review of this literature

firms only make up a subset of firms in each country, aggregate profits and investment are much more concentrated among the large public firms, making this dataset well-suited to our study. The Worldscope data covers 99% of world market capitalization and has been used in other studies on global market power and competition including De Loecker and Eeckhout [2018]. We drop ADRs and securities, firms in utilities (SIC 49), real estate and financial services (SIC 53, 60-69), small island economies, firms with missing assets of sales and negative values of lagged invested capital. We also drop observations if a country-year has less than 10 firms. In robustness tests, we also present results restricting accounting standards to US GAAP and IFRS to ensure that our results are not driven by different treatment of income statement and cashflow items by local accounting standards.

We define star firms as firms that realize high returns for their investors. We use a standard definition of Return on Invested Capital (ROIC) as our measure of returns, where ROIC for firm i in year t is defined as:

$$ROIC_{it} = \frac{Profits_{it}}{Invested\,Capital_{it-1}} \tag{1}$$

Given the concerns with the measurement of intangible assets and how it affects ROIC (see Ayyagari et al. [2023]), following Peters and Taylor [2017],[8] we first construct measures of intangible capital for Worldscope firms. We then adjust the definitions of Invested Capital and Profits for intangible capital. Specifically,

$$Invested\,Capital_{it} = PPENT_{it} + ACT_{it} + ICAP_{it} - LCT_{it} - GDWL_{it} - max(CHE_{it} - 0.02 \times SALE_{it}, 0) \tag{2}$$

where $PPENT$ is Net Property, Plant, and Equipment (Worldscope Item 2501), ACT is Current Assets (Worldscope Item 2201), LCT is Current Liabilities (Worldscope Item 3101), $GDWL$ is Goodwill that represents the excess cost over equity of an acquired company (Worldscope Item 18280), CHE is Cash and Short-term Investments (Worldscope Item 2001), and $SALE$ is net sales (Worldscope Item 1001). $ICAP_{it}$, is defined as the sum of externally purchased intangible

[8] Earlier attempts to address intangible capital include Peles [1971], Hirschey [1982], Falato, Kadyrzhanova, and Sim [2013] and Eisfeldt and Papanikolaou [2013].

capital (*INTAN*, Worldscope Item 2649) and internally purchased intangible capital, both measured at replacement cost. Internally purchased intangible capital is in turn measured as the sum of knowledge capital *K_int_know* and organization capital *K_int_org*. The perpetual-inventory method is applied to a firm's past research and development expenses, *XRD* (Worldscope Item 1201) to measure the replacement cost of its knowledge capital. Similarly, a fraction (0.3) of past selling, general, and administrative (*SGA*, Worldscope Item 1101)[9] spending is used as an investment in organization capital, which includes human capital, brand, customer relationships, and distribution systems.

We exclude Goodwill, which are the intangible assets arising out of M&A transactions when one company acquires another for a premium over fair market value, in the computation of invested capital in equation 2. Thus, our measure is not distorted by price premiums paid for in acquisitions, allowing for an even comparison of operating performance across companies. As a result, ROIC measures the return that an investment generates for the providers of capital and reflects management's ability to turn capital into profits.[10] We also subtract cash stocks in excess of those estimated required for transactions purposes. Following Koller et al. [2017], we treat cash above 2% of sales as excess cash and subtract it from the firm's invested capital. Our estimates are not affected by firms' decisions on whether to stockpile cash in low-tax jurisdictions in order to manage their tax liabilities, as is the case of many large U.S. multinationals.

Correspondingly, the adjusted profits are given by:

$$Profits_{it} = EBIT_{it} + AM_{it} + XRD_{it} + 0.3 \times SGA_{it} - \delta_{RD} \times K\_int\_know_{it} - \delta_{SGA} \times K\_int\_org_{it} \quad (3)$$

where *EBIT* is Earnings before Interest and Taxes (Worldscope Item 18191); *AM* is Amortization of Intangible Assets (Worldscope Item 1149); δ_{RD} is the depreciation rate associated with knowledge capital and is set to 15% following Peters and Taylor [2017]; δ_{SGA} is the depreciation rate associated

[9]Since *SGA*(Worldscope Item 1101) is the sum of SG&A and R&D, we isolate SGA as Worldscope Item 1101-Worldscope Item 1201. We set this difference to be just *SGA*(Worldscope Item 1101) if R&D¿SGA & R&D¡COGS. If SGA is missing, we take the difference to be missing too.

[10]In particular, if we do not subtract *GDWL* from *ICAP* we would run the risk of capitalizing future monopoly rents reflected in high acquisition premiums, thereby incorrectly attenuating the relation between ROIC and pricing power when one firms buys another.

with organization capital and is set to 20% following Falato et al. [2013].

ROIC, as used in the Council of Economic Advisors [2016] report and Ben-David et al. [2013], among many others, computes the earnings that a corporation realizes over a period, as a fraction of capital that investors have invested into the corporation. The advantage of ROIC is that it measures investment capital as more than physical capital (fixed asset investment) which Doidge, Kahle, Karolyi, and Stulz [2018] show to be a declining portion of total assets over time in the US.

We define *World Star* as a dummy variable that takes the value 1 if the firm's ROIC is above the 90^{th} percentile of ROIC across all firms in the world in a particular year and 0 otherwise. We define *Country Star* as a dummy variable that takes the value 1 if the firm's ROIC is above the 90^{th} percentile of ROIC across all firms in its country in a particular year and 0 otherwise. As alternate definitions, we couple the Star definition with firm size to define $World\ Star_{Large}$ and $Country\ Star_{Large}$ where Large firms are defined as firms whose total assets in USD are greater than or equal to the median value of USD assets in their country in a particular year.

As our main firm-level measure of market power, following Foster, Haltiwanger, and Syverson [2008], we use cost shares, *Markups*. We base our measure of variable inputs on Operating expenses (Worldscope Item 1249) rather than Cost of Goods Sold (Worldscope Item 1051) as in De Loecker and Eeckhout [2017] because COGS have been shown to be a declining share of variable costs in countries like the US (see the discussion in Traina [2018]). Other expenses, such as Selling, General, and Administrative Expenses are increasingly a lion's share of variable costs and COGS has been a declining share of variable costs. Operating expenses includes Cost of Goods Sold (COGS), Selling, General, and Administrative Expenses (XSGA) and Other Operating Expenses. While we agree with Traina [2018], our argument is that part of XSGA is actually capital expenses which builds the capital stock of a firm and not operating expenses. Specifically, we treat research expenditures as an intangible investment and 30% of the Selling, General, and Administrative expenses as an organizational investment. Hence we re-compute operating expenses without these two components, and instead treat them as additions to capital stock of the firm. Thus, we have:

$$OPEX^{*} = OPEX - XRD - RDIP - 0.3 \times SGA \tag{4}$$

Markups are then simply given by:

$$Markups_{it} = \frac{Sales_{it}}{OPEX^{*}_{it-1}} \tag{5}$$

While the above cost shares definition of markups requires constant returns to scale, the derivation is transparent and is not subject to econometric and optimization challenges faced by alternative methods that rely on explicit estimates of productivity using the control function approach (Rovigatti and Mollisi [2018]). Furthermore, this is close to the Lerner Index (measured by the difference between the output price of a firm and the marginal cost divided by the output price) that is widely used in the literature as a measure of market power (see e.g. Grullon et al. [2019],Gutiérrez and Philippon [2017]).

1.2 Cartels

There has been a recent surge in cartel prosecution activities globally with the advent of Leniency laws which have been introduced at different times in different countries over the past few decades.[11] Leniency programs allow corporations or individuals involved in cartel activity to receive amnesty if they collaborate in conviction of the cartel and have been shown to be a key development in antitrust enforcement and cartel detection and deterrence (e.g. see Chen and Rey [2013]).

Our analysis is based on data from the Private International Cartel (PIC) database. The data has been recently used in a number of papers including Dong et al. [2019], González, Schmid, and Yermack [2019], and Campello, Ferrés, and Ormazabal [2017]. The PIC data contain information on the universe of private international cartels discovered, disclosed, and sanctioned by regulators since 1990. The data set does not include cartels that are protected by sovereignty or multilateral treaties, such as OPEC (Organization of the Petroleum Exporting Countries), as well as those for which no sanctions were imposed within five years of the authorities discovery. The data provides rich details on each firm's name, country of incorporation, the markets and locations where collusion

[11] For instance, the first leniency program was introduced by the US in 1978. At first, the law granted full amnesty to the first informant firm and was amended in 1994 to grant amnesty to individuals and in 1999 to decrease fines in exchange for information on other cartels that the convicted firm was involved in. Leniency programs were introduced in the EU in 1996, in Latin America (Brazil) in 2000, and in Asia (Korea) in 1997.

took place, the duration of the collusive agreement including the begin and end dates, the fines imposed, and whether the firm was granted amnesty under a plea deal. The information is hand-collected from court filings, documents, reports, press releases from antitrust authorities in different countries, and news media articles from Factiva, Lexis-Nexis, etc. See Connor [2014] for a detailed description of the dataset.

To construct our sample, we begin with the companies included in the international cartel dataset and then name match these firms with Worldscope to create a sample of firms whose cartel membership ended over the period 1981 to 2017.

1.3 Import Tariffs

To identify an exogenous measure of intensifying competition, we assemble tariff data from Schott [2008] and follow the procedure in Fresard [2010] to identify the cuts in import tariffs. For each year from 1989 (starting year of the data in Schott [2008]) to 2017, for each importing country, we have information on the dutiable values of imports (Free-on-Board value of imports) and the duties collected by the U.S. Customs at the commodity level (US Harmonized Tariff Schedule (HTS)-8 level). Each HTS-8 commodity code is also assigned to a corresponding SIC 4-digit code. We first aggregate the dutiable values and calculated duties of all products by industry-year and define the ad valorem tariff rate as the ratio of duties collected to the dutiable values. Next, we identify whether a tariff cut occurs by comparing the yearly change of industry tariffs with a median of tariff change across all industry-years. Specifically, whenever there is a negative tariff change that is at least two times larger than the industry median, we identify it as a tariff cut. As in Fresard [2010], we exclude cases where a negative change is offset by positive change with an equivalent scale in the subsequent two years to ensure that the tariff cuts represent true non-transitory changes in the competitive environment. Thus the variable *Cut* takes the value 1 if a 4-digit industry has a tariff cut at both t-1 and t and 0 otherwise.

After dropping observations that were not matched up to a 4-digit SIC code, we have tariff data on 471 industries across 30 years for a total of 13,389 industry-year observations. Figure 1 plots the number of the industries which have tariff cuts each year and shows that the tariff cuts across

industries spikes around 1996 with over 250 4-digit industries having a reduction in import tariffs. All our results are also robust to computing the tariff cuts based on the SIC 3-digit industry code. Finally, we merge the tariff cut data with the WorldScope sample by SIC4 and year. We assign a value of 0 to *Cut* variable with missing values.

1.4 Identifying Star Firms across the World

Table 1 presents summary statistics on the distribution of World Stars across different countries and industries. Panel A shows the distribution of World Stars by income group across time. Over the period 1981 to 2017, high income countries have the largest percentage of World Stars (66.21%) followed by Upper-middle income countries (25.68%) and Lower-middle income countries (8.11%). However, these aggregate statistics mask a change in the distribution over time. There is a steady increase in the percentage of world stars from middle income countries over time, specially after 1990. The percentage of stars from middle income countries has gone from 0-1% in the 80's and early 90's to 14% in 2017 from Lower-middle income countries and 33% from Upper-middle income countries.

Panel B of Table 1 shows variation across industry sectors. While the majority of the World Stars are from Manufacturing (average of 47% over our sample period), a increasing percentage of World Stars over time are from the Services sector. The last column of panel B shows the percentage of high intangible capital firms that are World Stars each year where high intangible capital firms are defined as firms with above median intangible capital/assets ratio in their country in that particular year. The column shows that World Stars are typically firms with high intangible capital - 40% of the World Stars on average are high intangible capital firms in their country in a particular year. Figure 2 plots the distribution of Country Stars across industries. The figure shows an increasing proportion of Country Stars from the services sector over time, especially in high income countries. By 2017, we find that while in high income countries, country stars are as likely or even more likely to be in the services sector compared to manufacturing, in middle income country countries, a majority of the country stars are still from the manufacturing sector.

To examine how persistent the star status is, in panels A and B of Table 2 we use rolling four

year windows to see the distribution of star firms by their status four years ago and four years later respectively. Panel A shows that in high income countries, 44.4% of the star firms today were also star firms four years ago, 34.8% were in the top 11-50% of ROIC four years ago and 20.8% were in the bottom 20% of ROIC in the world four years ago. The corresponding numbers in lower middle income countries are 45.24%, 41.67%, and 13.10% respectively suggesting that a larger proportion of firms in high income countries rise from the bottom 20% to become star firms. We find similar results in panel B when we look at the star status of today's star firms four years later. 23.71% of star firms today in high income countries are in the bottom 50% of ROIC four years later and the corresponding number is 15.09% in lower middle income countries. These numbers are suggestive of greater dynamism and churning in high income countries, which presumably have higher quality institutions and more competitive markets.

In panel C of Table 2, we examine the short-run future performance of the star firms. Columns 1, 3, 5, and 7 show that on average, firms that were stars four years ago have higher ROIC, sales growth, employment growth and labor productivity growth than firms that were not stars four years ago. Overall, panel C suggests that despite the churning noted in the previous panels, star status is associated with higher future performance and there is a fair degree of persistence in star status as firms that were stars five years ago have higher average returns, valuation, growth, and productivity over the subsequent five-year period than firms that were not stars.

2 Empirical Findings

2.1 Markups, Intangible Capital, and Star Status

In this section, we explore the relation between markups and being a star firm. For firm i, in country k, in industry j, in year t, we estimate the following regression:

$$Star_{ijkt} = a + \beta_1 \times SizeQuantile_{it-1} + \beta_2 \times AgeDummies_{it-1} + \beta_3 \times Markups_{it-1} + \beta_4 \times Log(GDP/capita)_{kt-1} + \gamma_t \times \delta_j + \phi_k + \mu_i + \epsilon_{ijkt} \quad (6)$$

where *Star* is one of the following four dependent variables - World Star, Country Star, Large World Star, Large Country Star; *Size Quantile* are four size quantile dummies; *Age Dummies* are three age dummies for less than 10 years, 10-15 years, and over 15 years; and *Markups* are the cost share markups. All the regressions are estimated using ordinary least squares (linear probability models) using country fixed effects and industry x time fixed effects in columns 1, 3, 5, and 7 and firm fixed effects in columns 2, 4, 6, and 8. We cluster the standard errors at the firm level to capture the lack of independence among the residuals for a given firm across years (Petersen [2009]).

The main coefficient of interest in the above specification is β_3 which shows the sensitivity of star status to firm markups. A high markup is consistent with market power, as competition would erode the firm's ability to charge above variable costs. Importantly, since markups do not take into account the cost of tangible and intangible capital, high markups are consistent with both high and low rates of return to invested capital. Intuitively, it is natural to think of high markups as resulting from a firm's exercise of market power by reducing sales and thereby realizing high returns on invested capital. However, it is possible for a firm to have a low markup, high sales per unit of invested capital and to be a star firm. Thus, the extent to which star status is related to high markups is an empirical question.

Columns 1 to 4 of panel A of Table 3 use *country* and *industry x year* fixed effects and show the relationship between markups and star status for each of the four definitions of star status. Columns 5 to 8 repeat these specifications but using firm fixed effects in place of country and industry-year fixed effects. All the eight columns show a positive association between star status and markups. Columns 5 to 8 show that increases in firm level markups in a particular year are associated with the increase in probability that the firm is a star firm.

In panel B of Table 3 we examine if there is a difference between sectors that are exposed to international competition (tradeables) vs those that are more exposed to domestic competition (non-tradeables). In both instances, we find the relation between markups and star status to hold for both World Stars and Country Stars. While these results include firm and industry x year fixed effects we find similar results if we were to replace firm fixed effects with country fixed effects.

In Table 4, we explore the heterogeneity in the relationship between markups and star status across different levels of intangible capital by estimating the following equation:

$$Star_{ijkt} = a + \beta_1 \times SizeQuantile_{it-1} + \beta_2 \times AgeDummies_{it-1} + \beta_3 \times Markups_{it-1} + \beta_4 \times ICAP_{it-1} + \beta_5 \times ICAP_{it-1} \times Markups_{it-1} + \beta_6 \times Log(GDP/capita)_{kt-1} + \gamma_t \times \delta_j + \mu_i + \epsilon_{ijkt} \quad (7)$$

Table 4 examines the interaction between markups and intangible capital for different country income groups and across tradeable vs non-tradeable sectors. The dependent variable is World Stars in columns 1 to 5 and Country Stars in columns 6 to 10. Table 4 shows that in all specifications, the interaction of Markups and Intangible Capital is negative and significant suggesting that for high intangible capital firms, markups are less likely to be associated with star status.

2.2 Are star firms' profits associated with lower output and investment?

An important policy concern surrounding star firms is the extent to which they affect consumer welfare by their output decisions. There are several viewpoints on this. On the one hand, star firms could attain their high profits by producing higher volumes, given their efficiency. This is the implication in the original theoretical work on market power and profitability by Demsetz [1973] and more recently in the empirical analysis of Autor, Dorn, Katz, Patterson, and Van Reenen [2020] who argue that more productive firms (higher Z and lower marginal cost) will have higher outputs given their markups.

On the other hand, studies such as Gutiérrez and Philippon [2017] and Grullon et al. [2019] argue that high profits come from restrictions in market output and investment, and we would not expect higher output of star firms, controlling for their markups fixed.[12]

We examine the relation between star status and output empirically in Table 5 in a multivariate regression framework, controlling for *Invested Capital*, *Log Age*, firm fixed effects, industry x year

[12]This is consistent with the earlier literature (e.g. Bresnahan [1989] and Schmalensee [1989]) that argued that a concentrated market structure will generally lead to higher price-cost margins, higher profitability of firms, lesser output and lower welfare and allocative efficiency.

fixed effects. One concern with using sales as a measure of output is that sales may be artificially inflated due to monopoly power. Hence, in addition to output we also look at the association between markups and investment - capital expenditures, and R&D investment. If star firms invest more than non-star firms at the same level of markups, then it provides plausible evidence that star status is derived from high efficiency. For output, we use *Sales/Invested Capital* and for investment, we use both physical investment *Capex/Invested Capital* and intangible investment (*XRD/Invested Capital*). All the independent variables are lagged by one period. Specifically, we estimate:

$$Output/Investment_{ijt} = a + \beta_1 \times SizeQuantile_{it-1} + \beta_2 \times AgeDummies_{it-1} + \beta_3 \times Markups_{it-1} + \beta_5 \times Log(GDP/capita)_{kt-1} + + \gamma_t \times \delta_j + \mu_i + \epsilon_{ijkt} \quad (8)$$

Table 5 shows that star firms have higher Sales/Invested Capital and greater investment, both CAPEX, and Intangible (R&D) Investment compared to all other firms.

In Figures 3 to 5, we present a non-parametric estimator of the regression function without covariates. Specifically, following Cattaneo, Crump, Farrell, and Feng [2019], we present binned scatterplots of Sales/Invested Capital, Capex/Invested Capital and R&D Investment/Invested Capital against markups in Figure 3, 4, and 5 respectively. The figures are drawn with robust confidence intervals and uniform confidence bands for both High Income countries and Upper and Lower Middle income countries. Figure 3 shows that while there is a decline in output for both World Stars and non-star firms, for star firms, output is higher at each level of markup than for all firms in general, suggesting that these firms are not restricting output more than other firms with the same markups. The difference is particularly high at lower markups, suggesting that low-markup star firms, in particular, are adopting a high volume marketing strategy. Similarly, Figures 4 and 5 show that at every level of markup, star firms have higher Capex and R&D investment than non-stars. Overall, we find no evidence of additional harm to consumer welfare that regular star firms might cause by systematically decreasing output beyond that predicted by their markups.

2.3 Role of Competition

In this section, we explore more closely how competitive shocks moderate the relationship between markups and star status. As a first step, we use the exogenous variation in industry-level import tariffs as a quasi-natural experiment. Softening of trade barriers versus tariff cuts should present a substantial increase in the competitive pressure from foreign rivals. If star firms rely on market power to generate profits more than non-star firms, we would expect that the unexpected change in product market environment should affect star firms less than non-star firms. Specifically, we estimate the following equation:

$$\begin{aligned} Star_{ijkt} = a + \beta_1 \times SizeQuantile_{it-1} + \beta_2 \times AgeDummies_{it-1} + \beta_3 \times Markups_{it-1} \\ + \beta_4 \times Cut_{jt-1} + \beta_5 \times Cut_{jt-1} \times Markups_{it-1} + \beta_6 \times Log(GDP/capita)_{kt-1} \\ + \gamma_t \times \delta_j + \phi_k + \epsilon_{ijkt} \quad (9) \end{aligned}$$

The main coefficient of interest in the above equation is the interaction between $Markups_{it-1}$ and Cut_{jt-1}. Since tariff reductions occur in different industries in different periods, the control group consists of all firms operating in industries that do not experience a reduction in tariff in year t, even if they have experienced a tariff reduction in the past or experience one in the future. Thus the coefficient measures the difference in markups-star status sensitivity between firms that experience an unanticipated competitive shock and firms that do not. If the positive association between markups and star status arises because of the exercise of market power, then this relation should be dampened by tariff reductions.

Table 6 presents the results of these estimations. We find no evidence that the association between markups and star status is dampened by increase in competitive pressures. Tariff cuts do not differentially affect the association between markups and star status in high income countries and for high intangible capital firms. On the contrary, we see that with an increase in competitive environment from cuts in import tariffs, high markups are more likely to be associated with being a star firm for low intangible capital firms and for firms in middle income countries. In Table 7, examine if star firms' behavior and investment are differentially affected by competition by

interacting import tariff cuts with star status. To mitigate reverse causality, we measure star status as of two years prior. Most of the interaction terms are insignificant - except in two instances for investment - suggesting that star firms do not behave differentially when exposed to greater competition.

While the above shock was at the industry level, as an alternate competitive shocks we use the end of cartel membership as a firm-level shock. We match the sample of Cartel firms to Worldscope to create a sample of firms whose cartel membership ended over the period 1981 to 2017. Since many of these firms are members of multiple cartels, our empirical strategy relies on looking within each cartel and comparing cartel members to a control group of firms in the same country of incorporation, same two digit SIC code, and same size quantile that were never identified to be a part of a cartel. We treat the end of the cartel as an exogenous shock to competition and use a difference-in-difference setting where we compare the markups and performance of cartel members pre- and post- the end of the cartel to the control firms over the same period. For each firm i, in country k, cartel c, at time t:

$$\begin{aligned} Markups/Performance_{ikct} = \alpha_0 + \beta_1 \times Log(GDP/Capita)_{kt-1} + \\ \beta_2 \times Treat_{ikct} + \beta_3 \times Post_{it} + \beta_4 \times Treat_{ikct} \times Post_{it} + \\ \gamma_t + \phi_c + \delta_k + \epsilon_{kict} \end{aligned} \quad (10)$$

Our main coefficient of interest is β_4. We require that both treated firms (cartel members) and control firms are available in our sample over a nine-period *[t-3, t+5]* where t is the year the cartel ended. Thus we define the variable *Treat* to take the value 1 if the firm is a member of a cartel and 0 if the firm is never a cartel member. The variable *Post* takes the value 1 for years t to *t+5* and 0 for the years *t-3* to *t-1*.

Table 8 presents the difference-in-difference (DiD) estimates around the break-up of a cartel for the full sample as well as for just large firms. Columns 1 to 4 include only cartel and year fixed effects whereas columns 5 to 8 include cartel, country, and year fixed effects. In all cases, we find that markups of cartel member firms decline following the break-up of a cartel compared to firms from the same country, industry, and size class that were never members of cartels. Appendix Table

A1 shows a test of the parallel trends assumptions behind the DiD specification wherein we see that none of the interaction coefficients prior to the break-up of the cartel are significant. The significant interaction of $Treat\ x\ Post$ is driven by the significant interactions in t+1 and thereafter. In Table 9, we compare Star firms and non-stars after the breakup of the cartel. We see that the results in Table 8 are driven by the Non-star firms. Star firms do not have a decline in markups after the break-up of a cartel. Columns 3 and 4 show that star firms actually cut output and investment after the break-up of a cartel.

3 Conclusion

A large academic and public policy debate has focused on the rise in market concentration over the past few decades which has given rise to "star firms", a small set of firms that generate abnormal returns for their investors. The dominant concern with these firms is that they exert excess market power and behave as traditional monopolists restricting competition. However, we have little systematic evidence on the characteristics of star firms worldwide and whether they exploit their market power in traditional ways by cutting output and investment compared to other firms.

In this paper, we analyze panel data from over 70 countries over the period 1980-2017 to examine the incidence of star firms across different countries and industries. While World stars, defined as firms in the top 10% of return on invested capital (ROIC) worldwide in a given year, are more likely to occur in high income countries and in the manufacturing sector, an increasing share are from middle income countries and the services sector over time. In addition, nearly 40% of World stars are high intangible capital firms over our sample period, consistent with the rise of a new knowledge economy.

While star firms have higher markups than other firms, at each level of markups we find that star firms produce more and invest more than other firms. We also find no evidence that star firms are differentially exposed to competitive shocks compared to non-star firms. First, using cuts in import tariffs to identify exogenous intensification of competition, we find no evidence that the relationship between markups and star status is dampened by increase in competitive pressures. Second, we find that for those star firms that were members of cartels there is no evidence of a

decline in markups following the end of cartel membership.

Overall, we see little evidence that across the world, star firms are using market power to restrict output to generate super-normal returns for their investors or that they derive their market power from collusive and anti-competitive policies. While concerns about the potential for star firms to foreclose future competition may be warranted, our findings suggest that other factors, such as greater efficiency and/or intangible capital may drive the association between firm markups and star status.

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Figure 1: **Tariff Cuts across US Industries**

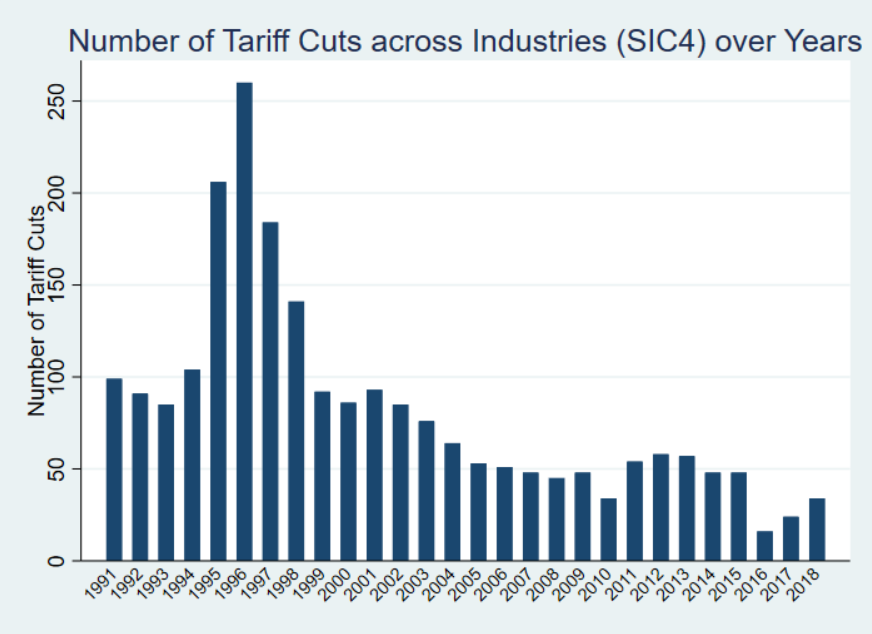

Figure 2: **Country Stars across Country Income Groups and Industry**

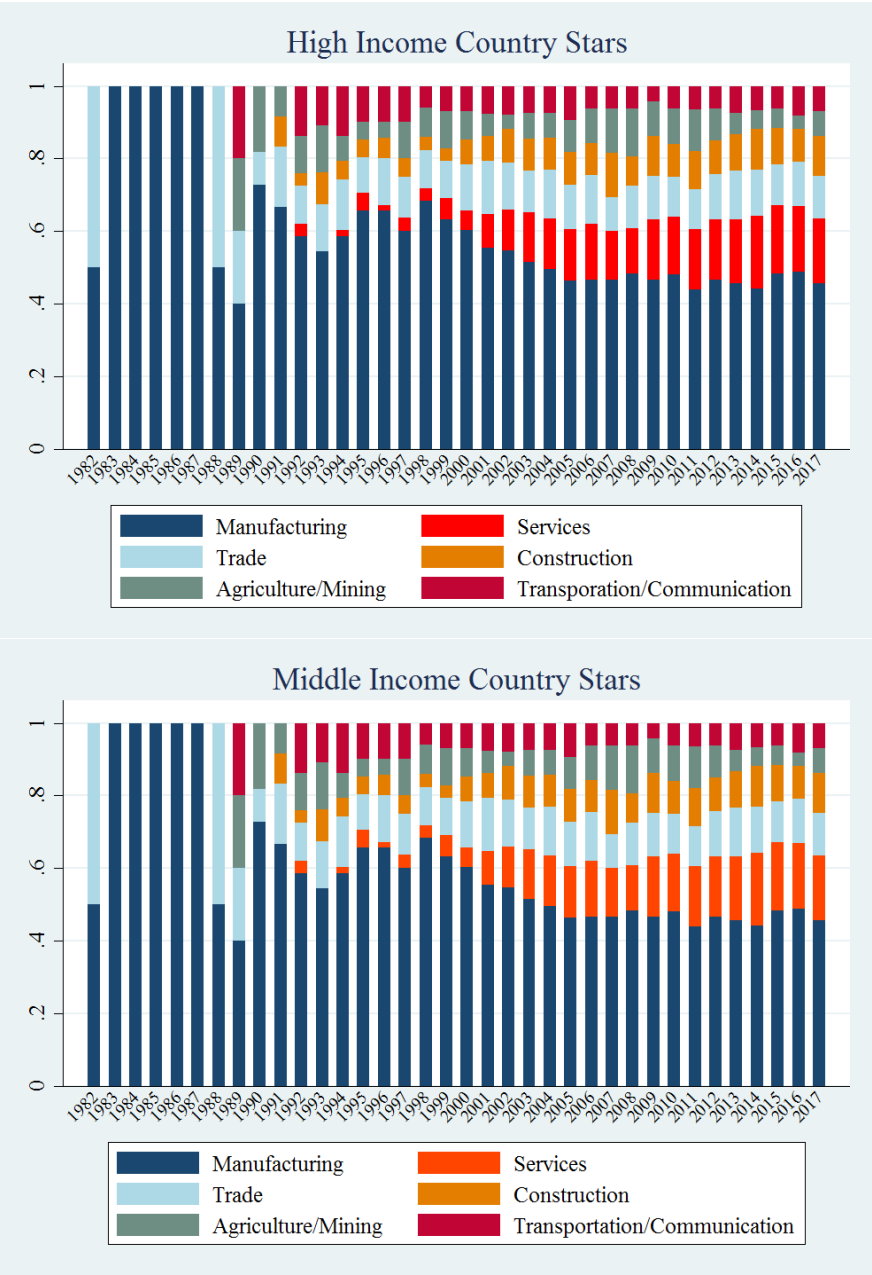

Figure 3: **Output and Markups over time**
This figure plots the binned scatterplots with robust pointwise confidence intervals and uniform confidence bands of Sales/Invested Capital on $Markups$ for $World$ stars and all other firms. $World$ $Stars$ are firms that are in the top 10% of $ROIC$ across the world in a particular year. $Markups$ are defined as Sales/Variable Cost where we use operating expenses with intangible capital adjustments as a measure of variable cost in estimation of markups.

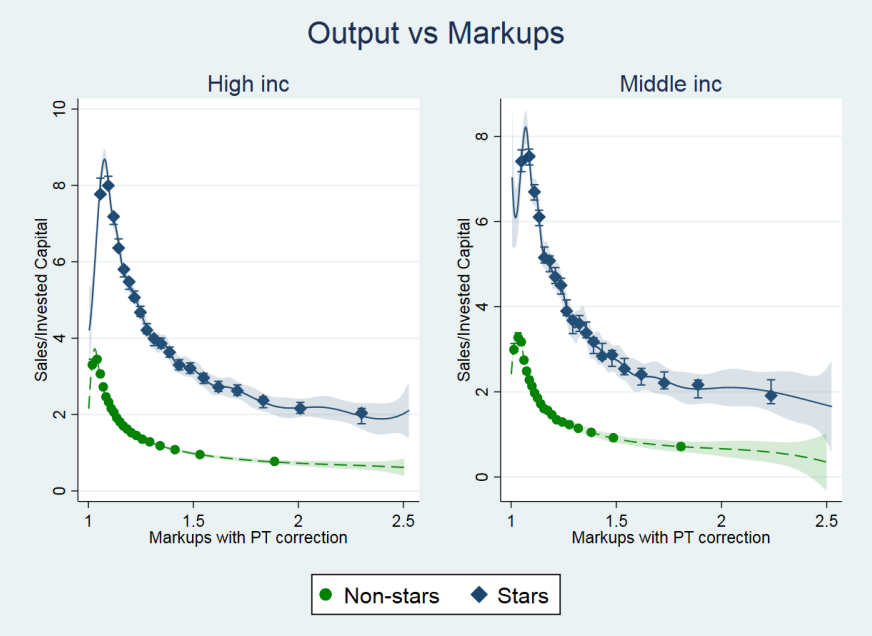

Figure 4: **Investment and Markups over time**
This figure plots the binned scatterplots with robust pointwise confidence intervals and uniform confidence bands of Capex/Invested Capital on *Markups* for *World* stars and all other firms. *World Stars* are firms that are in the top 10% of *ROIC* across the world in a particular year. *Markups* are defined as Sales/Variable Cost where we use operating expenses with intangible capital adjustments as a measure of variable cost in estimation of markups.

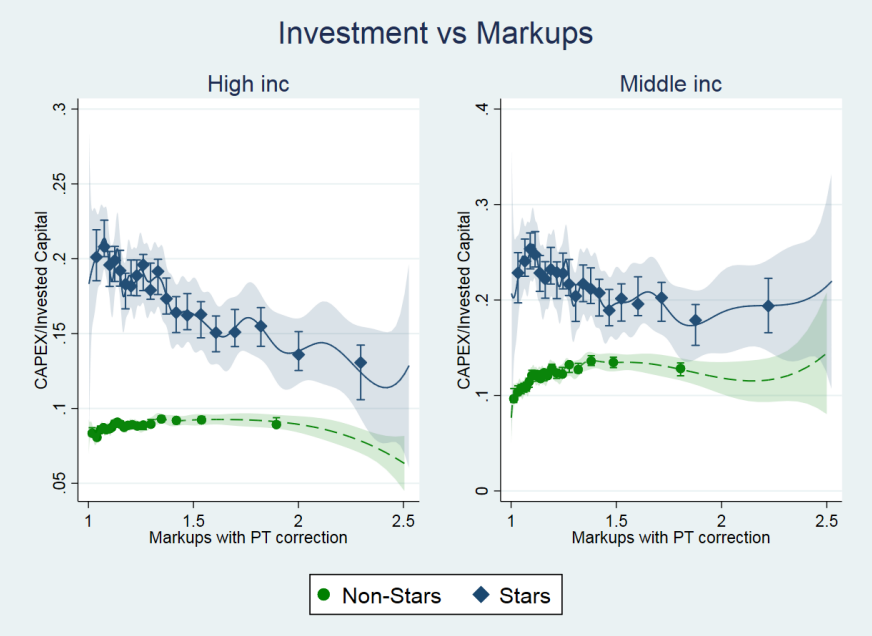

Figure 5: **R&D and Markups over time**
This figure plots the binned scatterplots with robust pointwise confidence intervals and uniform confidence bands of R&D Investment/Invested Capital on *Markups* for *World* stars and all other firms. *World Stars* are firms that are in the top 10% of *ROIC* across the world in a particular year. *Markups* are defined as Sales/Variable Cost where we use operating expenses with intangible capital adjustments as a measure of variable cost in estimation of markups.

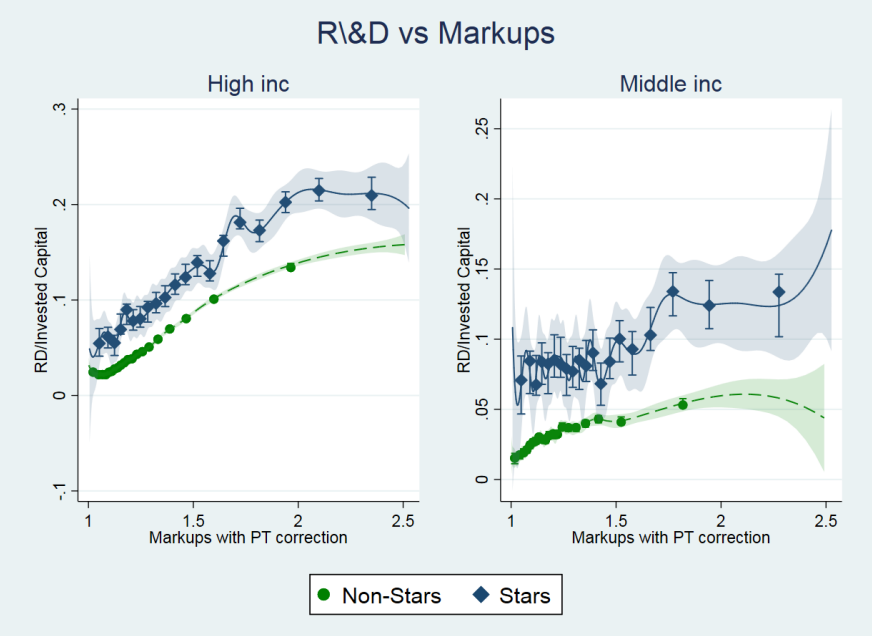

Table 1: **Star Firms across the World**

This table shows the distribution of World Stars by country income group, industry, and intangible capital to asset ratio. A firm is defined as a star firm if the firm i's $ROIC$ is above the 90^{th} percentile of $ROIC$ across all firms worldwide in a particular year and 0 otherwise. Panel A shows the percentage of firms in each country income group that are World Stars. The last column of panel B shows the percentage of high intangible capital firms that are star firms each year. High intangible capital firms are defined as firms with above median intangible capital/assets ratio in their country in that particular year. Detailed variable definitions are in the Appendix.

Panel A: Distribution of World Stars by Income Group

Year	High inc	Upper-mid	Low/Lower
1981	100.00%	0.00%	0.00%
1982	100.00%	0.00%	0.00%
1983	99.44%	0.56%	0.00%
1984	98.48%	1.52%	0.00%
1985	98.66%	1.34%	0.00%
1986	97.62%	2.38%	0.00%
1987	97.31%	2.69%	0.00%
1988	94.69%	5.31%	0.00%
1989	96.76%	3.24%	0.00%
1990	90.93%	9.07%	0.00%
1991	92.03%	7.97%	0.00%
1992	84.75%	11.07%	4.17%
1993	80.40%	12.69%	6.92%
1994	76.98%	16.31%	6.71%
1995	89.12%	7.51%	3.37%
1996	87.10%	9.11%	3.79%
1997	89.20%	8.64%	2.16%
1998	89.38%	7.41%	3.21%
1999	91.05%	6.17%	2.78%
2000	81.24%	16.71%	2.06%
2001	74.28%	23.13%	2.59%
2002	75.74%	20.99%	3.27%
2003	78.20%	19.72%	2.08%
2004	77.22%	20.92%	1.86%
2005	78.74%	19.06%	2.20%
2006	69.56%	22.83%	7.61%
2007	66.22%	24.43%	9.35%
2008	57.61%	31.10%	11.28%
2009	52.21%	35.56%	12.23%
2010	49.33%	38.18%	12.49%
2011	51.16%	37.09%	11.75%
2012	53.28%	36.22%	10.50%
2013	53.04%	34.90%	12.06%
2014	53.76%	33.28%	12.96%
2015	51.30%	36.13%	12.57%
2016	53.19%	33.57%	13.23%
2017	53.24%	32.84%	13.92%
Total	66.21%	25.68%	8.11%

Table 1: **Star Firms across the World (Continued...)**

Panel B: Distribution of World Stars by Industry

	01-14	15-17	20-39	70-89	50-59	40-49	
Year	Agri & / Mining	Construction	Manufacturing	Services	Trade	Transp. & /Commun.	High ICAP
1981	3.52%	4.93%	63.38%	15.49%	9.86%	2.82%	60.56%
1982	3.11%	9.32%	57.14%	17.39%	9.94%	3.11%	47.20%
1983	2.23%	8.38%	50.84%	22.35%	12.85%	3.35%	38.55%
1984	2.02%	6.06%	57.58%	15.15%	16.16%	3.03%	35.35%
1985	2.23%	7.59%	59.38%	14.73%	12.95%	3.13%	25.45%
1986	1.98%	5.95%	50.00%	17.86%	18.65%	5.56%	24.21%
1987	4.04%	7.41%	50.17%	18.18%	15.15%	5.05%	26.96%
1988	1.68%	7.26%	47.21%	19.83%	18.99%	5.03%	28.90%
1989	3.49%	7.48%	44.64%	19.45%	20.45%	4.49%	32.07%
1990	3.49%	8.60%	47.67%	17.67%	18.14%	4.42%	30.37%
1991	0.84%	10.27%	49.06%	15.72%	20.13%	3.98%	24.84%
1992	2.90%	6.72%	52.09%	17.97%	15.97%	4.36%	31.19%
1993	3.79%	7.91%	50.91%	19.77%	13.67%	3.95%	35.68%
1994	4.57%	6.71%	51.98%	17.68%	12.80%	6.25%	37.67%
1995	1.94%	4.40%	52.07%	25.00%	11.92%	4.66%	50.00%
1996	2.13%	3.67%	51.48%	25.56%	12.07%	5.09%	50.42%
1997	3.46%	3.46%	47.30%	28.40%	12.85%	4.54%	47.29%
1998	2.51%	2.61%	43.59%	35.17%	11.42%	4.71%	50.55%
1999	1.91%	2.69%	41.88%	36.66%	11.99%	4.87%	49.87%
2000	3.09%	3.48%	44.81%	31.51%	11.96%	5.15%	45.26%
2001	3.81%	3.45%	44.32%	28.38%	14.58%	5.46%	39.57%
2002	3.77%	4.02%	45.38%	26.21%	15.40%	5.22%	39.30%
2003	4.83%	3.88%	41.91%	28.76%	15.51%	5.11%	39.93%
2004	5.26%	3.66%	42.91%	28.89%	13.91%	5.36%	40.03%
2005	6.70%	4.10%	39.62%	31.37%	12.41%	5.80%	43.95%
2006	7.78%	5.84%	42.11%	27.80%	11.07%	5.40%	41.60%
2007	7.75%	6.96%	42.12%	27.07%	10.35%	5.74%	41.56%
2008	8.86%	6.69%	43.17%	24.95%	10.59%	5.74%	41.20%
2009	7.25%	7.01%	46.00%	23.93%	10.43%	5.38%	37.08%
2010	8.03%	7.24%	46.87%	22.24%	10.30%	5.32%	34.46%
2011	8.66%	8.04%	43.78%	23.88%	10.63%	5.02%	38.37%
2012	6.95%	7.18%	41.66%	26.95%	11.81%	5.44%	43.64%
2013	4.84%	7.98%	42.00%	26.96%	11.64%	6.58%	44.06%
2014	4.10%	8.23%	41.21%	29.37%	11.17%	5.92%	42.88%
2015	3.64%	8.55%	43.31%	29.07%	9.52%	5.91%	40.90%
2016	4.27%	8.47%	41.25%	30.40%	10.02%	5.60%	43.53%
2017	5.17%	8.95%	40.83%	29.38%	10.50%	5.17%	42.43%

Table 2: **Churning and Persistence**

Panel A: Classification of star firms by their status at t-4

	Top 10%	**Top 11-50%**	**Bottom 50%**
High Income	44.40%	34.80%	20.80%
Upper Middle Income	55.74%	31.17%	13.09%
Lower Middle Income	45.24%	41.67%	13.10%

Panel B: Classification of star firms by their status at t+4

	Top 10%	**Top 11-50%**	**Bottom 50%**
High Income	28.87%	47.42%	23.71%
Upper Middle Income	31.30%	46.92%	21.78%
Lower Middle Income	35.85%	49.06%	15.09%

Table 2: **Churning and Persistence (Continued...)**

Panel C: Future Performance of Star Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROIC		Sales Growth		Emp Growth		Labor Productivity	
$\text{Log(Assets)}_{\text{t-4}}$	4.403***	2.182***	-0.004	-0.004	0.000	-0.001	0.164***	0.150***
	(0.248)	(0.172)	(0.003)	(0.003)	(0.002)	(0.002)	(0.011)	(0.012)
$\text{Log(Age)}_{\text{t-4}}$	-0.133	-0.152	-0.049***	-0.052***	-0.033***	-0.034***	-0.050	-0.052*
	(0.739)	(0.582)	(0.006)	(0.006)	(0.005)	(0.005)	(0.031)	(0.031)
$\text{ROIC Star}_{\text{t-4}}$	43.589***		0.027***		0.036***		0.333***	
	(1.351)		(0.008)		(0.009)		(0.053)	
$\text{ROIC}_{\text{t-4}}$		0.465***		0.000		0.000***		0.003***
		(0.015)		(0.000)		(0.000)		(0.000)
N	22917	22917	21242	21242	13626	13626	19789	19789
adj. R-sq	0.397	0.660	0.096	0.094	0.119	0.122	0.397	0.405
Firm FE	N	N	N	N	N	N	N	N
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry X year FE	Y	Y	Y	Y	Y	Y	Y	Y

Table 3: **Markups and Star Status**

Panel A: Across all Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	World Star	World Star	Country Star	Country Star	LargeWorld Star	LargeWorld Star	LargeCountry Star	LargeCountry Star
L.Markups	0.134***	0.086***	0.140***	0.079***	0.074***	0.051***	0.079***	0.049***
	(0.008)	(0.010)	(0.008)	(0.009)	(0.007)	(0.008)	(0.006)	(0.007)
Size Quantile 2	0.004	0.004	0.003	0.010**	0.011***	0.017***	0.007***	0.013***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)	(0.002)	(0.003)
Size Quantile 3	0.010*	0.013*	0.011**	0.018***	0.063***	0.062***	0.056***	0.056***
	(0.005)	(0.007)	(0.005)	(0.006)	(0.003)	(0.005)	(0.003)	(0.005)
Size Quantile 4	0.024***	0.009	0.026***	0.026***	0.095***	0.073***	0.093***	0.072***
	(0.006)	(0.009)	(0.006)	(0.008)	(0.005)	(0.007)	(0.005)	(0.007)
10-15 years	-0.067***	-0.062***	-0.051***	-0.042***	-0.020***	-0.018***	-0.015***	-0.010***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
15+ years	-0.097***	-0.071***	-0.084***	-0.050***	-0.042***	-0.023***	-0.036***	-0.016***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)	(0.005)
L.Log(GDP/Capita)	0.049***	0.010	0.014	0.024	0.015	0.015	-0.003	0.011
	(0.016)	(0.019)	(0.013)	(0.017)	(0.012)	(0.016)	(0.011)	(0.015)
Industry x Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	N	Y	N	Y	N	Y	N
Firm FE	N	Y	N	Y	N	Y	N	Y
N	333364	329278	333364	329278	326329	322281	326329	322281
adj. R-sq	0.200	0.454	0.158	0.425	0.184	0.420	0.150	0.381
N_clust	42052.000	37984.000	42052.000	37984.000	41450.000	37420.000	41450.000	37420.000

Table 3: **Markups and Star Status (Continued...)**

Panel B: Tradeables vs. Non-tradeables

	1	2	3	4	5	6	7	8
	World Star	World Star	Country Star	Country Star	Large World Star	Large World Star	Large Country Star	Large Country Star
Sector	Tradeables	Non-tradeables	Tradeables	Non-tradeables	Tradeables	Non-tradeables	Tradeables	Non-tradeables
L.Markups	0.110***	0.071***	0.099***	0.066***	0.058***	0.046***	0.057***	0.044***
	(0.019)	(0.010)	(0.016)	(0.010)	(0.015)	(0.009)	(0.012)	(0.009)
Country FE	N	N	N	N	N	N	N	N
Industry x Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
N	175958	153320	175958	153320	172631	149650	172631	149650
adj. R-sq	0.430	0.475	0.397	0.443	0.384	0.449	0.338	0.410

Table 4: **Markups and Star Status - Heterogeneity across Intangible Capital**

	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
	World Star	World Star	World Star	World Star	World Star	Country Star	Country Star	Country Star	Country Star	Country Star
	Full	High Inc	Middle Inc	Tradeables	Non-Tradeables	Full	High Inc	Middle Inc	Tradeables	Non-Tradeables
L.Markups	0.123***	0.115***	0.149***	0.156***	0.103***	0.113***	0.124***	0.104***	0.146***	0.093***
	(0.012)	(0.012)	(0.023)	(0.023)	(0.013)	(0.010)	(0.012)	(0.021)	(0.018)	(0.012)
L.ICAP	0.026***	0.023***	0.038	0.055***	0.007	0.015**	0.019***	0.055	0.035***	0.003
	(0.007)	(0.007)	(0.058)	(0.013)	(0.008)	(0.007)	(0.007)	(0.056)	(0.012)	(0.008)
L.Markups x L.ICAP	-0.082***	-0.078***	-0.156***	-0.092***	-0.079***	-0.073***	-0.072***	-0.174***	-0.087***	-0.066***
	(0.009)	(0.009)	(0.058)	(0.013)	(0.012)	(0.008)	(0.008)	(0.065)	(0.013)	(0.010)
Industry x Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	324147	260541	62375	174173	149974	324147	260541	62375	174173	149974
adj. R-sq	0.457	0.453	0.491	0.432	0.478	0.429	0.444	0.446	0.400	0.448

Table 5: **Stars: Output and Investment**

	1	2	3	4	5	6	7	8	9
	Output	Output	Output	Investment	Investment	Investment	R&D	R&D	R&D
Sample	Full	High	Mid	Full	High	Mid	Full	High	Mid
L.World Star	0.826***	0.832***	0.746***	0.050***	0.042***	0.056***	0.024***	0.028***	0.013***
	(0.026)	(0.030)	(0.040)	(0.003)	(0.003)	(0.005)	(0.002)	(0.002)	(0.002)
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry x Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	403374	310060	92136	386911	295622	90064	186609	163461	21927
adj. R-sq	0.744	0.750	0.763	0.468	0.505	0.462	0.765	0.761	0.717

Table 6: **Import Tariff Cuts, Markups, and Star Status**

	1	2	3	4	5	6
	World Star	World Star	World Star	World Star	World Star	World Star
Sample	Full	Full	High Income	Mid Income	High Intan	Low Intan
L.Cut	-0.001	-0.085***	-0.019	-0.166**	-0.028	-0.109**
	(0.005)	(0.033)	(0.027)	(0.067)	(0.035)	(0.049)
L.Markup	0.131***	0.128***	0.095***	0.209***	0.139***	0.142***
	(0.009)	(0.009)	(0.008)	(0.019)	(0.010)	(0.013)
L.Cut x L.Markup		0.072**	0.019	0.134**	0.029	0.089**
		(0.029)	(0.024)	(0.059)	(0.031)	(0.045)
Country FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
N	334565	334565	269117	65448	185426	144288
adj. R-sq	0.114	0.114	0.099	0.178	0.155	0.133

Table 7: **Stars and Tariff Cuts: Output and Investment**

	1	2	3	4	5	6	7	8	9	10	11	12
	Output	Output	Output	Output	Investment	Investment	Investment	Investment	R&D	R&D	R&D	R&D
	High Income	Mid/Low Income	High Intangible	Low Intangible	High Income	Mid/Low Income	High Intangible	Low Intangible	High Income	Mid/Low Income	High Intangible	Low Intangible
Ł2.World Stars x L.Cut	0.190	0.236	0.115	0.230	-0.003	0.027**	0.024*	0.010	0.001	0.005	0.002	0.003
	(0.152)	(0.196)	(0.141)	(0.190)	(0.010)	(0.014)	(0.013)	(0.012)	(0.007)	(0.004)	(0.008)	(0.003)
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	152365	54086	103957	99558	145203	52928	101233	94288	96939	17000	73338	39101
adj. R-sq	0.260	0.294	0.282	0.293	0.173	0.172	0.177	0.152	0.368	0.353	0.365	0.286

Table 8: **End of Cartel Membership as a Shock to Markups**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups
Sample	All	All	Large	Large	All	All	Large	Large
	[-3,+5]	[-3,+3]	[-3,+5]	[-3,+3]	[-3,+5]	[-3,+3]	[-3,+5]	[-3,+3]
Treat	0.026**	0.024**	0.026**	0.025**	0.022**	0.019*	0.022*	0.019*
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.011)
Post	0.003	-0.003	0.003	-0.001	0.003	-0.003	0.003	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Treat x Post	-0.011***	-0.012***	-0.010**	-0.012***	-0.011***	-0.012***	-0.010**	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Lgcap	0.051***	0.044***	0.052***	0.045***	-0.085**	-0.103**	-0.089**	-0.104**
	(0.011)	(0.010)	(0.011)	(0.010)	(0.038)	(0.048)	(0.039)	(0.049)
Fixed Effects	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Country, Year	Cartel, Country, Year	Cartel, Country, Year	Cartel, Country, Year
N	101244	92787	99201	89950	101244	92787	99201	89950
adj. R-sq	0.170	0.194	0.171	0.165	0.176	0.200	0.178	0.172
N_clust	421.000	438.000	405.000	418.000	421.000	438.000	405.000	418.000

Table 9: **End of Cartel Membership: Stars and Non-stars**

	1	2	3	4	5	6	7	8
	Markups	Markups	Output	Output	Inv	Inv	R&D	R&D
Treated Firms	Stars	Non-stars	Stars	Non-stars	Stars	Non-stars	Stars	Non-stars
Treat	-0.002	0.030**	0.340*	-0.343***	0.052***	-0.004	0.022***	0.005***
	(0.023)	(0.012)	(0.185)	(0.046)	(0.013)	(0.003)	(0.006)	(0.002)
Post	0.002	0.003	-0.007	-0.012	-0.001	-0.001	0	0
	(0.002)	(0.002)	(0.015)	(0.014)	(0.001)	(0.001)	(0.000)	(0.000)
Treat x Post	0.012	-0.014***	-0.233*	0.023	-0.035***	0	-0.013***	-0.004***
	(0.018)	(0.003)	(0.129)	(0.028)	(0.010)	(0.002)	(0.004)	(0.001)
L.Log(GDP/Capita)	0.062***	0.055***	-0.831***	-0.654***	-0.071***	-0.059***	0.012*	0.013*
	(0.013)	(0.012)	(0.106)	(0.112)	(0.012)	(0.010)	(0.007)	(0.007)
Fixed Effects	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year	Cartel, Year
N	93458	100102	96703	103349	95692	102248	79353	84866
Adj. R-sq	0.165	0.171	0.185	0.18	0.228	0.216	0.123	0.132