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The Impact of Excess Capacity on the Investment Falloff

Summary: I documented a widespread decline in the rate of capacity utilization in the US manufacturing industry during the last decades, which parallels a worsening trend of gross capital formation. I conducted several exploratory exercises to investigate whether utilization rates were actually related to the investment performance during 1952-2014. Vector auto-regressive estimates imply a non-trivial quantitative relationship between utilization rates and investment, which accounts for a decline equivalent to more than 30% of the average investment falloff over the whole period considered. Finally, I used firm-level data to control for other investment determinants. The relationship remains statistically and economically significant. In addition, I found a link between past accumulated utilization variation and current investment, suggesting that excess capacity could be a relevant force behind current investment weakness.

Keywords: Investment, Capacity utilization.

JEL: E20, E22.

Almost ten years after the financial collapse of 2007-2008, developed economies remain stuck in prolonged economic stagnation. According to Gauti B. Eggertsson, Neil R. Mehrotra, and Lawrence Summers (2016), sluggish output growth and below-target inflation characterized the economic situation prevailing before the COVID-19 pandemic. While economic slack has since declined, this obeyed largely to downward revisions in potential output rather than to strengthening aggregate demand. In this framework, investment demand posted the poorest performance among other demand components, with business fixed capital formation accounting for the bulk of the decline. Moreover, Rodrigo Pérez Artica, Leandro Brufman, and Lisana Belén Martinez (2017) documented a trend of worsening business investment performance in a long-term perspective, which has been pervasive for non-financial firms from several developed economies.

Along with this decline in business investment, a number of industries such as automobile, steel, and shipbuilding show eloquent signs of excess capacity and have recently caused official concerns (Organization for Economic Co-operation and Development OECD 2014). The detrimental effect of excess capacity on capital formation is established at a theoretical level by several strands of the macroeconomic literature. However, as far as we are concerned, rather few investigations addressed the long-term evolution of capacity utilization and its relationship with business investment at the industry level.

This study intended to fill that gap by using industry-level data available for the US manufacturing sector. First, we aimed to assess the long-term evolution of capacity utilization. Second, we analyzed whether capacity utilization has had any relationship with industry investment. For this, several time series methods were employed and, thus, a first clue about its quantitative relevance was obtained. Finally, we aimed to capture a more precise measure of the effect of excess capacity on investment by considering a firm-level model, which allows controlling for other theoretically relevant determinants of investment.

1. Facts: The Long-Term Decline of Investment and Capacity Utilization

As mentioned above, this section presents the two main facts motivating this study, namely the secular decline in the investment and capacity utilization rates in US manufacturing industries. We used capital formation and utilization rates data at the industry level from the Annual Data on Investment and Capital Stocks statistics and Table Z17, respectively. Both sources are published by the US Federal Reserve. Additionally, the evidence was discussed in the light of other studies and related findings.

1.1 Declining Investment Rate

Fixed capital investment in the US private sector has experienced a downward trend in recent decades. Panel A of Table 1 displays the results of regressing the ratio of fixed capital formation to the stock of net fixed capital (including structures and equipment) over time for the whole sample of 85 industries over the period 1952-2014. In addition, the sample was split in deciles of investment rate, and the trend coefficients were evaluated within each group.

The results show negative and statistically significant trends for the whole sample of industries and almost every investment decile. Column 1 evidences that, for the entire sample, the investment rate decreased at an average yearly pace of 0.02 percentage points (pp), which is equivalent to a decline of 1.2 pp over the whole sample period. Considering that the average investment rate before 1960 amounted to 5.5%, this average trend coefficient represents a one-fifth contraction of the total investment rate.

When taking into account trend coefficients within different investment deciles, groups with considerably higher rates of contraction were identified. For instance, for the tenth decile, investment fell at pace more than twice as fast. However, there is no clear correlation between average investment rates and the average investment contraction over the whole period.

As already stated in the Introduction, the collapse of capital formation is documented at length in the period following the financial breakdown of 2007-2008. In fact, most studies tend to focus on the investment weakness occurring in the aftermath of the crisis. Private investment collapsed during the financial disruption and, although housing investment fell particularly sharply, business capital formation accounted for the bulk of the decline, only partially recovering since then. The fragile resumption of corporate investment after the crisis contrasts with increasing profits in most advanced economies and buoyant equity markets in a number of them. Some observers label this seemingly paradoxical fact as an "investment puzzle" (Jason Furman 2015).

Table 1 Trends of Investment Rates

	Whole sample	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Panel A. Period 1952-2014											
Trend	-0.000211***	-0.000127***	-2.03e-05	2.99e-05	-0.000368***	-0.000316***	-0.000187***	-0.000134***	-0.000211***	-0.000274***	-0.000520***
	(1.32e-05)	(2.94e-05)	(3.83e-05)	(4.40e-05)	(3.93e-05)	(4.20e-05)	(2.94e-05)	(3.35e-05)	(4.04e-05)	(4.14e-05)	(6.95e-05)
Constant	0.469***	0.284***	0.0801	-0.0158	0.776***	0.675***	0.422***	0.321***	0.478***	0.604***	1.107***
	(0.0262)	(0.0583)	(0.0760)	(0.0873)	(0.0780)	(0.0832)	(0.0583)	(0.0664)	(0.0801)	(0.0821)	(0.138)
Observations	5,418	567	567	504	567	504	567	567	504	567	504
R-squared	0.045	0.032	0.001	0.001	0.136	0.103	0.068	0.028	0.052	0.073	0.102
Number of industries	86	9	9	8	9	8	9	9	8	9	8
Panel B. Period 1952-2007											
	Whole sample	**Decile 1**	**Decile 2**	**Decile 3**	**Decile 4**	**Decile 5**	**Decile 6**	**Decile 7**	**Decile 8**	**Decile 9**	**Decile 10**
Trend	-0.000223***	-9.48e-05***	-5.45e-05	0.000127**	-0.000415***	-0.000416***	-0.000234***	-0.000156***	-0.000142***	-0.000314***	-0.000543***
	(1.62e-05)	(3.42e-05)	(4.27e-05)	(5.43e-05)	(4.84e-05)	(5.20e-05)	(3.56e-05)	(4.13e-05)	(4.93e-05)	(5.09e-05)	(8.63e-05)
Constant	0.493***	0.220***	0.147*	-0.207*	0.869***	0.872***	0.515***	0.363***	0.340***	0.684***	1.152***
	(0.0320)	(0.0677)	(0.0845)	(0.107)	(0.0958)	(0.103)	(0.0705)	(0.0817)	(0.0976)	(0.101)	(0.171)
Observations	4,730	495	495	440	495	440	495	495	440	495	440
R-squared	0.040	0.016	0.003	0.013	0.132	0.129	0.082	0.028	0.019	0.073	0.084
Number of industries	86	9	9	8	9	8	9	9	8	9	8

Notes: Panel A of Table 1 shows the results of regressing the investment rate on a time trend and industry fixed effects for the period 1952-2104. The first column displays the results for the whole sample of 86 industries available in the Annual Data on Investment and Capital Stocks database. Columns 2 to 11 provide the regression results for each industry-size decile. The industry size is computed on the basis of the average net capital over the whole period. Panel B of Table 1 shows the same regression results for a reduced sample period covering 1952-2007. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Author's calculations.

According to the International Monetary Fund (2015), the accelerator effect plays a prominent role in explaining the private investment weakness after the crisis. Indeed, given the observed contraction of aggregate output and the historical relation of this variable to capital expenditures, the detected decline of private investment in the countries analyzed in that study follows the predicted pattern. Similar conclusions regarding the prevalence of the accelerator effect for the post-2008 period were drawn by other investigations such as those conducted by the Organisation for Economic Co-operation and Development (OECD 2015 a, b) and Furman (2015). In addition, a rather small share of the investment failure is also attributed to financial frictions and policy uncertainty.

However, Panel B of Table 1 shows that the investment contraction occurred long before the financial collapse of 2007-2008. This is true for the whole sample regression, as well as for every investment decile.

Recent studies take a closer look at this long-term nature of the investment decline. Pérez Artica, Brufman, and Martinez (2017) provided firm-level evidence that shows a protracted and widespread decline in capital formation among firms from different countries, industries, and firm size segments in developed economies. Moreover, this contraction seems to have responded to tighter financial constraints for those firms that are typically excluded from external finance, a growing volatility of the operational environment, and the weakening of product markets dynamism.

Importantly, private investment contraction contributed to the emergence of a positive net lending position among the non-financial corporate sector in advanced economies, which, computed as the difference between gross savings and capital formation of the sector, improved consistently during the last two and a half decades. Apart from the investment deterioration, Peter Chen, Loukas Karabarbounis, and Brent Neiman (2017) showed that corporate savings have risen since the 1980s, mainly due to higher operating profits caused in turn by a declining labor share.

Further research suggests that an increase in industrial concentration and the consequential easing of market competition pressures were also responsible for the investment falloff in the US corporate sector. Moreover, this effect operates not only through concentration at the product-market level, but also through common ownership of firms that would otherwise be natural competitors. Germán Gutiérrez and Thomas Philippon (2017), José Azar, Martin C. Schmalz, and Isabel Tecu (2018) and Azar, Sahil Raina, and Schmalz (2022) provided evidence for the US economy as a whole and the banking and airline industries, respectively.

One source of concern that this literature has dealt with is the rise of intangible investment. Measurement problems involved with intangibles may render the overall investment decline misleading because of the underestimation of this type of investment.

Nevertheless, Gutiérrez and Philippon (2017) concluded that properly accounting for intangible investment does not exclude the overall investment contraction. On the contrary, intangible investment exhibits a weakness quite similar to that of tangible capital expenditures.

At least for the United States, this contraction of investment took place in a gradually worsening business environment. According to Ryan A. Decker et al. (2014), the rate of business startup and the weight of young and dynamic firms have been in decline since the 1960s, which points to a prolonged deterioration of business dynamism and entrepreneurship. Furthermore, the decrease of high-growth young firms after the year 2000 has coincided with lower activity by young firms in key innovative sectors like the IT industries and has reduced the pace of employment and productivity growth (Decker et al. 2016).

The increasing survival of old and non-viable firms that experience persistent problems meeting their interest payments is strongly related to this declining dynamism. In ideal competitive conditions, these firms would usually exit the market. However, an incipient literature shows that resources sunk on such “zombie” firms have been growing since the mid-2000s. The main reason behind this trend is the enlarged share of fragile banks after the 2008-2009 global financial crisis, which are now more inclined to roll over loans into non-viable firms in order to avoid writing them off and realizing losses (Guillaume Plantin and Viral Acharya 2016).

According to Müge Adalet McGowan, Dan Andrews, and Valentine Millot (2017), the growing market congestion created by “zombie” firms blocks access to new and more dynamic entrants and prevents the expansion of healthier and more productive firms that are already in the market. These facts may provide a valuable description of the context in which capacity utilization and investment have interacted in recent years, since market congestion influence may potentiate the deterring effects of growing excess capacity on private capital expenditures.

1.2 Declining Rate of Capacity Utilization

In this section, the evolution of the capacity utilization rate at the industry level is discussed. For this purpose, annual capacity utilization rates from the Federal Reserve’s Table Z17 are used, which provides estimates for 67 industries. The main source of the Federal Reserve Board (FRB) data is the Survey of Plant Capacity Utilization, conducted by the US Census Bureau.

A number of methodological caveats have to be addressed. To begin with, capacity measures are intended to quantify sustainable practical capacity, defined as the greatest output a plant can sustain within the framework of a realistic work schedule. Based on the Survey questions, Michalis Nikiforos (2016) argued that the rate of utilization is stationary by construction. Correspondingly, several studies found a steady-state level of non-accelerating inflation capacity utilization rate of 82% (Wolfgang Franz and Robert J. Gordon 1993; Alan Garner 1994).

Similarly, according to Norman Morin and John Stevens (2004), the scope of the survey evolved over the years, with a significant change occurring in 1982, when respondents were asked to complete the forms even when the plant had remained idle. This means that, due to the fact that idle plants were undercounted before 1982, the series are not straightforwardly comparable before and after that year. Moreover, in part because of these shortcomings, a number of previous studies have resorted to alternative measures of capital utilization (J. Joseph Beaulieu and Joe Mattey 1998).

Nevertheless, FRB data on capacity utilization have been widely used to study a variety of topics such as inflation, growth dynamics, and policy assessment (Franz and Gordon 1993; Daniel Murphy 2017). Additionally, notwithstanding those caveats, as shown below, our results seem robust enough to believe they reflect a real economic matter. Moreover, these results are particularly pronounced for the period beginning in 1990, thereby avoiding comparability problems between the intervals before and after 1982.

Table 2 Trends of Capacity Utilization Rates

	Panel A. Period 1952-2014										
	Whole sample	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Trend	-0.171***	-0.264***	-0.277***	-0.224***	-0.253***	-0.133***	-0.439***	-0.186***	-0.0928***	-0.0241	-0.0720***
	(0.00671)	(0.0223)	(0.0184)	(0.0293)	(0.0214)	(0.0118)	(0.0458)	(0.0387)	(0.0115)	(0.0250)	(0.0157)
Constant	418.8***	599.0***	626.4***	523.9***	582.0***	342.1***	953.9***	449.7***	267.1***	130.9***	228.6***
	(13.35)	(44.45)	(36.66)	(58.30)	(42.58)	(23.49)	(91.24)	(77.07)	(22.99)	(49.75)	(31.09)
Observations	4,312	447	530	321	523	739	129	358	446	338	481
R-squared	0.133	0.242	0.303	0.158	0.215	0.148	0.424	0.062	0.130	0.003	0.043
Number of industries	86	9	10	7	11	13	3	8	10	7	8

	Panel B. Post-1982 period										
	Whole sample	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Trend	-0.252***	-0.353***	-0.560***	-0.410***	-0.0798**	-0.0657**	-0.704***	-0.300***	-0.136***	-0.108**	-0.210***
	(0.0134)	(0.0395)	(0.0416)	(0.0449)	(0.0367)	(0.0280)	(0.0652)	(0.0648)	(0.0179)	(0.0480)	(0.0375)
Constant	582.4***	778.6***	1,194***	896.4***	235.2***	208.8***	1,485***	679.7***	353.9***	299.4***	505.1***
	(26.76)	(78.88)	(83.18)	(89.78)	(73.35)	(56.06)	(130.4)	(129.5)	(35.68)	(95.92)	(74.92)
Observations	2,752	288	320	224	352	416	96	256	320	224	256
R-squared	0.118	0.224	0.369	0.279	0.014	0.013	0.559	0.080	0.158	0.023	0.113
Number of industries	86	9	10	7	11	13	3	8	10	7	8

	Panel C. Post-1990 period										
	Whole sample	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
Trend	-0.463***	-0.701***	-0.441***	-0.620***	-0.0500	-0.309***	-0.746***	-0.709***	-0.326***	-0.384***	-0.284***
	(0.0225)	(0.0634)	(0.0896)	(0.0861)	(0.0545)	(0.0619)	(0.0816)	(0.0785)	(0.0406)	(0.0789)	(0.0675)
Constant	1,004***	1,476***	957.8***	1,315***	177.9	695.7***	1,571***	1,500***	733.8***	851.3***	655.3***
	(44.98)	(127.0)	(179.4)	(172.4)	(109.1)	(123.9)	(163.5)	(157.3)	(81.33)	(158.0)	(135.2)
Observations	1,608	264	96	144	168	168	144	144	216	120	144
R-squared	0.216	0.326	0.210	0.274	0.005	0.135	0.379	0.373	0.238	0.172	0.115
Number of industries	67	11	4	6	7	7	6	6	9	5	6

Notes: Panel A of Table 2 shows the results of regressing the capacity utilization rate on a time trend and industry fixed effects for the period 1952-2014. Panel B displays the results of regressing the capacity utilization rate on a time trend and industry fixed effects for the period 1952-1990. The first column of Panel A provides the results for the whole sample of 57 industries available in the Annual Data on Investment and Capital Stocks database. Columns 2 to 11 show the regression results for each industry-size decile. The industry size is computed on the basis of the average net capital over the whole period. Panel B displays the same regression results for a reduced sample period covering 1990-2014. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Author's calculations.

Column 1 of Table 2 shows the results of regressing the rate of capacity utilization over time for the whole sample of industries, which display a negative and statistically significant trend. This is also economically significant, with an annual reduction of 0.171 pp and an overall decline of 10.6 pp all through the sample period.

In addition, in order to identify whether this negative evolution is widespread enough or instead is confined to a small number of industries, the evolution of capacity utilization is explored within each group of "normal" capacity utilization rate. That is, we acknowledged that each industry may have a different normal or desired rate of capacity utilization and, thus, considered if different groups of normal utilization experienced a similar decrease. The normal capacity utilization was estimated by calculating the average rate of capacity utilization for each industry over the whole sample period and, then, splitting the sample into deciles of normal utilization rate. The results confirm that the decline extended to all groups and show deciles in which the average capacity utilization reduction was even more pronounced, falling by more than 16 pp over the whole period (deciles 1 and 2, for instance).

Panels B and C of Table 2 evaluate these trends for two different and shorter periods: one beginning in 1982 because of the methodological break taking place in that year (Panel B of Table 2), and the other beginning in 1991 (Panel C of Table 2). We found that these trends gradually accelerated and were considerably stronger during the last 25 years, with the average industry experiencing a total decline of 11 pp (0.46 pp a year). This implies that most of the decrease documented in Panel A for the whole period is concentrated in the last 25 years.

These findings are even more puzzling in the face of the evidence previously discussed, showing a decline of investment rate across all industries. Indeed, lower investment should lead to a decelerating capacity growth, thus increasing utilization rates.

On the other hand, however, these results are consistent with existing evidence of growing excess capacity in specific industries. According to our data, the industries that experienced the highest drop in utilization were chemicals (code 3251, according to the North American Industry Classification System (NAICS)), primary metals including iron, steel, and aluminum manufacturing (NAICS 331), and automobile production (NAICS 3361), among others.

Several other studies determined that these industries underwent excess capacity, particularly in the aftermath of the global financial turmoil in 2008. In addition to a great deal of press articles covering it, John Humphrey and Olga Memedovic (2003) and Caroline Klein and Isabell Koske (2013) discussed a number of causes leading the automotive industry to overinvestment and excess capacity, principally in developed economies. In the United States, 16 assembly plants closed because of the significant decrease in automobile sales during the financial crisis. Furthermore, the bankruptcy proceedings agreed upon with the government contributed to this result. Consequently, the three main US assemblers reduced their capacity by almost 2.6 million units. Still, the utilization rate remained at 70%, 20 pp below the pre-crisis peak (Thomas Klier and James M. Rubenstein 2013).

In 2014, the OECD Ministerial Council Meeting expressed the need to address excess capacity in industries such as steel and shipbuilding, which have been on the rise since the financial crisis (OECD 2014). According to the OECD (2015b), demand in the global steel market recovered after the slump experienced in 2008-9, but this recovery was uneven and did not keep pace with the growth in supply, leading to one of the highest levels of excess capacity in the history of that industry.

Critical excess capacity also occurred in the shipbuilding industry. Over the five years in the run-up to the financial crisis, however, offshore vessels production had soared in the midst of the oil-price booming years. Despite this, their demand collapsed because of falling oil prices, particularly in 2014. As a result, utilization rates in the OECD shipbuilding industry dropped to levels prevailing before the offshore boom, hovering around a utilization rate of 60%. In addition, a number of risks were grouped as a consequence of reorienting shipyards towards the offshore sector, such as high costs of technological adjustments and research, intensive employee training, stringent regulations, etc. (OECD 2015c).

These studies addressed several causes of the structural increase in excess capacity, but government actions hindering adjustments that would theoretically occur in competitive markets are seen as the main culprits (OECD 2015b). While interested in alleviating unemployment problems or reducing their dependency on imports, government policies imply subsidies for the creation of new capacity or the maintenance of inefficient capacities. In this way, policies end up contributing to global excess capacity and prevent the "optimal" exit of the least productive plants.

Furthermore, industry-specific studies may provide valuable insights into the internal mechanisms governing the long-term decrease in utilization rates. In effect, according to OECD (2015b), adjustment processes can take longer than expected, with regions experiencing extended periods of excess capacity. In turn, this may obey to high exit barriers, such as costs of closure that discourage prompt adjustments.

For instance, capacity closures entail high costs of dismantling structures, as well as those related to equipment, the environment, and labor. The growing market and operational uncertainty at the firm level may push firms to delay exit rather than incur such exit costs.

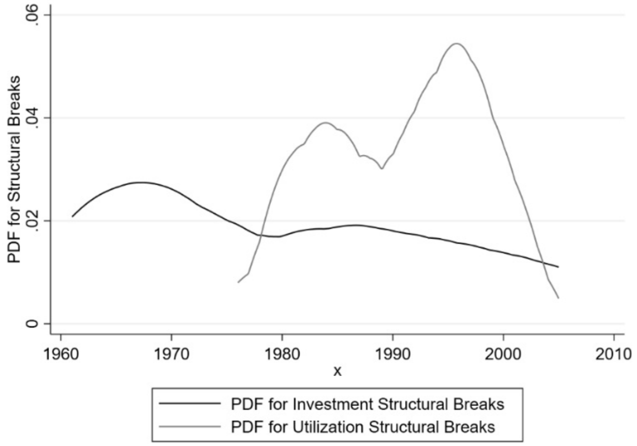
1.3 A Structural Break Analysis of the Utilization Series

So far, a negative trend in investment and utilization rates has been documented. Nonetheless, we have not yet analyzed in a systematic way whether there was a turning point in this trend. That is, for instance, did this negative trend in utilization rates take place over the whole sample period for all industries or, instead, a structural break in utilization series can be identified?

In order to address this, we searched for structural breaks in the investment and utilization series for each industry using the Zivot-Andrews (Eric Zivot and Donald W. K. Andrews 1992) test of structural breaks. Specifically, a structural break in the trends of the series was tested. As the analysis was performed for every industry separately, we identified several turning points in the series. Thus, so as to provide a synthetic overview of the results, we plotted the distribution of the industry-level turning points in the trends over the entire period. As shown below, the linear trends exhibit gradual changes when the whole period is considered, and fluctuate sharply for shorter and more recent periods.

Figure 1 shows the Kernel density function of the turning points found for each industry in the sample. For the utilization series, it describes a somewhat bimodal distribution, with the most frequent structural breaks concentrating around the late 1990s and, to a lesser extent, in the first half of the 1980s. Regarding the investment series, the most frequent turning points cluster around the end of the 1960s and, to a much lesser extent, during the late 1980s.

However, as evidenced in Figure 1, the distribution of the structural breaks is much more concentrated for the utilization series, with 90% of these breaks agglomerating between 1980 and 2000, and 60% of them clustering between 1990 and 2000. Definitely, some structural shift seems to have occurred in this last decade as regards utilization behavior in the manufacturing sector.



Notes: Figure 1 shows the Kernel probability density function for the year of structural breaks found for the investment and utilization series, respectively.

Source: Author's calculations.

Figure 1 Kernel Probability Density Function for the Year of Structural Breaks for Investment and Utilization Series

Table 3 Trends before and after the Structural Breaks

	(a)	(b)	(c)	(d)
	Investment before structural break	**Investment after structural break**	**Capacity utilization before structural break**	**Capacity utilization after structural break**
Trend	-0.000200***	-0.000321***	-0.0531***	-0.250***
	(3.57e-05)	(2.19e-05)	(0.0115)	(0.0186)
Constant	0.449***	0.688***	186.8***	576.0***
	(0.0702)	(0.0437)	(22.72)	(37.17)
Observations	2,491	2,927	2,563	1,749
R-squared	0.013	0.070	0.009	0.098
Number of industries	86	86	86	86

Notes: Columns (a) and (b) of Table 3 show the results of regressing the investment rate on a time trend and industry fixed effects. In column (a), for each industry, we considered the observations before the structural break found for the investment series by means of the Zivot-Andrews test. In column (b), for each industry, those observations after that structural break were taken into account. Columns (c) and (d) show the results of regressing the capacity utilization rate on a time trend and industry fixed effects. In column (c), for each industry, we considered the observations before the structural break of the capacity utilization series found using the Zivot-Andrews test. In column (b), for each industry, those observations after that structural break were taken into account. Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Source: Author's calculations.

In order to confirm how these structural breaks impact the trends observed above, we may test the time trends for the panel database by splitting the sample, so as to consider, for each industry, the observations before and after the corresponding structural break. This is what Table 3 shows. In effect, it can be confirmed that the negative trends for both investment and utilization rates become substantially more marked after the structural breaks identified. In the case of the investment rate, after the structural break of each industry, the trend starts to decline and accelerates by 50%. For utilization rates, it increases five times.

2. Theoretical Approaches to the Relationship between Capacity Utilization and Investment

A broad theoretical literature deals with this topic. On the one hand, a number of classical studies within heterodox economic traditions addressed the short-term relationship between capacity utilization and aggregate investment. For structuralist Post-Keynesian models, the investment rate is positively affected by the difference between actual and desired (cost-minimizing) rates of capacity utilization, such that whenever actual utilization exceeds its desired level, firms will be encouraged to invest and develop new capacity. This theoretical rationale is found in Joseph Steindl (1952) and Michal Kalecki (1971) is further formalized by an extensive and more recent literature (Lance Taylor 2004; Nikiforos 2016).

Most importantly, the utilization rate plays a central role in these macroeconomic models, since an equilibrium utilization rate can be derived where savings equal investment. A controversy arises from this equilibrium utilization rate and the possibility for it to differ from the desired level (Gerard Dumenil and Dominique Levy 1997; Marc Lavoie, Gabriel Rodríguez, and Mario Seccareccia 2004; Anwar Shaikh 2009).

On the other hand, in the neoclassical specification for the investment spending analysis, the accelerator effect referred to above is identified with growing sales or output, rather than making higher utilization rates explicit. Certainly, this mechanism operates by increasing utilization rates and, thus, the consequential desire of firms to raise their production capacity.

Dale Jorgenson (1971) pioneered this approach, describing a firm that maximizes its discounted flow of profits over an infinite horizon, while subsequent formulations added delivery lags, adjustment costs, and vintage effects to this specification (for a review of this literature, see Robert S. Chirinko 1993). In this framework, a positive relationship emerges between the desired stock of capital and the level of output.

The effect of capital overhang over investment spending was studied in more detail in the early 2000s. The investment boom of the 1990s was suspected to have produced a capital overhang, which, in turn, could have caused the investment weakness observed at the beginning of the cyclical upswing.

Mihir A. Desai and Austan Goolsbee (2004), for instance, evaluated whether a capital overhang originated the low level of investment in the early 2000s. They tackled this question by testing if those industries facing the largest increases in investment rates during the 1990s boom were, in turn, the ones experiencing the weakest investment performance during 2000-2002. Although they did not find strong evidence supporting this relationship for the whole economy, a significant negative correlation between the investment rates during the boom and its performance in the 2000-2002 period surfaced for the manufacturing industry.

Jonathan Mccarthy (2004), in addition, found that communication industries had a disproportionate share of total investment in the end of the boom of 2000, reflecting a misperception of future profits within that sector. Moreover, the author identified that those industries showing the highest investment during the 1990s tended to reduce it more sharply during the bust in 2001.

However, as far as we are concerned, no systematic empirical exploration of the long-term dynamics of this relationship has been attempted. In light of the secular trends experienced by both variables, this seems an interesting research objective. In what follows, we addressed this broad exploratory exercise in several subsequent steps.

3. An Exploratory Study of the Relationship between Capacity Utilization and Business Investment

This section presents an exploratory study of the long-term effects of the capacity utilization decline on the investment rate at the industry level. We could only attempt to conduct an exploratory inquiry into this long-term relationship, given that we used industry-level data and could not control for other theoretically relevant determinants of business investment, such as profitability, financial access, and sales growth, which are not available in our main dataset. In the following section, further firm-level exercises were performed to address this issue more properly.

To begin with, we enquired the extent to which a positive relationship between capacity utilization and investment was found in the sample of manufacturing industries considered. We did this through a variety of econometric approaches. Second, we attempted to quantify the magnitude and time persistence of the average effect observed in the data for the whole sample period.

3.1 Data and Methodology

As explained above, we used annual and industry-level capacity utilization rates from Table Z17 and capital formation data from the Annual Data on Investment and Capital Stocks statistics, both sources produced by the US Federal Reserve.

Time series properties of the utilization and investment series. We began by evaluating whether the time series for each industry are stationary or follow a unit-root process instead. First, a number of tests for unit roots or stationarity in panel datasets were used. These are the tests developed by Richard D. F. Harris and Elias Tzavalis (1999), Jörg Breitung (2000), In Choi (2001), Andrew Levin, Chien Fu Lin, and Chia Shang James Chu (2002), Kyung So Im, M. Hashem Pesaran, and Yongcheol Shin (2003) and Breitung and Samarjit Das (2005). These tests have as the null hypothesis that all panels contain a unit root. All the tests clearly reject the null hypothesis for both variables. Although the test results are not shown here, they are available upon request to the author.

We further investigated whether there are specific industries for which a unit-root process cannot be rejected by using the augmented Dickey-Fuller test in three different specifications. First, we tested for the presence of a unit root with no trend or drift terms and, then, the stationarity involving a deterministic trend. Finally, a drift term was included and also tested. The results are summarized in Table 4. Each column shows the proportion of industries for which the existence of a unit root at a 5% confidence level was rejected for each of the specifications. The first row presents the results for the utilization rates, and the second, the ones for the investment rate.

Table 4 Results of Unit-Root Tests by Industry

Augmented Dickey-Fuller test	No trend, no drift	Trend	Drift
Capacity utilization	74,63%	50,75%	100,00%
Capital formation	73,26%	54,65%	98,84%

Notes: Table 4 summarizes the results of the augmented Dickey-Fuller tests for a unit root in every industry. For each series (capacity utilization and capital formation), it shows the percentage of industries for which the tests reject the presence of a unit-root process. Each column presents this proportion for different specifications of the test: augmented Dickey-Fuller tests without trend and drift, with a trend, or with drift.

Source: Author's calculations.

When including a drift term for each industry, a unit-root process was rejected in all the utilization series, and for all but one industry in the case of the capital formation series. Almost three quarters of the industries were found to be stationary when testing for the presence of a unit root in the specification without trend and drift terms. Overall, considering the test for a panel unit root and the industry-level stationarity with drift, it is fair to regard the variables of interest as stationary, and, thus, a vector auto-regressive analysis is suitable.

Analyzing utilization-investment through VAR models. In a first step, the relationship between both variables was analyzed using a reduced form Vector Auto-regressive (VAR) approach. This methodology allowed exploring the long-term relationship between both variables without imposing an a priori direction of causality, since both variables were considered as jointly endogenous. More concretely, the following model of simultaneous equations for each industry was estimated:

$$gcf_t = c_0 + \sum_{i=1}^{n} \alpha_i \, gcf_{t-i} + \sum_{i=1}^{n} \beta_i \, cap\_util_{t-i} + u_{1t}; \quad (1)$$

$$cap\_util_t = c_1 + \sum_{i=1}^{n} \theta_i \, cap\_util_{t-i} + \sum_{i=1}^{n} \lambda_i \, gcf_{t-i} + u_{2t}. \quad (2)$$

We were particularly interested in the sign and statistical significance of the β_i coefficients, but in the evaluation as well of the significance of λ_i in order to determine the importance of the reciprocal effect. One VAR model for each industry was computed, and the joint statistical significance of the β_is and λ_is was checked by means of Granger causality tests. The proportion of industries for which the coefficients β_is and λ_is are statistically significant was identified at different levels of significance.

In order to obtain the optimal lag structure for each industry, the information criteria of Akaike (AIC), Hannan-Quinn (HQIC), and Schwarz-Bayesian (SBIC) were used to compare models with up to five total lags. The set of optimal lag structures was obtained for every industry according to each of these three criteria. Subsequently, we decided between them by evaluating the autocorrelation of the residuals for the VAR models estimated using the set of lag structures suggested by each information criterion.

VAR models were assessed for every industry using the lag structure suggested by each criterion. Then, the autocorrelation of the residuals was tested applying a Lagrange Multiplier test for AR(1) and AR(2). The results are summarized in Table 5, which shows the proportion of industries for which the autocorrelation of the residuals was not observed at lags 1 and 2. Each column presents this proportion when the VARs were estimated using the optimal lag structure found by each criterion.

Table 5 Lag Structure Selection: Autocorrelation Tests Results

	AIC	SBIC	HQIC
AR(1)	98%	76.74%	88.37%
AR(2)	93.02%	83.72%	90.70%

Notes: Table 5 shows the proportion of industries for which a residual autocorrelation was rejected at lags 1 and 2 when a VAR model was runned for each industry. This was done by using the optimal lag structure, applying the Akaike, Schwartz-Bayesian, and Hannan-Quinn Information criterion.

Source: Author's calculations.

As can be seen, the proportion of VARs showing residual autocorrelation is minimized when applying the lag structure found according to the AIC. Although VAR models for a small number of industries yielded residual autocorrelation, these seemed few enough to consider the overall analysis as valid. Consequently, in what follows, the estimation results arising from the set of lag structures suggested by AIC were used.

3.2 Results

The results shown in Table 6 suggest that the utilization rate has an impact on a fairly large proportion of industries. First, when considering Granger causality tests for the whole sample period, the proportion of industries for which a statistically significant effect of capacity utilization on the investment rate was detected amounts to 44% at the 5% confidence level, and 56% at the 10% confidence level.

If the sample period is restricted to the years following 1970, a slight increase in the proportions is observed, with 45% and 57% of the industries showing a statistically significant effect of capacity utilization at the 5% and 10% confidence level, respectively.

On the other hand, the λ_is, the lag coefficients of the investment rate in Equation (3) are also jointly statistically significant for 31% and 42% of the industries at the 5% and 10% confidence level, respectively.

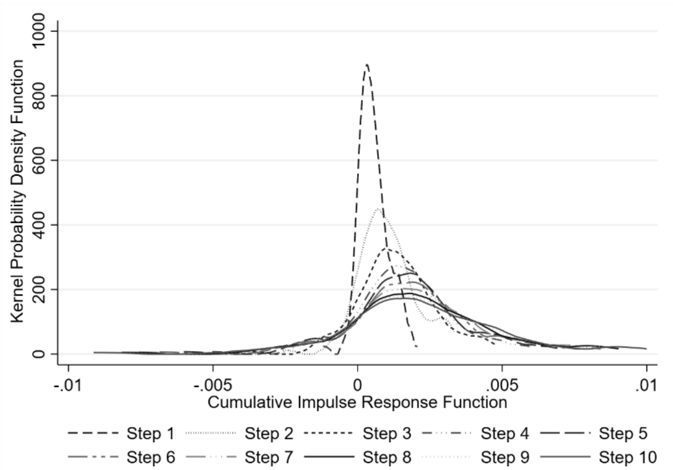
To assess the magnitude of the long-term effect of capacity utilization, the cumulative impulse response function (IRF) was computed for each industry at steps going from 1 to 10. Subsequently, the probability distribution function of these long-term effects was analyzed for different numbers of total steps. Figure 2 shows the Kernel probability distributions of the cumulative IRF that emerge for every number of total steps considered, going from 1 to 10.

Table 6 Proportion of Industries Showing Statistically Significant Effects of Capacity Utilization and Investment

	Panel A: Capacity utilization			Panel B: Capital formation		
	1%	5%	10%	1%	5%	10%
Whole sample	33.72	44.19	55.81	15.12	31.40	41.86
Since 1970	31.40	45.35	56.98	16.28	33.72	46.51
Since 1980	18.60	34.88	47.67	25.58	37.21	48.84
Since 1990	15.12	29.07	43.02	23.26	33.72	39.53

Notes: Table 6 shows the results of the Granger causality tests derived from the estimated VAR models. Panel A columns show the proportion of industries for which Granger causality is found at different confidence levels with variations in capacity utilization preceding variations in capital formation. Panel B columns present the proportion of industries for which Granger causality is observed with the opposite direction.

Source: Author's calculations.



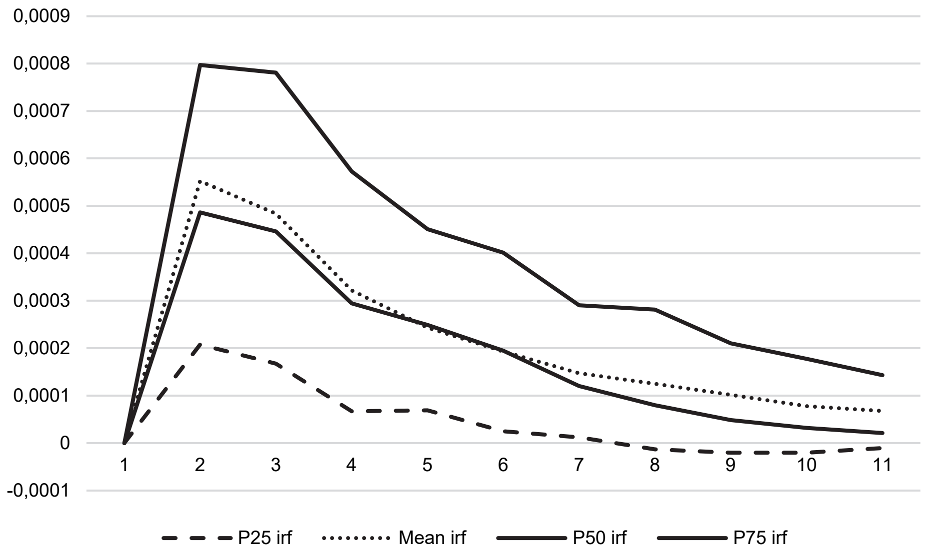
Notes: Figure 2 shows the Kernel probability density functions of the total cumulative effect of the capacity utilization rate on gross capital formation for the 86 industries considered, and for different lag structures, going from 1 to 10 lags.

Source: Author's calculations.

Figure 2 Kernel Probability Density Functions of the Cumulative Effect

As can be seen from Figure 2, the mean value of the Kernel distribution of the long-term effects is positive for any number of steps. Moreover, most of the probability density function is concentrated on values higher than zero. The number of industries for which the cumulative IRF is higher than zero is not less than 64 (75%) for any quantity of total steps. For fewer steps, the mean value of the distribution decreases, but its probability of occurrence is higher. The mean values of the long-term effect seem to be of a substantial order of magnitude, growing as the number of total steps involved increases, from 0.0006 to 0.0023. Considering the average linear trend decline of 0.6 pp in investment rates since 1970, documented in Section II.b, and the average cumulative IRF for steps 5 and 10, the long-term effect of capacity utilization on industry investment ranged between 28% and 36% of the total decline. This represents between 3.75% and 4.8% of the average investment after the year 2010.

In order to evaluate the distribution of the effect over time, Figure 3 shows the IRF at steps 0 to 10 for industries located in the 25th, 50th, and 75th percentiles of the distribution at every step. It is clear that the IRFs converge to zero as the steps increase. Most of the effect took place within the first two years, and the size of the residual impact decreased in subsequent steps.



Notes: Figure 3 shows the Impulse-response functions arising from the VARs estimated using the optimal lag structures. The impulse is a one-standard deviation shock in capacity utilization, while the responses are variations in gross capital formation at subsequent steps. P25 is the IRF of the industry in the 25th percentile of the distribution of the response at every step. P50 represents the median response, and P75 is the 75th percentile.

Source: Author's calculations.

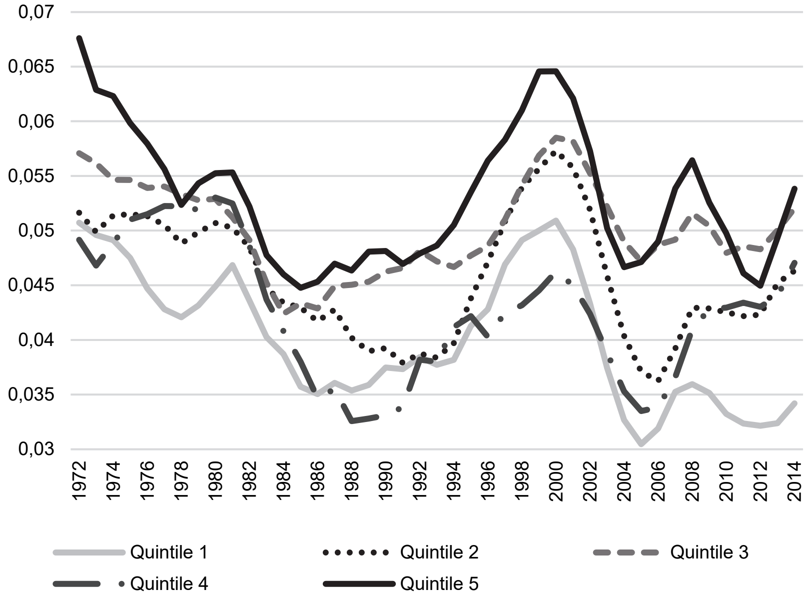
Figure 3 Impulse-Response Functions

Summing up thus far, not only a declining trend of capacity utilization is found, but also the theoretically expected relationship between utilization and capital formation is detected for a large proportion of the sample, at least according to these preliminary bivariate exercises. From an economic point of view, this relationship seems relevant as well, representing up to 36% of the average decline in investment since 1970. In what follows, we intended to obtain a more accurate measure of this effect during the last decade. To this end, we first assessed the investment performance for industries with different levels of utilization decline. Second, we conducted a firm-level analysis to allow for more precise controls.

4. The Impact of Excess Capacity on Investment in the Last 15 Years

A first insight into the effect of decreasing utilization rates on the recent investment falloff emerges when dividing our industry-level sample into groups according to their degree of utilization decline. Figure 4 shows the evolution of the median capital formation rate for each quintile of capacity utilization variation between the first half of the 1970s and the first half of the 2000s.

Quintile 1 represents the 20% of the industries for which utilization contracted the most, while Quintile 5 contains the 20% facing the least important decline. The following figure displays a clear-cut relationship: regarding capital formation, industries showing the slightest decline in utilization performed consistently better than the rest, while firms in Quintile 1 recorded a uniformly poorer investment.

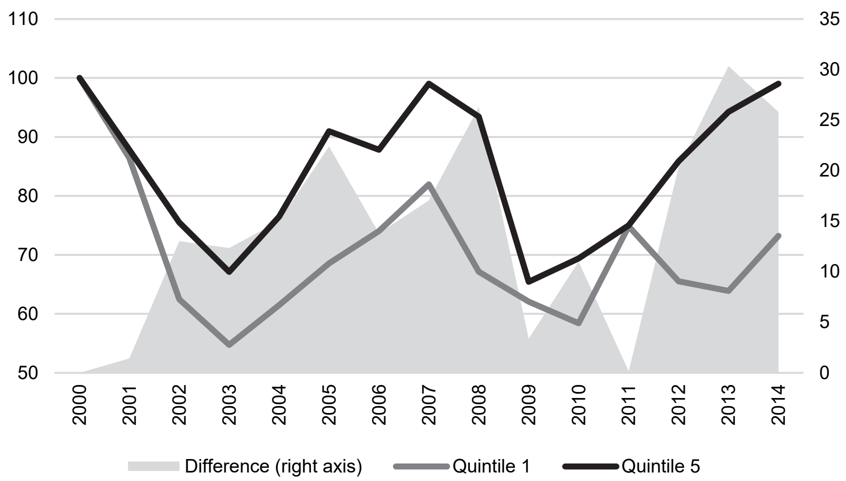


Notes: Figure 4 shows the evolution of the median capital formation rate for every quintile of capacity utilization variation between 1972-1977 and 2000-2005.

Source: Author's calculations.

Figure 4 Evolution of the Capital Formation Rate by Quintiles of Utilization Variation

Figure 5, on the other hand, focuses on the last 15 years and aims to show the business cycle dynamics of the relationship. Panel A displays the evolution of capital formation for each quintile following the *dot-com* financial crisis, with a rate equal to 100 in the year 2000. Industries in Quintile 1 experienced not only the worst contraction during the ensuing recession (-45%, compared with -33% for Quintile 5), but also the second weakest recovery during the growth years up to 2007. Moreover, a great deal of the divergence in investment levels between Quintiles 1 and 5 throughout this cycle seems to obey to a weaker increase during the expansionary phase, rather than to a sharper contraction over the recession. In fact, the difference between the investment rates for these extreme quintiles amounted to 12% until 2003, but increased further to 17% during the recovery.



Notes: Figure 5 shows the evo lution of the median capital formation rate for Quintiles 1 and 5 of the capacity utilization variation between 1972-1977 and 2000-2005. Each series is represented by an index equal to 100 in the year 2000.

Source: Author's calculations.

Figure 5 Evolution of the Capital Formation Rate by Quintiles of Utilization Variation

The recession beginning in 2008 produced a similar result. However, this time, the bulk of the difference between both quintiles was generated in the aftermath of the recession, owing to the slow recovery of the lowest quintile investment. It can be seen that, over the whole 15-year period, the divergence relative to their rate levels in 2000 grew to 25%.

4.1 A firm-Level Analysis

In this section, we delved further into measuring the effect of utilization rates on capital formation by using firm-level data and including control variables. The Compustat North America Fundamentals database was applied to obtain accounting data for US firms operating in the 67 industries with three-digit NAICS code for which FRB reports capacity utilization rates.

The resulting dataset contains 250000 firm-quarter observations for 6500 US firms and covers the period 1990-2014. In this firm-level context, investment was measured as the ratio of capital expenditures to total assets.

Firm *fixed-effects* and *between* panel models were used to identify the effect of utilization rates and utilization variation on investment. To begin with, we performed bivariate models applying the investment rate as a dependent variable and capacity utilization measures as the only regressor.

Four models were estimated. The first one is a firm fixed-effects model using data for the whole period 1990-2014. Since we were interested in capturing the effect of capacity utilization fluctuations over the years, our main variable of interest was the annual industry-level utilization rate. Second, several between panel models were computed in order to assess the impact of the previous decline in industry-level capacity utilization on current firm-level investment. We analyzed whether firms that had recorded/experienced the greatest decline in utilization rates before the beginning of the sample period presented a poorer investment performance afterwards. In these models, our sample period was restricted to the years 2006-2014, and our main variable of interest was the accumulated variation in the utilization rate up to the start of that sample period.

Column 1 of Table 7 shows the results for the firm fixed-effects model. It evidences that the coefficient for the utilization rate is, as expected, positive and statistically significant. Column 2 of Table 7, on the other hand, presents the effect of the accumulated decline in utilization rates between the early 1970s (a within-industry average for the period 1972-1975) and the early 2000s (2001-2005), on the average investment of the firm after that year. Its coefficient is positive, although not statistically significant. By contrast, a positive and significant coefficient was obtained when considering the impact of the utilization variations between the late 1980s (1985-1989) and early 2000s and, also, when using the variation between the late 1990s (1995-1999) and early 2000s. These results are shown in Columns 3 and 4.

Table 7 Firm-Level Regression Results

Variables	(1) FE 1990-2014	(2) BE 1 2006-2014	(3) BE 2 2006-2014	(4) BE 3 2006-2014
Capacity utilization	0.000343*			
	(0.000204)			
CU variation 1		0.0138		
		(0.0101)		
CU variation 2			0.0503***	
			(0.00899)	
CU variation 3				0.0196**
				(0.00920)
Constant	0.00460	0.0263***	0.0300***	0.0271***
	(0.0162)	(0.00107)	(0.00108)	(0.00115)
Observations	270,850	73,390	73,390	73,390
R-squared	0.000	0.001	0.008	0.001
Number of firms	7,048	3,662	3,662	3,662

Notes: Table 7 presents the regression results for the firm fixed-effects and between models. Column 1 shows the results for the firm fixed-effects model using data for the whole 1990-2014 period. Columns 2 to 5 provide the results of the between panel models assessing the impact of the cumulated utilization variation over different periods on subsequent firm-level investment. In Column 2, the capacity utilization variation was measured as that taking place between the early 1970s (average utilization for 1972-1977) and the early 2000s (2000-2005). In Column 3, the CU Variation was estimated from the difference between the late 1980s (1985-1989) and early 2000s, and, in Column 4, the CU Variation accounts for the difference in capacity utilization between the late 1990s (1995-1999) and early 2000s. The time period used for each model is specified in the heading of each column.

Source: Author's calculations.

In what follows, several variables were included in the model in order to control for a number of theoretically relevant determinants of investment, namely the impact of financial constraints, the accelerator effect, idiosyncratic volatility, and balance-sheet variables such as firm indebtedness and liquid assets holding.

First, firms facing more dynamic demand will experience higher pressure to increase their capital expenditures. Hence, following the accelerator effect, firms with greater sales growth are expected to invest more.

Second, the financial literature shows that access to external funding fluctuates among firms, affecting their investment performance. Firms with more access to external funding will be in a better position to invest; additionally, those facing financial constraints will show higher sensitivity of investment to internal funding (Steven Fazzari, Glenn Hubbard, and Bruce Petersen 1988). It is also a well-established fact that larger firms, with better reputation and more pledgeable assets, will be less financially constrained. Consequently, these effects were controlled by adding two variables: the logarithm of firms' total assets and the net cash flow in each quarter.

A set of control variables was also included to capture the effects of different financial policies. To begin with, following the financial flexibility literature (David J. Denis 2011), the financial management policy of firms may affect funds available for investing when corporate cash ratios or capital structure differ from the optimal or desired levels of firms, which secure financial flexibility to them. A liquidity shortfall or unpredicted cash needs may deviate cash or debt ratios from target levels, leading firms to pour internal savings into the accumulation of liquid assets or the reduction in liabilities, thus cutting capital expenditures. In our model, these financial policies were captured by the lagged values of corporate leverage, the short-term debt-to-assets ratio, and the liquidity holdings to assets. We expected firms with relatively higher leverage to show greater investment, reflecting the effect of less financial constraints, and those with higher short-term debt to present lower investment, evidencing the need to use internal savings in order to reach lower and targeted levels of debt. Similarly, the cash ratio was supposed to have a positive coefficient, reflecting the need for reducing investment to accumulate more cash when this falls below optimal levels.

Seoungpil Ahn, Denis, and Diane K. Denis (2006) argued that the level of diversification of firms affects gross capital formation. Thus, the ratio of non-operating assets was used to total assets and its variation, as proxies for the level of diversification to non-core activities.

Finally, a significant number of empirical studies found a negative correlation between firm-level volatility and investment. For instance, higher idiosyncratic return volatility, price volatility, and dispersion of subjective probability distribution of future demand for products proved to have a negative effect on firm investment (John V. Leahy and Toni M. Whited 1996; Luigi Guiso and Giuseppe Parigi 1999; Vivek Ghosal and Prahash Loungani 2000). As a result, in the exercise below, the effect of idiosyncratic volatility was controlled by adding the coefficient of variation of the return on assets (ROA) ratio. This coefficient of variation was computed for a five-quarter moving window. Table 8 summarizes the list of regressors used in the firm-level model, as well as the expected signs.

Let us consider the results when the set of control variables were included. Overall, the positive sign of the coefficients for the utilization variables remained the same, and the statistical significance increased for "CU Variation 1".

As in Table 7, Column 1 of Table 9 shows the results for the firm fixed-effects model. The effect of the utilization rate is again positive and statistically significant. It also represents an economically relevant impact of utilization rates, since an interquartile change in utilization increased net capital formation by an 18% of the sample median investment.

Table 8 Description of the Firm-Level Regression Variable

Variables	Description	Expected sign
ln of Total Assets	Natural logarithm of total assets	(+)
Net Cash Flow	Net cash flow from operating activities/total assets	(+)
Leverage	Total liabilities/total assets	(+)
Short-Term Leverage	Current liabilities/total assets	(-)
Liquidity demand	Cash and short-term assets/total assets	(+)
Non-Operating Assets	(Non-current assets - property, plant, and equipment)/total assets	(-)
Acquisitions	Acquisitions/total assets. Acquisitions are the cash outflow or funds and/or costs related to the acquisition of a company in the current year or the effects of an acquisition in a prior year carried over to the ongoing quarter.	(-)
Sales Growth	Rate of quarterly growth of firm sales.	(+)
NCF Volatility	5-quarter rolling coefficient of variation of the net cash flow	(-)
Capacity Utilization	Annual capacity utilization rate at the industry level, as reported by Table Z17 from the Federal Reserve Board.	(+)
CU Variation 1	Percent of variation in the capacity utilization rate at the industry level between its average value during 1972-1977 and 2000-2005.	(+)
CU Variation 2	Percent of variation in the capacity utilization rate at the industry level between its average value during 1985-1989 and 2000-2005.	(+)
CU Variation 3	Percent of variation in the capacity utilization rate at the industry level between its average value during 1995-1999 and 2000-2005.	(+)

Notes: Table 8 presents the description and expected signs of the regressors included in the firm-level model.

Source: Author's calculations.

Column 2 of Table 9, on the other hand, presents the effect of the accumulated decline in utilization rates between the early 1970s and the early 2000s on the average investment of firms after that year. Its coefficient is positive and significant, meaning that firms in the industries that accumulated a larger increase (decrease) in utilization rates had a higher (lower) investment over the following period. The economic relevance of this coefficient is also clear: with a value of 0.02, it suggests that a firm operating in the 75th percentile of utilization variation between the early 1970s and the early 2000s invested more than that in the 25th percentile by a magnitude equivalent to 14% of the median investment in the sample.

Moreover, differences in the investment rates of firms after 2010 continued to have a relationship with the utilization decline occurred before 2005. This is shown in Column 3 of Table 9, where the same between panel model was run for the period 2010-2014.

The impact of utilization variations between the late 1980s (1985-1989) and early 2000s, and of those between the late 1990s (1995-1999) and early 2000s also remained after including the set of control variables. These results are shown in Columns 4 and 5.

Table 9 Firm-Level Regression Results

Variables	(1) FE 1990-2014	(2) BE 1 2006-2014	(3) BE 2 2010-2014	(4) BE 3 2006-2014	(5) BE 4 2006-2014
ln of Total Assets	0.000962***	0.000843***	0.00158***	0.000812***	0.000830***
	(0.000156)	(0.000215)	(0.000207)	(0.000217)	(0.000216)
Net Cash Flow	-0.00167***	-0.000459*	0.000132	-0.000472*	-0.000464*
	(0.000113)	(0.000252)	(0.000209)	(0.000252)	(0.000252)
Leverage	0.000177***	0.000259	0.000274	0.000266	0.000256
	(4.09e-05)	(0.000238)	(0.000351)	(0.000238)	(0.000238)
Short-Term Leverage	-0.000236***	-0.000258	-0.000276	-0.000264	-0.000254
	(4.30e-05)	(0.000250)	(0.000369)	(0.000251)	(0.000251)
Liquidity demand	-0.0348***	-0.0292***	-0.0242***	-0.0277***	-0.0283***
	(0.000815)	(0.00226)	(0.00228)	(0.00228)	(0.00226)
Non-Operating Assets	-0.0467***	-0.0464***	-0.0434***	-0.0457***	-0.0461***
	(0.000925)	(0.00291)	(0.00282)	(0.00294)	(0.00292)
Acquisitions	-0.0125***	-0.00780***	-0.0460***	-0.00783***	-0.00788***
	(0.000256)	(0.00130)	(0.00455)	(0.00130)	(0.00130)
Sales Growth	4.88e-06	-2.42e-06	-1.19e-05	-1.60e-06	-2.14e-06
	(3.45e-06)	(1.99e-05)	(2.27e-05)	(1.99e-05)	(1.99e-05)
NCF Volatility	6.02e-07	-7.06e-06	1.65e-05*	-6.96e-06	-7.40e-06
	(4.77e-07)	(1.99e-05)	(8.92e-06)	(2.00e-05)	(2.00e-05)
Capacity Utilization	0.000382***				
	(1.27e-05)				
CU Variation 1		0.0259***	0.0231***		
		(0.00780)	(0.00778)		
CU Variation 2				0.0161**	
				(0.00704)	
CU Variation 3					0.0156**
					(0.00703)
Constant	0.00843***	0.0383***	0.0292***	0.0372***	0.0375***
	(0.00126)	(0.00169)	(0.00167)	(0.00165)	(0.00170)
Observations	170,272	62,533	18,303	62,533	62,533
R-squared	0.045	0.106	0.166	0.105	0.105
Number of firms	6,110	3,209	2,225	3,209	3,209

Notes: Table 9 presents the regression results for the firm fixed-effects and between models. Column 1 shows the results for the firm fixed-effects model using data for the whole 1990-2014 period. Columns 2 to 5 present the between panel models assessing the impact of the cumulated utilization variation over different periods on subsequent firm-level investment. In Column 2 and 3, the capacity utilization variation was measured as that taking place between the early 1970s (average utilization for 1972-1977) and the early 2000s (2000-2005). In Column 4, the CU variation represents the difference between the late 1980s (1985-1989) and early 2000s, and, in Column 5, the CU Variation accounts for the difference in capacity utilization between the late 1990s (1995-1999) and early 2000s. The time period used for each model is specified in each Column heading.

Source: Author’s calculations.

To sum up, in this section, a strong and economically relevant connection was found between utilization rates and firm investment, even controlling for other determinants of investment. More specifically, a within-firm relationship was documented, indicating that whenever industry-level utilization rates went up, firm investment increased. Importantly, a strong link was also observed between the accumulated decline in utilization rates in the past and current investment, suggesting that excess capacity could have reduced/hampered investment in the last years of our sample.

5. Summary and Discussion

Amid growing concerns about stagnant aggregate output and demand in advanced economies in the aftermath of the global financial crisis, there is increasing anecdotal evidence regarding chronic excess productive capacity in specific industries such as automobile, steel, and shipbuilding, among others. This state of affairs even led governments to struggle to scale capacity down as a means of restoring the economic viability and financial situation of firms.

In this context, the first purpose of this article was to evaluate the extent to which this decline in capacity utilization is a phenomenon distressing a few isolated industries, or instead represents a rather widespread feature in manufacturing industries. This was addressed by evaluating the capacity utilization statistics of the Federal Reserve for the United States, by industry, over the period 1952-2014.

We found that the decline in capacity utilization rates not only affected the average industry during the aforementioned period, but also was a fairly widespread phenomenon in the sample of manufacturing industries considered. It seems to be an economically relevant decline as well, with the average industry reducing utilization by 7 pp all over the sample period.

The second purpose was to assess the effect of such a decline in capacity utilization on business investment in the industries considered. A variety of exercises was conducted in order to obtain a first clue as to whether there was a Granger causality effect and which the magnitude of the average effect was.

Granger causality relationships with the theoretically expected sign were found for a high proportion of industries, hovering around 50% depending on the specification of the test. In addition, when trying to measure the magnitude of the impulse-response relationship, our vector autoregressive estimates showed that a positive cumulative relationship tended to dominate in most of the industries, and detected a considerably large total impact of utilization rates on investment, which represents an investment contraction fluctuating between 28% and 36% of the average investment decline.

Finally, firm-level data was used to consider other determinants of investment. Firm investment was found to be sensitive to utilization fluctuations when we controlled for financial constraints and flexibility issues, firm sales growth rate, idiosyncratic volatility, and corporate diversification. More importantly, the past accumulated utilization decline showed a strong correlation with the capital expenditures of firms in the most recent period in our sample, possibly reflecting the detrimental effect of excess capacity on investment.

Overall, the evidence discussed above provides insight into the factors disrupting investment expenditures that might have been overlooked in recent academic debates about the investment falloff. This sheds new light on the structural and long-term obstacles that reduce private capital expenditures, reinforcing the case for a secular stagnation hypothesis.

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