Is there an investment gap in advanced economies? If so, why?[1]

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Abstract

We analyze private fixed investment across European economies and in the US over the past 20 years, focusing on tangible and intangible investment and the role of competition and financial constraints. In both regions, we find that investment is weak, but we argue that the reasons are more cyclical in Europe and more structural in the US. In the US, we find that investment is lower than predicted by fundamentals starting around 2000, and that the gap is driven by industries where competition has decreased over time. The decline in US investment has coincided with increased concentration and decreased anti-trust enforcement. In Europe, on the other hand, investment is roughly in line with measures of profitability and Tobin's Q for the majority countries, except at the peak of the crisis, most notably Spain and Italy. Unlike in the US, concentration has been stable or even declining in Europe, while product market regulation have decreased and anti-trust regulation has increased. Regarding intangible investment, we find that it accounts for some but not all of the weakness in measured investment. We also find that EU firms have been catching up with their US counterparts in intangible capital. The process of intangible deepening happens mostly within firms in Europe, as opposed to between firms in the US.

1   Introduction

There is widespread agreement that investment, and investment growth, has decreased across Advanced Economies including Europe (see, for example, (IMF, 2014)). The decline in investment has been discussed in policy papers (IMF, 2014; Kose, Ohnsorge, & Ye, 2017), academic research (e.g. Bussiere and Ferrara 2015) and the media.[5]

There is less agreement, however, on what has caused the decline in investment drop, whether it is permanent or transitory, and to what extent it can be explained by economic fundamentals. Some authors have emphasized weak aggregate demand

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[5]   See, for example, "Weak Investment Knocks German Economy", Wall Street Journal, Nov. 15, 2016; "Lean on me", The Economist, March 31, 2016

as an explanation (Bussiere & Ferrara, 2015), while others have emphasized financial constraints and increased uncertainty (particularly for stressed economies).

This paper aims to differentiate and quantify the contribution of these alternate hypotheses. The main contributions of the paper are to show that: (i) low investment in Europe is largely explained by depressed asset values (Tobin's Q); and (ii) the trends in Europe contrast with those in the US where investment is low despite high levels of Q. As discussed in (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016), the difference appears to be explained by rising concentration in the US

We start from the fact that two broad categories of theories can explain low investment rates: theories that predict low investment *because* they predict low Tobin's Q and theories that predict low investment *despite* high Tobin's Q. The first category includes explanations based on high risk premia or low expected growth. The standard Q-equation holds in these theories, so the only way they can explain low investment is by predicting low values of Q. The second category ranges from credit constraints to oligopolistic competition, and predicts a gap between Q and investment due to differences between average and marginal Q (e.g., market power, growth options) and/or differences between firm value and the manager's objective function (e.g., governance, short-termism).

In Europe, we find that asset values are low and that this explains the majority of the decrease in private fixed investment. In fact, investment relative to Q is not significantly below trend for Europe as a whole, as evidenced by fixed effects in Country- and Industry-level regressions. A wedge appears at the height of the financial and sovereign debt crisis. But it has largely closed since then.

Country and industry-level regressions leave large unexplained residuals, however, and we study several potential explanations. We focus in particular on financial constraints, rising intangible investments, and lack of competition. Testing these theories requires a lot of data, at different levels of aggregation. Some are industry-level theories (e.g., competition), some firm-level theories (e.g., financial constraints), and some theories that can be tested at the industry level and/or at the firm level. We therefore gather country-, industry- and firm-level data. Unfortunately, these data are not readily comparable, because they differ in their definitions of investment and capital, and in their coverage. As a result, we must spend a fair amount of time simply reconciling the various data sources. Much of the work is explained in Section 3 and in the Appendix.

Throughout the paper, we contrast recent investment patterns between the US and Europe. A clear fact emerges: investment in Europe is largely in line with Q while investment in the US is well-below trend. The gap can be explained by rising concentration across a wide range of US industries.

The remainder of this paper is organized as follows. Section 2 briefly discusses the literature. Section 3 discusses our data sample. Section 4 summarizes the empirical evidence on profitability, investment and competition in the US and Europe; and studies the behaviour of investment relative to Q. Section 5 discusses theories that

may explain gaps between Q and investment; while. Section 6 discusses the results of our tests. Section 7 concludes.

2   Related Literature

This paper relates to several strands of literature.

First and foremost, our paper adds to the literature documenting the sluggish recovery and associated weak investment in the Eurozone since the financial crisis. There is a broad literature discussing investment weakness in Europe and the world. We simply highlight key references. Most references highlight a mixture of weak demand, financial frictions and political uncertainty as drivers of weak investment.

(IMF, 2014) discusses weak investment globally and shows that private (business) investment is responsible for most of the investment slump, as opposed to public (or residential) investment. This evidence justifies our focus on business investment. (IMF, 2014) argues that weak demand, financial frictions and political uncertainty are the main drivers of weak investment. Similarly, (Bussiere & Ferrara, 2015) use an augmented accelerator model to show that decreases in expected demand go a long way in explaining the weakness in investment since the Global Financial Crisis. (Lewis & Menkyna, 2014) estimate investment gaps relative to the steady state and find gaps of around 2 percentage points or more in most OECD economies. They again highlight weak demand, financial factors and uncertainty. (ECB, 2016) discusses trends in investment before and after the Great Recession, and finds evidence that credit constraints have declined in recent years. (Vermeulen, 2016) compares investment in the US and Europe following the Great Recession, and highlights the relatively faster recovery of US investment. (Kose, Ohnsorge, & Ye, 2017) highlight weakness in investment growth in both developing and advanced economies.

Our results confirm the findings of (Kalemli-Ozcan, Laeven, & Moreno, Debt Overhang, Rollover Risk and Investment in Europe, 2015), that debt overhang and rollover risk have contributed to weak investment during the Eurozone crisis. Our paper adds to the literature by using Q-theory as the benchmark for investment, by studying differences in trends across asset types – highlighting the effect of rising intangibles – and by focusing on product market competition.

Second, our paper relates to the emerging literature that documents rising concentration in the US. The downward trend in business dynamism has been highlighted by numerous papers (e.g., (Decker R. , Haltiwanger, Jarmin, & Miranda, 2014)) but the trend has been particularly severe in recent years. In fact, (Decker R. A., Haltiwanger, Jarmin, & Miranda, 2015) argue that, whereas in the 1980s and 1990s declining dynamism was observed in selected sectors (notably retail), the decline was observed across all sectors in the 2000s, including the traditionally high-growth information technology sector. (CEA, 2016) discusses a perceived decrease in competition in the goods market. (Grullon, Larkin, & Michaely, 2016) study changes in industry concentration. They find that "more than three-fourths of U.S.

industries have experienced an increase in concentration levels over the last two decades" and conclude that "U.S. product markets [have] undergone a structural shift that has weakened competition." (Autor, Dorn, Katz, Patterson, & Reenen, 2017) link the increase in concentration with the rise of more productive, superstar firms. (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016) link the rise in concentration to weak investment; and they establish causality between Competition and investment in (Gutiérrez & Philippon, Declining Competition and Investment in the U.S., 2017).

This paper adds to the literature by contrasting concentration in Europe to the US. We find that concentration in Europe has not increased, possibly due to relatively more active antitrust enforcement than in the US in recent years. The relative competition hypothesis can explain why investment is roughly in line with Q in Europe while it is significantly below its predicted value in the US. If this hypothesis is correct, it would mark a reversal of the historical pattern where the US has traditionally led the way in fostering competition in goods and services.

Another related strand of literature concerns the growing role of intangible capital in light of recent advances in information technologies. (Corrado, Hulten, & Sichel, 2009) and (Corrado & Hulten, 2010) are among the early contributions that attempt to measure the intangible capital in US national accounts. Their approach is applied by (Falato, Kadyrzhanova, & Sim, 2013) to measure a stock of firm level intangibles, and has further been refined by (Peters & Taylor, 2016). While there have been advances in measuring intangible capital, there is still substantial measurement error, which may explain why investment is not fully captured by Q theory. In line with our findings that intangible-intensive industries and firms invest less, (Döttling, Ladika, & Perotti, The (Self-) Funding of Intangibles, 2016) argue that this may be due to the fact that intangible investments require smaller upfront outlays. (Döttling & Perotti, 2017) argue that this effect can account for some of the secular trends in the US economy since the 1980s.

3   Data

Testing the above theories requires the use of micro data. We gather and analyze a wide range of country-, industry- and firm-level data. The data fields and data sources are summarized in Table 1. Sections 0 and 3.2 discuss the country and industry datasets, respectively. Section 3.3 discusses the firm-level investment and Q datasets; as well as other data sources, including the explanatory variables used to test each theory. We discuss data reconciliation and data validation results where appropriate. Throughout the paper, we restrict results to those periods where available data suffices to reasonably represent the EU economy.

Table 1

Data sources

Data sources	Data Fields used	Granularity	Coverage	History	Notes
OECD National Accounts	Output (GOS, OS, etc.) from SNA Table 1	Country and sector	~EU28	1976-2015 for most countries	Supplemented with data from Bank of Spain and Bank of Italy
	Balance Sheet (Financial and Non Financial Assets) from SNA Tables 710R and 9B				
	Non-Financial Transactions (Capital Formation, etc.) from SNA Table 14				
OECD STAN	Output (GOS, OS), Capital (K) and investment data (I, NI)	Country and industry	~EU28; ISIC Rev. 4 Level 2	1976-2015 for most countries	Supplemented with KLEMS when missing
KLEMS EU	Output (GOS, OS), Capital (K) and investment data (I, NI)	Country, industry and asset type	10 EU countries 35 segments based on ISIC Rev. 4 Level 2 10 asset types	Starts between 1970 and 2000 depending on country. Ends on 2014.	
Compustat Global	Firm-level Financials	Firm-level	All public firms	As early as 1970; good coverage from 1990	Substantial missing data for some fields, even as late as 2005
BVD Amadeus	Firm-level Financials	Firm-level	Public and Private firms	1999-2014 following vintage merging	Substantial missing data for some fields,
Other EU aggregates not used in core analyses	R&D Expenditors from OECD ANBERD	Country and industry	~ ISIC Rev. 4 L2	1998-2013 for most countries	
	Business demographic from OECD SBDS	Country and industry	~ ISIC Rev. 4 L2	2004-2014; many countries only from 2010	
	Business demographic from Eurostat	Country and industry	~ ISIC Rev. 2 L2	2004-2014; many countries only from 2010	

3.1   Country data

Country-level data on funding costs, profitability, investment and market value is gathered from the OECD. We gathered data for the total economy of each country as well as the non-financial corporate sector. The time period of availability varies, but most series start to be widely populated from 1995 onward.

In particular, we source aggregate output data from SNA Table 1, sectoral financial balance sheet data from SNA Table 710R, Non-financial asset data from SNA Table 9B and Non-Financial Transaction data from SNA table 14A. The data appendix summarizes the data series and definitions used.

Non-financial assets data is not available in the OECD for Italy, so we source that information directly from the Bank of Italy.[6] Similarly, OECD databases provide no information for the non-financial sector of Spain. We gather that data directly from the Bank of Spain.[7]

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[6]   See http://dati.istat.it/Index.aspxhttp://dati.istat.it/Index.aspx

[7]   See http://www.bde.es/bde/en/secciones/informes/Publicaciones_an/Central_de_Balan/ http://www.bde.es/bde/en/secciones/informes/Publicaciones_an/Central_de_Balan/%20

We use these data in aggregate and country-level analyses discussed in Section 3 and Section 4.4; in the construction of aggregate Q; and to reconcile and ensure the accuracy of more granular data.

We define the Investment rate as the ratio of Gross fixed capital formation (NFP51P) to lagged Fixed Assets (N11). The depreciation rate as the ratio of Gross fixed capital consumption (NFK1MP) to lagged Fixed Assets; and the net investment rate as the Gross investment rate minus the depreciation rate. Note that we exclude changes in inventories and asset acquisitions from our definition of investment. We also compute the ratio of 'Gross fixed capital formation' to lagged 'Operating surplus and mixed income, gross' (NFB2G_B3GP) and refer to it as I/GOS; and the ratio of net investment ('Gross fixed capital formation' minus 'Gross fixed capital consumption') to net operating surplus ('Operating surplus and mixed income, gross' minus 'Gross fixed capital consumption'. We use current value for all of these calculations because chained values are not available for all countries – most notably Spain.

We also construct our empirical measure of Q using OECD data. Namely, we follow (Hall, 2001) and define

$$Q = \frac{V^e + (L - FA)}{P_k K}$$

where V_e is the market value of equity ('Equity, Liabilities'), L are the value of total liabilities.[8] Note that liabilities are mostly measured at book values, but this is a rather small adjustment, see (Hall, 2001). FA are financial assets (LFAS). For the US, we subtract the value of inventories from the numerator. Data on inventory values is not available for Europe. [9]

Similar calculations are performed for the US using data from FRED. See the data appendix for additional details.

3.2 Industry data

3.2.1 Investment and Output: OECD industry dataset

Our primary investment dataset is sourced from OECD STAN. OECD STAN is chosen as the basis for our analyses for two reasons: first it provides longer coverage than KLEMS; second, it covers a broader set of European economies (essentially all large countries are available). It also provides additional industry granularity which helps us validate our results and the accuracy of other datasets.

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[8]   Computed as `Financial liabilities' (LFLI) minus 'Equity, Liabilities' (LF5LI)

[9]   The above measure aims to isolate the value of productive capital in the numerator and denominator. An alternative measure is the "equity Q", which following (Piketty, 2014) is defined as $Q^{eq} = \frac{V^e}{P_k K + FA - L}$. Both series exhibit very similar trends at the aggregate, though differ in some cases at the country-level (see Appendix for more details). We use the traditional measure of Q in all our analyses.

STAN includes measures of private fixed assets (current-cost and chained values for the net stock of capital, depreciation and investment) and value added (gross operating surplus, compensation and taxes). It provides breakdowns by country and industry. Data is available as early as 1976 for some countries; but data for some countries does not begin until 2000 (e.g., Netherlands).

Using these data, we compute the gross investment rate as the ratio of Gross Fixed Capital Formation (GFCF) to lagged net capital stock (CAPN); the depreciation rate as the ratio of Fixed net investment rate as the ratio of Consumption of fixed capital (CFCC) to lagged net capital stock; and the net investment rate as the difference between gross investment rate and the depreciation rate. We use current replacement cost series for the reported results, but all conclusions are robust to using chained values. We also compute GOS/K, OS/K, I/GOS and NI/NOS. See data appendix for additional details.

Spain and Great Britain are not covered in the dataset, so we supplement them with KLEMS. Unfortunately, STAN provides a more granular segmentation than KLEMS. In order to map across datasets we must first map all STAN industry segments to KLEMS (see the next section and data appendix for details); and then replace the mapped gross investment rate and net investment rate for total gross fixed assets.

Similar calculations are performed for the US using data from the BEA; and the US industry segments (which are based on NAICS Level 3) are mapped to ISIC Rev. 4 segments. The mapping is not always perfect, but for most industries the categories are very similar. See data appendix for details.

3.2.2 Investment and Output: KLEMS industry dataset

The main downside of using STAN is that no granularity is available across asset types: data is only available for the total fixed capital. [10]

Thus, we use the 2016 release of KLEMS EU to complement STAN. KLEMS EU provides a great level of detail, but is available only over a short time period (1995 - 2014 for most countries; and only after 2001 for Germany). KLEMS also covers only a subset of European economies. Similar to STAN, KLEMS includes measures of private fixed assets (current-cost and chained values for the net stock of capital, depreciation and investment) and value added (gross operating surplus, compensation and taxes). It provides breakdowns by country, industry and asset-type from 1995 onward.

The dataset covers ten countries: Austria, Belgium, Germany, Spain, Finland, France, Great Britain, Italy, Netherlands and Sweden. We group all countries except Great Britain and Sweden into the 'EU KLEMS' grouping throughout the rest of the document, and report series for Great Britain separately where appropriate. Note

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[10]   R&D expenditures are also available from ANBERD but this dataset does not cover all industries, nor accounts for all intangible assets. We therefore use KLEMS for intangibles.

that only output data is available for Belgium. Belgium is therefore included in the EU KLEMS segment but excluded from regressions based on KLEMS.

Data is available at the sector level (19 groups) following the ISIC Rev. 4 hierarchy. Data for some sectors is further broken out (e.g., manufacturing is split into 11 groups). In principle, this leads to 34 categories; but capital data is not available for some of these groupings (e.g., for Wholesale and Retail trade). We use the most granular segmentation for which data is available, which corresponds to 31 KLEMS categories.

We then exclude Financials to focus on the corporate sector; and Real Estate given its unique experience during the crisis. We also exclude Utilities (Electricity, Gas and Water Supply); Public administration and defence; activities of households as employers; and activities of extraterritorial organizations given the influence of government actions on their investment and the limited coverage of Compustat Global for these industries. This leaves us with 25 industry groupings for our analyses. All other datasets are mapped into these 25 industry groupings.

Capital data fields include nominal and real fixed capital formation by asset type; nominal and real capital stock by asset type; as well as geometric depreciation rates used by KLEMS to compute capital services. Data is available for ten different asset types, which can be grouped into six segments:

- ICT Equipment: Computing equipment, Communications equipment,

- Intellectual Property Products: Computer software and databases, Research and development, Other IPP assets (which includes mineral exploration and artistic originals)

- Machinery and Equipment: Transport Equipment, Other Machinery and Equipment

- Cultivated assets

- Residential structures

- Other buildings and Structures

This breakdown allows us to (i) study investment patterns for intellectual property separate from the more `traditional' definitions of K (structures and equipment); and (ii) better capture total investment in aggregate regressions, as opposed to only capital expenditures.

It is important to note that KLEMS data on gross fixed capital formation, prices, and capital stocks is consistent with Eurostat and the OECD at most industry levels. However, depreciation rates at the more granular asset type-industry level are not part of the official System of National Accounts. Implicit depreciation rates can be derived from official data, but these are often highly volatile. KLEMS therefore reports and applies geometric depreciation rates to compute capital services.

The differences in depreciation rates implies that measures of capital stock from the Eurostat are not fully consistent with KLEMS measures of rates of return, rental prices and consequently capital services. Moreover, evolving capital based on the `net investment rate' implied by the KLEMS depreciation does not result in the next period's capital stock. These differences are typically small but can have material implications for some industries as shown in **Chart 2** below.

It is not clear how to address these discrepancies, so we use the KLEMS-implied depreciation rates to compute net investment at the granular asset-type level. Namely, we define country and industry-level gross investment rates as the ratio of 'Nominal gross fixed capital formation' to lagged `Nominal capital stock'; and net investment rates as the gross investment rate minus the geometric depreciation rate reported by KLEMS. Investment rates are computed for each asset type individually, as well as grouping assets into tangible and intangible assets – in which case we exclude residential structures. When combining asset types, we compute the depreciation rate by applying the KLEMS depreciation rates to the lagged levels of Capital within each country, industry and asset type. We use nominal values of capital and investment, but all results are robust to using chained-quantity indices.

Output data includes gross output, gross value added, compensation of employees and number of employees. We compute the Gross Operating Surplus as the 'Gross value added at current basic prices' minus 'Compensation of employees', and the Net Operating Surplus as the `Gross Operating Surplus' minus the total depreciation amount by country and industry implied from the capital dataset. OS/K is defined as the `Net Operating Surplus' over the lagged nominal capital stock.

3.3   Firm-level investment and Q data

3.3.1   Dataset

Firm-level data is used for two purposes: first, we aggregate firm-level data into industry-level metrics and use the aggregated quantities to explain industry-level investment behavior (e.g., by computing industry-level Q and Herfindahls). Second, we use firm-level data to analyze the determinants of firm-level investment through panel regressions (see Section 6 for additional details).

3.3.1.1   Compustat Global

Firm-level data is primarily sourced from Compustat Global – Fundamentals Annual, which is available through WRDS and includes all public firms in Europe. Data is available from 1987 through 2016. However, until the mid-1990s the data quality is relatively poor, and there are many missing values for some key variables. For example, before 1994 CAPX is missing for all firms in Austria and Germany. While we use data from 1990 to compute our variables of interest, these considerations lead us to mostly restrict our analysis to the years 1995 and later.

To compute market values, we merge the accounting data with Compustat Global - Security Daily. This dataset contains information about stock prices and outstanding shares for separate stock issues. It is not always obvious how to combine the different stock issues to calculate a company's total market value, and we refer to the appendix for a detailed description of our procedure. We compare our resulting market values to those obtained from the US Compustat-CRSP merged sample to validate our results.

The data is reported in several different currencies. We use exchange rates from the IMF International Financial Statistics to convert all values to Euros.[11]

We exclude firm-year observations with missing assets, or assets under €5 million. Since Tobin's Q and investment are central to our analysis, we also exclude observations with missing q, negative book or market equity, or strictly negative capital expenditures, R&D or SG&A expenses.

Firms are mapped to KLEMS industry segments using ISIC Rev. 4 codes. In order to more closely mirror the aggregate figures for the Non Financial Corporate Sector, we exclude utilities (KLEMS segments D35 to D39), financial firms (segments D64 to D66) and real estate (segment D68). As noted above, we also drop industry segments D84 ("Public administration and defence; compulsory social security") and D99 ("Activities of extraterritorial organizations and bodies"), since they have very little coverage and investment decisions are likely driven politically.

Most of our analysis focuses on firms incorporated in Eurozone KLEMS countries. Our final Eurozone sample has a total of 3244 firms, of which roughly a third is incorporate in France, and another third in Germany. We repeat some firm-level regressions using the entire sample of EU-28 firms. The final EU-28 sample has a total of 8052 firms, of which around 2500 are incorporated in the UK.

For comparisons with the US, we also source data from US Compustat from 1980 – 2016. We only keep firms with fiscal incorporation in the US and otherwise apply the same industry-mapping and sampling restrictions as on our European sample.

3.3.1.2   BvD Amadeus and Orbis

Compared to the US, a larger fraction of firms is held privately in European countries. For example, after applying our sampling restrictions, for the period 1995-2016 Compustat covers around 15 times as many US than German firms. In contrast, US GDP in 2016 is only around 5 times that of Germany.

One concern with using public firms is therefore that they do not adequately represent the European economy. While the aggregates computed from Compustat for investment and Q closely follow the industry and country data (see below), we

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[11]   Before the introduction of the Euro we convert to European Currency Units, the former official monetary unit of the European Union. Some firms still report in national currencies that have been replaced by the Euro (especially in 2000 and 2001). In these cases, we convert using the conversion rate that was fixed when the currency was replaced by the Euro. These conversion rates are available from the ECB

find that this is a larger problem when computing Herfindahls and other measure of competition. For this reason, we also use Bureau van Dijk's Orbis and Amadeus databases, which contain accounting information for private as well as public firms.

There are many problems with these databases, and a long, reliable and representative time series can only be obtained by merging different vintages of the Orbis and Amadeus databases. We are grateful to Sebnem Kalemli-Ozcan and Carolina Villegas-Sanchez for providing us with a historical time series of Herfindahls and Top-firm Market Shares computed based on the merged vintage dataset from (Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych, & Yesiltas, 2015). We refer to the original paper for details on the sampling and merging procedure.

Herfindahl's and Top firm shares were provided over the 1999 to 2012 period at two levels of granularity. First, at the country-industry level, treating each country as an isolated market. Second, at the EU-wide industry-level, treating all countries in the EU KLEMS sample as a single market.

Investment and capital definition

We consider two firm-level investment definitions. First, the `traditional' gross investment rate is defined as capital expenditures (Compustat item CAPX) at time t scaled by the stock of tangible capital at time t-1, which we measure as net Property, Plant and Equipment (item PPENT). The net investment rate is calculated by imputing the industry-level depreciation rate from KLEMS figures. In particular, note that the depreciation figures available in Compustat include only the portion of depreciation that affects the income statement, and therefore exclude depreciation included as part of Cost of Goods Sold. For consistency, and because we are interested in aggregate quantities, we assume all firms in a given industry have the same depreciation rate, and compute the net investment rate as the gross investment rate minus the KLEMS-implied depreciation rate in each industry.

Second, we estimate investment in intangibles using expenditures on R&D (item XRD) and a fraction of 20% of SG&A (item XSGA). These expenses represent investments in knowledge capital, organizational structure and brand equity.

A problem with measuring the stock of intangible capital is that firms do not report the value of most intangible assets on their balance sheet. Instead, accounting rules require firms to expense intangible investments, and deduct them from their earnings. We follow the common approach in the literature to calculate the stock of internally created intangible assets by capitalizing R&D and SG&A spending (e.g. (Döttling, Ladika, & Perotti, The (Self-) Funding of Intangibles, 2016; Döttling, Ladika, & Perotti, The (Self-) Funding of Intangibles, 2016) (Peters & Taylor, 2016) (Falato, Kadyrzhanova, & Sim, 2013))

The procedure uses the perpetual inventory method to capitalize past years' R&D spending. We use R&D depreciation rates from KLEMS, reported to be 20% for all

industries. Similarly, we capitalize a portion of 20% of SG&A expenditures, as it includes spending that enhances organizational capital.[12]

Compustat almost always adds R&D expenditures to SG&A. Therefore, we subtract R&D from SG&A, unless R&D exceeds SG&A. We follow the literature and set a depreciation rate of 20% for SG&A.

To calculate the initial stock of internally created intangibles, we divide the first positive, non-missing R&D and SG&A expenditure by the depreciation rate.[13]

A challenge in the European accounting data is that before the adoption of IFRS in 2005, many European firms were reporting in national accounting standards that do not separate out spending on SG&A. This is visible in the data, which has a lot of zero values for SG&A, especially before 2005. We confirmed with S&P that the zeros show up when SG&A is not reported in a national accounting standard. To adequately represent the growth of intangible capital before 2005, we interpolate SG&A spending whenever it shows up as zero, as described in more detail in the appendix. For intangible investment we do not want to use interpolated values, and instead set zero SG&A values to missing. We find that this procedure yields reasonable time series in the aggregate, that compare to investment data from national accounts.

The total stock of intangible assets is defined as the sum of capitalized R&D and SG&A spending, plus balance sheet intangibles (item INTAN) net of goodwill (item GDWL). We subtract goodwill, because it includes the market premium for tangible assets. Intangible investment is defined as the sum of R&D and 20% of SG&A at time t, scaled by total intangible assets at t-1.

Total capital is defined as the sum of PPE and intangible assets. Similarly, total investment is defined as the sum of CAPX and intangible investment at time t, scaled by total capital at t-1.

For comparability, we calculate intangible investment in the US in the same way as in Europe, except that we do not need to interpolate SG&A expenses. US GAAP requires companies to report SG&A throughout our sample period.

3.3.2 Definition of intangible intensity

Part of our analysis focuses on how investment patterns of intangible-intensive firms differ from those of that tend to invest more in physical assets. For that purpose, we define as a firm's intangible ratio the stock of intangible assets divided by its total capital (PPE plus intangibles).

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[12] A weight of 20% on SG&A is the common assumption in the literature, see e.g. (Falato, Kadyrzhanova, & Sim, 2013) and (Döttling, Ladika, & Perotti, 2016)

[13] This approach follows (Falato, Kadyrzhanova, & Sim, 2013). A more accurate approach calculates the initial stock of intangibles by imputing intangible investment backward to a firm's founding year (see (Peters & Taylor, 2016)). However, we do not have data on firm founding years.

We define as high intangibles (HINT) firms those in the highest tercile of the intangible ratio distribution in a given year, and as low intangibles (LINT) firms those in the lowest tercile.

3.3.3   Q definition

Firm-level stock Q is defined as the book value of total assets (AT) plus the market value of equity (ME) minus the book value of equity scaled by the book value of total assets (AT). The market value of equity (ME) is defined as the total number of common shares outstanding (item CSHOC from Security Daily) times the average monthly closing stock price in a given year (item PRCCD from Secuirty Daily). Book value of equity is computed as AT - LT - PSTK. (Peters & Taylor, 2016) propose a new proxy of Q that explicitly accounts for intangible capital. This new proxy (referred to as 'total Q') is shown to be a better proxy of both tangible and intangible investment. We also compute total Q as the market value of equity divided by the sum of the stock of tangible (PPENT) and intangible capital.

3.3.4   Financial constraints and other firm-level controls

One of our hypothesis is that firms may under-invest because they are financially constrained during the Eurozone crisis. To test this hypothesis, we identify firms that are more adversely affected by the crisis.

In particular, we calculate a firm's leverage as total debt (sum of items DLTT and DLC), divided by total assets (AT). We also compute a firm's maturity as long term debt (DLTT) divided by total debt. We interact these two measures with dummies for the Eurozone crisis, as described in more detail in section 6.

For firm-level regressions we compute several other controls. Cash holdings are defined as cash (CHE), scaled by total assets (AT). Firm age is computed as the number of years since a firm entered the sample, and firm size as total assets. To calculate operating surplus, start from a firm's operating income before depreciation (item OIBDP). From this, we subtract interest and tax expenses (items XINT and XTXT), and the depreciation numbers computed using KLEMS depreciation rates. Since spending on R&D and SG&A are investment rather than expenses, we also add back intangible investment net of depreciation. This way, we have a clear measure of a firm's income from operations.

3.4   Data validation

As described above, we rely on a variety of country-, industry- and firm-level datasets. Unfortunately, these data are not readily comparable. They differ in their definitions of investment and capital, and in their coverage. As a result, we must spend a fair amount of time simply reconciling the various data sources. This section summarizes some of the key reconciliation results across datasets.

Our primary reconciliation effort relates to firm and aggregate (country / industry) data. **Chart 1** compares I/K, NI/K, I/GOS and Q between the OECD country data for the Non Financial Corporate sector and the aggregate/median computed from our Compustat sample. As shown, the trends between Compustat and the OECD are largely similar across all measures. There are some differences – in terms of levels and trends. Differences in levels are primarily due to differences in definitions of capital between Economic and Accounting measures – where the former are used in National Accounts and lead to larger levels of capital; while the latter tend to depreciate assets `too quickly' leading lower stocks of capital. Differences in trends are likely due to differences in the behaviour of large public firms and smaller firms; and differences between accounting rules and NSI methodologies.

Chart 1

Reconciliation of National Accounts and OECD industry datasets
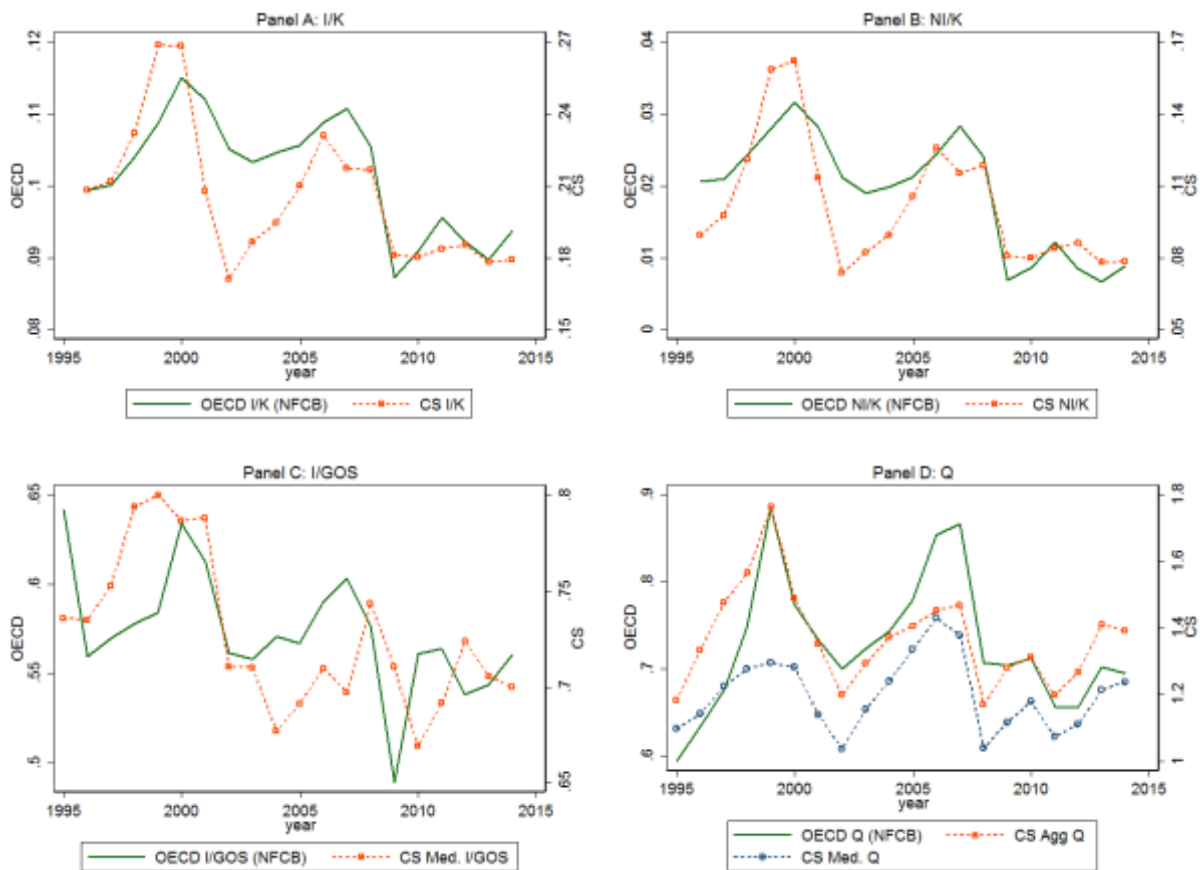
Sources: : Annual data for EU KLEMS countries. Data series for Non-Financial Corporate Sector sourced primarily from OECD, except for Spain and Italy for which some of the data

is sourced directly from the corresponding central banks (see Section 3 for more details). Capital stock for Italy back-filled from 1996 until 2000 using the mean ratio of NFCB fixed capital to total economy capital based on KLEMS. European series cover all countries from 1996 onward. Compustat series cover the same countries and exclude Utilities, Finance and Real Estate and a few other industries as noted in the text. Either the aggregate (i.e., weighted mean) or median is shown, as noted.
Notes: Figure compares I/K, NI/K, I/GOS and Q for the NFCB sector based on the OECD and across all firms in Compustat Global.

We also confirm that alternate aggregate sources (i.e., across OECD datasets and between OECD and KLEMS) yield similar time series. **Chart 2** compares STAN and KLEMS data for representative industries to highlight the key issues.
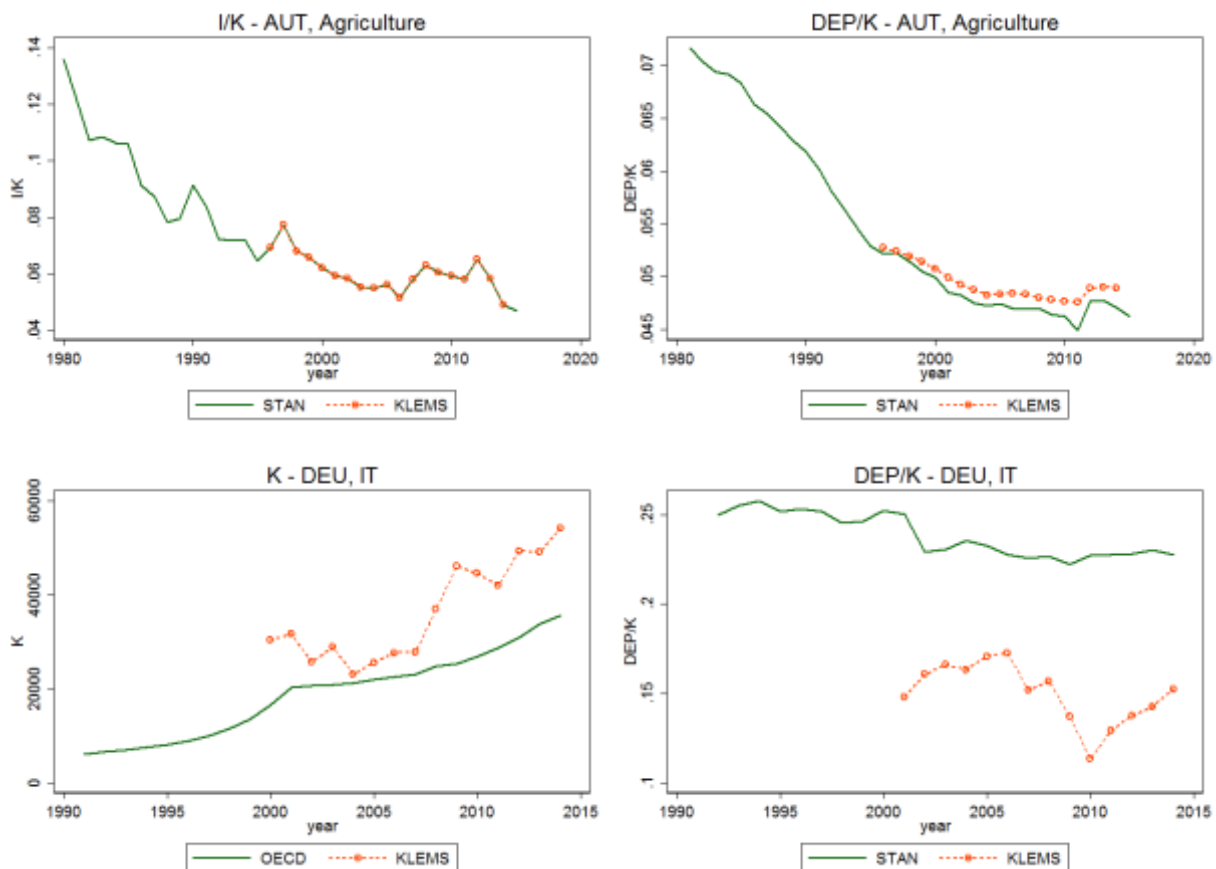
The top two charts are representative of most country-industry pairs: the level of capital stock and gross investment is almost always exactly the same across datasets. And the depreciation rate implied by KLEMS geometric depreciation rates is generally very similar from the depreciation rate reported in OECD STAN for all asset types. The KLEMS depreciation rate is typically more stable.

For some country-industry pairs, however, the series differ substantially. This is particularly true for information technology industries, which have a higher share of intangible assets. The bottom two plots highlight these issues focusing on the IT industry for Germany. As shown, the capital stock and depreciation rates can differ substantially in some cases. The differences in capital and investment rates disappear at a higher level of aggregation (i.e., combining all Information and Communication businesses) but they can be material at lower levels of granularity.

These issues affect primarily the capital stock of high intangible industries, which limits our ability to compare the stock of intangible capital between the US and Europe. We therefore use the share of investment in intangibles as our primary measure of intangible intensity.

Chart 2

Reconciliation of STAN and KLEMS industry datasets

Sources: Annual data from OECD STAN and KLEMS EU
Notes: Plots show a comparison of I/K, Dep/K or the level of capital for particular country-industry pairs, as noted in the title of each chart. Top two plots are representative of most timeseries and show that STAN and KLEMS values almost always align with each other. For some country-industry pairs (most notably information and communication industries), the series differ substantially. This is illustrated in the bottom two plots. The differences are primarily driven by differences in depreciation rates. See text for additional discussion.

4   Business Investment in Europe and the US

We present five important facts related to investment in Europe and the US in recent years. We focus on the non-financial sector for three main reasons. First, this sector is the main source of non-residential investment. Second, we can roughly reconcile country and industry data from the OECD with firm-level data from Compustat Global and Amadeus. Third, we can use data on the market value of bonds and stocks for the non-financial corporate sector to disentangle various theories of secular stagnation. And we can use capital and output data from STAN and KLEMS EU for a more granular measure of investment and depreciation across asset types – including intangibles.

For consistency throughout the paper, all results are based on the countries covered by KLEMS, unless otherwise noted. In particular, we refer to the combination of Austria, Belgium, Germany, Spain, Finland, France, Italy and Netherlands as 'EU KLEMS'. For comparison, we sometimes report time-series for Great Britain. See Section 3 for additional details on our sample. Results are robust to including a broader set of countries.

4.1   Fact 1: Investment is Low in the US and Europe

Chart 3 shows the net investment rate by the non-financial corporate sector. The left plot covers Great Britain and the Eurozone; and right plot covers the US. Note that these series include residential structures as well as intangibles.

As shown, gross investment in Europe remained relatively stable from 1995 until the financial crisis, at which point it drops substantially. This is not shown in the plot, but depreciation rates increase slightly in the early 2000s but decrease after the crisis. As a result, the trend in net investment is similar to the trend in gross investment: it remains flat and drops sharply after the crisis. Net investment in the US rises in the late 1990s with the Dot-Com bubble but drops drastically thereafter. It drops even further with the Great Recession.

Chart 3

Net Investment Rate (NI_t/K_{t-1}) for EU KLEMS and US
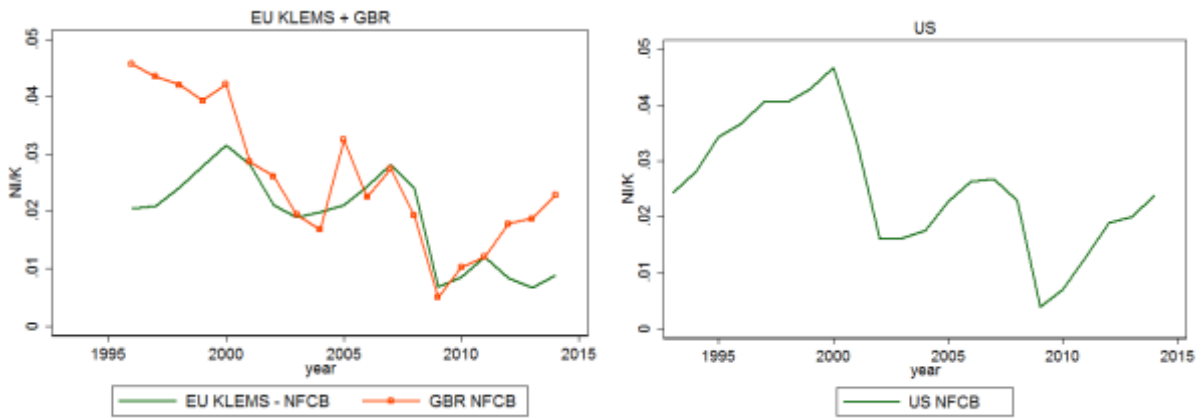
Sources: Annual data for Non-Financial Corporate sector. US data sourced from FRED. Data for European economies sourced primarily from OECD, except for Spain and Italy for which some of the data is sourced directly from the corresponding central banks (see Section 3 for more details). Capital stock for Italy back-filled from 1996 until 2000 using the mean ratio of NFCB fixed capital to total economy capital based on KLEMS. EU KLEMS series covers all countries from 1996 onward except for Finland which starts on 2001.

The composition of investment also exhibits very different trends (see **Chart 4**). In Europe, the share of Equipment decreased consistently since 2000, offset by an increase in the share of Intangible investment. The share of Structures has remained largely stable. By contrast, the share of intangibles in the US increased drastically during the 1990s, but has remained largely stable since the early 2000s. The share of intangibles increases at the height of the Great Recession as corporates cut down on Equipment investment, but returns to the 2003 level by 2015. Despite the rise in Europe, intangibles continue to account for a smaller share of investment in Europe than the US – although this may be in part due to differences in definitions.

Chart 4

Share of Investment by Asset type: EU KLEMS and US
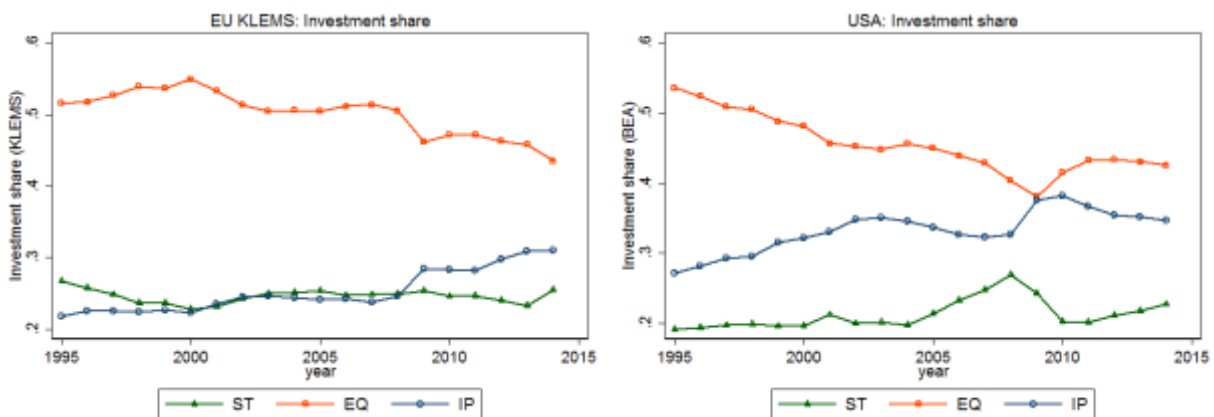
Sources: Annual data from EU KLEMS for Europe and BEA for US. Both series exclude Utilities, Finance and Real Estate. EU KLEMS series includes most countries since 1995 and all countries by 2000

4.2 Fact 2: Profits are High in US and Low in Europe

Figure **Chart 5** shows the operating return on capital of the non financial corporate sector, defined as net operating surplus over the replacement cost of capital:

$$\text{Net Operating Return} = \frac{P_t Y_t - \delta_t P_t^k K_t - W_t N_t - T_t^y}{P_t^k K_t}$$

As shown, the operating return for European corporates increased in the run-up to the crisis and decreased sharply thereafter. Profit remains substantially lower than pre-crisis levels. By contrast, profits in the US decreased in 2008 and 2009 but have since returned to peak levels.

Chart 5

Net Operating Return (OS_t/K_t) for Non Financial Corporate sector: Europe and US
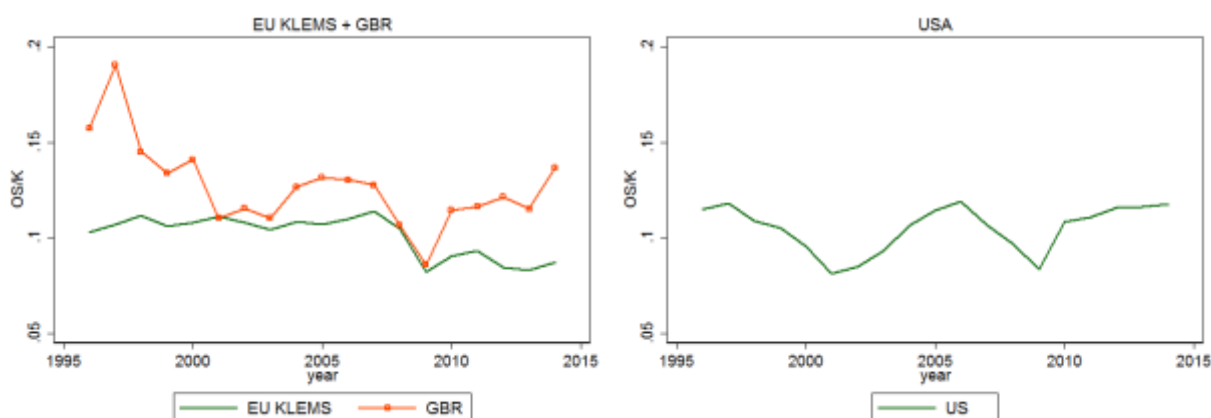
Sources: Annual data for Non-Financial Corporate sector. US data sourced from FRED. Data for European economies sourced primarily from OECD, except for Spain and Italy for which some of the data is sourced directly from the corresponding central banks (see Section 3 for more details). Capital stock for Italy back-filled from 1996 until 2000 using the mean ratio of NFCB fixed capital to total economy capital based on KLEMS. Eurozone includes all EU KLEMS countries as defined in Section 3, as well as Belgium; and covers all countries from 1996 onward except for Finland which starts on 2001.

One may think that investment is low because profits are low. And this is, in fact, part of the story. However, as shown in **Chart 6** it is not the full story. **Chart 6** shows the ratio of gross investment to gross operating surplus; and net investment to net operating surplus for the non financial business sector:
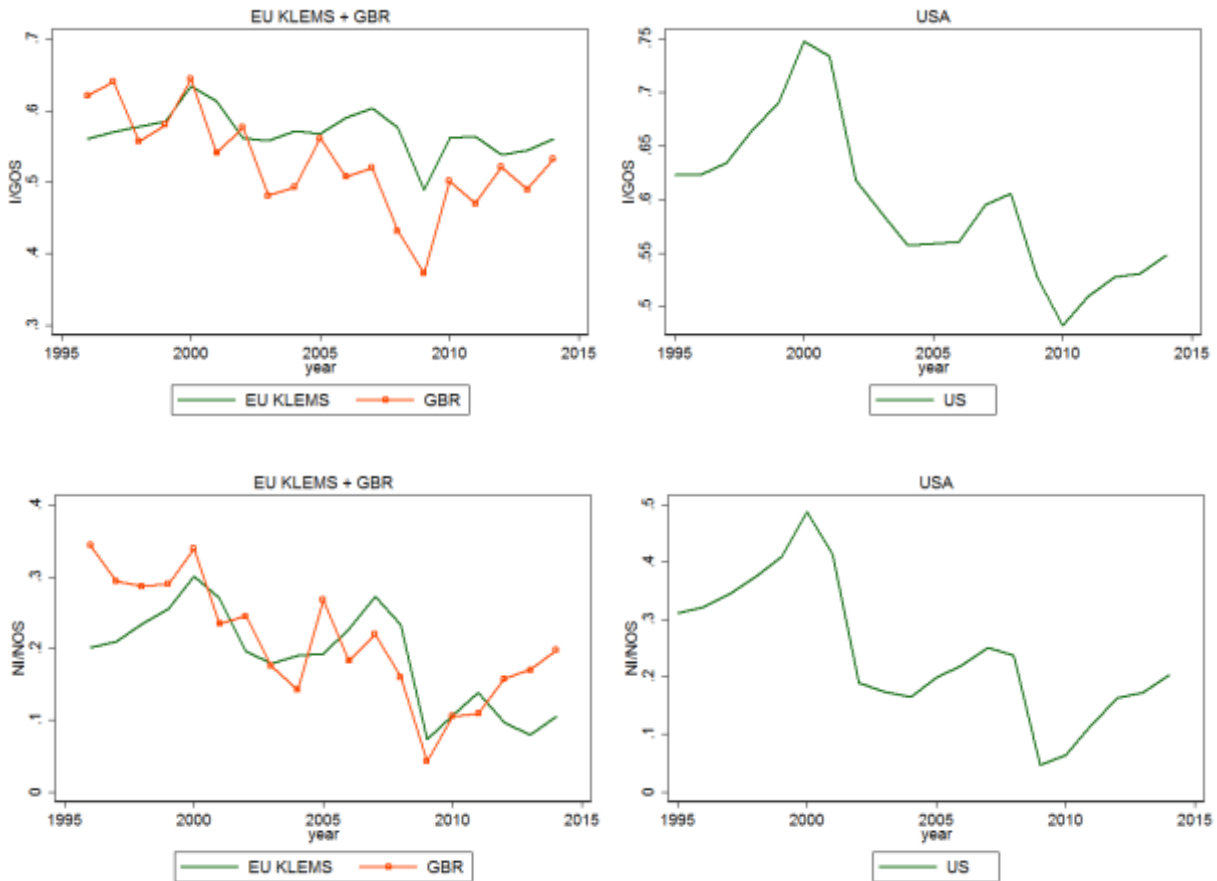
$$\frac{I}{GOS} = \frac{P_t^k I_t}{P_t Y_t - W_t N_t - T_t^y}$$

$$\frac{NI}{OS} = \frac{P_t^k (I_t - \delta_t K_t)}{P_t Y_t - \delta_t P_t^k K_t - W_t N_t - T_t^y}$$

As shown, the operating return for European corporates increased in the run-up to the crisis and decreased sharply thereafter. Profit remains substantially lower than pre-crisis levels. By contrast, profits in the UK and US have recovered since the Great Recession. In the US, profits have remained consistently near their historical peak since 2010.

Chart 6

Sources: Annual data for Non-Financial Corporate sector. US data sourced from FRED. Data for European economies sourced primarily from OECD, except for Spain and Italy for which some of the data is sourced directly from the corresponding central banks (see Section 3 for more details). Capital stock for Italy back-filled from 1996 until 2000 using the mean ratio of NFCB fixed capital to total economy capital based on KLEMS. EU KLEMS series covers all countries from 1996 onward except for Finland which starts on 2001.

4.3   Fact 3: Q is High in US and Low in Europe

Of course, economic theory does not say that NI/OS should be constant over time. Investment should depend on expected future operating surplus, on the capital stock, and the cost of funding new investment; it should rely on a comparison of expected returns on capital and funding costs. The Q-theory of investment captures this trade-off.

Consider a firm that chooses a sequence of investment to maximize its value. Let K_t be capital available for production at the beginning of period t and let μ_t be the profit margin of the firm. The basic theory assumes perfect competition so the firm takes μ as given. In equilibrium, μ depends on productivity and production costs (wages, etc.). The firm's program is then

$$V_t(K_t) = \max_{I_t} \mu_t P_t K_t - P_t^k I_t - \frac{\gamma}{2} P_t^k K_t (\frac{I_t}{K_t} - \delta_t)^2 + \mathbb{E}_t[\Lambda_{t+1} V_{t+1}(K_{t+1})]$$

where P_t^k is the price of investment goods. Given our homogeneity assumptions, it is easy to see that the value function is homogeneous in K. We can then define $\mathcal{V}_t = V_t/K_t$ which solves

$$\mathcal{V}_t = \max_x \mu_t P_t - P_t^k(x_t + \delta_t) - \frac{\gamma}{2} P_t^k x^2 + (1+x)\mathbb{E}_t[\Lambda_{t+1}\mathcal{V}_{t+1}]$$

where $x_t = \frac{I}{K_t} - \delta_t$ is the net investment rate. The first order condition for the net investment rate is

$$x_t = \frac{1}{\gamma}(Q_t - 1)$$

where

$$Q_t \equiv \frac{\mathbb{E}_t[\Lambda_{t+1}\mathcal{V}_{t+1}]}{P_t^k} = \frac{\mathbb{E}_t[\Lambda_{t+1}V_{t+1}]}{P_t^k K_{t+1}}$$

Q is the ex-dividend market value of the firm divided by the replacement cost of its capital stock; and γ controls adjustment costs.

Chart 7 shows the evolution of Q for the non financial corporate sector of EU KLEMS and Great Britain on the left and the US non financial corporate sector on the right. As shown, Q exhibits a highly cyclical pattern in both countries. Q for EU KLEMS countries remains well below pre-crisis levels. By contrast, Q for the US and UK exhibits much larger swings and a much stronger recovery. In both cases, Q has increased substantially since the Great Recession, reaching levels last seen in the early 2000s. The recovery aligns with the rise in corporate profits observed for the US and UK but not for EU KLEMS.

It is worth noting that Q for the EU KLEMS countries appears consistently lower than for the UK and US. This is consistent with results in (Piketty, 2014), who argue that lower levels are due to mixture of (i) over-estimation of capital; (ii) under-estimation of equity values; and (iii) differences in control rights valuation across countries.

Chart 7

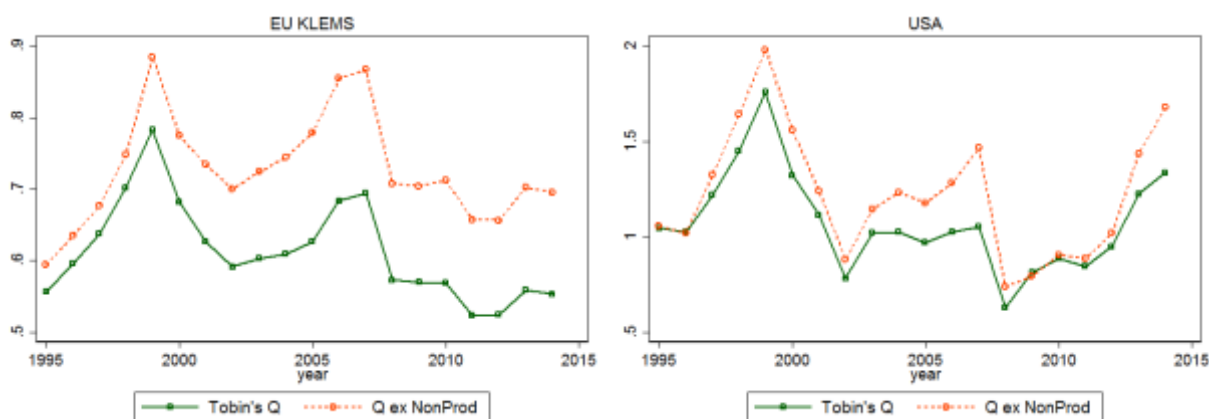Tobin's Q for Non Financial Corporate sector: Europe and US
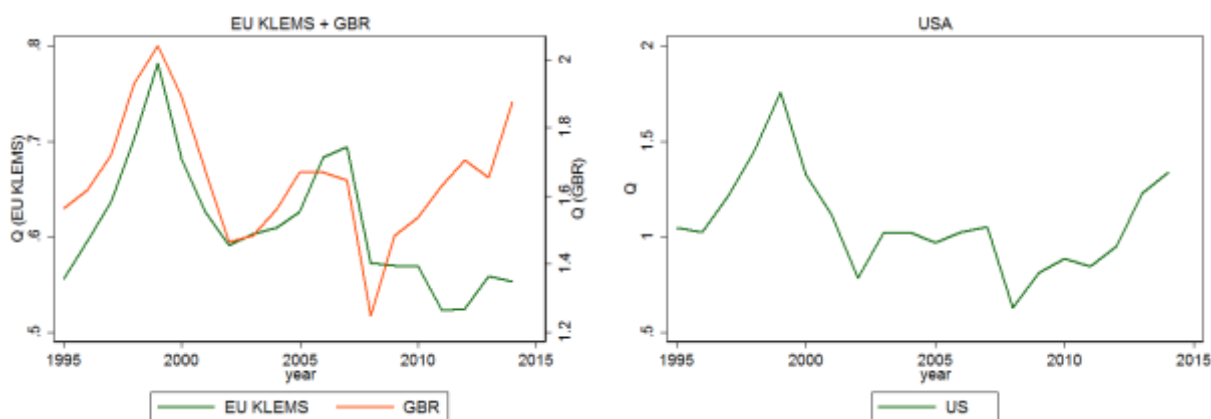
An issue we face constructing these measures of Q is that some countries do not report the value of non-produced assets for the non financial corporate sector (mainly land) while others combine the value of produced and non-produced assets. There are three alternatives: we can include only those countries where non-produced asset values are available; we can exclude non-produced assets from Q; or we can proxy for the value of non-produced assets.

The first option forces us to exclude several critical countries; so we do not consider it. Series for the next two are shown in **Chart 8**; where we proxy for missing values of non-produced assets as follows: if a country reports land asset values, we estimate the value of non-produced assets by applying the ratio of non-produced assets to land assets for those countries where data is available. If a country does not report land values, we estimate the value of non-produced assets based on the media ratio of produced and non-produced assets for those countries where data is available.

As shown in **Chart 8** excluding non-produced assets yields a higher measure of, which also exhibits an upward trend. We use Q with non-produced assets for our analyses, though results are robust to excluding them as long as we remove the trend / include year fixed effects. Importantly, the trends in these measures of Q are largely consistent with those observed from firm-level (see Section 3 for additional details).

Chart 8

Tobin's Q including and excluding Non-produced assets for Non-Financial Corporate sector: EU KLEMS and US

4.4 Fact 4: Concentration has been stable in Europe and rising in the US

Chart 9 plots mean sales Herfindahls for the EU and the US. (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016) show that low investment in the US is associated with rising concentration. The increase in concentration in the US is evident in the average Herfindahl, that has been trending upward since the early 2000s. The increase is even more pronounced when controlling for common ownership.

For the EU, Herfindahls are displayed both on an EU-wide level, treating the European Union as a single market, as well as on a country level, assuming nationally segmented markets. While we are not able to compute EU Herfindahls before 1999, they have been stable or decreasing since the beginning of our sample.[14] The mean country-level Herfindahl is comparable to the US – at least in the first years of our sample. On an EU-wide level, concentration is (mechanically) lower.

A similar picture emerges looking at the market share of the largest companies in the EU. **Chart 10** plots the fraction of sales by the largest 4 and respectively 50 companies, on an EU-wide and country-level basis. As above, the share of the top 4 firms has been stable or decreased, either when considering the EU as a single market or taking weighted averages across countries.

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[14]   We are in the process of expanding our European firm level data to the 1990s.
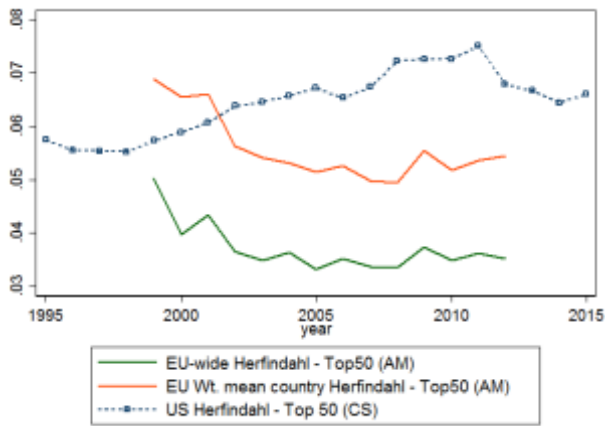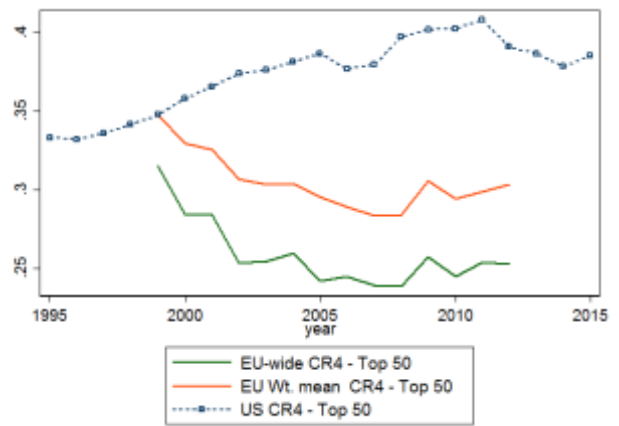
Chart 9

EU and US Herfindahls

EU-wide Herfindahl - Top50 (AM)
EU Wt. mean country Herfindahl - Top50 (AM)
US Herfindahl - Top 50 (CS)

Sources: European values based on Herfindahls and sales provided by Sebnem Kalemli-Ozcan and Carolina Villegas-Sanchez; based on the dataset constructed for (Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych, & Yesiltas, 2015). US Herfindahls from Compustat
Notes: EU-wide Herfindahl is computed treating the EU KLEMS countries as a single market. Country Herfindahls treat European countries as separate markets, and compute the EU average weighting by aggregate sales in a given industry. The US Herfindahl is computed using Compustat. All Herfindahls are computed based on the top 50 companies in terms of sales in a given industry

Chart 10

EU market share of largest companies in terms of sales

EU-wide CR4 - Top 50
EU Wt. mean CR4 - Top 50
US CR4 - Top 50

Sources: European values based on data provided by Sebnem Kalemli-Ozcan and Carolina Villegas-Sanchez based on the dataset constructed for (Kalemli-Ozcan, Sorensen, Villegas-Sanchez, Volosovych, & Yesiltas, 2015). US Herfindahls from Compustat
Notes: EU-wide market shares are computed treating the EU as a single market. Country-level market shares treat European countries as separate markets, and compute the EU average weighting by aggregate sales in a given industry

4.5 Fact 5: Investment is on-par with Q in most of Europe yet below Q in the US

Chart 6 above shows that investment has decreased for both Europe and the US, while **Chart 7** shows that Q remains depressed for Europe yet is high for the US.

This leads us to our first conclusion: investment in Europe is largely in-line with Q, while it is well-below Q for the US. We reach this conclusion by estimating time series regressions of net investment on Q, as shown in **Chart 11**. The top-left plot shows the actual and predicted net investment rate for the EU KLEMS sample based on a time series regression of net investment on Q from 1996 to 2009.

Based only on this plot, a gap between Q and investment appears starting on 2009. The bottom two charts separate Spain and Italy from the rest of EU KLEMS countries and show that the gap is concentrated in the former two countries – which were most heavily hit by the Great Recession. Combining the rest of EU KLEMS countries we find no investment gap – some of these countries exhibit a small investment gap (Germany and Belgium) while others exhibit some over-investment (Netherlands). But on the whole investment appears largely aligned with Q for these countries. The gaps appear to be explained by a rising share of intangibles.

The top-right plot shows the same result for US, except the regression is based on 1990 to 2001 (given the longer sample available and the presence of a gap as early as 2000 – see (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016) for additional discussion). As shown, investment has remained well below Q since 2000.

In unreported tests, we confirm these conclusions by studying the time effects of regressions of net investment on Q at the industry and country-industry level. See **Chart 12** in Section 6.1 for sample results for Europe.

Chart 11

Actual and Predicted Net investment by Non-Financial Corporate Sector: EU KLEMS and US
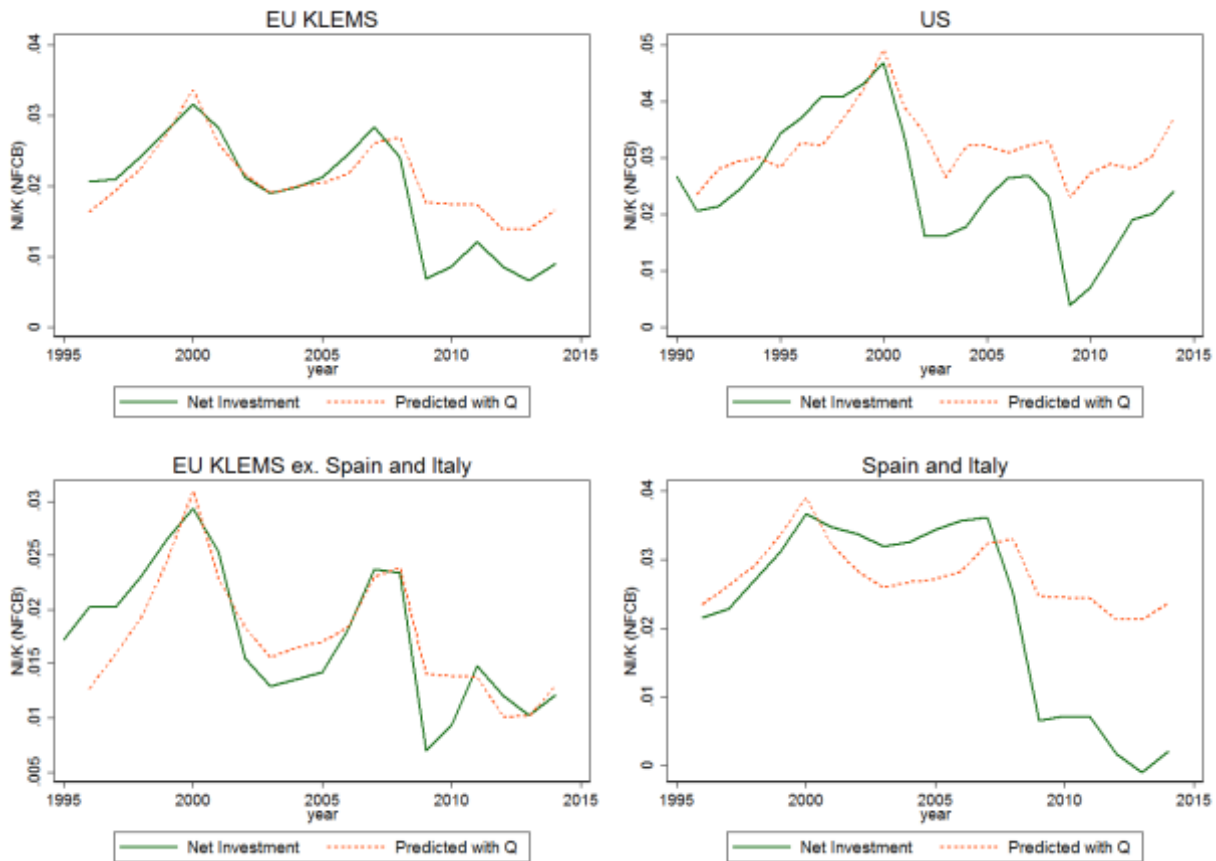
Sources: Annual data for Non-Financial Corporate sector. US data sourced from FRED. Data for European economies sourced primarily from OECD, except for Spain and Italy for which some of the data is sourced directly from the corresponding central banks (see Section 3 for more details).

Notes: Figure shows the actual and predicted net investment rate by for Non-Financial Corporate sector. Predicted series based on a regression of net investment on lagged Q from 1996 to 2009 for Europe and 1990 to 2001 for the US.

5   What might explain deviations from Q?

The above results highlight the presence of gap between investment and Q for some countries. Moreover, they leave large unexplained residuals. We therefore study alternate theories that may explain deviations between investment and Q.

The basic Q -equation (1) says that Q should be a sufficient statistic for investment, while equation (2) equates Q with the average market to book value. This theory is based on the following assumptions (Hayashi, 1982):

- no financial constraints;

- shareholder value maximization;

- constant returns to scale and perfect competition;

Deviations between investment and Q could be explained by a variety of theories – we consider the following three:

1. **Financial frictions:** A large literature has argued that frictions in financial markets can constrain investment decisions and force firms to rely on internal funds. See Fazzari et al. (Fazzari, Hubbard, & Petersen, 1987), (Gomes, 2001) (Moyen, 2004) (Hennessy & Whited, 2007) and (Hennessy & Whited, 2007). There is considerable controversy about the implications of financial frictions, of course, but this does not matter for our analysis because we are not interested in estimating elasticities. While financial frictions make internal funds relevant, it is not at all clear that they increase the sensitivity of investment to cash flows. (Kaplan & Zingales, 1997) and (Gomes, 2001) show that financial frictions might not decrease the fit of the Q equation much. show that industrial sectors that are relatively more in need of external financing develop disproportionately faster in countries with more developed financial markets. Thus, if certain sectors depend on external finance to invest and are unable to obtain the required funds, they may under-invest relative to Q. Financial constraints may differ between bank-dependent firms and firms with access to the capital markets. As a result, we also test whether bank dependent firms are responsible for the under-investment (see, for instance, (Alfaro, Beck, & Calomiris, 2015))This hypothesis is supported by recent papers such as (Chen, Hanson, & Stein, 2016), which shows that reductions in small business lending has affected investment by smaller firms (in the US).

2. **Intangibles:** The rise of intangibles may affect investment in several ways: first, intangible investment is difficult to measure and is therefore prone to measurement error. Under-estimation of I would lead to under-estimation of K, and therefore over-estimation of Q; and would translate to an observed under-investment at industries with a higher share of intangibles. Second, firms that invest a lot in intangibles may have lower overall investment needs. (Döttling, Ladika, & Perotti, The (Self-) Funding of Intangibles, 2016) argue that the creation of intangibles is supported by highly skilled employees who co-invest their human capital. Since employees are gradually paid over time, and often in the form of deferred compensation, this implies that intangible investments require smaller upfront outlays. Alternatively, intangible assets might be more difficult to accumulate. A rise in the relative importance of intangibles could then

lead to a higher equilibrium value of Q even if intangibles are correctly measured.[15]

3. Competition

(a) **Regulations & uncertainty**: Regulation and regulatory uncertainty may affect investment in two ways. First, increased regulation may stifle competition by raising barriers to entry. Second, per the theory of investment under uncertainty, irreversible investment in an industry may decline if economic agents are uncertain about future payoffs (see, for example, (Bernanke, 1983)). Thus, increased regulation and the associated regulatory uncertainty may restrain investment. Increases in firm-specific uncertainty may also lead to lower investment levels due to manager risk-aversion and/or irreversible investment (Dixit & Pindyck, 1994). We test this hypothesis using stock market return and sales volatility; and find some, albeit limited support.

(b) **Concentration:** A large literature has studied the link between competition, investment, and innovation (see (Aghion, Howitt, & Prantl, 2014) for a discussion). From a theoretical perspective, we know that the relationship is non-monotonic because of a trade-off between average and marginal profits. For a large set of parameters, however, we can expect competition to increase innovation and investment. Firms in concentrated industries, aging industries and/or incumbents that do not face the threat of entry might have weak incentives to invest.

6   Results

Armed with the requisite country-, industry- and firm-level data, we can analyze the determinants of country-, industry and firm-level investment. Throughout this section, we label firms with i, industries with j and countries with c.

We start by showing that EU-wide industry-level investment is strongly related to Q; both when considering total investment and when separating intangibles. We then discuss regression results at the country-industry-level, which allow us test for the impact of competition, intangibles and, to a lesser extent, financial constraints. Last, we report firm-level regression results. The latter allow us to test for the effect of intangibles and financial constraints.

It is well-known that OLS regressions of Q suffer from two problems: the slopes on Q are biased due to measurement error in Q; and the corresponding R^2 depends on

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[15] Intangibles can also interact with information technology and competition. For instance, Amazon does not need to open new stores to serve new customers; it simply needs to expand its distribution network. This may lead to a lower equilibrium level of tangible capital (e.g., structures and equipment), thus a lower investment level on tangible assets. But this would still be consistent with Q theory since the Q of the incumbent would fall. On the other hand, Amazon should increase its investments in intangible assets. Whether the Q of Amazon remains large then depends mostly on competition. Finally, intangible assets can be used as a barrier to entry. For all these reasons, we think that it is important to consider intangible investment together with competition.

the extent of measurement error. We report results based on simple panel regressions but also confirm that key conclusions are robust to using the cumulant estimator of (Erickson, Jiang, & Whited, 2014)].

6.1 Country-Industry results

Chart 11 shows that European investment has remained largely in-line with Q. In this section, we further test this hypothesis by studying investment at the country-industry level. This also allows us to test for the effect of alternate hypotheses (financial constraints and intangibles) on investment.

In particular, we expand the above panel regression to be based on country-industry level investment; and include additional measures for each theory:[16]

$$\frac{NI_{j,c,t}}{K_{j,c,t-1}} = \beta_0 + Q_{j,c,t-1}\beta_{1,j,c} + X_{j,c,t-1}\beta_{1,j,c} + \mu_c + \eta_t + \varepsilon_{i,t}$$

where, β_0, μ_c and η_t represent a constant, country fixed effects, and year fixed effects, respectively. $X_{j,c,t-1}$ denotes variables we include to test our hypotheses, including financial constraints, and intangible ratios; as well as industry-level controls. Country fixed effects control for stable heterogenous variation across countries such as long term growth rates; as well as data issues disproportionately affecting some countries (see data appendix for discussion). Time effects are included because our identification strategy relies on the cross-section. We control for average firm age in all regressions.

Table 2 shows the results of these regressions. Columns (1) to (5) are based on STAN investment rates; while columns (6) to (8) are based on KLEMS to separate across asset types.

For all regressions, we test whether country-industry level or EU-wide industry-level predictors exhibit stronger significance. EU-wide Q and Intangibles work better; while country-level Herfindahls works better. This suggests perhaps a more direct integration of asset markets than of product markets. That said, the significance of EU-wide Q is not primarily due to recent years: it is a more robust predictor over virtually all historical periods for which data is available. This is consistent with short term volatility in country-level premia that firms with long horizon might discount.[17]

The results show the stability of coefficients on Q across regressions and asset types. We emphasize the following points:

- Col 1: the coefficients are similar to those obtained for the US by (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016)

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[16]   Results using log-Q are similar to those using Q directly

[17]   Note that we do not use XTREG because this is not a `true' panel: observations across countries are highly correlated. We use AREG and confirm that coefficients are signficiant with a variety of treatment of standard errors.

- Col 2: adds the Herfindahl, which exhibits a negative coefficient.

- Col 3: adds the industry-average share of investment in intangible assets. If a decrease in the investment needs driven by the rise of intangibles explains low investment, the coefficient on intangibles ratio should be negative and significant – as observed.

- Col 4: combines Herfindahl and industry-average intangibles and finds that both are robust predictors of investment.

- Col 5: adds measures of financial constraints interacted with a recession dummy. This dummy takes the value 1 if a country is officially in a recession at any point in a given year. Industries with higher leverage and more short term debt cut investment more during recessions.

- Col 6-8 are based on KLEMS to separate tangible and intangible assets. These data are more noisy and the coefficients are similar in magnitudes but not significant in some cases – likely due to noise in measurement and depreciation.

In Column 8 we test the idea that the EU is catching up with the US in intangible investment. To do so we introduce the intangible investment gap, defined as the gap between the share of intangible assets in the US and Europe as of 2001. The intangible gap with the US is a strongly significant predictor of more intangible investment in Europe, consistent with the catching up hypothesis.

Table 2

Net Investment by Industry and Country.

	All Fixed assets						Tangible	Intangible
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time period	1995-2014	1999-2012	1995-2014	1999-2012	1999-2012	1999-2012	1999-2012	1999-2012
Data source	STAN	STAN	STAN	STAN	STAN	KLEMS	KLEMS	KLEMS
Median $Q_{j,t-1}$ (CS)	**0.020****	**0.017****	**0.018****	**0.015****	**0.015****	**0.011+**	**0.016****	
	[7.37]	[4.45]	[6.39]	[3.95]	[3.94]	[1.94]	[3.23]	
Median $Q_{cj,t-1}$ (CS)								**0.011***
								[2.80]
Herfindahl$_{cj,t-1}$ (AM)		**-0.037****		**-0.037****	**-0.035****	**-0.044****	**-0.042****	-0.03
		[-5.61]		[-5.42]	[-5.06]	[-4.02]	[-4.28]	[-1.03]
Intangible inv.share$_{j,t-1}$ (KL)			**-0.121****	**-0.125****	**-0.119****	**-0.088***	**-0.111****	-0.173
			[-3.75]	[-3.42]	[-3.24]	[-2.59]	[-3.17]	[-1.20]
Mean Leverage$_{cj,t-1}$ (CS)					0.014	-0.016	-0.011	-0.009
					[1.19]	[-1.39]	[-0.99]	[-0.33]
Recession dummy					-0.012+	-0.013*	-0.021**	0.036*
					[-2.03]	[-2.74]	[-3.46]	[2.66]
Mean Leverage$_{cj,t-1}$(CS) × Recession					**-0.043****	**-0.040***	**-0.043***	-0.05
					[-3.12]	[-2.50]	[-2.26]	[-1.23]
Mean Maturity$_{cj,t-1}$ (CS)					-0.002	-0.001	-0.005	0.014
					[-0.35]	[-0.17]	[-0.80]	[1.37]
Mean Maturity$_{cj,t-1}$(CS) × Recession					0.02	0.016+	**0.025****	-0.033
					[1.61]	[1.90]	[2.92]	[-1.41]
Intangible Gap '01 (KL and BEA)								**0.162****
								[4.54]
Mean LogAge$_{cj,t-1}$ (CS)	-0.014	-0.026*	-0.012	-0.022*	-0.022*	-0.015+	-0.013	-0.060*
	[-1.44]	[-2.53]	[-1.37]	[-2.27]	[-2.55]	[-1.85]	[-1.47]	[-2.43]
Observations	3616	2650	3616	2650	2650	2290	2290	2290
R^2	0.388	0.403	0.394	0.407	0.416	0.486	0.43	0.454
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Sources: Authors calculations based on annual data from OECD STAN, EU KLEMS, Amadeus and Compustat Global. Herfindahl's provided by Kalemli-Ozcan and Villegas-Sanchez
Notes: Table shows results of regressions of Net investment at the country-industry level on Q, along with alternate regressors. All regressions include a control for the average age of firms in a given industry. Column 1 includes only median Q across all firms in Compustat for a given industry. Column 2 adds the Herfindahl computed based on Amadeus for a given country-industry pair over the 1999-2012 period. Column 4 includes the share of investment in intangible assets for a given industry, computed based on KLEMS. Column 3 includes both the Herfindahl and Intangible investment share. Column 5 adds two measures of financial constraints (leverage and maturity) interacted with a recession dummy defined for each country. Column 6 shifts to KLEMS data. Results are fairly stable although the coefficient on Q is lower. Column 7 focuses on tangible assets and shows that financial constraints disproportionately affect these types of assets. Column 8 focuses on intangible investment and adds the gap between the share of intangible assets in the US and Europe as of 2001 as a predictor. It shows that (i) financial constraints have a lower effect on intangible assets and (ii) that industries with a larger investment gap invested more on intangible assets relative to Q. T-stats in brackets. Standard errors clustered at the industry level. + p<0.10, * p<0.05, ** p<.01.

Our benchmark for investment is the Q-equation. To assess the extent to which our hypotheses can explain the investment gap, **Chart 12** shows the time-series of time effects from country-industry regressions on Q, along with the corresponding mean. Note that net investment (the dependent variable of the regression) is not de-meaned so average time effect need not be zero.

The top left plot includes only industry, country and time fixed effects, and shows that investment decreased after 2000

The top right plot adds Q and Age and shows that these two variables explain the majority of underinvestment; but a drop remains. This corresponds to column 1 above.

The Bottom left adds intangible share and financial constraints and shows that time effects no longer exhibit a clear trend or drop. Our explanatory variables appear to explain the drop in investment. This corresponds to column 4 above but excluding the Herfindahl to cover a longer time period.[18]

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[18] Similar results are obtained separating asset types or considering EU-wide industry level regressions; but are not reported for brevity.

Chart 12

Time effects of Country-Industry regressions, by predictor variables included
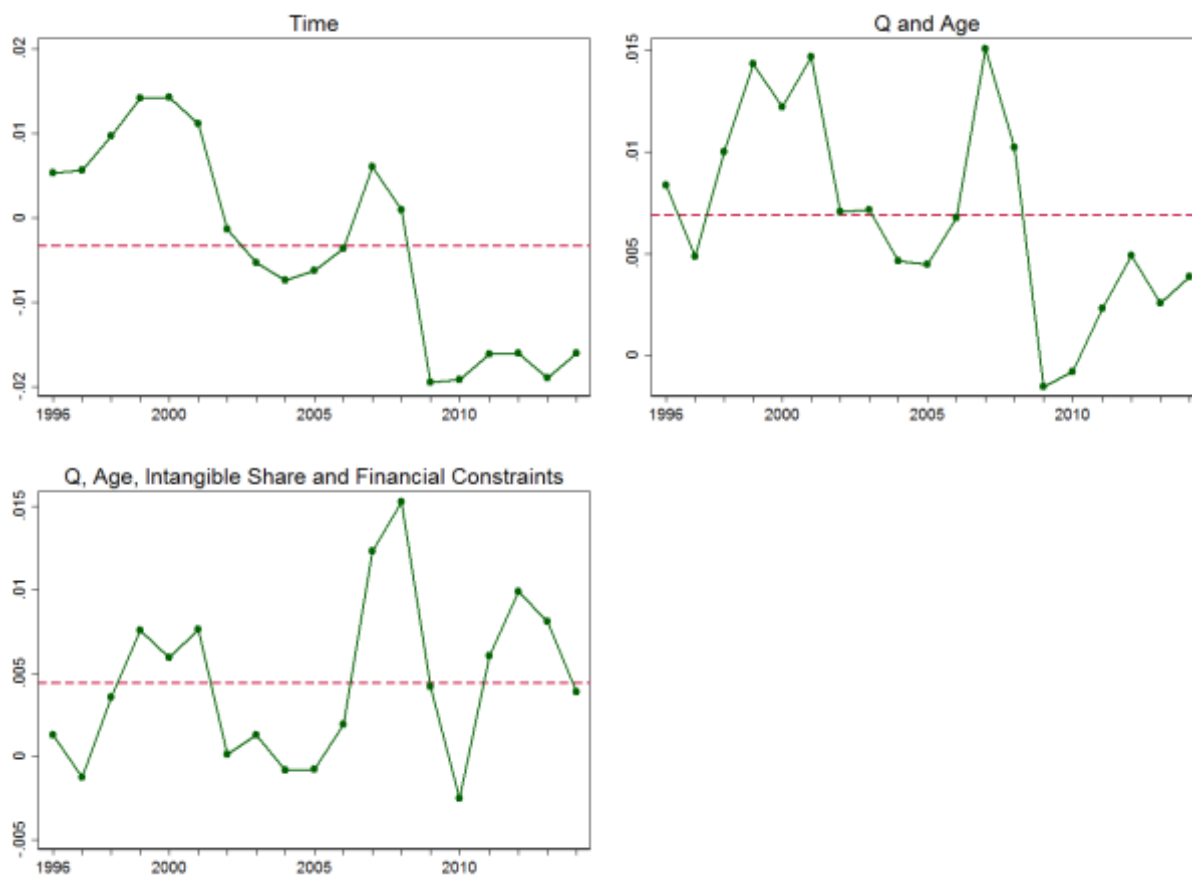
Sources: Annual data. Aggregate data sourced from BEA for US and KLEMS for Europe. Exclude Finance, Real Estate and Utilities. Compustat data from Compustat Global for Europe and Compustat NA for US.

6.1.1   Concentration: detailed discussion

The results in **Table 2** highlight the effect of concentration on investment; and section 4.4 notes the differences in trends between the US and Europe. In Europe, we see weakly decreasing concentration and this has a limited impact on investment. On the other hand, concentration is rising in US and this has a fairly large effect on investment, as argued in (Gutiérrez & Philippon, Investment-less Growth: An Empirical Investigation, 2016).

To further highlight the differences between Europe and the US, **Chart 13** studies investment patterns at the top 5 concentrating industries in the US (excluding Textiles for which concentration does not reflect decreasing competition but rather increasing *foreign* competition). The series are aggregated across industries based

on the US share of sales for Herfindahl and US share of capital for I/K and NI/K to ensure a common weighting of industries.[19]

We find that, in these industries, investment has decreased much more in the US than in Europe. The differences in investment also appear when controlling for Q through regressions. These differences are likely due to decreased competition. Differences in concentration trends suggest that factors other than economies of scale/network effects are at play, since these would presumably have similar effects in both regions. This questions the "superstar firm" explanation and suggests a role for policy.

Chart 13

Comparison of concentration and investment at Top 5 concentrating industries in US
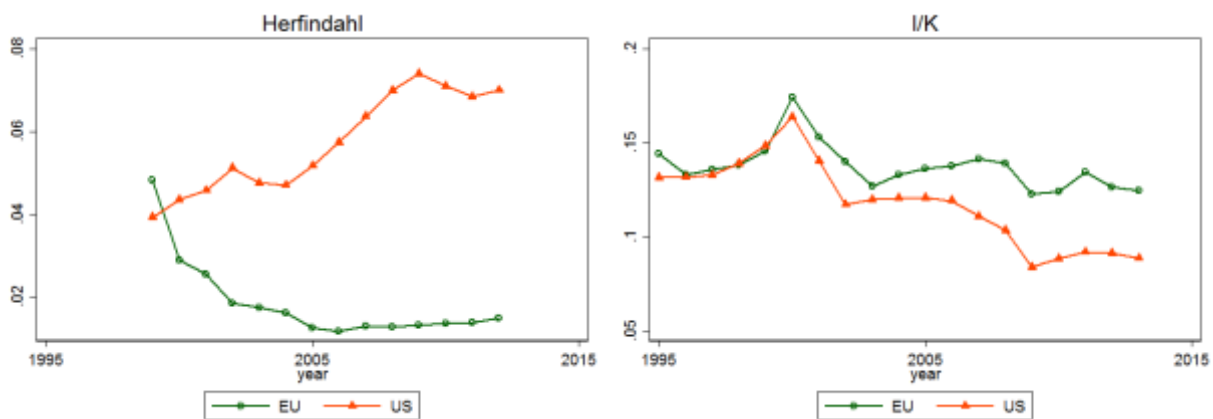
Sources: Authors calculations based on annual data from OECD STAN, Amadeus and Compustat.
Notes: Figure based on the top 5 concentrating industries in the US after excluding Manufacturing – Textiles which is heavily affected by Chinese competition (results are similar including Manufacturing - Textiles). These industries include Information Telecom, Arts and Recreation, Wholesale and Retail trade, Other Services and Information Publishing. First chart shows the weighted average Herfindahl across these industries, weighted by sale. The second chart shows the weighted average investment rate, weighted by capital stock, As shown, concentration increased drastically in the US while decreased for Europe. Investment in Europe appears relatively stable – especially compared to the US where it decreases drastically.

This begs the question of what may explain the rise in concentration in the US? Gutiérrez & Philippon argue that regulations and reduced anti-trust enforcement have played a role.

In the EU, on the other hand, **Chart 14** shows the OECD Indicators of Product Market Regulation (PMR) across EU KLEMS countries as dots and the US as the line.[20] PMR has decreased drastically for all EU economies, while it has remained stable for the US. If we take this evidence at face value, it suggests that the US used to be more competitive, but that is no longer the case.

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[19]   Note that US concentration is based on Compustat while EU concentration is based on Amadeus. EU Herfindahl assumes EU is one market, but trend similar at country level.

[20]   The PMR are a comprehensive and internationally-comparable set of indicators that measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable. They measure the economy-wide regulatory and market environments in 35 OECD countries in 1998, 2003, 2008 and 2013; they are consistent across time and countries. Not all years are available for all countries. For further details see (Koske & Barbiero, 2015).

Chart 14

OECD Economy-wide Product Market Regulation (PMR) Indices: US vs. Europe
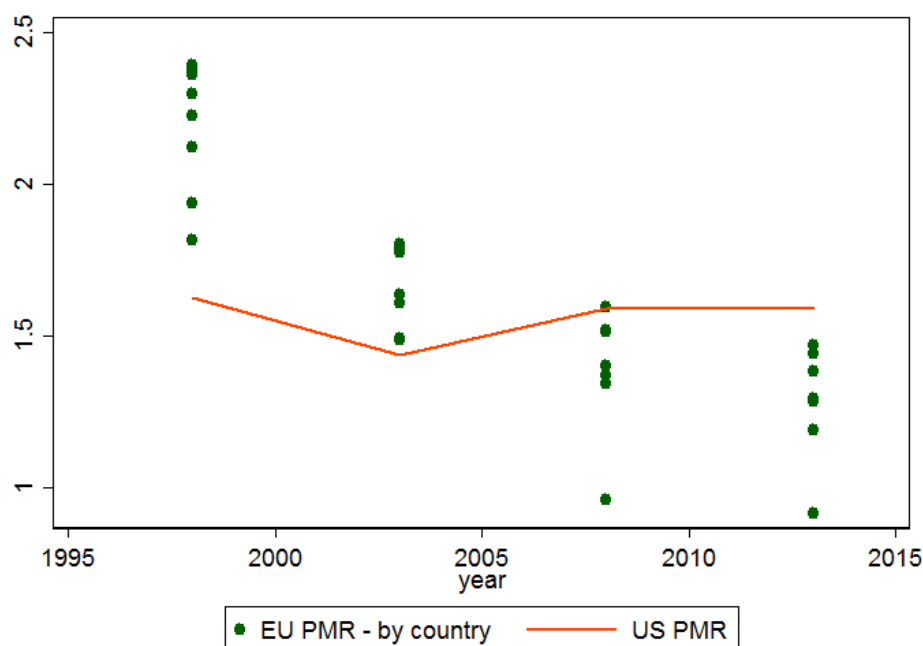
Sources: OECD indicators of Product Market Regulation (PMR). PMR indices are a comprehensive and internationally-comparable set of indicators that measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable.

6.1.2   Intangibles: detailed discussion

Intangible investment is a critical driver of productivity growth. Historically, Europe has lagged the US in intangible investment. We want to understand if and when the EU has closed this intangible gap. We reaching three broad conclusions.

First, we find fairly clear evidence of catching up. The EU appears to be closing the intangible gap.[21] Second, the gap is being closed by older firms, in contrast to the US where high intangible firms appear to be younger. Third, Europe appears to lead the US in certain industries while lag in others; and the differences are highly persistent.
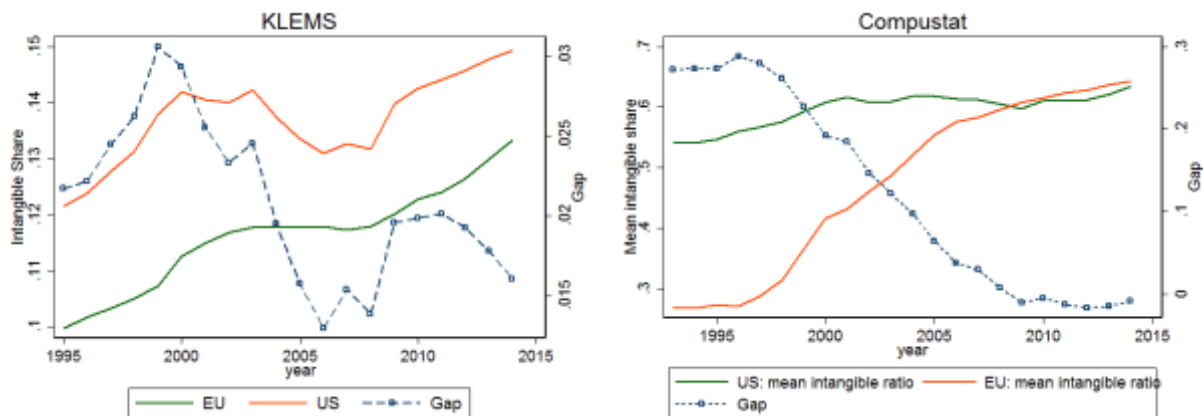
Chart 15 compares the share of intangibles as a percent of total capital for the US and EU – as measured in KLEMS (left) and Compustat (right).

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[21]   The data for the capital stock is noisy, however. Depreciation assumptions vary widely for the EU, and are often much higher than in the US. This has material implications for capital accumulation and the comparison of intangible capital stock across geographies. Indeed using Compustat and the (Peters & Taylor, 2016) definition of intangible the gap appears to be fully closed; while using national accounts, a substantial gap remains.

Both figures show that Europe has substantially closed the gap; though the decrease is far more pronounced when using Compustat.[22] This is likely for two reasons: (i) high depreciation assumptions in national accounts; and (ii) the catch-up in Europe appears to be driven by larger, older firms, as we discuss below.
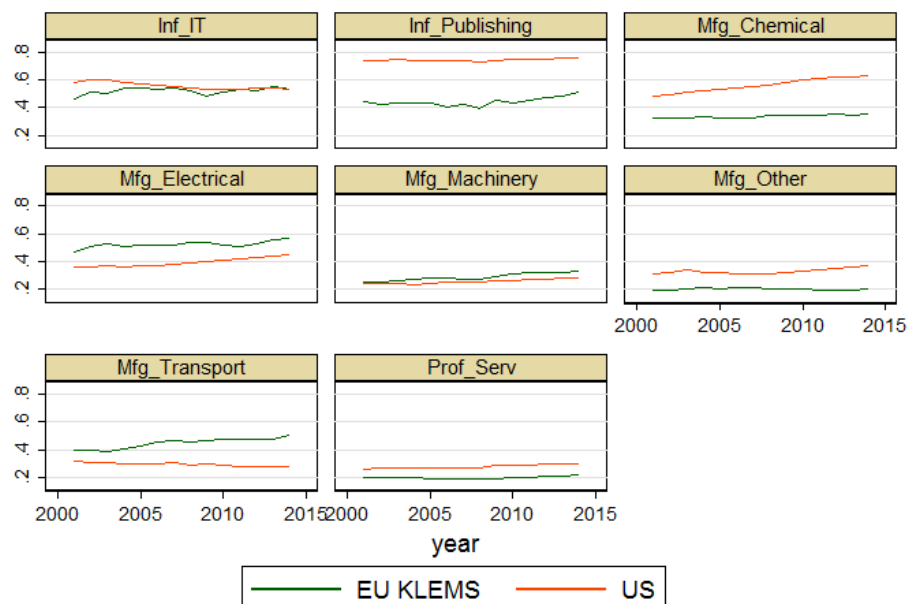
Sources: Annual data. Aggregate data sourced from BEA for US and KLEMS for Europe. Exclude Finance, Real Estate and Utilities. Compustat data from Compustat Global for Europe and Compustat NA for US. EU KLEMS series includes most countries since 1995 and all countries by 2000 (German and Netherlands enter in 2000).

Another interesting question to ask is whether the US' lead in intangible exists across all industries. The answer is: not exactly. **Chart 16** shows the share of intangible capital by industry for the US and Europe for the 8 industries with the highest intangible share in the US as of 2001. As shown, the US leads Europe in some, but not all industries; most notably Information – Publishing and Manufacturing – Chemical. Europe, by contrast, appears to lead the US in heavy manufacturing industries (Electrical and Transport). At the industry level the gaps can be fairly persistent.

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[22]   National accounts report higher investment in Europe, but also much higher depreciation assumptions than the US. In Compustat, we use common depreciation assumptions which likely explains the faster catch up. Also, Compustat Global exhibits substantial missing values for SG&A expenses before 2005, which are input to the calculation of intangible capital. These values were backfilled using SG&A expenses after 2005 – thus capital levels in the early 1990s may be mis-estimated. See Section 3.3 for additional details. Nonetheless, what appears robust is that the share of intangibles has increased drastically in Europe and now is very much in line with the US – at least for public firms..

Chart 16

Comparison of Intangible Share for EU and US by industry

Graphs by ind_short

Sources: Annual data sourced from BEA for US and KLEMS for Europe. EU KLEMS series includes all countries.

Chart 17 shows the gross investment rate in intangibles and CAPX for the 5 highest intangible industries in the US as of 2001. As before, we weigh across industries based on US-capital levels across industries so all five industries are given the same weight.

For these industries, investment rates in Europe are substantially higher for both intangibles and CAPX – and the difference is largest for intangibles. Nonetheless, the intangible gap appears to be growing for these industries. This is due to much larger depreciation assumptions in Europe.

The bottom left plot shows the intangible capital depreciation assumed in EU KLEMS when computing capital services (EU (KLEMS)); implied by the EU KLEMS chained capital stocks and investment levels; and implied by BEA figures in the US. As shown, the EU depreciation rates implied by chained capital stocks far exceed those assumed by KLEMS and the BEA. This differences substantially affect the level of capital stock.

Ultimately, these results suggest that Europe is closing the intangible gap; but this is less observable in National accounts. It is difficult to reconcile depreciation assumption when comparing the level of capital stock between the US and Europe. This is why we use share of investment in intangibles as a measure of intangible intensity in our industry-level regressions instead of the share of intangible capital.
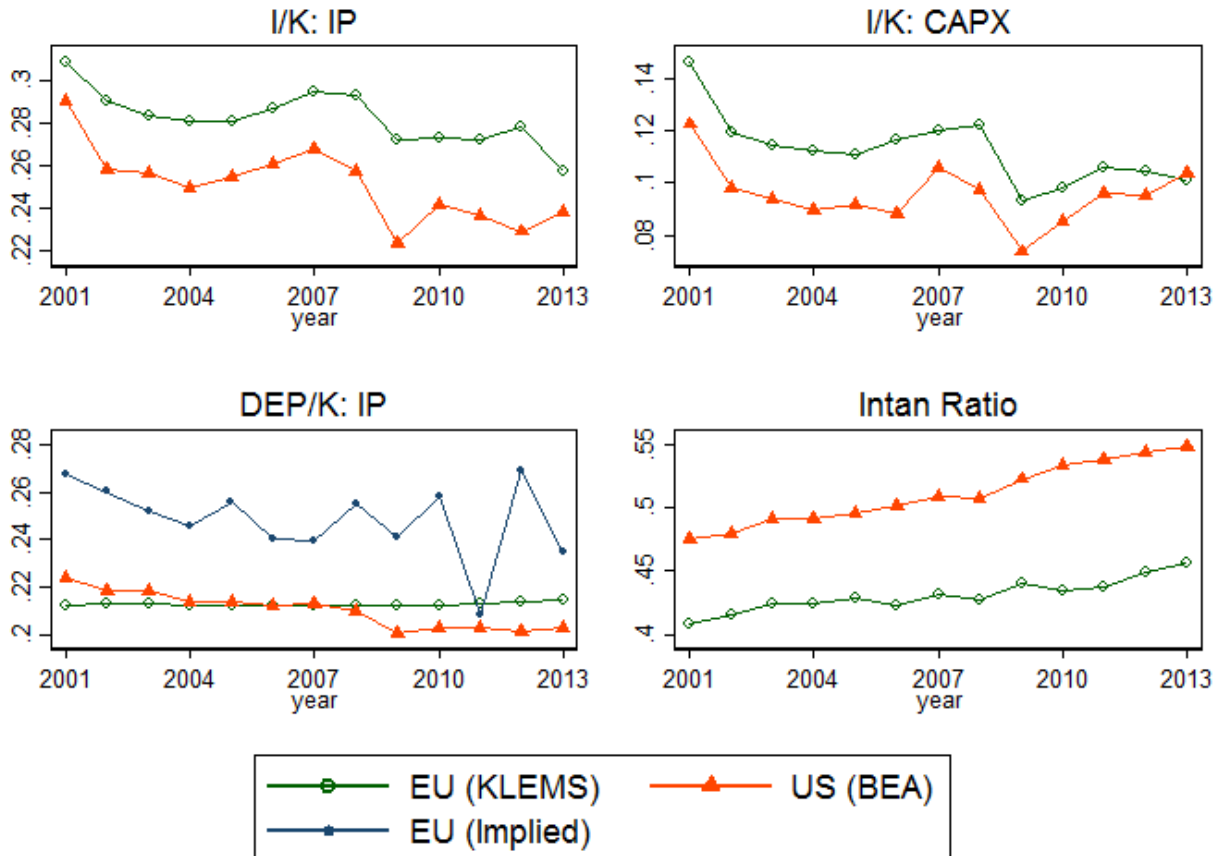
Sources: Authors calculations based on annual data from EU KLEMS for Europe and the US BEA for US.

Notes: Figure based on the 5 industries with the highest intangible share in the US as of 2001. These industries include Information Publishing, Information IT, Manufacturing Chemical, Manufacturing Electrical and Manufacturing Transport. Top two charts show the weighted average investment rate in intangible and tangible assets, respectively. Bottom left chart shows the depreciation rate. We include two depreciation series for the EU – one based on the geometric depreciation rates reported by KLEMS and one based on the implied depreciation using investment as well as changes in the level of capital. As shown, the implied depreciation is substantially higher than the reported geometric depreciation or the depreciation used in the US. Differences in depreciation rates disproportionately affect intangible assets, and therefore materially affect the stock of capital. The bottom-right plot shows that the higher intangible investment rate does not translate to a higher share of intangible capital (as percent of total capital) precisely due to differences in depreciation assumptions.

Chart 18 shows the share of intangible assets by entry year into Compustat, for Europe and the US. High intangible firms are largely concentrated in new entrants in the US. By contrast, older European firms appear to have substantially increased their intangible share over time – reaching levels similar to those observed in US firms.

Thus, it appears that European firms may have been slow to increase intangibles but have done so drastically starting in the late 1990s. Public firms are now largely similar in terms of intangible share between the US and Europe – at least according to the Peters & Taylor measure. Importantly, the share of intangible capital due to R&D and SG&A is largely similar across countries suggesting that the 'type' of intangible capital is in fact similar.

Chart 18

Intangible share by Cohort: EU KLEMS vs. US
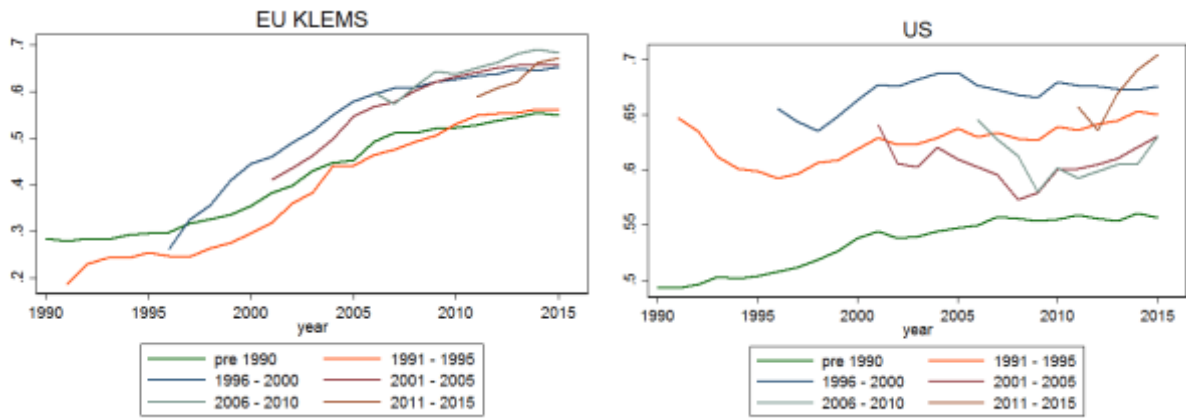
Sources: Annual data based on Compustat Global for Europe and Compustat NA for US.

Chart 19 shows that high-intangible firms tend to have lower investment rates. The figure plots total (CAPX plus intangible) NI/K by firms in the highest tercile of the intangibles distribution and those in the lowest tercile. In the US high intangibles firms have consistently lower investment rates than low intangible firms, suggesting that there is a fundamental difference between these types of firms. In Europe the differences has become much smaller over time, consistent with the idea that existing large firms have increased their intangible investment in Europe, as opposed to new entrants in the US.

Chart 19

Investment by high (HINT) and low intangible firms
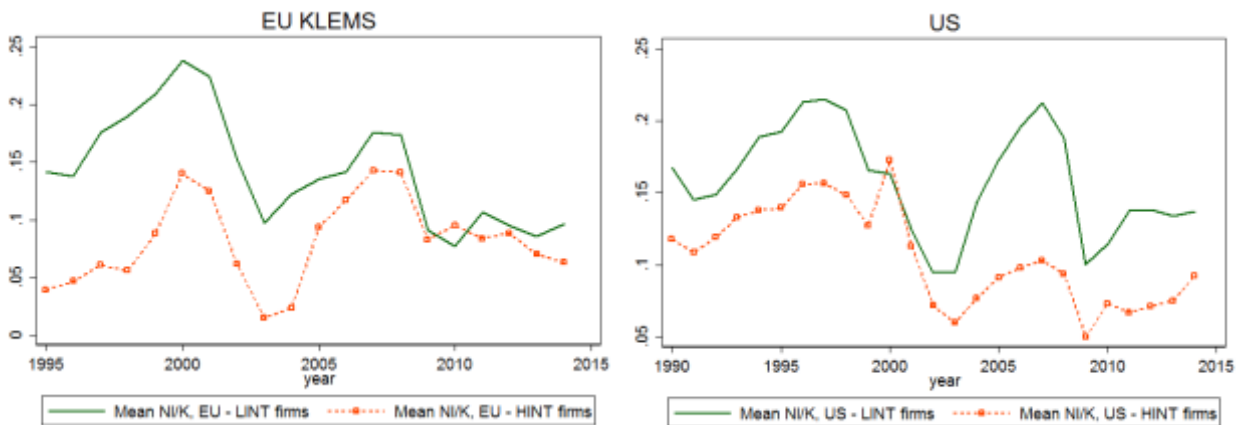
Sources: Annual data based on Compustat Global for Europe and Compustat NA for US.
Notes: The figure shows total (CAPX plus intangible) net investment by high-intangibles (HINT) and low-intangibles (LINT) firms. HINT firms are defined as those in the highest tercile of intangible ratio in a given year, and LINT firms as those in the lowest tercile.

6.2   Firm level Results

The above results suggest that financial constraints and the rise of intangibles matter for measured investment. Both of these hypotheses are likely to affect firm-level investment more than industry-level investment. It is therefore natural to test them at the Firm-level.

Table 3 shows the results of regressing firm-level investment on measures of concentration, financial constraints and intangibles. All regressions include year and industry/firm fixed effects as noted. Columns 1 to 3 weigh observations by lagged total capital because we care about the economic impact on aggregate investment – particularly in the case of competition. Columns 4 to 9 weigh observations equally as financial constraints are more likely to affect smaller firms.

Columns 1 to 3 consider total net investment,

- Column 1 shows that firm-level Q explains investment. Column 2 shows the Herfindahl is negative and statistically significant. The coefficient is larger than observed at the industry-level (NI/K is more volatile and somewhat larger in the firm level data).

- Column 3 shows that the share of intangible assets is strongly significant: a high intangible ratio is associated with lower investment consistent with **Chart 19**. Comparing Tables 2 and 3, we see that competition is relatively more important at the industry level, while intangible investment is relatively more important at the firm level.

The remaining columns 4 to 9 focus on financial constraints.

- Columns 4 and 5 consider log(I/K) for CAPX.[23] Column 4 includes industry fixed effects; and column 5 includes firm fixed effects. Both columns show that more financially constrained firms decreased investment more in bad times.

- Columns 6 and 7 focus on intangibles. The former regresses the ratio of R&D expenses to assets and the latter log-I/K for intangible investment. As shown, most coefficients are intuitive and statistically significant for R&D/Assets but not so for intangible investment. This is likely due to measurement difficulties highlighted in Section 3.3.

- Columns 8 and 9 expand the sample to include all firms in the EU28 countries, since financial constraints are likely more severe at periphery economies than the core countries included in KLEMS. We test for the effect of financial constraints by interacting the log-leverage and maturity with a GIIPS dummy that is 1 in a GIIPS country (Greece, Ireland, Italy, Spain and Portugal) for those

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[23]   We use log-gross investment rate because firm-level depreciation assumptions are not available – those reported in accounting statements often over-state depreciation (due to accounting rules) while also including only the portion of depreciation that is not included in cost of goods sold. An alternative is to use KLEMS-based depreciation but this is available only for a subset of countries and we want to consider the full Eurozone sample given that financial constraints likely affected periphery economies more than those in the KLEMS population.

years when the corresponding sovereign bund spread exceeds 200bps. The dummy captures the effect of the Eurozone crisis. Consistent with the notion that low investment is explained by a weak macroeconomic environment, the GIIPS dummy has a negative, significant coefficient. The interaction terms also exhibit the expected signs, suggesting that financial constraints affected investment above and beyond Q.[24]

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[24] We note that our ability to test for financial constraints is somewhat limited given our focus on public firms – which tend to have better access to external financing than smaller, private firms. Nonetheless, we find some effect of financial constraints on investment

Table 3

Firm level Net Investment: OLS Regressions

	(1) NIK	(2) NIK	(3) NIK	(4) Log I/K	(5) Log I/K	(6) XRD/AT	(7) Log I/K	(8) Log I/K	(9) Log I/K
Asset type	**All**	**All**	**All**	**Tangible**	**Tangible**	**R&D**	**Intangibles**	**Tangible**	**Tangible**
Log-Q (t-1) (CS)	**0.052**	**0.057**	**0.058**	**0.475**	**0.474**	**0.006+**	**0.212**	**0.503**	**0.478**
	[6.86]	**[7.33]**	**[7.17]**	**[19.86]**	**[17.27]**	**[1.89]**	**[8.96]**	**[32.25]**	**[26.94]**
Industry Herfindahl$_{cj,t-1}$ (AM)		**-0.107***							
		[-1.98]							
Intangible ratio (t-1) (CS)			**-0.093**						
			[-6.44]						
Log-Leverage (t-1) (CS)				-0.087**	-0.093**	-0.002+	-0.031**	-0.143**	-0.152**
				[-10.16]	[-9.24]	[-1.67]	[-3.80]	[-21.79]	[-19.59]
Recession Dummy				-0.170**	-0.138**	-0.011**	-0.016		
				[-3.62]	[-2.91]	[-3.00]	[-0.50]		
Recession x Log-leverage(t-1) (CS)				**-0.044**	**-0.039**	**-0.004***	**-0.007**		
				[-3.90]	**[-3.35]**	**[-2.19]**	**[-0.93]**		
Maturity (t-1) (CS)				-0.017	-0.001	-0.004	0	0.006	0.008
				[-0.57]	[-0.05]	[-0.88]	[-0.01]	[0.33]	[0.39]
Recession x Maturity(t-1)				**0.100***	**0.089+**	**0.001**	**-0.018**		
				[2.07]	**[1.82]**	**[0.24]**	**[-0.51]**		
GIIPS								-0.471**	-0.373**
								[-5.69]	[-4.33]
GIIPS x Log-leverage(t-1)								**-0.101**	**-0.098**
								[-2.91]	**[-2.63]**
GIIPS x Maturity(t-1)								**0.165+**	**0.092**
								[1.75]	**[0.96]**
Log Age (t-1) (CS)	0.021**	0.016*	0.021**	-0.173**	-0.147**	-0.002	-0.038	-0.156**	-0.209**
	[2.73]	[2.03]	[2.70]	[-7.28]	[-3.76]	[-0.47]	[-1.34]	[-10.76]	[-8.41]
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	YES	NO	NO	NO	YES
Weighted by Capital	YES	YES	YES	NO	NO	NO	NO	NO	NO
Observations	27433	20577	27417	25119	25119	9463	17647	55326	55326
R^2	0.099	0.109	0.128	0.121	0.121	0.007	0.05	0.121	0.121

Sources: Annual data from Compustat Global (CS) and Amadeus (AM). Herfindahl's provided by Sebnem Kalemli-Ozcan and Carolina Villegas-Sanchez
Notes: Table shows the results of firm-level regressions of Net I/K and Log-I/K on predictor variables. All regressions include log-firm age as a control. Regressions in columns 1-7 are based on the EU KLEMS sample; while columns 8 and 9 broaden the sample to all EU countries to study the impact of recessions and sovereign stress in GIIPS countries on investment. Column 1 includes only firm-level Q. Column 2 adds the Herfindahl computed based on Amadeus for a given country-industry pair over the 1999-2012 period. Column 3 includes the share of intangible capital, computed using Compustat. Column 4 focuses on tangible investment and shows firms with higher leverage or shorter-term debt reduced investment more during recessions. Column 5 is the same as column 4 but including firm fixed effects. Column 6 focuses on R&D/AT and again shows that firms with higher leverage cut investment more. Column 7 includes intangible investment; the results are inconclusive likely due to difficulties in measuring intangible investment in Compustat (see Section

3.3.1.1 for details). Columns 8 and 9 add all Eurozone countries and replace the Recession dummy with a GIIPS dummy equal to one for Greece, Italy, Ireland, Portugal and Spain for the periods when they exhibit a spread greater than 200 bps over the Bund spread. Column 9 includes firm fixed effects. T-stats in brackets. Standard errors clustered at the firm level. + p<0.10, * p<0.05, ** p<.01.

7   Conclusion

We make two contributions.

First, we argue that the explanations for depressed investment in the US and in Europe are different. In Europe, investment is depressed because of depressed asset values, consistent with financial constraints, high risk premia, low expected demand and low expected cash flows. These effects are likely to be temporary and we can expect an increase in investment once sovereign and banking issues are resolved. In the US, investment is depressed because industries have become more concentrated over time and competitive pressures to invest are lacking. Our findings suggest that the weakness of investment is more cyclical in Europe and more structural in the U.S. They also suggest a role for anti-trust regulation. Over the past 15 years, anti-trust has become weaker in the US and stronger in Europe, a reversal of the historical pattern of the past century. Our results suggest that this difference has real consequences for investment.

Second, we examine the role of intangible investment in the two regions. We find that the rising share of intangibles explains some but not all of the weakness in measured investment. At the same time we find that EU firms have been catching up with their US counterparts in terms of intangible investment. But the processes of intangible deepening are different. In the US, intangible deepening happened by the entry of new firms with high intangible ratios, mostly in the 1990s and early 2000s. In Europe, the process was a bit slower and took place within incumbent firms that become more intangible intensive over time.

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